Workers' Compensation Section

Presents

Legal Specialization Boot Camp 2019

Medical Knowledge and Issues

Saturday, July 27, 2019

2:10 p.m. – 4:10 p.m.

Anaheim, CA

Speakers:

Dr. Steven Feinberg

Justin Drake

Ray Frost

Conference Reference Materials

Points of view or opinions expressed in these pages are those of the speaker(s) and/or author(s). They have not been adopted or endorsed by the California Lawyers Association and do not constitute the official position or policy of the California Lawyers Association. Nothing contained herein is intended to address any specific legal inquiry, nor is it a substitute for independent legal research to original sources or obtaining separate legal advice regarding specific legal situations.

© 2019 California Lawyers Association
All Rights Reserved

California Lawyers Association is an approved State Bar of California MCLE provider.

Workers' Compensation Boot Camp 2019

Medical Knowledge and Issues

Steven D. Feinberg, MD, MS, MPH
Ray Frost, Esq.
Justin Drake, Esq.

CA State Bar Workers' Compensation Law Examination Specifications

Subject Area 4: Medical Knowledge & Issues

4.1 Anatomy/physiology

4.2 Terminology

4.3 Industrial diseases

4.4 Treatment guidelines / UR / IMR / MPN / Medical Treatment Utilization Schedule (MTUS)

4.5 Determination of medical issues (AME/QME)

CA Workers' Compensation

- Understanding basic theory how injuries occur
- Anatomy & medical terminology
- Presenting claim to medical evaluator
- Effectively use of the AMA Guides

Handouts

- Medical School for Attorneys
- ACPA Resource Guide to Pain Medication and Treatments
- Diagnosing and Treating Complex Regional Pain Syndrome
- Guide to the (AMA) Guides

Medical School for Attorneys

- Musculoskeletal disorders
- Spasm, strain and sprain
- Myofascial pain & fibromyalgia
- Osteoarthritis
- Neck pain & injuries
- Thoracic Outlet Syndrome (TOS)
- Shoulder pain & injuries
- Elbow/Forearm pain & injuries
- Ulnar nerve compromise in the elbow
- Carpal tunnel syndrome
- Hand injuries
- Low back pain & injuries
- Lumbar spinal stenosis
- Hip pain & injuries
- Knee pain & injuries
- Ankle & foot injuries
- Headaches: Evaluation & treatment

ACPA Resource Guide to Chronic Pain Management

- Overview of Chronic Pain Treatment
- What does successful pain treatment look like?
- Pain Types, Sources & Classification
- Pain in Special Populations
- Major Types of Interventions for Pain
- Functional Restoration Approaches & Programs
- Self-Directed Interventions
- Active Interventions
- Psychological & Behavioral Approaches
- Complementary, Alternative & Integrative Medicine
- Physical Modalities
- Invasive Interventions
- Medications
- Tapering/Weaning off Pain Medications
- Self-Medication: Alcohol, Tobacco, Medication, and Illicit Substances

Diagnosing and Treating Complex Regional Pain Syndrome

- CRPS Definition
- CRPS general features and Diagnostic Criteria
- Causation of CRPS
- CRPS Types
- CRPS Prevention
- Treatment

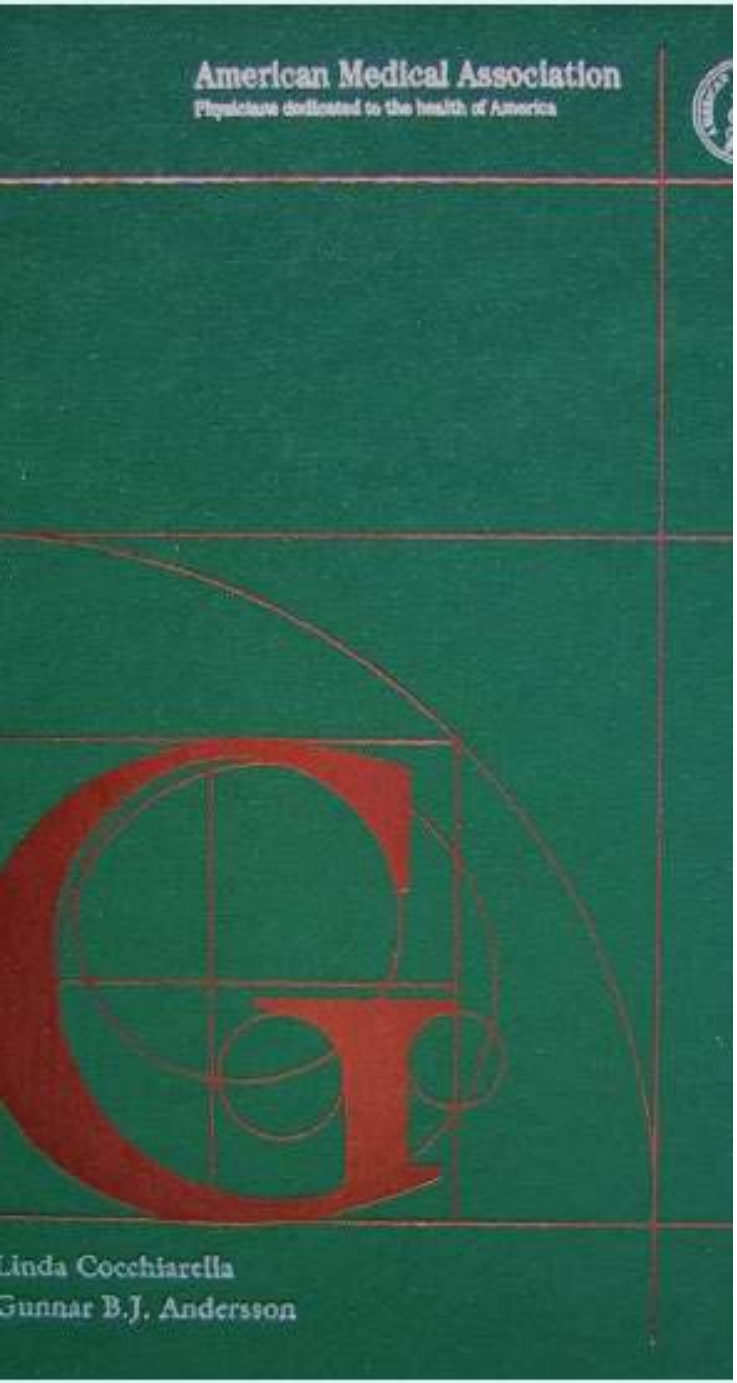
Guide to the (AMA) Guides

Evaluator's Resource Algorithm to the

AMA *Guides to the*

Evaluation of Permanent Impairment, Fifth Ed.

- Musculoskeletal, Nervous System and Pain



AMA Guides

- Philosophy, Purpose, and Appropriate Use of the *Guides*
- Practical Applications of the *Guides*
- Cardiovascular System – Heart & Aorta
- Cardiovascular System – Systemic & Pulmonary Arteries
- Respiratory System
- Digestive System
- Urinary & Reproductive Systems
- Skin
- Hematopoietic System
- Endocrine System
- Ear, Nose & Throat
- Visual System
- Central & Peripheral Nervous System
- Mental & Behavioral Disorders
- Spine
- Upper Extremities
- Lower Extremities
- Pain

AMA Guides

1. **Philosophy, Purpose, and Appropriate Use of the *Guides***

Table 1-2 Activities of Daily Living Commonly Measured in Activities of Daily Living (ADL) and Instrumental Activities of Daily Living (IADL) Scales [6,7]

Activity	Example
Self-care, personal hygiene	Urinating, defecating, brushing teeth, combing hair, bathing, dressing oneself, eating
Communication	Writing, typing, seeing, hearing, speaking
Physical activity	Standing, sitting, reclining, walking, climbing stairs
Sensory function	Hearing, seeing, tactile feeling, tasting, smelling
Nonspecialized hand activities	Grasping, lifting, tactile discrimination
Travel	Riding, driving, flying
Sexual function	Orgasm, ejaculation, lubrication, erection
Sleep	Restful, nocturnal sleep pattern

AMA Guides

2. Practical Applications of the *Guides*

AMA Guides

3. Cardiovascular System – Heart & Aorta
   - Coronary heart disease (CHD) is most commonly due to arteriosclerosis of the coronary arteries, resulting in reduced coronary blood flow.
     - Heart attack – primarily from blockage of coronary artery
     - Cardiac arrest – occurs when the heart electrical system malfunctions and becomes suddenly irregular & fast.
     - Arrhythmias – irregular heartbeats generated at a site other than the normal sinus node.

AMA Guides

4. Cardiovascular System – Systemic & Pulmonary Arteries
   - Hypertension (high blood pressure) possible consequences
     - Stroke
     - Enlarged heart
     - Heart failure
     - Peripheral vascular disease
     - Heart attack
     - Kidney disease/failure

AMA Guides

5. Respiratory System
   - Terminology
     - Dyspnea – shortness of breath
     - Cough, sputum production, and hemoptysis
     - Wheezing – due to partial airway obstruction

AMA Guides

5. Respiratory System
    - Disease states
        - Asthma
        - Lung cancer
        - Asbestosis - a chronic lung disease caused by inhaling asbestos fibers. Prolonged exposure to these fibers can cause lung tissue scarring and shortness of breath. Asbestosis symptoms can range from mild to severe, and usually don't appear until many years after continued exposure.
        - Pneumonia
        - Tuberculosis
        - Obstructive sleep apnea (OSA) - is a sleep disorder that involves cessation or significant decrease in airflow in the presence of breathing effort. It is the most common type of sleep-disordered breathing and is characterized by recurrent episodes of upper airway collapse during sleep.

AMA Guides

6. Digestive System
   - Upper digestive tract
     - Gastroesophageal reflux disease (GERD) - occurs when stomach acid frequently flows back into the esophagus. This backwash (acid reflux) can irritate the lining of the esophagus.
   - Colon, Rectum, and Anus
   - Liver and biliary tract
   - Hernias - when an organ pushes through an opening in the muscle or tissue that holds it in place. Can be caused by lifting, straining while voiding and persistent coughing/sneezing.
     - Abdominal
     - Inguinal (groin)

AMA Guides

7. Urinary and Reproductive Systems
   - Urinary issues & Sexual dysfunction
     - Brain injury
     - Spinal cord injury
     - Lumbar spine injury
     - Medication related

AMA Guides

8. Hematopoietic System
   - Blood diseases
   - Lymphatic system issues
   - Bone marrow issues
   - **Deep venous thrombosis (DVT)** is a blood clot that forms in the deep veins in the leg. The clot can break off and travel to the long and cause a pulmonary embolism.

AMA Guides

9. Skin
   - Skin cancer
   - Burn injuries
   - **Scars, disfigurement** – can be rated using Table 8-2. Rated based on how they affect activities of daily living and medical care needs.

AMA Guides

10. Endocrine System – not often seen as industrial but may be linked to toxic chemical exposure or traumatic brain injury.
    - Pituitary
    - Thyroid
    - Parathyroid
    - Adrenal
    - Pancreas
    - Ovaries
    - Testes

AMA Guides

11. Ear, Nose & Throat
    - Hearing loss – common industrial injury.
    - Vestibular disorders – refers to balance/disequilibrium. Rating based on ADL deficits.
    - Tinnitus – the perception of noise or ringing in the ears. Only ratable with measurable hearing loss.

AMA Guides

12. Visual System
    - Visual loss – not a common work injury but seen with direct trauma/projectile injuries.

AMA Guides

13. Central & Peripheral Nervous System
    - Central Nervous System (CNS)
        - Brain injury
    - Cranial Nerves
    - Chronic Pain
        - CRPS
    - Peripheral Nerves
    - Station & Gait/Movement
    - Neuromuscular/Muscular
    - Autonomic Nervous System
    - Spinal Cord/Central Impairment
        - Spinal cord injury

AMA Guides

14. Mental & Behavioral Disorders
    - GAF

AMA Guides

15. Spine
    - Lumbar (DRE or ROM)
    - Thoracic (DRE or ROM)
    - Cervical (DRE or ROM)
    - Pelvis
    - Corticospinal (spinal cord)
        - One Upper Extremity
        - Two Upper Extremities
        - Station and Gait Disorders
        - Neurologic Impairment of the Bladder
        - Neurologic Anorectal Impairment
        - Neurologic Impairment of Respiration

AMA Guides

16. Upper Extremities
    - Shoulders
    - Elbows
    - Wrists
    - Hand/Fingers
    - Entrapments/nerve compromise
        - Thoracic outlet syndrome
        - Ulnar nerve entrapment at elbow
        - Carpal Tunnel Syndrome

AMA Guides

17. Lower Extremities
    - Pelvis
    - Hip
    - Thigh/Knee
    - Calf/Ankle/Foot
    - Toe
    - Peripheral Nerves
    - Peripheral Vascular
    - Gait Derangement

AMA Guides

18. Chronic Pain – A 3% WPI may be appropriate but must be pain in excess of that which would be expected and not already included in the impairment rating.

CA State Bar Workers' Compensation Law Examination Specifications

Subject Area 4: Medical Knowledge & Issues

4.1 Anatomy/physiology

4.2 Terminology

4.3 Industrial diseases

4.4 Treatment guidelines / UR / IMR / MPN / Medical Treatment Utilization Schedule (MTUS)

4.5 Determination of medical issues (AME/QME)

Medical Treatment in Workers Compensation

1. LC 4600 – treatment which is “reasonably required to cure or relive” the injured worker from the effects of the injury shall be provided
2. Medical treatment is not apportionable per Granado v. WCAB 33 CCC 647
3. Causation of injury v. Causation of disability
   A. 1% cause of injury = employee gets 100% treatment
   B. 1% cause of disability = employee get 1% of PD rating

Treatment Authorization in Workers' Compensation

Four Step Process

1) Request for Authorization (RFA) is completed by treating physician and sent to the administrator
2) RFA approved, deferred, sent back to treating physician as incomplete or sent to Utilization Review (UR)
3) UR approval, modification, denial, or delay
4) Independent Medical Review (IMR) and/or WCAB

RFA or Not?

- All requests must be on DWC Form RFA
  - What if the requested treatment is not on a DWC Form RFA?
    - Don't ignore! Do one of the following:
    - 1) Treat as completed RFA and comply with rules OR
    - 2) Return to requesting physician marked "not complete" no later than five (5) business days from receipt
    - Also recommend sending treating physician a copy of DWC Form RFA and request it be completed pursuant to 8 CCR 9792.9.1(a) and 9785.5

Deferral of RFA

- What if the RFA requests treatment for a denied claim or body part or system not part of the accepted claim?
  - Send timely written deferral and comply with 8 CCR 9792.9.1(b)
  - Issue written notice within five (5) business days from receipt of DWC Form RFA deferring UR for the requested treatment
  - Service requirements same as a denial letter - notice must be sent to requesting physician, Applicant, and Applicant's Attorney (if applicable)

Deferral of RFA

- Per 8 CCR § 9792.9.1(b)(1) Deferral letter must contain the following:
  - The date on which the DWC Form RFA was first received
  - A description of the specific course of proposed medical treatment for which authorization was requested
  - A clear, concise, and appropriate explanation of the reason for the claims administrator's dispute of liability for either the injury, claimed body part or parts, or the recommended treatment
  - A plain language statement advising the injured employee that any dispute under this subdivision shall be resolved either by agreement of the parties or though the dispute resolution process of the Workers' Compensation Appeals Board, and
  - ***Mandatory language*** see 8 CCR 9792.9(b)(1)(E)

Deferral of RFA and LC 4610(g)(7)

- Labor Code § 4610 (g)(7) provides:
  - UR of a treatment recommendation shall not be required while the employer is disputing liability of injury to treatment of the condition for which treatment is recommended pursuant to Section 4062.
- Don't forget to object pursuant to Section 4062 when deferring a UR decision

Who Can Approve, Deny, Delay or Modify?

Adjuster can approve or authorize requested treatment or defer UR (Labor Code 4610(e))

Adjuster cannot deny, modify, or delay (only defer) a properly completed RFA based on medical necessity ($25,000 penalty)

Who Can Deny, Delay or Modify?

No person other than a **licensed physician who is competent to evaluate the specific clinical issues involved** in the medical treatment services, and where these services are within the scope of the physician's practice, requested by the physician may modify, delay, or deny requests for authorization of medical treatment for reasons of **medical necessity to cure or relieve**. (LC 4610(e))

Adjuster can approve or authorize requested treatment or defer UR (LC 4610(e))

Adjuster cannot deny, modify, or delay (only defer) a properly completed RFA based on medical necessity ($25,000 penalty)

UR – Timely Decision

- Timely decision and communication is usually the crux of issue
  - Review LC 4610 and 8 CCR 9792.9.1
- General rule - **five (5) business** days to deny, modify, or delay (LC 4610(g)(1))
  - Start counting the day after the receipt of the DWC Form RFA, except when timeframe is measured in hours. (8 CCR 9792.9.1(c)(1))
  - Exception is expedited review – 72 hours from actual hour receipt of DWC Form RFA
- UR may issue a delay, but final decision must be made with 14 calendar days from receipt of RFA

UR - When is RFA "received"?

- 8 CCR § 9792.9.1
  - Your records - electronic date stamp on fax or email receipt received by claims administrator or UR department (a)(1)
  - Their records - electronic date stamp on fax or email transmission by requesting physician (a)(1)

RFA received or transmitted after 5:30 PM PST = next business day (a)(1)

  - Regular mail - five (5) business days after deposit in mail (a)(2)(A)
  - Certified mail – date on return receipt (a)(2)(B)

  - If none of the above, RFA deemed received five (5) days after the latest date the sender wrote on the document (a)(2)(C)

UR – Timely Communication

- UR shall be communicated to the requesting physician within 24 hours of the decision by phone, fax, or email (Labor Code § 4610(g)(1) and 8 CCR § 9792.9.1(e)(3))
  - If communication by telephone written notice shall follow (8 CCR § 9792.9.1(e)(3))
    - Concurrent review: 24 hours from decision
    - Expedited review: 72 hours from receipt of request
    - Prospective review: two (2) business days
    - Retrospective review: 30 days of receipt of RFA and medical info reasonably necessary to make request (8 CCR § 9792.9.1(e)(4))

UR – Timely Communication

- Written decision modifying, delaying or denying treatment shall be provided to the following:
  - Requesting physician
  - Injured Worker
  - Injured Worker's representative or Attorney
- Written proof of service on all required individuals is key
- Untimely UR may not be remedied; it is the same as no UR at all
  - Applicant will argue *SCIF v. WCAB (Sandhagen)* 44 Cal. 4th 230, 77 Cal. Comp. Cases 981 (2008)

Timeliness

- If UR decision is timely, IMR is the sole vehicle for reviewing the UR physician's expert opinion regarding medical necessity of a proposed treatment, even if the UR process did not fully comply with section 4610's requirements
  - i.e. issues with sufficiency of medical records provided, expertise of the reviewing physician, and compliance with MTUS…are all questions for the medical professionals
  - See *Dubon v. World Restoration Inc.,* 79 Cal.Comp.Cases 1298 *(Dubon II)*

UR – Delay – 5 Business Days

.UR can be delayed for up to 14 calendar days provided the delay is requested within 5 business days (8 CCR § 9792.9.1 (f)(2)(A))

.UR must explain what information is needed and why it is needed

- The decision shall specify the reason for the decision and specify the information that is needed (Labor Code § 4610(g)(4))

UR – Delay beyond 14 days

- Delay beyond 14 days - 8 CCR § 9792.9.1 (f)(1)
- Must provide written notice of one of the following
  - (A) Administrator or review is not in receipt of all the information reasonably necessary to make a determination
  - (B) The reviewer has asked that an additional examination or test be performed that is reasonable and consistent with professionally recognized standards
  - (C) Reviewer needs specialized consultation and review of medical information by an expert reviewer

UR – Delay – Conditional Denial

- If additional information not received within 14 calendar days, UR shall conditionally deny the RFA and reconsider when the additional information is received (8 CCR § 9792.9.1 (f)(3)(A))
- If additional testing or specialized consultation is not received within 30 days of the RFA, UR shall conditionally deny the RFA and reconsider when the additional information is received (8 CCR § 9792.9.1 (f)(3)(B))

UR – Delay – Document Attempt

- Whenever a reviewer issues a decision to deny a request for authorization based on the lack of medical information necessary to make a determination, the claims administrator's file must document the attempt by the claims administrator or the reviewer to obtain the necessary medical information from the physician either by facsimile, mail, or email (8 CCR § 9792.9.1 (g))
  - UR decisions frequently fail on this point. Calling and leaving a voice mail does not count.

UR - Delay

- What if UR issues delay and requests information that is already in possession of claims administrator?
  - Delay is invalid, therefore UR not timely denied and Applicant Attorney likely to take the issue before WCAB
  - Information must not be in possession of reviewer or claims administrator (8 CCR § 9792.9.1 (f)(1))
  - This frequently occurs when reviewer does not have all records. i.e. reviewer cites a lack of functional improvement to deny the treatment when medical records actually demonstrate functional improvement

IMR – Timelines

- Applicant must request IMR within 30 days from service of UR – Labor Code § 4610.5(h)
- Administrative Director certifies IMR – no time limit
- Maximus contacts all parties requesting IMR information
- Defendant has 15 days from IMR notification date to submit documents
- Applicant may submit documents
- IMR to issue decision within 30 days of receipt of all documents

IMR – Documents

Labor Code § 4610.5(f)(3) and (l)

- Applicant may provide information to IMR
- The employer (administrator) shall provide the following within 10 days (plus 5 for mailing):
  - All employees' medical records in possession or control relevant to the following:
    - Current medical condition
    - Medical treatment being provided by the employer
    - Disputed medical treatment requested by employee
  - Any materials submitted by employee or treating physician in support of request for treatment
  - Other relevant documents used by employer or UR in making UR decision
  - Newly developed or discovered medical records after initial documents were provided (continuing requirement to serve relevant records??)
- Serve employee all documents not previously served when sending to IMR
- If previously served on employee, ok to send a list of documents provided to IMR

IMR - Appeal

- Applicant may appeal IMR decision to WCAB per 8 CCR 10957.1 and LC 4610.6
- Five grounds for appeal:
  - Administrative Director acted in excess of powers
  - Determination is procured by fraud
  - IMR has material conflict of interest
  - IMR was biased on basis of race, sex, age, religion, sexual orientation, color, or disability
  - Plainly erroneous express or implied finding of fact
- If reversed, WCAB orders another IMR!!!

WCAB –Expedited Hearing

- Applicant's will frequently file for an expedited hearing if UR is untimely and file for IMR
- Applicant must first prove UR is untimely
- Then, WCAB determines medical necessity per *SCIF v. WCAB (Sandhagen)* 77 Cal. Comp. Cases 981 (2008)
  - Need to show treatment consistent with uniform guidelines
  - Applicant will also assert that under *Sandhagen* untimely UR is not admissible

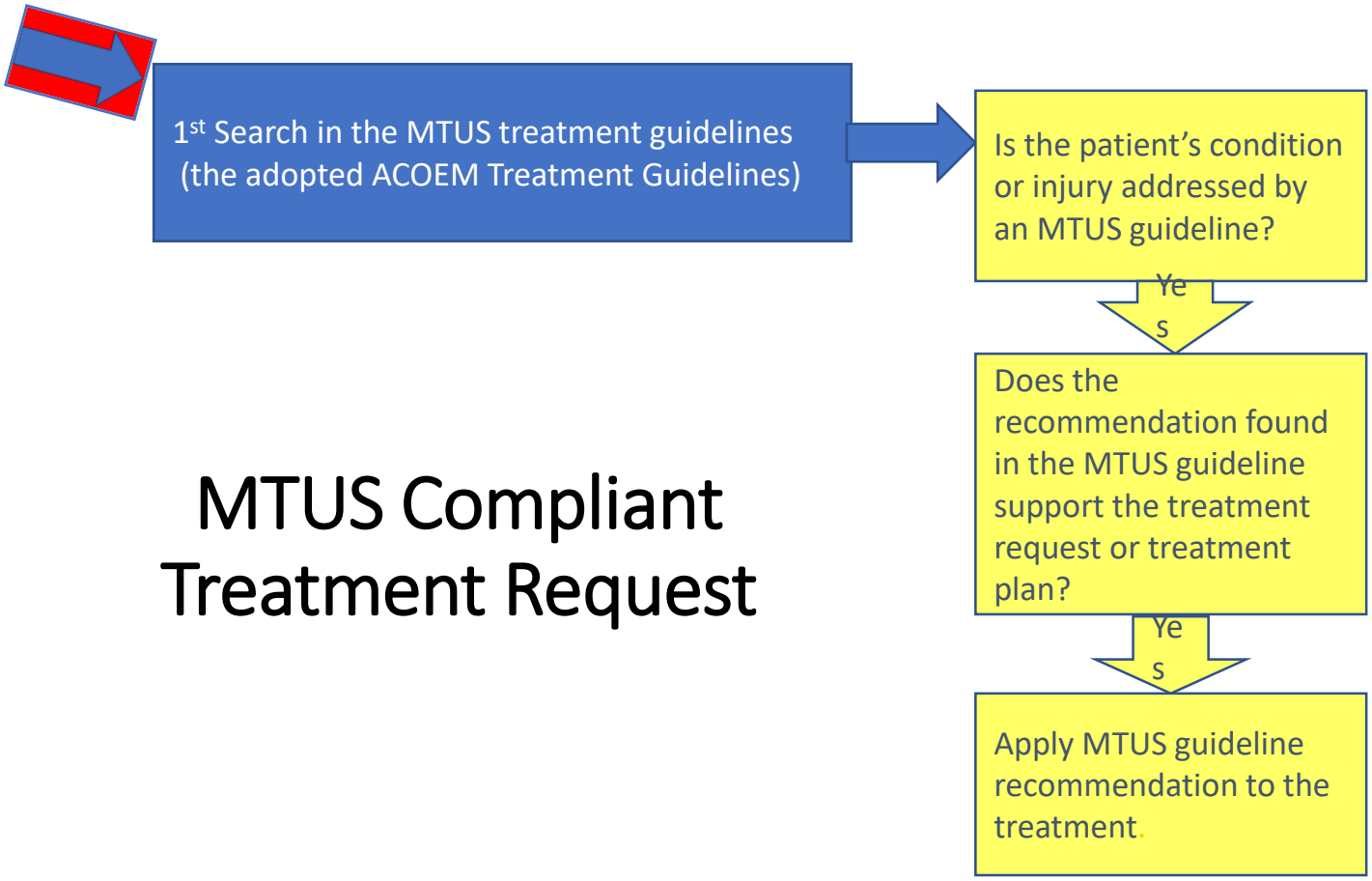
MTUS Guidelines & MTUS Drug Formulary

- **MTUS Presumptively Correct**
- (12/1/17 – ACOEM Guidelines)
- (1/1/18 – MTUS Formulary)
- **MTUS & Formulary Linked**

MTUS Search Sequence - Required

https://www.dir.ca.gov/t8/9792_21_1.htm

MTUS Compliant Treatment Request

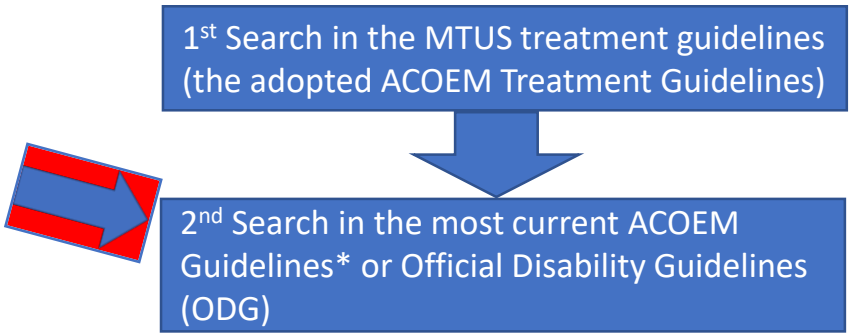


Recommendations Found Outside of the MTUS

There are only two limited situations that may warrant treatment based on recommendations found outside of the MTUS treatment guidelines:

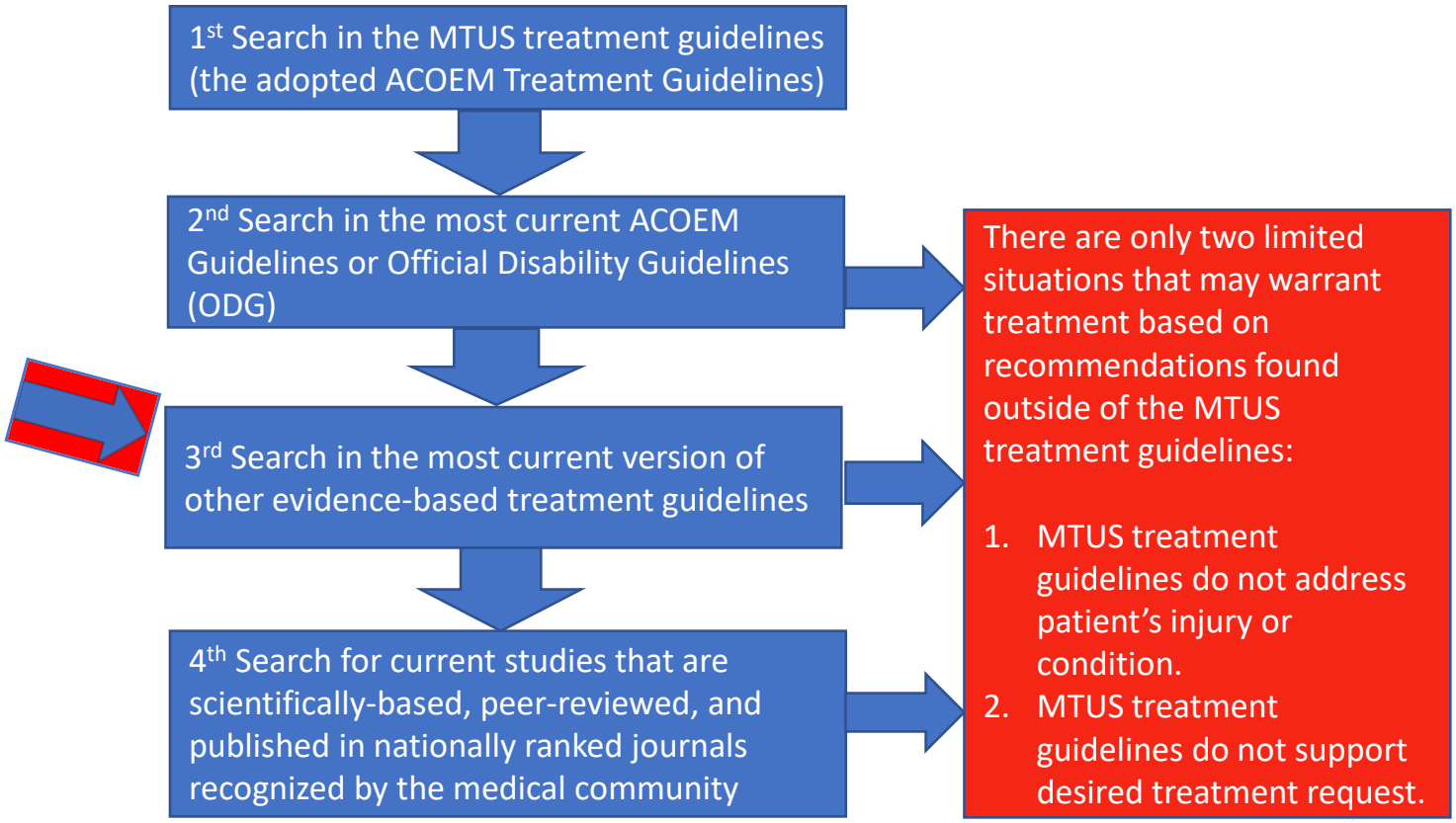
1. MTUS treatment guidelines do not address patient's injury or condition.
2. MTUS treatment guidelines do not support desired treatment request.

Recommendations Found Outside of the MTUS

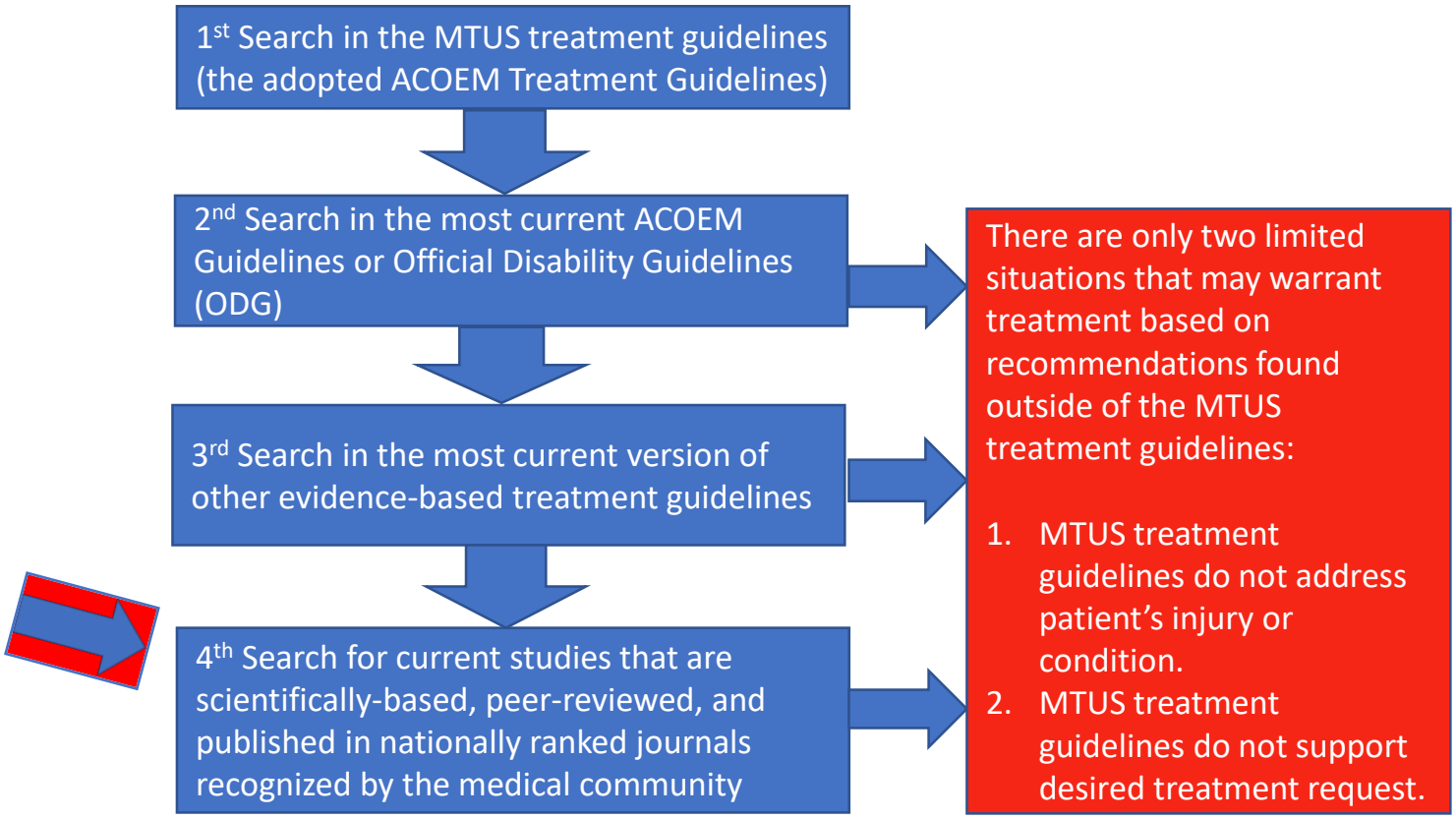


*** An ACOEM guideline is NOT yet part of the MTUS until the DWC formally adopts it**

Recommendations Found Outside of the MTUS



Recommendations Found Outside of the MTUS



CA State Bar Workers' Compensation Law Examination Specifications

Subject Area 4: Medical Knowledge & Issues

4.1 Anatomy/physiology

4.2 Terminology

4.3 Industrial diseases

4.4 Treatment guidelines / UR / IMR / MPN / Medical Treatment Utilization Schedule (MTUS)

4.5 Determination of medical issues (AME/QME)

Reason for Panel

- LC 4060 – compensability
  - case is denied in its entirety. Not for disputed body parts
  - No time requirement for requesting panel
- LC 4061 – Permanent Disability and need for medical treatment
  - No time requirement, but potential latches defense
- LC 4062 – Temporary Disability and medical diagnosis
  - Additional body parts
  - 20-day requirement for abjection when represented
  - 30-day requirement when unrepresented
  - Time starts upon receipt of objectionable report – JC Penny v. WCAB 74 ccc 826

Form of Objection

- In writing
- Indicate identity of PTP
- Indicate date of objectionable report
- Describe dispute
- “I am in receipt of the 1/1/19 report of treating physician, Dr. Wrong and hereby object to Dr. Wong’s conclusions regarding permanent and stationary status, PD, TD, medical diagnosis, or lack thereof pursuant to LC 4061 and/or 4062. Abenset agreement to an evaluator a panel in orthopedic surgery (MOS) will be requested.”

Requesting a Panel

- **QME FORM 106 (REPRESENTED)**
- **ONLINE SUBMISSION ONLY**

- **QME FORM 105 (UNREPRESENTED)**
- **NO ONLINE SUBMISSION**

Unrepresented Employee

- Form 105 must be provided to the EE with instructions. If EE does not request panel within 10 days ER can mail Form 105 to Med Unit with proof compliance with LC 4060, 4601, 4602
  - What is Administrator is out of state?
- Selection of QME after panel issued
  - EE has 10 days to select and inform ER who will then set. If EE does no select and inform, ER can select and set

Submitting Panel Request

- Remember: the 16th day is actually the 15th day at 5:00
- You should never be getting a panel at any time other than 5:00
- Start counting the day after your service date
- If the 15th day falls on a Saturday, Sunday, or State holiday then you move to the next business day (often Monday) but remember they get the full day to object so that moves you to 5:00
- Recommendation: as soon as it turns to 5:00 on your computer hit the button
- This is a race! We are talking seconds make a difference. Don't count to ten, don't take a deep breath, just click it ASAP

Ok I have a panel, now what?

- Rule of thumb – If you request, strike in 10 days per LC 4062.2(c)
- Other party gets additional 5-days for mailing
- If party fails to strike other party may chose and set.

Don’t like the QME or Panel – Can you get a new one?

Request replacement panel with Med Unit per 8 CCR 31.5(a)

- QME does not practice in specialty requested by party with right to request panel
- Cannot schedule within 60 days
- Employee moved
- QME in same practice group as another QME on panel
- QME unavailable per 8 CCR 33
- QME was or is the employees primary treating physician
- Parties agree to a different panel location
- Specialty is inappropriate
- Other grouds see 8CCR 31.5(a)

Scheduling the Evaluation

- Applicant has 10-days to set evaluation after both parties strike per LC 4602.2(d)
- Party with right to set can waive 60-day requirement to set up to 90-dayus per 8 CCR 31.3(e)
- QME must serve notice of exam on parties within 5 business days of the date exam scheduled per 8 CCR 34(a)
- QME shall schedule the exam only at the address listed on the panel per 8 CCR 34(b)

Information to Evaluators

- Defendant shall and injured worker may provide the following (per 8 CCR 35 and LC 4062.3):
- All records of the employees PTP or PTPs
- Other medical records or information relevant to the determination of the medical issue(s) in dispute
- A letter outlining the issues to address, to be served on opposing party no less than 20-days before evaluation
- Non-medical records, including sub rosa films and video which are relevant to the medical issues in dispute

Information to Evaluators

- All communication with an evaluator shall be in writing and sent simultaneously to the opposing party (no ex parte), excepts as provided by LC 4062.3 (c),(k),(l)
- At least 20 days before information is to be provided to QME it shall be served on the opposing party per LC 4062.3(b)
- If opposing party objects to the information, it should not be sent to QME.

Information to Agreed Evaluators

- Parties agree as to what information to be provided to an AME per LC 4062.3(c) and 8 CCR 35(b)(2) but still must provide to opposing party 20 days before evaluation

Communication with an Evaluator

- All communications in writing and served on aposing party 20 days before evaluation per LC 4062.3(e)
- Ex parte communication – aggrieved party may terminate evaluation and select new evaluator or proceed per LC 4062.3(g)
  - Shall be subject to contempt and liable for costs and fees incurred by opponent due to ex parte communication per LC 4602.3(h)

Communication with an Evaluator

- Ex parte communication (LC 4062.3(e) and (g)) does not apply to employee or dependents of deceased employee in the course of the exam or at the request of the evaluator in connection with the exam per LC 4062.3(i)
- WCAB determines ex parte communication per 8 CCR 35.5(a)

AME/QME Exam and Report

- QME shall not engage in ex parte communication per 8 CCR 41(b)
- Review all relevant medical and non-medical records and must list and summarize all records reviewed per 8 CCR 41(c)(2)
- Report shall issue within 30 days of evaluation even if not all records received per LC 139.2(j)(1)(a), 4062.5, 8 CCR 35(i), 38(a) and (g)

AME/QME Exam and Report

- Evaluator may seek extension of 30 days to issue initial report
- Supplemental report shall issue no more than 60 days after request per 8 CCR 38(i)
- Remedy for late initial report?
  - Must object prior to report being issued per 8 CCR 38(b) and you get a new evaluator per 8 CCR 31.5
  - QME does not get paid
  - Remedy for late supplemental?

Cross Exam/Depo of Evaluators

- Shall make themselves available with 120 days of the notice of deposition
- Deposition shall be held at exam location, whenever possible, or at a facility that is not more than 20 miles from the exam
- Remedy if unavailable? Likely inadmissible

Additional Panels

Additional Panels

- Med Unit shall issue a panel in another specialty for good cause
  - Order from WCJ per 8 CCR 32.6
  - Written agreement between represented parties per 8 CCR 31.7(b)(1) and via Form 31.7
  - In unrepresented case after parties have conferred with I&A officer per 8 CCR 31.7(b)(4)

MEDICAL SCHOOL

FOR ATTORNEYS

STEVEN D. FEINBERG, MD, MPH

American Board of Pain Medicine
American Board of Physical Medicine & Rehabilitation
Qualified Medical Evaluator

Adjunct Clinical Professor
Stanford Anesthesiology, Perioperative and Pain Medicine Department
Stanford University School of Medicine

Feinberg Medical Group
Functional Restoration Programs
825 El Camino Real
Palo Alto, CA 94301
Tel 650-223-6400
Fax 650-223-6408
stevenfeinberg@hotmail.com
www.FeinbergMedicalGroup.com

TABLE OF CONTENTS

MUSCULOSKELETAL DISORDERS **3**
- **SPASM, STRAIN & SPRAIN** **3**
- **MYOFASCIAL PAIN & FIBROMYLAGIA** **4**
- **OSTEOARTHRITIS** **7**
- **NECK PAIN & INJURIES** **14**
- **THORACIC OUTLET SYNDROME (TOS)** **19**
- **SHOULDER PAIN & INJURIES** **22**
- **ELBOW & FOREARM PAIN & INJURIES** **27**
- **ULNAR NERVE COMPROMISE AT THE ELBOW** **30**
- **CARPAL TUNNEL SYNDROME** **34**
- **HAND INJURIES** **39**
- **LOW BACK PAIN & INJURIES** **46**
- **LUMBAR SPINAL STENOSIS** **52**
- **HIP PAIN & INJURIES** **55**
- **KNEE PAIN & INJURIES** **61**
- **ANKLE & FOOT INJURIES** **69**

HEADACHES: EVALUATION & TREATMENT **76**

MUSCULOSKELETAL DISORDERS

INTRODUCTION

Musculoskeletal pain syndromes and the accompanying physical and emotional sequelae account for one of six patient visits to physicians. Numerous others self-medicate or seek alternative health professionals for treatment and often subject themselves to expensive medical evaluations and ineffective treatments. Thus, these problems are not minor in nature and consume considerable numbers of health care dollars and associated resources along with missed time and lost productivity from the workplace. When severe, these disorders may result in loss of overall function in daily life activities, may be accompanied by mental health problems and may result in a chronic pain syndrome.

TERMINOLOGY

The musculoskeletal system can be divided into bones, joints, and supporting soft tissue structures (muscles, ligaments, tendons and bursa). Soft tissue complaints are very common disorders and dwarf those of bone and joints in terms of frequency. Although the terms commonly used for damage or irritation of muscles (fibrositis), ligaments (enthesitis), tendons (tendinitis), and bursa (bursitis) suggests inflammation, in fact these conditions are usually non-inflammatory. Current terminology also describes soft tissue complaints involving the muscles and contiguous bony prominences that are either localized (myofascial pain syndrome or MPS) or widespread throughout the body (fibromyalgia syndrome or FMS).

SPASM, STRAIN & SPRAIN

Muscles contract and relax when instructed by nerves to make various body parts move. A MUSCLE SPASM occurs when a muscle is continually contracting due to tension or injury. When a muscle is in constant spasm, there is not enough oxygen and blood moving through it to remove waste products such as lactic acid, which produces pain as it accumulates, causing burning and cramping.

A STRAIN is an abnormal stretch of muscle usually due to fatigue or over-exertion, leading to injury and is less severe than a SPRAIN, which is abnormal stretching (Grade 1), partial tearing (Grade 2) or complete tearing (Grade 3) of ligaments (the tough fibers that hold the bones together at the joints) or tendons. Normally, sprains and strains go away spontaneously in a few days or weeks with proper rest, exercise, medication, and therapy. Unfortunately, with continued pain and spasm, there is not time for healing. The muscle only becomes weaker and shortened, more easily injured and less able to function normally.

MYOFASCIAL PAIN & FIBROMYLAGIA

MYOFASCIAL PAIN SYNDROME (MPS) & FIBROMYALGIA SYNDROME (FMS)

The terms MYOFASCIAL PAIN and FIBROMYALGIA refer to syndromes of musculoskeletal discomfort.

Myofascial Pain Syndrome (myo = muscle and fascial = the covering of the muscle) or MPS refers to soft tissue tenderness and pain with a specific zone of discomfort or pain ("trigger point") within the muscle that triggers pain that refers away from the trigger point to contiguous areas.

The examiner can roll the muscle between the thumb and index finger to feel this taut band or trigger point, which then causes pain to be felt in the referral zone. This palpation is typically accompanied by a characteristic localized twitch response of the muscle. The patient's behavioral reaction to firm palpation of a trigger point is termed a positive jump sign; the patient withdraws ("jumps") or gives a verbal response such as "that's it."

Trigger points may be characterized as either active or latent. Active trigger points cause spontaneous pain at rest or with motion that stretches or overloads the muscle. There is some restricted motion of the associated muscle. Latent trigger points are quiescent and result primarily in muscle tightness and dysfunction with associated pain upon palpatory pressure.

In the experience of examiners, the described taut bands and visible muscle "twitching" are not consistently seen, but trigger points are accepted as manifestations of myofascial pain.

Common complaints with MPS include muscle spasm, tenderness, stiffness, limitation of motion, and weakness. Myofascial pain occurs equally in both sexes. X-rays and laboratory test abnormalities are not part of this condition and are either coincidental or reflect another condition.

Conversely, myofascial pain occurs frequently in inactive individuals indicating that trauma, either acute or cumulative, is not necessary for causation. Perhaps deconditioning itself can cause this condition. Still, in the presence of appropriate acute or cumulative trauma, industrial causation is reasonably medically probable as it would be for a muscle strain.

Causes of myofascial pain syndromes can therefore include acute and cumulative trauma, the physical condition and emotional state of the individual and also familial factors. In patients with a remote history of trauma and latent trigger points, MPS activation may come about with intense heat or cold, weather changes or emotional stimuli.

Myofascial pain or muscle strain defines primarily a muscle process. Referred pain from deeper structures, including bone, ligament, bursa, tendon, disc, joint and even viscera, must be excluded, especially when the pain is severe. Myofascial pain should not produce severe symptoms, so that an underlying cause should be sought in such situations. Severe pain, weakness or loss of motion should suggest another source, either organic or non-organic.

The characteristics of myofascial pain may long outlast the precipitating event, which sets up a self-generating pain cycle that is perpetuated through lack of proper treatment, sustained muscle tension, distorted posture, pain reinforcing behavior, and failure to reduce other contributing factors such as sleep disturbance.

Fibromyalgia Syndrome (FMS) is a chronic pain disorder characterized by diffuse muscle soreness and stiffness associated with specific, reproducible tender points. Most individuals suffer from sleep disturbance and many from emotional dysfunction. Many patients with fibromyalgia have multiple complaints suggesting a profound constitutional disorder. They commonly have subjective complaints of joint pain, stiffness, swelling, numbness or coldness of the extremities, headaches, bowel pain and irregularity, non-refreshing sleep and fatigue. Physical examination characteristically is normal, except for the described tender points. X-rays and laboratory tests are normal.

FMS is usually idiopathic (without a specific etiology). There is some thought that fibromyalgia may be triggered by physical or psychological trauma. Fibromyalgia appears to be quite common, possibly affecting 10 million Americans and an estimated 3–6% of the world population. FMS prevalence varies amongst ethnic and racial groups. While it is most prevalent in women - 75-90 percent of the people who have FM are women (most commonly between the ages of 30-50) - it also occurs in men and children of all ethnic groups.

The American College of Rheumatology notes that doctors diagnosed fibromyalgia based on all the patient's relevant symptoms and normal and no longer just on the number of tender places during an examination. There is no test to detect this disease. Though there is no cure, medications can reduce symptoms in some patients. Patients also may feel better with

proper self-care, such as exercise and getting enough sleep.

Fibromyalgia can coexist with other musculoskeletal disorders. The presence of other conditions does not exclude the diagnosis of fibromyalgia nor should the other condition be assumed the cause. On rare occasion hypothyroidism can cause similar symptoms that will respond to thyroid replacement. Treatment of a coexisting musculoskeletal condition, however, does not usually effectively treat fibromyalgia, confirming that fibromyalgia can coexist with and is usually not caused by other musculoskeletal disorders.

Many medical disorders are associated with FMS, including hepatitis C infection, HIV infection, systemic lupus erythematosus and rheumatoid arthritis, to name a few. The evaluation of FMS must consider these possibilities.

Most individuals with FMS have other concurrent complaints that roughly parallel the severity of the disorder and prognosis. These can include headaches, non-anatomic paresthesias, atypical (non-cardiac) chest pain, irritable bowel syndrome (recurrent abdominal pain and constipation and/or diarrhea), difficulty concentrating and thinking, non-refreshing sleep, fatigue, temporomandibular disorder, and other less common complaints. These are not part of the FMS criteria but are common complaints.

DIIFERENTIAL DIAGNOSIS

The differential diagnosis includes inflammatory and degenerative joint diseases, other connective tissue diseases, malignancy, visceral dysfunction, endocrine disorders (particularly thyroid), neurological diseases and psychological disorders. Chronic Fatigue Syndrome (CFS) and Multiple Chemical Sensitivity (MCS) patients have similar complaints to individuals with fibromyalgia, although with CFS, fatigue and cognitive problems seem to predominate, and with MCS, environmental sensitivities. With pain down a limb, a radiculopathy secondary to a herniated disk is a consideration, but similar symptoms can be found in patients with a myofascial pain syndrome.

Once other causes have been ruled out, attention should be focused on deciding if the diagnosis of MPS or FMS is reasonable. It is important to remember that people and their illnesses present as frequently complex with many factors contributing to their complaints.

Myofascial pain tends to be more acute in onset, regional in presentation, more amenable to treatment and characterized by trigger points. FMS tends to be more insidious in onset, more global in presentation, more guarded in prognosis, and characterized by discrete reproducible tender points.

TREATMENT

Treatment should be circumspect, well directed and realistic. Expectations and treatment must be tempered by the knowledge that outcome is frequently frustrated by continued symptoms.

Treatment for myofascial pain and fibromyalgia is directed first towards diagnosing and treating factors such as structural abnormalities, medical conditions or emotional dysfunction. Trigger or tender points are then identified and treated directly with a number of different techniques including spray (with an icy cold vapo-coolant such as fluormethane) and stretch, massage and acupressure. Acupuncture may also be beneficial. Other techniques include needling (trigger point injections) of the affected areas either with or without a local anesthetic. Steroid injections are not recommended.

A careful and graduated physical rehabilitation program of stretching, strengthening and conditioning coincides with these treatments. A TENS (transcutaneous electrical nerve stimulation) unit may be helpful. Other treatments include gentle aerobic conditioning, psychological approaches (biofeedback, psychotherapy, cognitive-behavioral therapy) and non-opioid medications (antidepressants, anti-neuropathic agents, muscle relaxants and nonsteroidal anti-inflammatory agents).

Treatment for fibromyalgia has proved less effective than for myofascial pain in terms of long-term results. The prognosis for these patients often includes a waxing and waning course without a true cure of the condition. One author reported no more than a 20% remission rate. Treatment should be limited, goal oriented and directed toward safely alleviating symptoms while assisting the patient in coping with a chronic problem.

FIBROMYALGIA, MYOFASCIAL PAIN AND THE INJURED WORKER

Based on the absence of objective findings neither of these disorders should usually be severely disabling in themselves in term of work and recreational activities, but the injured worker's perception of being ill may lead to somatic preoccupation and symptom magnification. The well-meaning health care practitioner whether it is a medical physician, nurse practitioner,

physician assistant, chiropractor or physical therapist, through excessive attention and treatment may inadvertently encourage illness behavior on the patient's part and thus "enable" the perception of disability and inability to work.

At the other extreme, these individuals may have seen several health care practitioners and been told there is nothing wrong with them and that they should see a psychiatrist. They can be anxious, frustrated, depressed, tired and impatient both with their illness and the medical profession. It is the job of the physician to gain the patient's confidence and reassure them that they have a legitimate condition for which there is treatment and that they do not have a life threatening or severely incapacitating illness.

The injured worker should remain emotionally and physically active and healthy and on the job. Disability from myofascial pain and fibromyalgia should not be severe given the well-preserved muscle bulk and strength, relatively good motion, and the paucity of correlating objective factors or findings of disability. Still, very physically strenuous or repetitive activities might need to be precluded depending upon the severity of the complaints.

Deciding a disability rating for individuals with FMS or MPS can be contentious due to lack of objective tests and soft (subjective) physical findings. Individuals classically do not have muscle wasting, muscle weakness, or loss of motion. Laboratory testing is normal. Indeed, no evidence of tissue damage has been documented. These observations indicate that disability is best rated on subjective findings taking into account the absence of objective findings. The AMA Guides does not provide an impairment rating for these disorders absent an objective finding.

SUMMARY

Myofascial Pain Syndrome and Fibromyalgia Syndrome continue to be regarded by some as specific and separate diseases while others consider them a continuum of the same problem. Other physicians consider either MPS or FMS wastebasket terms for soft-tissue complaints while others consider them simply nonexistent. Part of this confusion stems from the lack of attention to appropriate diagnostic criteria and the absence of correlating diagnostic testing abnormalities in patients who appear to demonstrate many psychological and behavioral symptoms.

There is significant clinical information though to support that both MPS and FMS are true medical entities and deserve appropriate attention and recognition. Evaluation and treatment of myofascial pain and fibromyalgia should include consistency, conviction and compassion.

Consistency in diagnosis and level of disability should be fair and based on the injured worker's true functional capacity for work activities; conviction that these disorders do exist and are common while realizing that they should not be over treated nor should the patient's perception of disability be encouraged; and compassion that these disorders defy analysis by more sophisticated techniques but are valid sources of physical discomfort and disability.

OSTEOARTHRITIS

INTRODUCTION

Osteoarthritis is the most common type of arthritis, dwarfing all other types combined. By 40 years of age, 90 percent of the population has radiologic changes of osteoarthritis, but many have no symptoms. Osteoarthritis causes symptoms in 25 percent of the population, usually becoming symptomatic after the age of 50. Osteoarthritis before the age of 40 is rare and suggests secondary causes.

TYPES OF OSTEOARTHRITIS

Primary osteoarthritis is of unknown cause and represents the vast majority of cases. Secondary osteoarthritis is caused by a known event such as trauma to the joint and underlying bone (subchondral bone), developmental deformity of the normal congruity of the joint or misalignment from ligamentous instability leading to imperfect movement of one joint surface on the other or the result of past disease of the joint, such as infection or rheumatoid arthritis. Progression in secondary osteoarthritis can occur prematurely and progress more rapidly.

PATHOGENESIS

The normal joint consists of bone capped with a unique type of cartilage (hyaline cartilage) that is stronger than any synthesized substitute. Underneath the cartilage cap is subchondral bone. This bone consists of a tough outer shell (cortex) and an internal system of struts that intertwine (trabecular bone). The struts provide lightness, strength, and increased shock absorption. The forces of the joint are transmitted through the cartilage to the subchondral bone, decreasing stress and wear on the cartilage.

The perimeter of the joint is lined with synovium -- a thin sheet of cells that encompasses the entire periphery and attaches at the margins of the joint. This provides nutrition and secretes a fluid that reduces joint friction. The joint capsule also entirely surrounds the joint and is composed of a specialized layer of ligaments that form a second compartment that augments joint stability. Surrounding this entire arrangement are additional ligaments, providing further stability, tendons and muscles that attach near the joint to provide joint power and motion and bursa that act as friction pads for joint motion.

The architecture of the joint also provides joint stability and dictates the direction of joint motion. Specialized pads of fibrocartilage, and not hyaline cartilage, that are more susceptible to trauma, form menisci of the knee. The lateral meniscus is in the lateral compartment of the knee, and the medial meniscus is in the medial compartment of the knee. These attach to the margins of the knee, enhancing joint stability and by spreading stress over a larger area, reducing the wear on the joint. Dysfunction of the meniscus allows instability and more wear of the joint. Internal ligaments of the knee (cruciate ligaments) also provide stability. Tear of either the menisci or internal ligaments can lead to secondary arthritis. Some joints, like the ball-and-socket joint of the hip, are inherently very stable. Most other joints, however, require ligamentous integrity for normal stability and motion. Damage to this normal support system of ligaments can lead to misalignment that can cause secondary osteoarthritis. Damage to the articular cartilage, especially if combined with damage to the subchondral bone, can cause secondary osteoarthritis. Diseases that affect joints, such as rheumatoid arthritis or infection, can permanently damage the joint and cause osteoarthritis.

In both primary and secondary osteoarthritis, the cartilage deteriorates because of biochemical events that degrade the normal composition and function of the cartilage. What initiates this process is unknown. Cartilage is lost irregularly, so that joint space loss on x-ray (which appears as decreased space between the ends of the bones forming the joint) is usually irregular. Bony spurs (osteophytes) form near the margins of the joints or vertebral bodies. These are a reaction to loss of cartilage and an attempt to further buttress the joint. Spurs alone, however, are common without damage to the joint or disc and cannot be considered definitive evidence of true osteoarthritis.

In more advanced cases the subchondral bone eburnates (polishes and enlarges). This is manifested on x-ray as density (sclerosis) of the subchondral bone. Bony cysts in the subchondral bone form by a mechanism not totally understood.

Of all these findings, irregular joint space narrowing or intervertebral disc narrowing is most diagnostic of osteoarthritis. As mentioned above, bony spurs are common without true damage to the joint or disc space. Without joint or disc space narrowing, spurs cannot be considered true osteoarthritis but degenerative changes that occur with aging.

Indeed, the term degenerative arthritis is a misnomer, as this suggests deterioration from aging and wear and tear. Neither is mainly responsible for primary osteoarthritis, which requires active biochemical events in the cartilage to cause cartilage deterioration.

EPIDEMIOLOGY

Osteoarthritis occurs with aging but is not caused by aging for the reasons noted above. Osteoarthritis of the hip is much less common in Asians and Afro-Americans than Caucasians. Osteoarthritis of the fingers is more common in women, especially nodal osteoarthritis associated with Heberden's and Bouchard's nodes of the distal and proximal interphalangeal joints, respectively. Osteoarthritis of the thumb carpometacarpal joint (CMCJ) is much more common in women than men. Osteoarthritis of the knee is equal in men and women, but when it occurs before the age of 50, is more common in men. Osteoarthritis also occurs with certain diseases, but this is beyond the scope of this paper. The role of acute and cumulative trauma in causing osteoarthritis, especially in the workplace, will be discussed below.

CLINICAL FINDINGS

Pain is the hallmark of symptomatic osteoarthritis and usually occurs with motion or weight bearing. Stiffness of the joint, especially after being kept in one position too long or first thing in the morning upon arising, is common but is usually rapidly relieved by motion. Joint enlargement from soft tissue proliferation around the joint, osteophytes and bony enlargement of the subchondral bone, make the joints feel either firmly enlarged or swollen but without large amounts of fluid (effusion). Indeed, large effusions (fluid in the joint) are relatively uncommon. Crepitus (grinding and popping of the joint with motion) is caused by motion of the irregular joint surface. Pain usually begins insidiously but can be punctuated by acute episodes, sometimes accompanied by a large effusion. Most symptomatic osteoarthritis is slowly progressive, although the disease can spontaneously arrest.

The pattern of involvement is important both in terms of the type of osteoarthritis and the extent of disability. Primary osteoarthritis commonly involves select joints: The distal interphalangeal joints and proximal interphalangeal joints of the fingers, the thumb carpometacarpal joint, the acromioclavicular joint lying above the true shoulder joint, the hip, the knee and the great toe metatarsal phalangeal joint. A similar process affects the facet joints of the spine and the intervertebral discs. The discs are actually composed of fibrocartilage and are not true joints, but the same term (osteoarthritis) commonly refers to disc degeneration. Other terms, perhaps more appropriate, for disc degeneration are spondylosis and degenerative disc disease. When other joints are involved, for example the wrist, elbow, true shoulder joint (glenohumeral joint) or ankle, secondary causes should be scrupulously investigated, as these are rarely involved in primary osteoarthritis.

JOINT SPECIFIC CHARACTERISTICS

Osteoarthritis of the distal (DIP) and proximal (PIP) interphalangeal joints of the fingers can be associated with prominent nodal enlargement (Heberden's nodes of the DIP and Bouchard's nodes of the PIP joints), which is a subset of osteoarthritis that is genetically determined and is much more common in women around the menopause. In typical osteoarthritis of the fingers or with nodal osteoarthritis, decreased joint motion and fist closure is common. Joint deformities, which are usually mild, are also common, but disability is usually not severe, as pain is usually not severe. The hand has tremendous reserve function, which is why osteoarthritis typically produces less disability. Thumb carpometacarpal (CMC) joint osteoarthritis, however, is the exception. Because the thumb represents 50 percent of the function of the hand, especially for pinching and power grasping, very symptomatic osteoarthritis of this joint causes substantial disability. Bony enlargement of the thumb

gives a squared-off appearance to the base of the thumb. Subluxation laterally is common in more advanced cases, although the joint is not usually hypermobile but actually has reduced motion, especially abduction and adduction.

The acromioclavicular joint above the true shoulder joint is usually enlarged by the time symptoms occur. This joint can be painful, or inferior spurs of the joint can impinge on the tendons of the shoulder (rotator cuff) leading to impingement syndrome and rotator cuff wear and tear.

Many authorities believe that osteoarthritis of the hip arises from minor developmental deformities of the joint leading to joint incongruity and excessive wear. Pain can localize to the groin, as the hip joint actually sits deep in the pelvis. Sometimes pain referred to the knee is much more prominent than hip pain, emphasizing the importance of examining both when knee pain is prominent. Pain on flexion combined with abduction and external rotation of the hip (Patrick's test, also referred to as FABERE test) is common. Reduced internal rotation is usually the first sign of limited motion.

Knee osteoarthritis is frequently associated with angulation of the knee. Most commonly the loss of the medial joint space leads to a varus deformity (knees together), and less commonly loss of the lateral joint space leads to valgus deformity (knees apart). The patellofemoral joint (kneecap) can be involved alone, but usually is involved with other compartments of the knee. Pain with motion or weight bearing is usually the first complaint. Firm or bony enlargement is common. Limited motion and joint line tenderness occur later. Joint effusions are usually small, but occasionally acute episodes are associated with large joint effusions.

Osteoarthritis of the metatarsal phalangeal joint (MTP) of the big toe can lead to enlargement and stiffness of the joint. This can cause pain on toe-off during walking or climbing.

Spinal osteoarthritis can affect all three areas of the spine, but thoracic osteoarthritis rarely causes symptoms. The disc acts as a roller bearing so that reduced forward motion in symptomatic osteoarthritis of the disc is common but can occur without pain. The facet joints are responsible for most lateral and oblique movements and extension. Both the disc spaces and facet joints are frequently tender in symptomatic osteoarthritis, and motion is frequently painful and limited. Bony overgrowth, combined with disc space and intervertebral narrowing, can cause compression of the nerves. When this occurs in the central spinal canal, it is referred to as central spinal stenosis. When this occurs in the intervertebral foramen, it is termed foraminal stenosis. Both can cause aching of the leg with standing or walking (spinal neurogenic claudication). Sometimes back pain is more prominent than leg pain, and other times it is the reverse. When a disc herniates, previously asymptomatic spinal stenosis can be converted to symptomatic spinal stenosis by loss of further space in the spinal canal or intervertebral foramen. Neurologic findings in spinal stenosis occur much less commonly, including changes in sensation and reflex, loss of muscle power and bulk and nerve root tension signs, such as straight leg raising. This makes evaluation more problematic.

DIAGNOSTIC TESTING

Osteoarthritis is not associated with blood abnormalities. Blood tests are done to exclude other diagnoses. Joint fluid, when present, shows minimal abnormalities with slightly increased white blood cell counts. X-rays remain the best tool to confirm the diagnosis. Sometimes symptoms precede x-ray changes. The most reliable sign of osteoarthritis, either of the joint or disc is actual narrowing of the joint or disc space. Other findings, such as spurring, can simply indicate aging and do not necessarily mean true osteoarthritis. MRI of both the joints and spine can detect earlier changes than x-rays. The significance of these abnormalities in correlating with a clinical diagnosis must be on a case by case basis. Important mechanical causes of osteoarthritis, however, include significant leg length discrepancy, and examination for any ligamentous or internal joint instability. A careful work and recreational history may point to a traumatic event in the past. Frequently the history, physical findings and simple laboratory testing, including blood testing, synovial fluid analysis and x-rays, yield the proper diagnosis.

DISABILITY

The location of the joint involved, the number of joints involved and the severity of pain, loss of motion and weakness determine loss of functional ability or disability. The fingers can tolerate substantial loss of motion and still function relatively well. Severe pain is less common with finger joint involvement but can occur and cause substantial disability. The

thumb carpometacarpal joint, when more symptomatic, markedly reduces hand function because of its prominent contribution to power grasp and pinch. Acromioclavicular joint disability is rarely severe except for its contribution to impingement of the rotator cuff. Hip and knee osteoarthritis, when very symptomatic, are very disabling, as these are weight bearing joints. Involvement of the great toe metatarsal phalangeal joint rarely causes severe disability except when pain and stiffness significantly limit toe-off during walking and climbing. Spine involvement can be very disabling from disc or facet pain and, less commonly, spinal stenosis.

Usually osteoarthritis, except of the fingers, is limited to only one or two joints. When more than three areas are involved, the condition is termed generalized osteoarthritis. This is not uncommon. Multiple joint involvement can be confused with other diseases, and it frequently causes more disability. The same is true of disability from bilateral involvement of the hips or knees.

TREATMENT

The primary goals are to decrease pain and improve function. Education of the patient in the nature of the disease and the principles of treatment are the first priority. The patient should be strongly encouraged to increase physical activity that is not high impact, improve diet and achieve near ideal body weight. Obesity places increased stress on the joints. Generalized exercise, especially aerobic exercise, and exercises specific for the involved joint or spine, decrease pain and improve function. Generalized exercises are essential. Specific exercises increase joint mobility, reduce joint instability, and improve muscle strength. Strengthened muscles frequently reduce pain. Muscles provide stability and shock absorption for joints. For example, improvement of the rotator cuff muscles of the shoulder re-balances the muscles and can lessen impingement. Improvement of strength of the knee acts as a natural shock absorber for the knee, reducing pain. Increased muscle strength of the extensor and flexor muscles of the spine increases stability and reduces pain.

When such treatment is not enough, medication to reduce pain should start with the simplest and that associated with the least side effects. Tylenol can frequently help in milder cases. In moderate cases nonsteroidal anti-inflammatory drugs (NSAIDs) provide more relief. These medications can occasionally have serious side effects, especially in high-risk groups. Gastrointestinal side effects are common, and ulcers of the stomach and duodenum can cause serious morbidity and even mortality. In high risk groups there are prophylactic gastrointestinal protective medications that can reduce the risk. Individuals prone to kidney disease, especially diabetics, elderly individuals, those with heart failure and those on certain medications for hypertension or heart failure, are at increased risk of kidney dysfunction. These patients require more frequent monitoring. Other side effects, including liver disease, are much less common. Individuals at high risk must be monitored with blood testing frequently initially and those at low risk less frequently.

Supports and splinting can provide additional relief by resting the joint or enhancing stability. Intra-articular injections of corticosteroids can reduce symptoms up to months and sometimes even longer. Hyaluronate injections can restore normal viscoelasticity of the joint fluid and reduce pain for months.

In more advanced cases a variety of invasive techniques are available. Sometimes simple lavage (rinsing out) of the joint can provide temporary relief. This can be done with needles or at the time of arthroscopy. Arthroscopic debridement (scraping) of the joint surface, used for the knee, can provide relief for months and sometimes a year or more. Drilling holes in areas of cartilage loss can promote fibrocartilage generation, which can increase the joint space, decrease pain and improve function, sometimes for extended periods.

Certain specific procedures are available, such as removal of the acromioclavicular joint (Mumford procedure) and high tibial osteotomy to realign knee joints with primarily early medial joint compartment involvement. Arthrodesis (fusion) of finger and the thumb IPJs and the metatarsal phalangeal joint of the great toe are preferred, since joint replacements frequently break down. Still, replacement of finger and great toe joints is sometimes used, especially in individuals with primarily pain and not much loss of motion. Specialized procedures for the thumb CMCJ besides arthrodesis include implanting ligaments, (anchovy procedure) in the joint space, acting as a cushion and reducing pain. Total hip and knee joint replacements are successful in the vast majority of cases. The longevity of currently used devices is quite good. Total knee replacements frequently last indefinitely. Total hip replacements deteriorate at approximately one percent per year. Obviously, these replacements are best saved for older individuals, but they can be used very successfully even in younger individuals. Even

with excellent results significant prophylactic disability must be imposed to prevent premature wear of these devices. Fusion of painful lumbar spinal discs using cages of metal in the disc space that promote bony ingrowth and pedicle screw systems to enhance fusion are new and still controversial techniques. These are the equivalent of arthrodesis (fusion) of a painful joint, except for the disc. Many remain skeptical that lumbar disc fusion will be as successful as joint fusion, and disc fusion should be approached with caution.

PREVENTION

Little is known about prevention beyond the basics. As what causes primary osteoarthritis is not known, there is no antidote. Certain common-sense rules apply: Eating a healthy diet, exercising moderately, maintaining near ideal body weight and avoiding acute injury. In the workplace proper ergonomics, rotating workers through repetitive, strenuous jobs, and workplace safety could substantially reduce the risk of osteoarthritis.

WHEN IS OSTEOARTHRITIS INDUSTRIAL?

Acute trauma can light up preexisting and even asymptomatic osteoarthritis.

Cumulative trauma is more problematic. Clearly, repetitive, especially when strenuous, use of the joints places substantial stress on the joints. Bending at the waist, squatting, kneeling, climbing, heavy carrying and lifting, or even standing and walking in obese individuals, imparts considerable stress to the joints.

There is both clinical and experimental evidence that repetitive use of joints, especially when combined with strenuous use, can lead to osteoarthritis in certain circumstances. Strenuous use of the spine can cause or accelerate osteoarthritis of the spine in susceptible individuals. Even the relatively durable hyaline cartilage of joints can be stressed to the point of damage by repetitive and strenuous work. Less problematic is the contribution of repetitive trauma to already existing osteoarthritis. Such joints and discs are more susceptible to trauma, and the threshold for accepting causation is less.

Osteoarthritis of the knees is associated with obesity, especially in women. Kneeling and strenuous work are also associated with osteoarthritis of the knees and hips. Whole body vibration is strongly associated with osteoarthritis of the spine, whereas segmental vibration of the extremities is rarely associated with osteoarthritis. The best studies of pattern of use are those of the hand, where pattern of use has been associated with increased osteoarthritic changes on x-ray, strongly suggesting that certain repetitive use of the fingers can cause or accelerate osteoarthritis.

The bottom line is that each case must be evaluated on its own merits, carefully documenting the work history and the likelihood of cumulative trauma depending upon how strenuous and repetitive the pattern of use and the pre-existing state of the joint or disc involved.

SUMMARY

Osteoarthritis is the gradual and irregular deterioration of joint hyaline cartilage or spine fibrocartilage. It is not simply wear and tear or aging but rather an active biochemical process that damages the cartilage. Although the hyaline cartilage of joints is relatively impervious to trauma, trauma can cause osteoarthritis in certain circumstances, especially when there is permanent damage to the cartilage and subchondral bone, malalignment of the bone, joint instability or illnesses that damage the joints. Although most individuals have degenerative changes on x-ray by the age of 40, only 25 percent of the population develops symptomatic osteoarthritis, usually past the age of 50. Still, this makes osteoarthritis a very common disease, exceeding all other types of arthritis combined.

The hallmark of symptomatic osteoarthritis is pain. Other findings include bony enlargement and soft tissue swelling of the joint with large effusions the exception, limited motion, crepitus and disc and joint tenderness. The best diagnostic test remains x-ray. Narrowing of the joint or disc space indicates deterioration of the joint or disc cartilage and is the best determinant of osteoarthritis. The significance of early MRI changes of osteoarthritis remains problematic and requires matching complaints and physical findings.

Treatment is frequently successful, starting with the least risky measures, such as weight reduction, exercise and diet, and progressing up the pain ladder, using analgesic cream, supports, acetaminophen and non-steroidal anti-inflammatory drugs. Opioids should be avoided. Injections of corticosteroids and hyaluronate can reduce symptoms for months and sometimes longer. More aggressive management includes joint lavage, joint debridement and drilling of osteoarthritic areas to promote fibrocartilage growth. Surgery, most commonly total hip and knee replacement is frequently successful. Arthrodesis (fusion) of other joints, including the fingers and great toe metatarsal phalangeal joint, are usually preferred to joint replacement. The thumb carpometacarpal joint can be fused or cushioned using ligament imposition. The acromioclavicular joint can simply be removed, as it has very little function. Surgery for degenerative arthritis of the spine including using instrumentation (plates, cages and screws) is appropriate in selected cases. Prevention includes diet, exercise and maintaining ideal body weight. In the workplace avoiding prolonged, repetitive, strenuous activities by job rotation, proper ergonomics and workplace safety could substantially reduce osteoarthritis. The disability from osteoarthritis can be substantial, especially if it involves multiple joints or weight bearing joints of the lower extremities.

NECK PAIN & INJURIES

INTRODUCTION

Neck or cervical pain is ubiquitous in society and particularly common as a presenting cause of pain and disability among injured workers. It is so common that the expression "a pain in the neck" has become a figure of speech in our language. Causes for these cervical problems are numerous and include cervical spine or disc degenerative disease (spondylosis), damage to the spinal cord (myelopathy) or nerve roots (radiculopathy), muscular or myofascial syndromes and other more ominous spinal and non-spinal conditions.

EPIDEMIOLOGY

Neck pain represents less than 2% of all workplace injuries and is far less prevalent than low back pain as a cause of worker absenteeism. The one-year prevalence rate of neck pain in most industrialized countries is approximately 20%. The majority of these injuries are diagnosed as either a strain or sprain.

Certain occupations seem to have a predisposition to neck symptoms. Manual laborers have more symptoms than office workers, and the type of work seems to affect the risk. A history of twisting and bending during work as well as older age are strong risk factors. Workers who have been required to do repetitive tasks with their upper extremity as well as prolonged sitting with their head in a flexed position, such as during keyboarding, are at risk of developing mechanical neck pain. Studies have additionally pointed out the importance of non-physical or psychosocial factors such as job or life satisfaction in determining disability status and treatment outcome. X-rays cannot be used to predict symptoms or disability status.

ANATOMY

The cervical spine is significantly different in motion and function from the rest of the spine. Whereas the lumbar spine is well suited to accommodate heavy loads and provide stability, the cervical spine is better suited for mobility and is not required to transmit heavy loads. The neck is more subject to injury than any other portion of the spine because of its position and mobility.

The cervical spine is positioned on top of the relatively immobile thoracic spine. The head needs to be very mobile because it is balanced on top of the neck to bend and rotate through a wide range of motion, which maximizes our visual and auditory ability. The cervical spine also supports the muscles of the shoulder girdle and those that move the thoracic outlet during breathing.

In addition to the special articulations of the head and neck (occiput and C1) and C1 and C2 (atlanto-axial) as well as cervical vertebrae C3 through C7, other areas at risk for possible injury include the posterior facet (zygapophyseal) joints, the intervertebral discs, as well as the cervical spine muscles and their attachments.

There are seven cervical vertebrae with the upper two, the atlas (C1) and the axis (C2) being unusual in configuration while the lower five (C3 - C7) are similar in appearance. It is best to think of the cervical spine as made up of functional units: each two adjacent vertebra and their interposed tissues forming a functional unit. The bony structure and the ligaments that connect the vertebrae limit neck motion. The anterior portion of the functional unit comprises two vertebral bodies separated by the intervertebral disc which functions like a hydraulic shock absorber. The posterior portion includes the transverse processes, the posterior spinous processes and the supporting ligaments along with the articulating synovial facet (zygapophyseal) joints. These joints allow the complex movements of lateral flexion and axial rotation in addition to anteroposterior flexion and extension. When injured, the facet joints can refer pain into the neck, shoulders, and posterior head (occiput).

The eight cervical nerve roots exit through and occupy one-third of canal-like structures called the intervertebral foramina. The foramina are largest at vertebrae C2-3 and progressively decrease in size to C6-7. The first cervical root exits between

the skull and the atlas (C1 vertebra) with the last cervical root (C8) exiting between vertebra C7 and T1. A C5-6 disc herniation will affect the C6 nerve root and a C6-7 herniation will affect the C7 root.

CERVICAL SPONDYLOSIS

Cervical spondylosis or degenerative disease of the cervical spine and its cartilaginous and ligamentous structures occurs over time due to cumulative and specific trauma. It is also a natural consequence of the aging process and is a common finding on x-rays of older individuals. While in the majority of cases, cervical spondylosis is not associated with significant symptoms, it can be associated with muscular and neurologic dysfunction along with pain and disability.

The discs, even in asymptomatic normal individuals, fragment, lose water content and collapse as we get older. Over time this disc degeneration leads to mechanical stress and bone formation or overgrowth at the vertebral body edges leading to bony bars (osteophytes) that can extend, impinge and encroach on nervous tissue. These osteophytes or "hard" discs are distinguished from "soft" disc protrusions or herniations that occur more commonly in young and middle-aged people.

Bony overgrowth and protrusions or collapse may contribute to spinal stenosis, a narrowing of the spinal canal or the neural foramina (the channel that the nerve roots run through). This can result in spinal cord impingement (myelopathy) or nerve root compromise (radiculopathy).

While there is some debate as to the role of cumulative occupational trauma in cervical spondylosis, it is generally accepted that an increased incidence is noted in individuals who carry heavy loads on their heads or shoulders and degenerative cervical disease is also seen in dancers and gymnasts. In an individual with a spine already compromised by spinal stenosis, repeated or severe cervical motion, particularly at the extremes of range over time will lead to cumulative trauma. Even when cumulative trauma is not specifically involved, cervical problems may develop associated with work activities and "light up" an underlying cervical degenerative (spondylosis) problem.

While cervical spondylosis is common and most often asymptomatic in the general population in middle and later years, it may also result in a variety of symptoms leading to complaints of pain and dysfunction.

CERVICAL RADICULOPATHY

Cervical radiculopathy is a pathologic process involving compromise and damage of the nerve root arising from compression secondary to disc herniation, cervical spondylosis or stenosis, tumor or trauma. Cervical radiculopathy can also present without any clear cause. It stands to reason that a similarly sized disc herniation in two individuals can result in two completely different clinical pictures. A disc herniation, when there is also congenital spinal stenosis, may be much more damaging than when no stenosis is present. One spine has more "room" to accommodate the encroaching disc herniation without severely compressing the nerve while in the individual with stenosis significant compromise may occur.

The most commonly involved nerve roots in cervical radiculopathy are caused by C5-6 or C6-7 disc herniations or spondylosis. The symptoms of cervical radiculopathy can include pain, abnormal sensations (paresthesias) and weakness. Complaints may involve the neck and upper back and/or the upper extremity. While there may be "objective" findings of reflex or strength changes in the affected limb in some individuals, the neurologic examination may be normal in others. Many patients present with a normal neurologic exam yet complain bitterly of neck and upper back or scapular discomfort with or without radiation to the arm. The pain may also be atypical and present as chest, breast, or facial pain. Complaints of headaches are common.

In addition to checking circumferential measurements for muscle atrophy, range of motion, strength, sensation and reflexes, the examiner may check neck or foraminal compression (Spurling’s maneuver) in which the head is extending backwards and to the symptomatic side and pressure is applied to the top of the head. This movement and pressure compresses or further narrows the space in the foramina for the nerve root thus eliciting symptoms.

CERVICAL MYELOPATHY

While a radiculopathy affects a nerve root, a myelopathy suggests compression and injury to the spinal cord itself. Cervical myelopathy, when not related to immediate trauma, is commonly secondary to degenerative spondylitic changes. It typically presents after the fifth decade and is often confused with other diseases. Individuals with this problem present with a slow progressive history of neurologic deterioration with remissions and exacerbations. Progressive myelopathy leads to subtle gait disturbance with lower extremity increased reflexes and tone (upper motor neuron lesion) and polyradiculopathic (lower motor neuron) changes in the upper extremities. There may be bowel and bladder dysfunction with episodes of incontinence. The differential diagnosis can include such diseases as amyotrophic lateral sclerosis (ALS) or multiple sclerosis (MS).

WHIPLASH

Whiplash injuries are based on physical pathology but are significantly affected by psychosocial factors. These factors can include such issues as coping strategies, family and work place problems, and an adversarial compensation/litigation system. Whiplash injuries result in a collection of musculoligamentous symptoms (sprain/strain) typically involving rapid neck acceleration-deceleration and torsion often as the result of an automobile accident. The diagnosis is determined by the history provided, by the mechanism of injury, the symptoms and the physical findings on examination.

Neck pain is the most common manifestation of whiplash. The pain is typically described as dull and movement worsens aching over the back of the neck which. Sharp pain is often noted with quick movement and there are often associated complaints of stiffness and restricted neck motion. Pain may radiate to the head, upper back or shoulders. Headaches are also a common feature of whiplash with pain starting in the back of the head and moving forward. Other complaints can include visual disturbances, insomnia, dizziness, swallowing problems, weakness, and arm pain, sensations of numbness and tingling and occasionally memory and concentration problems. Whiplash sufferers can present with temporomandibular joint (TMJ) dysfunction, thoracic outlet syndrome and also with upper body myofascial pain and fibromyalgia complaints.

Common physical findings include posterior cervical tenderness and limited, painful cervical range of motion. Both cervical and upper back musculature may be tender and in "spasm." The neurological examination is usually normal. Radiologic findings will be minimal and may show straightening of the normal cervical curve secondary to muscle spasm. Pre-existing degenerative changes may be evident.

It is a mistake to discount physical injury and pain after whiplash as "compensation or litigation neurosis." There is good clinical evidence to support the physiologic basis of physical injury after whiplash. On the other hand though, it should be strongly emphasized that how an individual responds to injury and discomfort will often have more to do with psychosocial, historical and genetic factors than the physical damage itself.

OTHER CAUSES OF UPPER BODY COMPLAINTS

There are many possible causes of pain, sensory complaints and weakness that can affect the neck and upper body. This includes, but is not limited to, carpal tunnel syndrome, ulnar nerve entrapment at the elbow (tardy ulnar palsy), thoracic outlet syndrome, various tendinitis/bursitis problems, shoulder damage, neuropathy, and brachial plexus injuries. There are a host of other more ominous spinal and non-spinal conditions that deserve consideration, and which may present as cervical pain.

DIAGNOSTIC TESTING

Cervical x-rays can be helpful to define the degree of degenerative changes but must be considered with caution as cervical spondylosis is commonly found in asymptomatic individuals. Plain x-rays can reveal disc space narrowing, rheumatologic disease, destructive lesions, slippage, stenosis, fractures and instability with flexion-extension views. Magnetic resonance imaging (MRI) is noninvasive while showing good detail of neural elements. Gadolinium can be used in post-surgical spines to evaluate he presence scar tissue. When there are technical or individual reasons why the patient cannot undergo MRI testing, the most reasonable alternative is Myelography/CT scanning. Electrodiagnostic studies (electromyography or EMG and nerve conduction velocity or NCV) may help distinguish the presence of a radiculopathy at a certain cervical root level or show evidence of peripheral nerve compromise.

GENERAL TREATMENT GUIDELINES

Initial care starts with providing patient education and assurance. Patient comfort is important and can usually be achieved with nonprescription analgesics. When such medications are insufficient, prescribed pharmaceuticals may be added along with physical methods.

Acetaminophen is the safest effective medication for acute cervical problems, but nonsteroidal anti-inflammatory drugs (NSAIDs), including aspirin and ibuprofen, are also effective although they can cause gastrointestinal or other problems. These drugs should not be taken concomitantly with regular alcohol intake.

Muscle relaxants are commonly prescribed but seem to be no more effective than NSAIDs and cause drowsiness in up to 30 percent of patients taking them.

Corticosteroids both orally or by epidural injection can be effective with cervical root irritation but have limited usefulness and need to be part of an overall rehabilitation-oriented treatment regimen.

Opioids appear no more effective than safer analgesics for managing acute neck symptoms. Opioids should be used sparingly and only for a short time in most situations. There is a role though for the use of opioids in chronic cervical pain syndromes in selected individuals when increased function results without untoward side effects.

Physical methods of treatment are numerous and include manipulation, traction, physical modalities, invasive techniques and other various therapies. Acupuncture is effective in selected individuals.

Spinal manipulation is safe and effective for patients in the first month of cervical symptoms without radiculopathy. If manipulation has not resulted in symptomatic and functional improvement after 4 weeks, the patient should be reevaluated.

Passive modalities such as heat and massage may play a limited role in acute cases but should be short term and part of a more functionally oriented neck rehabilitation program. Many cervical patients have referred pain to the upper back and extremity and should engage in a regular stretching and exercise program. Traction does appear to benefit the individual with a disc herniation but will often cause increased discomfort when the cause of symptoms is musculoskeletal or mechanical.

Patients with acute cervical problems should avoid undue irritation from activities and postures that increase stress on the neck and thus aggravate symptoms. Proper neck positioning and posture with work simplification should be taught to the patient. Debilitation should be avoided by having the patient engage in an incremental, gradually increasing program of aerobic (endurance) conditioning exercises.

Isometric exercises should be started early followed by gentle range of motion exercises. More vigorous strengthening, stretching and conditioning should follow this. The individual should be taught proper neck care and good body mechanics. This should all be followed with a self-directed neck rehabilitation program.

Surgery may be a reasonable alternative for selected individuals when psychological issues are at a minimum and there is a good correlation between the clinical and radiologic findings.

RETURN TO WORK ISSUES

Keeping the injured worker with acute cervical symptoms on the job is often a difficult decision for the clinician. Being off work for more than short periods of time can lead to increasing perceptions of being disabled and unable to return to the job. Alternatively, work activities, particularly prolonged sitting with poor posture or with the head in a fixed position can aggravate neck symptoms.

The best prescription for return to work should take into consideration the job demands balanced by the injured worker's diagnosis and functional ability. The clinician, injured worker and employer should work together to arrange for appropriate ergonomic job modifications that allow for safe early return to work.

SUMMARY

Neck or cervical pain is ubiquitous in society and particularly common as a presenting cause of pain and disability among injured workers. Causes for these cervical problems are numerous and include cervical spine or disc degenerative disease (spondylosis), damage to the spinal cord (myelopathy) or nerve roots (radiculopathy), muscular or myofascial syndromes and other more ominous spinal and non-spinal conditions. Diagnosis should start with a careful history and physical examination followed by rehabilitation oriented functional treatment program. Selected individuals benefit from surgical intervention. Injured workers who become increasingly psychologically and physically dysfunctional should be referred to the appropriate center for chronic pain management.

THORACIC OUTLET SYNDROME (TOS)

INTRODUCTION

The diagnosis and treatment of thoracic outlet syndrome (TOS) has evolved over many years surrounded by controversy and disagreement. In fact, even the existence of this syndrome as a true clinical entity has been questioned. The weight of clinical and scientific evidence though does suggest that certain individuals have symptoms and signs compatible with the diagnosis of thoracic outlet syndrome. In the great majority of these patients, a successful outcome can be achieved with a careful diagnostic workup and a conservative rehabilitation approach. Surgery is occasionally indicated in specific cases or when the rehabilitative approach has failed.

DESCRIPTION & ANATOMY

Thoracic outlet syndrome is a term describing compression of the nerves (brachial plexus) and/or the vessels (subclavian artery and vein) to the upper limb. This compression occurs in the region (thoracic outlet) beneath the clavicle (collar bone) between the neck and the shoulder. The thoracic outlet is bounded by several structures: the anterior and middle scalene muscles, the first rib, the clavicle, and, at a lower point, by the tendon of the pectoralis minor muscle.

The brachial plexus is a branching group of nerves that form from the nerve roots as they leave the spinal cord in the region of the cervical spine (neck). The brachial plexus passes anteriorly and downward, passing behind and underneath the clavicle (collar bone) where it branches into the peripheral nerves which course below and in front of the shoulder, and then down the arm to provide motor (strength) and sensory (feeling) function to the upper extremity.

As the brachial plexus and subclavian vessels pass through the thoracic outlet, there is potential for both static and dynamic compression and/or compromise. Since the thoracic outlet is a closed space, any intrusion or swelling such as from a fractured clavicle, hypertrophied or spasming muscle or tumor can lead to static compression of the structures that pass through that space. Further, in an already “tight” or compromised thoracic outlet, dynamic movements, such as holding the arm overhead and backward (hyperabduction), will put further compression on the enclosed structures and bring on symptoms. Even breathing can add compression to the thoracic outlet. Breathing is normally begun with the diaphragm, but in paradoxical or chest breathing the patient starts by elevating the upper ribs with the scalene muscles and this tightens the thoracic outlet.

SYMPTOMS

The character and pattern of symptoms will vary depending on the degree to which the nerves and/or blood vessels are compromised. The patient may complain of tingling, numbness, weakness and discomfort particularly down the inside of the arm going into the hand. There may also be swelling, paleness and coldness of the arm and hand. Other related symptoms may include headaches in the back of the head and pain in the neck, shoulder and arm. Symptoms can be brought on by overhead activities such as hair combing, or at night when sleeping on one side which can put pressure on the structures within the thoracic outlet. Each of these maneuvers/positions causes a tightening or compression of the thoracic space. Thus the nerves and/or blood vessels may be compromised and produce the associated symptoms.

THE CONTROVERSY

Over the years TOS has taken on a negative connotation because of poor surgical results or because it has often been employed as a “wastebasket” term when the treating clinician is short on a diagnosis and unable to explain the patient’s complaints. This has resulted in much controversy and disagreement among professionals along with confusion and distrust among claims examiners and patients.

TOS is commonly confused with the following clinical entities: cervical nerve root compression from a protruded disc or degenerative spine disease, stretch injuries to the brachial plexus, tumors, a myofascial pain syndrome or peripheral upper extremity nerve entrapment.

Once the diagnosis is made, too many practitioners have been quick to offer a surgical remedy. A surgical approach is at the core of the controversy precisely because it has either been too often recommended to treat clinical entities that are not TOS or else surgery has been inappropriately used in patients with TOS, with poor results in either case.

Thoracic Outlet Syndrome does exist and is usually treatable with a non-invasive physical rehabilitation approach. Surgery should be reserved for the exceptional case.

DIAGNOSIS

At the foundation of appropriate treatment for TOS, or for any pathology for that matter, is careful diagnosis. Diagnostic tests, such as EMG's or NCV's, may show non-specific abnormalities, but are often normal in patients with TOS. Therefore, these tests are used more for differential diagnosis than confirmation of the diagnosis of TOS. Specific protocols for TOS MRI scanning have become available.

After taking a thorough history, the physician or therapist will do a physical examination and then may perform a variety of thoracic outlet compression maneuvers during the physical examination to reproduce the patient's symptoms and thus help pin down the diagnosis. Thoracic outlet compression tests must be interpreted carefully, since even asymptomatic individuals can develop arm numbness, tingling, pain, and diminution of the wrist pulse with these maneuvers. It is a challenge to the clinician to determine the significance of findings on examination in light of the entire clinical picture, including consideration of non-organic, psychosocial factors of disability and dysfunction.

TREATMENT

Treatment approaches for thoracic outlet symptoms are directed toward alleviation or reduction of compression of this space. Surgery, if indicated, may involve total or partial removal of the first rib and an occasionally present extra cervical rib. One of the scalene muscles may also be removed if it felt to be entrapping or compressing the neurovascular structures. The risks with TOS surgery are significant and include brachial plexus and nerve injury, hemorrhage, infection, and pulmonary complications. Compared with a non-surgical approach, patients receiving surgery had greater medical costs and have been found to be three to four times more likely to be work disabled. Therefore, due to often unnecessary surgery with poor results and the above-mentioned risks, surgery is not typically the preferred treatment.

More commonly and appropriately though, first-line treatment is directed towards a physical rehabilitation program, in which physical therapy plays a large role. Initial treatment emphasis is placed on weight loss, postural re-education, and shoulder girdle exercises along with stretching, strengthening, conditioning and the passage of time. Evaluation of activities of daily living and the workplace environment is a must. Physical therapy management of TOS requires accurate evaluation of the peripheral nervous system, posture, and the cervico-scapular muscles. Patients should be instructed in postural correction in sitting, standing and sleeping, stretching exercises, and strengthening exercises of the lower scapular stabilizers beginning in gravity-assisted positions to regain normal movement patterns in the cervico-scapular region. Other techniques include evaluation of joint mobility and muscular imbalance. Patient education, compliance to an exercise program, and behavioral and ergonomic modification at home and work are critical to long-term successful conservative management. Selected patients may benefit from trigger point injections or acupuncture treatments.

Short-term modalities such as heat, cold, massage, ultrasound and electrical stimulation may reduce symptoms temporarily and through pain reduction allow treatment and stretching of the effected tissues. The patient is taught to avoid postures or positions that aggravate symptoms. Patients are told to avoid drooping shoulders, to guard against the arms being above shoulder level and in a sustained position overhead. It is important to not carry heavy objects in the hand of the affected extremity or on the affected shoulder. The patient should avoid sleeping on the affected side. Biofeedback and/or relaxation training can be helpful in relaxing the involved musculature, retraining skilled hand function at the computer and improving postural awareness.

PSYCHOSOCIAL ASPECTS of TOS

Each person responds and reacts differently to discomfort. There are many individuals who for whatever reason are somatically preoccupied and/or may have underlying psychopathology or psychosocial dysfunction which seems to enhance their perception of pain and disability. Some patients become extremely angry and some display a deep sense of entitlement. Surgically removing a structural "abnormality" such as a cervical rib (a normal finding in many asymptomatic people) may be a devastating mistake in a patient whose problem is not a significant TOS, but rather emotional dysfunction, anger, entitlement or somatic preoccupation.

Patients with non-physiologic pain behavior, psychosocial dysfunction, anger or a sense of entitlement are difficult to treat. Often our best efforts lead to poor results and even more complaints of pain and disability. While difficult to treat, they need to be approached from a model of cognitive restructuring or altering thought processes. Basically, cognitive restructuring is used to change patterns of negative thoughts and self-defeating attitudes in order to generate more healthy and positive thoughts, emotions and actions. These patients tend to do better in a tightly controlled, behaviorally oriented, functional restoration program of chronic pain management.

SURGERY for TOS

If the patient is not responding to conservative physical rehabilitation treatment approaches, it is then important to differentiate between the occasional patient who should be considered for surgery and others for whom surgery would be a mistake and a potential disaster.

What patient then is a good candidate for surgery when conservative measures have failed? Surgery should be considered an option in the few select emotionally stable patients with significant neurovascular compression at the thoracic outlet. Even in some individuals with less than optimal results with conservative treatment, surgery is a mistake and will only lead to further problems. Surgery is never a "last resort," but rather only one tool to be considered for use.

SUMMARY

Thoracic Outlet Syndrome occurs with compression of the neurovascular bundle as it exits the cervical area, traverses behind the clavicle and progresses towards the upper arm. It is best treated with a rehabilitation approach but certain cases justify surgical intervention. A number of injured workers with TOS, with or without surgery, may appear considerably dysfunctional and disabled.

It is useful to find reasonable and knowledgeable physicians who are willing to take the time to provide excellence in diagnosis along with caring, but firm treatment. It is critically important for the physician to assist the patient in understanding that TOS is not life-threatening, is treatable and should not prevent return to some type of gainful employment.

Formal physical therapy should be time-limited with the patient being weaned away from medical intervention and thereafter engaged in a self-directed exercise and conditioning program. Medications should be limited to acetaminophen, aspirin, or one of the non-steroidal anti-inflammatory drugs. In an occasional patient, a tricyclic antidepressant may help with pain relief and insomnia.

Injured workers with chronic problems are often difficult to treat, but a rehabilitation approach with early intervention and rapid return to work best serves all parties concerned.

SHOULDER PAIN & INJURIES

INTRODUCTION

A variety of disorders affects the shoulder and result in pain and functional disability. Shoulder injuries may result from specific acute, traumatic events or from repetitive overuse activities. A thorough history and physical examination are essential tools in constructing a differential diagnosis and treatment plan for the patient. This article will focus on the functional anatomy of the shoulder, as well as the more common conditions associated with shoulder injury.

FUNCTIONAL ANATOMY

As with other musculoskeletal disorders, a complete understanding of the anatomy and function of the shoulder is essential. The use of the term "shoulder joint" requires clarification. This term generally refers to the glenohumeral joint which is only one of the four joints that comprise the shoulder. Since all these joints are responsible for normal shoulder motion, the term shoulder girdle or shoulder complex is preferred. The shoulder complex is difficult to assess because of its many structures, complex movements and the variety of lesions that can occur either inside or outside the joints.

The glenohumeral (GH) joint is formed by the articulation of the humeral head with the glenoid cavity of the scapula. This joint is the most mobile joint in the body. It is a multiaxial ball-and-socket synovial joint, like the hip. However, the glenoid cavity is quite shallow, and mobility is obtained at the expense of stability. The glenoid labrum is an oval disc of fibrocartilage that is attached to the glenoid rim and serves to deepen the glenoid cavity, thus stabilizing the joint. This capsule and surrounding muscles and ligaments provide most of the stability.

Several muscles collectively referred to as the rotator cuff muscles (supraspinatus, infraspinatus, subscapularis and teres minor) perform the important motions of the GH joint. These four rotator muscles have a conjoined tendinous insertion that comprises the cuff. This is a common site of injury. Additionally, bursae surround this region and commonly become inflamed, resulting in a bursitis.

The acromioclavicular (AC) joint is formed by the articulation of the acromion of the scapula and the clavicle. It is a diarthrodial joint whose structural integrity arises from an intrinsic capsule, an articular disc and surrounding ligaments. Disruption of one or all of these ligaments may occur with a fall onto the lateral aspect of the shoulder. It is also a common source of symptoms caused by arthritic changes occurring within the joint.

The sternoclavicular (SC) joint is similar to the AC joint, however it is rarely involved in clinical complaints. Along with the AC joint it enables the humerus to move through 180 degrees of abduction. There is a disc between the two bony articulations, which adds significant stability. Disruption of this joint is most commonly seen in sports injuries or motor vehicle accidents.

Although the scapulothoracic (ST) "joint" is not a true joint, it functions as an integral part of the shoulder complex. It is comprised of the scapula (shoulder blade) and the muscles covering the posterior chest wall (thorax). It is important because it connects the upper extremity to the axial skeleton, and normal shoulder motion is dependent upon scapulothoracic movement. The scapula glides on the thorax during movement of the upper extremity. This motion is additive to the movement of the GH joint. After the initial 20 degrees of abduction at the GH joint, scapular motion contributes 1 degree of motion for every 2 degrees of GH motion. Several muscles act on these joints to coordinate complex movements of the shoulder. Injury to the nerve supply to these muscles, or the muscles directly will adversely affect shoulder function.

SPECIFIC INJURIES

The incidence of shoulder injuries has become increasingly prevalent in the workplace. The reason for this is unclear; however, an improved understanding of shoulder biomechanics and pathologic conditions affecting the shoulder has led health care providers to a better awareness of these disorders. The use of computers, resulting in prolonged repetitive keyboarding, may also be responsible for injuries to the shoulder as a result of cumulative microtrauma.

Fortunately, most shoulder injuries can be managed non-surgically with conservative treatment. Proper evaluation begins with a thorough history and physical examination. The presenting symptom is most often pain with or without associated weakness. A comprehensive history leads to a correct diagnosis in most cases. Determining the precipitating event and the mechanism of injury is essential in developing an accurate diagnosis. Physical examination begins with a careful visual inspection and palpation of the bony structures and soft tissues comprising the shoulder girdle. This is followed by range of motion (ROM) testing, neurological examination, special tests and examination of related areas. A systematic approach is the best way to avoid misdiagnosis.

SHOULDER PAIN ETIOLOGY: Intrinsic & Extrinsic

Causes of shoulder pain can be classified as either intrinsic or extrinsic. Intrinsic disorders arise from within the shoulder complex, while extrinsic disorders originate outside the shoulder. Intrinsic disorders of the shoulder characteristically involve complaints of pain aggravated by using the shoulder (e.g. raising the arm), localized or diffuse tenderness to palpation over the shoulder, and pain that can be elicited by active or passive motion of the arm. Intrinsic disorders can be conveniently divided into two types; overuse and traumatic injuries. The importance of the shoulder in daily work, home and recreational activities is usually taken for granted until it is injured. Overuse injuries include impingement syndrome, glenohumeral instability, degenerative arthritis, and adhesive capsulitis. Repetitive overhead activities or unaccustomed repetitive strenuous activities are frequently implicated as the cause.

Rotator cuff impingement syndrome is as a very common cause of shoulder pain. Impingement syndrome encompasses many previously used terms and may range in severity from bursitis and tendinitis to frank tendinous disruption (cuff tear). Disorders of the rotator cuff commonly occur secondary to repetitive overuse, which results in cumulative microtrauma. In addition, trauma and age-related degenerative changes can result in greater susceptibility of these tissues to injury. The rotator cuff muscles stabilize the glenohumeral (GH) joint and include the supraspinatus, infraspinatus, subscapularis and teres minor. These muscles are responsible for internal and external rotation and abduction of the arm.

In addition, these muscles depress the humeral head and oppose the strong upward pull of the deltoid muscle. The supraspinatus and infraspinatus are the most commonly involved structures in an impingement syndrome. Normally, the tendons glide smoothly in the space beneath the acromion (subacromial). Any change in the size of the subacromial compartment may also give rise to impingement signs. Common causes include bony spur formation and variations in the shape of the acromion and/or coracoid processes, which differ among individuals. Occasionally, calcification of the coracoacromial ligament may occur and can lead to impingement. There is also an area within the supraspinatus tendon that has a poor vascular supply and is susceptible to inflammation and tearing.

The subacromial bursa is located between the acromion and the rotator cuff and usually connects with the subdeltoid bursa. The purpose of the bursa is to facilitate movement and reduce shearing forces between the structures. They usually become inflamed in the early stages of an impingement syndrome, and may become chronically scarred and thickened. This results in a relative decrease in the subacromial space and may result in a worsening impingement. In patients with a rotator cuff injury, the humeral head tends to migrate upward against the acromion, resulting in pain and weakness, and propagates further insult and injury to the tendons. Weakness of the rotator cuff muscles may also occur with injury to the specific nerves innervating the muscles.

IMPINGEMENT SYNDROME

Early diagnosis of impingement syndrome is critical in preventing further progression, and in insuring a good response to conservative treatment. However, clinical signs and symptoms are often non-specific and too often diagnosis is delayed until a full-thickness tear has developed. There are usually complaints of pain localized to the anterior, lateral and superior aspects

of the shoulder. Mild pain may be present at rest, but is usually exacerbated by reaching at or above shoulder level, pulling, pushing, or related activities. Physical examination typically reveals tenderness over the anterior and lateral shoulder with restricted active and/or passive range of motion. The presence of an impingement syndrome is suspected when the patient demonstrates a painful arc of motion, especially with abduction and flexion (shoulder elevation). Positive impingement signs are often associated with rotator cuff pathology. The Neer impingement test is positive when passive forward flexion of the arm above 130 degrees elicits pain. The abduction internal rotation impingement reinforcement test is performed with the arm abducted 90 degrees and bringing the forearm from neutral to internal rotation. Another positive impingement test (disappearance of pain after intrabursal injection of lidocaine) helps to support the diagnosis. A positive drop arm test, where the patient has difficulty slowly lowering the abducted arm, may also indicate a rotator cuff tear.

BICIPITAL & CALCIFIC TENDINITIS

Associated conditions such as bicipital tendinitis and calcific tendinitis may present alone or concomitantly with an impingement syndrome or glenohumeral instability. Bicipital tendinitis refers to overuse of the long head of the biceps brachii muscle. The long head of the biceps originates from the supraglenoid tubercle of the scapula and passes over the top of the humeral head to unite more distally with the short head in middle of the upper arm. The long head of the muscle moves the arm away from the body and rotates it inwardly.

The long head of the biceps is usually affected inside the bicipital groove. The inflammatory process involves the tendon and its sheath. This may occur secondary to direct trauma, overuse of the arm in an overhead position, or because of abnormalities in the soft tissues that surround the tendon. In addition, a shallow bicipital groove may lead to subluxation of the tendon.

The most common complaint is pain in the area of the bicipital groove. The pain increases with activity and abates with rest. Physical exam typically reveals tenderness over the biceps tendon. There are also provocative tests such as Speed's test (resistance to forward flexion of the arm with elbow extended and forearm supinated) and Yergason's sign (resisted supination with elbow flexed at 90 degrees) which help to confirm the diagnosis.

Most cases of bicipital tendinitis respond to non-operative treatment. Initial management includes avoiding offending movements (modified rest), NSAIDs, and gentle stretching exercises. Therapeutic ice and heat may help. Patients typically respond to a regimen of active physical therapy with progressive stretching and strengthening exercises. Local corticosteroid injections may also be beneficial.

GLENOHUMERAL INSTABILITY

Glenohumeral instability may be classified with respect to the mechanism of injury as either atraumatic or traumatic. Atraumatic instability is often associated with general ligamentous laxity and both shoulders may be affected. It is often associated with capsular laxity without disruption of the glenoid labrum or surrounding soft tissues. Instability may be unidirectional or multidirectional. Traumatic instability may be associated with either a single high-velocity trauma, often associated with fracture and/or dislocation, or microtrauma from repetitive overhead activities. Traumatic instability is also often associated with labral fraying or tearing and usually results in anterior/inferior instability. Management of instability is often dependent on the type of instability present. Patients with glenohumeral instability may also have associated impingement syndrome and bicipital tendinitis. Often the cause for these problems (especially in young adults) is the underlying instability. Instability may also be associated with numbness, particularly in the ulnar nerve distribution. Pain is often present in the posterior aspect of the glenohumeral joint. Assessment should always include evaluation for generalized ligamentous laxity. There is a wide range of variability in the degree of laxity among individuals, and therefore comparison to the uninvolved or asymptomatic shoulder is recommended. Provocative stress testing (apprehension test) can be demonstrated by gently abducting and externally rotating the patients arm. If the shoulder is ready to dislocate, the patient will likely resist further motion. Treatment is often coordinated similarly to impingement syndromes. Surgical intervention may be necessary in patients with chronic subluxation and/or dislocation who fail to respond to conservative treatment and/or who have neurologic dysfunction as a result of the instability.

DEGENERATIVE ARTHRITIS

Degenerative arthritis may develop from many years of task-specific work, or after a significant traumatic event (post-traumatic arthritis) although the actual cause may be difficult to prove. Primary osteoarthritis of the glenohumeral joint is relatively uncommon when compared with the incidence in weight-bearing joints. Arthritic changes occur more commonly in the AC joint. Pain from degenerative arthritis is usually gradual in onset and occurs with joint movement. Tenderness may be noted over the GH joint (usually posteriorly) or the AC joint (anteriorly). Range of motion may be restricted, painful and associated with crepitus. Plain x-rays typically demonstrate joint space narrowing and/or osteophyte (bone spur) formation. Treatment usually consists of the judicious use of non-opioid analgesics, anti-inflammatory agents, and ice. Patient education is important to instruct the individual to avoid activities resulting in repetitive microtrauma (joint protection). In progressive cases where function is severely impaired, surgery, including joint replacement may be indicated.

ADHESIVE CAPSULITIS

Adhesive capsulitis is also referred to as "frozen shoulder." Its cause remains unknown. Ongoing debate as to pathogenesis has led to the proposal of several different treatment approaches. Controlled studies comparing outcome are lacking. The most remarkable pathologic change is fibrosis that can involve the articular capsule. Adhesive capsulitis may present independently or as part of a more complex clinical presentation. It often presents as a late sequelae of prolonged shoulder immobilization secondary to a variety of orthopedic and neurologic disorders affecting the arm, however it may present insidiously with no known specific precipitating event. Likewise, spontaneous resolution is known to occur. Findings on examination are limited active and passive shoulder movement, especially in internal and external rotation and abduction. Complaints of a painful arc (as described in impingement syndrome) may or may not be reported. Treatment regimens vary, however it is agreed that the best therapy is prevention. Thus, at the earliest onset, the patient should be involved in an aggressive physical therapy program. Adjuncts such as analgesics and intra-bursal or intra-articular steroid injections may also be useful. In progressive cases, passive manipulation under general anesthesia or surgery may be required. These interventions should be immediately followed by aggressive physiotherapy. Other intrinsic disorders include humeral fractures, rheumatoid arthritis, gout, pseudogout, and osteonecrosis. These will not be discussed.

Extrinsic disorders originating outside the shoulder may refer pain to the shoulder and present a diagnostic challenge. Pathology involving the cervical spine, brachial plexus, visceral disease (e.g. gallbladder disease) or neoplastic disease may be culprits. One example of a common extrinsic disorder causing shoulder pain is cervical degenerative disease and radiculopathy. Assessment of the shoulder region should always include evaluation of the cervical spine to rule out referred symptoms. Discussion of specific extrinsic disorders related to shoulder pain is outside the scope of this article. Nonetheless, the importance of a complete history and physical examination to exclude these potential causes is imperative. Definitive diagnosis and treatment of these disorders usually necessitates referral to the appropriate specialist.

DIAGNOSTIC IMAGING

Plain radiographs are the first imaging step in the diagnosis of shoulder injuries. They should always be obtained when direct trauma to the shoulder occurs (e.g. fall onto the shoulder), or when the clinical presentation and findings suggest fracture, dislocation, bony tumor invasion, bony infection or rheumatological disorder. Plain x-rays may be helpful in assessing overuse injuries but should only be obtained if the patient fails to respond to conservative management. Degenerative changes within the AC or GH joint may be seen. Calcium deposits would suggest calcific tendinitis, and a modified transcapular or outlet view will demonstrate the configuration of the acromion. Although there is no consistent radiographic finding in acute or partial rotator cuff tears, indirect evidence of chronic tears may be seen radiographically as a narrowing of the space between the acromion and the humeral head, and sclerosis of the greater tuberosity. Additional diagnostic studies such as computed tomography (CT), CT arthrography, magnetic resonance imaging (MRI) and fluoroscopy may be indicated in conditions that do not respond favorably to treatment, and that might require surgical intervention. Because of its high soft-tissue contrast resolution and multiplanar imaging capability, MRI has been demonstrated to be an effective means of early identification of impingement syndrome and rotator cuff tears.

TREATMENT

Treatment for all these conditions is typically conservative, especially in acute and mild cases. Initial therapy should be aimed at reducing pain, inflammation, and mechanical dysfunction and improving shoulder motion. Therapy is based on activity modification, a decrease in the load placed on the shoulder, stretching and increasing the strength of the rotator cuff muscles (Codman's exercises). Oral anti-inflammatory agents and/or analgesics are frequently used to relieve discomfort and facilitate therapy. Ultrasound, heat, ice and steroid injections may be used similarly. Reinjury prevention is also an important aspect of treatment. Those patients who have a more severe clinical presentation or those who do not improve over three to four months or worsen will require further diagnostic evaluation, and more aggressive treatment. Indications for surgery are made on an individual basis and should take into account the persons age, underlying pathology, clinical course (e.g. acute vs. chronic), functional limitations, progress with conservative treatment, and obviously the patient's wishes. Specific surgical procedures will not be discussed.

SUMMARY

The incidence of shoulder pain is increasing in the workplace. The normal use of our arms is required for the vast majority of industrial and non-industrial activities, and shoulder pain can result in significant impairment and disability. The differential diagnosis of shoulder pain is quite extensive, and a comprehensive history and physical examination are important in order to establish a diagnosis and a focused treatment plan. Most conditions respond well to conservative management, however in certain instances surgical intervention may be warranted.

ELBOW & FOREARM PAIN & INJURIES

ANATOMY

The elbow is a hinge and pivotal joint that has the primary function of positioning the hand. Movements of the elbow include flexion and extension, as well as rotation - pronation (palm facing downward) and supination (palm facing upward). Normal range of motion is from 0 degrees (fully extended) to 145 degrees (fully flexed), and 75 degrees pronation to 85 degrees of supination.

The bony structures comprising the elbow include the end of the humerus in the upper arm and the proximal portion of the radius and ulna in the forearm. There are three bony articulations; the ulna and humerus (ulnohumeral), the radius and humerus (radiohumeral), and the radius and ulna (radioulnar). The ligaments around the elbow include the medial and lateral collateral ligaments, the annular ligament (which holds the radial head to the ulna), and the interosseous ligament between the radius and ulna.

Several muscles are involved with functional movement of the elbow. These include the biceps and brachialis (flexion), triceps and anconeus (extension), pronator teres, and supinator muscles. Additionally, several muscles originate at the elbow and are involved in common musculoskeletal problems associated with elbow pain. These include the wrist and finger flexor and extensor muscles.

Several neurovascular structures cross the elbow including the ulnar, radial, and median nerves, and the brachial artery and vein. The location of these structures is important when evaluating patients after traumatic injury to the elbow and additionally when considering procedural interventions near the elbow.

MEDICAL PROBLEMS

Medical problems involving the elbow area typically present with pain (most common), stiffness and/or swelling. Pain and swelling soon after an injury may be secondary to a fracture or dislocation or a tendon rupture. The patient should be evaluated for neurovascular injury, which if present will require emergent intervention. An x-ray is usually indicated when pain and swelling follow a specific trauma. A fracture or dislocation will be evident on x-ray. If the x-ray is unrevealing, a tendon rupture should be considered. When there is a bulbous swelling associated with redness and warmth at the tip of the elbow, an olecranon bursitis should be suspected. This bursitis may or may not be related to direct elbow trauma. When sudden swelling and pain are present, consideration should also be given to infection or an inflammatory condition such as gout or rheumatoid arthritis.

ULNAR NERVE COMPROMISE AT THE ELBOW

This topic is covered in detail in the next article.

LATERAL & MEDIAL EPICONDYLITIS

An epicondylitis is actually not a tendinitis or inflammatory condition, but rather involves tissue degenerative or tendinosis. This condition is very common and most often develops from overuse of the forearm muscles in motions that require rotation of the forearm and movements of the wrist. Lateral epicondylitis or "tennis elbow" describes a condition characterized by lateral elbow pain. The individual usually complains of pain over the outside of the elbow and in the upper outer forearm. The pain can be provoked when the elbow is extended, palm down while the individual attempts to extend the fingers and wrist against resistance. The pain can be debilitating and work disabling. It may be caused by direct injury or from repetitive overuse activities of the upper extremity. It is associated with recreational activities such as tennis and other racquet sports and is commonly seen in occupations that require repeated contractions of the extensor and supinator muscles. A medial epicondylitis or "golfers elbow" occurs on the inside of the elbow and can be seen in golfers and handball players. It is usually seen in occupations that require repeated contractions of the flexor and pronator muscles. Professions in which

repeated contractions are performed against a resisting force are particularly prone to development of lateral and/or medial epicondylitis.

Treatment is typically directed towards eliminating activities that cause pain, the use of non-steroidal anti-inflammatory medications and/or a short course of oral steroids. A tennis elbow strap or wrist brace may be helpful and are basically used to remind the individual to avoid painful activities. The tennis elbow strap theoretically prevents excessive muscle contraction by constriction and thus changes the forces at the lateral and medical epicondyle.

In the acute stage ice may be helpful, and when chronic, the patient may prefer heat. Ultrasound to tolerance and deep friction massage may be beneficial. A carefully designed progressive stretching and strengthening program is indicated, but it is just as critical to look at ergonomic issues so as to prevent further injury and/or reinjury in both work and recreational activities. A series of no more than three steroid injections may also be beneficial.

Some patients with refractory epicondylitis may actually have a radial tunnel syndrome, which is entrapment of the posterior interosseous nerve (a branch of the radial nerve) as it passes under the supinator muscle. In these recalcitrant cases, a surgical release may be indicated.

OLECRANON BURSITIS

Posterior elbow pain is usually associated with an olecranon bursitis, which is an inflammation of the bursa between the tip of the elbow and the skin. This bursa is superficial and is prone to trauma and irritability. Patients with an acute bursitis usually have pain and swelling, which can be treated with aspiration (removing fluid with a needle and syringe) and compression along with non-steroidal anti-inflammatories. If there is redness, warmth, significant tenderness, or a nearby break in the skin, the bursa must be aspirated, and the fluid sent for culture to rule out infection. If an infection is suspected, treatment with oral antibiotics is indicated. With chronic olecranon bursitis, there may be recurrent swelling along with the sensation of tender nodules from scarring. In these cases, the physician may decide to instill a steroid after aspiration. Surgical treatment is only required with repeated recurrences or infections unresponsive to antibiotic treatment. The differential diagnosis includes fracture of the olecranon process, rheumatoid arthritis, gout or a synovial cyst of the elbow joint.

DEGENERATIVE JOINT DISEASE

Degenerative changes in the elbow are relatively rare and usually seen in patients with a history of previous trauma. It is often difficult to attribute degenerative changes in the elbow to industrial causation, however specific and/or cumulative trauma may aggravate underlying degenerative disease. Patients will usually complain of varying degrees of pain and stiffness. They may have reduced range of motion. Occasionally, a loose body may occur when a bone spur "breaks off" after an acute trauma, and this may require arthroscopic removal. Prosthetic joint replacement is reserved for severe and debilitating degenerative disease.

DISLOCATIONS

Elbow dislocations are the second most common dislocation in adults, second only to the shoulder, and are typically related to trauma. They are most common in young adults due to sport injuries (50%). Posterior dislocations are the most common (98%) with a fall on the outstretched hand as the most likely cause. Elbow dislocations rarely occur in isolation and are usually accompanied by other injuries such as a radial head fracture or damage to the radial artery or median nerve. The patient usually presents with pain, swelling and the inability to bend the elbow. An x-ray usually confirms the diagnosis. Treatment involves reduction as soon as possible followed by a posterior elbow splint. Anti-inflammatory medication may be helpful and after one to two weeks the splint is removed, and gentle range of motion exercises are initiated. Prolonged immobilization should be avoided because of the potential for loss of elbow motion. Repeat dislocation or ongoing instability is uncommon.

FRACTURES

Fractures of the distal humerus are relatively rare but may be associated with serious complications. Nondisplaced fractures can be treated with splinting and early motion. Displaced fractures require open reduction. Following an injury, the individual presents with pain, swelling, deformity and discoloration (ecchymosis) around the area.

Fractures of the olecranon are more common because of its location. The olecranon is the proximal end of the ulna and is the bony prominence at the tip of the elbow. The swelling may cause nerve compression and associated numbness distally in the fingers. Nondisplaced fractures can be treated with a splint with the elbow at 90 degrees. Most displaced fractures are best treated surgically by internal fixation with plates or a combination of wires and pins. With the more severe fractures, the elbow may lack full motion and there may be loss of strength. In addition to persistent elbow pain, the individual may develop subsequent degenerative joint arthritis.

Fractures of the radial head usually result from a fall on the outstretched hand with the arm and forearm turned in. Dislocation of the elbow is often associated with radial head fractures. These fractures may be difficult to visualize on initial x-rays and follow-up films 10 to 14 days and/or bone scan may be necessary to confirm the diagnosis. Sometimes a prominent posterior fat pad is the only radiographic evidence seen and is a result of bleeding into the joint secondary to the fracture. Treatment is conservative with a splint for nondisplaced fractures followed by range of motion exercises. Surgery is reserved for more severe injuries. A poor outcome will result in loss of motion and instability.

SUMMARY

The elbow is very important in allowing position and functional use of our hands. Elbow and forearm pain is common and may be secondary to both vocational and avocational activities. Elbow and forearm problems are frequently seen in workers who are using a computer keyboard repeatedly and/or continuously, and in those occupations that require forceful gripping. Ergonomic assessment and activity modification may dramatically affect the clinical course and outcome. Traumatic injuries to the elbow may result in nerve or vascular injury, and/or loss of motion resulting in disability. Early diagnosis and appropriate treatment is essential.

ULNAR NERVE COMPROMISE AT THE ELBOW

INTRODUCTION

Injured workers can present with symptoms suggestive of injury to the ulnar nerve. This nerve can be entrapped or compromised at various locations along its path. This article will address ulnar nerve compression at the elbow.

ANATOMY

As the C8 and T1 nerve roots in the lower neck area leave the spinal cord and become part of the brachial plexus (located between the neck and the shoulder underneath the clavicle/collar bone), some of their fibers reform into the ulnar nerve which then courses down the arm. At the middle of the arm, as the ulnar nerve passes posteriorly and at the inside of the elbow, the nerve enters a groove formed by the medial epicondyle of the humerus and olecranon of the ulna. The ulnar nerve then continues along the medial forearm and through the wrist into the hand. You may be able to find your own ulnar nerve by feeling on the inside of the elbow. There is a depression between the two bony ridges and the ulnar nerve travels in this groove. The nerve feels like a piece of thick string or thin rope. If you tap on it ("funny-bone"), you may get a jolt-like electric shock.

FUNCTION

The ulnar nerve in the elbow area contains both sensory (feeling) and motor (movement) fibers. The sensory portion provides sensation to the medial palm and half of the fourth and the entire fifth finger. The ulnar motor function includes flexing the wrist and last two fingers toward the ulna side and spreading the fingers apart.

TERMINOLOGY

Various terms have been used in the medical literature to describe ulnar nerve compromise about the elbow. Terms utilized have included "Tardy Ulnar Palsy" (tardy meaning late, i.e. occurs years after an elbow injury, dislocation or fracture) and "Cubital Tunnel Syndrome" (from the Latin cubitum meaning elbow). In medical reports you will also see terms such as ulnar nerve compromise, compression and entrapment at the elbow. Other accepted terminology includes "Ulnar Neuropathy at the Elbow."

ETIOLOGY

The ulnar nerve at the elbow is quite superficial and is easily injured. The sensory and motor fibers that innervate the hand are more superficial and therefore more susceptible to damage than those to the forearm. The ulnar nerve is more easily traumatized with the elbow flexed as with flexion, the groove or tunnel is actually smaller.

Almost everyone has had the experience of hitting their elbow or "funny bone" and getting a jolting shock-like electrical sensation down the arm. When this happens, the ulnar nerve is hit and produces this uncomfortable feeling. Usually, hitting it just once without too much force doesn’t cause any damage, but with a severe enough injury or with repeated trauma over time, the nerve can be damaged and lead to numbness, weakness and pain in the forearm and hand.

Something as simple as chronically leaning on or flexing your elbow can lead to ulnar nerve problems in some individuals. Some patients with other medical problems, i.e., diabetes, are in fact more sensitive than others to such nerve injury. Further, anatomical differences such as a narrow groove or fibrous bands can lead to certain people being more susceptible to ulnar nerve compromise about the elbow.

Additionally, approximately 16% of asymptomatic individuals have a hypermobile ulnar nerve which "pops" out of the bony ulnar groove with elbow flexion. For most of us, this "dislocating" ulnar nerve remains quiescent or asymptomatic, but it is

more likely to be subject to direct or indirect trauma. For instance, an individual who leans on the elbow a lot at work may traumatize the nerve cumulatively over time.

Entrapment or compromise of the ulnar nerve at the elbow is actually the second most common compression neuropathy of the upper extremity, with only carpal tunnel syndrome presently more frequently. Injury to the ulnar nerve at the elbow represents a major disability in the work force, particularly considering the increased use of computers and the accompanying use of the elbows in a flexed posture.

Potential causes of ulnar nerve injury at the elbow are many. There may be an anomalous constricting muscle or fibrous band compressing the nerve. Previous trauma or a congenitally narrowed bony ulnar groove or a short nerve may be responsible. Space-occupying lesions such as ganglions, lipomas, bony osteophytes, rheumatoid synovitis, or hematomas may all lead to ulnar compromise at the elbow.

"Sensitive" nerves from an underlying metabolic problem an/or neuropathy (diabetes, renal failure, alcoholism, etc.) may be implicated. Habit patterns and work positions (leaning on or flexing the elbows) may be factors in the etiology of ulnar neuropathy at the elbow. Importantly, there may be a combination of these factors which together lead to symptoms.

PRESENTATION & EVALUATION

The physical findings for patients with ulnar nerve compromise at the elbow can include the following: The patient may complain of medial elbow and forearm pain. There may be tenderness and/or enlargement of the nerve as it passes behind the medial epicondyle of the humerus (ulnar groove or tunnel) where it is easily palpable.

The patient may complain of numbness, tingling and coldness in the region innervated by the ulnar nerve, especially the ring and little finger. There may be weakness and atrophy in the muscles supplied by the ulnar nerve as well. With nerve injury, there can also be a burning, hypersensitivity type of pain (causalgia).

Examination should additionally address whether there is subluxation or dislocation of the nerve with elbow flexion and whether with gentle tapping over the nerve at the elbow there is a positive Tinel's sign (reproduction of the shock-like sensation). Remember, gentle tapping should be used, as too vigorous percussion will give a positive Tinel's test even in normal individuals. Symptoms may also be reproduced by a provocative test, holding the elbow flexed for several minutes. Alternatively, elbow extension may relieve symptoms.

A staging or grading system has been devised to distinguish mild from moderate and severe ulnar nerve compromise. Such a system can help in determining outcome and for recommending treatment. Mild cases includes paresthesias (numbness and tingling) that come and go, subjective weakness and complaints of clumsiness and elbow flexion testing and/or Tinel's sign which may be positive. Moderate cases also have paresthesias that come and go, but there is measurable weakness and the elbow flexion and/or Tinel's sign are positive. In Severe cases, paresthesias are persistent, vibration perception is decreased, there is abnormal two-point discrimination along with measurable weakness and atrophy and testing for elbow flexion and Tinel's sign is positive.

In addition to these clinical findings on history and physical examination, an electrodiagnostic (electromyography/EMG and nerve conduction testing/NCV) evaluation can be extremely useful in localizing the problem to the ulnar nerve at the elbow. The electromyographer can determine that there is specific electrical slowing of nerve conduction across the ulnar nerve at the elbow along with needle EMG changes in the distal muscles specific to this diagnosis. An x-ray including special views of the cubital tunnel may be helpful in revealing bony abnormalities.

DIFFERENTIAL DIAGNOSIS

Differential diagnosis includes ruling out a C8 and/or T1 cervical radiculopathy, thoracic outlet syndrome or ulnar nerve compromise at the wrist or elsewhere. Rarely, a pancoast tumor at the lung apex may compress the brachial plexus and present early as involvement of the ulnar nerve.

It is also possible that two different problems are occurring at the same time; this is termed a "double crush" syndrome. The patient may have an ulnar entrapment at the elbow along with another problem such as a lower cervical radiculopathy, a thoracic outlet syndrome or ulnar nerve entrapment at the wrist.

As an example, if the injured worker has a mild thoracic outlet syndrome along with ulnar nerve compromise at the elbow, either one alone may be sub-clinical, but together they add up to being symptomatic suggesting an ulnar nerve problem. If recognized as a dual problem, simply treatment with thoracic outlet exercises and padding the elbow to protect the ulnar nerve may be sufficient treatment and will avoid needless surgery for either.

Further, in the patient with ulnar nerve compromise at the elbow the clinician must consider whether this finding is singular and related to compromise at the elbow alone or rather only an early symptom of a more diffuse process such as a peripheral neuropathy. Recognition and treatment of an underlying metabolic dysfunction or neuropathy will lead to a more successful outcome while avoiding unnecessary and potentially damaging surgery. Once medically stabilized, if the compression is progressive or severe, surgery may be indicated to prevent neurologic deterioration.

PREVENTION & TREATMENT

In mild cases of ulnar nerve compromise at the elbow where symptoms are predominantly sensory with little or no weakness, conservative care is successful in the majority of cases. Patients are told to wear an elbow protector (cushioned pad), to minimize working or sleeping with the elbow flexed and to discontinue leaning on the elbow.

For patients undergoing any surgical procedures or for those comatose or obtunded in intensive care units, positioning is important to prevent injury to the ulnar nerve. The shoulder should be externally rotated and elbow flexion minimized while the elbow is also protected with a soft pad.

Nonsteroidal anti-inflammatory drugs (NSAIDs) and a Transcutaneous Electrical Nerve Stimulator (TENS) can be helpful. Hand therapy for strengthening and range of motion is recommended.

In moderate to profound cases where there is progressive weakness, especially in the presence of significant electrical slowing across the elbow and severe EMG changes, surgical treatment may be warranted. There is some controversy in the medical literature about whether surgery should be limited to decompression of the nerve and release of any restricting bands versus freeing up the nerve and transposing or moving it anteriorly so it no longer gets "stretched" or damaged in the bony ulnar groove. Some surgeons recommend removing the medial epicondyle of the humerus. Of greater controversy is whether an "internal neurolysis" should be performed. In this procedure the surgeon tries to separate nerve bundles (fascicles) and release scar tissue.

If surgery for ulnar compromise at the elbow is to be carried out, the least invasive procedure is usually the best; i.e., a decompression alone is the safest and usually the best procedure. Trying to move nerves, chip off pieces of bone and separate out small nerve bundles can lead to iatrogenic (doctor caused) injury and can result in a patient who is worse off than before the procedure. This does not mean that a more involved surgical procedure is never indicated. When there is post-traumatic scarring, a space-occupying cause such as a bony ridge (osteophyte) or a subluxing nerve, then more involved surgery may be appropriate.

Surgical results depend greatly on the degree of preoperative compression and nerve damage. Those patients with muscle weakness and atrophy have the poorest outcome. With surgery, there may be immediate postoperative relief of paresthesias, but the patient should expect a gradual recovery process of weeks to months depending on the preoperative severity. Post-operative therapy and rehabilitation are recommended.

When surgery has failed and the patient's symptoms have not responded to operative intervention, a number of possibilities exist. Consider whether enough time has gone by to allow for healing and was the original diagnosis correct and if so, was the correct procedure performed. Re-exploration and a more involved procedure may be warranted, but the patient must be cautioned that improvement may be minimal and there is potential for symptom worsening.

Making a recommendation with regard to treatment and surgery is where the "art" of medicine and surgery comes in. The best physician is usually a well-trained and meticulous individual who doesn't always think that a more complicated and involved procedure is necessarily best and doesn't feel they are invincible and can do no harm. This "physician-healer" weighs all aspects of the patient's presentation, both physical and emotional, makes a recommendation based on all the available information, and then proceeds with caution and concern.

SUMMARY

The ulnar nerve may be compromised at the elbow for a variety of reasons. The first step is diagnosis to determine if the problem is limited to the elbow, secondary to a more widespread problem such as a neuropathy or possibly related to an entirely different cause. The history, physical examination and electrodiagnosis are important tools leading to a diagnosis.

Once diagnosed as an ulnar nerve compromise at the elbow, initial treatment should include wearing a protective pad, limited elbow flexion and preventing leaning on the elbow. An ergonomic evaluation of the workstation is appropriate. Medications and therapy may be of benefit. Surgery should be avoided if possible but if needed, a simple decompression is usually best. In certain circumstances, more involved surgery is recommended.

CARPAL TUNNEL SYNDROME

INTRODUCTION

This section will focus on the prevention, diagnosis, management and treatment of carpal tunnel syndrome. CTS is the most common peripheral neuropathy and the foremost cumulative trauma disorder (CTD) of the upper extremities. It also is one of the costliest and frequently reported workers' compensation claims. CTS results from injury to, or excessive pressure on, the median nerve at the wrist.

ANATOMY

The carpal tunnel is bounded on three sides by the carpal bones (the bottom) and by the transverse carpal ligament (the roof) on the palm side of the wrist. In addition to the median nerve, running through this tunnel are blood vessels and the finger flexor tendons.

The flexor tendons are important because they allow us to move the fingers and the hand, such as when we grasp objects. The tendons are covered by smooth, slippery synovium that allows the tendons to glide against each other as the hand is used to grasp objects.

The median nerve runs into the hand to supply sensation on the palm side to the thumb, index finger, long finger, and half of the ring finger. The nerve also supplies a branch to the muscles of the thumb, the thenar eminence. These muscles help move the thumb and are very important in moving the thumb so that you can touch each of the other fingers (called opposition).

PATHOPHYSIOLOGY

The diameter of the carpal tunnel normally allows enough space for the structures that pass through it. For whatever reason, when this confined space is compromised, the median nerve and its blood supply may become compressed and the nerve damaged.

Any condition, which causes irritation or inflammation of the tendons, can result in swelling and thickening of synovium. When this occurs, the pressure begins to increase in the carpal tunnel because the bones and ligaments that make up the tunnel are not able to stretch in response to the swelling. Increased pressure in the carpal tunnel begins to squeeze the median nerve against the transverse carpal ligament. Eventually, the pressure reaches a point when the nerve can no longer function normally. Pain and numbness in the hand begins.

INCIDENCE AND PREVALENCE

The condition can occur at any age but is most often encountered in working individuals over 30 years of age and in the general population between 50 to 60 years of age. Carpal Tunnel Syndrome affects 0.1% of the general population and as many as 15% of workers in high-risk industries such as electronic parts assemblers, musicians, and dental hygienists. One study found the risk of CTS was almost 15 times greater for workers in jobs combining high repetitiveness and cold temperatures. It occurs three to five times more frequently in women than in men.

Although the use of highly repetitive wrist movements appears to be correlated with the development of carpal tunnel syndrome, other factors, such as medical conditions like diabetes, rheumatoid arthritis, thyroid disease, and pregnancy may be even more important. Nonetheless, the incidence rises with increasing repetition of hand use (such as typing), and by a high level of force with each motion, (such as with meat packers), in whom the incidence of carpal tunnel syndrome has been reported as high as 15%.

Approximately 25% of individuals with rheumatoid arthritis and 10% of individuals with diabetes mellitus will develop CTS during the course of their disease.

In recent years, increased numbers of workers have presented with carpal tunnel syndrome. One reason for this increase may be that automation and job specialization have fragmented workers' tasks to the point where a given job may involve only a few manipulations performed thousands of times per workday.

SYMPTOMS

The individual with a carpal tunnel syndrome typically complains of a feeling of numbness, tingling or burning pain in the distribution of the median nerve, particularly with wrist and hand activities. The symptoms may wake them at night. The complaints may actually be worse in the early morning hours or upon awaking and may be partially relieved by shaking the hands. Symptoms are particularly worsened by prolonged activities with the wrists flexed or with using the fingers and gripping fists, e.g., driving, tool handling, keyboarding, knitting, sewing, etc.

Symptoms are frequently bilateral, but usually worse in the dominant hand. Pain can extend to the forearm and shoulder or neck. The individual may complain of weakness, dropping things or clumsiness.

CAUSES

It is important for the physician to obtain a detailed medical, occupational and social history, including recreational activities and hobbies. CTS tends to run in families, so this part of the history is important too.

Any condition that compromises the median nerve at the wrist, either by compression or vascular impairment may lead to carpal tunnel syndrome. This could include:

- Distortion of the bony or ligamentous configuration (fractures, injuries, infections, etc.)
- Increasing the volume of the contents may cause compression of the median nerve (tumors, synovial inflammation, swelling during pregnancy, with rheumatoid arthritis or with fluid retention in heart or kidney failure, etc.)
- Job-related factors, including working with the wrist and hand in stressful postures, vibration, exposure to cold through air temperature, materials or tool use, excessive strength requirements, poor gripping surfaces, excessive direct pressure on the palm of the hand, and repetitive movements of the fingers and wrists
- Avocational activities, such as home-building projects, gardening, sewing, crocheting, knitting, racket sports and throwing, etc.
- In conditions where there may be an underlying neuropathy or nerve sensitivity, such as in diabetes mellitus or kidney failure, the median nerve may be more sensitive to trauma or compression, which in the normal individual would not result in nerve damage
- CTS can be seen with other systemic factors, including endocrine disorders, various drug and environmental toxins, vascular disorders and with inflammatory disease
- Other positive important factors include obesity, older age, and lack of exercise and wrist dimensions (individuals with squarer wrists are more likely to develop CTS than those with rectangular wrists).

DIFFERENTIAL DIAGNOSIS

Not all symptoms in the distribution of the median nerve mean that the patient has a carpal tunnel syndrome. Other problems may mimic or be confused with carpal tunnel syndrome. These include cervical disc disease with radiculopathy, thoracic outlet syndrome, pronator syndrome (median nerve compression at the elbow) and ulnar nerve compromise at the elbow. Other non-neurologic conditions include epicondylitis (tennis elbow), de Quervain’s tenosynovitis, myofascial pain syndrome, fibromyalgia and cumulative trauma overuse syndromes.

Symptoms, which would suggest the problem is not carpal tunnel syndrome, include pain that radiates above the shoulder, numbness with coughing or sneezing, or numbness without pain.

DIAGNOSIS, TESTS AND EXAMINATION

Diagnosis relies first on the medical history which often clearly points to a carpal tunnel syndrome. The physical exam may reveal a sensory loss in the median nerve distribution (the thumb, index and middle finger) and there may be weakness and atrophy of the median innervated hand muscles (the thenar eminence or pad of the thumb).

Tinel's sign may be positive where the wrist is gently tapped above the median nerve and a tingling sensation occurs. Phalen's test is positive when the patient complains of numbness and tingling when the wrist is maintained in a flexed position for up to 60 seconds.

X-rays of the wrists will rule out any bony abnormality. Laboratory blood tests should be done to rule out an underlying systemic disease. Electromyogram (EMG) and nerve conduction studies are highly diagnostic and are considered the gold standard in making the diagnosis. A nerve conduction study measures the time it takes for the median nerve impulse to travel across the carpal tunnel. An abnormal latency or delay in conduction of the nerve, in the presence of associated symptoms, confirms the diagnosis.

TREATMENT

Conservative treatment is indicated unless the condition is severely advanced or requires immediate resolution of symptoms. Early treatment is critical because function lost as a result of nerve damage may never be fully restored. Approximately 50% of individuals can be managed successfully without surgery.

Recurrence of symptoms, even after seemingly successful treatment, is not uncommon, particularly if the individual returns to similar activities that brought on the condition in the first place.

Conservative, non-operative treatment options include the following:

- Patient education is important, including splint care, avoiding certain wrist and hand postures and motions procedures to avoid swelling and tendon-gliding exercises.
- A neutral or slight extension position wrist splint will sometimes decrease the symptoms, especially the numbness and pain occurring at night. When the wrist is in this position, the carpal tunnel is at its maximize size so the nerve has as much room as possible.
- Diuretic agents ("water" pills) may decrease excess fluid and swelling thus relieving pressure within the carpal tunnel.
- Oral steroids or non-steroidal anti-inflammatory medications (NSAIDs) may also help control the swelling of the synovium and reduce the symptoms of carpal tunnel syndrome.
- In some studies, high doses of Vitamin B-6 have also shown some efficacy in decreasing the symptoms of carpal tunnel syndrome.
- A steroid injection into the carpal tunnel may be helpful. This medication will decrease the swelling of the synovium and may give temporary relief of symptoms.
- Activity modification and pacing at home and at work may be beneficial and avoid cumulative trauma and re-injury.
- Treating underlying systemic disease such as rheumatoid arthritis will effectively reduce carpal tunnel swelling and thus allow the median nerve adequate space.
- Removal of constricting devices bindings, bandages or jewelry is recommended.
- Rehabilitation exercises & strengthening provided by a physical or occupational therapist with special expertise in hand therapy can be of value.
- Ergonomic evaluation & modification of the work site is equally important as medical treatment alone may not be successful without addressing job related causative factors. Changes can include tool and task redesign, desk height modification, an ergonomic chair, pacing of activities and a host of other changes to make the job safer, as well as leading to greater worker productivity. The injured worker can be a great resource for needed modifications and should be included with the employer and ergonomist in evaluating the work site.

PROGNOSTICATING SUCCESS WITH CONSERVATIVE TREATMENT

Five factors have been identified which suggest limited success with conservative, non-surgical medical management for CTS. These include age over 50, symptom duration greater than 10 months, constant paresthesias (numbness, tingling and burning), flexor tenosynovitis and a positive Phalen's test at less than 30 seconds. When none of these factors are present, two-thirds of the patients are cured with medical management. When three factors are present, there is less than a 5% likelihood of response to medical management, and with four or five factors, none of the patients are cured.

SURGICAL TREATMENT

In addition to the above criteria, surgery becomes an option when conservative measures have failed and/or the condition is severe (pain, atrophy & weakness) and progressive, or when there is a space-occupying lesion in the carpal canal.

Surgery may be open or endoscopic. At a minimum, it involves surgical release of the transverse carpal ligament. Some surgeons advocate an internal neurolysis, but there is no conclusive proof that this more expensive and extensive procedure is more effective, and there are risks with increased handling of the nerve.

Endoscopic surgical procedures have been developed and advocates claim less morbidity and a faster recovery and return to work. Critics note the cost of this new surgery and claim there is more nerve damage and other operative complications from the small incision.

An estimated 50,000 to 100,000 carpal tunnel operations are done each year. Of the patients treated surgically, approximately 90% have a good result with partial or complete symptom resolution. Another 5% experience a worsening or no change with surgery. In another 5% of cases, symptoms redevelop.

Post-surgical care emphasizes activities that control edema, maintain range of motion and restrict the formation of tendon adhesions. Treatment includes hand elevation and upper extremity exercises. The wrist is splinted in a position of slight extension for two to three weeks. Progressive hand use and exercises follow thereafter.

After surgery, office workers can be back on the job in one week; however, carpenters or athletes may be incapacitated for 4 to 6 weeks.

EXPECTED OUTCOME

The patient should have less pain with improvement in sensory and motor function. There should be a reduction in paresthesias (numbness, tingling, burning). Improved grip strength and dexterity should be demonstrated. Surgery should prevent further deterioration in nerve function.

PREVENTION

Employers, insurance carriers and workers can play a major role in preventing CTS and other work place injuries by evaluating patterns of injury and identifying jobs with a high problem incidence. This implies not waiting for injuries to occur but rather having an ongoing active surveillance system to prevent injuries.

Ergonomic evaluation and redesign of the workplace and job tasks are appropriate starting points in preventing carpal tunnel syndrome. Workers should be taught proper gripping techniques and to work with the wrist straight while decreasing repetitive motions. Pacing of work activities is recommended with rest and alternate hand use. The worker should use the minimal pressure, force and speed necessary to get the job done.

Employers should evaluate whether the worker and job make a good "fit." An ergonomic workstation is both worker and job specific. It should be realized though that body habitus (size, height and shape) and physical condition (medical and aerobic) play a role in successful ongoing completion of job tasks. Lastly, workers with ongoing psychosocial problems, whether at home or on the job, may be more prone to injury. Once "injured" they may be more difficult to successfully treat and return to work. If the "true" problem is psychogenic or social, neither conservative medical care nor surgery will "fix" the injured worker and lead to gainful re-employment.

SUMMARY

Carpal tunnel syndrome or CTS is one of the most commonly reported cumulative trauma problems and in some industries appears to be approaching epidemic proportions. Prevention is the most cost-effective approach by recognizing potential problems before they occur, and through ergonomically evaluating and redesigning the job and workstation. CTS presents with discomfort, numbness and tingling in the median nerve distribution of the hand and is more commonly associated with repetitive wrist and finger use. Effective treatment includes identification and elimination of causative physical factors, diagnosis and treatment of underlying medical conditions, hand rehabilitation and possibly surgery.

HAND INJURIES

INTRODUCTION

Our hands are truly complex, active and intricate parts of our bodies, allowing for a variety of functions. They allow us to feel, grasp, perform fine movements and discriminate while displaying exquisite dexterity. The primary function of the entire upper extremity is to place the hand in a position for optimal function. Hand intricacy is attributed to the large portion of the brain dedicated to their control.

In the United States more than 16 million people each year receive emergency care for hand injuries. These common emergencies include fractures, ligamentous injuries and infections. Work related injuries can be devastating leading to pain, suffering, disability and loss of ability to compete on the open labor market.

The first treatment goal of hand injuries is to restore function followed by pain relief and cosmetic appearance. The hand and fingers tolerate injury and immobilization poorly and thus immediate and appropriate medical attention is of paramount importance as delay of treatment can have dire long-term consequences.

This article is about the wrist, hand and fingers and how they can be injured in the workplace.

TERMINOLOGY & ANATOMY

The terms "lateral" or "radial" and "medial" or "ulnar" are used to distinguish the thumb side of the hand from the little-finger side of the hand, respectively. The hand is described as having a palmar surface (the palm) and a dorsal side (the back of the hand). The thenar eminence is the prominence that the thumb muscles form on the lateral side of the hand while the hypothenar eminence is the area formed by the little-finger muscles on the medial side. Rotation of hand from neutral position to palm up position is called supination. The reverse is called pronation.

The hand and wrist are made up of 27 bones (excluding the radius and ulna), 17 articulations, and 19 intrinsic and 20 extrinsic muscles.

There are multiple joints between various bones along with fascia, tendon sheaths and tendons, blood vessels and nerves and numerous hand muscles. In addition to the small muscles of the hand itself, there are tendons from muscles extending on both the flexor and extensor surface of the forearm that control hand movement.

The wrist joint is the junction (articulation) between the forearm radial and ulna bones and the eight carpal bones (made up of two rows). The wrist moves in flexion (80^0), extension (70^0), radial deviation (20^0 thumbward) and ulnar deviation (30^0 towards the small finger). Between the carpal bones and the phalanges of the fingers are the elongated five metacarpal bones. Distal to the metacarpals are the phalanges, two in number for the thumb and three for each of the other digits. The joints between the various bones of the hand are termed the carpometacarpal joints, metacarpal phalangeal joints and the interphalangeal joints (proximal and distal).

CUMULATIVE TRAUMA DISORDERS

Cumulative trauma disorders or CTDs involve repetitive use over time leading to microtrauma that occurs to such a degree that it overwhelms and exceeds the adaptive and healing capacity of normal tissues. There are many factors that can lead to CTDs including repeated, sustained or forceful exertions; excessive intensity or duration; localized mechanical stresses; prolonged constrained posture; extreme joint positioning; low temperatures; vibration; repetitive impact; tool and workplace design; job stress; and work organization.

Early treatment of CTDs is non-surgical and is based on reducing pain, controlling inflammation, facilitating tissue healing

and monitoring activity levels. Initial treatment may include “active rest” which can be accomplished by decreasing the frequency of the work activity, modifying the job or by altering the activity by using a supportive device (i.e., splint). Anti-inflammatory medications, hand therapy and ergonomic work modifications are the mainstay of treatment. If the problem persists, a local steroid and anesthetic injection may prove beneficial. In appropriate situations that do not respond to conservative care, surgery can be an option.

Ganglion cysts are most commonly found as a rubbery swelling on the back of the wrist. They may also occur on the palmar surface of the fingers, wrist and hand. They are non-cancerous, fluid-filled cysts arising from irritated or inflamed ligaments, joint linings, or tendon sheaths. It is not unusual for the cysts to change size quickly or even disappear entirely. Ganglion cysts are not dangerous, and most do not require treatment unless they are cosmetically unsightly, painful, or interfere with hand function. Treatment can include removing the fluid with a small needle and syringe, injecting steroids, or removing the cyst surgically.

DeQuervain's stenosing tenosynovitis is an irritation and swelling of the sheath or tunnel that surrounds the thumb muscle tendons as they pass from the back of the wrist to the thumb (specifically the extensor pollicis brevis and abductor pollicis longus of the thumb). It is most common in women between the ages of 30 and 50. This disorder usually occurs after repetitive use (especially wringing) of the wrist and has also been called "washerwoman’s" sprain.

The major symptom is aching pain at the wrist and thumb, aggravated by motion, along with pain when grasping or pinching. Tenderness is elicited just distal to the radial styloid process over the site of the involved tendon sheaths. Sometimes a lump or thickening can be felt in this area. If the hand is made into a fist with the thumb "tucked in" and bent towards the little finger, the pain gets worse (Finkelstein test). This test includes passive movement at the wrist performed in all ranges of motion, and if forcible deviation of the wrist towards the ulnar side (little finger) provokes severe pain at the site of the affected tendon sheaths, then the test is considered positive.

DeQuervain's stenosing tenosynovitis is seen in workers secondary to repetitive strain or overuse and can also be seen in association with pregnancy or with an inflammatory arthritis such as rheumatoid disease. If treated early, many cases improve with rest in a splint, warm soaks, an injection with a steroid and/or taking anti-inflammatory medications. More severe cases or those that do not respond to other treatment may require surgery. Modification of the activities which caused the symptoms initially may also be required. A careful review of job functions may reveal offending activities.

Carpal Tunnel Syndrome: (see previous article) CTS is the most common peripheral neuropathy and the foremost cumulative trauma disorder (CTD) of the upper extremities. It also is one of the most costly and frequently reported Workers’ Compensation claims. CTS results from injury to, or excessive pressure on, the median nerve at the wrist. The individual with a carpal tunnel syndrome typically complains of a feeling of numbness, tingling or burning pain in the distribution of the median nerve, particularly with wrist and hand activities. The symptoms may wake them at night. Symptoms are particularly worsened by prolonged activities with the wrists flexed or with using the fingers and gripping fists, e.g., driving, tool handling, keyboarding, knitting, sewing, etc. The individual may complain of weakness, dropping things or clumsiness. The gold standard for diagnosis is electrodiagnostic testing. Treatment includes rest, splinting, anti-inflammatories, injections and occasionally surgery.

HAND ARTHRITIC DISORDERS

When we talk about hand arthritis, we need to distinguish between degenerative osteoarthritis and inflammatory conditions such as rheumatoid arthritis.

Large joints such as the hips and knees receive continuous stress from walking, running, sporting activity, or injury and are more commonly affected by the wearing of cartilage (degenerative arthritis) than the hand joints. However, the joints of the hand do experience stress in everyday use, and because the hand joints are smaller, these stresses are concentrated over a smaller surface area. The high ratio of stress to surface area can cause the smooth joint cartilage to wear down over the years. As the cartilage degenerates, the underlying bone becomes exposed. When the deteriorated joint moves, bone rubs upon bone causing pain, swelling, limiting motion, and frequently causing a grinding or popping sensation. Furthermore, forms of arthritis that are caused by inflammation (rheumatoid or psoriatic arthritis) of the tissues lining the joint frequently affect the small joints of the hands and wrists to cause joint destruction.

Degenerative Joint Disease or Osteoarthritis of the hands has a genetic predisposition to primarily affect the distal finger joints (DIP), and moderately affect the proximal finger joints (PIP) and the first carpometacarpal joints (the basilar joint of the thumb), with extensive synovitis and cyst formation.

Bony enlargement of the DIP joints (Heberden's nodes) and bony overgrowth of the PIP joints (Bouchard's nodules) are present, often without significant soft tissue swelling. The MCP joints (knuckles) and wrists are usually spared in osteoarthritis. The thumb basal joint (where the thumb meets the wrist) is exposed to very high stresses with normal activities. Forces felt at the tip of the thumb are multiplied twelve times in their effect to the thumb base, thus predisposing this joint to wear.

Degenerative arthritis of the thumb basal joint is very common, especially in women, and frequently requires joint replacement. Attempts at silicone replacement of this joint have not been as successful as hoped for due to implant failure and bone destruction. Thus, the most common joint replacement procedure for the thumb base is done with natural material. The procedure is termed the ligament reconstruction-tendon interposition procedure (LRTI). This procedure uses the patient's own tendon to stabilize the thumb and resurface the joint. LRTI provides stability and pain relief. Long term results have been excellent. This has also been called the tendon roll or "anchovy" procedure because the tendon used is curled to form the new joint cushion.

Unlike with rheumatoid arthritis, in degenerative arthritis blood tests are usually normal, regardless of disease severity. Treatment can include range-of-motion exercises in warm water, intermittent splinting to prevent deformity, use of analgesics or NSAIDs, and occasional intra-articular injections of corticosteroids for acutely symptomatic joints to relieve pain and prevent limited motion. All patients should continue moving their hands as disuse frequently results in stiffness.

Rheumatoid Arthritis is not caused by work, but in a patient with this disease, the workplace activities may cause a lighting up or worsening of the already existing disease. Rheumatoid arthritis frequently causes swelling, pain, and stiffness in the wrists, as well as the small joints in the middle and at the base of the fingers.

Rheumatoid arthritis frequently causes hand deformities. Tissue lumps called rheumatoid nodules can form over the joints of the hand and wrist. The joints of the fingers and thumb can become deformed and contracted by the destruction of the supporting ligaments, so that grasping and pinching movements are not possible.

The diagnosis of hand joint problems typically involves evaluating symptoms, physical examination and the x-ray appearance of the joints. Blood testing is sometimes also helpful in the assessment process. Joint replacement surgery becomes a treatment option when significant joint destruction and/or deformity are present.

Surgical options include cleaning of the abnormal cartilage and bone, including removal of bone spurs, joint fusion and joint replacement surgery. The optimal surgical treatment of arthritis of the hand and wrist varies from patient to patient and is based on many factors. These factors include the patient's age, hand dominance, employment, level of pain, functional goals, and underlying disease.

Surgical cleaning of the joint is usually performed in cases of early "wear and tear" degenerative arthritis and painful bone spurs, or in cases of rheumatoid arthritis with large amounts of inflamed tissue. Removal of bone spurs is especially helpful when the arthritis involves the joints at the ends of the fingers (distal interphalangeal or DIP joints).

Fusion of a joint involves removing the joint and surgically "fusing" the bone ends so that the two bones effectively become one solid bone. This procedure terminates all motion at that joint and thus eliminates the pain. The benefit of fusion is pain relief, but consequences include elimination of motion at the fused joint, which can hinder function. This surgical option is reserved for patients with advanced arthritis.

Joint fusion is usually the best surgical option in patients who are younger and very active. Younger patients may not be candidates for joint replacement because of the increased stress demand on the joints which accompany higher activity levels. This increased stress demand can quickly wear out an artificial joint.

Joint replacement surgery in the hand is an excellent option for treating rheumatoid arthritis of the hand in older, low activity patients. Joint replacement surgery can provide pain relief, increase finger range of motion, and improve hand function.

COMMON HAND AND FINGER DEFORMITIES

Dupuytren's (du-pwe-TRAHNZ) Contracture is a hereditary scar-like thickening of the tissue (fascia) that lies just below the skin of the palm. Dimpling and puckering of the skin over the area eventually occur. This condition may vary from small lumps or bands to very thick bands that may eventually pull the affected finger into the palm and limit straightening of the finger into extension.

Dupuytren's contracture varies in its rate of progression from minor skin puckering for many years to rapid contracture (fixed flexed position) of the fingers. Dupuytren's contracture initially may cause only a minor painless lump in the palm of the hand near the base of the finger(s). Dupuytren's contracture most commonly affects the ring finger but can affect any and all fingers. Dupuytren's contracture can also affect one or both hands.

The precise cause of Dupuytren's contracture is not known. While the condition may not be specifically caused by work, there is a general consensus that job specific activities my light up this condition. It usually affects more men than woman, in the fifty to seventy-year age group. Dupuytren's disease is sometimes inherited, and may be associated with cigarette smoking, vascular disease, epilepsy, diabetes and alcoholism.

The treatment of Dupuytren's contracture depends on its severity.
Most patients with Dupuytren's contracture require reassurance that the problem is treatable with stretching exercises with heat application. When the palm is persistently sore with grasping, ultrasound treatments can be beneficial. Sometimes local inflammation is best relieved with a cortisone injection. Surgery is recommended if there is progressive contracture drawing the fingers into the hand. Small nodules or lumps in the palm do not need treatment until they are very large and interfere with hand function. Even with successful surgical removal, the bands may reappear or occur in other fingers.

Trigger Finger is an irritation of the digital sheath that surrounds the flexor tendons. When the tendon sheath becomes thickened or swollen it pinches the tendon and prevents it from gliding smoothly. In some cases, the tendon catches and then suddenly releases as though a "trigger" were released. The constriction is usually due to inflammation of the sheath (tenosynovitis) that commonly results from overuse or trauma to the underside of the finger. Less commonly it results from a puncture wound that leads to infection of the tendon and its sheath. Trigger finger usually occurs in the third and fourth fingers. Sometimes the swelling can be treated with rest, activity modification, nonsteroidal anti-inflammatory drugs (NSAIDs), or steroid injections and splinting to provide a gentle stretch. The tendon sheath will then return to its normal, pain-free conditions. More severe cases may require surgery to release the tendon. This can be done as an outpatient procedure.

Mallet Finger is a flexion deformity of the terminal interphalangeal joint in which the fingertip droops and extension is not possible. This deformity may result from an extensor tendon injury or bony avulsion, causing a flexion lag at the distal interphalangeal (DIP) joint. Closed injuries may be treated with splinting that holds the DIP joint in extension and leaves the proximal interphalangeal (PIP) joint free. There is a potential to develop a Swan Neck Deformity if a mallet finger is left untreated.

A Swan-Neck Deformity involves only the fingers and presents with flexion of the knuckle (Metacarpal flexion), hyperextension of the middle (PIP) joint, and flexion of the distal (DIP) joint. It is the result of contracture of the intrinsic muscles. Although a swan-neck deformity is a characteristic finding in rheumatoid arthritis, this deformity is also seen after trauma. The inability to overcome hyperextension of the PIP joint makes finger closure impossible and can cause severe disability. Treatment for a swan-neck deformity is aimed at correcting the underlying cause when possible such as bony misalignment, rebalancing the extensor mechanism or releasing spastic intrinsic muscles.

True swan-neck deformity does not affect the thumb, which is "missing" a phalangeal joint. However, severe hyperextension of the interphalangeal joint of the thumb with flexion of the metacarpophalangeal (MCP) joint is called a "Z" Deformity. If associated with thumb instability, this deformity can interfere greatly with prehension (pinch). This deformity is usually hereditary or due to rheumatoid arthritis and can usually be corrected by interphalangeal joint fusion (arthrodesis).

A Boutonniere (buttonhole) Deformity presents with a fixed flexion of the middle (PIP) finger joint accompanied by extension of MCP and hyperextension of the distal (DIP) joint. This may result from lacerations, dislocation, fracture, osteoarthritis, or rheumatoid arthritis. Classically, the deformity is caused by disruption of the central slip attachment base of

the middle phalanx extensor tendon, creating a so-called buttonholing of the proximal phalanx between the lateral bands of the extensor tendon. Surgical reconstruction after fixed deformities develop is often found to be unsatisfactory.

ACUTE HAND INJURIES

Acute hand injuries can lead to severe disability and hand dysfunction. These injuries should be taken seriously and treated aggressively. The normal course after an acute hand injury is swelling, which may rapidly lead to pain and stiffness of the fingers. The swollen, painful hand is often held straight at the knuckles (a position of metacarpophalangeal joint extension) and flexed at the finger joints (interphalangeal joint flexion). When the hand is held in this position for an extended period, the collateral ligaments rapidly contract to produce permanent contractures. Therefore, the injured hand should be splinted with the fingers at 90 degrees to the palm (MCP joints flexed, the interphalangeal joints extended) and the thumb abducted. Hand therapy with mobilization should begin as soon as possible; once hand deformities become relatively established, they cannot be significantly altered by splinting, exercise, or other non-operative treatment.

Gamekeeper's Thumb results from disruption of the ulnar collateral ligament of the thumb resulting from forced radial deviation of the MCP joint of the thumb. Gamekeeper's thumb was originally described as an occupational hazard of gamekeepers in England, who used their hands to break the necks of rabbits. When encountered now, it is usually an aftermath of a fall in which the thumb is jammed onto a hard surface. Conservative management with a splint is often satisfactory, but early surgery should be considered if there is considerable deviation or instability.

A Colles fracture of the distal radius is caused by a forced dorsiflexion of the wrist and typically occurs in individuals over 50 years of age who fall on an outstretched hand. The fracture is typically dorsally displaced and angulated.

The scapholunate ligament may be ruptured by a fall on the outstretched hand. The injury is frequently thought to be a wrist sprain; however, the pain localizes to the region of the scapholunate ligament. Stress testing the ligament by radial and ulnar deviation of the wrist while palpating the scaphoid and lunate confirms the diagnosis. A posteroanterior x-ray of the clenched fist shows abnormal widening of the gap between the scaphoid and lunate. Treatment of an acute injury involves surgical ligament repair. A chronic painful scapholunate ligament rupture requires reconstructive surgery.

Lunate Dislocation is secondary to anterior displacement of the lunate with relatively normal alignment of the rest of the carpus. Perilunate Dislocation is secondary to displacement of the rest of the carpus with relatively normal alignment of the lunate. Significant trauma to the wrist may completely disrupt the two carpal rows, also resulting in lunate dislocation (the lunate is seen lying anterior to the wrist on the lateral x-ray) or in perilunate dislocation. The result is wrist pain and numbness along the distribution of the median nerve (dorsal and palmar thumb and index and middle fingers and lateral half of the ring finger). Perilunate dislocation is often associated with fracture of the scaphoid. Lunate and perilunate dislocations are reduced with open repair and stabilization, especially of the fractured scaphoid.

Metacarpophalangeal Fractures and Joint Dislocations are characterized by pain, limited movement, and digit deformity. Some may be treated with closed reduction, but open reduction and internal fixation or surgical repair is frequently required.

A Hook of the Hamate Fracture may occur while striking the ground with a stick or making a divot playing golf. Clinically, this fracture is suspected by tenderness over the hook of hamate in the palm. It is also indicated by pain on resisted flexion of the little finger, which localizes to the region of the hamate. X-ray or CT scan of the carpal tunnel confirms the diagnosis. Treatment of the nondisplaced fracture requires open reduction and fixation, or excision, of the fragment.

Distal Phalanx Tuft Fractures result from a crush injury to the fingertip (jammed finger). A subungual hematoma indicates a nail bed laceration. Open fractures require irrigation, repair of the nail bed with fine sutures, and replacement of the nail plate to act as a splint. Large displaced fractures are held with a K-wire. Hyperesthesia frequently persists long after the fracture has healed, requiring desensitization techniques.

DEFORMITIES SECONDARY TO NERVE INJURY

In some cases after nerve injuries, recovery may be incomplete and lead to hand deformities.

An "Ape-Hand" Deformity is the result of median nerve palsy leading to wasting of the thenar eminence. The thumb falls back in line with the fingers as a result of the pull of the extensor muscles and the individual is unable to oppose or flex the thumb.

A Bishop's or Benediction Hand Deformity is due to wasting of the ulnar innervated intrinsic hand muscles. The index finger is semi-straight while the middle, ring and little fingers are flexed.

A Drop-Wrist Deformity is due to weakness or paralysis of the radial nerve innervated extensors of the wrist and fingers.

A Claw Fingers Deformity results from intrinsic muscle weakness and the over-action of the extensor muscles on the proximal phalanx of the fingers. The MCP joints are hyperextended and the PIP and DIP joints are flexed. When intrinsic muscle function is completely lost, the term "intrinsic minus" hand is used. The deformity is most often due to a combination of median and ulnar nerve damage.

KIENBÖCK'S DISEASE

Kienböck's Disease (avascular necrosis of the lunate bone) is a relatively unusual condition of unknown cause. It occurs most commonly in the dominant hand of men aged 20 to 45 years old. Patients usually have no recollection of trauma. Symptoms generally start with insidious onset of wrist pain, localized to the region of the lunate carpal bone. It is bilateral in 10% of cases and most often occurs in workers performing heavy manual labor.
Diagnosis may be accomplished at an early stage by MRI or CT and confirmed by the x-ray appearance of a sclerotic lunate, which gradually develops cystic changes and a coronal fracture, and then collapses.

Treatment is aimed at relieving pressure on the lunate by surgery to shorten the radius or lengthen the ulna. Alternative treatments attempt to revascularize the lunate. Salvage procedures are required once the lunate has collapsed and produced fixed rotation of the scaphoid and subsequent degeneration of the carpal joints. Total wrist arthrodesis is performed as a last resort to relieve pain when the condition has progressed to an advanced stage.

HAND INFECTIONS

A Paronychia (pair-oh-NICK-ee-ah) is an inflammation of the nail fold or abscess curving right around a nail bed of a finger. Simple sterile lancing of the abscess is generally enough to cure the infection without oral antibiotics. The nail will be scarred and wrinkled, or perhaps even shed, as a result of the infection. The nail will usually grow back in a couple of months without any permanent deformity. The inflammation can be bacterial or fungal and is not contagious. Chronic paronychias mainly occur in people who have constantly wet hands, such as dairy farmers, fishermen, bar tenders and housewives. It is more likely to occur, and more difficult to clear up, in those with poor circulation, especially during the winter months.

The most common cause of a bite infection is a tooth-induced injury to the MCP joint as a result of a punch to the mouth. A small puncture wound may hide significant injury to the tendon, capsule, and cartilage of the joint. The oral flora of humans and animals contains a mixture of potential pathogens. All bite injuries are potentially dangerous and can cause significant infection. They should be debrided surgically, with the wounds left open. Systemic antibiotics should be given to prevent septic arthritis with permanent destruction of the MCP joint.

A Felon is an infection of the pulp space of a phalanx. The most common site is the distal pulp, which may be involved centrally, laterally, and apically. The septa between pulp spaces ordinarily limit the spread of infection, resulting in an abscess, which creates pressure and necrosis of adjacent tissues. The underlying bone, joint, or flexor tendons may become infected, and intense throbbing pain and a swollen pulp are present. Treatment involves prompt incision and drainage (adequately dividing the fibrous septa) and administration of appropriate antibiotics (usually a cephalosporin).

A Palm Compartment Abscess may spread between the metacarpals, from the midpalmar space to the dorsum, presenting as an infection on the dorsum of the hand. Palm abscesses present as intense throbbing pain with swelling and severe tenderness on palpation. Incision and drainage with wound cultures, with care to avoid the many important structures, are required in conjunction with appropriate antibiotic therapy.

Infections of the Tendon Sheath present with pain and swelling with tenderness along the length of the tendon sheath and pain with extension of the finger indicate infection of the flexor tendon sheath. Pus may pass from the thumb proximally

through the carpal tunnel and communicate with the little finger, forming a horseshoe abscess. Acute calcific tendinitis or systemic rheumatic diseases with tendon sheath involvement can occasionally mimic tendon sheath infections. Tendon sheath infections require surgical drainage (i.e., irrigation of the tendon sheath by inserting a cannula into one end and allowing the irrigating fluid to pass along the tendon sheath to the other end). Antibiotic therapy is also required.

Herpetic Whitlow is a viral infection of the distal finger, often mistaken for a felon. Herpes simplex virus may cause intense, painful cutaneous infection. The appearance of vesicles on the volar or dorsal distal phalanx is diagnostic. Pain preceding the appearance of the vesicles may cause confusion. The condition is self-limited, and surgery is contraindicated. It can be seen in health care workers dealing with oral secretions.

SUMMARY

Our hands are important parts of our bodies allowing for a variety of functions including feeling, grasping, performing fine movements and discriminating along with allowing for exquisite dexterity. The primary function of the entire upper extremity is to place the hand in a position for optimal function. The first treatment goal of hand injuries is to restore function followed by pain relief and cosmetic appearance. The hand and fingers tolerate injury and immobilization poorly and thus immediate and appropriate medical attention is of paramount importance as delay of treatment can have dire long-term consequences. Proper early treatment provides the injured worker the best opportunity to manage pain and regain function leading to return to home and work activities.

LOW BACK PAIN & INJURIES

INTRODUCTION

Low back problems are ubiquitous and about two-thirds of adults suffer an episode of low back pain at some. In any one year, about 50% of adults have low back symptoms with 15 to 20% of them seeking medical attention. About 2% of the U.S. workforce report back injuries each year. In working persons under the age of 45, low back problems are the most common cause of activity restriction.

The US Department of Labor estimates that 100 million workdays are lost annually because of low back pain. Across all major industries in the United States, the back is reported to be the single most common anatomic location for which workers' compensation claims are made. Claims for low back pain represent 20% to 30% of all compensable work injuries, and about one third of worker compensation costs.

In the United States, there is a wide variety in practice patterns in treating low back pain suggesting some ambiguity regarding optimal care. Some have argued that there has been excessive radiologic imaging, over-medication and too much passive care for this problem.

Acute low back pain is defined as activity intolerance due to lower back or back-related leg symptoms of less than 3 months duration. Continued symptoms thereafter are referred to as chronic low back pain.

Although back pain is among the most common of human conditions, fortunately the majority of causes of back pain are benign. Some 60% of patients recover in a week, and about 90% in 6 weeks. Advanced age, pain radiating into the leg, and psychosocial and occupational factors have all been identified as increasing the risk for developing chronic low back pain.

Strong evidence exists for forceful or heavy lifting, bending and twisting of the trunk, whole body vibration, and heavy manual work as occupational risk factors for low back disorders. Obesity and poor conditioning are risk factors as well. Static work postures, such as remaining seated or standing for long periods, may also contribute to low back pain. Jobs associated with low back pain are most commonly those associated with physical labor or material handling tasks.

In most cases of back pain, the precise origin or diagnosis remains unknown. Indeed, excluding degenerative changes, the majority of patients are given only a symptom diagnosis of low back pain, strain or sprain.

Proper treatment of low back pain involves shifting the focus of care towards increasing activity tolerance and away from treating the pain alone. This approach decreases the chance of low back pain becoming chronic.

CLASSIFICATION & ETIOLOGY

The conditions that may present as back pain generally fall into the categories of rheumatologic, neoplastic (cancerous), vascular, infectious, traumatic, metabolic, neurologic, and mechanical. Among these, the mechanical and the rheumatologic conditions are by far the most common, whereas others, including neoplastic, infectious, and vascular, are less common but the most urgent.

Low back pain may originate from many different spinal structures, including ligaments, facet joints, the vertebral periosteum (dense fibrous membrane covering the surface), the paravertebral musculature and fascia (A sheet or band of fibrous connective tissue), blood vessels, the annulus fibrosus, and spinal nerve roots.

The more common causes are related to musculoligamentous injuries and age-related degenerative changes followed by disk herniation and spinal and foraminal stenosis.

INITIAL ASSESSMENT & DIAGNOSIS

There are basically three questions to be answered when evaluating the patient presenting with low back pain. Is there underlying systemic or serious medical disease, are there psychosocial factors playing a role in the patient's presentation and is there a neurological compromise suggesting the need for more acute or surgical intervention?

The initial assessment by the physician starts with a focused medical history and physical examination directed to rule out the minority of cases with evidence of potentially serious underlying conditions. Absence of these "red flags" rules out the need for special studies during the first month of symptoms when spontaneous recovery is expected in the majority of individuals.

Serious spinal or special conditions ("red flags") can include fracture after a fall or after a vehicular accident. In the older or osteoporotic patient, fractures can occur with even minor trauma. Tumors or infections should be considered particularly if the individual with back pain is under 20 or over 50 years old. Particular concern exists when there is a past history of cancer or in individuals with a history of a disorder with a predilection for infection or hemorrhage. Constitutional symptoms such as fever or unexplained weight loss should alert the physician that an underlying serious condition might exist. Elderly patients with a new onset of back pain should raise concern.

Certain individuals are at higher risk for spinal infection such as those with recent bacterial infections, intravenous drug users, or with immune suppression (from a transplant, steroids or HIV). A possible tumor or infection should be considered in the individual who complains of severe nighttime pain or pain that worsens with lying down.

One emergency situation is when the individual presents with symptoms of a cauda equina syndrome. This occurs with severe compression on the lumbosacral nerve roots in the spinal canal. The individual presents with saddle numbness about the groin area, recent onset bowel and/or bladder dysfunction and a severe or progressive neurologic deficit with weakness and a sensory change in the lower extremities. This condition is considered a surgical emergency.

The physician must be wary of rheumatological disorders such as ankylosing spondylitis. Non-spinal pathology can include abdominal aortic aneurysm (the patient may present with a pulsatile abdominal mass), kidney stones, low-grade urinary tract infection, pancreatitis, peptic ulcer disease, pelvic inflammatory disease, ectopic pregnancy, prostatitis, large-bowel obstruction and abdominal bleeding or tumors. The patient with hip pathology may present with buttock area pain suggesting referral from the lower back region.

Of all of the simple laboratory tests that may be of use in low back pain, the erythrocyte sedimentation rate (ESR) is the most important, but also the least specific. Not only is it generally elevated in metastatic disease, but it also elevates in infectious disorders of the spine (such as osteomyelitis, discitis, or epidural abscess). It may be the only test to be abnormal in epidural abscess, since this may present without fever or elevated white blood cell count. The ESR may also give a clue as to the inflammatory nature of the complaint in spondyloarthropathies. However an ESR does carry a relatively low sensitivity and specificity regarding individual disorders and should be interpreted cautiously. Back pain with an elevated white blood cell count, usually associated with infection, requires additional consideration as well.

Assuming the low back problem is not caused by non-spinal pathology (pelvic, abdominal, thoracic) and is not a potential serious or life-threatening spinal condition, then consideration is given to the diagnosis of either sciatica (back-related lower limb symptoms suggesting lumbosacral nerve root compromise) or nonspecific back symptoms (suggesting neither nerve root compromise or a serious underlying condition).

The great majority of patients with back pain have symptoms secondary to musculoligamentous, spinal or disc pathology. Degenerative spine disease (osteoarthritis or spondylosis) can be secondary to cumulative trauma but also is a naturally occurring process with normal aging. It is important to understand that degenerative processes of the spine are not always associated with pain. The posterior elements of the spine including the facets are not meant to be weight bearing and can be a source of pain both from faulty posture and degenerative changes. Spinal stenosis can be congenital but also related to degenerative changes combining bony overgrowth and disc protrusions.

The sacroiliac joint is an often overlooked source of low back pain. The common referral pattern from the sacroiliac joint is to the buttock, although the posterior thigh and the groin may be involved.

Spondylolysis (a "fracture" of the pars interarticularis) leading to a spondylolisthesis (slippage of one vertebra over another) places many back tissues under stress, including the discs, facet joints, and ligaments of the spine. In the young patient, the pain may come directly from the spondylolysis bone defect. This is not likely in the older patient in whom the pain is more probably caused by over-stressed tissues.

When a nerve root is compromised from a herniated disc and/or stenosis, the patient often develops a nerve root compromise leading to a radiculopathy. Facet degenerative changes (arthropathy) can also lead to nerve root compromise. This can cause pain, numbness, weakness and tingling down the limb. Symptoms are often worsened with sitting and the individual may report that they prefer changing positions frequently. Sitting involves lumbar flexion and especially with twisting, this increases intradiscal pressure significantly. They may also prefer lying on their side in the fetal position. Disc herniation can occur even without significant trauma because an already weakened disc can suddenly give way with something as simple as light lifting, bending over, twisting, bearing down or coughing.

MEDICAL HISTORY AND PHYSICAL EXAMINATION

The medical history serves to elicit information to make a diagnosis but importantly also serves to establish a rapport between the clinician and the patient. It also serves to provide insight into concerns, expectations, and non-physical (psychological and socioeconomic) issues that may alter the patient's response to treatment. It is important for the clinician to determine an estimate of the patient's perception of his or her functional activity tolerance.

The physical examination is guided by the medical history and includes observation of the patient, a regional back exam, neurologic screening plus testing for sciatic tension signs. The exam is mostly subjective since patient response or interpretation is required except for reflex testing and circumferential measurements for girth atrophy.

INITIAL CARE OF ACUTE LOW BACK PAIN

Initial care starts with providing patient education and assurance. Patient comfort is important and can usually be achieved with nonprescription analgesics. When such medications are insufficient, prescribed pharmaceuticals may be added along with physical methods. Activity alteration is appropriate but complete rest is to be avoided.

Patients who present without red flags should be advised that there is no evidence of a severe underlying problem and that a rapid recovery can be expected.

Acetaminophen is the safest effective medication for acute low back problems, but aspirin and various other non-steroidal anti-inflammatory drugs (NSAIDs) are also effective although they can cause gastrointestinal or other problems. These drugs should not be taken concomitantly with regular alcohol intake.

Muscle relaxants are commonly prescribed but seem to be no more effective than NSAIDs and cause drowsiness in up to 30 percent of patients taking them. Muscle relaxants may have a limited role when true muscle spasm exists. Opioids appear no more effective than other analgesics for managing acute low back symptoms. Opioids, if prescribed at all for acute back pain, should be used sparingly and only for a short time. Oral steroids are not recommended for the treatment of acute lower back pain with the exception of patients with nerve root compromise with a radiculopathy. In these patients, epidural steroid injections or nerve root blocks may also be useful to reduce swelling and inflammation. Antidepressants may be useful in patients with chronic back pain but are not helpful in the acute stages.

Physical methods of treatment are numerous and include manipulation, traction, physical modalities (ice, heat, diathermy, and ultrasound), invasive techniques and other various therapies. Physiologically, it makes more sense to use cold in the acute stages of back pain and heat in later stages.

Corsets, braces, and back belts are widely used, but there is no scientific evidence of positive effect in acute back pain. In patients with chronic and recurrent problems, there is conflicting evidence, as is the case with the preventive use of back belts in industry. Continuous use of corsets may result in weakening of the trunk muscles and should be avoided. Traction may be beneficial for herniated discs with radiculopathy but will often prove more painful for mechanical back pain.

Spinal manipulation is safe and effective for patients in the first month of acute low back symptoms without radiculopathy and may even speed recovery. For patients with symptoms lasting greater than one month, manipulation is probably safe but its efficacy is unproved. If manipulation has not resulted in symptomatic and functional improvement after four to six weeks, it should be stopped and the patient reevaluated. Obviously this statement is controversial, but my bias is that manipulation is a passive treatment and that the back pain patient needs to engage in functionally oriented back rehabilitation. Manipulation should not be used in patients with neurologic deficits. Manipulation has no preventive value.

Aerobic exercise programs such as walking, biking, or swimming and trunk muscle exercises and stretching should be started early in patients with back pain once the acute episodes settles down. A stretching and fitness program should be continued indefinitely in all patients but particularly those with recurrent or chronic problems. This program should begin with supervised physical therapy but may progress to an independent gym or home program. Maintaining good physical fitness allows a more rapid recovery and a physically fit spine may be protective against recurrences.

Most patients will not require bed rest as inactivity actually can lead to potential debilitating effects. Two to four days of bed rest are reserved for patients with the most severe limitations (primarily due to leg pain from sciatica).

Prolonged bed rest actually leads to deconditioning and is counterproductive. A gradual return to normal activities is part of the recommended treatment. Patients with acute back problems should avoid undue back irritation from activities and postures that increase stress on the back and thus aggravate symptoms. Repetitive activities involving low back flexion and flexion with rotation should be minimized. Prolonged sitting is usually best avoided. Proper lifting techniques and posture with work simplification should be taught to the patient and encouraged. Ergonomic work place modifications should be considered.

Debilitation should be avoided by having the patient engage in an incremental, gradually increasing program of aerobic (endurance) conditioning exercises such as walking, stationary biking, swimming and even light jogging. There is no evidence to indicate that back-specific exercise machines are effective for treating low back problems. Specific spinal exercises that focus on flexibility and trunk strengthening are important.

Some of the medications such as opioids together with decreased activity can lead to constipation with back pain. Appropriate diet and stool softeners can be of benefit.

An epidural steroid series may prove beneficial for nerve compression and inflammation from a protruding disc or stenosis. Selective nerve root and facet blocks may be effective in selected patients.

Surgery should be considered only when serious spinal pathology or nerve root dysfunction obviously due to a herniated disc, stenosis or spondylolisthesis is detected. Even in those conditions, non-operative treatment is often successful and surgery should not be performed without appropriate attempts at such treatment.

Patient who present with neurologic deterioration or cauda equina syndrome remain the exception and should be addressed surgically on an emergent basis. Otherwise, surgical nerve root decompression can be considered if the sciatica is both severe and disabling, the symptoms of sciatica persist without improvement for longer than 4 weeks or with rapid and extreme progression, and there is strong physiologic evidence of dysfunction of a specific nerve root with intervertebral disc herniation confirmed at the corresponding level and side by findings on an imaging study.

Patients with acute low back pain alone, without findings of serious conditions or significant nerve root compression, rarely benefit from surgery. Even individuals with strong clinical findings of nerve root dysfunction due to disc herniation recover activity tolerance with 1 month and evidence indicates that delaying surgery for this period does not worsen outcomes. With or without an operation, more than 80 percent of patients with obvious surgical indications eventually recover. Surgery should be viewed as a way for speeding recovery of patients with obvious surgical indications, but benefits fewer than 40 percent of patients with questionable physiologic findings. Moreover, surgery increases the chance of future procedures with higher complication rates.

Work Status

Keeping the injured worker with acute back symptoms on the job is often a difficult decision for the clinician. Being off work for more than short periods of time can lead to increasing perceptions of being disabled and being unable to return to the job. Alternatively, work activities, particularly prolonged sitting and unassisted lifting can aggravate back symptoms. The best prescription for return to work should take into consideration the job demands balanced by the injured worker's functional ability. The physician, injured worker and employer should work together to arrange for appropriate work modifications that allow for safe early return to work.

SPECIAL STUDIES AND DIAGNOSTIC CONSIDERATIONS

Routine testing (laboratory tests, plain x-rays of the lumbar spine or an EMG) or imaging studies (MRI's, CAT or bone scans) are not recommended during the first month of activity limitation due to back symptoms except when a red flag raises suspicion of a dangerous low back or non-spinal condition. If the patient's limitations due to low back symptoms do not improve in 4 weeks, reassessment is recommended regarding further testing.

Selection of a test or special study should be based on clinical judgment considering either the emergence of a red flag or physiologic evidence of tissue insult or neurologic dysfunction. In years past, it was often stated that there was no reason to order an imaging study unless it was needed to define a lesion prior to surgery or when a progressive neurological deficit was present. In reality, patients can have significantly symptomatic disc disease without positive or abnormal neurologic findings. An MRI or CT scan can help the clinician define the cause of the problem and allow for directed rehabilitation treatment and certainly may result in greater prophylactic work restrictions if abnormalities are found.

Reliance on imaging studies to evaluate the source of low back symptoms carries a significant risk of diagnostic confusion as such studies may falsely identify a finding that was present long before the symptoms were present and may be of no clinical consequence. This is known as an incidental finding. Studies have demonstrated that even in healthy, asymptomatic individuals who undergo imaging studies, "abnormalities" are found in over one-third of non-symptomatic people tested.

Electromyography (EMG) including H-reflex testing may be useful to identify subtle focal neurologic dysfunction in patients with leg symptoms lasting longer than 3-4 weeks. Sensory evoked potentials (SEPs) may be added to the assessment if spinal stenosis or spinal cord myelopathy is suspected.

Laboratory tests such as erythrocyte sedimentation rate (ESR or sed rate), complete blood count (CBC), and urinalysis (UA) can be useful to screen for nonspecific medical disease (especially infection and tumor) of the low back. A bone scan can detect active degenerative changes, physiologic reactions to suspected spinal tumors, infection or occult fracture.

Discography is used by some physicians to define abnormal disks and is used as a pre-surgical tool to define the extent of surgery.

MANAGEMENT CONSIDERATIONS AFTER SPECIAL STUDIES

When special studies fail to define the exact cause of symptoms, the patient should not receive the impression that "nothing is wrong" or that the problem could be "in their head." The patient should be assured that a clinical work-up is highly successful in detecting serious conditions but does not reveal the precise cause of most low back symptoms.

Physicians can get themselves and their patients in serious trouble at times with continued passive treatment and further unnecessary tests, procedures and surgery. There is the risk of both a bad outcome from treatment (iatrogenic illness) but also the risk of the patient staying in a dysfunctional and disability-enabled mode from continued passive interventions.

Once it has been determined that the problem is not amenable to surgical intervention, then patients should be encouraged to become progressively more functional and return to normal activities of everyday life within their functional capacity.

FURTHER MANAGEMENT CONSIDERATIONS

Following diagnostic or surgical procedures, the management of most patients becomes focused on improving physical conditioning through an incrementally increasing exercise program. The goal of this program is to build activity tolerance and overcome individual limitations due to back symptoms. At this point in treatment, symptom control methods are only an adjunct to making prescribed exercises more tolerable. The therapy prescription should start with low-stress aerobic activities followed by specific muscle conditioning. Finally, specific training to perform activities required at home and at work can begin.

Certain questions should be raised when the patient has difficulty regaining the ability to tolerate pre-injury activities. Could the patient have a serious, undetected medical condition? Are the patient's activity goals realistic? Should alternatives be sought such as a job change through vocational rehabilitation? Are there psychosocial, non-physiologic issues clouding the patient's presentation?

Some of these patients will benefit from psychological counseling to help deal with continued pain, dysfunction and the inability to return to former activity levels. Biofeedback, hypnosis and therapies targeting development of coping skills are excellent adjuncts to psychological counseling.

Some of these individuals will unfortunately progress to a chronic pain state with increasing pain complaints and dysfunction. They are difficult to evaluate and treat. They should be referred for a multidisciplinary evaluation and possibly treatment.

SUMMARY

Low back problems affect virtually everyone at some time during their life. In persons under the age of 45, low back problems are the most common cause of disability. About 90% of individuals with an acute low back problem will spontaneously recover activity tolerance within one month.

Initial care starts with providing patient education and assurance followed by the judicious use of medications and physical rehabilitation. Selection of a test or special study should be based on clinical judgment considering either the emergence of a red flag or physiologic evidence of tissue insult or neurologic dysfunction. Surgical intervention is reserved for individuals with a progressive neurological deficit or when orthopedic and neurological abnormalities in a psychologically stable individual suggest surgical remediation will result in a positive outcome.

The body has an amazing ability to heal itself with proper nutrition, exercise and a positive mental attitude. Our medicines, tests, procedures and surgeries can prove very beneficial, but they can also inadvertently inflict harm. Knowing the patient well and taking into consideration all the information in a comprehensive fashion, helps to avoid potential pit-falls and the likelihood of making a challenging problem worse.

LUMBAR SPINAL STENOSIS

INTRODUCTION & DEFINITION

Lumbar spinal stenosis is defined as a narrowing of the lower spinal canal. The radiologic diagnosis is made by an x-ray, MRI and/or CT scan. Spinal stenosis is actually very common, particularly in later adulthood and is most often asymptomatic. A finding of spinal stenosis on a radiologic study does not necessarily equate to the presence of disease or a physiologic abnormality.

Lumbar spinal stenosis becomes symptomatic when the narrowing leads to compression and compromise of the lumbar and sacral nerve roots (the cauda equina) prior to their individually exiting the spine. In addition to constriction of the nerve roots, there can also be compression of the small blood vessels (arterioles and capillaries) in this region along with congestion of the venules (veins). Additionally, the flow of spinal fluid to the nerves is restricted. Research studies have shown that abnormal blood flow and congestion are common in symptomatic individuals while those with spinal stenosis by radiologic studies without symptoms have less congestion.

SYMPTOMS

Symptoms can vary due to many factors including the degree of inflammation, spine position (symptoms often increase with back extension or bending backwards), progression of the underlying degenerative process, and from new processes such as a disc herniation. Symptoms appear worse when there has been a more rapid progression.

Spinal stenosis symptoms tend to wax and wane over time with the intensity varying from periods with relatively few complaints to periods with increasing pain and dysfunction. The patient may have alternating leg and back pain with changing physical examination findings, depending on the severity of symptoms.

The changes seen with lumbar spinal stenosis are basically the same as those seen with degenerative spine and disc disease that occurs naturally with aging. In certain individuals, though, when a certain threshold is reached and the space available is too narrow or there is new inflammation, symptoms develop. Given the large number of structures that can be involved, it is not unusual to see varying complaints in degree and over time. Pain may involve both sides or vary from side to side. For many individuals, symptoms will worsen, but more than half will stabilize or even show improvement with time. As the individual ages, radiographic studies will show a progression of changes over time. Approximately one-quarter of patients have one episode that resolves in less than six months and never have significant symptoms again.

Lumbar spinal stenosis typically occurs after the age of 60, but can occur in younger individuals, particularly those who have had prior spine trauma or problems. For example, an individual may undergo spine surgery for a disc herniation in their thirties with a good result, but years later have problems with spinal stenosis as other factors such as inflammation or normal progressive degenerative changes add to an already compromised, but previously asymptomatic spine.

DIAGNOSTIC ASSESSMENT

The history and physical examination are most important. The individual often describes back and leg pain that increases with activity and position (leaning backward or walking uphill) with symptoms relieved somewhat by position changes (bending forward or alternating sides). The patient often describes leg heaviness, fatigue, pain, or numbness and tingling. Typically leg symptoms outweigh back complaints. In more severe cases, there may be urinary urgency or incontinence.

The physical examination is rarely dramatic and may be normal or produce subtle findings in most cases. The physician looks for muscle weakness, reflex asymmetry, sensory changes, or positive straight leg raising. If the exam is normal at rest, it should be repeated after exercise as this may bring out subtle changes. It can be particularly useful to have the patient, while standing, lean over the exam table backward in extension, as this often reproduces symptoms. Weakness and positive straight

leg raising are uncommon and if found should suggest additional pathology such as a disc herniation or a synovial cyst of the facet.

The differential diagnosis includes vascular claudication (not enough blood gets to the limbs due to constriction of the arterial vessels) but this tends to be more activity-related than position dependent. One must also rule out myofascial problems, infection, disc herniations, and tumors.

Radiologic studies include plain x-rays that may show degenerative changes but are not particularly helpful except in advanced cases. CT scanning and Magnetic Resonance Imaging (MRI) are more definitive for diagnostic purposes.

TREATMENT

Treatment approaches should begin and progress in a stepwise fashion starting with physical rehabilitation and medications, progressing through chronic pain management in selected individuals and ending possibly with surgical intervention.

Certain patients with high grade focal stenosis demonstrated by myelographic block or MRI should probably be surgically decompressed early on because the operation is small (micro) while the disease is precarious and usually resistant to prolonged conservative care. Prolonged conservative care is more important in patients with spondylolisthesis (slippage of vertebrae over another), scoliosis, and multifocal disease because the operation is much more involved and hazardous.

The majority of individuals can be treated successfully with stretching, strengthening and aerobic conditioning along with proper pacing of activities. Postural training is extremely important as symptoms are worsened with a lordotic (back extended) posture and with poor body mechanics. Weight loss in overweight and deconditioned individuals is important. Some patients do better with an aquatics rehabilitation program.

The appropriate use of analgesic and anti-inflammatory medications combined with judicious use of muscle relaxants and anti-depressants can be extremely helpful. In selected patients, pain management techniques including relaxation techniques, biofeedback, and meditation may be helpful. The treatment of secondary problems such as myofascial pain or fibromyalgia may be beneficial. When there is an inflammatory component, an occasional epidural or nerve root steroid injection may be helpful.

The use of opioid medication should be avoided but may be useful briefly for flare-ups. Some individuals find a TENS unit can be helpful, and for some acupuncture can be of benefit. Some individuals with lumbar spinal stenosis seek manipulative treatment, but there should be concerned about possible negative effects in an individual with an already compromised spine. There is no really good scientific data about manipulation specifically for spinal stenosis, but if used it probably should be limited to early, milder cases.

Operative intervention should be based on the patient's quality of life and level of function. In most cases, surgery should not be considered unless a non-operative rehabilitation effort has failed or there is evidence for a high-grade focal stenosis. Surgery tends to be more effective in lumbar spinal stenosis for leg pain rather than for back symptoms. In younger patients (below the age of sixty), the individual may outlive any beneficial results from surgery and even develop new or recurrent symptoms. Prolonged deconditioning can be devastating and should be avoided. The individual who is limited to household only ambulation for greater than six weeks or is bed ridden for even shorter periods should be considered for surgery. This assumes a lack of intervening significant psychosocial factors.

The surgical risk for lumbar spinal stenosis is low with a single level micro decompression alone whereas the risk is considerable with a multi-level fusion with instrumentation. There are no single functional criteria that by itself leads to a decision to go forward with surgery. Each individual is very unique regarding the level of pain, dysfunction, and disability they will present even with similar radiographic and physical findings.

We should be reminded by teachings of Dr. William Osler who reminded us that, "It is more important to know about the patient who has the disease than about the disease the patient has." It is a terrible mistake to focus on subjective complaints or radiologic findings alone, when other psychosocial variables may have more to do with an individual's presentation and

complaints. The patient with a history of psychosocial dysfunction and who is unhappy about his or her job or marriage may do poorly with surgery or even non-operative care, unless these issues are realized and addressed. The seemingly symptomatic elderly patient may have radiologic evidence of lumbar spinal stenosis but are the symptoms of back pain truly related to the radiologic findings or are the complaints a function of depression, loneliness and the need for attention.

A few years ago, a neighbor asked me to see his elderly father. This gentleman had terrible degenerative disease and spinal stenosis and had already been scheduled for back surgery. His symptoms were resolved, though, with a short course of medication, physical therapy, and involvement in a senior activity center. He did have rather severe degenerative lumbar spine stenosis, but his problem was a combination of poor posture, myofascial pain, depression and loneliness.

Surgery involves decompression directed at the cauda equina and nerve roots. This type of surgery can lead to spinal instability and in certain cases a spinal fusion with instrumentation may be needed. A surgical fusion is a more complicated and costly procedure with greater risks and higher morbidity. Over time instability may develop above and below the fusion. There is no guarantee of a successful fusion and post-operative complications may cause increased complaints and disability.

On the other hand, severe restriction of mobility in the patient can have serious constitutional effects. If the patient remains unable to ambulate for weeks or longer despite liberal analgesia, root or epidural blocks, and encouragement, these serious debilitating effects must be weighed against the surgical risks. A surgical evaluation will usually be able to determine pre-operatively the number of levels needing decompression, whether a fusion may be anticipated and over how many levels. The surgeon may also feel there is no operable option. Deformity, instability and osteoporosis may be such that there is no reasonable "fixing" of the problem with surgery.

Studies have suggested a fairly good success rate (75% or greater) in carefully selected cases, particularly with leg pain. The long-term results deteriorate over time. Patients may develop a similar problem at another level or recurrence at a non-fused level. The "half-life" of good results seems to be about 8-10 years.

SUMMARY

Lumbar spinal stenosis is a narrowing in the lumbar bony canal and/or foramen which becomes increasingly more prevalent as we grow older. In the majority of individuals, it is asymptomatic, but when there is compression and compromise of the nerve roots, symptoms may develop. Complaints typically include back and leg pain along with fatigue, numbness and tingling. Treatment includes both medications and physical rehabilitation techniques, but surgery may be indicated in selected cases.

HIP PAIN & INJURIES

INTRODUCTION

Hip pain is a common complaint in both a primary medical and orthopedic practice. Determining the source of hip pain is often challenging as hip problems may occur as a result of direct injury, cumulative trauma or secondary to lighting up an underlying degenerative process. Hip dysfunction presents both with localized and referred pain complaints and commonly results in abnormal gait patterns.

HIP STABILITY AND ANATOMY

The hip is a large, deep "ball-and-socket" synovial joint. This joint is composed of two parts: the hip socket referred to as the acetabulum; and the "ball" which is the head of the femur (thighbone). The deep acetabulum receives the head of the femur to form the hip joint. As compared to the shoulder, the hip joint has gained stability at the expense of some loss of motion. The strength of the hip joint results largely from the shape of the articular surfaces and in the ligaments, rather than from the associated musculature. In general, the major ligaments have a common action in limiting internal rotation of the femur.

Muscles attach near the neck of the femur and exert forces that translate into leg movement. There is a cushioning bursa, the trochanteric bursa that protects the tissues lateral to the hip. When the bursa becomes inflamed, it is termed a trochanteric bursitis.

The nerve supply to the hip comes from the femoral, sciatic and obturator nerves. The sciatic nerve is made of a medial peroneal nerve and a lateral tibial nerve division. The peroneal division is more susceptible to injury with hip dislocations or during total hip replacement. When damaged, the patient may present with a foot drop (dorsi-flexor weakness). The blood supply to the femoral head is derived primarily from two arteries that encircle it. These vessels run upward along the neck of the femur and make them susceptible to disruption when the neck of the femur is fractured.

BIOMECHANICS & GAIT

The hip is subject to considerable stress over a lifetime from movement, weight-bearing and repetitive impact. Any derangement in the smooth gliding of the joint surfaces can produce abnormal stress that can initiate a progressive deterioration of cartilage and subsequently the joint. The hip moves in a combination of three basic planes, flexion and extension, abduction and adduction (side-to-side) and external and internal rotation.

The muscles that hold us erect and allow walking and stair climbing exert considerable forces across the hip in the range of 3 to 6 times body weight. Thus a 25-pound weight gain may seem like 150 additional pounds to the hip. It is easy to recognize that degenerative changes (osteoarthritis) of the hip may be symptomatic much earlier and to a greater extent in obese patients.

The lower extremities are dedicated to the important tasks of weight bearing and ambulation. A gait abnormality is usually a consequence of pain, weakness, and/or a difference in leg length. The hips play an important role in normal walking and running and thus gait is usually significantly affected by hip pathology.

There are two phases in the normal gait cycle: stance phase when the foot is on the ground; and swing phase, when it is moving forward. Most hip problems become apparent in stance phase. The individual with hip pathology will typically shorten the stance phase and will lean over the affected hip. The gait will be characterized as antalgic (painful). During the swing phase, the pelvis may not rotate normally around the painful and stiff hip joint.

Reducing the overall load or increasing the surface area over which the load acts can decrease stress on the hip. Canes, crutches, and walkers decrease overall load and are therefore a common part of the non-surgical treatment for arthritis of the hip. Properly used, a cane will significantly improve walking distance and comfort.

HISTORY AND PHYSICAL EXAMINATION

The patient may present with specific complaints of hip pain, but often the complaints are more diffuse in nature involving the buttocks, groin and knee. Complaints commonly involve anterior groin pain, lateral thigh pain, posterior gluteal (buttock) pain and referred pain to the knee. Pain may also be referred from other areas such as the low back or may be due to non-muscular causes.

VARIOUS CAUSES OF HIP PAIN ARE AS FOLLOWS:

Musculoskeletal

- Avascular Necrosis (Osteonecrosis)
- Inflammatory Arthritis
- Osteoarthritis
- Bursitis
- Myositis
- Stress Fractures
- Traumatic Fracture
- Pathologic Fracture
- Post-Surgical
- Metabolic Conditions

Other Orthopedic Conditions

- Spinal Stenosis
- Degenerative Disk Disease
- Facet Joint Arthropathy
- Knee Osteoarthritis

Non-Muscular Conditions

- Hernias
- Aneurysms
- Atherosclerosis
- Meralgia Paresthetica
- Thrombophlebitis
- Cellulitis
- Abdominal Disease
- Retroperitoneal Pathology

Since the hip begins as a stable joint, problems are usually related to either specific or cumulative trauma, either of which may progress to osteoarthritis. A thorough history is essential in revealing evidence for a specific trauma versus progressive and cumulative problems over time, especially if industrial causation is an issue. The clinician should describe the mechanism of injury if known, and the nature, location, duration and intensity of symptoms. Additional clues such as the time of day when it occurs or is worse, how the symptoms respond to change in position and activity and whether there are associated swelling or other constitutional symptoms can narrow the differential diagnosis. Other issues that should be addressed involve body type, posture and body mechanics, occupation and leisure activities

The location of the symptoms may help the examiner better understand the potential source of the complaints. Pain over the anterior and lateral aspects of the thigh may be referred form the L2 or L3 nerve roots. Pain into the knee may be referred from L4 or L5 nerve roots or from the hip joint. Pain over the lateral hip area may be secondary to a trochanteric bursitis and pain posteriorly can result from a piriformis syndrome or ischial bursitis.

Observation is the first step of the examination. The patient who is leaning backward while sitting may have decreased hip flexion. For the individual leaning to one side, there may be an ischial bursitis, sacroiliac dysfunction or referred pain from the low back. The examiner may gather further information by observing the patient changing positions, as there may be changes in facial expression or other evidence of pain behavior. When the patient goes from a sitting to a standing position, the observer watches for difficulty in moving or weight bearing on the limb. With walking the individual may demonstrate a short stance phase or other gait deviations due to hip pain.

Closer inspection and palpation may demonstrate areas of localized atrophy or swelling, tenderness, discoloration or wounds, and/or temperature or skin changes. One should look for changes in symmetry between the two sides or any leg length discrepancies. The examiner should note loss of motion, weakness, and sensory or reflex changes.

OSTEOARTHRITIS

Osteoarthritis (OA) or degenerative joint disease of the hip occurs most commonly in patients over 50 years old. In the early stages progressive hip joint stiffness develops and the patient complains of pain with movement. Osteoarthritis may start as a primary degenerative process or it may develop secondary to a variety of childhood hip disorders. It may also be the result of some other inciting factor during adult life such as trauma, infection, or a metabolic or endocrine disorder. Recognized predisposing factors include congenital abnormalities (hip dysplasia), slipped capital femoral epiphysis, unrecognized avascular necrosis (from steroids, etc.) and age, but interestingly <u>not</u> obesity.

The pain is often unilateral. Early complaints can include morning stiffness and pain with weight bearing. It is usually described as dull and aching and it may subside initially with rest and the application of heat. Hip pain may be referred to the groin and/or knee. In fact, some patients present with groin or knee pain as their primary complaint.

As the OA progresses, the patient will complain of pain at rest. They will begin to notice night pain and soon there will be a noticeable limp followed by constant pain regardless of the activity. Internal rotation is usually the first motion to be restricted.

From a physical examination standpoint, the patient may have pain on internal rotation and extension as an early sign of osteoarthritis. Pain with motion of the leg may differentiate hip pain from other pelvic pain. Radiologic studies will typically reveal degenerative changes. Initial conservative treatment includes non-steroidal medications, localized heat, and hip strengthening exercises. As symptoms progress one should consider the use of a cane, which is properly used in the hand opposite the most affected hip.

In advanced cases, surgery may be indicated. Surgical options include osteotomy, fusion, or hip replacement. Osteotomy is the surgical realignment of one or both joint surfaces. A correctable deformity if treated may delay further deterioration of the hip as well as other affected joints such as the knee and ankle. Hip osteotomies are not common in the United States.

A hip fusion involves fusing the femur to the pelvis, but this results in loss of motion. The spine provides the flexibility required for walking and sitting. Fusion is commonly offered to highly symptomatic young patients where the goal is to delay a hip replacement until the individual is older. There are problems though with a hip fusion including increased risk of femur fracture and accelerated degenerative disease of the knee and spine.

Total hip replacement is a surgical procedure for replacing the hip joint. During the procedure, the head of the femur (ball) and the acetabulum (socket) of the hip joint are removed and replaced with smooth artificial surfaces. These artificial pieces are implanted into healthy portions of the pelvis and femur and affixed with bone cement (there are cementless varieties too). In some cases, only one of the two components (socket or stem) may be fixed with cement and the other is cementless. This is called a "Hybrid" hip prosthesis.

A total hip replacement (THR) is usually performed for a severe arthritic condition. The operation is sometimes performed for other problems such as hip fractures (especially in the elderly) or for aseptic necrosis. Most patients who have artificial hips are over 55 years of age, but the operation is occasionally performed on younger adults. Circumstances vary, but generally patients are considered for total hip replacements if:

- Pain is severe enough to restrict work, recreational activities, and/or activities of daily living.
- Pain can not be adequately managed conservatively by medications, the use of a cane or other assistive devices, and/or activity modification.
- Significant stiffness of the hip.
- X-rays demonstrate advanced arthritis, avascular necrosis or other significant problems.

A THR will provide pain relief in 90 to 95 percent of patients. It allows most patients to carry out normal activities of daily living. The artificial hip may allow return to active sports or heavy labor. Most patients with stiff hips before surgery will regain near-normal motion, and nearly all have improved motion. The most common complications are not directly related to the hip and do not usually affect the result of the operation. These include blood clots in the leg, urinary infections or difficulty urinating and blood clots in the lung. Complications that affect the hip are less common, but in these cases, the operation may not be as successful. This can include a leg length difference, stiffness, dislocation of hip (ball pops out of socket) and joint infection. A few of the complications, such as infection or dislocation, may require re-operation. Infected artificial hips sometimes have to be removed, leaving a short (by one to three inches), somewhat weak leg, but one that is usually reasonably comfortable and one on which you can walk with the aid of a cane or crutches.

Success rates for hip replacement surgery range from 90 to 95 percent up to 10 years. The major long-term problem is loosening of the prosthesis. This occurs either because the cement crumbles (as old mortar in a brick building) or because the bone melts away (resorbs) from the cement. By 10 years, 25 percent of all artificial hips will look loose on x-ray. Somewhat less than half of these (about 5% to 10% of all artificial hips) will be painful and require revision. Loosening is in part related to how heavy and how active the patient is. It is for this reason that orthopedists do not typically operate on very obese patients or young, active patients. Loose, painful artificial hips can usually, but not always, be replaced. The results of a second operation are not as good as the first, and the risks of complications are higher.

INFLAMMATORY ARTHRITIS

Rheumatoid arthritis (RA) is a chronic, inflammatory disease with bilateral and often symmetric involvement of joints. While RA occurs at all ages, it is more common with advancing age with the incidence peaking between the fourth to sixth decades. Women are twice as often affected than men. Rheumatoid arthritis of the hip is usually a late manifestation of more widespread disease. An x-ray will show joint space narrowing and osteoporosis about the hip area. Patients with RA will often have various other findings not involving the joints including rheumatoid nodules, neuropathy, pericarditis (inflammation about the heart), splenomegaly (enlarged spleen) and lymphadenopathy (enlarged lymph nodes). Other types of inflammatory arthritis include ankylosing spondylitis and psoriatic arthritis. Occasionally, gout will involve the hip. Joint infection is another form of inflammatory arthritis and if not treated early with antibiotics, may result in severe hip damage.

TROCHANTERIC BURSITIS

The bones, ligaments, tendons and muscles are kept from rubbing each other by four small fluid filled sacs call bursae. These bursae are susceptible to an inflammatory response from direct or indirect trauma. The hip or trochanteric bursa is located between the hip and the overlying muscles and skin. A trochanteric bursitis usually affects the lateral aspect of thigh. It is often associated with osteoarthritis and trauma. Bursitis is usually treated with NSAIDs, ice, physical therapy modalities, and possible activity modification. Local corticosteroid injections may help cure or alleviate bursitis in the more refractory cases.

AVASCULAR NECROSIS

Avascular necrosis, aseptic necrosis or osteonecrosis of the femoral head is presumed secondary to a local vascular insufficiency. In the initial stages only the femoral head is involved and the acetabular cartilage remains normal. The degree of femoral head collapse is variable. Over time, movements of the irregular joint surfaces cause degenerative changes in the acetabular cartilage as well. Alcohol abuse and corticosteroid treatments are the most common identifiable factors associated

with avascular necrosis of the hip. Metabolic and hematological (blood) abnormalities may be involved as well. Patients on renal dialysis and those with systemic lupus erythematosus are at an increased risk. Traumatic avascular necrosis can occur after hip fracture or dislocation (more commonly in older patients). There may be little pain early in the disease and only subtle physical findings may be present such as loss of hip internal rotation. Acute pain often follows the collapse of the femoral head followed by pain and symptoms of degenerative arthritis. Plain x-rays may appear normal in early avascular necrosis, but as the disease progresses, the femoral head appears sclerotic and loses its spherical shape. A bone scan late in the disease is almost always positive because of new bone formation. An MRI is a sensitive indicator of early avascular necrosis. Short of a total hip replacement, a core decompression surgery is effective in some cases. The theory behind this approach is that drilling one or more channels into the bone will relieve congestion and thus improve circulation to the area.

HIP JOINT EFFUSIONS

An effusion refers to fluid in the hip joint. It is commonly seen secondary to intracapsular fractures, toxic synovitis of the hip, septic arthritis, osteomyelitis and Legg Perthes disease in children. The person suffering from a painful hip joint effusion is most comfortable when seated with the painful thigh lightly abducted and externally rotated at the hip joint. This orientation reduces tension in synovial membrane to a minimum because it maximizes encapsulation of the femoral head by the acetabular cavity and labrum. The most sensitive indicator of a hip joint effusion in an x-ray is the presence of an inferolateral displacement of femoral head from the acetabular cavity.

HETEROTOPIC OSSIFICATION

Heterotopic ossification may present with signs of localized inflammation or pain and with elevated skin temperature. It tends to occur after spinal cord injury, head injury, burns and bruising injuries. X-rays will show soft tissue bone formation (ossification), but this usually does not appear in the first month. A bone scan may reveal increased isotopic intake by the second week. Blood tests will show an elevated alkaline phosphatase which correlates with the bone scan abnormality. Non-operative treatment includes non-steroidals such as Indomethacin. Etidronate (a medication) is used to delay mineralization and is effective in heterotopic ossification. Radiation therapy is also an option. Operative resection is delayed until the heterotopic bone has matured (about 12 months). The main disadvantage of early resection is risk of recurrence. Bone scans and alkaline phosphatase levels may not be helpful in predicting maturity of the ossification.

HIP FRACTURES AND DISLOCATIONS

High-impact injuries to the hip region, most often seen in automobile accidents and falls, can cause severe hip and pelvic fractures. Hip fractures in the elderly are most often secondary to falls with associated osteoporosis. Pathological fractures may be seen with metastatic disease. Fracture types usually include intertrochanteric (fracture occurs between greater and lesser trochanters) and subtrochanteric (between lesser trochanter and 5 cm distal) and femoral neck fractures.

Hip dislocations are typically caused by high-energy trauma, usually from motor-vehicle accidents. They occur most frequently in young patients. There are three types: anterior, posterior and central acetabular fracture dislocations. Clinical findings in patients with posterior hip dislocations include internal rotation of the hip, whereas patients with anterior dislocations will have external rotation of the hip. If this is not the case, the examiner should be suspicious of a femoral neck or shaft fracture or a same-sided knee dislocation. The diagnosis is confirmed by an x-ray. With posterior dislocations the head will migrate superiorly while with anterior dislocations the head will migrate inferiorly or medially. Complications after a dislocation can include heterotopic ossification, avascular necrosis and sciatic nerve injury.

DIFFERENTIAL DIAGNOSIS

There are a number of structures near the hip region that can present with pain and need to be considered in the differential diagnosis of hip problems.

Ischial bursitis is associated with activities that involve prolonged sitting. It can be seen with bicycle riding. It presents with sharp, abrupt pain upon sitting. Patients report that it hurts to stand on tiptoes. The ischial tuberosity may be painful on rectal exam. The differential diagnosis includes lumbar spinal pain, thrombophlebitis and sacroiliitis. The treatment includes rest, NSAIDs and injections (difficult into this bursa).

Iliopectineal bursitis involves inflammation of psoas bursa. Pain may present in the pelvis, groin and thigh. It may cause a hernia-like bulge. The patient will have pain on extension of the hip or with attempted flexion against resistance. There is not much pain on rotation. It may be associated with rheumatoid arthritis.

Hip pain may be referred to the groin area, but symptoms may be primary from this area as well. The patient may have a groin ligament strain or inguinal or femoral hernia. Many of the muscles about the hip area and buttocks may develop myofascial pain and associated trigger points and may mimic hip pain and also sciatica.

SUMMARY

Injured workers can develop work disabling hip problems as a result of direct injury, related to cumulative trauma or secondary to lighting up an underlying degenerative process. Hip dysfunction presents both with localized and referred pain complaints and commonly results in an abnormal gait. A careful history, comprehensive physical examination and appropriate diagnostic studies can narrow the differential diagnosis, lead to more directed treatment and improved functional outcomes. Treatment approaches include anti-inflammatories, the early use of modalities followed by stretching and strengthening exercises. Assistive devices such as canes may be useful in selective cases. Surgery may be warranted with fractures and with severe degenerative disease.

KNEE PAIN & INJURIES

INTRODUCTION

The knee is commonly injured in all age groups. Knee injuries typically occur with sports and exercise, but also occur as a result of work-related activities. Knee injuries can frequently lead to significant limitations and lost time from work. Prompt diagnosis and treatment of these injuries is of paramount importance in order to prevent and/or reduce long term disability.

The knee is the largest joint in the body. It basically functions as a hinge joint, similar to a door hinge and it provides a fairly wide range of motion, especially in flexion. By permitting bending of the lower extremity, the knee is very important for performing many daily activities and for efficient walking.

The knee is susceptible to trauma because it is not protected by layers of muscle or fat and is located at the end of two long lever arms; the proximal end of the tibia (the shin bone) and the distal end of the femur (thigh bone). The patient often gives a history of a twisting episode followed by swelling, clicking, popping, grinding, giving way (buckling) or locking.

There are many areas around the knee that can be injured, but the most commonly affected structures are the cartilage (menisci) and ligaments. The ligaments are found on each side of the joint and there are two other ligaments that cross inside the knee, known as cruciates (anterior and posterior).

Although many problems about the knee can be treated conservatively with early mobilization, ice, physical therapy, and NSAIDs (non-steroidal anti-inflammatory drugs), some conditions, such as meniscus tears usually will require arthroscopic surgery.

ANATOMY

A better understanding of knee problems starts with the anatomy and how the different parts work together to maintain normal function. The medial side of the knee is on the inside of the leg and faces the other knee while the lateral side is on the outside. The important parts of the knee include bones, ligaments, tendons, and cartilage.

The knee is composed of three bones (femur, tibia and patella). The femur is the large bone of the thigh. The tibia is the large bone of the lower leg (the fibula is the small bone just lateral to the tibia and is not part of the knee mechanism). The femur and the tibia meet to form the knee and the joint is protected in front by the moveable patella (kneecap). The patella is aligned to improve the power of the large thigh muscle (quadriceps) on the front of the leg. The underside of the patella is covered with cartilage, which is the smooth covering of joint surfaces. This slippery surface helps the patella glide in a special groove on the front of the femur. By displacing the quadriceps anteriorly, it increases the muscle's mechanical advantage by 25%. The patella has the thickest cartilage of any bone in the body. It experiences significant loads during activities such as stair climbing, running and jumping.

Since the hips are wider apart than the knees, the femurs point inward towards the tibia thus creating a valgus angle ("knock-kneed" if extreme). Since the quadriceps lies along the femur, when it contracts, it pulls the patella laterally. This displacement laterally is counteracted by the inside or medial fibers of the quadriceps (vastus medialis). Any imbalance of these forces can lead to a pre-arthritic condition, chondromalacia patellae (*chonro* means "cartilage" and *malacia* means "softening"). The knee is composed of two articulations (where two bones come together), the tibiofemoral (tibia & femur) and the patellofemoral (patella & femur). The tibiofemoral joint is formed by two large bulbous areas from the femur (femoral condyles) which rest on the relatively flat tibial plateau. This joint is inherently unstable with potential for movement in four directions (Flexion-extension, side-to-side, external-internal rotation and anterior-posterior). This movement can vary from individual to individual and is stabilized by muscles and ligaments.

The joint is cushioned by cartilage that covers the ends of the tibia and femur as well as the underside of the patella. This white, shiny material has a rubbery consistency. The function of cartilage is to absorb shock and provide an extremely

smooth surface to facilitate motion. There is cartilage essentially everywhere the two bony surfaces come together (articulate). Two structures called menisci sit between the femur and the tibia. The menisci (lateral and medial) are pads of cartilage that further cushion the joint, acting as shock absorbers between the bones. They also help with knee stability.

The knee has very little bony stability and behaves more like a round ball (femur) on a flat surface (tibia). Because there is no inherent bony stability, the ligaments of the knee are very important. The ligaments, all taken together, are probably the most important structures controlling stability of the knee. There are two pairs of major ligaments (medial and lateral collateral ligaments, anterior and posterior cruciate ligaments) and many minor or capsular ligaments that stabilize the knee joint.

The medial and lateral collateral ligaments lie on either side of the knee and prevent excessive side-to-side displacement of the tibia relative to the femur. The anterior and posterior cruciate ligaments lie within the knee (intra-articular) in the midline. The posterior cruciate is the larger of the two and acts like a gate hinge and also prevents posterior displacement of the tibia on the femur. The anterior cruciate ligament prevents anterior displacement and excessive internal rotation of the tibia on the femur.

Ligament injuries usually occur in pairs. Once there is compromise of the ligaments, there will be excessive movement of the knee. Increased laxity leads to excessive shear stress resulting in accelerated erosion of the meniscal surfaces and increased synovial fluid (joint swelling) production due to irritation of synovial tissues (synovitis).

Finally, the extensor or quadriceps mechanism sits in front of the knee joint. This includes the patella and the patellar tendon that connects the patella to the tibia. This tendon covers the patella and continues proximally as the quadriceps tendon (the quadriceps muscle covers the front of the thigh). The patella fits into a groove called the patellofemoral groove on the front of the distal femur. The way in which the patella fits into this groove, and slides as the knee bends, can affect the overall function of the knee. The patella functions like a fulcrum, and increases the force exerted by the quadriceps muscles as the knee straightens. When the quadriceps muscle contract, the knee straightens. When the quadriceps relaxes, the knee bends. The quadriceps or extensor mechanism is the motor that drives the knee joint and allows us to walk.

INJURY HISTORY

The history of injury usually provides us with the likely diagnosis, and we rely on the physical examination and diagnostic tests primarily to confirm or refute our initial impressions. It is extremely important to note the mechanism of injury. Appropriate questions include: What activity was the individual engaged in? What type of surface was the patient walking/running on and what type of shoes were worn? What direction(s) was force sustained? Was there a direct trauma or specific injury or did symptoms progress over time from cumulative effects? Has it been recurrent and/or progressive? Is there a history of a twisting episode? Do the patient report swelling, clicking, popping, grinding, giving way (buckling) or locking? What are the patient's functional limits (walking, squatting, kneeling, stair climbing, etc.)? Is there a problem with sitting? Is there stiffness upon arising in the morning or after sitting?

PHYSICAL EXAMINATION

The physical examination starts out with observation of the patient during walking, sitting and moving about the exam room. It is helpful to ask the patient to point to the spot where and when it hurts the most. The physician or therapist is looking for gait deviations, alignment problems, bruising, swelling, temperature changes, muscle wasting, kneecap (patella) grinding, ligament instability, and/or loss of motion. There are also several provocation tests to evaluate for meniscal and/or ligamentous injury. The Apprehension sign involves passive lateral movement of the patella. When positive, this will result in a reflex contraction of the quadriceps muscle, thus indicating lateral instability of the patella. Collateral ligament testing provides force to test for laxity of the medial and lateral collateral ligaments. A positive Lachman’s test and/or Anterior Draw sign indicate a potential tear of the ACL. The McMurray maneuver and/or Apley test are used to assess for meniscal injuries. Specific descriptions of these tests are beyond the scope of this article.

RADIOLOGIC STUDIES

X-rays do not show ligament or cartilage damage but do show fractures and degenerative changes. A Magnetic Resonance Imaging (MRI) scan can be helpful but is not necessary unless the physician feels strongly that the outcome of the scan will contribute to or change the proposed course of treatment. It is strongly recommended that clinicians match clinical signs and symptoms with MRI findings since there is some suggestion in the literature that abnormal MRI findings such as meniscal tears are found even in asymptomatic people.

DIFFERENTIAL DIAGNOSIS

Patients who present with knee complaints do not necessarily have a knee problem. Hip pathology typically refers pain to the groin and knee. Patients with lumbar disc disease (radiculopathy) or femoral nerve compromise may have knee pain as a primary presenting complaint. When an individual has pathology in the back, hip, ankle or foot, improper body mechanics and gait may result in abnormal forces on the knee eventually leading to true knee problems. The treatment needs to be directed at the initial offending problem. There are medical problems that may involve the knee. Gout while most commonly found in the toes, foot and ankle is also found in the knee. Pseudogout is found predominantly in the knees and wrists and hydroxyapatite deposition may involve the knee, although it is more common in the shoulder. Detailed descriptions of these conditions are beyond the scope of this article.

BURSITIS OF THE KNEE

The bones, ligaments, tendons and muscles are kept from rubbing each other by four small fluid filled sacs call bursae. These bursae are susceptible to an inflammatory response from direct or indirect trauma. The prepatellar bursa is the most commonly affected area (housemaid's knee) and may present with a significant degree of swelling. Traumatic prepatellar bursitis may be caused by acute injury such as a fall directly on the patella or by recurrent minor injuries. The infrapatellar and deep patellar bursae are infrequently affected. The fourth bursa (pes anserine) is located over the medial tibial area and is rarely affected with bursitis and is a diagnosis of exclusion. Bursitis conditions occurring about the knee are usually treated with NSAIDs, ice, physical therapy modalities, and possible activity modification. The treatment of knee bursitis can include aspiration and steroid injection. When infection is present, incision and drainage may be required when the patient fails to respond to non-surgical treatment.

MENISCAL INJURY

The meniscus is a commonly injured structure in the knee. The injury can occur in any age group. In younger people, the meniscus is fairly tough, and tears usually occur as a result of a fairly forceful twisting injury. The meniscus grows weaker with age, and in the working age population, meniscal tears can occur as a result of a fairly minor injury, even from the up and down motion of squatting. There are various specific types of meniscal tears (bucket handle, horizontal, longitudinal, oblique, radial, flap) or the tear can be a degenerative type tear where a portion of the meniscus is frayed and torn in multiple directions. A meniscal tear most often involves the medial meniscus.

The patient may give a history of knee injury associated with a rotational component. They usually present with complaints of a catching, locking or giving way sensation. There may be mild to moderate knee joint swelling. Thigh atrophy may be present. Pain is the most common problem caused by a torn meniscus. It may be felt along the joint line where the meniscus is located or may be vaguer and involve the whole knee. If the torn portion of the meniscus is large enough, locking may occur. The fragment of meniscus gets caught in the hinge mechanism of the knee and will not allow the leg to straighten completely. There are long term effects of a torn meniscus as well. The constant rubbing of the torn meniscus on the articular cartilage may cause wear and tear on the surface, leading to arthritis of the joint.

Initial treatment for a torn meniscus usually is directed towards reducing the pain and swelling in the knee. If the symptoms continue, arthroscopic surgery may be required to either remove the torn portion of the meniscus or to repair the tear. Repair of the meniscus is not possible in most cases. Young people with relatively recent meniscal tears are the most likely candidates for repair. Degenerative type tears in older people are not repairable.

The menisci provide a larger area of contact between the femur and tibia which provides cushioning and stability. A torn meniscus that cannot resist peripheral displacement will no longer provide a protective function. With the meniscus removed there is an increase in shear force that may cause premature degeneration of cartilage.

ANTERIOR CRUCIATE LIGAMENT INJURIES (ACL)

In the intact knee, the ACL provides 85% of the restraint to anterior displacement. The ACL is commonly damaged in a forceful valgus-external rotation injury. This type of injury is frequently associated with damage to the medial collateral ligament and medial supporting structures. Acute disruption is commonly associated with an audible sound, hemarthrosis with blood in the joint, guarded or painful range of motion and profound disability. MRI scanning is effective in defining ACL lesions. Functional bracing may be of benefit when there is low-grade laxity and under mild load conditions. Up to 70% of patients complains of "giving way" even with bracing.

If left untreated, the torn ACL leads to anterior laxity, rotatory instability, meniscal tears and progressive degenerative changes. Reinjury is common after resuming previous athletic activity level. Individuals with an isolated ligament injury who are willing to moderate the activity will find non-operative treatment to be satisfactory in the majority of cases. The ACL is the more commonly injured than the PCL.

POSTERIOR CRUCIATE LIGAMENT INJURIES (PCL)

The major cause of injury to the PCL, like the ACL, is probably sports related. This injury occurs when the knee is forcefully twisted or hyperextended. The PCL controls how far backward the tibia moves in relation to the femur. If the tibia moves too far the PCL can rupture. This tearing of the ligament results in a feeling of instability in the knee. The PCL may not be the only ligament injured when the knee is injured violently, such as in a car wreck or blow to the upper tibia from the front. It is common to see several ligaments in addition to the PCL injured during a knee dislocation.

The symptoms following a tear of the PCL are variable. Since the PCL is really outside of the knee joint, swelling from torn blood vessels in the ligament may not fill the joint with blood (in contrast to the ACL tear). The instability caused by the torn ligament leads to a feeling of insecurity and giving way of the knee, especially when trying to change direction on the knee.

The pain and swelling from the initial injury will usually resolve after 2 to 4 weeks, but the instability remains. The symptom of instability, and the inability for the patient to trust the knee for support is what requires treatment. There is clinical evidence that long term instability leads to early arthritis of the knee.

The history and physical examination is probably the most important tool in diagnosing a ruptured or a deficient PCL. The physician assesses by examination if the tibia moves too far back on the femur. X-rays of the knee to rule out a fracture may also be ordered. Since ligaments and tendons do not show up on x-rays, the most accurate test without actually looking into the knee, is the MRI scan. In some cases, arthroscopy may be used to make the definitive diagnosis if there is a question about what is causing the problem. The vast majority of PCL tears are diagnosed without resorting to surgery, and arthroscopy is usually reserved to treat the problems.

The first goal of treatment for a posterior cruciate ligament injury is to limit swelling and pain. Immediately after this type of injury, ice is a good first aid treatment. A long-leg brace and use of crutches may help protect the knee from further. An anti-inflammatory medication may be prescribed, and physical therapy is then begun. Less severe tears are treated with a progressive rehabilitation program. Patients involved in high level activities, like cutting, pivoting, or working on unlevel surfaces may require a dynamic knee brace before returning to work or sports.

The key to conservative treatment is to provide long term control of swelling, giving way, and pain. If these areas can be managed, surgery may not be needed. However, the individual may also need to modify recreational and/ occupational activities. Specific physical therapy modalities to help control pain and inflammation can include electrical stimulation, cold packs/wraps, and cold whirlpool. In addition, the individual should be instructed to apply the RICE (rest, ice, compression, and elevation) principle several times a day as a home supplement to supervised visits. As swelling and pain decrease, the patient will move through a gradual and progressive rehabilitation program. Treatment will focus on restoring normal movement of the knee, developing control in the quadriceps muscle group, and applying functional exercises that simulate

normal activity. This will progress to higher level agility, endurance training, and cutting or pivoting activities based on specific return to sport or work needs. To help improve stability a brace may be suggested.

Surgery may be suggested if the symptoms of instability are not controlled by a brace and a rehabilitation program. Most surgeons now favor arthroscopic reconstruction of the PCL using a piece of tendon or ligament to replace the torn PCL. After surgery, a physical therapy rehabilitation program should be instituted which usually takes about 6 months after surgery to achieve the best results.

COLLATERAL LIGAMENT INJURIES

The Collateral Ligaments are commonly injured structures in the knee. These injuries can occur in many ways. The injury usually involves a significant force, such as a fall while skiing or a direct force to the side of the leg.

The collateral ligaments limit side to side motion of the knee. If these ligaments are stretched too far, they may tear. The tear may occur near the ends or in the middle of the ligament, such as in this tear of the medial collateral ligament. If the force is great enough other ligaments may also be injured. The most common combination is a tear of the medial collateral ligament and a tear of the anterior cruciate ligament. The lateral collateral ligament on the other side of the knee can also be torn, but it is less commonly injured.

An injury violent enough to tear one of the collateral ligaments usually causes significant damage to the surrounding soft tissues. There may be bleeding and/or swelling of the tissues, and perhaps inside the knee joint (causing an effusion). The knee typically is stiff and painful. As the initial stiffness and pain reside there may be a feeling of instability, and the knee may buckle.

The initial physical examination usually gives a very good indication of what ligaments have been torn in and around the knee. X-rays may be required to rule out the possibility that bony damage has occurred as well. Stress x-rays (plain x-rays taken with someone attempting to open the side of the joint that is suspected to be unstable) may confirm that one of the collateral ligaments has been torn. The x-rays will show a widening of the joint space on that side if instability is present. An MRI scan may be ordered, primarily when there is evidence that multiple injuries have occurred, including injury to the meniscus and possibly, the anterior cruciate ligament.

Most injuries to the collateral ligaments will heal with simple immobilization in a cast or brace for 4-6 weeks. An isolated injury to one of the collateral ligaments infrequently requires surgical repair or reconstruction. The initial treatment for a collateral ligament injury focuses on decreasing inflammation. Rest and anti-inflammatory medications can help accomplish this. As the ligament heals, a physical therapy program will help in decreasing pain and inflammation, improving motion, and regaining strength. Physical therapy treatment modalities can include electrical stimulation, cold packs/wraps, and ultrasound. Initial rest is followed by range of motion and by progressive stretching and strengthening.

PATELLOFEMORAL PROBLEMS

Patellofemoral pain accounts for 25% of all knee injuries and is very common in runners. Nearly all patellofemoral disorders can be traced to some underlying predisposition of malalignment of the knee extensor mechanism. This can be the result of soft tissue inflexibility, muscle imbalances or bony malalignment of the lower extremity. Problems develop when the patella suffers wear and tear. The underlying cartilage begins to soften (Chondromalacia Patellae). Degeneration can develop from generalized wear and tear from use over time, but problems can also arise from excessive tightness of the muscles on the front or outside of the thigh. Patients can have early patellofemoral problems with normal x-rays and even without evidence of chondromalacia.

One of the more common problems is an abnormality in the way the patella moves as the knee is bent or straightened. This usually results from either a muscle or structural imbalance and is referred to as Patellofemoral Syndrome. The patella normally moves along a path that is controlled by the quadriceps muscle located on the front of the thigh. If the inside part of this muscle group is weak, a muscle imbalance occurs, and the patella will stray from its normal path. In time this faulty movement can cause wear and tear of the cartilage. The femoral condyle is a protrusion on the outside part of the knee that

normally acts as a buttress for the patella, keeping it in the groove. In cases where the femoral condyle is too small, the patella has a tendency to slip outward.

Despite these imbalances, some people never have significant knee pain. Others experience vague pain in the knee that is difficult to localize. Pain may be felt along the inside edge of the patella, though this is not always the case. Typical complaints include pain when walking down stairs or hills, keeping the knee bent for long periods as in the car or theater or with pressure to the patella. The knee may feel as if it gives out on occasion, but this is thought to be a reflex response to the pain and not an indication of instability.

Diagnosis begins with a complete history the knee problem followed by an examination of the knee, including the patella. While an x-ray can help determine is the patella is abnormally worn, it may not be helpful in determining if the patella is potentially tracking properly as this is primarily a clinical diagnosis. In the later stages, arthritis may be seen between the patella and femur. An MRI scan can help rule out other conditions such as a torn cartilage if this is suspected.

The initial treatment for patellar dysfunction begins by decreasing inflammation in the knee. Rest, anti-inflammatory medication and physical therapy can help decrease the pain, inflammation and swelling. If these measures fail to provide lasting improvement, surgery may be indicated. A lateral release may be performed to relieve pressure on the articular cartilage, allowing the patella to shift back to a normal position. In this operation, the tight ligaments on the outside (lateral side) of the patella are cut to allow the patella to slide more towards the center of the femoral groove. These ligaments eventually heal with scar tissue that fills in the gap created by the surgery. In cases of severe malalignment, a lateral release alone may not be enough. The tendons on the inside edge of the knee (the medial side) may have to be tightened. In very severe cases, such as in a dislocating patella, the attachment of the patellar tendon may also have to be moved.

KNEE OSTEOARTHRITIS

The knee is the most common joint to be involved in osteoarthritis and it is a common problem for many people over 50. Osteoarthritis is sometimes referred to as degenerative, or wear and tear arthritis. Osteoarthritis may result from an injury to the knee earlier in life. Fractures involving the joint surfaces, instability from ligament tears, and meniscal injuries can all cause abnormal wear of the knee joint. Not all cases of osteoarthritis are related to prior injury, however. Research has shown that some people are prone to develop osteoarthritis, and this tendency may be genetic. Obesity has been shown to be a causative (and not just associated) risk factor. The medial compartment of knee is most commonly affected when obesity is a factor. The problem is more common in females. Treatment is geared towards walking, weight loss, wraps to minimize effusion, ice/heat, NSAIDs and eventually may lead to knee replacement.

The main problem in osteoarthritis is degeneration of the cartilage that covers the joint. This results in areas of the joint where bone rubs against bone. Bone spurs may form around the joint as the body attempts to repair itself. Osteoarthritis develops slowly over several years. The symptoms of osteoarthritis are pain, swelling, and stiffness. The pain is usually worse during and after activity. Early in the course of the disease, pain may be absent or minimal while walking, but after sitting for several minutes the knee becomes stiff and painful. As the condition progresses, pain can interfere with even simple daily activities. In the late stages, the pain can be continuous and even affect sleep patterns.

The diagnosis can usually be made on the basis of the initial history and examination. X-rays are very helpful in the diagnosis and will be the only special test required in the majority of cases. Treatment is directed at decreasing the symptoms, and slowing the progression. The first goal is to help reduce pain. Acetaminophen or an anti-inflammatory medication should be used in combination with physical therapy. The patient is encouraged to keep the muscles around the knee flexible and strong and to avoid unnecessary trauma. A cane may be helpful to unload weightbearing. It should be used in the opposite hand to provide a wider base of support. A good pair of shoes may help reduce impact. Avoiding excessive stair climbing or prolonged standing and walking on hard surfaces is also recommended.

If the symptoms persist or progress, a steroid injection may be used to bring the inflammation under better control and ease the pain. Steroids are very powerful anti-inflammatory medications but may have secondary effects that limit usefulness in the treatment of osteoarthritis. The major drawback of intra-articular injections is that it may actually speed the process of degeneration with repetitive use. Most physicians avoid multiple injections unless the joint is already in the end stages of degeneration.

Arthroscopy is sometimes useful in the treatment of osteoarthritis of the knee. Looking directly at the articular cartilage surfaces of the knee is the most accurate way of determining how advanced the osteoarthritis is. Arthroscopy also allows the surgeon to debride the knee joint. Debridement essentially consists of cleaning out the joint of all debris and loose fragments. The areas of the knee joint that are badly worn may be roughened to promote the growth of new cartilage. If successful, arthroscopy usually affords temporary relief of symptoms for somewhere between 6 months to 2 years.

Osteoarthritis usually affects the inside half (medial compartment) of the knee more often than the outside (lateral compartment). This can lead to the lower extremity becoming slightly bowlegged, or in medical terms, a genu varum deformity. The result is that the weight bearing line of the lower extremity moves more medially (towards the medial compartment of the knee). The end result is that there is more pressure on the medial joint surfaces, which leads to more pain and faster degeneration. There is a knee brace available for medial compartment osteoarthritis.

In some cases, realigning the angles in the lower extremity can result in shifting the weight-bearing line to the lateral compartment of the knee. This, presumably, places the majority of the weight-bearing force into a healthier compartment. The result is to reduce the pain and delay the progression of the degeneration of the medial compartment. The procedure to realign the angles of the lower extremity is called a proximal tibial osteotomy. In this procedure a wedge of bone is removed from the lateral side of the upper tibia. This converts the extremity from being bow-legged to knock-kneed. This procedure is not always successful, and generally will reduce pain, but not eliminate it. The advantage to this approach is that very active people still have their own knee joint, and once the bone heals there are no restrictions to activity. The proximal tibial osteotomy in the best of circumstances is probably only temporary. It is usually done in hopes of postponing the need for a total knee replacement.

The ultimate treatment for advanced osteoarthritis of the knee is to replace the joint surfaces with an artificial knee joint. The decision to proceed with a total knee replacement is usually only considered in people over the age of 60, although younger patients sometimes require the surgery simply because no other acceptable solution is available to treat their condition. The main reason that orthopedic surgeons are reluctant to perform the surgery on younger individuals, is that the younger the patient, the more likely the artificial joint will fail. Replacing the knee the second and third time is much harder and much less likely to succeed.

Artificial knee joints last about 12 years in the elderly population. Younger patients are more active and place more stress on the artificial joint and this can lead to loosening and premature failure. Obviously, younger patients are also more likely to outlive their artificial joint and will almost surely require a revision at some point down the road.

KNEE INJURES IN THE WORKPLACE

Most work-related knee injuries can be diagnosed on the basis of the specific mechanism of injury. A detailed account of the injury, including the nature of the injury and initial impairment is critical in validating the industrial claim. The development of MRI scanning and arthroscopy has resulted in a dramatic change in advancing our ability to diagnose and treat knee injuries in injured workers. This has led to accelerated healing with earlier return to the workplace.

Several studies have examined the causal relationship between osteoarthritis (OA) of the knee and occupational activity. Although most of these studies are either occupation specific (e.g. carpet layers, roofers, coal miners) they generally form similar SUMMARYs. The majority of studies propose that osteoarthritis of the knee is more commonly seen in those occupations which require frequent or repetitive squatting, kneeling or climbing. In one study, the increase in risk associated with kneeling or squatting appeared to be more marked in subjects whose jobs entailed heavy lifting, however the size of the study prohibited a direct correlation. (Cooper C. Ann Rheum Dis 1994 Feb;53(2):90-93)

Another study reviewed the literature on the risk of knee disorders in connection with kneeling or squatting work and heavy physical work. They concluded that all the studies demonstrated a significantly increased prevalence of knee osteoarthritis for subjects with kneeling or squatting work, and four of eight studies demonstrated a significantly increased prevalence in those performing heavy physical work. All the studies on bursitis showed an increased prevalence of bursitis in subjects with kneeling work. Occupational exposure could not be sufficiently documented as the cause of meniscal lesions and chondromalacia.

A study at Stanford University, examined the roles of physical activity (both work and leisure), obesity, and a history of significant knee injury in the development of OA. They concluded that the obesity, significant knee injury and long-term heavy physical activity are important risk factors for the development of OA of the knee.

SUMMARY

The knee is the largest joint in the body and basically functions as a hinge joint providing a fairly wide range of motion. By permitting bending of the lower extremity, the knee is very important for performing many daily activities and for efficient walking. The knee is commonly injured in all age groups and injuries can frequently lead to significant limitations and lost time from work. Prompt diagnosis and treatment of these injuries is of paramount importance in order to prevent and/or reduce long term disability.

The knee is susceptible to trauma because of its location and because it is not protected by layers of muscle or fat. The patient often gives a history of a twisting episode followed by swelling, clicking, popping, grinding, giving way (buckling) or locking. There are many areas around the knee that can be injured, but the most commonly affected structures are the cartilage (menisci) and ligaments. The ligaments are found on each side of the joint and there are two other ligaments that cross inside the knee, known as cruciates (anterior and posterior).

Industrial exposure may contribute to knee pathology and therefore disability through specific injury but also secondary to cumulative trauma. Although many problems about the knee can be treated conservatively with early mobilization, ice, physical therapy, and non-steroidal anti-inflammatory drugs, some conditions will require surgery.

ANKLE & FOOT INJURIES

INTRODUCTION

We may ignore and take for granted our feet and ankles either by wearing poorly designed footwear or by engaging in harmful activities, but we realize soon enough if they have suffered abuse or are injured. Foot and ankle problems are actually very common, and it is not unusual to hear someone say, "oh my aching feet."

This part of our body is critical for providing a stable platform of support in standing, to assist with efficient forward propulsion of the body, to adapt to changes in uneven terrain and to attenuate impact loading (shock absorption). The disorders of the ankle and foot are difficult to describe due to their complexity. The ankle and foot are composed of more than 28 bones. The complexity is further reflected by the presence of numerous muscles, tendons, ligaments, fascial structures, nerves and blood vessels as well as skin, hair and nails. The ankle and foot are subject to numerous static disorders and multiple potential traumatic events.

ANATOMY OF THE ANKLE & FOOT

The ankle is a complex mechanism. It is a hinge joint. What we normally think of as the ankle is actually made up of two joints: the first, the true ankle joint is composed of 3 bones. The tibia projects downward to form the medial malleolus (the inside, or medial, portion of the ankle), the fibula projects downward to form the lateral malleolus (the lateral or outside portion of the ankle) and the talus coming up from the foot underneath.

The true ankle joint is responsible for the up and down motion of the foot. Beneath the true ankle joint is the second part of the ankle, the subtalar joint, which consists of the talus on top and calcaneus on the bottom. The subtalar joint allows side to side motion of the foot. The ends of the bones in these joints are covered by articular cartilage.

The foot itself is composed of 14 phalangeal, 5 metatarsal, 7 tarsal and various accessory bones. The posterior portion of the foot includes two of the largest bones of the foot, the calcaneus and the talus. The calcaneus (heel bone) rests beneath the talus (ankle bone) and forms the posterior segment of the foot. The anterior segment is best thought of as having a medial component (mostly concerned with propulsion) and a lateral component (chiefly serves for balance).

The ligaments of the ankle are crucial for support. The deltoid ligament (medial collateral ligament) on the inside of the ankle is a strong triangular band that provides medial stability (prevents eversion). Turning the ankle out (eversion) will injure this ligament and/or cause an avulsion "chip" fracture of the distal tibia (medial malleolus). More commonly injured is the lateral collateral ligament (on the outside of the ankle) with the foot pointing down (plantar flexion) and turning in (inversion injury). The lateral collateral ligament is actually made of three separate ligaments.

EXAMINATION OF THE ANKLE & FOOT

The examination starts with inspecting the ankle and foot with the patient standing, walking and sitting. Any deformity, swelling, temperature change or discoloration is noted. Changes in the skin, hair pattern or nails is observed. The peripheral pulses are checked. Ankle and foot range of motion and any associated discomfort is recorded. Any areas of tenderness are documented. Strength and sensation are checked. A side-to-side rocking motion tests the subtalar joint and the midtarsal joints are moved to note motion in adduction and abduction.

ACHILLES TENDINITIS / TENDINOSIS

While there are many causes of posterior ankle pain, there are two distinct conditions that may affect the Achilles tendon, tendinitis and tendinosis, each having a distinct prognosis. Tendinitis involves a peritendinous inflammation which does not generally progress to degenerative tendinosis or rupture. It often results from over exercise, especially in runners. Tightness

of the heel cord (contracture) will exacerbate the patient's symptoms. On exam, the patient generally does not have a strength deficit and does not have tenderness to deep palpation. Treatment includes local heat or ultrasound and heel cord stretching in mild cases. For moderate cases, a short period of rest followed by gradual mobilization with temporary avoidance of repetitive activities such as running may be helpful. Steroid injections into or around the Achilles tendon may provoke rupture and should generally be avoided. Tendinosis is a degenerative process that can occur without signs of inflammation and may be related to region of diminished blood supply just above the tendon insertion. Often the tendinosis remains subclinical until it presents as a rupture. The differential diagnosis includes systemic conditions such as gout. On examination, deep palpation will elicit tenderness. There may be palpable nodularity in the tender aspect of the tendon and weakness is evidenced by inability to raise up on the toes. X-rays may show calcification within the Achilles tendon, which may indicate a more proximal tendinosis.

ANKLE SPRAINS & STRAINS

The terms sprains and strains are often used interchangeably but they actually represent different types of injuries. Strains involve a pull, bruise, or tear in a muscle or tendon and occurs from improper or overuse of a muscle. A sprain occurs when a joint has been twisted or wrenched severely enough to tear or damage supporting ligaments (fibrous tissue that surrounds the joint, adding additional strength and stability). A sprain generally requires a longer healing period and is considered a more serious injury than a strain.

Ankle sprains may be the most common acute orthopedic injury. It's not unusual to hear from a patient that this has happened before, sometimes on multiple occasions. Sports or work activities requiring a lot of climbing, stopping, starting and twisting motions have a high incidence of ankle injuries. Caution should be taken when the terrain is uneven or there are potholes. The injured person usually presents with a history of their ankle "turning." Sometimes a "pop" or "snap" is felt or heard. Difficulty walking follows the incident and in a short time the ankle swells, sometimes so excessively that the individual is sure that it's broken.

The typical ankle sprain results when the foot turns in (inversion) and results in a stretching or tearing of the small ligaments that attach bone to bone on the outside or lateral aspect of the ankle (lateral collateral ligament).

Sprains of the medial ankle, or Deltoid ligament, are less common and involve eversion injuries where the foot turns severely outward. In fact, an injury to the ankle that forcefully everts the ankle will usually cause bony damage rather than spraining the ligament.

Lateral ankle sprains (lateral collateral ligament) are classified into three grades. A grade 1 sprain is a partial tear of the anterior talofibular ligament (ATF). A grade 2 sprain is usually a tear of the ATF, but the calcaneofibular ligament (CF) remains intact. A grade 3 sprain is a tear of both of these ligaments. The physical examination almost always shows swelling and discoloration (black and blue) over the outside part of the joint. Frequently, there is instability noted when the heel structures are moved forward and back as the leg is stabilized (the drawer test). Range of motion in the ankle can be limited secondary to pain. X-rays are essential even though sprains are usually negative because fractures must be ruled out, as the treatment would be different with some unstable fractures requiring surgical internal fixation.

Although the treatment varies from place to place, for any acute ankle sprain, the best initial treatment includes protection, rest, ice, compression, non-steroidal anti-inflammatory medication and elevation. If the sprain is minor (grade 1), these measures will suffice, although additional bracing or taping of the ankle gives much more support and allows the patient more confidence while ambulating or exercising.

The more severe sprains (grades 2 - 3), that have greater instability and tearing of the ligaments, should be placed in a walking cast for three weeks to allow the injured structures to heal. These casts can be non-removable fiberglass or the removable variety. Following this three-week period, the patient should engage in exercises and two to three weeks of physical therapy to strengthen the ankle and reduce swelling. During this period, the ankle is often taped or braced by the physician, therapist, or trainer.

Surgical intervention for more severe (Grade 3) ankle ligamentous injuries is controversial with some authors advocating non-operative treatment while others propose surgical intervention. A detailed discussion of this controversy is beyond the scope of this article but in general, the non-athlete is best treated conservatively.

In the long run, the very best treatment of ankle sprains is prevention. This means that during activities that have a high incidence of ankle injuries the individual should wear appropriate footwear, a brace or get the ankle taped. Hightop gym shoes or boot can effectively provide ankle support. Braces are relatively inexpensive and easy to use. Taping works well, but requires someone available who is well trained to apply it appropriately.

HEEL PAIN

The most common cause of deep pain on the bottom surface of the heel is *plantar fasciitis* (inflammation of the plantar fascia). The plantar fascia is a broad band of fibrous tissue that runs along the bottom surface of the foot from the heel to the toes. It is just below the skin and subcutaneous fat. It helps to secure the arch. Long standing inflammation causes the deposition of calcium at the point where the inserts into the heel bone. This results in the appearance of a bony heel spur on x-ray. The spur itself is usually not the source of the pain.

Symptoms can include sharp pain localized to the bottom and/or inside margin of the heel often worse on arising in the morning and after rest. The pain is often aggravated by prolonged weightbearing and ambulation and may severely limit activities. It is most common in middle-aged and overweight adults. Causes can include excessive load on the foot from obesity, excessive flattening of the arch on weight bearing, a tight plantar fascia and over *pronation* of the foot (a complex motion including outward rotation of the heel and inward rotation of the ankle).

Treatment can include application of ice to the heel area after prolonged activity along with wearing supportive shoes with a stiff heal counter (the part of the shoe which wraps around the heel) and a good arch. A well-made running or walking shoe is a good example. Sometimes a shoe with a moderately high heel will relieve pressure on the fascia. Stretching exercises for the calf muscles will also help stretch the plantar fascia. This should not be attempted when the heel is sore. Anti-inflammatory medication can be helpful also as can a localized steroid injection. Physical therapy modalities such as localized heat or the application of ultrasound may be beneficial along with taping and padding to relieve strain on the plantar fascia. An orthotic such as a shoe insert may help control foot function. Surgical release of the plantar fascia and excision of the heel spur is rarely required.

Other causes of heel pain include various types of arthritis, trauma to the heel, a calcaneal stress fracture, inflammation of the tendons around the heel, a heel neuroma (benign tumors of the nerves around the heel), abnormality in the shape of the heel bone and a foreign body such as a splinter in the heel.

FOREFOOT PAIN

There are a number of possible causes of forefoot pain including stress fractures, Morton's neuroma (benign tumor of a nerve running between the metatarsals), metatarsalgia (painful and inflammation of the metatarsal bones and their soft tissue sheath), capsulitis (painful and inflammation of the joints between the metatarsal bones and toes), tendonitis (inflammation of the tendons which course along the top of the foot), dislocation of a joint between a metatarsal and a toe (metatarsal-phalangeal joint), severe plantar callus (callus on bottom of the foot) or bursitis (an inflamed fluid-filled sac often between a bone and an area of pressure).

STRESS FRACTURES

A stress fracture is a break in a bone cause by repetitive stress. It may occur in any bone, but is quite common in the metatarsal bones of the foot. There is often no recollection of injury. The patient may simply develop a painful forefoot after some activity such a walking, sports, or stooping down onto the ball of the foot. A small crack develops in the cortex (outer shell) of the bone. Without proper treatment this may progress to a through and through fracture of the bone. The second and third metatarsals are the most commonly affected. Metatarsal stress fracture may not become apparent on x-rays until a few weeks after the injury. The individual will complain of sharp pain in the forefoot, aggravated by walking and there will be

tenderness to pressure on the top surface of a metatarsal bone along with diffuse swelling of the skin over the forefoot. Causes of stress fractures include decreased density of the bones from osteoporosis and from unusual stress on a metatarsal due to malposition or another forefoot deformity (e.g. bunion). The problem can be related to obesity, abnormal foot structure or mechanics (e.g. flatfoot) and to increased levels of activity, especially without proper conditioning.

Evaluation includes x-rays and possibly a bone scan. Initial treatment includes icing to reduce swelling, limiting weight bearing, applying orthopedic taping and padding to relieve stress from the metatarsals, and using a special surgical/trauma shoe with a rigid sole. In some cases, a plaster cast may be necessary. Medication can be prescribed for pain relief and to reduce inflammation. Physical therapy may be helpful.

METATARSALGIA

Metatarsalgia is essentially pain and tenderness of the bottom surface (plantar) of the metatarsal bones (this is commonly referred to as the ball of the foot) that bear a disproportionate amount of the body weight. In the normal foot the metatarsal heads bear one-half of a person's body weight when stepping on the front or ball of the foot. Any foot and ankle problem that concentrates weight bearing on the metatarsal heads may lead to metatarsalgia. The finding of tenderness at the area of the metatarsal heads makes the diagnosis. Treatment can include weight reduction and heel cord stretching if a heel cord contracture is present. A metatarsal pad or bar and/or orthotics can reduce forefoot pressure and transfer weight bearing to longitudinal and metatarsal arches and can lower the heel to reduce metatarsal head pressure. Rocker bottom shoes can reduce forefoot motion and pressures and a carefully placed metatarsal pad proximal to painful metatarsal head can relieve discomfort.

PES CAVUS & PES PLANUS

Pes cavus, also termed clawfoot or hollow foot, is essentially a foot with a very high arch. This can be totally asymptomatic but when symptoms do exist the individual experiences pressure on the metatarsal heads or unusual fatigue when walking or standing. Mild cases can be treated with properly fitted shoes with a low heel and a metatarsal bar. Stretching exercises are recommended. Surgery should be avoided if at all possible and should only be considered in severe cases. Pes planus, or flat feet, as known as "fallen arches" is usually congenital and is caused by ligamentous laxity. Treatment usually involves arch supports or orthotics.

CORNS OR CALLUSES

Corns or calluses are hyperkeratoses of the skin. This is a thickening of the surface layer of the skin in response to pressure. Calluses usually form on the ball of the foot, the heel, and the underside of the big toe (hallux). They may, however, form over any bony prominence. Corns usually form on the toes, where the bone is prominent and presses the skin against the shoe, ground, or other bones. As a corn becomes thick the tissues under the corn are subject to increased irritation. There may be a deep-seated nucleation. This is like a core where the corn is thickest and most painful. As corns become inflamed, there is pain and sometimes swelling and redness. Common places where corns form are the top surface of the toe, at the tip of the toe, and between the toes.

Symptoms can include a hard growth usually on the toes or ball of the foot and pain on weight bearing that is relieved by rest. The problem is more common in women than men. Causes include thin soled and high-heeled shoes, mal-alignment of the metatarsal bone, abnormalities of gait, flat feet and high arched feet, excessively long metatarsal bone, obesity, bony prominences, loss of the fat pad on the underside of the foot and a short Achilles tendon.

Sometimes a shoe can be too loose with the foot sliding forward with each step. Corns can also form from prolonged walking on a downward slope. Preventive treatment includes avoiding shoes that are too tight or loose and buying supportive shoes with an extra depth toe box (the part of the shoe over the toes) and a cushioned insole. It is also important to not apply socks or stockings tightly around the toes. A pumice stone or other abrasive can be used to reduce the thickness of the corn. Non-medicated pads can be around the corn to relieve pressure. Caution should be exercised with corn removing solutions as they contain acid and sometimes increase discomfort. Diabetics and others with diminished circulation should never use them. The orthopedic foot specialist or podiatrist may carefully debride (pare down) the corn and any deep-seated core it may have. It

should be stressed that this provides only temporary relief, if the pressure continues after treatment. In selected cases crooked or deformed toes can be surgically straightened or the surgeon can remove bony prominences.

Complications that can result from corns include development of a bursitis (formation of a painful inflamed fluid-filled sac beneath the corn), infection, development of an ulcer or open area that forms within the corn. This may even extend down to bone. Because of the serious consequences of infection, diabetics and those with diminished circulation should always seek professional help. Discomfort of the back, hips, knees, legs, or feet may occur due to changes in posture and/or gait in an attempt to "protect" the painful callus. Other conditions which can resemble corns include warts, various tumors of the skin and subcutaneous (below the skin) tissues or reaction to a foreign body (e.g. splinter).

BUNIONS

Bunions are one of the most common deformities of the forefoot. There is a displacement of the first metatarsal bone toward the mid-line of the body and a simultaneous displacement of the great toe away from the mid-line (and toward the smaller toes). This causes a prominence of bone on the inside (medial) margin of the forefoot and this is termed a bunion. With continued drifting of the great toe *(hallux)* toward the smaller toes, it may come to rest under (occasionally over) the second toe. The incidence of bunions is much higher in women than men. This is thought to be due to shoe fashion. There are genetic factors and certain predisposing abnormalities of foot function. Wearing narrow toed and high-heeled shoes can greatly accelerate the formation of a bunion. Symptoms include redness, swelling, or pain along the inside margin of the foot just behind the great toe. There is usually moderate to severe discomfort at the bunion when wearing shoes, particularly if tight fitting. A painful callus may develop over the bunion. There may be a painful corn on the adjacent sides of the first and second toes and there may be irritation caused by overlapping of the first and second toes. Additionally there may be stiffness and discomfort in the joint between the great toe and the first metatarsal. There may be a fluid filled cyst or bursa between the skin and the "bunion bone". Skin over the bunion may break down causing an ulceration that can become infected.

Bunions may be caused by a number of factors including an abnormality in foot function, particularly a pronated foot. This is probably the most important and common causative factor. There may be a family history of bunions. Narrow toed dress shoes and high heels may contribute to the formation of a bunion. Bunions are common in patients with Rheumatoid and Psoriatic arthritis. The individual may have a genetic or neuromuscular disease resulting in muscle imbalance. A limb length inequality can cause a bunion on the longer limb. Bunions may form when there is generalized laxity of the ligaments. Bunions may also form when there has been trauma to or surgery on the soft tissue structures around the great toe (first metatarsal-phalangeal) joint.

The individual can self-treat by applying a commercial non-medicated bunion pad around the bony prominence and wear shoes with a wide and deep toe box. The person should avoid all high-heeled shoes. For a bunion that becomes painful, red, and swollen, the individual may elevate the foot and apply ice for about 20 minutes every hour. For persistent or increasing symptoms a orthopedic foot specialist or podiatrist should be consulted. The practitioner may apply special pads and dressings to protect the bunion from shoe pressure. Injecting a steroid and local anesthetic around the bunion may help to reduce inflammation. This is especially useful if there is an associated bursitis. Another approach is to apply various splints or digital orthotics to reposition the great toe joint. Specially made shoes may be recommended. Finally, bunion surgery may be recommended.

Other causes of pain at the great toe joint include arthritis of the first metatarsal-phalangeal joint, injury to the soft tissue structures around the first metatarsal-phalangeal joint and fracture of the great toe or first metatarsal. Tight shoes may cause pain at an otherwise normal joint. Sesamoiditis, an inflammation of one or both small bones that rest in tendons under the first metatarsal-phalangeal joint, should also be considered in the differential diagnosis.

INGROWN TOENAILS

Ingrown toenails are one the more common foot problems. They can be very painful with people limiting their activity to keep off their sore feet. Ingrown toenails are caused by impingement of the skin along the margins of the nail by the nail plate. Some ingrown toenails are chronic with repeated episodes of pain and infection. Pain can be present without infection and occasionally infection is present without pain. The usual signs of infection include redness, swelling, increased warmth, and pain. Pain is felt along the margin(s) of the toenail and is aggravated by wearing shoes, particularly those with narrow

toes. The area may be sensitive to any pressure, even the weight of the bedclothes. There may be signs of infection with drainage of pus or a watery discharge tinged with blood.

Trauma, improper trimming of toenails, tight fitting shoes that compress the toes together and hose or socks that are too tight can cause the problem. There may be an abnormally shaped nail plate or other toenail deformities (e.g. excessively thick nail plate). Treatment starts with prevention by cutting the toenails straight across and leaving them slightly longer then the end of the toe and to avoid tight fitting footwear. Soaking the foot in a basin of warm water two or three times a day can help discomfort. An infected ingrown nail requires prompt professional attention. Treatment can include antibiotics and trimming a small spicule of nail to relieve the pressure. *Callus* (dead skin) accumulated in the nail groove can be removed. Routine ingrown toenail care may need to be done periodically. There may be a need to elevate the end of the nail plate to prevent impingement on the soft tissues or to surgically drain an infection or completely remove a deformed toenail so it will not grow back.

SINUS TARSI

The sinus tarsi is the depression found on the lateral side of the tarsus and is distal to and on the same level as the lateral malleolus. In the Sinus Tarsi Syndrome there is pain and tenderness on the lateral side of the hindfoot originating from the area of the sinus tarsus.

TARSAL TUNNEL SYNDROME

The Tarsal Tunnel Syndrome is a compression syndrome of the tibial nerve in the tarsal tunnel. The tarsal tunnel is formed by the flexor retinaculum behind and distal to the medial malleolus. Patients note pain, paresthesias, and in some cases atrophy of foot intrinsic muscles. Pain will radiate along the plantar side of the foot. A positive Tinel's sign can often be elicited behind medial malleolus. Manual compression for 30 seconds may reproduce symptoms. The differential diagnosis includes stress fractures, inflammatory arthritides, plantar fasciitis, herniated disk, peripheral neuropathy, a ganglia or neoplasm. Electrodiagnostic testing may reveal a prolonged distal motor latency and needle EMG abnormalities in the associated innervated muscle. An MRI may be used to identify ganglia or extrinsic masses and the specific site of compression. Conservative treatment includes removing external causes such as poorly fitting shoes, a medial arch support or orthotic device, non-steroidal medication and local steroids. Operative decompression is considered for patients with space occupying lesions.

ANKLE & FOOT FRACTURES

Fractures and fracture dislocations result from forces applied in various combinations and degrees that produce excessive motion or compression. From practical standpoint, the examining physician needs to analyze the accident to determine the direction of the causative force and the degree of instability that has resulted. Fracture reduction is accomplished by various means of applying force in the opposite direction. Surgery may be required. Post reduction and surgical treatment usually involves some type of immobilization (traction, cast, brace, strapping, etc.) for a period of time depending upon the stability of the fracture and the healing time for the particularly individual. Rehabilitation follows with heat, massage and exercises to restore function.

While it is beyond the scope of this article to discuss the numerous and varied types of fractures involving the ankle and foot, a few of the more common work-related fractures will be discussed. A crush injury of the calcaneus (heel fracture) is particularly painful and disabling. The usual mechanism of injury is a fall from a height. The extent of damage and resultant disability will vary considerably with the fall distance, landing surface, and the patient's height, weight and occupation. There may be an associated lower spine compression fracture as well. Calcaneal fractures involve many months of immobilization and non-weight bearing is usually required during healing. With more involved fractures, an ankle fusion may be needed. Tarsal fractures and dislocation, other than those involving the calcaneus are less common. Fractures of the neck of the talus and partial or complete dislocation of this bone, are the next most common tarsal fractures.

Direct or indirect forces may cause fractures of the metatarsal shaft. Metatarsal stress fractures are discussed elsewhere in this article. Treatment for undisplaced fractures is a walking boot with a soft or spongy sole. In grossly displaced fractures surgery is usually required. Immobilization is required post-operatively to allow adequate fracture union.

Fracture phalanges are often caused by stubbing or crush injuries of the toes. Treatment includes careful cleansing of any damaged tissue with careful wrapping with a protective gauze dressing. Walking may be permitted if pressure on the toe can be avoided.

The most common dislocation is the first metatarsophalangeal joint (base of the big toe). Traction and direct plantar pressure with flexion of the phalanx readily reduce it. The joint needs protection for a period of time from excessive plantar pressure and a metatarsal bar in the shoe may be helpful.

FUNGAL INFECTIONS OR ATHLETE'S FOOT

Athlete's foot is a fungal infection characterized by itchy, scaly lesions between the toes that frequently leads to fissure formation. Secondary infections are not uncommon. Prevention relies on proper hygiene. Once the foot is infected, medication is available for treatment.

MEDICAL CONDITIONS & THE FOOT

Patients with peripheral vascular disease may develop increasing loss of distal blood flow resulting in cool feet with loss of sensation. The feet are more prone to trauma and skin breakdown. The patient with rheumatoid arthritis is particularly prone to degenerative changes, abnormal biomechanics and resultant pain and deformity. The patient with diabetes is prone to vascular disease and neuropathy with associated decreased sensation. The feet may be more prone to injury, yet with lack of pain from decreased sensation the individual my not realize that there is skin breakdown and infection developing. Toes may become necrotic, ulcers may develop and not heal in a timely manner and in the worse case, amputation may be necessary. For all of these medical conditions, prevention is the key to successful treatment with emphasis on careful observation for skin changes or deformity, cleanliness, proper footwear and pacing activities to avoid overuse or abuse to the feet. Medications specific to the disease are also important.

SUMMARY

We may take our ankles and feet for granted, but they let us know when they have been abused or traumatized. In fact, ankle and foot problems are very common. Work related trauma whether on a cumulative or specific injury basis deserves immediate attention and medical care. The general podiatrist shares the care of ankle and foot problems with the family physician, internist, and sports injury specialist, physiatrist or general orthopedist in most cases. More complex case with difficult problems may require the podiatrist or orthopedist foot specialist to render care. While most ankle and foot problems respond to conservative care, surgery may be needed in certain cases. Proper treatment always starts with prevention by wearing proper footwear, avoiding abuse and being careful during work and sports activities.

HEADACHES: EVALUATION & TREATMENT

INTRODUCTION

Headache is ubiquitous in society and one of the most common presenting complaints to physicians. It is a major cause of decreased productivity and sickness absence from work. Greater than two-thirds of people suffer from at least one headache a year, and chronic recurrent headaches are experienced in 36% of women and 19% of men. Headaches can be debilitating, and frequently cause alarm and fear, but they are rarely (.004%) a symptom of underlying serious disease. There is no consensus on what constitutes ideal headache management. Various conventional and alternative health care practitioners and self-help remedies share the burden of treatment.

HEADACHE DIAGNOSIS

The diagnosis of headache by a doctor, in contrast to many other medical conditions, depends almost entirely on the medical history, as objective physical findings are rarely present. The astute physician will best be able to help the headache sufferer by taking a clear history and thus be able to distinguish some sort of headache pattern. Important questions include age of onset, frequency and duration of each headache, location, and quality, time of onset, associated phenomena, and aggravating or relieving factors.

On physical examination, the physician is interested in first getting a general sense of whether the patient is mentally alert and looks well or ill overall, followed by a thorough, general and neurological examination. Because there is no way to measure the quality and severity of another person's headache, it is important for the physician to also gauge the nature and extent of psychological and social factors which may be impacting on the patient's presentation and perception of pain. Medications and other therapies will be of little benefit if the headache is used as a means to get attention, drugs or avoid working.

TESTS

An accurate medical history usually suffices in the majority of patients, but when there is diagnostic difficulty or a suggestion of a serious illness, further testing becomes mandatory. These can include blood tests, lumbar puncture, EEG, radiologic studies (x-rays, CT, MRI), and radioisotope scanning. The actual differential diagnosis can be quite extensive.

OMINOUS WARNING SIGNALS

The sudden onset of a new severe headache that appears "out of the blue" may suggest a hemorrhage (subarachnoid) or meningitis. A progressively worsening headache may be a danger signal of increased intracranial pressure on the brain (brain tumors, subdural hematoma). Headaches brought on or worsened by exertion (straining, coughing, sexual activity) may indicate a vascular headache, but also may indicate a hemorrhage (subarachnoid) or increased intracranial pressure. Another warning signal are associated symptoms, such as drowsiness or confusion, a change in neurologic findings, or medical illness such as fever, chills, or diffuse aching pains. Since most headaches start before middle age, the onset of a first headache after age 50 should be investigated further until proven benign. Finally, an abnormality on physical examination is uncommon with most headaches, and further consideration is therefore warranted.

TENSION-TYPE HEADACHES

Tension-type headaches usually start episodically, associated with stress, fatigue, or such activities as prolonged reading, but they may progress into a chronic condition. They represent the great majority (about 90%) of all headaches. Women represent 75% of tension-type headache sufferers, and 40% of patients have a family history of headaches. These headaches are usually described as dull, diffuse, and persistent, while varying in intensity throughout the day. Patients often describe a

feeling of pressure, tightness or heaviness in a band around the head. About 10% of these individuals also have migraine, which confuses the presentation.

Tension-type headaches can occur related to expected or actual stressors, or unpleasant events. The headaches may last hours or days and are considered episodic rather than chronic if they occur less than fifteen times in a month.

Depression and anxiety are commonly found associated with tension-type headaches. The cause of these headaches is unclear, but there may be a relationship to psychological stress or excessive muscle contraction. Treatment includes a combination of psychological, physical, and medication approaches. Stress reduction and relaxation techniques, meditation, biofeedback, stretching, exercise, and conditioning can be helpful. Effective medications can include simple, over-the-counter analgesics and prescription anti-depressants.

MIGRAINE HEADACHES

Migraine, although common, is still poorly understood, with treatment often depending upon trial and error. It is not a single entity and has two major and multiple less common variants. Migraine is present in 12-15% of adults and 2-3 times more common in women than men. Migraine predominantly affects adults below the age of 40.

The two major variants include migraine without (approximately two-thirds) and with (one-third) aura (flashing lights, shimmering zigzagging lines, and areas of lost vision). Migraine sufferers typically go through four distinct phases that blend together during an attack. Up to 50% of individuals suffer from some sort of premonitory symptoms or prodrome. Symptoms develop slowly and precede the migraine attack and can include heightened or dulled perception, sudden mood changes, irritability or withdrawal, cravings for certain foods (particularly sweets), excessive yawning, or speech difficulties. These symptoms may not be marked or even realized by the patient. Phase 2, or the aura, include visual disturbances, unilateral weakness and/or pins and needles in the hands, and difficulty speaking. The aura usually proceeds the headache by 60 minutes or less.

Phase 3 is the headache itself. It is usually severe, pulsatile, and typically on one side of the head only, but it can be on both sides. The headache is frequently aggravated by routine physical activity and frequently accompanied by nausea and vomiting or intolerance to noise or light and is aggravated by movement. The migraine sufferer typically, therefore, prefers a quiet, dark room to rest during the headache, which typically lasts between 2 to 72 hours.

Phase 4 is the postsyndrome, lasting up to 24 hours, after the headache has subsided, during which the individuals feels drained or washed-out, with tired achy muscles. Some patients may actually experience a period of euphoria after the headache has disappeared.

The cause of migraine remains a mystery, but there does appear to be a strong genetic influence. There appears to be a relationship between cerebral blood flow and migraine, with the symptoms of migraine a result of constriction of the cranial blood vessels and the headache then caused by subsequent blood vessel enlargement or dilatation. Scientists now believe, though, that there is not a single factor that can be blamed for migraines, but rather a complex interplay of many biochemical and neurologic changes, which interact to trigger and sustain the headache.

Migraine is characterized by attacks separated by symptom-free intervals. The physical and neurologic examination is normal. Migraine therapy can be divided into acute treatment of the attack and preventive treatment. Precipitating factors (triggers) should be avoided. Acute treatment includes over-the-counter analgesics and stronger prescription pain medication. Abortive medications are best used early in a migraine attack. At present the most effective drugs for interrupting a migraine attack are the triptans. All the acute treatments for migraine are more effective if followed by a short rest period or a nap.

Migraine trigger avoidance strategies are important. Factors commonly associated with triggering migraine attacks include loud noise, strong smells, flashing or fluorescent lights, missing or delayed meals, mental stress, changes in sleep patterns, menstruation and certain foods such as citrus fruits, cheese, chocolate, and alcohol.

For frequent migraine sufferers, prophylactic medication can be useful to reduce the frequency of attacks. The most commonly used drugs are NSAIDs, the beta-blockers (e.g. Propranolol), the calcium channel antagonists (e.g. Verapamil), and anti-depressant medications (e.g. Amitriptyline). Side effects can be a problem from these medications.

Botulinum toxin injections can be effective for migraine headaches.

Among the non-drug treatments, behavioral therapies such as relaxation and biofeedback can be effective. Some reports have stated that acupuncture is effective in certain cases.

The exact cause of migraine is still unknown but appears to be related to both vascular and neurogenic components. Migraine symptoms in many individuals cease or diminish into late adult life and after menopause in women.

CLUSTER HEADACHES

These less common headaches (0.5% of males and less than 0.1% of females) tend to be devastatingly severe and lead to progressive emotional and physical decompensation. They typically begin in the 20 to 40 age range and do not have a genetic predisposition.

Cluster headaches are characterized by excruciating pain that lasts 15-90 minutes, located behind or around one eye, although pain can radiate to the temple, jaw, nose, chin, and teeth. There is often tearing on the same side, eye redness (conjunctival injection), and nasal congestion. The eyelid may droop, the pupil may decrease in size, there may be sweating and facial flushing. In contrast to migraine, there is no aura, no visual or sensory symptoms, and nausea and vomiting are unusual.

Attacks occur during specific periods or "clusters" which last from 2-12 weeks, more commonly occurring in the spring or autumn, separated by remissions lasting at least 14 days but usually several months.

While in a cluster period, the patient may suffer one or more attacks daily, often at the same time of day.

Attacks regularly begin during sleep but can occur during the day. Cluster headaches develop into a crescendo and are so severe that sufferers are unable to lie down and remain still and typically pace about. Cluster headaches may be provoked by external stimuli, such as alcohol, cold or heat air blowing onto the face, excitement, sleep, and vasodilators found in foods and medications.

Treatment with 100% oxygen inhalation can be effective for an acute attack within 10-15 minutes in 60-70% of cases. Injection of sumatriptan or dihydroergotamine is presently the most effective treatment of cluster headaches. Other drugs used in prophylactic treatment include methysergide, methylergonovine, ergonovine maleate, lithium, and calcium antagonists.

The cause of cluster headaches is unclear but appears to involve a mixture of vascular and neurogenic mechanisms possibly related to a vulnerable carotid artery affected by neural influences. Cluster headaches, like other vascular headaches, tend to decrease in frequency and intensity as the individual gets older.

POST-TRAUMATIC HEADACHE / POST-CONCUSSION SYNDROME

This syndrome is found post mild to moderate closed head injury and also after flexion-extension (whiplash) injuries. The primary symptoms, usually strikingly consistent from patient to patient, include one or more of the following: 1) headache, neck and shoulder pain; 2) sleep disturbance; 3) cognitive abnormalities; 4) mood and personality changes; and 5) dizziness.

Post-traumatic headache is a common complaint in individuals after head trauma. In most cases the patient notes the onset of headache within twenty-four hours of injury, but in some cases, it may not be apparent for several days to weeks. The

headache usually consists of a bilateral pressure-like sensation located in the back or front of the head, although it can be one-sided. While most patients complain of a constant headache, it can also wax and wane in intensity and severity. Exercise, bending over, coughing or rapid movement of the head usually increases complaints. Symptoms decrease with rest, relaxation and sleep. Patients may complain of migraine-like symptoms such as nausea and vomiting plus light sensitivity (photophobia). A brain injury can be the initiating factor for chronic migraine and cluster headaches.

Headaches represent the most common symptoms in patients after a closed head injury and usually persist for more than two months in 60% of patients. There does not appear to be any correlation with the degree of injury or period of unconsciousness. With a usual lack of "objective" findings, there is occasional skepticism regarding the validity of the injured workers complaints, but malingering is rare, and the majority of patients have truly valid symptoms. When there is cognitive dysfunction, treatment includes reassurance, cognitive retraining, psychosocial readjustment, communication, leisure skills training, physical rehabilitation and vocational counseling/rehabilitation. Specific treatment for post-traumatic headaches can include appropriate education, medications, biofeedback, TENS, acupuncture, stress management training along with physical rehabilitation and conditioning.

DRUG REBOUND HEADACHES

Some drugs commonly used in the treatment of headaches, particularly if used improperly or chronically, may actually cause headaches. These can include analgesics like aspirin, acetaminophen, benzodiazepines, barbiturates, various opioids (although they should mostly be avoided in treating headaches) or ergotamine (Cafergot). Headache analgesic abuse is much more common in females, and the majority of abusers are 30-50 years of age. While it is more common in migraine sufferers, daily drug use ("abuse") can also be found in individuals with tension-type headaches.

A drug rebound headache typically is present on waking and varies in intensity but lasts throughout the day. It is often described as mild to moderate, dull, bilateral, frontal-occipital, or diffuse. Migraine attacks may be superimposed upon the drug rebound headache. Rebound headache sufferers typically self-medicate throughout the day, and any pain relief is usually transient and rarely complete.

Treatment involves rapid withdrawal of non-opioid medications (opioids should be withdrawn slowly secondary to problems with dependence). Inpatient hospital care may be needed to deal with withdrawal symptoms, both physical and emotional. Upon drug discontinuance, a severe headache is to be expected, lasting 3-6 days.

Once withdrawal is complete, a thorough headache reassessment is appropriate, along with counseling regarding future medication use. Prophylactic medications are useful in decreasing any rebound headache effects and are found to be most effective for the underlying headache phenomenon once the drug rebound agents are discontinued. Non-medical treatments, such as relaxation, biofeedback, and meditation, should be encouraged.

PERMANENT & STATIONARY DISABILITY RATINGS

The AMA Guides 5th Edition does not address headaches in the Central and Peripheral Nervous System Chapter but does allow use of the Pain Chapter to provide up to 3% for headaches.

SUMMARY

Headache is the most common pain complaint and one of the most common presenting complaints to physicians. It is a major cause of decreased productivity and absence from work. Headaches can be debilitating, and frequently cause alarm and fear, but they are rarely a symptom of underlying serious disease. The diagnosis of headache, in contrast to many other medical conditions, depends almost entirely on the medical history, as objective physical findings are rarely present. It is important to consider psychological and social issues as well.

Certain warning signals such as the sudden onset of a new severe headache, a progressively worsening headache and headaches brought on or increased by exertion deserve immediate medical attention. Symptoms such as drowsiness or

confusion, a change in neurologic findings or medical illness such as fever, chills, or diffuse aching pains warrants further attention.

Tension-type headaches are the most common (90%) and usually start episodically, associated with stress, fatigue, or such activities as prolonged reading, but they may progress into a chronic condition. Depression and anxiety are commonly found associated with tension-type headaches. The cause of these headaches is unclear, but there may be a relationship to psychological stress or excessive muscle contraction. Treatment includes a combination of psychological, physical, and medication approaches.

Migraine headaches typically start with premonitory symptoms or a prodrome (sudden mood changes, cravings for certain foods, excessive yawning, or speech difficulties). This stage is followed by the aura (visual disturbances, unilateral weakness and/or pins and needles in the hands) followed by the headache itself. It is usually severe, pulsatile, and typically on one side of the head only, but it can be on both sides. The headache is frequently aggravated by routine physical activity and frequently accompanied by nausea and vomiting or intolerance to noise or light and is aggravated by movement. There is a period after the headache has subsided, during which the individual feels drained or washed-out sometimes followed by a period of euphoria.

Migraine treatment includes avoidance of triggers plus the use of over-the-counter analgesics, triptans, and, when appropriate, stronger prescription pain medication. A vasoconstrictor may be useful. Behavioral therapies are recommended. Botulinum toxin may be effective in selected cases.

Cluster headaches are rare but tend to be severe and lead to progressive emotional and physical decompensation. Drug rebound headaches may be secondary to the very drugs used to treat headache and should be suspected in individuals with daily and increasing drug use ("abuse"). Inpatient hospital care may be needed to deal with withdrawal symptoms, both physical and emotional.

In the post-traumatic headache/post-concussion syndrome symptoms include headache, neck and shoulder pain; sleep disturbance; cognitive abnormalities; mood and personality changes; and dizziness. Post-traumatic headache is a common complaint in individuals after head trauma. When there is cognitive dysfunction, treatment includes reassurance, cognitive retraining, psychosocial readjustment, communication, leisure skills training, physical rehabilitation and vocational counseling/rehabilitation. Specific treatment for post-traumatic headaches can include appropriate education, medications, biofeedback, TENS, acupuncture, stress management training along with physical rehabilitation and conditioning.

Guide to *the Guides:*

Evaluator's Resource Algorithm to the

AMA *Guides to the Evaluation of Permanent Impairment, Fifth Ed.*

- Musculoskeletal, Nervous System and Pain

Steven D. Feinberg, MD

Christopher R. Brigham, MD

© 2014 – 2017 Steven D. Feinberg, MD and Christopher R. Brigham, MD. All rights reserved. No part of this publication may be reproduced or transmitted by any means without written permission. Permission granted for use by WorkCompCentral.

This book is for information purposes only. It is not intended to constitute medical, legal or financial advice. If medical, legal, financial, or other professional advice is required, the services of a competent professional should be sought.

No part of this publication may be reproduced, storied in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without the prior written permission of the authors.

© 2014 – 2017 Steven D. Feinberg, MD and Christopher R. Brigham, MD. All rights reserved. No part of this publication may be reproduced or transmitted by any means without written permission. Permission granted for use by WorkCompCentral.

Preface

This resource is designed to simplify use of the AMA *Guides to the Evaluation of Permanent Impairment* and improve the accuracy of ratings. The reality is that there is no easy way to learn the AMA *Guides* but this is an approach at perhaps making it a little simpler. It is critical that you keep the AMA *Guides* 5th Edition available as you review this resource. We have provided you with a format such that if the examiner answers the questions and fills out the integrated fill-in squares and check off boxes, the examiner should at least identify and address all possible issues for an AMA *Guides* impairment evaluation. We welcome your feedback.

Authors

Steven Feinberg, MD

Feinberg Medical Group, 825 El Camino Real, Palo Alto, CA 94301; 650-223-6400; stevenfeinberg@hotmail.com; www.FeinbergMedical Group.com

American Board of Pain Medicine, American Board of Electrodiagnostic Medicine, American Board of Physical Medicine & Rehabilitation, Qualified Medical Evaluator, Adjunct Clinical Professor, Stanford University School of Medicine, and Medical Director of Cedaron AMA Guides Impairment Rating software. Dr. Feinberg served on the ACOEM Chronic Pain Guidelines Panel Chapter Update and also as Associate Editor, as a Medical Reviewer for the ACOEM 2014 Opioid Guidelines and he also serves ongoing as a Medical Consultant to the Official Disability Guidelines (ODG) and on the Reed Group's Medical Advisory Board. He served as a Reviewer for the AMA Guides to the Evaluation of Permanent Impairment, 6th Edition.

Christopher R. Brigham, MD

President, Brigham and Associates, Inc., Brigham and Associates, Inc., PO Box 1500, Kailua, HI 96734, 888-507-7920; cbrigham@cbrigham.com; https://www.cbrigham.com

American Board of Preventive Medicine – Occupational Medicine, Fellow American Academy of Disability Evaluating Physicians and Certification in Evaluation of Disability and impairment rating, Fellow American College of Occupational and Environmental Medicine, Certified Independent Medical Examiner and Founder of American Board of Independent Medical Examiners, Editor-in-chief of the AMA *Guides Newsletter* and *Guides Casebook* and was co-author *of Understanding the AMA Guides in Workers' Compensation*. Senior Contributing Editor for the AMA *Guides to the Evaluation of Permanent Impairment*, Sixth Edition, and contributor/author for the musculoskeletal chapters. For the Fifth Edition, served on the Advisory Committee and as a contributor.

© 2014 – 2017 Steven D. Feinberg, MD and Christopher R. Brigham, MD. All rights reserved. No part of this publication may be reproduced or transmitted by any means without written permission. Permission granted for use by WorkCompCentral.

Table of Contents

PREFACE 3

AUTHORS 3

TABLE OF CONTENTS 4

ORIENTATION 4

CHAPTER 13 – THE CENTRAL AND PERIPHERAL NERVOUS 6

CHAPTER 15 – THE SPINE 18

CHAPTER 16 – THE UPPER EXTREMITIES 31

CHAPTER 17 – THE LOWER EXTREMITIES 52

CHAPTER 18 – PAIN 72

INDEX 74

Orientation

The AMA *Guides to the Evaluation of Permanent Impairment, Fifth Edition* is the standard for rating impairment. Physicians and others are trying to learn it and then apply it in a fair and equitable manner.

It is imperative that the physician understand and follow the principles of the *Guides*. Chapter 1 Philosophy, Purpose and Appropriate Use of the *Guides* and Chapter 2 Practical Applications of the *Guides* define standards that apply to all ratings. The individual chapters define principles of assessment and the rating process.

Maximal Medical Improvement (MMI) or Permanent and Stationary (P&S)

The examinee **must be at maximal medical improvement (MMI)**, the equivalent of Permanent and Stationary (P&S), to produce an impairment rating. It is necessary to determine that the patient is stable, and that no further restoration of function is probable. If the examinee shows up and is in the middle of a flare-up or has had a new injury that interferes with the examination, it is premature to do an impairment rating. In other words, the examinee must be stabilized medically for the physician to fairly assess the impairment rating. If the condition is changing or likely to improve substantially with medical treatment, the impairment is not permanent and should not be rated. For example, an examinee has a known industrial injury problem, but the day before the examination is in an auto accident and has increased complaints. An impairment rating examination that is a fair representation of the examinee at MMI status in this situation cannot be done. Assuming the examinee has reached MMI and is not having a flare-up or other problem, the physician can go forward with the impairment rating.

© 2014 – 2017 Steven D. Feinberg, MD and Christopher R. Brigham, MD. All rights reserved. No part of this publication may be reproduced or transmitted by any means without written permission. Permission granted for use by WorkCompCentral.

Activities of Daily Living (ADL)

Impairment percentages or ratings are estimates that reflect the severity of the medical condition and the degree to which the impairment decreases an individual's ability to perform common activities of daily living (ADL), *excluding* work. Throughout the AMA Guides, the examiner is given the opportunity to adjust the Impairment Rating based on the extent of any ADL deficits (5th ed., Table 1-2, 4). The following are typical ADLs.

- Self-care & personal hygiene
  - Urinating, defecating, brushing teeth, combing hair, bathing, dressing oneself, eating
- Communication
  - Writing, typing, seeing, hearing, speaking
- Physical activity
  - Standing, sitting, reclining, walking, climbing stairs
- Sensory function
  - Hearing, seeing, tactile feeling, tasting, smelling
- Nonspecialized hand activities
  - Grasping, lifting, tactile discrimination
- Travel
  - Riding, driving, flying
- Sexual function
  - Orgasm, ejaculation, lubrication, erection
- Sleep
  - Restful, nocturnal sleep pattern

© 2014 – 2017 Steven D. Feinberg, MD and Christopher R. Brigham, MD. All rights reserved. No part of this publication may be reproduced or transmitted by any means without written permission. Permission granted for use by WorkCompCentral.

Chapter 13 – The Central and Peripheral Nervous System

Overview

This chapter provides criteria for evaluating permanent impairments due to documented dysfunction of the brain, cranial nerves, spinal cord, nerve roots, and/or peripheral nerves and muscles. It is comprised of the following sections:

13.1 Principles of Assessment
13.2 Criteria for Rating Impairments Due to Central Nervous System Disorders
13.3 Criteria for Rating Cerebral Impairments
13.4 Criteria for Rating Impairments of the Cranial Nerves
13.5 Criteria for Rating Impairments of Station, Gait, and Movement Disorders
13.6 Criteria for Rating Impairments of Upper Extremities Related to Central Impairment
13.7 Criteria for Rating Spinal Cord and Related Impairments
13.8 Criteria for Rating Impairments Related to Chronic Pain
13.9 Criteria for Rating Impairments of the Peripheral Nervous System, Neuromuscular Junction, and Muscular System
13.10 Nervous System Impairment Evaluation Summary

Criteria for Rating Impairment Due to Central Nervous System Disorders

Ratings are provided only for documented central nervous system dysfunction, when at maximum medical improvement. This section is not used solely for subjective complaints.

The following are considered in rating central nerve system disorder impairment, as explained in Sections 13.2 (5th ed., 308) and 13.3 (5th ed., 309-327)

(1) State of consciousness and level of awareness, whether permanent or episodic;
   a. See Table 13-2 (5th ed., 309), (Criteria for Rating Impairment of Consciousness and Awareness - 13.3a (5th ed., 309);
   b. Table 13-3 (5th ed., 312), (Criteria for Rating Impairment Due to Episodic Loss of Consciousness or Awareness – 13.3b (5th ed., 311); and
   c. Table 13-4 (5th ed., 317), (Criteria for Rating Impairment Due to Sleep and Arousal Disorders – 13.3c (5th ed., 317).

(2) Mental status evaluation and integrative functioning - 13.3d (5th ed., 319);
   a. Table 13-6 (5th ed., 320), Criteria for Rating Impairment Related to Mental Status.

(3) Use and understanding of language – 13.3e (5th ed., 322); and
   a. Table 13-7 (5th ed., 323), Criteria for Rating Impairment Due to Aphasia or Dysphasia.

(4) Influence of behavior and mood – 13.3f (5th ed., 325).
   a. Table 13-8 (5th ed., 325), Criteria for Rating Impairment Due to Emotional or Behavioral Disorders

© 2014 – 2017 Steven D. Feinberg, MD and Christopher R. Brigham, MD. All rights reserved. No part of this publication may be reproduced or transmitted by any means without written permission. Permission granted for use by WorkCompCentral.

Step #1: Each AMA *Guides* Table (13-2, 3, 4, 6, 7, 8 - see below for page numbers) has a description and it is your task to pick the category that best fits the impairment. Each category has a percentage range as well and the number you choose should be a function of whether the impairment is closer to the category above or below and how ADLs are affected (the greater ADL loss, the higher the range).

When you have considered the 4 categories, fill in the following Criteria for Rating Cerebral Impairments Form. You need to identify the most severe cerebral impairment from these four categories to be used to determine a cerebral impairment rating. There may be impairment in all four categories but you only take the highest impairment rating from the most severe category.

Criteria for Rating Cerebral Impairments Form (Tables (13-2, 3, 4, 6, 7, 8 - see below for page numbers)

		WPI Percentage
1. State of consciousness and level of awareness, whether permanent or episodic		
	Impairment of Consciousness and Awareness (page 309)	
	Impairment Due to Episodic Loss of Consciousness or Awareness (page 312)	
	Impairment Due to Sleep and Arousal Disorders (page 317)	
2. Mental status evaluation and integrative functioning		
	Impairment Related to Mental Status (page 320)	
3. Use and understanding of language		
	Impairment Due to Aphasia or Dysphasia (page 323)	
4. Influence of behavior and mood		
	Impairment Due to Emotional or Behavioral Disorders (page 325)	
	Highest impairment rating from the most severe category	

Table 13-2 State of consciousness and level of awareness, whether permanent or episodic (5th ed., 309)

Table 13-3 Criteria for Rating Impairment Due to Episodic Loss of Consciousness or Awareness (5th ed., 312)

Table 13-4 Criteria for Rating Impairment Due to Sleep and Arousal Disorders (5th ed., 317)

Table 13-5 Clinical Dementia Rating (CDR) (5th ed., 320)

> Note: To use the CDR, score the individual's cognitive function for each category (M, O, JPS, CA, HH, and PC) independently. The maximum CDR score is 3. Memory is considered the primary category; the other categories are secondary. If at least three secondary categories are given the same numeric score as memory, then CDR = M. If three or more secondary categories are given a score greater or less than the memory score, CDR = the score of the majority of secondary categories unless three secondary categories are scored on one side of M and two secondary categories are scored on the other side of M. In this case, CDR = M.

Table 13-6 Criteria for Rating Impairment Related to Mental Status (5th ed., 320)

Table 13-7 Criteria for Rating Impairment Due to Aphasia or Dysphasia (5th ed., 323)

Table 13-8 Criteria for Rating Impairment Due to Emotional or Behavioral Disorders (5th ed., 325)

© 2014 – 2017 Steven D. Feinberg, MD and Christopher R. Brigham, MD. All rights reserved. No part of this publication may be reproduced or transmitted by any means without written permission. Permission granted for use by WorkCompCentral.

Step #2: Your next task is to combine the most severe impairment from categories 1 through 4 from the Criteria for Rating Cerebral Impairments Form that you just completed with any or multiple distinct neurologic impairments listed in Table 13-1 (5th ed., 308, using the Combined Values Chart, p. 604. The distinct neurologic impairments are as follows:

- Cranial nerve impairments
- Station, gait, and movement disorders
- Extremity disorders related to central impairment
- Spinal cord impairments
- Chronic pain
- Peripheral nerve, motor, and sensory impairments

Criteria for Rating Impairments of the Cranial Nerves

Criteria for Rating Impairments of the Cranial Nerves – 13.4 (5th ed., 327)

	WPI
I—the Olfactory Nerve – 13.4a (5th ed., 327)	
II—the Optic Nerve – 13.4b (5th ed., 327)	
III, IV, and VI—the Oculomotor, Trochlear, and Abducens Nerves -13.4c (5th ed., 330)	
V—the Trigeminal Nerve – 13.4d (5th ed., 330)	
VII—the Facial Nerve – 13.4e (5th ed., 332)	
VIII—the Vestibulocochlear Nerve – 13.4f (5th ed., 333)	
IX and X—the Glossopharyngeal and Vagus Nerves – 13.4g (5th ed., 334)	
XI—the Spinal Accessory Nerve – 13.4h (5th ed., 334)	
XII—the Hypoglossal Nerve – 13.4i (5th ed., 334)	
Combine all of the above using the CVC	

- I—the Olfactory Nerve – 13.4a (5th ed., 327) (circle only one)

1 %
2 %
3 %

- II—the Optic Nerve – 13.4b (5th ed., 327) (fill in %):

%

- III, IV, and VI—the Oculomotor, Trochlear, and Abducens Nerves -13.4c (5th ed., 330) (fill in %) (also see Chapter 12).

%

- V—the Trigeminal Nerve – 13.4d (5th ed., 330) (fill in %).

%

- VII—the Facial Nerve – 13.4e (5th ed., 332) (fill in %).

%

© 2014 – 2017 Steven D. Feinberg, MD and Christopher R. Brigham, MD. All rights reserved. No part of this publication may be reproduced or transmitted by any means without written permission. Permission granted for use by WorkCompCentral.

- VIII—the Vestibulocochlear Nerve – 13.4f (5th ed., 333) (fill in %).

  %

- IX and X—the Glossopharyngeal and Vagus Nerves – 13.4g (5th ed., 334) (fill in %).

  %

- XI—the Spinal Accessory Nerve – 13.4h (5th ed., 334) (fill in %).
  - Is Voice/Speech impaired? Go to ENT Chapter (Table 11.8) to enter Voice impairment.
  - Is Head Turning Impaired? Use Cervical ROM Method in Spine Chapter.
  - Is Shoulder Motion Impaired? Use Upper Extremity Chapter for Shoulder

  %

- XII—the Hypoglossal Nerve – 13.4i (5th ed., 334) (fill in %).

  %

Criteria for Rating Impairments of Station, Gait, and Movement Disorders (remember you are in Chapter 13 and an Impairment should involve The Central and Peripheral Nervous System)

Criteria for Rating Impairments of Station, Gait, and Movement Disorders – 13.5 (5th ed., 336)

- Problems maintaining balance and a stable **GAIT** can develop from a CNS or peripheral neurologic impairment. Impairment ratings for station and gait disorders are determined according to the effect on ambulation (see Table 13-15 (5th ed., 336) (fill in %).
  GAIT

  %

MOVEMENT DISORDERS are assessed for their interference with ADLs as described for the lower extremities in Tables 13-15 (5th ed., 336, for one upper extremity in Table 13-16 (5th ed., 338, and for two upper extremities in Table 13-17, 340.

- **MOVEMENT DISORDERS**
  - Lower extremities _____%
  - One upper extremity _____%
  - Two upper extremities _____%
  - Use the CVC Table (5th ed., 602) (fill in %).

  %

© 2014 – 2017 Steven D. Feinberg, MD and Christopher R. Brigham, MD. All rights reserved. No part of this publication may be reproduced or transmitted by any means without written permission. Permission granted for use by WorkCompCentral.

Criteria for Rating Impairments of Upper Extremities Related to Central Impairment (remember you are in Chapter 13 and an Impairment should involve The Central and Peripheral Nervous System)

Criteria for Rating Impairments of Upper Extremities Related to Central Impairment – 13.6 (5th ed., 338)

- Use Tables 13-16 (5th ed., 338), for one extremity and Table 13-17 (5th ed., 340), for involvement of both upper extremities for rating upper extremity dysfunction from any lesion in the brain manifested by weakness, tremor, or pain that affects ADL.
    - One Extremity _____%
    - Two Extremities _____%

%

Criteria for Rating Spinal Cord and Related Impairments (remember you are in Chapter 13 and an Impairment should involve The Central and Peripheral Nervous System such as with a spinal tumor or other spinal cord insult but if there is an associated Spine (bone) injury, then Chapter 15, The Spine, should be used with the DRE Method combining the corticospinal "spinal cord" impairment in that Chapter)

Criteria for Rating Spinal Cord and Related Impairments – 13.7 (5th ed., 340)

	WPI
Respiratory System Neurologic Impairments	
Urinary System Neurologic Impairments	
Anorectal System Neurologic Impairments	
Sexual System Neurologic Impairments	
Combine all of the above using the CVC	

- **Respiratory System Neurologic Impairments** – 13.7a (5th ed., 341)
    - Neurologic impairment of one's ability to breathe is considered in Table 13-18 (5th ed., 341, only in terms of neurologic limitations. Other aspects of respiratory function are covered in Chapter 5, The Respiratory System (fill in %).

%

- **Urinary System Neurologic Impairments** – 13.7b (5th ed., 341)
    - The ability to control bladder emptying provides the criterion for evaluating permanent bladder impairment resulting from spinal cord and central nervous system disorders (see Table 13-19 (5th ed., 341) (fill in %).

%

© 2014 – 2017 Steven D. Feinberg, MD and Christopher R. Brigham, MD. All rights reserved. No part of this publication may be reproduced or transmitted by any means without written permission. Permission granted for use by WorkCompCentral.

- **Anorectal System Neurologic Impairments** – 13.7c (5th ed., 342)

    - The ability to control emptying provides the criterion for evaluating permanent impairment of the anus and rectum due to spinal cord or other neurologic dysfunction (see Table 13-20 (5th ed., 342) (fill in %).

      %

- **Sexual System Neurologic Impairments** – 13.7d (5th ed., 342)

    - Awareness and capability of having an orgasm are the criteria for evaluating permanent impairment of sexual functioning that may result from spinal cord or other neurologic system disorders (see Table 13-21 (5th ed., 342) (fill in %).

      %

Criteria for Rating Impairments Related to Chronic Pain

Criteria for Rating Impairments Related to Chronic Pain (causalgia, posttraumatic neuralgia, and RSD – also termed CRPS) – 13.8 (5th ed., 342)

These conditions can also be assessed in Chapter 16, The Upper Extremities. If the examiner chooses to assess impairment from both chapters, the approach that appears most appropriate for the case is selected; both methods cannot be combined. It is important that there be an objective basis for the pain complaints, otherwise Chapter 18 is applicable Complex Regional Pain Syndrome and diagnostic criteria are discussed in Section 16.5e (5th ed., 495-497).

- For upper extremity involvement, use Table 13-22 (5th ed., 342) If two upper extremities are involved, calculate each limb WP% and then combine using the CVC Table (5th ed., 602).
    - Right _____%
    - Left _____%

  Use the CVC Table (5th ed., 602), to Combine (fill in %) for upper extremity involvement:

  %

- For lower extremity involvement, use the station and gait impairment criteria given in Table 13-15 (5th ed., 336) (fill in %).

  %

  Use the CVC Table (5th ed., 602), to Combine (fill in %) for upper and lower extremity involvement.

© 2014 – 2017 Steven D. Feinberg, MD and Christopher R. Brigham, MD. All rights reserved. No part of this publication may be reproduced or transmitted by any means without written permission. Permission granted for use by WorkCompCentral.

Criteria for Rating Impairments of the Peripheral Nervous System, Neuromuscular Junction, and Muscular System

Criteria for Rating Impairments of the Peripheral Nervous System, Neuromuscular Junction, and Muscular System 13.9 (5th ed., 344)

Most of the time rating of peripheral nerve injuries will be based on approaches in Chapter 16 The Upper Extremities and Chapter 17 The Lower Extremities, rather than this section. This section is more often used when the peripheral nerve dysfunction is related to a neurological illness, as opposed to injury. Note, as opposed to Chapter 16, "classes" instead of "grades" are used to rate deficits, and the ordering is inverse.

Evaluating the peripheral nervous system requires documentation of the extent of loss of function due to sensory deficit, pain, or discomfort; loss of muscular strength and control of specific muscles or groups of muscles; and alteration of autonomic nervous system (ANS) control.

Spinal nerves are evaluated by loss of function in the peripheral nerve that receives contribution from the involved spinal root. If two or more spinal roots are involved, the increased loss of function from the contribution of two spinal roots to a peripheral nerve necessitates that the impairment be rated according to the brachial plexus (see Section 13.9b).

Roots of (single) Spinal Nerves – 13.9a (5th ed., 345)

- Calculation of the sensory deficit or pain is estimated according to Table 13-23, Classification and Procedure for Determining Impairment Due to Pain or Sensory Deficit Resulting From Peripheral Nerve Disorders (5th ed., 346.
    - There are four classes, with class 2, 3, & 4 having a percentage range.
    - Pick the percentage based on ADL deficits.

- Calculate the motor deficit according to 13-24, Classification and Procedure for Determining Nervous System Impairment Due to Loss of Muscle Power and Motor Function Resulting From Peripheral Nerve Disorders (5th ed., 348.
    - There are four classes, with class 2, 3, & 4 having a percentage range.
    - Pick the Deficit Percentage based on ADL deficits.

Nerves	Sensory Deficit or Pain Grade				Strength Grade			
	Right		Left		Right		Left	
	Class	Deficit %	Class	Deficit %	Class	Deficit %	Class	Deficit %
Spinal Nerve Root – C5	0 1 2 3 4 5 6		0 1 2 3 4 5 6		0 1 2 3 4 5 6		0 1 2 3 4 5 6	
Spinal Nerve Root – C6	0 1 2 3 4 5 6		0 1 2 3 4 5 6		0 1 2 3 4 5 6		0 1 2 3 4 5 6	
Spinal Nerve Root – C7	0 1 2 3 4 5 6		0 1 2 3 4 5 6		0 1 2 3 4 5 6		0 1 2 3 4 5 6	
Spinal Nerve Root – C8	0 1 2 3 4 5 6		0 1 2 3 4 5 6		0 1 2 3 4 5 6		0 1 2 3 4 5 6	
Spinal Nerve Root – T1	0 1 2 3 4 5 6		0 1 2 3 4 5 6		0 1 2 3 4 5 6		0 1 2 3 4 5 6	
Spinal Nerve Root – L3	0 1 2 3 4 5 6		0 1 2 3 4 5 6		0 1 2 3 4 5 6		0 1 2 3 4 5 6	
Spinal Nerve Root – L4	0 1 2 3 4 5 6		0 1 2 3 4 5 6		0 1 2 3 4 5 6		0 1 2 3 4 5 6	
Spinal Nerve Root – L5	0 1 2 3 4 5 6		0 1 2 3 4 5 6		0 1 2 3 4 5 6		0 1 2 3 4 5 6	
Spinal Nerve Root – S1	0 1 2 3 4 5 6		0 1 2 3 4 5 6		0 1 2 3 4 5 6		0 1 2 3 4 5 6	

Next, these percent deficits in the upper extremity are multiplied by the respective maximum sensory and/or motor impairments of the spinal nerve in question, Table 16-13 (5th ed., 489).

© 2014 – 2017 Steven D. Feinberg, MD and Christopher R. Brigham, MD. All rights reserved. No part of this publication may be reproduced or transmitted by any means without written permission. Permission granted for use by WorkCompCentral.

Table 16-13 Maximum Upper Extremity Impairment Due to Unilateral Sensory or Motor Deficits of Individual Spinal Nerves or to *Combined* 100% Deficits (identical to Table 15-17, 424)

	Maximum % Upper Extremity Impairment Due to:		
Spinal Nerve	Sensory Deficit or Pain	Motor Deficit	Combined Motor/Sensory Deficit
C5	5	30	34
C6	8	35	40
C7	5	35	38
C8	5	45	48
T1	5	20	24

For the spinal roots in the lower extremity to determine the maximum lower extremity impairment due to unilateral sensory or motor deficits use Table 15-18 (5th ed., 424).

Table 15-18 Unilateral Spinal Nerve Root Impairment Affecting the Lower Extremity

Nerve Root Impaired	Maximum % Loss of Function due to Sensory Deficit or Pain	Maximum % Loss of Function due to Strength
L3	5	20
L4	5	34
L5	5	37
S1	5	20

The sensory and motor impairments are combined using the Combined Values Chart (5th ed., 604) for the total upper extremity impairment, which is then converted to whole person impairment (Table 16-3 (5th ed., 439).

If deficits are bilateral, the whole person impairment is found for each extremity and then combined using the Combined Values Chart (5th ed., 604).

Brachial Plexus – 13.9b (5th ed., 346)

Table 16-14 (5th ed., 490, provides the maximum impairment due to unilateral sensory or motor deficits of the brachial plexus by the entire brachial plexus and the upper, middle, and lower trunks.

If there is partial recovery, individual muscles are graded according to Table 13-24 (5th ed., 348. This value is multiplied by the maximum upper extremity impairment for the nerve innervating the muscle listed in Table 16-15 (5th ed., 492.

Results from all the muscles are combined using the Combined Values Chart, p. 604, and the total upper extremity impairment converted to a whole person impairment, Table 16-3 (5th ed., 439.

Peripheral Nerve Impairments – 13.9c (5th ed., 347) *****

This section is used to rate sensory and motor impairments from individual nerve lesions or multiple nerve disorders such as polyneuropathy or mononeuritis multiplex. Grading procedures for sensory and motor impairments resulting from peripheral nerve disorders in the upper and lower extremities are found in Tables 13-23 and 13-24.

Calculate the sensory deficit or pain is estimated according to Table 13-23, Classification and Procedure for Determining Impairment Due to Pain or Sensory Deficit Resulting From Peripheral Nerve Disorders (5th ed., 346).

- There are four classes, with class 2, 3, & 4 having a percentage range.
- Pick the percentage based on ADL deficits.

© 2014 – 2017 Steven D. Feinberg, MD and Christopher R. Brigham, MD. All rights reserved. No part of this publication may be reproduced or transmitted by any means without written permission. Permission granted for use by WorkCompCentral.

Calculate the motor deficit according to 13-24, Classification and Procedure for Determining Nervous System Impairment Due to Loss of Muscle Power and Motor Function Resulting From Peripheral Nerve Disorders (5th ed., 348).

- There are four classes, with class 2, 3, & 4 having a percentage range.
- Pick the percentage based on ADL deficits.

This percent impairment is multiplied by the appropriate maximum loss of function for the nerve in question due to sensory deficit and pain or motor deficit, Table 16-15 (5th ed., 492) for the upper extremity and Table 17-37 (5th ed., 552) for the lower extremity.

Sensory and motor impairments of the upper extremity are combined using the Combined Values Chart (5th ed., 604).

The result is converted to whole person impairment, Table 16-3.

If multiple nerves are involved in one extremity, the same procedure is followed for each nerve.

Once the sensory and motor impairments for each nerve have been combined using the Combined Values Chart (5th ed., 604). All the nerves rated in one extremity are combined, again using the Combined Values Chart to determine the total impairment in the affected limb.

If more than one limb is involved, each total extremity impairment is converted to a whole person impairment (Table 16-3, 439), and these values are again combined using the Combined Values Chart (5th ed., 604)

Cases such as carpal tunnel are rated using the peripheral nerve section in Chapter 16, Upper Extremities.

Nerves	**Sensory Class / Deficit (%)**		**Motor Class / Deficit (%)**	
	Right	**Left**	**Right**	**Left**
Pectorals (medial and lateral)			0 1 2 3 4 5 6	0 1 2 3 4 5 6
Axillary	0 1 2 3 4 5 6	0 1 2 3 4 5 6	0 1 2 3 4 5 6	0 1 2 3 4 5 6
Dorsal scapular			0 1 2 3 4 5 6	0 1 2 3 4 5 6
Long thoracic			0 1 2 3 4 5 6	0 1 2 3 4 5 6
Medial antebrachial cutaneous	0 1 2 3 4 5 6	0 1 2 3 4 5 6		
Medial brachial cutaneous	0 1 2 3 4 5 6	0 1 2 3 4 5 6		
Median (above midforearm)	0 1 2 3 4 5 6	0 1 2 3 4 5 6	0 1 2 3 4 5 6	0 1 2 3 4 5 6
Median (anterior interosseous branch)			0 1 2 3 4 5 6	0 1 2 3 4 5 6
Median (below midforearm)	0 1 2 3 4 5 6	0 1 2 3 4 5 6	0 1 2 3 4 5 6	0 1 2 3 4 5 6
Radial palmar digital of thumb	0 1 2 3 4 5 6	0 1 2 3 4 5 6		
Ulnar palmar digital of thumb	0 1 2 3 4 5 6	0 1 2 3 4 5 6		
Radial palmar digital of index finger	0 1 2 3 4 5 6	0 1 2 3 4 5 6		
Ulnar palmar digital of index finger	0 1 2 3 4 5 6	0 1 2 3 4 5 6		
Radial palmar digital of middle finger	0 1 2 3 4 5 6	0 1 2 3 4 5 6		
Ulnar palmar digital of middle finger	0 1 2 3 4 5 6	0 1 2 3 4 5 6		
Radial palmar digital of ring finger	0 1 2 3 4 5 6	0 1 2 3 4 5 6		
Musculocutaneous	0 1 2 3 4 5 6	0 1 2 3 4 5 6	0 1 2 3 4 5 6	0 1 2 3 4 5 6
Radial (upper arm with loss of triceps)	0 1 2 3 4 5 6	0 1 2 3 4 5 6	0 1 2 3 4 5 6	0 1 2 3 4 5 6
Radial (elbow with sparing of triceps)	0 1 2 3 4 5 6	0 1 2 3 4 5 6	0 1 2 3 4 5 6	0 1 2 3 4 5 6
Subscapularis (upper and lower)			0 1 2 3 4 5 6	0 1 2 3 4 5 6
Suprascapular	0 1 2 3 4 5 6	0 1 2 3 4 5 6	0 1 2 3 4 5 6	0 1 2 3 4 5 6
Thoracodorsal			0 1 2 3 4 5 6	0 1 2 3 4 5 6
Ulnar (above midforearm)	0 1 2 3 4 5 6	0 1 2 3 4 5 6	0 1 2 3 4 5 6	0 1 2 3 4 5 6
Ulnar (below midforearm)	0 1 2 3 4 5 6	0 1 2 3 4 5 6	0 1 2 3 4 5 6	0 1 2 3 4 5 6
Ulnar palmar digital of ring finger	0 1 2 3 4 5 6	0 1 2 3 4 5 6		
Radial palmar digital of little finger	0 1 2 3 4 5 6	0 1 2 3 4 5 6		
Ulnar palmar digital of little finger	0 1 2 3 4 5 6	0 1 2 3 4 5 6		
Brachial plexus (C5 through C8, T1)	0 1 2 3 4 5 6	0 1 2 3 4 5 6	0 1 2 3 4 5 6	0 1 2 3 4 5 6
Upper trunk (C5, C6, Erb-Duchenne)	0 1 2 3 4 5 6	0 1 2 3 4 5 6	0 1 2 3 4 5 6	0 1 2 3 4 5 6
Middle trunk (C7)	0 1 2 3 4 5 6	0 1 2 3 4 5 6	0 1 2 3 4 5 6	0 1 2 3 4 5 6
Lower trunk (C8, T1, Déjerine-Klumpke)	0 1 2 3 4 5 6	0 1 2 3 4 5 6	0 1 2 3 4 5 6	0 1 2 3 4 5 6

© 2014 – 2017 Steven D. Feinberg, MD and Christopher R. Brigham, MD. All rights reserved. No part of this publication may be reproduced or transmitted by any means without written permission. Permission granted for use by WorkCompCentral.

Nerves	Sensory Class / Deficit (%)		Motor Class / Deficit (%)		Dysesthesia Class / Deficit (%)	
	Right	Left	Right	Left	Right	Left
Femoral	0 1 2 3 4 5 6	0 1 2 3 4 5 6	0 1 2 3 4 5 6	0 1 2 3 4 5 6	0 1 2 3 4 5 6	0 1 2 3 4 5 6
Obturator			0 1 2 3 4 5 6	0 1 2 3 4 5 6		
Superior gluteal			0 1 2 3 4 5 6	0 1 2 3 4 5 6		
Inferior gluteal			0 1 2 3 4 5 6	0 1 2 3 4 5 6		
Lateral femoral cutaneous	0 1 2 3 4 5 6	0 1 2 3 4 5 6			0 1 2 3 4 5 6	0 1 2 3 4 5 6
Sciatic	0 1 2 3 4 5 6	0 1 2 3 4 5 6	0 1 2 3 4 5 6	0 1 2 3 4 5 6	0 1 2 3 4 5 6	0 1 2 3 4 5 6
Common peroneal	0 1 2 3 4 5 6	0 1 2 3 4 5 6	0 1 2 3 4 5 6	0 1 2 3 4 5 6	0 1 2 3 4 5 6	0 1 2 3 4 5 6
Superficial peroneal	0 1 2 3 4 5 6	0 1 2 3 4 5 6			0 1 2 3 4 5 6	0 1 2 3 4 5 6
Sural	0 1 2 3 4 5 6	0 1 2 3 4 5 6			0 1 2 3 4 5 6	0 1 2 3 4 5 6
Medial plantar	0 1 2 3 4 5 6	0 1 2 3 4 5 6	0 1 2 3 4 5 6	0 1 2 3 4 5 6	0 1 2 3 4 5 6	0 1 2 3 4 5 6
Lateral plantar	0 1 2 3 4 5 6	0 1 2 3 4 5 6	0 1 2 3 4 5 6	0 1 2 3 4 5 6	0 1 2 3 4 5 6	0 1 2 3 4 5 6

Class	Sensory Deficit or Pain Grade	Deficit (%)	Strength Grade		Deficit (%)
1	No loss of sensibility, abnormal sensation, or pain	0	**1**	Active movement against gravity with full resistance	0
2	Normal sensation except for pain, or decreased sensation with or without pain, forgotten during activity	1 - 10	**2**	Active movement against gravity with some resistance	1 -25
3	Normal sensation except for pain, or decreased sensation with or without pain, present during activity	11 - 25	**3**	Active movement against gravity only, without resistance	26 – 50
4	Decreased sensation with or without pain, interfering with activity	26 - 60	**4**	Active movement with gravity eliminated	51 – 75
5	Decreased sensation with or without pain or minor causalgia that may prevent activity	61 - 80	**5**	Slight contraction and no movement	76 – 99
6	Decreased sensation with severe pain or major causalgia that prevents activity	81 - 95	**6**	No movement	100

N**euromuscular Impairments – 13.9d** (5th ed., 351)

Neuromuscular impairment as present in longstanding myasthenia gravis or myasthenic syndromes is accompanied by proximal weakness; impairment is rated by the impact on activities of daily living.

For the lower extremities, station and gait are rated as described in activities of Table 13-15 (5th ed., 336).

- There are four classes, with class 2, 3, & 4 having a percentage range.
- Pick the percentage based on ADL deficits.

The upper extremities are rated using Tables 13-16 (5th ed., 338, for one extremity and Table 13-17 (5th ed., 340) for both upper extremities.

- There are four classes, with class 2, 3, & 4 having a percentage range.
- Pick the percentage based on ADL deficits.

13.9e Muscular Impairments – 13.9e (5th ed., 351)

This is a varied group of disorders with proximal weakness best rated by ADL changes that includes muscular dystrophy, metabolic myopathy, abnormal potassium metabolism and muscle disease, endocrine myopathies, and inflammatory muscle disease.

For the lower extremities, station and gait are rated as described in activities of Table 13-15 (5th ed., 336).

- There are four classes, with class 2, 3, & 4 having a percentage range.
- Pick the percentage based on ADL deficits.

© 2014 – 2017 Steven D. Feinberg, MD and Christopher R. Brigham, MD. All rights reserved. No part of this publication may be reproduced or transmitted by any means without written permission. Permission granted for use by WorkCompCentral.

The upper extremities are rated using Tables 13-16 (5th ed., 338) for one extremity and Table 13-17 (5th ed., 340), for both upper extremities.

- There are four classes, with class 2, 3, & 4 having a percentage range.
- Pick the percentage based on ADL deficits.

Neuromuscular and muscular impairments otherwise for the lower extremities are rated using Tables 17-6, Impairment Due to Unilateral Leg Muscle Atrophy (5th ed., 530), and Table 17-8, Impairment Due to Lower Extremity Muscle Weakness (5th ed., 532) (Chapter 17).

- Also, Table 13-15 (5th ed., 336), is useful when gait is the most significant impairment from the neuromuscular or muscular disorder.

The Autonomic Nervous System – 13.9f (5th ed., 351)

- Neurologic conditions that have ANS involvement include polyneuropathy of various causes, familial dysautonomia, Landry-Guillain-Barré syndrome, syringomyelia, porphyria, cord and brain tumors, and myelopathy.
- Lack of control of blood pressure, body thermal regulation, and bladder and bowel elimination are prominent signs of ANS failure. Impairments related to transient loss of awareness or consciousness after a period of cerebral ischemia may be due to various mechanisms, including orthostasis, reflex actions, or cardiopulmonary disorders, and may be estimated by means of Table 13-2.
- Referring to other *Guides* chapters also may be necessary to estimate the magnitudes of the impairments (Chapters 3 through 5).

- _____%

© 2014 – 2017 Steven D. Feinberg, MD and Christopher R. Brigham, MD. All rights reserved. No part of this publication may be reproduced or transmitted by any means without written permission. Permission granted for use by WorkCompCentral.

Nervous System Impairment Evaluation Summary

Central & Peripheral Nervous System Summary Form

	WPI
Cerebral Impairments	
Cranial nerve impairments	
Gait	
Movement disorders	
Extremity disorders related to central impairment	
Spinal cord impairments	
Chronic pain (CRPS, causalgia, posttraumatic neuralgia, and RSD)	
Peripheral Nervous System, Neuromuscular Junction, and Muscular System	
Roots of (single) Spinal Nerves	
Peripheral Nerve Impairments (including brachial plexus)	
Neuromuscular Impairments	
Muscular Impairments	
Autonomic Nervous System	
Combine all of the above using the CVC Table	

© 2014 – 2017 Steven D. Feinberg, MD and Christopher R. Brigham, MD. All rights reserved. No part of this publication may be reproduced or transmitted by any means without written permission. Permission granted for use by WorkCompCentral.

Chapter 15 – The Spine

Overview

This chapter provides criteria for evaluating permanent impairments of the spine, including how they affect an individual's ability to perform activities of daily living (ADL). The spine consists of four regions: the cervical, thoracic, lumbar and sacral vertebrae, and associated soft tissues including muscles, ligaments, disks, and neural elements. Impairments of the spine discussed in this chapter include lumbar, thoracic, cervical, spinal cord, and pelvic impairments. It is comprised of the following sections:

15.1 Principles of Assessment

15.2 Determining the Appropriate Method for Assessment

15.3 Diagnosis-Related Estimates Method

15.4 DRE: Lumbar Spine

15.5 DRE: Thoracic Spine

15.6 DRE: Cervical Spine

15.7 Rating Corticospinal Tract Damage

15.8 Range-of-Motion Method

15.9 ROM: Lumbar Spine

15.10 ROM: Thoracic Spine

15.11 ROM: Cervical Spine

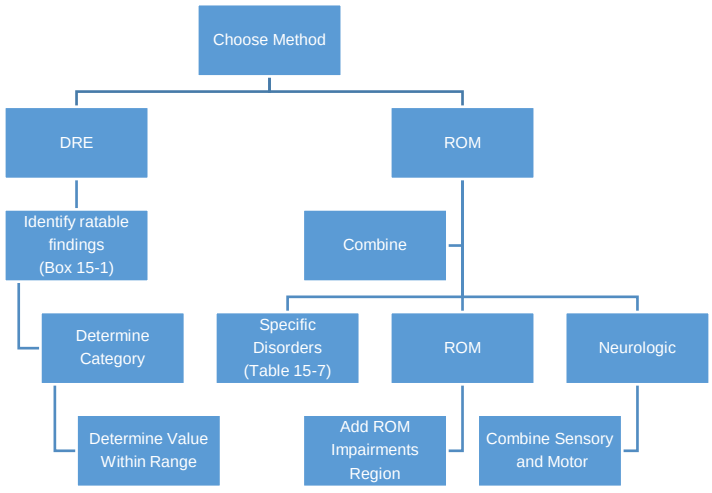
15.12 Nerve Root and/or Spinal Cord

15.13 Criteria for Converting Whole Person Impairment to Regional Spine Impairment

15.14 The Pelvis

15.15 Spine Evaluation Summary

Spine Impairment Evaluation Algorithm



© 2014 – 2017 Steven D. Feinberg, MD and Christopher R. Brigham, MD. All rights reserved. No part of this publication may be reproduced or transmitted by any means without written permission. Permission granted for use by WorkCompCentral.

Principles of Assessment

The examiner must follow the standards defined in Section 15.1 Principles of Assessment (5th ed., 374-379) for history, physical examination and imaging studies. Standards for the physical examination are defined in Table 15-1 (5th ed., 375).

Determining the Appropriate Method for Assessment

The first step is to **choose the DRE (Diagnosis-Related Estimates) or ROM (Range of Motion) Method**.

The **DRE method** is the principal methodology used to evaluate an individual who has had a distinct injury. When the cause of the impairment is not easily determined and if the impairment can be well characterized by the DRE method, the evaluator should use the DRE method.

The **ROM method** is used in several situations. First, when an impairment is not caused by an injury, if the cause of the condition is uncertain and the DRE method does not apply, or an individual cannot be easily categorized in a DRE class. It is acknowledged that the cause of impairment (injury, illness, or aging) cannot always be determined. The reason for using the ROM method under these circumstances must be carefully supported in writing. Second, when there is multilevel involvement in the same spinal region (eg, fractures at multiple levels, or disk herniations or stenosis with radiculopathy at multiple levels or bilaterally). Third, where there is alteration of motion segment integrity (eg, fusions) at multiple levels in the same spinal region, unless there is involvement of the corticospinal tract (then use the DRE method for corticospinal tract involvement). Fourth, where there is recurrent radiculopathy caused by either a new (recurrent) disk herniation or a recurrent injury in the same spinal region. Fifth, where there are multiple episodes of other pathology producing alteration of motion segment integrity and/or radiculopathy.

Evaluate the case.

- Are there fractures at more than one level in a spinal region? □ No □Yes
- Is there radiculopathy bilaterally or at multiple levels in the same spinal region? □ No □Yes
- It there multilevel motion segment alteration (such as a multilevel fusion) in the same spinal region? □ No □Yes
- Is there recurrent disk herniation or stenosis with radiculopathy at the same or a different level in the same spinal region? □ No □Yes

If any of above are yes, and there is no corticospinal impairment, then rate using the ROM Method

In the small number of instances in which the ROM and DRE methods can both be used, we should evaluate the individual with both methods and award the higher rating. Spinal pain attributed to "cumulative trauma" is a controversial issue, in terms of causation, apportionment, and rating of impairment. The individual evaluator should determine if the DRE method is applicable (i.e. the impairment can be well characterized), or whether the Range of Motion Method is more appropriate. Experts may differ on which method is more applicable.

© 2014 – 2017 Steven D. Feinberg, MD and Christopher R. Brigham, MD. All rights reserved. No part of this publication may be reproduced or transmitted by any means without written permission. Permission granted for use by WorkCompCentral.

Diagnosis-Related Estimates Method

The first step in using the DRE Method starts with choosing one of the three areas (Lumbar - Table 15-3 (5th ed., 384), Thoracic - Table 15-4 (5th ed., 389), or Cervical – Table 15-5 (5th ed., 392). Each spine area has five categories and it is your job to pick the category that best describes the examinee's spine condition. How do you do this? You read the descriptions and pick the one that best fits the examinee, based on your assessment and the presence of reliable findings.

The criteria for placement are provided in Box 15-1 Definitions of Clinical Findings Used to Place an Individual in a DRE Category (5th ed., 382-383). In your report you need to provide the rationale for the category you selected. Pick only one Category for each region of the spine. As with all ratings, your impairment must be based on reliable findings.

NB: It is critically important that your physical examination findings specifically document the Clinical Findings noted below.

Clinical Finding	Category I	Category II	Category III	Category IV	Category V
Muscle Spasm		+			
Muscle Guarding		+			
Asymmetry of Spinal Motion		+			
Nonverifiable Radicular Root Pain		+			
Reflex Loss (or marked asymmetry)			±		
Weakness and Loss of Sensation			±		
Atrophy			±		
Radiculopathy			+		
Electrodiagnostic Verification of Radiculopathy			+		
Alteration of Motion Segment Integrity to include single level fusion)				+	
Radiculopathy and Alteration of Motion Segment Integrity					+

- except cervical

Clinical Finding	DRE: Lumbar	DRE: Thoracic	DRE: Cervical
Muscle Spasm	Category II	Category II	Category II
Muscle Guarding	Category II	Category II	Category II
Asymmetry of Spinal Motion	Category II	Category II	Category II
Nonverifiable Radicular Root Pain	Category II	Category II	Category II
Reflex Abnormality	Category III (if radiculopathy)	Category III (if radiculopathy)	Category III (if radiculopathy)
Weakness and Loss of Sensation	Category III (if radiculopathy)	Category III (if radiculopathy)	Category III (if radiculopathy)
Atrophy	Category III (if radiculopathy)	Category III (if radiculopathy)	Category III (if radiculopathy)
Radiculopathy	Category III	Category III	Category III
Electrodiagnostic Verification of Radiculopathy	Category III	Category III	Category III
Alteration of Motion Segment Integrity	Category IV	Category IV	Category IV
Radiculopathy and Alteration of Motion Segment Integrity	Category V	Category V	Category IV

NB: Pick only one Category for each region of the spine

© 2014 – 2017 Steven D. Feinberg, MD and Christopher R. Brigham, MD. All rights reserved. No part of this publication may be reproduced or transmitted by any means without written permission. Permission granted for use by WorkCompCentral.

The second step, using these same Tables, is to pick a percentage within that category that you have picked and you have a 3% range to choose from. This is a clinical judgment call on your part and should be based on the degree of Activities of Daily Living (ADL) deficits (if any). "If residual symptoms or objective findings impact the ability to perform ADL despite treatment, the higher percentage in each range should be assigned." If there are little or no ADL deficits you would choose the lower end but you would choose a higher number (up to 3%) based on increasing ADL deficits. You should provide your rationale in writing by explaining that there are or are not ADL deficits to justify your decision.

DRE Method: Lumbar Spine (Table 15-3 (5th ed., 384)

- ❑ DRE Category I (WPI = 0%): ____%
- ❑ DRE Category II (WPI = 5-8%): ____%
- ❑ DRE Category III: (WPI = 10-13%) ____%
- ❑ DRE Category IV: (WPI = 20-23%) ____%
- ❑ DRE Category V:(WPI = 25-28%) ____%

%

DRE Method: Thoracic Spine (Table 15-4 (5th ed., 389)

- ❑ DRE Category I (WPI = 0%): ____%
- ❑ DRE Category II (WPI = 5-8%): ____%
- ❑ DRE Category III (WPI = 10-13%): ____%
- ❑ DRE Category IV (WPI = 20-23%): ____%
- ❑ DRE Category V (WPI = 25-28%): ____%

%

DRE Method: Cervical Spine (Table 15-392 (5th ed., 392)

- ❑ DRE Category I (WPI = 0%): ____%
- ❑ DRE Category II (WPI = 5-8%): ____%
- ❑ DRE Category III (WPI = 15-18%): ____%
- ❑ DRE Category IV (WPI = 25-28%): ____%
- ❑ DRE Category V (WPI = 35-38%): ____%

%

If you have identified WPI for more than one spine region (cervical, thoracic and/or lumbar), the WPI values should be combined to come up with a spine WPI.

Cervical Thoracic & Lumbar spine WPI:

%

© 2014 – 2017 Steven D. Feinberg, MD and Christopher R. Brigham, MD. All rights reserved. No part of this publication may be reproduced or transmitted by any means without written permission. Permission granted for use by WorkCompCentral.

Rating Corticospinal Tract Damage

The third step in using the DRE Method is to ascertain if there is a corticospinal (spinal cord) involvement and if so, then you would then go to Table 15-6, Rating Corticospinal Tract Impairment (5th ed., 396). Corticospinal involvement is relatively rare, and rating by this section must be supported by objective findings of this lesion.

You are then given a number of choices.

a) Impairment of One Upper Extremity Due to Corticospinal Tract Impairment
NB: You have to be careful to pick dominant or non-dominant extremity
b) Criteria for Rating Impairments of Two Upper Extremities
c) Criteria for Rating Impairments Due to Station and Gait Disorders
d) Criteria for Rating Neurologic Impairment of the Bladder
e) Criteria for Rating Neurologic Anorectal Impairment
f) Criteria for Rating Neurologic Sexual Impairment
g) Criteria for Rating Neurologic Impairment of Respiration

For each of these categories, you have a choice of four Classes (I, II, III, and IV) and you again pick the one that best fits the examinee. As you can see, each Class has a percentage range and this again involves your clinical judgment and you select a percentage impairment (rating) within the given range based on the degree of ADL deficits. Note that for the cervical and thoracic spine, corticospinal deficits involve a spinal cord injury but even for the lumbar area, when there is a cauda equina syndrome involving the nerve roots, this method is still used.

Rating Corticospinal Tract Involvement Table 15-6 (5th ed., 396)

❑	Impairment of One Upper Extremity	_____%
❑	Impairments Two Upper Extremities	_____%
❑	Station and Gait Disorders	_____%
❑	Neurologic Impairment of the Bladder	_____%
❑	Neurologic Anorectal Impairment	_____%
❑	Neurologic Sexual Impairment	_____%
❑	Neurologic Impairment of Respiration	_____%

Combined Value of Above _____%

The corticospinal impairment is combined with the Spine DRE impairment =

%

© 2014 – 2017 Steven D. Feinberg, MD and Christopher R. Brigham, MD. All rights reserved. No part of this publication may be reproduced or transmitted by any means without written permission. Permission granted for use by WorkCompCentral.

Range-of-Motion Method

The Range-of-Motion Method is more challenging. Although called the range-of-motion method, this evaluation method actually consists of three elements that need to be assessed (all of which are combinable): (1) the range of motion of the impaired spine region; (2) accompanying diagnoses (Table 15-7 (5th ed., 404); and (3) any spinal nerve deficit (see pages 423 - 424).

Measuring Range of Motion (ROM)

- Measurements must be obtained using an inclinometer according to the procedures defined in the *Guide* (5th ed., 399-402).

- Consistency should be sought and *inconsistent results should be disregarded. A*t least three consecutive measurements should be obtained and averaged. Measurements should not change substantially with repeated efforts. If the average is less than 50°, three consecutive measurements must fall within 5° of the mean; if the average is greater than 50°, three consecutive measurements must fall within 10% of the mean. Motion testing may be repeated up to six times to obtain three consecutive measurements that meet these criteria. If after six measurements inconsistency persists, the spinal motions are considered invalid. You can repeat the tests at a later date or disallow impairment related to that motion. Disallowing impairment will of course have a negative effect on the final impairment rating so it is critically important to explain to the examinee the benefits of providing good and consistent effort.

- Active ROM is done when a person can do the exercises by himself. Active-assisted ROM exercises are done by the person and a helper (this usually means the examiner provides some assistance). Passive ROM exercises are done for a person by a helper (the examiner). Remember that ROM is done actively by the examinee and the examiner should not provide any help or assistance – in other words the ROM exam should not be Passive or Active-assisted.

- Measure the range of motion in the relevant sagittal, frontal (coronal), and transverse planes (Figure 15-7 (5th ed., 402), and determine any angle of ankylosis or any restricted motion that is present. When ankylosis is present, (end-restricted movement), this value, taken as the ankylosis value, is used to determine impairment instead of the ROM. Ankylosis as a basis for impairment deficit is extremely rare. If the motion crosses the neutral position in any plane, the examiner should use the abnormal motion section of the appropriate table to determine the impairment for that plane. This is admittedly a little confusing so perhaps an example would help. For example, an individual who can flex the cervical spine from 30° to 60° but who lacks 30° of motion in reaching the neutral 0° position has restricted end motion and the same estimated impairment as if he or she had fixed ankylosis at 30° of cervical flexion. According to Table 15-12 (page 418), the individual's impairment is 30% of the whole person. On the other hand if cervical flexion (which is normally 50°) was from 0° to 60°, there would be no Impairment, and if it was from 0° to 30° (20° lost and 30° retained – note that the Table in the book is wrong), there would be a 2% Impairment of the Whole Person (see Table 15-12 (page 418).

- There are tables for abnormal motion of the Lumbar, Thoracic and Cervical regions. For each region, you use the tables to come up with a % Impairment of the Whole Person. If there are impairments due to loss of motion in more than one plane in the same spinal region (extension, flexion, or rotation), the impairments are added to determine total impairment due to loss of motion in a spinal region.

Step one for the ROM Method is to measure ROM. Record your findings using the Figures provided in the *Guide,* for the lumbar region Figure 15-10 (5th ed., 410), thoracic region Figure 15-14 (5th ed., 416), and lumbar region Figure 15-18 (5th ed., 422). Values must be consistent and the maximum value is used to define impairment.

© 2014 – 2017 Steven D. Feinberg, MD and Christopher R. Brigham, MD. All rights reserved. No part of this publication may be reproduced or transmitted by any means without written permission. Permission granted for use by WorkCompCentral.

© 2014 – 2017 Steven D. Feinberg, MD and Christopher R. Brigham, MD. All rights reserved. No part of this publication may be reproduced or transmitted by any means without written permission. Permission granted for use by WorkCompCentral.

CERVICAL SPINE ROM Method

CERVICAL SPINE (expected normal %) ❑ Normal exam	**Ankylosis**	**ROM**		
		C	**T1**	**True Angle**
Flexion (50º)				
Extension (60º)				
Right Lateral Flexion (45º)				
Left Lateral Flexion (45º)				
Right Rotation (80º)				
Left Rotation (80º)				

THORACIC SPINE ROM Method

THORACIC SPINE (expected normal %) ❑ Normal exam	**Ankylosis**	**ROM**		
		T1	**T12**	**True Angle**
Flexion (45º)	XXXXXX			
Extension (0º)	XXXXXX			
Left Rotation (30º)				
Right Rotation (30º)				

LUMBAR SPINE ROM Method

LUMBAR SPINE (expected normal) ❑ Normal exam	**Ankylosis**	**ROM**		
		T12	**S1**	**True Angle**
Flexion (60º) ‡	**XXXXX**			
Extension (25º) ‡	**XXXXX**			
Right Lateral Flexion (25º)				
Left Lateral Flexion (25º)				
Right Straight Leg Raising†	**XXXXX**		**XXXXXX**	
Left Straight Leg Raising†	**XXXXX**		**XXXXXX**	

‡Repeat the ROM at least three times and at most six times for flexion and extension to obtain a valid measurement set (three consecutive, reproducible measurements). Only the true lumbar spine flexion and extension angles need to be consistently measured within 5° if the average is less than 50°, or within 10% if the average is greater than 50°. The impairment is based on the maximum true extension and flexion angles from within the three measurements.

†If tightest SLR ROM exceeds sum of sacral flexion and extension by more than 15 degrees, lumbar flexion and extension measurements are invalid (assumes sacral flexion and extension are less than normal). *Note:* This accessory validity test is useful only when sacral flexion plus extension is less than the average for normal individuals (i.e., 65° for women and 55° for men).

© 2014 – 2017 Steven D. Feinberg, MD and Christopher R. Brigham, MD. All rights reserved. No part of this publication may be reproduced or transmitted by any means without written permission. Permission granted for use by WorkCompCentral.

Step two for the ROM Method is to clarify the Specific Spine Disorders.

Specific Spine Disorders

This is solely a component of the Range of Motion Method, and is never combined with the DRE Method.

After you have completed measuring the ROM and used the various tables to determine the Whole Person Impairment (WPI), it is time to go to Table 15-7 Criteria for Rating Whole Person Impairment Percent Due to Specific Spine Disorders (5th ed., 404). Use Table 15-7 to determine the percentage impairment for the part of the ROM diagnosis–based method. If there are two or more diagnoses within a spinal region, use that which is most significant. Here is a list of the Disorders in Table 15-7.

I. Fractures
II. Intervertebral disk or other soft-tissue lesion
III. Spondylolysis and spondylolisthesis, not operated on
IV. Spinal stenosis, segmental instability, spondylolisthesis, fracture, or dislocation, operated on

So, you have picked the single disorder that is most significant and you have used the Table to come up with a % Impairment of the While Person. Don't forget for II and IV to add for multiple levels and for multiple operations, as appropriate.

SPINE DIAGNOSIS (Table 15-7 Criteria for Rating Whole Person Impairment Percent Due to Specific Spine Disorders to Be Used as Part of the ROM Method* (5th ed., 404).

I. Fractures

- ❑ A. Compression of one vertebral body
  - 0%-25%
  - 26%-50%
  - > 50%
- ❑ B. Fracture of posterior element (pedicle, lamina, articular process, transverse process).
- ❑ C. Reduced dislocation of one vertebra.

II. Intervertebral disk or other soft-tissue lesion

Diagnosis must be based on clinical symptoms and signs and imaging information.

- ❑ A. Unoperated on, with no residual signs or symptoms.
- ❑ B. Unoperated on, with medically documented injury, pain, and rigidity* associated with none to minimal degenerative changes on structural tests
  - Structural tests include radiographs, myelograms with and without CT scan, CT scan and MRI with and without contrast, and diskogram with and without CT scan (* The phrase "medically documented injury, pain, and rigidity" implies not only that an injury or illness has occurred but also that the condition is stable, as shown by the evaluator's history, examination, and other diagnostic data, and that a permanent impairment exists, which is at least partially due to the condition being evaluated.)
- ❑ C. Unoperated on, stable, with medically documented injury, pain, and rigidity* associated with moderate to severe degenerative changes on structural tests;† includes herniated nucleus pulposus with or without radiculopathy.
- ❑ D. Surgically treated disk lesion without residual signs or symptoms; includes disk injection.
- ❑ E. Surgically treated disk lesion with residual, medically documented pain and rigidity.
- ❑ F. Multiple levels, with or without operations and with or without residual signs or symptoms
- ❑ G. Multiple operations with or without residual signs or symptoms

© 2014 – 2017 Steven D. Feinberg, MD and Christopher R. Brigham, MD. All rights reserved. No part of this publication may be reproduced or transmitted by any means without written permission. Permission granted for use by WorkCompCentral.

III. Spondylolysis and spondylolisthesis, not operated on

- ❑ A. Spondylolysis or grade I (1%-25% slippage) or grade II (26%-50% slippage) spondylolisthesis, accompanied by medically documented injury that is stable, and medically documented pain and rigidity with or without muscle spasm.
- ❑ B. Grade III (51%-75% slippage) or grade IV (76%-100% slippage) spondylolisthesis, accompanied by medically documented injury that is stable, and medically documented pain and rigidity with or without muscle spasm.

IV. Spinal stenosis, segmental instability, spondylolisthesis, fracture, or dislocation, operated on

- ❑ A. Single-level decompression without spinal fusion and without residual signs or symptoms.
- ❑ B. Single-level decompression without spinal fusion with residual signs or symptoms.
- ❑ C. Single-level spinal fusion with or without decompression without residual signs or symptoms.
- ❑ D. Single-level spinal fusion with or without decompression with residual signs and symptoms.
- ❑ E. Multiple levels, operated on, with residual, medically documented pain and rigidity

- ❑ **Number of Operations:** Cervical spine:___ / Thoracic spine:_____ / Lumbar spine: _____

Affected Levels Form

	Compression Fracture (1a)			Fracture of Posterior Element (1b)	Dislocation (1c)	Spinal Stenosis [IV(e)]		Intervertebral Disk [2(f)]
	0 – 25%	26 – 50%	>50%					
C1							C1 – C2	
C2							C2 – C3	
C3							C3 – C4	
C4							C4 – C5	
C5							C5 – C6	
C6							C6 – C7	
C7							C7 – T1	
T1							T1 – T2	
T2							T2 – T3	
T3							T3 – T4	
T4							T4 – T5	
T5							T5 – T6	
T6							T6 – T7	
T7							T7 – T8	
T8							T8 – T9	
T9							T9 – T10	
T10							T10 – T11	
T11							T11 – T12	
T12							T12 – L1	
L1							L11 – L2	
L2							L2 – L3	
L3							L3 – L4	
L4							L4 – L5	
L5							L5 – S1	

© 2014 – 2017 Steven D. Feinberg, MD and Christopher R. Brigham, MD. All rights reserved. No part of this publication may be reproduced or transmitted by any means without written permission. Permission granted for use by WorkCompCentral.

Step three of the ROM Method is to note any Spinal Nerve Deficits.

Spinal Nerve Deficits

- This is a little complicated and confusing, so follow closely.
- To determine any impairments due to neurologic deficits, such as radiculopathy or spinal nerve injury, go to page 423 for an explanation and then to page 424 for the accompanying Tables.
- You need to identify the nerve root involved based on the clinical evaluation and the dermatome distribution charts on page 377 for the lower (Figure 15-1) and upper extremity (Figure 15-2).
- Determine the extent of any sensory and motor loss due to nerve impairment, based on Tables 15-15 (5th ed., 424) and 15-16 (*424). Note that in the % Sensory Deficit and the % Motor Deficit columns on the right for each Table, there is a range. Picking a % Deficit in that range is a clinical judgment call on your part.
- Next, find the maximum impairment due to nerve dysfunction for the particular nerve root on page 424 in Table 15-17 for the upper extremity and Table 15-18 for the lower extremity. Note that in each table there is a separate column for Maximum % Loss of Function in the middle due to Sensory Deficit or Pain and on the right side due to Strength.
- The next step is to multiply the severity of the sensory or motor deficit you decided upon in Tables 15-15 and 15-16 by the maximum value of the relevant nerve (Tables 15-17, 15-18).
- If there is both sensory and motor impairment of a nerve root, the impairment percents are combined (Combined Values Chart, 5th ed., 604) to determine the extremity impairment. If both extremities are impaired, the impairment percent for each extremity is determined, converted to whole person impairment, and the two impairment ratings combined using the Combined Values Chart.
- The last step is to convert to whole person impairment by multiplying the upper extremity impairment by 0.6 and the lower extremity impairment by 0.4. For ease you can use the conversion tables.
  For the upper extremity Table 16-3 (5th ed., 439) is used and Table 17-3 (5th ed., 527) is used for lower extremities.

Spine Spinal Nerve Root Deficit

Nerves	Sensory Deficit or Pain Grade				Strength Grade			
	Right		Left		Right		Left	
	Grade	Deficit %	Grade	Deficit %	Grade	Deficit %	Grade	Deficit %
Spinal Nerve Root – C5	0 1 2 3 4 5		0 1 2 3 4 5		0 1 2 3 4 5		0 1 2 3 4 5	
Spinal Nerve Root – C6	0 1 2 3 4 5		0 1 2 3 4 5		0 1 2 3 4 5		0 1 2 3 4 5	
Spinal Nerve Root – C7	0 1 2 3 4 5		0 1 2 3 4 5		0 1 2 3 4 5		0 1 2 3 4 5	
Spinal Nerve Root – C8	0 1 2 3 4 5		0 1 2 3 4 5		0 1 2 3 4 5		0 1 2 3 4 5	
Spinal Nerve Root – T1	0 1 2 3 4 5		0 1 2 3 4 5		0 1 2 3 4 5		0 1 2 3 4 5	
Spinal Nerve Root – L3	0 1 2 3 4 5		0 1 2 3 4 5		0 1 2 3 4 5		0 1 2 3 4 5	
Spinal Nerve Root – L4	0 1 2 3 4 5		0 1 2 3 4 5		0 1 2 3 4 5		0 1 2 3 4 5	
Spinal Nerve Root – L5	0 1 2 3 4 5		0 1 2 3 4 5		0 1 2 3 4 5		0 1 2 3 4 5	
Spinal Nerve Root – S1	0 1 2 3 4 5		0 1 2 3 4 5		0 1 2 3 4 5		0 1 2 3 4 5	

© 2014 – 2017 Steven D. Feinberg, MD and Christopher R. Brigham, MD. All rights reserved. No part of this publication may be reproduced or transmitted by any means without written permission. Permission granted for use by WorkCompCentral.

Sensory Deficit or Pain Grade		Deficit (%)	Strength Grade		Deficit (%)
5	No loss of sensibility, abnormal sensation, or pain	0	**5**	Active movement against gravity with full resistance	0
4	Distorted superficial tactile sensibility (diminished light touch), with or without minimal abnormal sensations or pain, that is forgotten during activity	1 - 25	**4**	Active movement against gravity with some resistance	1 -25
3	Distorted superficial tactile sensibility (diminished light touch and two-point discrimination), with some abnormal sensations or slight pain, that interferes with some activities	26 – 60	**3**	Active movement against gravity only, without resistance	26 – 50
2	Decreased superficial cutaneous pain and tactile sensibility (decreased protective sensibility), with abnormal sensations or moderate pain, that may prevent some activities	61 – 80	**2**	Active movement with gravity eliminated	51 – 75
1	Deep cutaneous pain sensibility present; absent superficial pain and tactile sensibility (absent protective sensibility), with abnormal sensations or severe pain, that prevents most activity	81 – 99	**1**	Slight contraction and no movement	76 – 99
0	Absent sensibility, abnormal sensations, or severe pain that prevents all activity	100	**0**	No movement	100

Table 15-17 Unilateral Spinal Nerve Root Impairment Affecting the Upper Extremity (5th ed., 424)

	Maximum % Upper Extremity Impairment Due to:		
Spinal Nerve	Sensory Deficit or Pain	Motor Deficit	Combined Motor/Sensory Deficit
C5	5	30	34
C6	8	35	40
C7	5	35	38
C8	5	45	48
T1	5	20	24

Table 15-18 Unilateral Spinal Nerve Root Impairment Affecting the Lower Extremity (5th ed., 424)

Nerve Root Impaired	Maximum % Loss of Function due to Sensory Deficit or Pain	Maximum % Loss of Function due to Strength
L3	5	20
L4	5	34
L5	5	37
S1	5	20

Combining Range of Motion Components

- Your final task to complete ROM Method evaluation is to combine the % whole person impairment for each of the three elements - (1) the range of motion of the impaired spine region; (2) accompanying diagnoses (Table 15-7 (5th ed., 404); and (3) any spinal nerve deficit. You take the % whole person impairment for each, go to the Combined Values Chart (CVC) (5th ed., 604), and combine the values. The results will be the % whole person impairment for the spine region (the Lumbar, Thoracic or Cervical) you have selected using the ROM Method.

- You are now done with the Spine area you picked (Lumbar, Thoracic, or Cervical) and you should either now do the same thing if other Spine areas are affected the Lumbar, Thoracic or Cervical) on one of the other areas, if appropriate. If more than one Spine area is involved, when you are done calculating the % whole person impairment for each area, you then combine the values using the Combined Values Chart (CVC) (5th ed., 604).

© 2014 – 2017 Steven D. Feinberg, MD and Christopher R. Brigham, MD. All rights reserved. No part of this publication may be reproduced or transmitted by any means without written permission. Permission granted for use by WorkCompCentral.

The Pelvis

Pelvis Disorders can be determined in both Chapter 15, The Spine, but also in Chapter 17, The Lower Extremities. You may use either Chapter and take the higher Impairment Rating but not both.

Unless there is a Pelvis Disorder, you are done with the Spine Chapter. Pelvis disorders are evaluated using Table 15-19 (5th ed., 428). The table is self-explanatory and once you have chosen a % whole person Impairment, it may be combined with impairment ratings from either the DRE or ROM methods for the final spine impairment.

Pelvis Impairment – Spine Chapter Table 15-19 (5th ed., 428)

- ❑ 1. Healed fracture without displacement or residual sign(s): WPI = 0

- ❑ 2. Healed fracture with displacement and without residual sign(s) involving:
    - o a. Single ramus: WPI = 0
    - o b. Rami, bilateral: WPI = 0
    - o c. Ilium: WPI = 0
    - o d. Ischium: WPI = 0
    - o e. Symphysis pubis, without separation: WPI = 5
    - o f. Sacrum: WPI = 5
    - o g. Coccyx: WPI = 0

- ❑ 3. Healed fracture(s) with displacement, deformity, and residual sign(s) involving:
    - o a. Single ramus: WPI = 0
    - o b. Rami, bilateral: WPI = 5
    - o c. Ilium: WPI = 2
    - o d. Ischium, displaced 1 inch or more: WPI = 10
    - o e. Symphysis pubis, displaced or separated: WPI = 15
    - o f. Sacrum, into sacroiliac joint: WPI = 10
    - o g. Coccyx, nonunion or excision: WPI = 5
    - o h. Fracture into acetabulum, evaluate on basis of restricted motion of hip joint (Table 17-9, page 537)

© 2014 – 2017 Steven D. Feinberg, MD and Christopher R. Brigham, MD. All rights reserved. No part of this publication may be reproduced or transmitted by any means without written permission. Permission granted for use by WorkCompCentral.

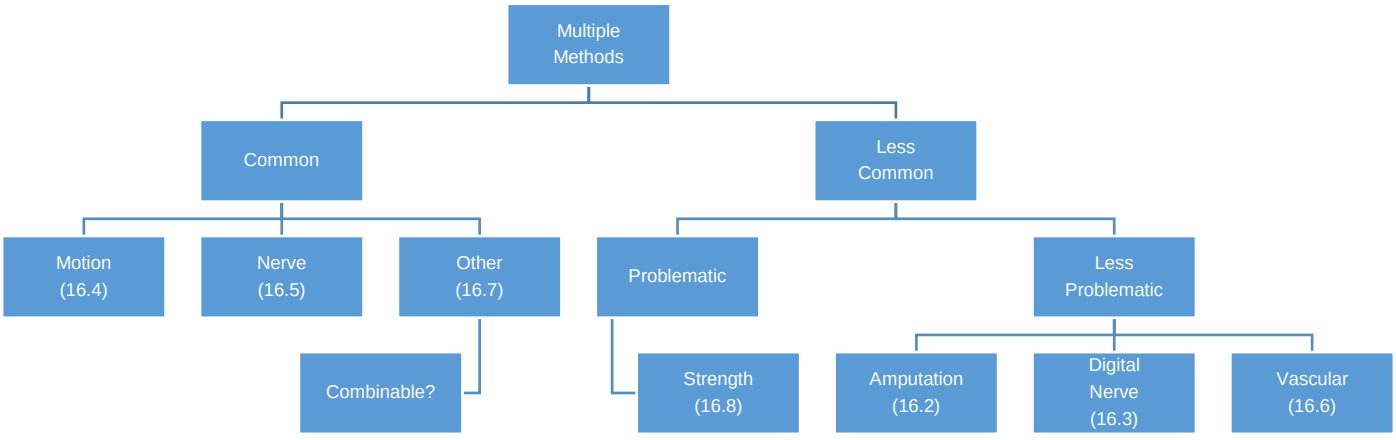
Chapter 16 – The Upper Extremities

Overview

This chapter provides criteria for evaluating permanent impairments due to anatomic impairments of the hand and the upper extremity. The methods discussed in this chapter for evaluation of upper extremity impairment due to amputation, sensory loss, and abnormal motion or ankylosis were based on A. B. Swanson's work and adapted from the fourth edition and updated with input from many of the specialty societies listed in the preface. It is comprised of the following sections:

16.1 Principles of Assessment
16.2 Amputations
16.3 Sensory Impairment Due to Digital Nerve Disorders
16.4 Evaluating Abnormal Motion
16.5 Impairment of the Upper Extremities Due to Peripheral Nerve Disorders
16.6 Impairment of the Upper Extremities Due to Vascular Disorders
16.7 Impairment of the Upper Extremities Due to Other Disorders
16.8 Impairment of the Upper Extremities Due to Other Disorders
16.9 Summary of Steps for Evaluating Impairments of the Upper Extremity
16.10 Clinical Examples

Upper Extremity Impairment Evaluation Algorithm



© 2014 – 2017 Steven D. Feinberg, MD and Christopher R. Brigham, MD. All rights reserved. No part of this publication may be reproduced or transmitted by any means without written permission. Permission granted for use by WorkCompCentral.

Principles of Assessment

The evaluation of anatomic impairment forms the basis for upper extremity assessment. The impairment ratings in this chapter reflect the degree of impairment and its impact on the ability of the individual to perform activities of daily living.

Impairment ratings in this chapter have not been adjusted for hand dominance, as is done in Chapter 13, The Central and Peripheral Nervous System, but hand dominance should be considered in the determination of disability. If you believe that hand dominance has a significant impact on the ability to perform activities of daily living, this can be discussed in the impairment evaluation report along with the resulting impairment rating. However, no additional increase is given in the final impairment rating.

Assuming the examinee has reached MMI and is not having a flare-up or other problem that prevents you from going forward with the impairment rating examination, you can proceed. It is necessary to measure findings of both upper extremities to determine what is normal for that individual.

This is one of the most difficult chapters due to issues that confuse many people regarding what can be added and what can be combined. Also, because the upper extremities and particularly the hands, are so important for ADLs, special care is needed in providing an impairment rating for these body parts. Let's start with the concept of combining and then discuss adding.

Combined Values

A 0% whole person (WP) impairment rating is assigned when there are no significant organ or body system functional consequences and no resulting limitations in the performance of the activities of daily living. At the other extreme, a 90% - 100% whole person rating suggests very severe organ or body system impairment that results in the individual being fully dependent on others for self-care, approaching death. Typically the highest ratings are with catastrophic head and spinal cord injuries.

The AMA *Guides* provide weighted percentages for various body parts but since the total impairment cannot exceed 100%, a Combined Values Chart (p. 604) accounts for the effects of multiple impairments with a summary value. Regardless of the number of impairments, the summary value cannot exceed 100% of the whole person. Using the combined values chart, multiple impairments are combined so that the whole person impairment value is equal to or less than the sum of all the individual impairment values.

In Chapter 16, The Upper Extremities, the examiner is advised when combining multiple impairments to combine the two smallest values first. In California, however in keeping with the California Permanent Disability Rating Schedule and prior use of the Multiple Disabilities Table the California Disability Evaluation Unit (DEU) is advising to combine the two largest values first.

Adding and Combining

Most of the times values are combined, however range of motion (ROM) deficits within a joint and multiple digital impairments (when converted to hand) are added. In general, impairment ratings within the same region are combined and adjusted before combining the regional impairment rating with that from another region in the same extremity. The extremity impairment then is combined with an impairment from another extremity/region or body system (unless criteria for the second impairments are included in the primary impairment) to determine final overall WPI. In California, with the Permanent Disability Rating Schedule, individual regional impairments once converted to whole person are adjusted and combined. When to *add a*s opposed to *combine* impairments is discussed in Sections 16.1c, Combining impairment ratings (5th ed., 438), and 16.1d, Principles for Adding Impairment Values **(5th ed.,** 440), and noted in Figure 16-1. It is fairly important to read these sections.

© 2014 – 2017 Steven D. Feinberg, MD and Christopher R. Brigham, MD. All rights reserved. No part of this publication may be reproduced or transmitted by any means without written permission. Permission granted for use by WorkCompCentral.

Upper Extremity Impairment Evaluation Record

The AMA Guides suggests that one method for recording results from a systematic examination is the use of the Upper Extremity Impairment Evaluation Record (Figure 16-1a (5th ed., 436), and Figure 16-1b (5th ed., 437). The impairment evaluation record form is designed for use with unilateral upper extremity impairments. Cases of *bilateral involvement* require completion of a separate record form for each upper extremity. Completion of this bilaterally will also assist in documenting what is normal for that individual

Part 1 (Figure 16-1a (5th ed., 436) of the evaluation record addresses the hand region and lists impairments due to abnormal motion or ankylosis, amputation, and sensory loss resulting from digital nerve lesions and to other disorders.

Part 2 (Figure 16-1b (5th ed., 437) is designed to assist impairment evaluation of the wrist, elbow, and shoulder due to abnormal motion or ankylosis, amputation, and "other" disorders, as well as those related to the peripheral nerve system, peripheral vascular system, and other disorders not included in regional impairments (e.g., grip strength).

Table 16-1 (5th ed., 438), gives conversions from digit to hand impairment, and Table 16-2 (5th ed., 439), gives those from hand to upper extremity impairment.

Regional impairments resulting from the hand, wrist, elbow, and shoulder regions are *combined* to provide the upper extremity impairment (Use of the Combined Values (5th ed., 604). The upper extremity impairment is then converted to a whole person impairment by means of Table 16-3 (5th ed., 439). If both upper extremities are involved, the values derived for each are then *combined* using the Combined Values Chart (*604) to derive the total whole person impairment.

If the total combined whole person impairment does not seem to adequately reflect the actual extent of alteration in the individual's ability to perform activities of daily living, this should be noted.; however, this does not alter the impairment rating itself.

Amputations

Section 16.2 (5th ed., 441) provides the methodology to rate amputation impairment. Table 16-4 Impairment Estimates for Upper Limb Amputation at Various Levels (5th ed., 440) and Figure 16-2 Impairment Estimates for Upper Extremity Amputation at Various Levels (5th ed., 441), along with Figure 16-3 Impairments of the Digits (values outside digits) (5th ed., 442) and the Hand (values inside digits) for Amputations at Various Levels, provides the basis for calculating the amputation impairment rating value.

From distally to proximally, each anatomic unit is given a relative value to the next larger unit and, eventually, the whole person. By multiplying the appropriate percent, impairment of each unit can be converted sequentially to hand, upper extremity, and whole person impairment.

As needed, you would then go from distally to proximally to obtain the Upper Extremity Impairment using the following Tables.

- Table 16-1 Conversion of Impairment of the Digits to Impairment of the Hand (5th ed., 438)
- Table 16-2 Conversion of Impairment of the Hand to Impairment of the Upper Extremity (5th ed., 439)
- Table 16-3 Conversion of Impairment of the Upper Extremity to Impairment of the Whole Person (5th ed., 439)

Evaluation of the residual stump must assess the status of soft tissue coverage, of the peripheral nerve and vascular systems, and of the bone itself. See Conditions Associated With Amputation 16.2d (5th ed., 444) for a further discussion of this topic.

© 2014 – 2017 Steven D. Feinberg, MD and Christopher R. Brigham, MD. All rights reserved. No part of this publication may be reproduced or transmitted by any means without written permission. Permission granted for use by WorkCompCentral.

Sensory Impairment Due to Digital Nerve Lesions

Section 16.3 (5th ed., 445) is used to rate digital nerve lesions. It is not used to rate more proximal peripheral nerves. It does provide direction on the evaluation of sensibility.

Only unequivocal and permanent sensory deficits are given permanent impairment ratings. Sensory impairment is rated according to the sensory quality and the distribution of the sensory loss.

The *sensory quality* is based on the results of the two-point discrimination test carried out over the distal palmar area of the digit, or on the most distal part of the stump in the presence of a partial amputation.

Sensibility defects on the dorsal surfaces of the digits are not considered impairing. The sensory quality impairment is classified according to Table 16-5 (5th ed., 447).

In total sensory losses (>15 mm), the response to touch, pinprick, pressure, and vibratory stimuli is absent. In partial sensory losses (7-15 mm), there is poor localization and abnormal response to the sensory stimuli. Anything less than 7 mm is considered normal.

The next step is to determine the distribution, or area, of sensory loss by the level of involvement (percentage of digit length affected) of either both digital nerves (transverse sensory loss) or one digital nerve on either the radial or ulnar side of the digit (longitudinal sensory loss). The percentage of digit length involved is derived from the top scale of Figure 16-6 (5th ed., 447) for the thumb and of Figure 16-7 (5th ed., 447) for the fingers.

A total transverse sensory loss represents 100% sensory loss (>15 mm) involving both digital nerves and receives 50% of the digit amputation impairment value for the corresponding level (Figures 16-6 (5th ed., 447) and 16-7 (5th ed., 447) bottom scale, and Table 16-6 (5th ed., 448) and Table 16-7 (5th ed., 448).

A partial transverse sensory loss represents 50% sensory loss (7-15 mm) involving both digital nerves and receives 25% of the digit amputation impairment value for the corresponding digit length percentage (Tables 16-6 (5th ed., 448) and 16-7 (5th ed., 448).

Longitudinal sensory loss impairments are based on the relative importance of the side of the digit for sensory function as follows: thumb and little finger, radial side 40% and ulnar side 60%; index, middle, and ring fingers, radial side 60% and ulnar side 40%. The surfaces used for opposition in various pinch functions and the ulnar aspect of the border finger are rated more highly. If the little finger has been amputated, the relative value of the ulnar side of the ring finger becomes 60% and that of the radial side, 40%. The digit impairment values are calculated similarly as above based on the sensory quality and distribution of the sensory loss.

Section 16.3 (5th ed., 445) is used to rate digital nerve lesions. It is not used to rate more proximal peripheral nerves. It does provide direction on the evaluation of sensibility. It should be noted sensory loss must be permanent and unequivocal. Dorsal surfaces with sensibility defects are not considered impairing.

Sensory Loss using the two-point discriminator over the distal palmar area of the digit or on the distal part of the stump in amputations. The following definitions of sensory loss are noted as referenced in Table 16-5 (5th ed, 447):

- None < 7 mm
- Partial 7-15 mm
- Total > 15 mm

It is important to know if there is transverse loss (both digital nerves involved) or longitudinal (either the radial or ulnar digital nerve involved).

For ease of determination, digit impairment values for total transverse and longitudinal and partial transverse and longitudinal sensory losses were calculated according to the percentage of digit length involved and are presented in table form. Consult Table 16-6 (5th ed., 448, for the thumb and little finger and Table 16-7 (5th ed., 448), for the

© 2014 – 2017 Steven D. Feinberg, MD and Christopher R. Brigham, MD. All rights reserved. No part of this publication may be reproduced or transmitted by any means without written permission. Permission granted for use by WorkCompCentral.

index, middle, and ring fingers. Corresponding hand impairment values can be derived from Table 16-1 (5th ed., 438), as shown in Figure 16-8 (5th ed., 449), for total sensory losses involving 100% of the digit length.

16.3d Digital Nerve Sensory Impairment Determination Method – 16.3d (5th ed., 449)

1. Use the two-point discrimination test to identify the sensory quality, or type of sensory loss, as total (>15 mm) or partial (7 through 15 mm) (Table 16-5 (5th ed., 447).
2. Determine the distribution of sensory loss involvement or whether one (longitudinal sensory loss) or both (transverse sensory loss) digital nerves are involved.
3. Identify the level of involvement, or percentage of digit length involved, using the top scale of Figure 16-6 (5th ed., 447, for the thumb and of Figure 16-7 (5th ed., 447, for the fingers.
4. Consult Table 16-6 (5th ed., 448, for the thumb and little finger and Table 16-7 (5th ed., 448, for the index, middle, and ring fingers to determine the digit impairment for either total or partial, transverse or longitudinal (ulnar or radial) sensory loss according to the percentage of digit length involved.
5. If both digital nerves are involved in the same digit, the sensory impairments relating to the ulnar or radial palmar nerves are *added.*
6. Convert the digit impairment to hand, upper extremity, and whole person impairment by using Tables 16-1 (page 438), 16-2 (page 439), and 16-3 (page 439). When a digit has more than one impairment, obtain the total digit impairment value by combining its various impairments before converting the digit values to a hand value.

Evaluating Abnormal Motion

Section 16.4 (5th ed., 450-480) provides specific directives in rating motion impairment. It is imperative that motion deficits are reliable, i.e. values should fall within 10% of each other. If the opposite extremity is uninjured, it may serve as a baseline for what is normal for that individual. For hand ratings it is highly recommend that you complete Figure 16-1a (5th ed., 436) to assure a reliable rating, with appropriate, adding, combining and versions. It is easy to misread a pie chart, therefore make sure you are reading the correct arc, i.e. V = the measured angle, I F % = the impairment due to flexion, I E % = the impairment due to extension, I A % = the impairment due to ankylosis. Impairments of motion at the same joint are added.

The reader is referred to this section in the book as the complexity of this section does not lend itself to a summary explanation.

Impairment of the Upper Extremities Due to Peripheral Nerve Disorders

Section 16.5 (5th ed., 480) presents a method of evaluating upper extremity impairments related to disorders of the spinal nerves (C5 to C8 and T1), the brachial plexus, and major peripheral nerves of the upper extremities. It also addresses the evaluation of specific conditions, including entrapment/compression neuropathy and complex regional pain syndromes (CRPS), which include CRPS I/reflex sympathetic dystrophy (RSD) and CRPS II/causalgia. Only objective neurological deficits with reliable findings are rated.

The upper extremity impairment is calculated by multiplying the grade of severity of the sensory deficit (Table 16-10a (5th ed., 482) and/or of the motor deficit (Table 16-11a (5th ed., 484) by the respective maximum upper extremity impairment value resulting from sensory and/or motor deficits of each nerve structure involved, as listed in Section 16.5c Regional Impairment Determination ((5th ed., 488-491): spinal nerves, Table 16-13 (5th ed., 489); brachial plexus, Table 16-14 (5th ed., 490); and major peripheral nerves, Table 16-15 (5th ed., 492). When both sensory and motor functions are involved, the impairment values derived for each are *combined* (Combined Values Chart, p. 604).

© 2014 – 2017 Steven D. Feinberg, MD and Christopher R. Brigham, MD. All rights reserved. No part of this publication may be reproduced or transmitted by any means without written permission. Permission granted for use by WorkCompCentral.

The steps of the impairment determination method are detailed on page 481, Impairment Determination Method, and are copied below:

1. If sensory deficits or pain is present, localize the distribution and relate it to the nerve structure involved (Table 16-12 and Figures 16-48, 16-49, and 16-50).
2. If motor deficits or loss of power is present, identify the key muscles involved and relate the motor deficit to the nerve structure(s) involved (Table 16-12 and Figures 16-47 and 16-50).
3. *Grade the severity of sensory deficits or pain* according to Table 16-10a and/or that of the *motor deficits* according to Table 16-11a.
4. Find the values for *maximum impairment of the upper extremity* due to sensory and/or motor deficits of the nerve structure involved: individual spinal nerve (Table 16-13), brachial plexus (Table16-14), and major peripheral nerves (Table 16-15).
5. For each nerve structure involved, *multiply* the grade of severity of the sensory and/or motor deficits (see step 3 above) by the appropriate maximum upper extremity impairment value (see step 4 above) to determine the upper extremity impairment percent for each function.
6. For a *structure with mixed motor and sensory fibers*, determine the upper extremity impairment for each function (steps 1 through 5), then *combine* the sensory and motor impairment percents (Combined Values Chart, p. 604) to obtain the total upper extremity impairment value.
7. When *more than one nerve structure* is involved, *combine* their respective upper extremity impairment values (steps 1 through 5) to obtain the total upper extremity impairment resulting from peripheral nerve disorders (Combined Values Chart).
8. When *multiple impairments of the extremity* are present because of amputation, loss of motion that is not strictly attributed to a peripheral nerve lesion, or peripheral vascular disorders, *combine* the peripheral nerve upper extremity impairment value with the other upper extremity impairment values (Combined Values Chart) to obtain the total upper extremity impairment.
9. The total upper extremity impairment is *converted* to a whole person impairment by means of Table 16-3.
10. If there is *bilateral upper extremity involvement*, determine separately the impairment values for each side, and convert them to whole person impairment. *Combine* the whole person impairment values for each side (Combined Values Chart) to obtain the total whole person impairment. Consult page 435 for further comments on bilateral upper extremity involvement.

Impairment rating of Entrapment/Compression Neuropathies

Only individuals with an *objectively verifiable diagnosis* should qualify for a permanent impairment rating, as explained on page 493. The diagnosis is made not only on believable symptoms but, more important, on the presence of *positive clinical findings and loss of function*.

The sensory deficits or pain, and/or the motor deficits and loss of power, are evaluated according to the impairment determination method described in Section 16.5b (see earlier in this article, Impairment of the Upper Extremities Due to Peripheral Nerve Disorders – 16.5 (5th ed., 480). Sensory impairments strictly due to lesions of digital nerves are evaluated according to Section 16.3.

In compression neuropathies, additional impairment values are not given for decreased grip strength.

© 2014 – 2017 Steven D. Feinberg, MD and Christopher R. Brigham, MD. All rights reserved. No part of this publication may be reproduced or transmitted by any means without written permission. Permission granted for use by WorkCompCentral.

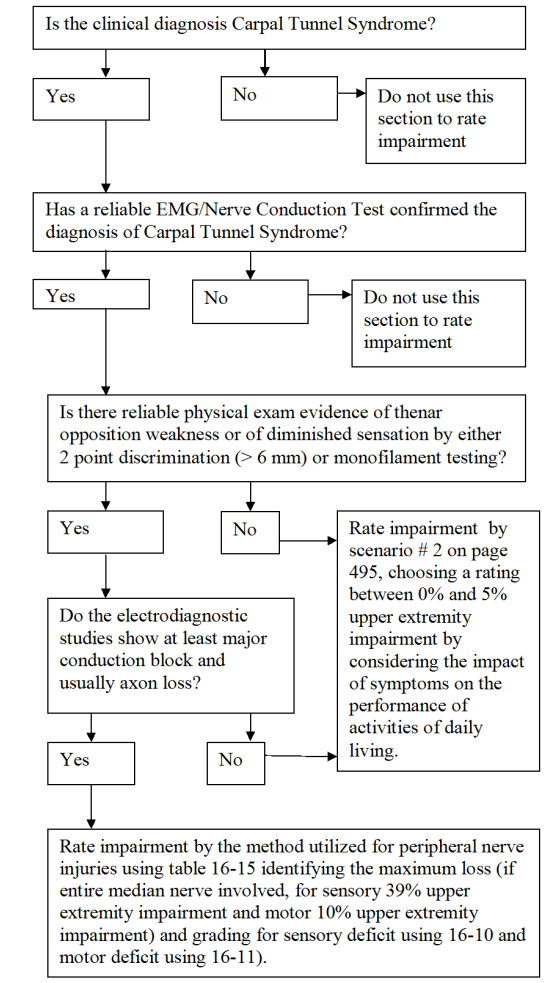
Carpal Tunnel Syndrome

The AMA Guides provide on page 495 three scenarios for impairment rating following surgical decompression when the individual continues to complain of pain, paresthesias, and/or difficulties in performing certain activities.

1. Positive clinical findings of median nerve dysfunction and electrical conduction delay(s): the impairment due to residual CTS is rated according to the sensory and/or motor deficits as described above.
2. Normal sensibility and opposition strength with abnormal sensory and/or motor latencies or abnormal EMG testing of the thenar muscles: a residual CTS is still present, and an impairment rating not to exceed 5% of the upper extremity may be justified.
3. Normal sensibility (two-point discrimination and Semmes-Weinstein monofilament testing), opposition strength, and nerve conduction studies: there is no objective basis for an impairment rating.

Scenario #2 presents an interesting dilemma for the individual who has not had surgical decompression but otherwise has normal sensibility and opposition strength with abnormal sensory and/or motor latencies or abnormal EMG testing of the thenar muscles. In other words, the individual is symptomatic, has abnormal electrodiagnostic testing, but has not had surgery. A CTS is present and we would argue that an impairment rating not to exceed 5% of the upper extremity may be justified (this is not official and is not so stated in the AMA Guides). The extent of impairment within the range of 0% to 5% upper extremity permanent impairment is based on the extent of involvement of activities of daily living.

Algorithm for Rating Carpal Tunnel Syndrome Impairment[1]



[1] Algorithm developed by James B. Talmage, MD based on procedures defined in the *AMA Guides to the Evaluation of Permanent Impairment, Fifth Edition.*

Complex Regional Pain Syndromes (CRPS), Reflex Sympathetic Dystrophy (CRPS I), and Causalgia (CRPS II)

For the upper extremities you may use Section 16.5e (5th ed., 495-497) which relies on anatomical changes to define impairment or alternatively you may rate impairment as explained in Chapter 13, the Central and Peripheral Nervous System, Criteria for Rating Impairments Related to Chronic Pain (causalgia, posttraumatic neuralgia, and RSD – also termed CRPS) – 13.8 (5th ed., 342). For upper extremity involvement, use Table 13-22 (5th ed., 342). Chapter 16 requires objective findings to rate complex regional pain syndrome (CRPS) as presented in Table 16-16 (5th ed., 496).

NB: If you choose to calculate an Impairment Rating using both Chapter 13, the Central and Peripheral Nervous System, and Chapter 16, The Upper Extremities, determine which method is most appropriate and explain your rationale for that approach. These impairments cannot be combined.

© 2014 – 2017 Steven D. Feinberg, MD and Christopher R. Brigham, MD. All rights reserved. No part of this publication may be reproduced or transmitted by any means without written permission. Permission granted for use by WorkCompCentral.

Impairment of the Upper Extremities Due to Vascular Disorders

Section 16.6 (5th ed., 497) and Table 16-17 (5th ed., 498) provides a classification of impairments due to peripheral vascular disease. Physical signs of vascular damage must be present and are the primary determinants in placing the examinee into one of these categories.

- There are five classes, each having a percentage range.
- Pick the percentage based on ADL deficits.

Impairment of the Upper Extremities Due to Other Disorders

Section 16.7 (5th ed., 498) provides additional approaches to rating impairment. Conditions not previously described that can contribute to impairments of the hand and upper extremity include bone and joint disorders (Section 16.7a), presence of resection or implant arthroplasty (Section 16.7b), musculotendinous disorders (Section 16.7c), and tendinitis (Section 16.7d), and loss of strength (Section 16.8). The severity of impairment due to these disorders is rated separately according to Tables 16-19 through 16-30 and then multiplied by the relative maximum value of the unit involved as specified in Table 16-18. Appropriate impairment percents are combined with other impairment percents by means of the Combined Values Chart (p. 604).

Note: Conditions not previously described that can contribute to impairments of the hand and upper extremity include bone and joint disorders. The severity of impairment due to these disorders is rated separately according to Tables 16-19 (5th ed., 500, through 16-30 (5th ed., 507, and then multiplied by the relative maximum value of the unit involved as specified in Table 16-18 (5th ed., 499. Appropriate impairment percents are combined with other impairment percents by means of the Combined Values Chart (5th ed., 604)/.

Bone and Joint Deformities

Section 16.7a (5th ed., 499) explains that if the same unit presents several findings, the following rules must be followed to avoid duplication of impairments.

1. If the same unit in the digits, wrist, and elbow presents with manifestations of joint translocation including lateral deviation, rotational deformity (digit), and/or subluxation or dislocation in any combination., to avoid duplication, the impairment values cannot be combined, and only the finding with the highest impairment value is rated.

2. Limited motion impairment is rated according to Section 16.4 (5th ed., 450) and can be appropriately combined with impairments due to "other disorders" listed in this section, except with those due to joint swelling from synovial hypertrophy, persistent joint subluxation or dislocation, and musculotendinous disorders (Section 16.7c (5th ed., 506).

3. Joint instability impairment values can be combined with other appropriate impairment values, including decreased motion, but not with arthroplasty.

4. Joint swelling due to synovial hypertrophy is rated only when no other findings are present.

5. Joint crepitation is not rated separately because other findings, such as those listed above, are more reliable indicators of the severity of the same arthritic process.

© 2014 – 2017 Steven D. Feinberg, MD and Christopher R. Brigham, MD. All rights reserved. No part of this publication may be reproduced or transmitted by any means without written permission. Permission granted for use by WorkCompCentral.

- **Joint Swelling Due to Synovial Hypertrophy (5th ed., 500)**
    - If synovial hypertrophy is the *only finding*, the joint impairment is rated according to Table 16-19 (5th ed., 500) and multiplied by the relative maximum value of the joint involved (Table 16-18 (5th ed., 499).
    - It *cannot* be combined with impairment due to decreased joint motion or other findings.

- **Digit Lateral Deviation (5th ed., 500)**
    - If lateral deviation is the only impairment, the severity of digit impairment (Table 16-20 (5th ed., 500) is multiplied by the relative hand value of the digit (Table 16-18 (5th ed., 499) to determine the hand impairment.
    - The lateral deviation impairment percent can be *combined* with other impairments of the same digits, including motion, according to the rules outlined on page 499 (see above rules).

- **Digit Rotational Deformity (5th ed., 500)**
    - The digit impairment percent due to rotational deformity (Table 16-21) is multiplied by the relative hand value of the digit (Table 16-18) to obtain the hand impairment.
    - The rotational deformity impairment can be *combined* with other impairments of the same digit, including motion, according to the rules outlined on page 499 (see above rules).

- **Persistent Joint Subluxation or Dislocation (5th ed., 501)**
    - If there is no restricted motion, the values shown in Table 16-22 are multiplied by the relative value of the joint (Table 16-18) to determine the joint impairment.
    - If the same joint presents other findings, the rules outlined on page 499 (see above rules) must be followed to avoid duplication of impairments.
    - Instability and translocation of the wrist and shoulder joints are evaluated according to methods described on pages 502 and 503.

- **Joint Passive Mediolateral Instability (5th ed., 501)**
    - The severity of mediolateral joint instability is rated according to the excess number of angulation degrees compared to the opposite, "normal" side (Table 16-23).
    - If both sides are involved, a comparison to accepted normal average values is made.
    - The percentage of impairment is then multiplied by the relative value of the joint (Table 16-18) to determine the joint impairment.
    - Carpal and shoulder instabilities are discussed on pages 502 and 503.
    - If the same joint presents other findings, the rules outlined on page 499 (see above rules) must be followed to avoid duplication of impairments.

- **Wrist Elbow Joint Active Radial and Ulnar Deviations (5th ed., 502)**
    - The severity of lateral deviation is rated according to the excess number of angulation degrees compared to the normal opposite side (Table 16-24).
    - The percentage of impairment is multiplied by the relative value of the joint (Table 16-18) to obtain the upper extremity impairment.
    - If the same joint presents other findings, the rules outlined on page 499 (see above rules) must be followed to avoid duplication of impairments.

© 2014 – 2017 Steven D. Feinberg, MD and Christopher R. Brigham, MD. All rights reserved. No part of this publication may be reproduced or transmitted by any means without written permission. Permission granted for use by WorkCompCentral.

- **Carpal Instability (5th ed., 502**)
    - Carpal instability patterns are classified as mild, moderate, or severe. The classification is usually based on the roentgenographic findings listed in Table 16-25.
    - A mild carpal instability exists also when a ligament tear has been diagnosed by arthrogram, arthroscopy, or MRI, even though the static roentgenographic findings may be normal.
    - The radiocarpal joint represents 40% of the upper extremity (Table 16-18). Therefore, the grades of mild (20%), moderate (40%), and severe (60%) impairment represent upper extremity impairments of 8%, 16%, and 24%, respectively.
    - Only one category of severity of carpal instability impairment is selected, based on the greatest severity of the roentgenographic findings.
    - The severity categories *cannot* be added or combined.
    - The selected upper extremity impairment value may be *combined only with limited wrist motion.*
    - Pain and decreased strength are not rated separately.

- **Shoulder Instability (5th ed., 503)**
    - Shoulder instability patterns are based on the parameters listed in Table 16-26 and can be classified as occult instability, instability with a subluxating humeral head, and instability with a dislocating humeral head.
    - The shoulder representing 60% of the upper extremity (Table 16-18), the patterns of occult (10%), subluxating (20%), and dislocating (40%) instabilities represent upper extremity impairments of 6%, 12%, and 24%, respectively.
    - This value may be combined only with impairments due to decreased motion (Section 16.4).
    - Pain and decreased muscle strength are not rated separately.

Arthroplasty

Resection arthroplasty of a joint may be carried out with or without implant replacement, as explained in Section 16.7b (5th ed., 505). Impairment ratings for the upper extremity following arthroplasty of specific joints are listed in Table 16-27. In the presence of *decreased motion*, motion impairments are derived separately (Section 16.4) and *combined* with the arthroplasty impairment (Combined Values Chart, p. 604). If the same joint presents other findings, the rules outlined on page 499 must be followed to avoid duplication of impairments. However, impairment due to arthroplasty *cannot be combined* with impairments due to instability, subluxation, or dislocation.

After *arthrodesis* (fusion) procedures, the impairment is based on the *ankylosis impairment* (IA%) for the corresponding angle of fusion (V) according to the guidelines in Section 16.4. A severe symptomatic failure of an implant arthroplasty procedure (e.g., symptomatic breakage or subluxation of the device) is given 100% of the joint value as listed in Table 16-18. Impairments involving the resection of malignant tumors with reconstructive surgery including arthroplasty should receive individual consideration.

Musculotendinous Impairments

Section 16.7c (5th ed., 506) provides ratings for the following disorders:

- Intrinsic Tightness
- Constrictive Tenosynovitis
- Extensor Tendon Subluxation at the MP Joints of the Fingers

© 2014 – 2017 Steven D. Feinberg, MD and Christopher R. Brigham, MD. All rights reserved. No part of this publication may be reproduced or transmitted by any means without written permission. Permission granted for use by WorkCompCentral.

Tendinitis

Section 16.7d (5th ed., 507) explains:

- These conditions (e.g., lateral and medial epicondylitis) are not given a permanent impairment rating unless there is some other factor that must be considered.
- If an individual has had tendon rupture or has undergone surgical release of the flexor or extensor origins or medial or lateral epicondylitis, or has had excision of the epicondyle, there may be some permanent weakness of grip as a result of the tendon rupture or the surgery, and in this case, impairment can be given on the basis of weakness of grip strength according to Section 16.8b.
- If you are going to use grip strength to determine post-surgical disability, the determination should not be made until one year post-operative.

Strength Evaluation

In terms of rating on the basis of strength loss, the *Guides* discuss the issues of strength evaluation and its very limited role in impairment evaluation in Section 16.7 9 (5th ed., 507-511). The primary application for strength evaluation is for the individual who has a specific, objective muscular injury that cannot be adequately assessed by other means; this is not such a rare case. The *Guides* state in Section 6.8 Strength Evaluation:

> Because strength measurements are functional tests influenced by subjective factors that are difficult to control, and the *Guides* for the most part is based on anatomic impairment, the *Guides* does not assign a large role to such measurements. Those who have contributed to the *Guides* believe further research is needed before loss of grip and pinch strength is given a larger role in impairment evaluation. (5th ed., 507)

The limited role for rating by strength loss is discussed in Section 16.8a Principles:

> In a rare case, if the examiner believes the patient's loss of strength represents an impairing factor that has not been considered adequately, the loss of strength may be rated separately.
> An example of this situation would be the loss of strength due to a severe muscle tear that healed leaving a palpable muscle defect. If the examiner judges that loss of strength should be rated separately in an extremity that presents other impairments, the impairment due to loss of strength *could be combined* with the other impairments, *only* if based on unrelated etiologic or pathomechanical causes. *Otherwise, the impairment ratings based on objective anatomic findings take precedence*. Decreased strength cannot be rated in the presence of decreased motion, painful conditions, deformities, or absence of parts (eg, thumb amputation) that prevent effective application of maximal force in the region being evaluated. (5th ed., 508)

Therefore, prior to rating by this section it is important to determine if this is a rare case where this is appropriate. Manual muscle testing is subject to the individual's conscious or unconscious control and should only be utilized when the effort is credible, reliable and reproducible and is not pain or fear limited. Section 16.8b Grip and Pinch Strength emphasizes the importance of obtaining reliable measurements, e.g. less than 20% variation in the readings with readings being "usually repeated three times with each hand at different times during the examination". If there is evidence that the individual is exerting less than maximal effort, measurements are invalid for estimating impairment.

Grip strength loss is rated using an index of loss of strength and Table 16-34 (5th ed., 509). Strength loss for the shoulder and elbow is rated using Table 16-35 (5th ed., 510). The following method is used:

> Subtract the limited strength from the normal strength. Divide the difference by the normal strength value. Your answer is considered the strength loss index. That number is then used to determine the impairment based on the values given in Table 16-34 (5th ed., 509).

© 2014 – 2017 Steven D. Feinberg, MD and Christopher R. Brigham, MD. All rights reserved. No part of this publication may be reproduced or transmitted by any means without written permission. Permission granted for use by WorkCompCentral.

NB: Strength testing in this section is reserved for a musculoskeletal disorder, not on a peripheral nerve injury. An example would be shoulder or elbow weakness post surgery, with normal motion and no pain.

Summary of Steps for Evaluating Impairments of the Upper Extremity

The reader is referred to pages 511-512 for a summary of steps for evaluating impairments of the upper extremity.

The following forms provide a mechanism for recording findings and considering regional impairments.

© 2014 – 2017 Steven D. Feinberg, MD and Christopher R. Brigham, MD. All rights reserved. No part of this publication may be reproduced or transmitted by any means without written permission. Permission granted for use by WorkCompCentral.

Upper Extremity Physical Examination Protocols

Amputation

Amputation	Right	Left
Scapulothoracic (forequarter)		
Shoulder disarticulation		
Arm: deltoid insertion and proximally		
Arm/forearm: from distal to deltoid insertion to bicipital insertion		
Forearm/hand: from distal to bicipital insertion to transmetacarpophalangeal loss of all digits		
Hand: all digits at MP joints		
Hand: all fingers at MP joints except thumb		
Thumb ray at/or near: CMC joint Distal third of 1st metacarpal		
Thumb at MP joint		
Thumb at IP joint		
Index or middle finger at MP joint		
Index or middle finger at PIP joint		
Index or middle finger at DIP joint		
Ring or little finger at MP joint		
Ring or little finger at PIP joint		
Ring or little finger at DIP joint		

© 2014 – 2017 Steven D. Feinberg, MD and Christopher R. Brigham, MD. All rights reserved. No part of this publication may be reproduced or transmitted by any means without written permission. Permission granted for use by WorkCompCentral.

Shoulder Examination

NB: for strength, use a circle ("O") for weakness that is neurological or for normal ("5") strength and draw a line ("\") through weakness due to joint or muscle dysfunction.

NB: Strength is rarely used and then only when the weakness is non-neurologic but rather related to the joint itself or muscle injury. Also, since strength is only considered in the absence of loss of ROM, only grades 3 & 4 are considered towards an impairment rating. All findings must be reliable.

SHOULDER ROM (5th ed., * = discomfort with testing)		**Right**				**Left**			
☐ Normal exam	**Ankylosis**	**ROM**	*	**Strength**	*	**ROM**	*	**Strength**	*
Flexion (180º)				0 1 2 3 4 5				0 1 2 3 4 5	
Extension (50º)				0 1 2 3 4 5				0 1 2 3 4 5	
Adduction (50º)				0 1 2 3 4 5				0 1 2 3 4 5	
Abduction (180º)				0 1 2 3 4 5				0 1 2 3 4 5	
External Rotation (90º)				0 1 2 3 4 5				0 1 2 3 4 5	
Internal Rotation (90º)				0 1 2 3 4 5				0 1 2 3 4 5	

- ❑ **Use uninvolved side as baseline for comparison**.
  - If a contralateral "normal" joint has less than average mobility; the impairment values(s) corresponding to the uninvolved joint can serve as a baseline and are subtracted from the calculated impairment from the involved joint. The rationale for this decision should be included in the report.
  - Enter rationale for using uninvolved side_____

❑ **Additional 2% motion Impairment** (If an involved joint has "normal" motion according to the values specified in the *Guides* and *the contralateral uninvolved joint has greater than average motion*, there is a relative loss of motion. In rare cases, when this results in a loss of function, based on the examiner's clinical judgment, an impairment percent not to exceed 2% of the maximum regional impairment value of a unit of motion could be given. The rationale for this decision must be explained in the report)

- ❑ Rationale:_____

❑ Upper Extremity Impairment Due to Symptomatic Shoulder Instability Patterns (Table 16-26 (5th ed., 505)

Right	**Left**
Occult: UEI = 6%	Occult: UEI = 6%
with subluxing humeral head: UEI = 12%	with subluxing humeral head: UEI = 12%
with dislocating humeral head: UEI = 24%	with dislocating humeral head: UEI = 24%

❑ Arthroplasty (Table 16-27 (5th ed., 506)

Right	**Left**
Total shoulder implant: UEI = 24%	Total shoulder implant: UEI = 24%
Total shoulder resection: UEI = 30%	Total shoulder resection: UEI = 30%
Distal clavicle resection (isolated): UEI = 10%	Distal clavicle resection (isolated): UEI = = 10%
Proximal clavicle resection (isolated): UEI = 3%	Proximal clavicle resection (isolated): UEI = 3%

© 2014 – 2017 Steven D. Feinberg, MD and Christopher R. Brigham, MD. All rights reserved. No part of this publication may be reproduced or transmitted by any means without written permission. Permission granted for use by WorkCompCentral.

Elbow Examination

NB: for strength, use a circle ("O") for weakness that is neurological or for normal ("5") strength and draw a line ("\") through weakness due to joint or muscle dysfunction.

NB: Strength is rarely used and then only when the weakness is non-neurologic but rather related to the joint itself or muscle injury. Also, since strength is only considered in the absence of loss of ROM, only grades 3 & 4 are considered towards an impairment rating. All findings must be reliable.

ELBOW (5th ed., * = discomfort with testing)		**Right**				**Left**			
☐ Normal exam	**Ankylosis**	**ROM**	*	**Strength**	*	**ROM**	*	**Strength**	*
Flexion (140º)				0 1 2 3 4 5				0 1 2 3 4 5	
Extension (0º)				0 1 2 3 4 5				0 1 2 3 4 5	
Supination (80º)				0 1 2 3 4 5				0 1 2 3 4 5	
Pronation (80º)				0 1 2 3 4 5				0 1 2 3 4 5	

❑ **Additional 2% motion Impairment** (If an involved joint has "normal" motion according to the values specified in the *Guides* and *the contralateral uninvolved joint has greater than average motion,* there is a relative loss of motion. In rare cases, when this results in a loss of function, based on the examiner's clinical judgment, an impairment percent not to exceed 2% of the maximum regional impairment value of a unit of motion could be given. The rationale for this decision must be explained in the report)

- ❑ Rationale:_____

❑ **Use uninvolved side as baseline for comparison**.

- If a contralateral "normal" joint has less than average mobility; the impairment values(s) corresponding to the uninvolved joint can serve as a baseline and are subtracted from the calculated impairment from the involved joint. The rationale for this decision should be included in the report.
- Enter rationale for using uninvolved side_____

❑ **Excessive Active Mediolateral Deviation** (Table 16-22 (5th ed., 502)

Right	**Left**
Mild (< 20)	Mild (< 20)
Moderate (20 – 30)	Moderate (20 – 30)
Severe (> 30)	Severe (> 30)

❑ **Arthroplasty** (Table 16-7 (5th ed., 506)

Right	**Left**
Total elbow implant: UEI = 28%	Total elbow implant: UEI = 28%
Total elbow resection: UEI = 35%	Total elbow resection: UEI = 35%
Radial head implant (isolated): UEI = 8%	Radial head implant (isolated): UEI = 8%
Radial head resected (isolated): UEI = 10%	Radial head resected (isolated): UEI = 10%

© 2014 – 2017 Steven D. Feinberg, MD and Christopher R. Brigham, MD. All rights reserved. No part of this publication may be reproduced or transmitted by any means without written permission. Permission granted for use by WorkCompCentral.

Wrist Examination

NB: for strength, use a circle ("O") for weakness that is neurological or for normal ("5") strength and draw a line ("\") through weakness due to joint or muscle dysfunction.

NB: Strength is rarely used and then only when the weakness is non-neurologic but rather related to the joint itself or muscle injury. Also, since strength is only considered in the absence of loss of ROM, only grades 3 & 4 are considered towards an impairment rating. ***The AMA Guides does not consider wrist strength.***

WRIST (5th ed., * = discomfort with testing)	**Right**					**Left**				
☐ Normal exam	**Ankylosis**	**ROM**	*	**Strength**	*	**Ankylosis**	**ROM**	*	**Strength**	*
Flexion (60º)				0 1 2 3 4 5					0 1 2 3 4 5	
Extension (60º)				0 1 2 3 4 5					0 1 2 3 4 5	
Radial Deviation (20º)				0 1 2 3 4 5					0 1 2 3 4 5	
Ulnar Deviation (30º)				0 1 2 3 4 5					0 1 2 3 4 5	

❑ **Additional 2% motion Impairment** (If an involved joint has "normal" motion according to the values specified in the *Guides* and *the contralateral uninvolved joint has greater than average motion,* there is a relative loss of motion. In rare cases, when this results in a loss of function, based on the examiner's clinical judgment, an impairment percent not to exceed 2% of the maximum regional impairment value of a unit of motion could be given. The rationale for this decision must be explained in the report)

- ❑ Rationale:_____

❑ **Use uninvolved side as baseline for comparison**.

- If a contralateral "normal" joint has less than average mobility; the impairment values(s) corresponding to the uninvolved joint can serve as a baseline and are subtracted from the calculated impairment from the involved joint. The rationale for this decision should be included in the report.
- Enter rationale for using uninvolved side_____

❑ **Excessive Active Mediolateral Deviation** (Table 16-22 (5th ed., 502)

Right	**Left**
Mild (< 20)	Mild (< 20)
Moderate (20 – 30)	Moderate (20 – 30)
Severe (> 30)	Severe (> 30)

❑ **Carpal instability** (Table 16-25 (5th ed., 305)

Roentgenographic Findings*	**Mild**		**Moderate**		**Severe**	
	Right	Left	Right	Left	Right	Left
Radiolunate angle†	11-20	11-20	21-30	21-30	>30	>30
Scapholunate angle	61-70	61-70	71-80	71-80	>80	>80
Scapholunate gap	> 3 mm	> 3 mm	> 5 mm	> 5 mm	> 8 mm	> 8 mm
Triquetrolunate stepoff	> 1 mm	> 1 mm	> 2 mm	> 2 mm	> 3 mm	> 3 mm
Ulnar translation‡	Mild	Mild	Moderate	Moderate	Severe	Severe

* Clenched fist neutral PA views.
† A positive angle (lunate extension) represents a DISI deformity.
A negative angle (lunate flexion) represents a VISI deformity.
‡ See text for description.

© 2014 – 2017 Steven D. Feinberg, MD and Christopher R. Brigham, MD. All rights reserved. No part of this publication may be reproduced or transmitted by any means without written permission. Permission granted for use by WorkCompCentral.

- **Arthroplasty** (Table 16-7 (5th ed., 506)

Right	Left
Total wrist implant: UEI = 24%	Total wrist implant: UEI = 24%
Radiocarpal implant: UEI = 16%	Radiocarpal implant: UEI = 16%
Ulnar head (isolated) implant: UEI = 8%	Ulnar head (isolated) implant: UEI = 8%
Ulnar head (isolated) resection: UEI = 10%	Ulnar head (isolated) resection: UEI = 10%
Proximal row carpectomy/resection: UEI = 12%	Proximal row carpectomy/resection: UEI = 12%
Carpal bone (isolated) implant: UEI = 8%	Carpal bone (isolated) implant: UEI = 8%
Carpal bone (isolated) resection: UEI = 10%	Carpal bone (isolated) resection: UEI = 10%
Radial styloid (isolated) resection: UEI = 5%	Radial styloid (isolated) resection: UEI = 5%

© 2014 – 2017 Steven D. Feinberg, MD and Christopher R. Brigham, MD. All rights reserved. No part of this publication may be reproduced or transmitted by any means without written permission. Permission granted for use by WorkCompCentral.

Hand Examination

- **Use uninvolved side as baseline for comparison**.
  - If a contralateral "normal" joint has less than average mobility; the impairment values(s) corresponding to the uninvolved joint can serve as a baseline and are subtracted from the calculated impairment from the involved joint. The rationale should be included in the report.
  - Enter rationale for using uninvolved side (identify digit)_____

- **Additional 2% motion Impairment** (If an involved joint has "normal" motion according to the values specified in the *Guides* and *the contralateral uninvolved joint has greater than average motion,* there is a relative loss of motion. In rare cases, when this results in a loss of function, based on the examiner's clinical judgment, an impairment percent not to exceed 2% of the maximum regional impairment value of a unit of motion could be given. The rationale for this decision must be explained in the report)
  - Rationale (identify digit):_____

THUMB	Right			Left		
	ROM	Ankylosis	Strength	ROM	Ankylosis	Strength
IP Flexion (80º)			0 1 2 3 4 5			0 1 2 3 4 5
IP Extension (30º)			0 1 2 3 4 5			0 1 2 3 4 5
MP Flexion (60 º)			0 1 2 3 4 5			0 1 2 3 4 5
MP Extension (40º)			0 1 2 3 4 5			0 1 2 3 4 5
CMC Radial Abd (50º)			0 1 2 3 4 5			0 1 2 3 4 5
CMC Add (0–8 cm)			0 1 2 3 4 5			0 1 2 3 4 5
CMC Opp (8 cm)			0 1 2 3 4 5			0 1 2 3 4 5

Index Finger	Right			Left		
	ROM	Ankylosis	Strength	ROM	Ankylosis	Strength
DIP Flexion (70º)			0 1 2 3 4 5			0 1 2 3 4 5
DIP Extension (30º)			0 1 2 3 4 5			0 1 2 3 4 5
PIP Flexion (100º)			0 1 2 3 4 5			0 1 2 3 4 5
PIP Extension (30º)			0 1 2 3 4 5			0 1 2 3 4 5
MP Flexion (90º)			0 1 2 3 4 5			0 1 2 3 4 5
MP Extension (20º)			0 1 2 3 4 5			0 1 2 3 4 5

Middle Finger	Right			Left		
	ROM	Ankylosis	Strength	ROM	Ankylosis	Strength
DIP Flexion (70º)			0 1 2 3 4 5			0 1 2 3 4 5
DIP Extension (30º)			0 1 2 3 4 5			0 1 2 3 4 5
PIP Flexion (100º)			0 1 2 3 4 5			0 1 2 3 4 5
PIP Extension (30º)			0 1 2 3 4 5			0 1 2 3 4 5
MP Flexion (90º)			0 1 2 3 4 5			0 1 2 3 4 5
MP Extension (20º)			0 1 2 3 4 5			0 1 2 3 4 5

Ring Finger	Right			Left		
	ROM	Ankylosis	Strength	ROM	Ankylosis	Strength
DIP Flexion (70º)			0 1 2 3 4 5			0 1 2 3 4 5
DIP Extension (30º)			0 1 2 3 4 5			0 1 2 3 4 5
PIP Flexion (100º)			0 1 2 3 4 5			0 1 2 3 4 5
PIP Extension (30º)			0 1 2 3 4 5			0 1 2 3 4 5
MP Flexion (90º)			0 1 2 3 4 5			0 1 2 3 4 5
MP Extension (20º)			0 1 2 3 4 5			0 1 2 3 4 5

Little Finger	Right			Left		
	ROM	Ankylosis	Strength	ROM	Ankylosis	Strength
DIP Flexion (70º)			0 1 2 3 4 5			0 1 2 3 4 5
DIP Extension (30º)			0 1 2 3 4 5			0 1 2 3 4 5
PIP Flexion (100º)			0 1 2 3 4 5			0 1 2 3 4 5
PIP Extension (30º)			0 1 2 3 4 5			0 1 2 3 4 5
MP Flexion (90º)			0 1 2 3 4 5			0 1 2 3 4 5
MP Extension (20º)			0 1 2 3 4 5			0 1 2 3 4 5

© 2014 – 2017 Steven D. Feinberg, MD and Christopher R. Brigham, MD. All rights reserved. No part of this publication may be reproduced or transmitted by any means without written permission. Permission granted for use by WorkCompCentral.

Fingertips to Palm

❑ Fingertip to palm testing is normal. All fingertips touch at the proximal, middle and distal palm.

Finger Triggering

❑ There is no finger triggering
❑ There is finger triggering:

	Right	Left
Thumb		
Index		
Middle		
Ring		
Little		

Grip and Pinch Strength

Note: This is rated only in a RARE case, and you must provide an explanation for your rationale for including this in the rating.

Grip * = with discomfort ** = pain limited	Right (kgs)	*/**	Left (kgs)	*/**
Trial 1				
Trial 2				
Trial 3				

Pinch	Right	*/**	Left	*/**
Trial 1				
Trial 2				
Trial 3				

❑ **Arthroplasty** (Table 16-7 (5th ed., 506)

Right	Left
Thumb CMC implant: UEI = 9%	Thumb CMC implant: UEI = 9%
Thumb CMC resection: UEI = 11%	Thumb CMC resection: UEI = 11%
Thumb MP implant: UEI = 2%	Thumb MP implant: UEI = 2%
Thumb MP resection: UEI = 3%	Thumb MP resection: UEI = 3%
Thumb IP implant: UEI = 4%	Thumb IP implant: UEI = 4%
Thumb IP resection: UEI = 5%	Thumb IP resection: UEI = 5%
Index or Middle Finger MP implant: UEI = 4%	Index or Middle Finger MP implant: UEI = 4%
Index or Middle Finger MP resection: UEI = 5%	Index or Middle Finger MP resection: UEI = 5%
Index or Middle Finger PIP implant: UEI = 2%	Index or Middle Finger PIP implant: UEI = 2%
Index or Middle Finger PIP resection: UEI = 3%	Index or Middle Finger PIP resection: UEI = 3%
Index or Middle Finger DIP implant: UEI = 1%	Index or Middle Finger DIP implant: UEI = 1%
Index or Middle Finger DIP resection: UEI = 2%	Index or Middle Finger DIP resection: UEI = 2%
Ring or Little Finger MP implant: UEI = 2%	Ring or Little Finger MP implant: UEI = 2%
Ring or Little Finger MP resection: UEI = 2%	Ring or Little Finger MP resection: UEI = 2%
Ring or Little Finger PIP implant: UEI = 1%	Ring or Little Finger PIP implant: UEI = 1%
Ring or Little Finger PIP resection: UEI = 1%	Ring or Little Finger PIP resection: UEI = 1%
Ring or Little Finger DIP implant: UEI = 1%	Ring or Little Finger DIP implant: UEI = 1%
Ring or Little Finger DIP resection: UEI = 1%	Ring or Little Finger DIP resection: UEI = 1%

© 2014 – 2017 Steven D. Feinberg, MD and Christopher R. Brigham, MD. All rights reserved. No part of this publication may be reproduced or transmitted by any means without written permission. Permission granted for use by WorkCompCentral.

Carpal Tunnel Syndrome

If, after an optimal recovery time following surgical decompression, an individual continues to complain of pain, paresthesias, and/or difficulties in performing certain activities, three possible scenarios can be present:

1. Positive clinical findings of median nerve dysfunction and electrical conduction delay(s): the impairment due to residual CTS is rated according to the sensory and/or motor deficits.

2. Normal sensibility and opposition strength with abnormal sensory and/or motor latencies or abnormal EMG testing of the thenar muscles: a residual CTS is still present, and an impairment rating not to exceed 5% of the upper extremity may be justified (circle one for the affected side).

Right	Left
1%	1%
2%	2%
3%	3%
4%	4%
5%	5%

3. Normal sensibility (two-point discrimination and Semmes-Weinstein monofilament testing), opposition strength, and nerve conduction studies: there is no objective basis for an impairment rating.

NB: While it is not official policy in California, some physicians would argue that even in the absence of surgery, #2 above can be used.

© 2014 – 2017 Steven D. Feinberg, MD and Christopher R. Brigham, MD. All rights reserved. No part of this publication may be reproduced or transmitted by any means without written permission. Permission granted for use by WorkCompCentral.

Upper Extremity Peripheral Nerve Deficits

Recording Form

Nerves	Sensory Grade / Deficit (%)				Motor Grade / Deficit (%)			
	Right		Left		Right		Left	
Pectorals (medial and lateral)	XXXXXXX	XX	XXXXXXX	XX	0 1 2 3 4 5		0 1 2 3 4 5	
Axillary	0 1 2 3 4 5		0 1 2 3 4 5		0 1 2 3 4 5		0 1 2 3 4 5	
Dorsal scapular	XXXXXXX	XX	XXXXXXX	XX	0 1 2 3 4 5		0 1 2 3 4 5	
Long thoracic	XXXXXXX	XX	XXXXXXX	XX	0 1 2 3 4 5		0 1 2 3 4 5	
Medial antebrachial cutaneous	0 1 2 3 4 5		0 1 2 3 4 5		XXXXXXX	XX	XXXXXXX	XX
Medial brachial cutaneous	0 1 2 3 4 5		0 1 2 3 4 5		XXXXXXX	XX	XXXXXXX	XX
Median (above midforearm)	0 1 2 3 4 5		0 1 2 3 4 5		0 1 2 3 4 5		0 1 2 3 4 5	
Median (anterior interosseous branch)	XXXXXXX	XX	XXXXXXX	XX	0 1 2 3 4 5		0 1 2 3 4 5	
Median (below midforearm)	0 1 2 3 4 5		0 1 2 3 4 5		0 1 2 3 4 5		0 1 2 3 4 5	
Radial palmar digital of thumb	0 1 2 3 4 5		0 1 2 3 4 5		XXXXXXX	XX	XXXXXXX	XX
Ulnar palmar digital of thumb	0 1 2 3 4 5		0 1 2 3 4 5		XXXXXXX	XX	XXXXXXX	XX
Radial palmar digital of index finger	0 1 2 3 4 5		0 1 2 3 4 5		XXXXXXX	XX	XXXXXXX	XX
Ulnar palmar digital of index finger	0 1 2 3 4 5		0 1 2 3 4 5		XXXXXXX	XX	XXXXXXX	XX
Radial palmar digital of middle finger	0 1 2 3 4 5		0 1 2 3 4 5		XXXXXXX	XX	XXXXXXX	XX
Ulnar palmar digital of middle finger	0 1 2 3 4 5		0 1 2 3 4 5		XXXXXXX	XX	XXXXXXX	XX
Radial palmar digital of ring finger	0 1 2 3 4 5		0 1 2 3 4 5		XXXXXXX	XX	XXXXXXX	XX
Musculocutaneous	0 1 2 3 4 5		0 1 2 3 4 5		0 1 2 3 4 5		0 1 2 3 4 5	
Radial (upper arm with loss of triceps)	0 1 2 3 4 5		0 1 2 3 4 5		0 1 2 3 4 5		0 1 2 3 4 5	
Radial (elbow with sparing of triceps)	0 1 2 3 4 5		0 1 2 3 4 5		0 1 2 3 4 5		0 1 2 3 4 5	
Subscapularis (upper and lower)	XXXXXXX	XX	XXXXXXX	XX	0 1 2 3 4 5		0 1 2 3 4 5	
Suprascapular	0 1 2 3 4 5		0 1 2 3 4 5		0 1 2 3 4 5		0 1 2 3 4 5	
Thoracodorsal	XXXXXXX	XX	XXXXXXX	XX	0 1 2 3 4 5		0 1 2 3 4 5	
Ulnar (above midforearm)	0 1 2 3 4 5		0 1 2 3 4 5		0 1 2 3 4 5		0 1 2 3 4 5	
Ulnar (below midforearm)	0 1 2 3 4 5		0 1 2 3 4 5		0 1 2 3 4 5		0 1 2 3 4 5	
Ulnar palmar digital of ring finger	0 1 2 3 4 5		0 1 2 3 4 5		XXXXXXX	XX	XXXXXXX	XX
Radial palmar digital of little finger	0 1 2 3 4 5		0 1 2 3 4 5		XXXXXXX	XX	XXXXXXX	XX
Ulnar palmar digital of little finger	0 1 2 3 4 5		0 1 2 3 4 5		XXXXXXX	XX	XXXXXXX	XX
Brachial plexus (C5 through C8, T1)	0 1 2 3 4 5		0 1 2 3 4 5		0 1 2 3 4 5		0 1 2 3 4 5	
Upper trunk (C5, C6, Erb-Duchenne)	0 1 2 3 4 5		0 1 2 3 4 5		0 1 2 3 4 5		0 1 2 3 4 5	
Middle trunk (C7)	0 1 2 3 4 5		0 1 2 3 4 5		0 1 2 3 4 5		0 1 2 3 4 5	
Lower trunk (C8, T1, Déjerine-Klumpke)	0 1 2 3 4 5		0 1 2 3 4 5		0 1 2 3 4 5		0 1 2 3 4 5	

Table 16-10 (5th ed., 482) and Table 16-11 (484)

Sensory Deficit or Pain Grade		Deficit (%)	Strength Grade		Deficit (%)
5	No loss of sensibility, abnormal sensation, or pain	0	**5**	Active movement against gravity with full resistance	0
4	Distorted superficial tactile sensibility (diminished light touch), with or without minimal abnormal sensations or pain, that is forgotten during activity	1 - 25	**4**	Active movement against gravity with some resistance	1 -25
3	Distorted superficial tactile sensibility (diminished light touch and two-point discrimination), with some abnormal sensations or slight pain, that interferes with some activities	26 – 60	**3**	Active movement against gravity only, without resistance	26 – 50
2	Decreased superficial cutaneous pain and tactile sensibility (decreased protective sensibility), with abnormal sensations or moderate pain, that may prevent some activities	61 – 80	**2**	Active movement with gravity eliminated	51 – 75
1	Deep cutaneous pain sensibility present; absent superficial pain and tactile sensibility (absent protective sensibility), with abnormal sensations or severe pain, that prevents most activity	81 – 99	**1**	Slight contraction and no movement	76 – 99
0	Absent sensibility, abnormal sensations, or severe pain that prevents all activity	100	**0**	No movement	100

© 2014 – 2017 Steven D. Feinberg, MD and Christopher R. Brigham, MD. All rights reserved. No part of this publication may be reproduced or transmitted by any means without written permission. Permission granted for use by WorkCompCentral.

Chapter 17 – The Lower Extremities

Overview

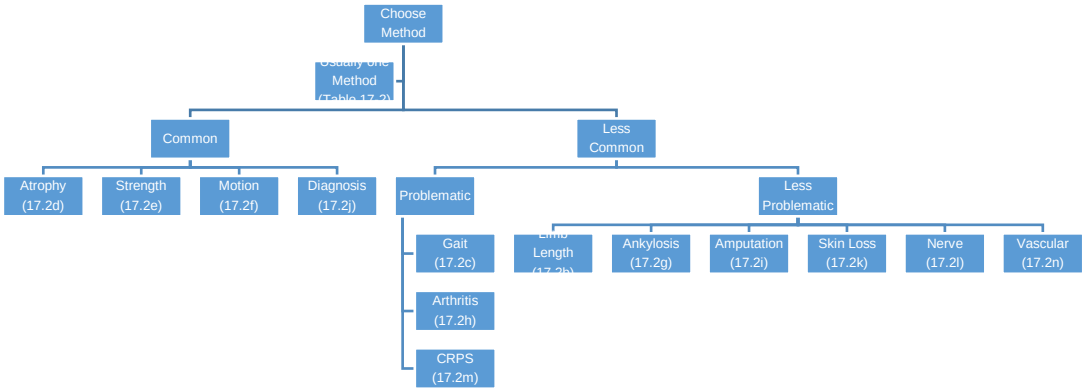
This chapter provides criteria for evaluating permanent impairment of the lower extremities, including impairment ratings that reflect an individual's ability to perform the activities of daily living (ADL). For evaluation purposes, the lower extremities are divided into six sections: the feet, the hindfeet, the ankles, the legs, the knees, the hips, and the pelvis. In addition to the skeletal framework, assessment of the lower extremities also requires an assessment of its joints and the associated soft tissues, vascular system, and nervous system. The lower extremities are evaluated on the basis of anatomic changes, diagnostic categories, and functional changes. It is comprised of the following sections:

17.1 Principles of Assessment

17.2 Methods of Assessment

17.3 Lower Extremity Impairment Evaluation Procedure Summary and Examples

Lower Extremity Impairment Evaluation Algorithm



© 2014 – 2017 Steven D. Feinberg, MD and Christopher R. Brigham, MD. All rights reserved. No part of this publication may be reproduced or transmitted by any means without written permission. Permission granted for use by WorkCompCentral.

Principles of Assessment

NB: It is important to ensure that lower extremity impairment discussed in this chapter is not due to underlying spine pathology. If lower extremity impairment is due to an underlying spine disorder, the lower extremity impairment would, in most cases, be accounted for in the spine impairment rating. So you would need to go to the Spine Chapter.

- The first step is to identify each part of the lower extremity that might possibly warrant an impairment rating (**Pelvis, Hip, Thigh/Knee, Calf/Ankle/Foot, & Toe**) and then determines whether ROM impairment or other regional impairments are present for each relevant part and derive an impairment rating.

- Let's start first by considering all the possible methods used for an impairment rating **(**w*e will come back later and select the clinically most appropriate (i.e., most specific) method(s) to calculate the impairment rating and then use the cross-usage chart (Table 17-2) to decide which methods and resulting impairment ratings may be combined*).

- Let's start first by considering all the 13 possible methods used for a Lower Extremity impairment rating, as specified in Table 17-1 (5th ed., 525).

13 possible methods used for a Lower Extremity impairment rating

Limb Length Discrepancy
Gait Derangement
Muscle Atrophy (Unilateral)
Manual Muscle Testing
Range of Motion
Joint Ankylosis
Arthritis
Amputations
Diagnosis-Based Estimates
Skin Loss
Peripheral Nerve Injuries
Causalgia and Complex Regional Pain Syndrome (Reflex Sympathetic Dystrophy)
Vascular Disorders

Limb Length Discrepancy

- Section 17.2b (5th ed., 528)

- While x-rays are the most accurate way to measure a limb length discrepancy, the most common measurement method is to place the individual supine and measure the distance between the anterior superior iliac spine and the medial malleolus on the involved side, and compare it with the opposite side.

- Impairments from limb length discrepancy depend on the magnitude of the leg length difference and are provided in Table 17-4 (5th ed., 528. When applicable, the leg length discrepancy impairment is combined with other impairments.

© 2014 – 2017 Steven D. Feinberg, MD and Christopher R. Brigham, MD. All rights reserved. No part of this publication may be reproduced or transmitted by any means without written permission. Permission granted for use by WorkCompCentral.

Gait Derangement

- Section 17.2b (5th ed., 529)

- Gait derangement is always secondary to another condition. An impairment rating due to a gait derangement should be supported by pathologic findings, such as x-rays. Except as otherwise noted, the percentages given in Table 17-5 (5th ed., 529, are for full-time gait derangements of persons who are dependent on assistive devices. *Whenever possible, the evaluator should use a more specific method.* When the gait method is used, a written rationale should be included in the report. Gait Derangement does not apply to abnormalities based only on subjective factors, such as pain or sudden giving-way, as with, for example, an individual with low-back discomfort who chooses to use a cane to assist in walking. Go to Table 17-5, Lower Limb Impairment Due to Gait Derangement (page 529), and you should pick the descriptor that best match the examinee's Gait Derangement. Record the WPI.

Muscle Atrophy (Unilateral)

- Section 17.2d (5th ed., 530-521)

- In evaluating muscle atrophy, the leg circumference should be measured and compared to the opposite leg at equal distances from either the joint line or another palpable anatomic structure. Thigh atrophy may involve measuring the thigh circumference with a tape measure 10cm above the patella and comparing it to a similar measure on the other leg. Calf circumference is compared at the maximum level bilaterally. Neither limb should have swelling or varicosities that would invalidate the measurements. Do not provide an impairment rating for Muscle Atrophy unless there is legitimate muscle atrophy. Impairment ratings from atrophy are provided in Table 17-6 (5th ed., 530).

- Diminished muscle function can be estimated using four different methods. Only one should be used; that is, use only one method for assessing muscle function. Atrophy ratings should not be combined with any of the other three possible ratings of diminished muscle function (gait derangement, muscle weakness, and peripheral nerve injury). When muscle dysfunction is present, assess the condition with all four methods. Use the method that most accurately and objectively reflects the individual's impairment.

Manual Muscle Testing

- Section 17.2e (5th ed., 531-533)

- There is considerable misunderstanding about manual muscle testing. This section is meant to be used for legitimate muscle weakness that is not due to a spinal or peripheral nerve injury. An example would be quadriceps weakness due to a direct muscle injury. Since muscle strength is under voluntary control, to be included as an impairment, any weakness must be correlated with pathological findings and medical evidence. Muscle "weakness" secondary to pain or fear of pain is not considered valid. Table 17.7 (5th ed., 531) lists the Criteria for Grades of Muscle Function of the Lower Extremity with "0" being no contraction and "5" being normal (active movement against gravity with full resistance). You then go to Table 17-8 (5th ed., 532) Impairment Due to Lower Extremity Muscle Weakness, to figure out the impairment rating.

© 2014 – 2017 Steven D. Feinberg, MD and Christopher R. Brigham, MD. All rights reserved. No part of this publication may be reproduced or transmitted by any means without written permission. Permission granted for use by WorkCompCentral.

Range of Motion

- Section 17.2f (5th ed., 533-538)

- Since pain and motivation can affect ROM, you must determine that there consistency of measurements and a true loss of motion to use ROM for the impairment rating. Figure 17-1 to 17-6 show ROM methods for the various lower extremity joints. Three measurements should be taken and the greatest one used. Use Tables 17-9 to 17-14 (5th ed., 537) to obtain lower extremity impairment ratings.

Joint Ankylosis

- Section 17.2g (5th ed., 538-544)

- An immobile joint is an impairment even when the ankylosis is in the optimal position. Malposition of the ankylosed joint increased the impairment. Tables 17-15 through 17-30 (5th ed., 538 to 543, are used to obtain the impairment ratings for ankylosed joints in optimal and malposition.

Arthritis

- Section 17.2h (5th ed., 544-545)

- Degenerative arthritis impairment is determined by x-ray grading of the cartilage interval (joint space narrowing) is more valid than ROM or crepitation. It is recommended that the bilateral films be taken for purposes of comparison. The following views should be taken:

    - Patellofemoral joint x-rays - "sunrise view" at 40 °.
    - Knee Joint - Proper-standing view in neutral flexion/extension position.
    - Hip Joint - positioning not critical
    - Ankle Joint - mortise view at 10 ° of internal rotation, flexion or extension
    - Hindoot Joint - lateral view
    - Mid/forefoot joints - anteroposterior view

- Table 17-31 (5th ed., 544) Arthritis Impairments Based on Roentgenographically Determined Cartilage Intervals, provides the impairment rating for the various lower extremity joints (abnormalities involve cartilage intervals of 0, 1, 2 and 3 mm). If the contralateral joint is asymptomatic but also has an "abnormal" cartilage interval (i.e., 3mm or less), you would then have to consider this the "normal" cartilage interval for this individual. The best way to explain this is with an example. If the injured knee has a 1mm cartilage interval but the unaffected "normal" other knee has a 3mm cartilage interval, you would only calculate the impairment rating for the injured knee as 2mm.

- For the knee, in an individual with a history of direct trauma, a complaint of patellofemoral pain, and crepitation on physical examination, but without joint space narrowing on x-rays, a 2% whole person or 5% lower extremity impairment is given.

© 2014 – 2017 Steven D. Feinberg, MD and Christopher R. Brigham, MD. All rights reserved. No part of this publication may be reproduced or transmitted by any means without written permission. Permission granted for use by WorkCompCentral.

Amputations

- Section 17.21 (5th ed., 545)
- Impairments of the lower extremity due to amputations are estimated using Table 17-32 (5th ed., 545).

Diagnosis-Based Estimates

- Section 17.2j (5th ed., 545-549)
- Some impairment estimates are best based on the diagnosis rather than on physical examination findings. Table 17-33 (5th ed., 546) provides impairment estimates for certain lower extremity impairments.
- Hip replacements should first be rated using Table 17-34 (5th ed., 548) and knee replacements with Table 17-35 (5th ed., 549) The points obtained from the assessment are then applied to Table 17-33 (5th ed., 546) for the diagnosis impairment rating. Also, if there is a limb length discrepancy, the impairment value should be combined with the one from the joint replacement.

Skin Loss

- Section 17.2k (5th ed., 550)
- Full-thickness skin loss (even when successfully covered with a skin graft) can result in significant impairment as shown in Table 17-36 (5th ed., 550. This table is also used for chronic osteomyelitis.

Peripheral Nerve Injuries

- Section 17.2l (5th ed., 550-551)
- Peripheral nerve injuries are divided in two components, sensory and motor deficits. Table 17-37 (5th ed., 552, lists the impairment for a complete motor or sensory deficit. Note that there is additional impairment given for a dysesthesia (a condition in which an unpleasant sensation is produced by ordinary stimuli).
- Most peripheral nerve deficits though are not complete. Partial motor and sensory deficits should be rated using Tables 16-10 for sensory deficits and 16-11 for motor deficits in the Upper Extremity Chapter 16.
- The next step may seem a little confusing but basically you multiply the value for a complete peripheral nerve injury that you obtain from Table17-37 by the value in Tables 16-10 for sensory deficits and 16-11 for motor deficits.
- Motor and sensory deficits should be combined but remember that the impairments from multiple peripheral nerves cannot exceed 40% (the maximum whole person impairment loss for one leg).
    - Note: This does get a little confusing so an example seems to be in order (see example 17-17 (5th ed., 552, for a complete description of this case). The examinee has a partial femoral nerve palsy with both a sensory and motor component. The sensory impairment can be rated using Tables 17-37 and 16-10. According to Table 17-37, the maximum value for a totally destroyed and nonfunctioning femoral nerve due to sensory loss and pain is 9% lower extremity impairment. The

© 2014 – 2017 Steven D. Feinberg, MD and Christopher R. Brigham, MD. All rights reserved. No part of this publication may be reproduced or transmitted by any means without written permission. Permission granted for use by WorkCompCentral.

sensory deficit and pain are forgotten with activity, so a severity multiplier of grade 4 may be chosen from Table 16-10; grade 4 includes a range of multipliers from 1% to 25%. If a multiplier of 20% is chosen, 20% of the 9% maximum value of the nerve is 2% lower extremity impairment for loss of sensation and pain. The motor weakness impairment can be calculated in a similar manner. Table 17-37 indicates that the maximal impairment for total loss of femoral nerve motor function is 37% lower extremity impairment. The exam shows that the examinee can move the leg through a full range of motion against gravity, but with only minimal added resistance. This is grade 4 weakness according to manual muscle testing criteria. Table 16-11 indicates that grade 4 weakness can qualify for a severity multiplier of anywhere from 1% to 25%. If a multiplier of 25% is chosen since the weakness is very significant, 25% multiplied by the 37% maximal value of the nerve for weakness yields a total of 9% lower extremity impairment. Using the Combined Values Chart (p. 604) to combine the 9% lower extremity impairment for motor weakness with the 2% lower extremity impairment for loss of sensation and pain yields a rating of 11% lower extremity impairment. The 11% lower extremity impairment is equivalent to 4% (11% × 0.4 = 4%) whole person impairment (the 0.4 multiplier comes from the lower extremity maximum value of 40% WPI).

Causalgia and Complex Regional Pain Syndrome (Reflex Sympathetic Dystrophy)

- Section 17.2m (5th ed., 553-534)
- The pathology in CRPS is currently believed to occur in the central nervous system, so the evaluator should use the station and gait impairment criteria in Chapter 13, Table 13-15 (5th ed., 336, to rate lower extremity impairments due to lesions in the central nervous system (brain and/or spinal cord). You should choose one of the four categories that best describes the examinee's impairment. There is a wide range for each category and you should choose the percentage impairment based on whether the impairment is closer to the category above or below the one you have pick and the extent of the examinee's ADL deficits.

Vascular Disorders

- Section 17.2n (5th ed., 553)
- Table 17-38 (5th ed., 554, classifies and provides criteria for impairments due to peripheral vascular disease.

Combining Lower Extremity Impairment

- It is imperative that you reference Table 17-2 Guide to the Appropriate Combination of Evaluation Methods (5th ed., 526) to determine which methods can be combined. "Typically one method will adequately characterize the impairment." (5th ed., 527).
- For each region of the lower extremity with an impairment, you may come up with an impairment rating but remember that the Lower Extremity impairment rating cannot exceed 100% and the whole person impairment cannot exceed 40%.
- If there are several impairments involving different regions of the lower extremity (eg, the thigh and the foot), evaluate each impairment separately, convert these regional impairments to whole person impairments, and combine the whole person impairment rating using the Combined Values Chart (p. 604). If there are multiple impairments within a region (eg, the toes and the ankle), combine these regional, lower

© 2014 – 2017 Steven D. Feinberg, MD and Christopher R. Brigham, MD. All rights reserved. No part of this publication may be reproduced or transmitted by any means without written permission. Permission granted for use by WorkCompCentral.

extremity impairments of the foot and convert the combined foot impairment to a whole person impairment. Similarly, when using separate methods on the same region, combine the regional impairments before converting to a whole person impairment rating.

Calculating Lower Extremity Impairment

- The last steps are to select the clinically most appropriate (i.e., most specific) method(s) to calculating the impairment rating and then to use the cross-usage chart (Table 17-2) to decide which methods and resulting impairment ratings may be combined.

- This can be a little confusing. You have made a series of measurements of the affected lower extremity body parts using the AMA Guides recommended 13 possible methods used for a Lower Extremity impairment rating. But, which ones can you use and which ones can be combined?

- The AMA Guides tells us to select the most appropriate method(s) based on the history and physical examination. It is the responsibility of the evaluating physician to explain in writing why a particular method(s) to assign the impairment rating was chosen. When uncertain about which method to choose, the evaluator should calculate the impairment using different alternatives and choose the method or combination of methods that gives the most clinically accurate impairment rating.

- Typically, one method will adequately characterize the impairment and its impact on the ability to perform ADL. In some cases, however, more than one method needs to be used to accurately assess all features of the impairment. When more than one rating method is used, the individual impairment ratings are combined using the Combined Values Chart (p. 604). Avoid combining methods that rate the same condition. Selecting the optimal approach or combining several methods requires judgment and experience. A careful examination and review of supporting material is essential to produce accurate and consistent results. If more than one method can be used, typically the one resulting in the higher rating is chosen, assuming that this method is reliable. (For example, if a patient demonstrates marked strength deficits and pain behaviors, however has minimal atrophy, a rating by strength may not be reliable and therefore would not be chosen.

- Some of the 13 methods can be combined and some can't. Some, such as Gait Derangement, cannot be combined with other methods and further, are not to be used unless no other method adequately describes the impairment.

- The next step is to use the cross-usage table (Table 17-2 (5th ed., 526) to ensure only the proper methods are combined. Simply put, open boxes indicate impairment ratings derived from these methods can be combined and an "X" means you cannot use these methods together for evaluating a single impairment.

- Although diminished muscle function can be evaluated by means of four methods (peripheral nervous system impairment, atrophy, manual muscle testing, or gait), the AMA Guides recommends using only the method that has the greatest specificity (e.g., a peripheral nerve injury, if present).

- Selecting the optimal approach or combining several methods requires judgment and experience. A careful examination and review of supporting material is essential to produce accurate and consistent results. If more than one method can be used, the method that provides the higher rating should be adopted.

- Converting from lower extremity to Whole Person Impairment (WPI) can be a little confusing. The tables in this chapter show the impairment percentages of the whole person (not in parenthesis); the lower limb impairment percents are in parentheses ( ); and, when applicable, the specific part impairments are in brackets [ ]. To calculate the lower extremity impairment percent from a specific part impairment percent (e.g., foot), multiply by 0.7. To calculate whole person impairment from a lower extremity impairment, multiply by 0.4. These values are shown in Table 17-3 (5th ed., 527).

© 2014 – 2017 Steven D. Feinberg, MD and Christopher R. Brigham, MD. All rights reserved. No part of this publication may be reproduced or transmitted by any means without written permission. Permission granted for use by WorkCompCentral.

- Some individuals may have several impairments involving different parts of the same lower extremity; others may have several impairments of the same lower extremity part. If there are several impairments involving different regions of the lower extremity (e.g., the thigh and the foot), evaluate each impairment separately, convert these regional impairments to whole person impairments, and combine the whole person impairment rating using the Combined Values Chart (5th ed., 604).

- If there are multiple impairments within a region (e.g., the toes and the ankle), combine these regional, lower extremity impairments of the foot and convert the combined foot impairment to a whole person impairment. Similarly, when using separate methods on the same region, combine the regional impairments before converting to a whole person impairment rating.

- If there are several alternatives, use the grouping that provides the greatest impairment percent. Convert a lower extremity impairment rating to whole person impairment using the appropriate tables. Combine whole person impairments for each injury/illness for the same extremity using the Combined Values Chart (5th ed., 604).

- If more than one leg is involved, each lower extremity is rated separately and converted to whole person; then both whole person ratings (right and left leg) are combined using the Combined Values Chart.

© 2014 – 2017 Steven D. Feinberg, MD and Christopher R. Brigham, MD. All rights reserved. No part of this publication may be reproduced or transmitted by any means without written permission. Permission granted for use by WorkCompCentral.

Lower Extremity Physical Examination Protocols

Amputation

Right	Left
❑ Hemipelvectomy	❑ Hemipelvectomy
❑ Hip disarticulation	❑ Hip disarticulation
❑ Above knee	❑ Above knee
o Proximal	o Proximal
o Midthigh	o Midthigh
o Distal	o Distal
❑ Knee disarticulation	❑ Knee disarticulation
❑ Below knee	❑ Below knee
o Less than 3"	o Less than 3"
o 3" or more	o 3" or more
❑ Syme (hindfoot	❑ Syme (hindfoot
❑ Midfoot	❑ Midfoot
❑ Transmetatarsal	❑ Transmetatarsal
❑ First metatarsal	❑ First metatarsal
❑ Other metatarsals	❑ Other metatarsals
❑ All toes at metatarsophalangeal	❑ All toes at metatarsophalangeal
❑ (MTP) joint	❑ (MTP) joint
❑ Great toe at MTP joint	❑ Great toe at MTP joint

The following forms provide a mechanism for recording findings and considering regional impairments.

© 2014 – 2017 Steven D. Feinberg, MD and Christopher R. Brigham, MD. All rights reserved. No part of this publication may be reproduced or transmitted by any means without written permission. Permission granted for use by WorkCompCentral.

Hip Examination

(Note: Rate each extremity separately.)

HIP (RANGE OF MOTION):				
	Right		Left	
	ROM	Strength	ROM	Strength
Flexion (100º)		0 1 2 3 4		0 1 2 3 4
Extension (30º)		0 1 2 3 4		0 1 2 3 4
Abduction (40º)		0 1 2 3 4		0 1 2 3 4
Abduction contracture		XXXXX		XXXXX
Adduction (20º)		0 1 2 3 4		0 1 2 3 4
External Rotation (50º)		0 1 2 3 4		0 1 2 3 4
Internal Rotation (40º)		0 1 2 3 4		0 1 2 3 4

- ❑ **Use uninvolved side as baseline for comparison**.
  - If a contralateral "normal" joint has less than average mobility; the impairment values(s) corresponding to the uninvolved joint can serve as a baseline and are subtracted from the calculated impairment from the involved joint. The rationale for this decision should be included in the report.
  - Enter rationale for using uninvolved side_____

Diagnosis Based Estimate (DBE) (do each side separately)

- ❑ Arthritis Impairments Based on Roentgenographically Determined Cartilage Intervals (Table 17-31 (5th ed., 544)

Right	Left
0 mm	0 mm
1 mm	1 mm
2 mm	2 mm
3 mm	3 mm

- ❑ Limb Length Discrepancy (Table 17-4 (5th ed., 528)
  - _____ cm
  - shortening due to overriding or malalignment or fracture deformities, but not to include flexion or extension deformities

- ❑ Impairment for Skin Loss (Table 17-36 (5th ed., 550)
  - Ischial covering that requires frequent unweighting and limits sitting time

- ❑ Femoral neck fracture, healed in
  - Good position (Evaluate according to examination findings)
  - Malunion plus range-of-motion criteria
  - Nonunion plus range-of-motion criteria

- ❑ Girdlestone arthroplasty Or estimate according to examination findings; use the greater estimate

- ❑ Trochanteric bursitis (chronic) with abnormal gait

- ❑ Total hip replacement (see Rating Hip Replacement Results below); includes endoprosthesis, unipolar or bipolar
  - Good results, 85-100 points
  - Fair results, 50-84 points
  - Poor results, less than 50 points

© 2014 – 2017 Steven D. Feinberg, MD and Christopher R. Brigham, MD. All rights reserved. No part of this publication may be reproduced or transmitted by any means without written permission. Permission granted for use by WorkCompCentral.

Table 17-34 Rating Hip Replacement Results (5th ed., 548 (do each hip separately if bilateral THR).

❑ **a. Pain**	❑ **d. Deformity**
○ None	○ Fixed adduction < 10°
○ Slight	○ Fixed adduction ≥ 10°
○ Moderate, 0ccasional	○ Fixed internal rotation < 10°
○ Moderate	○ Fixed internal rotation ≥ 10°
○ Marked	○ Fixed external rotation < 10°
❑ **b. Function**	○ Fixed external rotation ≥ 10°
○ Limp	○ Flexion contracture < 15°
▪ None	○ Flexion contracture ≥ 15°
▪ Slight	○ Leg length discrepancy < 1.5 cm
▪ Moderate	○ Leg length discrepancy ≥ 1.5 cm
▪ Severe	❑ **e. Range of Motion**
○ Supportive device	○ Flexion > 90°
▪ None	○ Flexion ≤ 90°
▪ Cane for long walks	○ Abduction > 15°
▪ Cane	○ Abduction ≤ 15°
▪ One crutch	○ Adduction > 15°
▪ Two canes	○ Adduction ≤ 15°
▪ Two crutches	○ External rotation > 30°
○ Distance walked	○ External rotation ≤ 30°
▪ Unlimited	○ Internal rotation > 15°
▪ Six blocks	○ Internal rotation ≤ 15°
▪ Three blocks	❑ **d. Deformity**
▪ Indoors	○ Fixed adduction < 10°
▪ In bed or chair	○ Fixed adduction ≥ 10°
❑ **c. Activities**	○ Fixed internal rotation < 10°
○ Stairs climbing	○ Fixed internal rotation ≥ 10°
▪ Normal	○ Fixed external rotation < 10°
▪ Using railing	○ Fixed external rotation ≥ 10°
▪ Cannot climb readily	○ Flexion contracture < 15°
▪ Unable to climb	○ Flexion contracture ≥ 15°
○ Putting on shoes and socks	○ Leg length discrepancy < 1.5 cm
▪ With ease	
▪ With difficulty	
▪ Unable to do	
○ Sitting	
▪ Any chair, 1 hour	
▪ High chair	
▪ Unable to sit comfortably	
○ Public transportation	
▪ Able to use	
▪ Unable to use	

© 2014 – 2017 Steven D. Feinberg, MD and Christopher R. Brigham, MD. All rights reserved. No part of this publication may be reproduced or transmitted by any means without written permission. Permission granted for use by WorkCompCentral.

Knee Examination

(Note: Rate each extremity separately.)

KNEE	Right	Left	Right	Left
☐ Normal exam	ROM	Strength	ROM	Strength
Flexion (150º)		0 1 2 3 4		0 1 2 3 4
Extension (0º)†		0 1 2 3 4		0 1 2 3 4
Varus††		XXXXX		XXXXXX
Valgus†† (3° to 10° valgus = normal)		XXXXX		XXXXXX
Ankylosis in internal or external malrotation		XXXXX		XXXXXX

† flexion contracture = loss of extension
†† Deformity measured by femoral-tibial angle
3° to 10° valgus = normal

❑ KNEE Special Tests	Right	Left
Lachman's	☐ Positive	☐ Positive
McMurray	☐ Positive	☐ Positive
Anterior drawer	☐ Positive	☐ Positive
Posterior drawer	☐ Positive	☐ Positive
Ligamentous laxity	☐ Positive	☐ Positive

* If laxity present, grade magnitude of laxity

- ❑ **Use uninvolved side as baseline for comparison**.
  - If a contralateral "normal" joint has less than average mobility; the impairment values(s) corresponding to the uninvolved joint can serve as a baseline and are subtracted from the calculated impairment from the involved joint. The rationale for this decision should be included in the report.
  - Enter rationale for using uninvolved side_____

Diagnosis Based Estimate (DBE) (do each side separately)

- ❑ Arthritis Impairments Based on Roentgenographically Determined Cartilage Intervals (Table 17-31 (5th ed., 544)
  - Knee – cartilage interval

Right	Left
0 mm	0 mm
1 mm	1 mm
2 mm	2 mm
3 mm	3 mm

  - Patellofemoral – cartilage interval

Right	Left
0 mm	0 mm
1 mm	1 mm
2 mm	2 mm
3 mm	3 mm

- ❑ In an individual with a history of direct trauma, a complaint of patellofemoral pain, and crepitation on physical exam. but without joint space narrowing on x-rays, a 2% whole person or 5% lower extremity impairment is given

- ❑ Patellar subluxation or dislocation with residual instability

© 2014 – 2017 Steven D. Feinberg, MD and Christopher R. Brigham, MD. All rights reserved. No part of this publication may be reproduced or transmitted by any means without written permission. Permission granted for use by WorkCompCentral.

- ❑ Patellar fracture
  - o Undisplaced, healed
  - o Articular surface displaced more than 3 mm
  - o Displaced with nonunion

- ❑ Patellectomy
  - o Partial / Total

- ❑ Meniscectomy, medial *or* lateral
  - o Partial / Total

- ❑ Meniscectomy, medial *and* lateral
  - o Partial / Total

- ❑ Cruciate *or* collateral ligament laxity
  - o Mild / / Moderate / Severe

- ❑ Cruciate *and* collateral ligament laxity
  - o Moderate / Severe

- ❑ Plateau fracture
  - o Undisplaced / Displaced: 5°-9° angulation / 10°-19° angulation 20°+ angulation

- ❑ Supracondylar or intercondylar fracture
  - o Undisplaced fracture
  - o Displaced fracture
    - ▪ Angulation: 5°-9° / 10°-19° / 20°+
    - ▪

- ❑ Total knee replacement including unicondylar replacement (see TKR Chart Table 17-35 below)
  - o Results: Good / Fair / Poor

Table 17-35 Rating Knee Replacement Results (5th ed., 549 (do each knee separately if bilateral TKR). The point total for estimating knee replacement results is calculated as the sum of the points in categories a, b, and c minus the sum of the points in categories d, e, and f.

❑ **a. Pain**	
o	None
o	Mild or occasional
▪	Stairs only
▪	Walking and stairs
o	Moderate
▪	Occasional
▪	Continual
▪	Severe
❑ **b. Range of Motion (flexion and extension added)_**	
o	Add 1 point per 5°
❑ **c. Stability** (maximum movement in any position)	
o	Anteroposterior
▪	< 5 mm
▪	5-9 mm
▪	> 9 mm
o	Mediolateral
▪	5°
▪	6°-9°
▪	10°-14°
▪	≥ 15°

© 2014 – 2017 Steven D. Feinberg, MD and Christopher R. Brigham, MD. All rights reserved. No part of this publication may be reproduced or transmitted by any means without written permission. Permission granted for use by WorkCompCentral.

❑ **d. Flexion contracture**	
	○ 5°-9°
	○ 10°-15°
	○ 16°-20°
	○ > 20°
❑ **e. Extension lag**	
	○ < 10°
	○ 10°-20°
	○ > 20°
❑ **f. Alignment**	
	○ 0°- 4°
	○ 5°-10°
	○ 11°-15°
	○ > 15° 20

- ❑ Proximal tibial osteotomy
  - ○ Good result
  - ○ Poor result (Estimate impairment according to examination and arthritic degeneration)

- ❑ Femoral shaft fracture Healed with 10°-14° angulation or malrotation 15°-19° & 20°+

- ❑ Skin Loss
  - ○ Tibial tuberosity covering that limits kneeling
  - ○ Chronic osteomyelitis with active drainage of upper tibia
  - ○ Chronic osteomyelitis with active drainage of femur

- ❑ Unilateral Thigh Muscle Atrophy ____cm (The circumference is measured 10 cm above the patella with the knee fully extended and the muscles relaxed)

© 2014 – 2017 Steven D. Feinberg, MD and Christopher R. Brigham, MD. All rights reserved. No part of this publication may be reproduced or transmitted by any means without written permission. Permission granted for use by WorkCompCentral.

Calf / Ankle / Foot Examination

(Note: Rate each extremity separately.)

ANKLE (ROM)				
☐ Normal exam	ROM	Strength	ROM	Strength
Ankle Dorsiflexion (40º)		0 1 2 3 4		0 1 2 3 4
Ankle Plantar Flexion (20º)		0 1 2 3 4		0 1 2 3 4
Ankle flexion contracture		XXXXX		XXXXX
Foot Inversion (30º)		0 1 2 3 4		0 1 2 3 4
Foot Eversion (20º)		0 1 2 3 4		0 1 2 3 4
Ankle Varus		XXXXX		XXXXX
Ankle Valgus		XXXXX		XXXXX
Ankle Internal Malrotation		XXXXX		XXXXX
Ankle External Malrotation		XXXXX		XXXXX

- ☐ Arthritis Impairments Based on Roentgenographically Determined Cartilage Intervals (Table 17-31 (5th ed., 544)

Joint	Cartilage Interval		Cartilage Interval		Cartilage Interval		Cartilage Interval	
	Right	Left	Right	Left	Right	Left	Right	Left
Ankle	3	3	2	2	1	1	0	0
Subtalar	3	3	2	2	1	1	0	0
Talonavicular	3	3	2	2	1	1	0	0
Calcaneocuboid	3	3	2	2	1	1	0	0

- ☐ Unilateral Calf Muscle Atrophy ____cm

- ☐ **Use uninvolved side as baseline for comparison**.
  - If a contralateral "normal" joint has less than average mobility; the impairment values(s) corresponding to the uninvolved joint can serve as a baseline and are subtracted from the calculated impairment from the involved joint. The rationale for this decision should be included in the report.
  - Enter rationale for using uninvolved side_____

Diagnosis Based Estimate (DBE) (do each side separately)

- ☐ Tibial shaft fracture, malalignment of
  - 10°-14° / 15°-19° / 20°+

- ☐ Ankle Ligamentous instability (based on stress x-rays‡)
  - Mild (2-3 mm excess opening) / Moderate (4-6 mm) / Severe (> 6 mm)

- ☐ Fracture Extra-articular with angulation
  - 10°-14° / 15°-19° / 20°+

- ☐ Fracture Intra-articular with displacement

- ☐ Hindfoot Fracture Extra-articular (calcaneal)
  - With varus angulation: 10°-19° / 20°+
  - With valgus angulation 10°-19° / 20°+

- ☐ Loss of tibia–os calcis angle§
  - Angle is 120°-110° / Angle is 100°-90° / Angle is less than 90°

- ❑ Intra-articular fracture with displacement
    - Subtalar bone
    - Talonavicular bone
    - Calcaneocuboid bone
- ❑ Midfoot deformity
    - Cavus
        - Mild / Moderate
    - "Rocker bottom"
        - Mild / Moderate / Severe
    - Avascular necrosis of the talus
        - Without collapse / With collapse

- ❑ Skin loss
    - Chronic osteomyelitis with active drainage of tibia
    - Heel covering that limits standing and walking time
    - Chronic osteomyelitis with active drainage of foot, requiring periodic redressing and limiting time using footwear

Toe Examination

(Note: Rate each extremity separately.)

- ❑ **Use uninvolved side as baseline for comparison**.
  - If a contralateral "normal" joint has less than average mobility; the impairment values(s) corresponding to the uninvolved joint can serve as a baseline and are subtracted from the calculated impairment from the involved joint. The rationale for this decision should be included in the report.
  - Enter rationale for using uninvolved side_____

Diagnosis Based Estimate (DBE)

- ❑ Forefoot deformity
  - Metatarsal fracture with loss of weight transfer

Right	Left
1st metatarsal	1st metatarsal
5th metatarsal	5th metatarsal
Other metatarsal	Other metatarsal

  - Metatarsal fracture with plantar angulation and metatarsalgia

Right	Left
1st metatarsal	1st metatarsal
5th metatarsal	5th metatarsal
Other metatarsal	Other metatarsal

- ❑ **Skin Loss**
  - Plantar surface, metatarsal head covering that limits standing and walking time

Right	Left
1st metatarsal	1st metatarsal
5th metatarsal	5th metatarsal

- ❑ **Muscle Weakness Great Toe**

Right	Left
0	0
1	1
2	2
3	3
4	4

- ❑ **Arthritis Impairments** Based on Roentgenographically Determined Cartilage Intervals (Table 17-31 (5th ed., 544)

Metatarsophalangeal	Cartilage Interval		Cartilage Interval		Cartilage Interval		Cartilage Interval	
	Right	Left	Right	Left	Right	Left	Right	Left
First	3	3	2	2	1	1	0	0
Second	3	3	2	2	1	1	0	0
Third	3	3	2	2	1	1	0	0
Fourth	3	3	2	2	1	1	0	0
Fifth	3	3	2	2	1	1	0	0

❑ **ROM**

TOE	**ROM**		**Ankylosis (position)**					
			Full-extension		Position-of-function		Full-flexion	
	Right	Left	Right	Left	Right	Left	Right	Left
Great Toe MTP Extension								
Great Toe IP Flexion								
MTP Extension Toe #2								
MTP Extension Toe #3								
MTP Extension Toe #4								
MTP Extension Toe #5								

Lower Extremity Peripheral Nerve Deficits

(Note: Rate each extremity separately.)

Nerves	Sensory Grade / Deficit (%)				Motor Grade / Deficit (%)				Dysesthesia Grade / Deficit (%)			
	Right		Left		Right		Left		Right		Left	
	Grade	%	Grade	%	Grade	%	Grade	%	Grade	%	Grade	%
Femoral	0 1 2 3 4 5		0 1 2 3 4 5		0 1 2 3 4 5		0 1 2 3 4 5		0 1 2 3 4 5		0 1 2 3 4 5	
Obturator	XXXXX	X	XXXXX	X	0 1 2 3 4 5		0 1 2 3 4 5		XXXXX	X	XXXXX	X
Superior gluteal	XXXXX	X	XXXXX	X	0 1 2 3 4 5		0 1 2 3 4 5		XXXXX	X	XXXXX	X
Inferior gluteal	XXXXX	X	XXXXX	X	0 1 2 3 4 5		0 1 2 3 4 5		XXXXX	X	XXXXX	X
Lateral femoral cutaneous	0 1 2 3 4 5		0 1 2 3 4 5		XXXXX	X	XXXXX	X	0 1 2 3 4 5		0 1 2 3 4 5	
Sciatic	0 1 2 3 4 5		0 1 2 3 4 5		0 1 2 3 4 5		0 1 2 3 4 5		0 1 2 3 4 5		0 1 2 3 4 5	
Common peroneal	0 1 2 3 4 5		0 1 2 3 4 5		0 1 2 3 4 5		0 1 2 3 4 5		0 1 2 3 4 5		0 1 2 3 4 5	
Superficial peroneal	0 1 2 3 4 5		0 1 2 3 4 5		XXXXX	X	XXXXX	X	0 1 2 3 4 5		0 1 2 3 4 5	
Sural	0 1 2 3 4 5		0 1 2 3 4 5		XXXXX	X	XXXXX	X	0 1 2 3 4 5		0 1 2 3 4 5	
Medial plantar	0 1 2 3 4 5		0 1 2 3 4 5		0 1 2 3 4 5		0 1 2 3 4 5		0 1 2 3 4 5		0 1 2 3 4 5	
Lateral plantar	0 1 2 3 4 5		0 1 2 3 4 5		0 1 2 3 4 5		0 1 2 3 4 5		0 1 2 3 4 5		0 1 2 3 4 5	

	Sensory Deficit or Pain Grade	Deficit (%)		Strength Grade	Deficit (%)
5	No loss of sensibility, abnormal sensation, or pain	0	**5**	Active movement against gravity with full resistance	0
4	Distorted superficial tactile sensibility (diminished light touch), with or without minimal abnormal sensations or pain, that is forgotten during activity	1 - 25	**4**	Active movement against gravity with some resistance	1 -25
3	Distorted superficial tactile sensibility (diminished light touch and two-point discrimination), with some abnormal sensations or slight pain, that interferes with some activities	26 – 60	**3**	Active movement against gravity only, without resistance	26 – 50
2	Decreased superficial cutaneous pain and tactile sensibility (decreased protective sensibility), with abnormal sensations or moderate pain, that may prevent some activities	61 – 80	**2**	Active movement with gravity eliminated	51 – 75
1	Deep cutaneous pain sensibility present; absent superficial pain and tactile sensibility (absent protective sensibility), with abnormal sensations or severe pain, that prevents most activity	81 – 99	**1**	Slight contraction and no movement	76 – 99
0	Absent sensibility, abnormal sensations, or severe pain that prevents all activity	100	**0**	No movement	100

Pelvis Examination

(Pelvis Disorders can be determined in both Chapter 17, The Lower Extremities, and in Chapter 15, The Spine. You may use either Chapter and take the higher Impairment Rating but not both.)

- ❑ Pelvic fracture (Table 17-33 (5th ed., 546)
  - Undisplaced, nonarticular, healed, without neurologic deficit or other sign
  - Displaced nonarticular fracture: — estimate by evaluating shortening and weakness
  - Acetabular fracture: estimate — according to range of motion and joint changes
  - Sacroiliac joint fracture: consider displacement
  - Ischial bursitis (weaver's bottom) requiring frequent unweighting and limiting of sitting time

- ❑ Sacroiliac Joint: Arthritis Impairments Based on Roentgenographically Determined Cartilage Intervals (Table 17-31 (5th ed., 544)
  - 3 mm (normal for the SI joint)
  - 2 mm
  - 1 mm
  - 0 mm

Chapter 18 – Pain

While the Guides emphasize objective assessment, subjective symptoms are "included" within the diagnostic criteria. There is a separate allowance for up to an additional 3% whole person permanent impairment when pain is above and beyond what would be expected for a particular condition, as explained in Chapter 18, Pain. However, non-verifiable pain conditions (such as fibromyalgia) are not ratable.

Workers compensation jurisdictions may provide specific directives on rating pain. For example, in California the Schedule For Rating Permanent Disabilities states on page 1-12:

> *3. Rating Impairment Based on Pain*
>
> Pursuant to Chapter 18 of the AMA Guides, a whole person impairment rating based on the body or organ rating system of the AMA Guides (Chapters 3 through 17) may be increased by 0% up to 3% WPI if the burden of the worker's condition has been increased by pain-related impairment in excess of the pain component already incorporated in the WPI rating in Chapters 3-17. (AMA Guides, p. 573.)
>
> A physician may perform a formal pain-related impairment assessment if deemed necessary to justify the increase of an impairment rating based on the body or organ rating system. (See Section 18.3f of the AMA Guides starting on page 575.)
>
> The maximum allowance for pain resulting from a single injury is 3% WPI regardless of the number of impairments resulting from that injury.
>
> The addition of up to 3% for pain is to be made at the whole person level. For example, if an elbow impairment were to be increased by 3% for pain, the rating for the elbow would first be converted to the whole person scale, and then increased. The resultant rating would then be adjusted for diminished future earning capacity, occupation and age.
>
> In the case of multiple impairments, the evaluating physician shall, when medically justifiable, attribute the pain in whole number increments to the appropriate impairments. The additional percentage added for pain will be applied to the respective impairments as described in the preceding paragraph.

The following criteria must be met to give an additional impairment rating for pain.

- When There Is Excess Pain in the Context of Verifiable Medical Conditions That Cause Pain
- When There Are Well-Established Pain Syndromes Without Significant, Identifiable Organ Dysfunction to Explain the Pain (i.e., headache, postherpetic neuralgia, Tic douloureux & CRPS/RSD

There is <u>no impairment rating</u> for low credibility, non-verifiable, ambiguous or controversial pain syndromes.

In California, the physician must apportion by body part (region). The Pain impairment rating can be divided by affected body part but can never be greater than 3% WPI total.

To justify an additional impairment rating for pain, the following questions must be answered.

1. Does the body system impairment rating adequately encompass the individual's pain?
    a. Yes; stop here, you cannot give an additional impairment for Pain.
    b. No; go on to the next question.

2. Does the pain related impairment increase the burden of the individual's condition slightly or severely?

   a. No; stop here, you cannot give an additional impairment for Pain.
   b. Yes; go on to the next question.

3. Is the individual credible?
   a. No; stop here, you cannot give an additional impairment for Pain.
   b. Yes; go on to the next question.

4. Do the individual's pain symptoms and/or physical findings match any known medical condition?
   a. No; stop here, you cannot give an additional impairment for Pain.
   b. Yes; go on to the next question.

5. Is the individual's pain presentation typical of the diagnosed condition?
   a. No; stop here, you cannot give an additional impairment for Pain.
   b. Yes; go on to the next question.

6. Is the diagnosed pain condition one that is widely accepted by physicians as having a well-defined pathophysiological basis?
   a. No; stop here, you cannot give an additional impairment for Pain.
   b. Yes; you may give up to an additional 3% Whole Person impairment rating by body region.

Pain Rating _____%

Index

A

Ankylosis, 23, 24, 30, 32, 34, 39, 43, 44, 45, 47, 52, 54, 62, 68
Arthritis, 37, 52, 54, 60, 62, 64, 65, 67, 70
Atrophy, 16, 20, 52, 53, 57, 64, 65
Avascular necrosis, 66
Award, 19

B

Bladder, 10, 16
Bowel, 16
Bursitis, 60, 70

C

Causation, 19, 71
  Injured, 54
  Prior, 31, 40
Cerebral, 6, 7, 8, 16, 17
Chronic pain, 6, 11, 36
Cognitive, 7
Compensation, 3
Complex Regional Pain Syndrome, 34, 36, 52, 56
  Reflex Sympathetic Dystrophy, 11, 17, 34, 36, 71
Complex Regional Pain Syndrome:, 17, 34, 36, 56, 71
Contracture, 60, 61, 62, 64, 65

D

Decision, 21, 43, 44, 45, 47, 60, 62, 65, 67
Degenerative, 25, 54
Diagnostic, 25, 51, 71
  Electrodiagnostic, 3, 20, 36, 49
Disability, 3, 31, 40, 71
Disorder, 6, 16, 25, 29, 41, 52
Dysfunction, 6, 10, 27, 36, 43, 44, 45, 49, 53, 71

E

Electrophysiologic, 36, 49
Entrapment, 34, 35
  Carpal Tunnel, 36, 49
Epicondylitis, 40
Evaluation, 3, 4, 6, 7, 17, 18, 23, 27, 28, 30, 31, 32, 33, 34, 40, 51

F

Finding
  Guarding, 20
  Spasm, 20, 26
Function, 4, 7, 10, 12, 13, 14, 27, 33, 35, 43, 44, 45, 47, 53, 56, 57, 61, 68
Functional, 31, 40, 51

H

Head, 9, 31, 39, 43, 44, 46, 48, 67
Headache, 71

I

Impairment, 4, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 22, 23, 24, 25, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 43, 44, 45, 47, 49, 51, 52, 53, 54, 55, 56, 57, 58, 60, 62, 64, 65, 67, 71, 72
  AMA Guides, 1, 3, 4, 31, 32, 36, 45, 57
Inconsistent, 23
Independent, 3
Injury, 4, 19, 22, 25, 26, 27, 40, 41, 43, 44, 45, 53, 55, 57, 58
  Accident, 4

J

Joint, 29, 31, 34, 37, 38, 39, 43, 44, 45, 47, 52, 53, 54, 55, 59, 60, 62, 65, 67, 70

K

Knee
  Cruciate, 63
  Meniscectomy, 63
  Patellofemoral, 54, 62

L

Lateral, 14, 15, 24, 37, 38, 40, 50, 63, 69
Lower, 9, 11, 13, 14, 15, 16, 21, 27, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 62, 69
Lower Extremity
  Ankle, 52, 56, 58, 65
  Calf, 52, 53, 65
  Foot, 52, 56, 57, 58, 65, 66
  Hip, 29, 52, 55, 59, 60, 61
  Knee, 52, 54, 55, 59, 62, 63, 64
  Leg, 16, 24, 52, 53, 55, 56, 58, 61
  Thigh, 52, 53, 56, 58, 64
Lumbar
  L3, 12, 26, 27
  L4, 12, 26, 27
  L5, 12, 26, 27
  S1, 12, 24, 26, 27

M

Medial, 14, 15, 40, 50, 52, 63, 69
Mood, 6, 7
Motion, 9, 18, 19, 20, 23, 25, 28, 29, 30, 31, 32, 34, 35, 37, 38, 39, 40, 41, 43, 44, 45, 47, 52, 54, 56, 60, 61, 63, 70
MRI, 25, 39
Muscle
  Quadriceps, 53
Musculoskeletal, 1, 41
  Muscle, 6, 12, 13, 15, 16, 17, 20, 26, 39, 40, 43, 44, 45, 52, 53, 56, 57, 64, 65, 67

N

Nervous, 1, 6, 9, 10, 12, 13, 16, 17, 31, 36, 51, 56, 57
Neurological, 34, 43, 44, 45
  Brain, 6, 10, 16, 56
  Motor, 8, 10, 12, 13, 14, 15, 16, 20, 27, 28, 32, 34, 35, 36, 37, 39, 40, 41, 43, 44, 45, 47, 48, 49, 50, 53, 55, 60, 62, 65, 67, 69, 70
  Paresthesias, 36, 49
  Radiculopathy, 19, 20, 25, 27
  Rating, 3, 4, 6, 7, 8, 9, 10, 11, 12, 18, 19, 22, 23, 25, 31, 32, 34, 35, 36, 37, 40, 43, 44, 45, 49, 52, 53, 54, 55, 56, 57, 58, 60, 61, 63, 71, 72
  Reflex, 16, 20, 34, 36, 52, 56
  Sensory, 8, 12, 13, 14, 15, 27, 28, 30, 32, 33, 34, 35, 36, 49, 50, 55, 69

O

Occupational, 3

P

Pain, 1, 3, 8, 10, 12, 13, 14, 15, 17, 20, 25, 26, 27, 28, 35, 36, 39, 40, 41, 48, 49, 50, 53, 54, 55, 61, 62, 63, 69, 71, 72
  Discomfort, 12, 43, 44, 45, 48, 53
Patella, 53, 64
Pelvic, 18, 70
Psychological
  Behavior, 6, 7
  Motivation, 54

R

Reflex Sympathetic Dystrophy, 34, 36, 52, 56

S

Sexual, 10, 11, 22
Side
  Left, 11, 12, 14, 15, 24, 27, 43, 44, 45, 47, 48, 50, 58, 59, 60, 62, 65, 67, 68
  Right, 11, 12, 14, 15, 24, 27, 43, 44, 45, 47, 48, 50, 58, 59, 60, 62, 65, 67, 68
Sign, 29, 70
Sleep, 6, 7
Specificity, 57
Spine
  Cauda equina, 22
  Cervical, 9, 18, 20, 21, 22, 23, 26, 28, 60
  Lumbar, 18, 20, 21, 22, 23, 24, 26, 28, 52, 53
  Sacral, 18, 24
  Sacroiliac, 29, 70
  Sciatica, 15, 69
  Spondylolisthesis, 25, 26
  Thoracic, 14, 18, 20, 21, 22, 23, 26, 28, 50
Stable, 4, 9, 25, 26, 63
Studies
  MRI, 25, 39
  X-Ray, 52, 53, 54, 62, 65
Subjective, 40, 53, 71
Surgery
  Arthroplasty, 37, 39, 43, 44, 46, 48, 60
  Arthroscopy, 39
  Fusion, 19, 26, 39
  Resection, 37, 39, 43, 44, 46
Syndrome, 16, 22, 36, 49

T

Tendonitis, 37, 40
Timeframe
  Chronic, 6, 8, 11, 17, 36, 55, 60, 64, 66
Treatment, 4, 21
  Operation, 36, 39, 40, 41
  Resection, 37, 39, 43, 44, 46

U

Upper, 6, 9, 10, 11, 12, 13, 14, 15, 16, 22, 27, 30, 31, 32, 34, 35, 36, 37, 38, 39, 41, 42, 43, 49, 50, 55, 64
Upper Extremity
  Arm, 14, 50
  Digit, 32, 33, 34, 37, 38, 47
  Elbow, 14, 32, 37, 38, 40, 41, 44, 50
  Finger, 14, 33, 34, 39, 47, 48, 50
  Hand, 23, 30, 31, 32, 34, 37, 38, 40, 47
  Shoulder, 9, 32, 38, 39, 40, 41, 43
  Thumb, 14, 33, 34, 40, 48, 50
  Wrist, 32, 37, 38, 39, 45, 46, 48

V

Validity, 24

W

Weight, 67
Work, 30

Diagnosing and Treating Complex Regional Pain Syndrome

Steven D Feinberg MD, Rachel A Feinberg DPT, Steven Stanos DO, Heather Pourpore- King, PhD, William G Brose, MD

INTRODUCTION

Complex regional pain syndrome (CRPS) is defined as a disorder of regions of the body characterized by pain that is disproportionate in time or degree to the usual course of any known trauma or other lesion. The pain is not restricted to a specific nerve territory or dermatome and usually has a distal predominance of abnormal sensory, motor, sudomotor, vasomotor, and/or trophic findings. The syndrome shows variable progression over time.

CRPS DEFINITION

Complex regional pain syndrome (CRPS) is a chronic pain condition characterized by spontaneous and evoked regional pain, usually beginning in a distal extremity that is disproportionate in magnitude or duration to the typical course of pain after similar tissue trauma. CRPS is distinguished from other chronic pain conditions by the presence of signs indicating prominent autonomic and inflammatory changes in the region of pain.

HISTORY OF THE NAME CRPS

CRPS is often a disputed diagnosis. When considering sources of reliable opinion on the issue of chronic pain, the recognized scientific body is the International Association for the Study of Pain (IASP). IASP published their first definition of standardized diagnostic criteria for CRPS in 1994.1 At that time a history of precipitating injury, the presence of burning pain in a regional distribution involving the primary injury site and the presence of signs including vasomotor (temperature, color, edema), sudomotor (sweating), pilomotor (hair growth) and/or trophic skin changes present during exam confirmed the diagnosis. These criteria were loosened subsequently by the IASP to incorporate patients with variability in signs by allowing a history of the signs if they were not present at the time of exam. The resulting increase in sensitivity, while desirable, was outweighed by a loss of specificity and yet further revision by multiple authors has been proposed. Continued research and information gains since that time have led to continued developments in diagnostic criteria for CRPS.

Returning to the authority of the IASP a multi-author publication dedicated to CRPS has been released. The peer review literature regarding diagnostic criteria for CRPS includes a 2013 Pain Medicine article by Harden, Oaklander, Burton, et al., which describes “the new IASP criteria”. This new criteria was approved and codified by the IASP committee on taxonomy, and is based on the Budapest Criteria. The article describes the empirical/statistical methods for validating diagnostic criteria for CRPS, discusses the results of validation studies to date and encapsulates the latest international consensus group’s action in

Budapest, Hungary, which approved and codified empirically derived criteria as a revision of the Orlando consensus group criteria. Figure 1 details the revised complex regional pain syndrome by the Budapest consensus group (accepted and codified by the Committee for Classification of Chronic Pain of the International Association for the Study of Pain) .

Table 1.

General Features of the Syndrome
CRPS is a syndrome characterized by a continuing (spontaneous and/or evoked) regional pain that is seemingly disproportionate in time or degree to the usual course of any known trauma or other lesion. The pain is regional (not in a specific nerve territory or dermatome) and usually has a distal predominance of abnormal sensory, motor, sudomotor, vasomotor, and /or trophic findings. The syndrome shows variable progression over time. There are two versions of the proposed diagnostic criteria: a clinical version meant to maximize diagnostic sensitivity with adequate specificity, and a research version meant to more equally balance optimal sensitivity and specificity. These proposed criteria are described in [the tables below]. Reproduced Table 1 from Harden RN, Oaklander AL, Burton AW, et al. (Pain Med 2013; 14(2): 180-229). 2

General Features of the Syndrome
CRPS is a syndrome characterized by a continuing (spontaneous and/or evoked) regional pain that is seemingly disproportionate in time or degree to the usual course of any known trauma or other lesion. The pain is regional (not in a specific nerve territory or dermatome) and usually has a distal predominance of abnormal sensory, motor, sudomotor, vasomotor, and /or trophic findings. The syndrome shows variable progression over time.

There are two versions of the proposed diagnostic criteria: a clinical version meant to maximize diagnostic sensitivity with adequate specificity, and a research version meant to more equally balance optimal sensitivity and specificity. These proposed clinical criteria are described below.

Table 2.
Clinical diagnostic criteria for complex regional pain syndrome

1. Continuing pain, which is disproportionate to any inciting event
2. Must report at least one symptom in *three* of the *four* following categories: Sensory: Reports of hyperalgesia and/or allodynia
3. Vasomotor: Reports of temperature asymmetry and/or skin color asymmetry Sudomotor/Edema: Reports of edema and/or sweating changes and/or sweating asymmetry Motor/Trophic: Reports of decreased range of motion and/or motor dysfunction (weakness, tremor, dystonia) and/or trophic changes (hair, nail, skin)
4. Must display at least *one* sign* at time of evaluation in *two* or *more* of the following

categories Sensory: Evidence of hyperalgesia (to pinprick) and/or allodynia (to light touch and/or deep somatic pressure and/or joint movement)

5. Vasomotor: Evidence of temperature asymmetry and/or skin color changes and/or asymmetry Sudomotor/Edema: Evidence of edema and/or seating changes and/or sweating asymmetry Motor/Trophic: Evidence of decreased range of motion and/or motor dysfunction (weakness, tremor dystonia) and/or trophic changes (hair, nail, skin)
6. There is no other diagnosis that better explains the signs and symptoms

*A sign is counted only if it is observed at time of diagnosis.

Reproduced Table 2 from Harden RN, Oaklander AL, Burton AW, et al. (Pain Med 2013; 14(2): 180-229). 2

Table 3.
Subtypes of complex regional pain syndrome (CRPS)

- CRPS I (old name: Reflex Sympathetic Dystrophy
- CRPS II (old name: Causalgia): defined earlier with electrodiagnostic or other definitive evidence of a major nerve lesion
- CRPS-NOS* (not otherwise specified): partially meets CRPS criteria; not better explained by any other condition.

*This subtype was added to capture any patients previously diagnosed with CRPS who now did not meet criteria.

Reproduced Table 3 from Harden RN, Oaklander AL, Burton AW, et al. (Pain Med 2013; 14(2): 180-229). 2

A test of these proposed criteria regarding ability to determine CRPS conditions from non-CRPS neuropathic pain groups indicates that the modifications from the previous IASP 1994 diagnostic criteria may increase diagnostic accuracy. Results indicate that applying a decision rule requiring *"two of four sign* categories and *three of symptom* categories to be positive…resulted in a sensitivity of 0.85 and a specificity of 0.69" for clinical diagnosis. (Harden, 2013)

The Committee for Classification of Chronic Pain of the IASP has accepted and codified the "Budapest" criteria for clinical and research diagnosis as described in Figure 3 above. In response to the consensus group's concern with the approximately 15% of patients previously diagnosed with CRPS, a third diagnostic subtype called CRPS-not otherwise specified was created that would capture those patients who did not meet the new clinical criteria but whose signs and symptoms could not be better elucidated by any other diagnosis. This subtype was a practical compromise and may not be necessary in the long term, as research provides specific information about mechanism(s) and thus diagnostic techniques.

In discussion of laboratory tests for CRPS (IASP 2005) it is recommended that to establish a diagnosis "a detailed case history and examination are mandatory and should be documented carefully. Tests to verify the clinical findings, including dynamic temperature evaluation and standardized functional tests, should be applied to enhance the accuracy of clinical diagnosis.

The problem of distinguishing CRPS type I vs type II is complicated clinically by the fact that the definitive tests of nerve damage, such as EMG, are considered unnecessarily painful (even cruel) to CRPS patients. Small nerve "dropout" has been demonstrated in the skin of the affected part in most subjects studied, but there is no guidance as to whether this constitutes "major" or "minor nerve damage"3. Moreover, these diagnostic distinctions may not have clinical significance or affect the specific therapeutic method used. Despite these limitations, the distinction between these two existing CRPS subtypes was preserved by the Budapest group, and the eventual re- evaluation of this matter was postponed until more data pertaining to its clinical importance becomes available.

Recognizing that the current understanding of the pathophysiology of the syndrome is incomplete, the statistical method described remains one of the few existing objective techniques for validating the IASP/CRPS criteria and indicating the direction of the modifications necessary to optimize their clinical and research value, we would promote that reliance on the newest and most evolved IASP criteria would be most appropriate.

CAUSATION OF CRPS:

In looking to the specific causation of the regional pain, the determination of a causative triggering event is often relatively simple. While there are reports of very delayed onset and much more cryptogenic causation most cases present within days to weeks of an inciting trauma with the hallmark pain and hypersensitivity. However, the causation for the subsequent CRPS is far more complicated than a simple coincident trigger.

Reviewing the literature on the prevalence of CRPS in the general population there is published literature that describes an incidence rate of 5.46 /100,000 and a prevalence rate of 20.57 for a population base of >100,000 in a single County in Minnesota. (Sandroni et al. 2003) and 26.2/100,000 for larger population based incidence estimate from 600,000 patients reviewed in the Netherlands. (De Ms et al. 2007).

The presentation with an evolution of pain and other symptoms outside of an originally injured body part is reported in absence of subsequent trauma and when re-injury of the same or alternative body part occurs. In CRPS that has been reported with patients who have concurrent and recurrent disease there is published research which has been reviewed in the more distant literature (Pain 1966, March 64(3) 463-6) where reflex sympathetic dystrophy was found to recur in the same and/or another limb in a minority of 1,183 patients, 34 of whom developed a recurrence of previous complex regional pain syndrome in the same limb and 76% who presented with recurrence in a different limb. These observations have fueled the investigation into disease rather than injury related contributions of causation to CRPS.

In a relatively recent publication of One hundred and eighty-five CRPS patients were retrospectively evaluated. Eighty-nine patients exhibited CRPS in multiple limbs. In 72 patients spread from a first to a second limb occurred showing a contralateral pattern in 49%, ipsilateral pattern in 30% and diagonal pattern in 14%. A trauma preceded the onset in the second limb in 37, 44 and 91%, respectively. (vanRijn, M et al, 2011) These authors argue that the compelling relationship between spreading and recurrence argue a supraspinal mechanism which would be clearly established as pre-existing disease related factor in the patient with expression dependent upon as yet incompletely understood factors.

Looking to the influence of heritability and genetics as well as prior disease related contributions it is difficult to argue that a patient did not have disease related risk. Spontaneous presentation of CRPS is clearly documented in the literature. (deRooij et al. 2010) Many authors describe this as unusual suggesting that traumatic triggering of such CRPS is required. But the data to support this empiric observation does not reach the level of strong medical evidence.

Satteson E et. al. set out to establish the epidemiologic basis for this question in their 2017 study. Ninety-three patients had a diagnosis of primary CRPS. Nineteen (20.4%) developed CRPS in one or more additional extremity compared to the incidence of 23.4 per 100,000 (0.0234%) in the literature (odds ratio 1069.6, $p<0.0001$, 95% CI 562.0-2035.7). Twenty patients had a documented secondary injury or surgery in a second extremity. Fifteen (75%) developed secondary CRPS compared to a CRPS incidence rate of 6.4% following distal radius fracture, as determined by literature review (odds ratio 11.7, $p<0.001$, 95% CI 5.9-23.2). Analysis of this data argues that, “an odds ratio of over 1000 when comparing the reported population incidence of CRPS to the rate of secondary CRPS documented in this study strongly suggests that patients with a history of CRPS may be at considerable risk of developing secondary CRPS. This finding is further supported by the more than 11-fold increased rate of secondary CRPS following a secondary inciting event seen in this study when compared to the reported rates of CRPS following distal radius fracture.” While these data are retrospective and the issue warrants further study it clearly supports a general predisposition for the development of secondary CRPS in those with a history with or without subsequent trauma. From this data the question as to whether CRPS is behaving more like a disease than like a response to injury is developed.

Adding to the evolution of CRPS as a disease rather than a consequence to injury a recent analysis of risk factors for post treatment CRPS in a Danish population (Petersen et al. 2018). Dr’s Petersen and colleagues describe, “Female gender, surgical treatment, and treatment to the upper

limb were risk factors. Elective surgery accounted for a large number of post- treatment CRPS patients. In CTS patients developing CRPS, normal neurophysiological examination findings were common, and it could be suspected that these patients were suffering from an pre-clinical stage of CRPS, not CTS.”

This misdiagnosis of pre-clincial CRPS rather than CTS in the presence of normal neurophysiologic examination would add further creedence to the disease specific rather than injury specific causation of CRPS in patients presenting with spreading or recurring disease. These authors go on to describe the correlation between other autoimmune disease states and CRPS as an explanation for the evolution of

symptoms. “A preclinical stage of disease has been described in autoimmune diseases such as rheumatoid arthritis, type 1 diabetes, and systemic lupus erythematosus among others, and typically there is the presence of autoantibodies related to the diseases years prior to the diagnosis. These autoimmune conditions exhibit 3 distinct phases during their development. In the initial phase, patients have a genetic risk for development of disease, but show no active autoimmunity or inflammation. Phase 2 is the preclinical stage, with presence of disease‐specific autoantibodies and other immunologic factors, but no apparent disease. Phase 3, clinically apparent disease, is characterized by development of clinical symptoms due to genetic, environmental, and/or endogenous factors. In the same manner, an autoimmune pathogenesis has been suggested in the development of CRPS. If a preclinical phase of CRPS and possible autoantibodies could be identified, it might lead to a better understanding of the disease.”

Early efforts at identifying the specific antibodies has been mixed. (Dirckx M et.al. 2015)
In performing Screening for antinuclear antibodies (ANA) to identify systemic autoimmune disease. Additionally, antineuronal antibodies are autoantibodies directed against antigens in the central and/or peripheral nervous system. In their work twenty seven (33%) of the 82 CRPS patients for whom serum was available showed a positive ANA test. This prevalence is significantly higher than in the general population. But only six patients (7.3%) showed a positive result for typical antineuronal antibodies. This proportion, however, does not deviate from that in the general population. This clearly indicates that the usual antineuronal antibodies do not appear to mediate the CRPS. As this research continues further elucidation of the autoimmune role in CRPS will be revealed but the data present today does help to describe longstanding and disease related risk factors that put the simplistic idea of injury triggered mechanism of action into serious question. While at present there is a currently held belief that he temporal connection between injury and CRPS is a causal one this belief is not established with clear pathophysiology. And furthermore as more clues to the underlying pathophysiology are revealed the more question there is about the injury as a primary etiology.

Of these, gender with a dramatic female predominance over men (3:1) (de Mos et al. 2007) and HLA haplotypes (Ref) are reported to confirm susceptibility for CRPS. These influences then the reporting of other authors who describe recurring CRPS manifestation in those with confirmed disease.. These alone, however, do not satisfy the mechanism of the disease. Rather, it is perceived that there is more complex causation that has been incompletely elucidated.

The finding of recurrent and spreading CRPS in other sufferers has lead to the speculation that brain stem activity rather than a triggering mechanism actual confers the risk of disease spread. (Drummond P et al, 2018) Drummond and colleagues have studied over 100 patients with CRPS describing, “These findings suggest that heightened excitability of nociceptive pathways in CRPS spreads to hemisensory convergence points in the brainstem or higher brain centers, possibly in association with compromised pain controls. The similarity of symptom profiles in chronic CRPS I and II implies shared mechanisms despite different triggers.”

Onset of Symptoms:

From a specific insult, typical symptoms occur within the first few weeks of initiating event but certainly during 3-4 months after the initiating insult. Variable and evolving symptoms described above may occur later either due to natural evolution or though related to treatment for an original injury including surgery

or additional insult secondary to compensatory trauma or misuse. Sometimes the diagnosis is made late because the symptoms were not recognized earlier by the treating physician(s).

CRPS Types:

"Warm CRPS" is associated with a warm, red, and edematous extremity, whereas "cold CRPS" presents with a cold, dusky, sweaty extremity. Acute CRPS is more often associated with a warm CRPS presentation, whereas chronic CRPS is more often characterized by a cold CRPS presentation.

Prognosis:

For acute CRPS, 74% of diagnosed CRPS cases resolved with relatively conservative care. In chronic cases, about 3300 patient's report resolution, 16% report progressive deterioration and the remaining 54% reports stable symptoms.

CRPS PREVENTION

While supplementation with vitamin C following fracture or surgery was reported to reduce the risk of developing CRPS. Subsequent detailed review of multi-author works over the last 5 years has failed to demonstrated a predictable effect.(Keefe, 2019)

TREATMENT

The selection of a treatment approach depends on the severity of symptoms and the degree of disability. Of paramount importance is that a successful treatment outcome for CRPS depends on a coordinated functional restoration interdisciplinary approach.

Building a therapeutic alliance between the patient and the treatment team is of critical importance.

Since pain and limb dysfunction are the major early complaints, pain control, education, physical rehabilitation and emotional stabilization are the main treatment objectives. Coexisting problems such as depression, sleep disturbance, anxiety, fear of reinjury, and generalized physical deconditioning should be evaluated and treated.

Therapeutic approaches include physical rehabilitation (i.e., physical and occupational therapy), psychological care including cognitive behavioral therapy (CBT), relaxation training, medication management, and a variety of techniques that, directly or indirectly, are aimed at blocking or interrupting chronic changes to an overactive nervous system (i.e., sensitization process) and in some cases decreasing sympathetic hyperactivity. Patients are encouraged to use the affected limb. Treatment is more successful if started early rather than later in the disease process.

While physicians and therapists have many tools in their treatment armamentarium, the single most important treatment for these patients is education and learning how to manage their chronic pain condition. Patients who can learn about the cause and meaning of their pain are able to make better choices regarding the use of their extremity which may improve the natural history of the disease process.

Virtually all patients who develop pain with CRPS begin their experience with an acute injury of some type that typically causes a nociceptive pain. The learned association between the pain and the injury is an important reinforcement of early belief systems that whatever hurts is due to harmful injury. Recognizing that CRPS develops from these nociceptive roots and harmful meaning patients almost uniformly attribute continuing pain after the usual time of tissue healing to a continued noxious source. Assisting patients to understand that while the injury was indeed harmful that the subsequent chronic pain state of CRPs that has emerged is not associated with ongoing actual or potential injury is critical to the recovery and rehabilitation process.

Most patients will not develop this understanding independently. They need to be taught and often need to borrow confidence from their teachers to proceed with a rehabilitative course against their intuition to regain control of the diseased region of the body.

The goals of medical treatment of CRPS will always be the facilitation of this learning and rehabilitation. Moreover, if the medical treatment is pursued without this teaching, the reinforcement of an even more refractory pain condition will ensue. Without being educated that their pain is due to abnormal function of the nervous system rather than ongoing tissue harm patients with CRPS will simply develop a belief that the persistent pain is ongoing evidence of tissue damage that cannot be cured or relieved and that they themselves cannot influence. These patients become CRPS sufferers with increasing dependence on medications, interventions and the providers who deliver those services. The search for a new and better pain reliever will be pursued to the detriment of their own health, relationships and life.

Medication Management

Medications may include treatment with oral, transdermal, topical agents, drug delivery patches, parenteral infusions, injections, and implanted devices. This may include steroids, anti-inflammatories, antidepressants, vasodilators, anti-spasm medications, and anticonvulsants type medications. Membrane stabilizers or medications that suppress sensitization of the nervous system and/or sympathetic activity including alpha 1 adrenoceptor antagonists. Opioids and viertually every known or reported analgesic has been employed in the search of a predictable pain reliever but to no avail. No single oral medication or injection is specifically approved by the FDA (Food and Drug Administration) for CRPS. There is no curative therapy and no single medication or combination of medications is proven to modify the disease (Duong, 2018) Medications should be functionally oriented to facilitate recovery and manage the impact of the pain.

A group of less conventional analgesics are discussed here to provide information but again these have no clearly established role. Bisphosphonates have been found effective for reducing pain in patients with early CRPS who have abnormal uptake on bone scan. (Massimo, et al, 2013) Publiahsed results of a trial enrolling 82 subjects with CRPS of the hand or foot who had a disease duration of four months or less and abnormal uptake in early and late phases of three-phase bone scintigraphy. Serious adverse effects of bisphosphonates include esophageal ulceration with oral use and osteonecrosis of the jaw non of which were reported.

Calcitonin has been proposed due to a putative role in bone mineralization. The mechanism responsible for analgesia is uncertain. There is conflicting evidence regarding the benefit for CRPS. The optimal dose and duration of is uncertain. A dose of 300 international units daily was used in the one positive randomized trial. (Golbeltet, 1992) If pain and/or function are improved with use, it can be continued, tapered, and discontinued as tolerated.

There has been considerable interest in N-methyl-D-aspartate (NMDA) blockers and particularly the anesthetic ketamine. The NMDA receptor complex may play an important role in the development of both peripheral and central nervous system hyperactivity. By blocking and/or desensitizing the receptor may help to decrease pain. NMDA receptor antagonists include dextromethorphan, memantine, and ketamine. ketamine infusion was compared with placebo in 60 patients with type I CRPS (Sigtermans, 2009) Patients assigned to five-day ketamine infusions had a statistically significant decline in pain scores but no sustained benefit was reported. Frequent side effects of ketamine in this trial included psychomimetic symptoms (eg, hallucinations, delirium), nausea, and vomiting.

Interventional Procedures

Usual procedures employed in diagnosis and treatment can include: stellate ganglion or thoracic sympathetic block; lumbar sympathetic block; intravenous regional sympathectomy; phentolamine infusion and intravenous lidocaine infusion. Sympathetic blockade may provide a useful adjunct to aggressive medical therapy, but it should not be considered as a sensitive or specific test for the diagnosis.

Each of these procedures is designed to alter the function of the nervous system temporarily. During this temporary alteration, patients are evaluated to see if pain, function and evidence of sympathetic dysfunction have been positively influenced. Frequently, patients will receive several of the above procedures as a trial to determine which, if any of them should be integrated into the multidisciplinary management plan.

The goal of each of these techniques is to provide a temporary but effective pause in neuronal hyperactivity, a contributor to the pain, thereby allowing the rehabilitative care to restore more normal healing and function to the affected tissues. If following a trial of the different procedures mentioned above, the treating physician feels that a significant benefit has been gained, then repeated administration of these procedures over a period of six to twelve weeks (and in some cases longer) is viewed as appropriate.

The desired outcome from each procedure should be as long a period of effective decreased pain and improved functional capacity as possible. The majority of practitioners recognizes a response profile of several days to a week as being optimal for the initial intensive treatment and would be willing to repeat these blocks on a weekly or perhaps twice weekly basis in order to facilitate the rehabilitation process. One should recognize, however, that sympathetic blocks on their own infrequently, if ever, “cure” patients. These blocks should be viewed as any other medical treatment; an effective form of temporary palliation and a useful tool to help the patient with the remainder of the multidisciplinary management provided by physical rehabilitation and psychological services.

Patients may have a tendency to view the medical components of treatment as curative alone and it is the job of the therapy team to reinforce the rehabilitative and psychological components as being critical, while the medical interventions are primarily palliative. This continued de-emphasis of the medical components of treatment will help to prevent patients from viewing the locus of control with regards to their ongoing improvement in this disease as being outside of themselves or within physician control. In other words, the patient should be responsible and in charge of their rehabilitation and pain management.

More aggressive medical strategies employed include the use of selective spinal analgesics and spinal cord or peripheral nerve stimulation.

Some physicians recommend selective intrathecal spinal analgesia via an implanted pump incorporates the delivery of extremely potent and selective analgesic medications to sites of action near the spinal cord and nerve roots, generally bypassing the brain and higher central nervous system. This selective delivery by intrathecal infusion pump potentially avoids many of the problems seen with systemic (oral or intravenous) administration of analgesics and may provide partial pain relief. My experience with implanted intrathecal drug therapy for complex regional pain syndrome has not been positive that I personally do not recommend it.

In addition to selective intrathecal spinal analgesics, there have been documented cases of clear beneficial effects from spinal cord stimulation (SCS) wherein small electrodes are placed in the epidural space outside the spinal cord to deliver microelectrical currents to the descending portions of the spinal cord. These currents induce activity in the patient's own intrinsic pain modulating system.

Both selective spinal analgesics via intrathecal infusion pump and spinal cord stimulation are potential treatments, but because of the associated risks and costs, should be considered only after conservative efforts at aggressive conservative management mentioned above have failed. As noted, my experience with intrathecal infusion pumps has not been positive and while the use of spinal cord stimulation is potentially beneficial, its use is limited and only for selected cases and should be part of an overall multidisciplinary functional restoration type of treatment program.

Before permanent implantation, a trial period is warranted. Permanent implantation should depend on objective evidence of benefit including improvement in functional capacity and in the overall rehabilitation program in order to justify the risk and expense associated with chronic implantation. Additionally, these modalities should be utilized only by physicians experienced with these techniques in a multidisciplinary setting. Patients who receive these therapies should be selected by careful medical and psychological screening.

All medical therapies whether conservative or sophisticated spinal cord stimulation or implanted drug delivery systems need to be presented to the patient and reinforced as approaches that are used to provide a "window of opportunity" for functional restoration therapy where they can be aggressively and intensively rehabilitated.

Education

An education program is important for the patient so they can understand what has happened to them and

what they can do about it. Since treatment often involves a 24-hour a day, seven days a week effort, the patient must be empowered to be able to provide self-treatment and gain confidence.

Education is one of the most important parts of any type of treatment of CRPS. The information on the internet can be beneficial, but can also be frightening for patients as they read horror stories or see pictures of swollen limbs. Unfortunately, patients often have also either been told incorrect information from other sources or have misinterpreted information from a past provider. The patient may have been told to not to use the limb if it was painful or that the symptoms are "all in their head."

Education on diagnosis, prognosis and expectations of treatment must begin as soon as possible. Many patients do not truly understand the diagnosis of CRPS and more importantly how it relates to their personal experience. This education includes an easy to understand discussion of the changes in the nervous system and how that explains the typical symptoms of CRPS. As the patient is provided education about his or her symptoms, it is important that they receive confirmation that their symptoms are expected to be variable but are "normal" in the sense that they are part and parcel of how CRPS presents.

The patient should be made aware of the extent of effort and hard work that is involved in obtaining a good outcome and successful treatment. The patient must understand that treatment will be painful but that they will receive help with managing symptoms and that the outcome is significant improvement in functional use of the affected extremity. Many patients believe that the focus of treatment is to reduce their pain level. The impression is that if the pain level decreases, then the functional increases will soon follow. However, this is often not the case with CRPS. Unfortunately, pain levels typically increase throughout treatment as the patient pushes their current level of function. Therefore, education regarding goals based on function, not pain changes, is important to assist the individual in feeling successful and attaining their goals. The patient must also be an active participant who takes control of their treatment and participates in goal setting. If the patient is unable or unwilling to participate completely with treatment, results are minimal. Goal setting can be directed towards functional activities that are important to the individual to assist them in becoming engaged in treatment.

Education must also include possible negative consequences of not using the affected extremity. These include spreading of CRPS proximally or to the contralateral or other limbs. Symptom spread may also be due to compensatory movement and overuse and development of secondary pain sites from guarding and abnormal movement with a worsening of symptoms.

Physical Rehabilitation

Although the diagnosis of CRPS is becoming increasingly recognized in the medical community, education on diagnosis, and especially treatment, is still limited in terms of physical & functional restoration for physical and occupational therapists.

The ultimate goal of therapy is to reduce pain and improve function of the patient's affected area. Physical rehabilitation can be detrimental if not applied appropriately.

Many therapists still limit treatment from concerns regarding causing further injury to the affected

extremity due to the often reported high levels of pain, color and swelling changes with use and movement.

Throughout the CRPS literature, there are recommendations for rehabilitation and recent literature is bringing brain re-training techniques more into mainstream treatment. However, most research on CRPS treatment including physiotherapy treatments were varied between studies and were often provided in combination with medical management (Daly and Bialocerkowski 2009). The available medical literature does not allow for an assessment of the effectiveness of specific treatments. Therefore, few of the therapy treatments have evidence-based research to support or refute their effectiveness.

Research suggests that working through the pain with an aggressive physiotherapy program often leads to far better results than a more cautious approach (Ek et al. 2009). However, from a clinical perspective, it is important to determine the most appropriate approach for each individual patient and find the best individual balance of each of the rehabilitation treatments.

This section discusses a variety of treatment modalities used in physical and occupational therapy. Treatment modalities can be passive or active, but overall, the direction of treatment should be toward individual self-management.

The evaluation starts with an assessment of appearance along with active and passive range of motion and measurement of swelling. A related soft tissues assessment, including that for myofascial trigger points, should also be included. The therapist also evaluates strength, sensation and pain response, coordination, dexterity, temperature changes and functional use ability.

Passive treatments include splinting, paraffin, massage, electrical stimulation, ultrasound, contrast baths and edema control treatments.

Active treatments include various desensitization techniques, active exercise or functional use, stress loading (scrubbing and carrying), normalizing compensatory movement patterns, and flare management techniques including pacing, cognitive behavioral therapy and relaxation techniques.

Active treatments are essential in all cases and the benefits of passive treatments are person specific. A functional restoration program (FRP) combines these active treatments with psychological care and medical/medication management.

Treatment is directed toward pain relief, desensitization, edema reduction, normalization of tone and sensation, proper posturing and positioning, range of motion and stretching to maintain and improve flexibility, stress loading, and strengthening. In more severe cases, splinting and bracing may be utilized. Prolonged splinting or bracing should be avoided and may contribute to development of other compensatory problems.

Treatment is a team effort with adequate analgesia provided. Treatment in severe cases usually starts slowly with edema relieving techniques, gentle desensitization and the use of passive modalities followed by gentle flexibility and strengthening exercises.

Desensitization therapy can be a critical component to a successful rehabilitation plan. Desensitization techniques are aimed at normalizing sensation and consists of progressive stimulation with soft materials increasing to rougher textures as tolerated over time. It can include light touch progressing to deep pressure. Desensitization approaches may also include graded increases in carrying light objects for short periods of time, a number of times per day, or scrubbing or loading the affected limb on a daily basis. Vibration at different frequencies can also be used to assist in desensitizing the affected extremity. Contrasts baths (switching back and forth from hot to cold water) is utilized and leads to increased hot and cold tolerance. A desensitization program is thought to reestablish normal sensory and motor integration and complex maladaptive connections between the brain and the affected body part.

Edema is managed by the use of specialized garments or wrapping techniques and therapy is directed towards manual edema mobilization techniques and education so the individual can practice edema reducing therapies at home and not in formal treatment.

Treatment may include stress loading (distraction and compression), elevation and active range of motion exercises.

Postural training and positioning are important and can minimize protective guarding, promote balance and facilitate improved functional use of the extremity.

As the patient improves, treatment consists of more aggressive range-of-motion exercises, stress loading, strengthening, and general aerobic conditioning.

While the importance of maximizing functional use of the affected limb cannot be overstated, it is just as important to realize that some individuals with residual symptoms of CRPS, will need to learn proper pacing of activities and avoidance of pain inciting events. The individual will need to learn skills to perform some functions in an alternate and less symptom provoking manner. Additional skills such as diaphragmatic breathing, relaxation techniques, imagery, and special mind-body exercises such as Tai Chi or Feldenkrais may be beneficial.

Normalization of use and functional rehabilitation comprise the final stages of therapy. This stage may include work hardening, vocational rehabilitation or retraining, and workplace modification. Patients may need weeks to several months to progress through this stage.

Patients need to understand their disease, which allows them to become active, educated participants in their treatment. The “locus of control” is patient-centered. Rehabilitation is a full-time effort. Those in the early stages of the condition typically respond better to vigorous therapy than those with more advanced cases.

Specific physical and occupational therapy approaches include: stretching, mobilization, active and passive exercises, aquatic therapy, strengthening, transcutaneous nerve stimulation (TENS), electrical stimulation, edema control (including massage, gradient pumps and compressive stockings or gloves), splinting, modalities (deep heat, such as ultrasound), thermotherapy (heat or ice packs) and a program of tactile desensitization (whirlpool, contrast baths, massage, gentle tapping and other sources of stimulation). Patients are encouraged to exercise and use the affected extremity. A home treatment

program is essential, since even several hours a day with trained therapists may not be sufficient.

Fear & Avoidance

Fear of re-injury, fear of movement (kinesiophobia) and avoidance due to increased pain levels is a common barrier in returning to normal life, work or recreational activities after an injury. Research suggests that an individual's pain related fear and avoidance are important factors in determining activity level 6-12 months after an injury.

With CRPS, the patient and often the provider do not understand the heightened pain response and the CRPS diagnosis may not be immediately recognized. The unrelenting pain of CRPS increases underlying fear and worry of a more malicious, yet undiagnosed, disease process. Driven by fear of further pain or the threat of further damage, many people with CRPS increasingly restrict activities and begin to exhibit a maladaptive avoidance response.

Fear, avoidance and the effect that this has on recovery continues to be widely researched. There are a few measures that can provide the clinician with the knowledge that fear or avoidance may be a barrier to recovery. These measures include the Tampa Scale of Kinesiophobia (TSK), the Fear Avoidance Beliefs Questionnaires (FABQ), the Pictorial Fear of Activities Scale-Cervical (PFActS-C) and the photograph series of Daily Activities for the upper or lower extremities (PHODA-UE/LE). However, there is limited evidence-based or clinical based information that suggests how to treat this barrier from a physical therapy perspective.

When treating a person with CRPS, the different aspects of fear and avoidance must first be determined. In many of the questionnaires and in the research, fear of re-injury, fear of increased pain level and avoidance due to other factors are grouped together, when in fact they are quite different. The clinician should spend the time to understand the concerns of the patient so that education can be directed towards addressing the aspect of fear that is limiting rehabilitation and recovery.

In an acute pain model, pain activates receptors at the site of injury which stimulate systems in the brain and spinal cord that signal us to avoid a painful activity and prevent additional damage as the body heals itself. This is an important and necessary process in an acute injury. However, in chronic diseases, this avoidance is not beneficial and can prevent recovery. A fear of re-injury implies the belief that pain equals damage and therefore should be avoided at all costs. When the diagnosis of CRPS is not quickly made, the patient can be left with many questions about why they are having so much pain. This lack of education can lead to an increased fear of re-injury. For patients that do have an underlying nerve disorder, it can be confusing as to how to differentiate pain that could be damaging and pain that is likely not damaging.

Unfortunately, this fear can be further propagated by healthcare providers as they instruct the patient to avoid painful movements. Treatment for over-coming fear of re-injury first involves the proper diagnosis and then to determination of the patient’s current beliefs on what processes are happening in their body. Education consists of what the diagnosis of CRPS is and why pain does not equal damage. Further education includes understanding the difference between pain and damage due to hypersensitivity and changes in the spinal cord and brain and the physiology behind why movement is not harmful. Much of

this education can be done by a physical therapist, but due to beliefs in our society about the medical field, often a medical doctor must be the one to convince the patient that they are safe to move the affected limb.

A fear of increased pain levels with movement can be another barrier to recovery. In this case, the patient may understand that the pain is not damaging to them, but he or she does not want to suffer through high levels of pain and is fearful of being unable to control the increased pain level. One of the first steps is education on the detrimental effects of guarding and disuse and the importance of movement in treatment of CRPS. The patient must understand the short and long term goals and express a willingness to push through higher levels of pain. However, many patients will initially resist the idea of pushing through high levels of pain and it is the clinician's responsibility to determine if this resistance can be changed. Often times, a strong resistance is based on a lack of education, the overwhelming nature of the fear and the knowledge that tools currently being used, such as medication, will not be helpful. In these cases, further education can be the key in changing this resistance. Many times, once a patient is aware that using a limb will help them to treat the disease, then many are willing to push through higher levels of pain in order to meet their physical goals.

Further treatment includes education and instruction on flare management skills such as relaxation breathing, pacing, meditation skills and appropriate activity progression. Initial sessions may be spent integrating these pain management tools into movements or exercises that the patient feels that they can already handle and slowly increasing the movement or demand level as these skills improve. Some patients will be ready to immediately tackle high levels of pain from the beginning. As the patient feels more comfortable using flare management skills and gaining control over higher levels of pain, the activity level is further progressed.

The Fear-Avoidance Model of Musculoskeletal Pain (FAM) details potential mal-adaptive thinking styles that can lead to higher levels of disability. This model encourages a psychological approach, although the physical therapist must also be able to recognize the mal-adaptive thinking and address it from a physical perspective. There are many different mal-adaptive thinking styles and once again, the clinician must ask questions to help determine which thoughts may be limiting each specific patient. Many people with CRPS deal with anxiety, a lack of feeling in control, catastrophizing, disappointment from only being able to perform at a low physical level and many other emotions and thinking styles. Other examples include a patient with lower extremity CRPS who was resisting treatment and commented to his physical therapist, "A doctor told me that I was going to eventually have my leg cut off anyway, so what is the point of forcing myself to walk on it." More details on this can be found in the chapter addressing psychological treatment.

Daly and colleagues further examined specific methods of treatment for fear related limitations (Daly and Bialocerkowski 2009). There is a distinction in therapy between in vivo exposure and graded activity. Treatment with in vivo exposure has the patient perform specific tasks that they identify as 'dangerous' or 'threatening', starting with the least threatening (Woods and Asmundson 2008). In graded activity, healthy behaviors and activities are positively reinforced and systematically progressed (Macedo et al. 2010). Research suggested that while only trend differences were observed for pain-related disability, patients in the graded in vivo exposure condition demonstrated significantly greater improvements on measures of fear of pain/movement, fear avoidance beliefs, pain-related anxiety, and pain self-efficacy

when compared to those in the graded activity condition (Woods and Asmundson 2008).

Overall, with any type of fear, treatment includes education, repeated exposure to activities that have been avoided and taking an active role in recovery. The patient is provided with an extensive level of education and pain management tools to manage their expected increased pain level. The patient begins at a level of activity that is just above their comfort level and is encouraged to slowly, but consistently push that level further.

Flare Management

To a patient dealing with the overwhelming symptoms of CRPS, the pain can appear uncontrollable with no way to manage it. The typical acute pain model tools are often minimally effective or can lead to further avoidance of use. In an acute pain model, healing and avoiding further pain is the main focus of treatment. Tools including medication, nerve blocks, passive modalities such as heat or ultrasound, rest and guarding are the most commonly used. In treatment of CRPS, these passive modalities are not typically as effective.

Flare-ups (an increase from the normal baseline level of pain) can cause both physical and emotional reactions. Physical reactions include guarding the limb, avoiding activity, tightening of muscles, holding the breath, stomach and chest tightening and nausea. When these physical reactions occur, the pain level worsens and propagates the cycle of flare-ups.

Flare-up management consists of learning a new set of active tools that can assist people with CRPS to feel more in control of their symptoms and be able to push themselves harder to meet their physical goals. There are multiple physical and cognitive tools that can be effective for patient with CRPS. These tools overlap widely and both physical and cognitive tools shoulder be used in order to allow the best flare management success.

Flare management tools include, but are not limited to relaxation breathing with focus on decreasing guarding, light movement, yoga, tai chi, mindfulness based stress reduction, cognitive behavior therapy practice, distraction, guided imagery, positive self-talk and pacing. Breathing and relaxation techniques are the foundations of active pain management skills and are taught early in treatment. Instruction on correct breathing and relaxation is imperative as the patient begins the painful rehabilitative process.

Pacing

Pacing is used as a flare management tool, but also as a way of performing activities during the day. Many people believe that pacing means being less productive, but in reality, the overall goal is to best manage the symptoms of CRPS and to become as productive as possible. Learning how to pace can be very frustrating as there are many ways to pace tasks and there are multiple non-physical barriers including old ways of doing things, thoughts of what someone should be able to do and pushing to be able to meet others expectations. Many people with CRPS become very frustrated due to a drastically different tolerance level and inability to perform even the simplest of activities due to high levels of pain.

Incorporating pacing into one’s lifestyle does not mean giving up enjoyable or necessary activities. It is

making modifications in intensity, duration, distance and taking breaks. What most people find is that they are more productive and successful once they begin using the pacing techniques.

The purpose of pacing and goal setting is to regulate daily activities and to structure an increase in tolerance through gradually increasing activity. Pacing activity requires the person to break an activity up into active and rest periods. Rest periods are taken before significant increases in pain level occur. It provides structure to the overall activity level and guides the individual to build an optimum schedule to minimize pain and maximize productivity during the day. Pacing also brings about a structure to the day, giving the person a sense of control.

To begin pacing, a baseline is established for the specific activity. The baseline is the amount of that activity that can be performed before a significant flare-up occurs. Although increased pain is expected, especially with a new activity, the activity should be stopped before the pain becomes difficult to control. The baseline may include a specific amount of time, speed, distance, number of repetitions or any other ways to measure tolerance. Baselines may also be required for sedentary positions including sitting, reading and computer work. Rest breaks focus on time to rest, stretch, to perform other flare management techniques or to change to a less demanding activity. Activity level is gradually increased with focus on slow progression in one area at a time. Pacing techniques include planning in advance on performing the activity, breaking the activity down, avoiding repetitive movement and taking rest breaks before the pain

There are many activities that are not as compatible with taking structured and scheduled rest breaks. For these times, other tools such as relaxation breathing, change of position, cognitive behavioral techniques and distraction can be helping in managing the pain level while completing the task.

Aerobic Conditioning, Strengthening and Stretching

These approaches vary widely but are an important part of CRPS treatment. They are all geared initially to physical reactivation and use of the limb to the extent possible and within reason but provide considerable value to non-affected other body parts. Physical activity not only increases general health, but appears to provide pain reduction benefits possibly through endorphin release but also serves to utilize time and keep the individual occupied while having the potential for socialization in a group setting (i.e., walking, at a fitness center, etc.). An exercise program focused on the non-affected areas can provide both endorphin release, but also a way to pace the exercise program and give the affected areas a break, while still staying active.

An aerobic conditioning program can vary widely depending on the severity of the CRPS and the areas affected. Sometimes walking can affect an upper extremity CRPS and therefore other lower extremity aerobic programs are needed or ways to support the limb with walking are required. With CRPS in the lower extremity, an arm bike, stationary bike or movement in the water may be the best way to perform an aerobic conditioning program. Often times, part of the overall program is increasing tolerance to an aerobic program even before the true benefits of aerobic conditioning can be gained.

A strengthening program can vary greatly depending on the limb affected, access to equipment, general endurance and strength of each individual and irritability of symptoms. A strengthening program may initially include exercises with resistance of only gravity or weights of less than 1 lb. Strengthening

exercises for the non-affected areas are performed as well, but there must be an awareness of how they contribute to increased symptoms in the affected area. Performing a few strengthening exercises on the affected area and then switching to the non-affected area can be part of a paced exercise program.

A stretching program in CRPS is often different than what is typically taught in the general community. Stretching should not consist of forcing through a movement as that leads to additional guarding and stress on the area. Instead, stretching focuses on teaching the body to relax through a movement as the muscle lengthens and relaxes. Many times with CRPS, pain limits the person from reaching a position where they can even feel a stretch. Therefore, an initial stretching program may have to focus on simply moving through a comfortable range of motion while teaching the body to relax as the pain level increases further into the range.

These activities also should focus on correcting postural abnormalities, normalizing movement patterns and overcoming avoidance. Depending on the patient's current level of disuse, each specific stretching or strengthening activity is modified to allow the patient to successfully complete the task. As the individual regains normalized movement patterns, increases their tolerance to use of the affected limb and is able to participate with relaxed and smooth movement, the exercises are progressed for further flexibility and strength gains.

A trial of aquatic therapy may be beneficial for individuals who have co-morbidities that preclude effective participation in a weight-bearing physical activity. Hydrostatic principals and buoyancy provide assistance in edema control and lessening stress on the affected joints. Aquatic therapy can be beneficial to begin to focus on movement and beginning weight-bearing techniques. Watsu is a gentle form of body therapy performed in warm water which combines elements of massage, joint mobilization, shiatsu, muscle stretching and relaxation skills. However, land therapy should be started as soon as possible as the body must gain tolerance to the demands of gravity.

Functional Activities

Functional activity training consists of activities that increase the ability to use the affected extremity in daily, work or recreational activities. These can include activities of daily living such as grooming or dressing, household activities such as cooking or cleaning or activities such as driving or grocery shopping. These tasks may be avoided completely or may be completed by compensating in different ways or performed on a modified basis with difficulty. In CRPS of an upper extremity, functional activities with the affected extremity can become minimal to non-existent and often the non-affected extremity is over-used. In CRPS of the lower extremity, any task that requires weight-bearing through that extremity is typically avoided or a compensatory movement is performed.

Functional activities may focus on general tasks such as lifting, carrying, gripping, pushing or pulling as well as specific activities such as brushing the teeth or writing. Treatment begins by determining the current level of function in a variety of different activities. For some people this may be lifting 1 lb.; for others it may be holding a toothbrush. Instruction consists of how to correct abnormal movement patterns, appropriate activity progression, modifications as needed and any education required to assist in over-coming barriers to goal success. This may include education on fear of re-injury, negative self-talk or expected symptom reaction with each activity. Each task is practiced with appropriate pacing of

activity, use of flare management tools and slow progression.

Work specific tasks may also be part of the treatment. Depending on the severity of the disease, time since onset and expected prognosis, permanent work modifications may need to be discussed. This can include voice-activated software, an ergonomic set-up, permanent restriction of work tasks and/or re-training to perform a new type of employment.

Recreational activities serve many purposes including exercise, socialization, time utilization and general enjoyment. Typically, these activities will require extensive education on ways to modify them and how to pace to be able to participate in them on some level. Therapy can include ways to gain tolerance to these activities, much like gaining tolerance to daily activities or exercise. Often times, people with CRPS may have to give up some recreational activities and replace them with new ones that are more reasonable.

Desensitization

CRPS is known for its central and peripheral sensitization changes. Symptoms of CRPS commonly include increased sensitivity to both noxious and non-noxious stimuli. Desensitization is simply finding ways to decrease or de-sensitize the over-excited somatic pain response. Desensitization techniques are aimed at normalizing this over-active response with a variety of different sensations. Many people with CRPS report difficulty tolerating long pants, socks and shoes, bra straps and jewelry on the affected limb. They may either avoid wearing these items or will wrap the affected area as a way to maintain a constant stimulus instead of a varying one such as the clothes and jewelry that shift and move.

A desensitization program is aimed at normalizing sensation by providing consistent stimulus to the affected area for short periods of time, frequently throughout the day. The brain responds to this sensory input by acclimating to the sensation, thereby gradually decreasing the body's pain response to the particular stimuli.

Desensitization can consist of progressive stimulation with soft materials increasing to rougher textures as tolerated over time. It can include light touch progressing to deep or sharper pressure. This can include a bowl of uncooked rice or beans, rubbing a piece of cotton on the affected skin or using sticks covered with different textures such as velvet and burlap. Vibration tools and contrast baths are often used as another form of desensitization. Many people with CRPS begin by starting to decrease the use of the brace or wrap that they have been using to protect and guard their extremity. Just exposing the limb to the open air and ambient temperature changes can be very painful. Other people begin by starting to wear socks and shoes or long pants for short periods of time. In all cases, part of the patient’s treatment is to expose the affected extremity to variable textures and conditions.

An important part of desensitization treatment is utilizing the flare management techniques. Focusing on relaxation breathing, different imagery techniques and pacing are important tools during desensitization. Increased stress levels, guarding and holding the breath can lead to increased symptoms, even greater than that caused by the actual treatment of desensitization.

Contrast Baths

Contrast Baths are the immersion of a body part alternately in cold and hot water. This causes alternate contraction and dilation of blood vessels, which increases blood flow, white blood cell activity, and the oxidation process to speed up healing. However, the vasomotor changes in advanced cases of CRPS do not always allow for the desired response, and many clinicians believe that the immersion in the cold water may exacerbate CRPS symptoms.

There are different suggested amounts of time of immersion in each bath, whether to start in cold versus hot, the duration of treatment, the actual water temperature used. The most commonly suggested ratio of time in hot water to cold water is from 4:1 to 3:1 ratio. Many people start with 3 minutes of warm water and 1 minute of cool water.

Contrast Baths can be used for different purposes in treatment of CRPS. Many people find relief from contrast baths and use them as a flare management tool. In these cases, the temperatures are kept at comfortable ranges. Others use contrast baths for desensitization as the temperature changes can be quite painful for the affected extremity. In this case, the water should be at a temperature that is just outside of the comfortable range. Even when used for desensitization, very cold water is not usually recommended if the limb is typically cold.

Paraffin

Paraffin can be used as a warm wax bath in which the body part is dipped into multiple times and then covered with a plastic bag and towel or covering like an oven mitt. While some people with CRPS cannot tolerate the feel of the wax on their skin or the warm temperature, many others find great relief in the warming properties. In the latter case, it is recommended to use paraffin before exercising the limb to allow for easier movement. Many people use paraffin as a way to control joint swelling or to help decrease contractures.

Electrical Stimulation

Electrical Stimulation is a common tool, although clinical experience suggests that patients either find good benefit from the tool from a flare management perspective or are highly flared due to hypersensitivity, even at a proximal site. There are many different types of electrical stimulation units used in therapy today. A few of these include TENS, NMES and H-Wave. There are other electrical stimulation forms including Microcurrent electro therapy (MET), but these have limited support from the research literature.

Transcutaneous Electrical Nerve Stimulation, or TENS, is one form of electrical stimulation. The mechanism of the analgesia produced by TENS is explained by the gate-control theory proposed by Melzack and Wall in 1965 (Melzack and Wall 1965). When painful stimuli occur, the gates are open, allowing pain transmission to the brain. With TENS, the electrical simulation competes with the pain transmission and causes inhibition of the pain transmissions.

Neuromuscular Electrical Stimulation (NMES) focuses on muscle activation and is used for muscle strengthening, to increase ROM and for muscle re-education/facilitation. NMES Some units function both

for NMES and TENS. NMES can be beneficial in treatment of CRPS by encouraging muscle activation which can promote blood flow and the health of the muscle.

While TENS and NMES are more general terms for a type of electrical stimulation, the H-Wave® Instrument states that the machine utilizes a completely distinct technology developed by Electronic Waveform Lab, and that the treatment system is not available from any other brand name or company. Although there is not specific evidence-based research on H-wave and CRPS, research on the use of H-wave for other diagnoses show significant change in regard to increased blood flow, angiogenesis and soft tissue rehabilitation (Blum et al. 2006). Initial changes on CRPS in the affected area are similar to symptoms normally observed in an inflammatory response including swelling, redness, warmth and pain. Most patients with CRPS experience changes in blood flow, sensation and temperature in the affected area due to different pathophysiologic responses. Anecdotal experience in patients with CRPS suggests positive results of repeated treatment using the low frequency settings which causes improved tissue fluid shifts versus the higher frequency which creates pain control.

With all electrical stimulation units, placing the pads directly on the affected area often causes high levels of increased pain due to the increased sensitivity in this area. Typically pads are placed proximal to the affected site.

Splinting

Splinting is often discussed as a treatment option in CRPS, although this tool is limited in its actual clinical use. Splinting can be used for protection or guarding or to prevent or reduce contractures. Using this treatment for protection or guarding should only be done in the early stages only and on a limited basis, as movement should be encouraged, not restricted. Ideally rigid splinting should be avoided but there may be certain circumstances where splinting may be necessary. Splinting may be necessary in severe cases of CRPS to maintain joint integrity and promote adequate circulation and nutrition to the tissues. For example, if a rapidly advancing flexion contracture is developing, a splint may be required. Splinting to prevent or reduce contractures is typically used later on when the patient is better able to control their pain level as this treatment can be very painful. Many patients will never be able to tolerate the use of splinting. Loss of movement may involve both flexion and extension. The treating therapist needs to be aware of finding the balance between increasing one range and not compromising the other. There is a wide variety of dynamic splints that help to restore function and prevent contracture. Flexion gloves can be useful but should only be used for short periods of time. These gloves are modular splints whereby the patient slips the hand into the glove and the fingers are held down by Velcro (Salter and Cheshire 2000). Again, if splinting can be avoided, this is preferable. The fabrication of splints and the difficulty applying them to hands with CRPS limits their use.

Edema Management

Edema is a common sign of CRPS and can vary greatly between people diagnosed with this disease. Looking on the internet can be frightening for a patient newly diagnosed with CRPS due to the pictures of very discolored and swollen hands and feet.

Edema in the early stages of CRPS should be addressed with edema management garments (such as

Isotoner gloves, Jobst garments, or Coban wrap) and active range of motion. Self- retrograde massage can be used if tolerated, but should not be performed by the therapist unless there is a strong trust that the practitioner will stop treatment if the patient can no longer tolerate it.

In the later stages of CRPS, changing levels of edema are common with physical activity and especially during times of flare-ups. This edema often recedes to its normal level after the activity or when the flare-up calms down. If this is the case, the edema should not be a limiting factor when performing physical activity.

Stress Loading: Scrubbing & Carrying

The stress loading protocol is a widely used rehabilitation tool in treatment and management of CRPS (Carlson and Warson 1988). The protocol involves stressful use of the affected extremity with minimal joint range of motion. Stress loading is comprised of two components: scrubbing and carrying. Each activity engages the affected extremity in consistent weight bearing activities within a small range of movement for gradually increasing periods of time. The loading of the limb provides inhibitory proprioceptive input to the nervous system, through the use of deep pressure. The key to stress loading is providing as much force or weight bearing as can be consistently tolerated during scrubbing and carrying, gradually increasing the frequency and duration of these activities throughout the day. Loading the affected area to tolerance and gradually increasing the frequency and duration of weight bearing activities enables the nervous system to acclimate to these stimuli. This acclimation progressively desensitizes the heightened pain response and allows the nervous system to "remodel" itself; the nervous system shifts from recognizing the stimulus presented as threatening, to accepting it as a normal sensation once again.

Scrubbing consists of applying a constant force through the affected area while the limb is moved back and forth as if scrubbing the floor. The protocol by Carlson & Watson calls for three minute scrubbing sessions, three times per day, gradually increasing in frequency and duration over a period of days or weeks, up until 7 to 10 minutes (Carlson and Watson 1988).

Carrying involves carrying a weighted object for increasing periods of time with the affected extremity or on the affected side, in order to provide "loading" to the area. Carrying any type of weighted object is effective for the upper extremity. Weight-bearing activities are effective loading for the lower extremity.

Unfortunately, although scrubbing and carrying are recommended in CRPS treatment in multiple articles and websites, there is not specific, evidence-based research on the effectiveness of these treatments.

Guarding/Postural Re-training

Due to the high levels of pain in CRPS, guarding and weight-bearing avoidance are common and are a typical initial reaction to the onset of symptoms. For an upper extremity, the limb is often held close to the body in an internally rotated and adducted position with the elbow and fingers flexed and the shoulder girdle elevated. For a lower extremity, weight-bearing is avoided as much as possible, even in the sitting position. Keeping the limb in a guarded position can be calming and allows the limb to feel protected. It can also keep the limb from being accidentally bumped or jostled. Unfortunately, this guarded positioning not only leads to avoidance of use of the limb, but can also cause other musculoskeletal secondary issues

such as muscle length changes and joint or soft tissue contractures.

Postural training and positioning can minimize protective guarding, promote balance and facilitate improved functional use of the extremity. Postural instruction and exercise assists in placing the affected extremity in a correct position to facilitate normal movement patterns and proper muscle retraining.

One of the most difficult parts to changing a habitual position or movement pattern is that while beneficial to the treatment of CRPS or other musculoskeletal issues, the change is typically very painful. Frequent verbal cueing is often necessary, as these abnormal postures are now performed sub-consciously. The transition to a more normal posture must often be done slowly, but frequently and with a graded progression.

Gait training is another important part of postural retraining for an affected lower extremity. Whether weight-bearing through the limb is entirely avoided or the weight is placed on only one part of the foot, gait, or the walking mechanics, become highly irregular. A normal gait pattern is typically painful and therefore avoided with multiple compensations. This can lead to patterns of weakness in the low back, hip, knee and ankle musculature. Gait training begins by determining not only what areas of the foot are being avoided, but also the tolerance to weight-bearing through these areas. Subtle changes in the weight-bearing through the foot are encouraged and complemented with weight-bearing exercises. Depending on the tolerance, weight-bearing exercises may first need to be performed in a more controlled setting, such as standing, before the gait pattern can be altered.

Brain Retraining Techniques

Although the pathophysiology of CRPS is not well understood, peripheral and central changes have been observed and altered central representation of perceptual, motor, and autonomic systems have been implicated (Jänig and Baron 2003).

Basic knowledge of cortical changes includes that prolonged non-painful stimulation during physical strain leads to an increase of cortical representation. However, many researchers have observed that the CRPS-affected cortical hand representation in the primary somatosensory cortex (S1) is dramatically decreased. Research has also shown that the magnitude of the reorganization was positively correlated with the extent of increased pain to painful stimuli and pain intensity of CRPS (Pleger et al. 2006; Maihofner et al. 2007). Other research showed that there is an enhanced activation level of neurons that respond to painful inputs. In follow-up studies Pleger and colleagues demonstrated that recovery from CRPS was paralleled by a reversal of these maladaptive cortical changes (Pleger et al. 2006). CRPS patients also show a significant reorganization of central motor circuits, with an increased activation of areas in the brain required for movement during finger tapping. Possible reasoning includes the requirement of more focus when having to complete motor tasks.

A brain-focused motor and sensory exercise program can help re-develop healthy nerve connections and brain organization. Certain pathways in the brain are activated when the brain needs to recognize a body part (sensory) and before and during a movement of that body part (motor). The goal of these treatments is to reorganize the brain and its pathways to diminish pain and sensitivity.

Graded motor imagery is a set of rehabilitation processes used to treat pain and movement problems related to an altered nervous system. The graded motor imagery program for patients with CRPS consists of limb laterality training, imagined hand movements and then mirror box therapy, in that order. Limb laterality recognition training consists of viewing photographs of a right and left hand in a variety of postures. Patients are asked to quickly and accurately respond whether they recognized the pictured hand to be a left hand or a right hand. Recognizing a pictured hand to be a left or a right hand activates brain areas involved in higher-order aspects of motor output, the so-called pre-motor cortices (Parsons 2001). Imagined hand movement training consists of patients deliberately imagining moving their own hand to adopt the posture shown in a given picture. Explicitly imagined movements activate the primary motor cortex (Decety 1996). A motor imagery program first activates cortical networks including pre-motor cortex in a manner that does not initially involve movement of the affected limb. This program re-trains the brain before adding the demands of actual movement. One strategy that aims to activate cortical networks and has been successful for acute CRPS is mirror therapy (McCabe et al. 2003). Mirror therapy involves movement of the limb inside a mirror-box such that visual feedback of the affected hand is replaced with that of the (reflected) unaffected hand. Mirror therapy is thought to reconcile motor output and sensory feedback and activate pre-motor cortices, which have intimate connections with visual processing areas. Although McCabe and colleagues reported reduced pain in acute CRPS patients during mirror therapy, there was no benefit for patients with chronic CRPS (Ramachandran et al. 1995; Seitz et al. 1998; di Pellegrino et al. 1992; McCabe et al. 2003).

In CRPS, the ability of the brain to recognize the affected body part and its sensations is affected. Sensory re-education helps to adapt the brain's response to injured areas to normalize object shape, size, texture, and location. The brain is retrained for constant touch compared to moving touch, where on the skin the touch is actually occurring and what direction the touch is moving in. Treatment may incorporate unaffected areas using the same procedure so that the sensation on the two sides may be compared.

Conclusions Regarding Physical Restorative Therapies

Information about physical rehabilitation techniques for people with CRPS continues to grow and develop, although further research studies are needed to determine efficacy in both early and late CRPS. A trained therapist can be helpful in directing the rehabilitation efforts and determining the plan for using the above-mentioned treatment tools. Overall, an active and patient-directed approach is important along with setting realistic short and long term goals.

Psychological Treatment

Patients with chronic pain problems benefit from psychological services offered in conjunction with physical rehabilitation and medical management techniques. Regardless of the individual's prior psychosocial history, it is common to struggle emotionally when dealing with chronic illness and pain.

Psychological services may include counseling for the patient and significant others, as well as a variety of techniques for pain control and reduction. This can include cognitive behavioral and acceptance and mindfulness based interventions, biofeedback,stress reduction, meditation, relaxation training and hypnosis. Services should be time limited, goal oriented, and coordinated as part of a multidisciplinary or

interdisciplinary treatment approach.

"Multidisciplinary" approaches include treatment directed by one clinician with multiple disciplines included such as physical and occupational therapy, pain psychology, relaxation therapy, medical management, vocational rehabilitation, and nursing education. Multidisciplinary treatment plans commonly use disciplines at different sites. In contrast, an "interdisciplinary" approach may utilize the same disciplines as mentioned above, but is more collaborative and structured. Care is delivered in one facility, where therapists can better communicate and adjust care. These programs are usually structured, outpatient, day programs, multiple hours per week, for weeks at a time and include both individual and group therapies (Stanos and Houle 2006).

Role of Psychology

Complex Regional Pain Syndrome (CRPS) can have a devastating impact on the injured person and the family. It has effects on the person's ability to function physically and emotionally. Patients suffering with chronic pain report higher rates of pain intensity, disability, depression, anxiety, limitations in functional activities, and decreased quality of life (Stalnacke 2011).

Patients with CRPS are in need of considerable support while they learn how to effectively manage their pain symptoms while improving functioning. All current evidence based medicine guidelines recommend a multidisciplinary approach for the management of chronic pain conditions. Given the complex nature of CRPS a multidisciplinary approach focusing on improved function and treating psychosocial and behavioral issues is recommended (Bruehl and Chung 2006). A functional restoration approach has been widely studied in the treatment of chronic pain (Flor et al. 1992).

Patients may have some misconceptions as to why they were sent to be treated by a psychologist. It should be empathized when making a referral to a psychologist that the doctor does not think "they are crazy or that they are faking." Patients often need to be reassured that no one thinks that their pain is all in their head, but that the referring doctor understands the impact living with CRPS has on their life, emotional state, and family interactions. They must be assured that their pain is real and that like many chronic illnesses, treatment with a psychologist can be helpful to better manage pain symptoms and the psychological sequelae of living with persistent pain. The person should be educated on the importance of a multi-disciplinary approach to pain treatment which may include appropriate medications, physical therapy, and psychological care.

Psychologists assist in teaching cognitive coping skills, relaxation and behavioral strategies for better pain control, improved mood and enhanced quality of life. In the medical setting they serve as an advocate for the patient and provide education regarding various medical conditions, cognitive and behavioral treatment options, and strategies to reduce barriers to recovery. Psychologists also assist patients with acceptance of their chronic physical condition. They will be taught and learn ways to manage pain while improving function, but they also need to grieve losses and accept that their condition is chronic. Without acceptance they are less likely to be adherent with the self-care skills training and physical reconditioning. Acceptance helps to shift their focus from using passive tools (resting or avoiding activity) to active tools (cognitive and behavioral coping strategies and reconditioning exercises). Common psychological topics of treatment include cognitive behavioral therapy, stress management, communication, family support,

time based pacing, goal setting, relaxation or self regulation skills training, and neuroscience education regarding CRPS.

Because of the complexity of CRPS a multidisciplinary team including a physician, psychologist, and physical or occupational therapist is recommended for a successful treatment outcome (Feinberg and Feinberg 2008). Treatment should address the influence that physiologic, biologic, cognitive, emotional, behavioral, and social/cultural factors have on the individual patient's reaction and perception of pain (Gatchel 2006). This approach is referred to as the biopsychosocial approach used in the assessment of chronic pain conditions (Gatchel et 2007). It focuses on the whole person not just the physical pathology. It takes into account all facets of the individual and tailors the treatment to meet the patient's specific needs versus a "one size fits all" treatment approach. Psychosocial and behavioral factors have been found to play an important role in maintenance of chronic pain and disability (Turk et al. 2008).

The first step to psychological treatment includes a biopsychosocial clinical intake which may include standardized and validated psychological testing. A thorough clinical assessment for chronic pain should address the following domains: Pain experience, pain-related behavior, mood/affect, cognitive coping skills, social functioning, health care utilization, and biological and physical fitness factors.

Clinical Intake: It is standard practice in the health psychology field that chronic pain conditions are conceptualized and treated from a biopsychosocial perspective (Turk and Monarch 2002). Assessment of a patient with CRPS should address psychiatric co-morbidity, cognitive, behavioral and emotional responses to CRPS, current psychosocial stressors, internal coping skills, and the family/support system. Untreated disorders, such as depression, can erode a person's adaptive energy thus decreasing their ability to participate in functional reconditioning. In patients with chronic pain depression has been associated with disability and reduced quality of life (Borsbo et al. 2009). Psychosocial stressors such as chronic stress, depression, anxiety, fear, or anger may be associated with the arousal component associated with CRPS. These negative mood states maintain the 'fight or flight' stress-pain cycle adding to increased pain and emotional suffering. Another important component of the clinical assessment is suicidal ideation and history. The level of uncontrolled pain, depression, hopelessness, age, gender, relationship status, social support network, decreased self-efficacy, psychological disorders, past suicide attempts and family history are associated with increased risk for suicide (Breitbart and Payne, 1998).

Cognitive areas of assessment include the patient's knowledge and beliefs about CRPS, their role in treatment, their stage of change and thinking patterns. By the time a person is sent for a psychological evaluation they have most likely been treated by numerous physicians, physical therapists, and other medical providers. Many patients have not been adequately educated on CRPS, their role in recovery, and treatment options. In the worst case scenario, their reports of pain may not have been believed by some of their providers or even their friends and family (support system). Understanding what a patient thinks about their condition is very important for treatment. Assessing maladaptive thinking styles and beliefs provides valuable insight into the person's internal thought processes. Negative thinking, such as catastrophizing (rumination, magnification and helplessness around pain), has been associated with higher levels of pain in CRPS patients compared to other chronic pain patients. A thorough assessment of a person's thoughts helps guide cognitive behavioral therapy (CBT) treatment (this is discussed in more detail later in this chapter). If a patient truly believes that increased pain is an indicator of further tissue damage, then they are less likely to be compliant with physical reconditioning exercises. Their

understanding of CRPS should be thoroughly assessed. Another important assessment is determining which stage of change the person is in (Djikstra 2005). The stages of change model, developed by Drs. James Prochaska, John Norcross, and Carlo DiClemente, explores sequential psychological and behavioral stages that patients move through during the process of change (Prochaska et al. 1992). The theory postulates that patients move through specific stages as they move from maladaptive behaviors to adaptive ones. These stages include precontemplation, contemplation, preparation, actions, maintenance and relapse. Therapy approaches should match the stage the person is in for optimal results. For example, a patient in the beginning stages of change, precontemplation or contemplation will need a different treatment focus to help move them into the more active stages of change (action, maintenance). It is also common for patients to have a relapse in their use of active coping. Relapse prevention is an important component of any behavioral change program. The treatment focus will change depending on which stage of change the person is in. For more information on the stages of change model see Prochaska, DiClemente, and Norcross and their book *Changing For Good* (Prochaska et al. 1992; Prochaska et al. 1994).

Behavioral factors include health habits (exercise, smoking, and caffeine intake), substance abuse history, compliance with prescribed medication, sleep, compliance with medical and physical therapy treatments, activities of daily living (ADLs), self-care, health care utilization, and pain behaviors. Patients with CRPS have a high rate of disuse of the affected limb due to high levels of pain. Avoiding movement, in the short term, allows them to escape increased levels of pain thus reinforcing this behavior. Although this strategy may seem like a good idea to the person with pain, it leads to reduced mobility and sensitization of the affected limb, increasing pain and disability. This cycle is summarized by Bruehl and colleagues who discussed the theoretical pathophysiological interaction in CRPS associated with learned disuse, pain-related behavior and the autonomic nervous system (Bruehl 2001). This vicious cycle of pain avoidance behaviors serve as barriers to regaining function and should be thoroughly assessed at intake.

The Neuromatrix of Pain: One way to introduce the role of a psychologist in the treatment of CRPS is to explain The Gate Control Theory (Melzack and Wall 1965). The Gate Control Theory describes the complex interplay between the perception of pain and one's thoughts, feelings, and behaviors. The theory postulates that there are hypothetical "gates" that can open (increasing pain) or close (decreasing pain) which are located in the brain and spinal cord. These gates are influenced by one's thoughts, mood state, and behaviors. This theory helps the patient with CRPS understand how negative thoughts, feelings and behaviors can actually increase their perception of physical pain by increasing the pain signal received by the brain. Negative thinking, focusing on the pain, stress, anger, fear, depression, poor nutrition, smoking, alcohol, overuse of medications, inactivity, and poor nutrition contribute to opening the gates (increased pain).

Learning healthy coping skills such as relaxation, stress management and cognitive restructuring can increase one's ability to control these gates and in turn reduce pain levels. The Neuromatrix Model of pain expanded the Gate Control Theory of Pain (Melzack 1999; Gatchel 2006; Turk and Monarch 2002). The Neuromatrix Model of pain describes the negative impact stress has on homeostatic balance, thus maintaining the stress-pain process. Increased stress leads to increased pain and increased pain is stressful leading to the stress-pain cycle. A helpful tool to explain this process is provided by www.PainEdu.org under Tools - the pathophysiology of pain. This teaching tool describes the transduction, transition, modulation, and perception of pain using the Gate Control Theory. Adequately explaining this theory

helps patients understand the role thoughts, feeling and behaviors have on their experience of pain. This sets the foundation for teaching active coping skills, increasing self-efficacy, and allowing them to have an active role in recovery.

Cognitive Behavioral Therapy (CBT): Living with CRPS affects a person's emotional well-being, self-concept, mood, sleep, social and recreational involvement, ability to work, interpersonal relationships, familial role and overall quality of life. As mentioned earlier psychosocial factors play an important role in the experience and maintenance of chronic pain conditions. The perception or experience of pain is both physical and emotional. The emotional impact on a person's life and secondary losses are referred to as suffering. The losses or suffering components are often more difficult to manage than the physical pain itself. The initial injury can have a rippling effect across many aspects of a person's life. If these losses are not addressed and treated they can serve as barriers to recovery. This is especially important when developing a treatment plan for patients with CRPS, given the devastating impact the illness has. In 2006 Gatchel noted that research demonstrates that patients with chronic pain have higher rates of depression than the non-pain population and goes on to discuss the negative impact of anger and anxiety (Gatchel 2006). Mood symptoms can erode a patient's adaptive energy required to participate with their recovery. Cognitive Behavioral Therapy (CBT) has been found to be an empirically validated treatment for chronic pain and other mood disorders. CBT focuses on identifying, challenging, and changing negative automatic thoughts (Morley et al. 1999; Gatchel 2006; Turk and Monarch 2002). The theory postulates that negative thoughts lead to and influence dysphoric feeling and unhealthy behaviors and vice versa. Turk discussed the use of cognitive behavior theory (a person's thoughts, feelings, behaviors and social environment) in the treatment of chronic pain (Turk and Monarch 2002). He eloquently states "According to the Cognitive Behavioral model, then, it is the pains sufferers perspective, based on his or her idiosyncratic beliefs, appraisal and unique schemas, that filter and interact reciprocally with emotional factors, social influences, and behavioral responses, as well as sensory phenomena. Moreover, patient's behaviors elicit responses from significant others (including health care professional) that can reinforce both adaptive and maladaptive modes of thinking, feeling, and behaving" (page 140). CBT teaches persons with CRPS how their individual beliefs, memories, and reactions to their pain symptoms can be challenged and changed to help them effectively cope. By adaptively coping with the pain they decrease emotional distress and pain intensity (the gate control theory can be used to illustrate this point). Common maladaptive thinking styles include: catastrophizing, filtering, all or nothing thinking, should statements, and mindreading. Common maladaptive thoughts include "I will never be able to handle this pain" or "This is going to ruin my life" and "what if this continues to get worse." Exploring these maladaptive thinking patterns and teaching the patient how to challenge and change these thoughts can lead to increased self-efficacy and perceived control. There are several CBT techniques that are useful in addressing these thoughts: The use of thought logs or journaling are helpful tools to identify, challenge and change unhelpful thought patterns. The goal is to bring these automatic thoughts into conscious awareness thus allowing the person to challenge and replace them with reality based coping thoughts.

Fear avoidance behaviors: Fear associated with increased pain and/or damage of tissue is common in patients with CRPS. This fear can be effectively addressed from a behavioral and cognitive approach. We are taught from young ages that if it hurts don't do it and that pain is the body's way of telling us something harmful is happening. Although this line of thinking may seem logical it does not hold true for all types of pain. With an acute injury (less than 3 months from injury) allowing the body to heal by

resting an injured body part would be appropriate – although even with most acute injuries we now stress careful use rather than rest. With chronic pain (more than 6 months), the majority of the healing has already taken place and movement is essential to reconditioning the body.

Fear avoidant behavior is a cycle of behavior that is often seen in patients with CRPS. Because movement can be excruciatingly painful, people fear that if they exercise or use the affected limb they will cause further damage. This cycle of behavior is problematic in CRPS since non-use of the affected extremity leads to atrophy, hypersensitivity increased pain and prolonged disability. By the time patients receive the proper diagnosis they have received mixed messages about increased pain and movement. If previous doctors or physical therapists have told them not to lift more than 10 pounds or to discontinue all activity if it leads to pain, they may not have confidence in the new message that in order to regain function they must begin to use the painful extremity.

Education is the first step to managing this problem. The symptoms of CRPS can appear frightening and bizarre so educating the patient that these symptoms are 'normal' is important. Teaching the person with CRPS how to assertively communicate with their providers about their questions is essential. They may need to have the doctor go over all test results to help them confidently believe that movement will not cause further damage and that their symptoms are expected with CRPS. If they do not believe that it is safe for them to move the affected limb, then they will never do it. It is critical that these messages are consistent from all healthcare providers. It is essential that all healthcare providers communicate and work closely together when treating these complicated disorders.

In addition to fear of re-injury the patient can also have intense fear of increased pain levels (Turk & Monarch 2002). This fear avoidance behavior is reinforced, by not moving the affected limb so they can avoid increased pain. Avoidance due to fear increases their pain and fear and this cycle of avoidance becomes a barrier to recovery. Addressing the underlying fear is essential to conquering the behavior pattern. The fear itself is often worse than the actual experience of pain; however, this is not to underestimate the amount pain involved with CRPS. Often, a combination of CBT, relaxation, and physical activity exposure can be very effective in addressing this issue. Addressing the thoughts that limit the person's willingness to participate in graded exposure exercises is essential to recovery. Challenging the automatic thoughts that drive this fear avoidant behavior is the key to any successful rehabilitation effort.

Behavioral/Pacing: Behavioral change is not about willpower, it is about setting realistic, measurable, achievable and timely goals. These goals serve as a guide to help the person with CRPS improve the quality of his or her life by progressively resuming normal activities and participating fully in life. Exercise, relaxation, and cognitive and behavioral coping tools are essential skills that aid in returning to a productive and meaningful life. Planning how to incorporate these skills into the patient's daily routine is part of goal setting. Setting daily and weekly goals helps keep patients with CRPS on track. It also helps to hold oneself accountable. Setting realistic and achievable goals assists with prioritization of tasks reducing overwhelming feelings and procrastination. The use of pacing can help guide the person on goal attainment without causing significant pain flares. With CRPS, pain should not be the person's only guide to activity, since initially they will have pain even with minimal movement. Pacing is a skill that helps the person resume normal activities slowly without causing a huge pain flare. The goal with pacing is to engage in an activity based on time not pain, then take a break, over and over until the task is complete.

During these rest breaks it is important to use some of the self-soothing skills mentioned below such as, breathing, stretching, meditation, etc. Breaks are intended for the person to use coping skills to help calm the nervous system (CRPS leads to changes in the nervous system and brain). The overall goal is to gradually increase tolerance for activities (time engaging in that activity) while decreasing the time of the rest break and to eliminate the "crash and burn" cycle of chronic pain. The CBT skills are helpful when teaching a person about pacing. Automatic negative thought like "If I take a break everyone will think I am lazy" or "I have so much to do, how can I take a break now?" if left unchallenged will interfere with the use of pacing.

Secondary Loss: Another aspect of quality of life is engaging in social and recreational activities. Helping the person with CRPS fully participate in events that make them feel happy and connected should be part of their recovery. Living with pain is bad enough, but often times it is not the only problem the person faces. Being unable to work, socialize, recreate, and engage in activities that one enjoys can lead to increased depression and disability in patients with chronic pain (Linton, 2000). Depression reduces one's pain threshold and can lead to a vicious cycle of disability. Engaging in quality life experiences helps reduce emotional suffering and is an important component of treatment.

Communication: Effective communication is an important skill to help us connect with the people in our lives and to get our individual needs met. Living with CRPS can cause a great deal of stress, disrupting the family system or social balance. The person with CRPS is tired of talking about the pain and significant others get tired of hearing about it which usually leads to a breakdown in communication. Learning to effectively communicate can help reduce the level of stress while improving the overall quality of relationships. One goal of this training is to address underlying beliefs that interfere with assertive communication. Addressing these unhelpful beliefs can open the door to new ways of communicating. Another helpful tool is to use 'I' statements. This allows one to express how they feel without blaming or attacking someone else. With assertive communication the person's words match his or her body language. They respect their own needs and feeling and the other person's point, even if there is a conflict of beliefs. Active listening without interrupting is also an important component of effective communication. Living with CRPS can lead to shutting down the lines of communication. Self-care is such an important component of recovery and being able to communicate how things may have to change and why is important. The person with CRPS often feels isolated and misunderstood while family members and friends feel helpless because they don't know how to help. Healthy communication can help reduce the negative impact living with CRPS has on the family system thus reducing everyone's stress levels.

Family: An important component of treating CRPS is involving the person's support system. Social support helps us feel connected to others providing a deep sense of belonging and strength. Most family members and friends of the person with CRPS are very confused about what is happening to their loved one. The support system usually expects a 'cure' so the injured individual can get back to normal. Education involves reinforcing that pain does not equal further damage, the course of treatment, the importance of movement in recovery, active coping skills, realistic expectations and that the goal is to manage CRPS not cure it. Following the education, they are encouraged to discuss the information as a family.

Some family members have solicitous behaviors. Solicitous responses usually come from a place of

caring, but unfortunately the consequence of the responses is passivity of the patient. Common responses include “Don’t do that!” or “You might hurt yourself” or “I can do that for you” or “Maybe you should call your doctor, something is wrong.” Family members can reinforce maladaptive pain behaviors so educating the family about CRPS is vital. Another common misconception is that family and friends often think of CRPS as an acute pain condition that can be “cured.” It should be empathized that CRPS is a chronic pain condition that can be managed but not cured. They should be involved with treatment so they can support healthy behavioral choices and have realistic expectations regarding the person’s function. Attending support groups is a great place to receive support and ideas of how to manage living with CRPS.

Stress Management: Stress has been shown to reduce the pain threshold, reduce immune functioning, slow healing times, and cause emotional distress. In patients with CRPS unmanaged stress leads to muscular bracing and guarding and reduce blood flow to the affected limb resulting in increased pain. Living with high levels of chronic pain can lead to non-stop stress. Effective stress management skills are essential in learning how to live a quality life even with pain. To describe the stress-pain cycle it is helpful to explain the interaction between pain and stress on the autonomic nervous system. The National Geographic movie: Stress: Portrait of a Killer is an excellent way to introduce the psychological and physiological relationship of the stress response. Having a basic understanding of the autonomic nervous system and stress sets the foundation for cognitive stress management skills and relaxation training.

Most patients believe that watching TV or sitting on the couch is “relaxation.” This is an important concept to explore. Although one may believe this type of activity is relaxing, it is not “the relaxation response” used as a stress or pain management technique. Herbert Benson coined the term “the relaxation response” in the 1970s. He proposed that if a person makes an effort to engage in regular relaxation, then physiological changes occur. These changes include reduced blood pressure, heart rate, breathing, and muscle tension. In addition vasodilatation increases blood flow to extremities and a reduction in stress hormones. Engaging in regular relaxation reduces pain levels and emotional distress. This also increases the person’s level of perceived control and provides active coping tools to manage the pain.

Relaxation: Relaxation training teaches self-soothing skills to engage the parasympathetic nervous system (restorative system) and emotional balance. Self-soothing skills, such as formal relaxation, help a person with CRPS calm their nervous system. Since CRPS is often sympathetically driven, anything that engages the sympathetic nervous system has the potential to increase pain and stress hormones. Engaging the parasympathetic nervous system revitalizes a ‘restorative state’ leading to increased blood flow and reduces muscular bracing and guarding, stress hormones, and emotional stress. There are a variety of relaxation techniques used in the treatment of CRPS which include: Biofeedback, autogenic training, guided imagery, affirmations, progressive muscle relaxation, diaphragmatic breathing and Mindfulness Based Stress Reduction (MBSR).

Biofeedback: Biofeedback is a type of training that teaches people how to improve their health by using bodily signals. The Merriam-Webster Dictionary definition of biofeedback “The technique of making conscious or involuntary bodily processes (as heartbeats or breathing) perceptible to the senses (as they use an oscilloscope) in order to manipulate them by conscious mental control”. The goal of biofeedback is to teach body awareness, in real time, to help with increased self-control through relaxation. Biofeedback therapy uses electronic sensors (EMG, skin conductivity, skin temperature, etc.) to help patients with

CRPS learn how to change physiological bodily processes. Biofeedback combined with counseling has been found to be efficacious in patient with CRPS who failed previous treatment (Grunert et al. 1990). These results included long-term (up to 1 year) reduction in pain levels and increased return to work rates. "Bio" refers to body and "feedback" refers to visual or audio feedback provided by the machine. During times of stress our body secretes stress hormones that lead to increased heart rate, blood pressure, vasoconstriction and changes in breathing. Vasoconstriction causes blood to be diverted to the large muscle groups leading to less blood flow to the periphery causing cold and clammy hands/feet. CRPS is often associated with decreased blood flow to the affected extremity leaving it cold or blue. Thermal biofeedback has been shown to be effective in managing CRPS (Lofland). Thermal biofeedback measures peripheral temperature using a thermister (temperature gauge) attached to the affected body part (usually best to begin with the unaffected limb). Deep relaxation increases vasodilatation, diverting less blood to the large muscle groups and so increases temperature to the periphery. Using thermal biofeedback can be a powerful tool to teach patients in 'real time' how the skill they are using affects the temperature of their extremities. Other modalities include breathing, skin conductance, and muscle sensors. Muscle biofeedback helps patients make connections between muscle bracing and guarding while practicing relaxation of that muscle group. EMG biofeedback is used in conjunction with progressive muscle relaxation and diaphragmatic breathing to induce a state of relaxation. This helps patients that have poor body awareness. For more information in biofeedback please visit the Biofeedback Certification Institute of American (BCIA) - http://www.bcia.org

Relaxation Exercises: Diaphragmatic breathing, Autogenics, guided imagery, progressive muscle relaxation, and mindfulness meditation are psychophysiologic techniques that are taught to patients with CRPS to help decrease pain and increase levels of perceived control. Breath training is a foundation skill to many types of relaxation training. Although breathing is an essential function of life, many people with chronic pain breathe in a way that leads to poorly oxygenated blood or a hyperventilation pattern of breathing. They take shallow rapid breaths mostly using their chest and other upper body muscles such as the upper trapezoids and employ minimal use of the diaphragm muscle. This 'chest' breathing pattern is associated with the stress response. Repetitive contraction of these muscle groups can also lead to pain in the upper trapezius and headaches. Psychologically this pattern of breathing is associated with anxiety and stress both of which is detrimental to chronic pain. During proper diaphragmatic breathing, engaging the diaphragm allows the lungs to fill fully. This is the way our body was intended to breathe. You can detect which patterns of breathing you have by placing one hand on the chest and one on the belly. Inhale and notice which hand moves more. The hand on the belly should rise with inhalation and fall with exhalation. The hand on the chest should remain still mostly still and the shoulders should not rise. The goal is to breathe using your diaphragm taking slow relaxed breaths.

Autogenics training was developed by Johannes Schultz, A German Psychiatrist, in the 1930s. Autogenics involves repeating phrases of relaxation that target the different systems associated with the autonomic nervous system. It is recommended that the phrases are practiced daily. Common phases include "my arms are warm and heavy and my breathing is calm and regular". These phrases target the systems associated with the PNS (restorative state). These phrases can be memorized and repeated in silence. In the beginning of learning relaxation self-guidance can be challenging. There are a variety of relaxation CDs that can help with the facilitation of relaxation.

Progressive muscle relaxation (PMR) focuses on tensing then relaxing various muscle groups. This can

help increase body awareness; it helps patients with CRPS recognize if they are bracing and guarding their muscles, increasing pain levels. Practice of PMR fosters healthy body awareness. Patients with CRPS are not conscious that they are bracing or guarding various muscle groups; this behavioral pattern has become an unhealthy habit that must be unlearned. PMR can help with changing this behavioral pattern.

Guided imagery is a form of mediation that incorporates the use of imagination. One imagines being in a place that is relaxing which could be a real or make believe place. It allows the mind to go on a mental vacation aiding in the experience of a relaxed state.

Mindfulness Meditation has been found to improve overall quality of life and even changes in the brain (Hölzel et al. 2001). Mindfulness was introduced to the field of western medicine by Jon Kabat-Zinn at the University of Massachusetts Medical Center. He developed Mindfulness Based Stress Reduction (MBSR) which is offered in medical centers across the United States to treat a variety of disorders including chronic pain. Mindfulness focuses on paying attention, on purpose, without judgment. The concept underlying mindfulness helps patients living with CRPS to 'notice' the pain without trying to change it and without judgment. Instead of fighting against the pain one learns how to co-exist with it. This also helps with acceptance and reduces the impact of negative emotional reactions.

With all forms of relaxation, the key to success is daily practice and passive concentration. These skills should become part of the patient's daily routine. If a person with CRPS waits to use breathing or the other relaxation skills until they have a huge pain flare, it is less likely to help. It should be emphasized that these skills should be used as a preventative strategy not just a reactive tool. It is like putting money in the bank every pay check so when you need to withdraw a large sum you have enough funds to cover it. Patients are encouraged to schedule relaxation time into their daily routines just like they would any other appointment.

Summary of Psychological Approaches

The treatment of CRPS is complex. CRPS is a devastating disease the significantly affects all aspects of the person's life. A multidisciplinary treatment approach that focuses on the biopsychosocial model of chronic pain is recommended for a successful outcome. Psychological treatment has been empirically validated for the treatment of chronic pain conditions. The goals of treatment should be specific to the patient's idiosyncratic needs. This chapter is a brief overview of the psychological treatment of CRPS. Common psychological aspects of treatment include a biopsychosocial clinical intake, general education regarding CRPS, the gate control theory, cognitive behavioral therapy, fear avoidance behaviors, stress management, communication, family support, pacing, goal setting, relaxation skills training, and relaxation skills training.

Functional Restoration & Multi- and Interdisciplinary Pain Management

The most effective approach for many CRPS patients involves a functional restoration multidisciplinary or interdisciplinary chronic pain program (Feinberg et al. 2008; Feinberg et al. 2013). These programs are cost-effective and involve an individualized, but highly structured, medication optimization, behavioral/psychological rehabilitation and physical conditioning program in a group setting.

Individuals engage in stretching, strengthening, aerobic conditioning and desensitization techniques, while learning behavioral and psychological approaches to better manage pain along with educational activities and work simulation.

Dependency on the doctor and therapist is discouraged and the program is geared towards healthy behaviors and return to leisure and work activities. The group setting provides friendship among patients and encourages mutual support.

References

Blum K, Chen TJ, Martinez-Pons M, Dinubile NA, Waite RL, Schoolfield J, Blum SH, Mengucci J, Downs, BW and Meshkin B. The H-wave small muscle fiber stimulator, a non-pharmacologic alternative to treatment of soft tissue injuries and neuropathic pain: an extended population observational study. *Adv Therapy*. 2006 Sep-Oct; 23(5):739-49.

Borsbo, B., Peolsson, M., Gerdle. B. (2009). The complex interplay between pain intensity, depression, anxiety and catastrophizing with respect to quality of life and disability. *Disability and Rehabilitation. 31 (19): 1605-1613.*

Breitbart, W., & Payne, D.K. (1998). Pain. In J. Holland (Ed.), *Psycho-Oncology* (pp. 450-467). New York: Oxford University Press.

Bruehl S. (2001). Do Psychological factors play a role in the onset and maintenance of CRPS? In: Harden R, Baron R, Janig W. eds. *Complex Regional Pain Syndrome*, Seattle, Wash IASP Press.

Bruehl, S. & Chung, O.K. (2006). Psychological and Behavioral Aspects of Complex Regional Pain Syndrome Management. *Clinical Journal of Pain*, 22 (5), June 2006.

Büntjen L1, Hopf JM1,2,3, Merkel C3, Voges J1, Knape S3, Heinze HJ2,3, Schoenfeld MA2,3 Somatosensory Misrepresentation Associated with Chronic Pain: Spatiotemporal Correlates of Sensory Perception in a Patient following a Complex Regional Pain Syndrome Spread. Front Neurol. 2017 Apr 10;8:142

Carlson L and Watson H. Treatment of Reflex Sympathetic Dystrophy using the Stress Loading Protocol. *Journal of Hand Therapy*. July-September 1988; 149-154.

Daly A.E. and Bialocerkowski A.E. Does evidence support physiotherapy management of adult Complex Regional Pain Syndrome Type One? A systematic review. *European Journal of Pain* 13 (2009) 339–353.

de Mos M1, de Bruijn AG, Huygen FJ, Dieleman JP, Stricker BH, Sturkenboom MC. The incidence of complex regional pain syndrome: a population-based study. J Neural Transm (Vienna). 2011 Sep;118(9):1301-9.

de Rooij AM, Perez RS, Huygen FJ, van Eijs F, van Kleef M, Bauer MC, van Hilten JJ, Marinus J. Spontaneous onset of complex regional pain syndrome. Mediators of Inflammation Volume 2015, Article ID 718201, 5 pages

Decety J. Do imagined and executed actions share the same neural substrate? *Cognit Brain Res*, 3 (1996), pp. 87–93.

di Pellegrino G, Fadiga L, Fogassi L, Gallese V and Rizzolatti G. Understanding motor events: a neurophysiological study. *Exp Brain Res*, 91 (1992), pp. 176–180.

Dijkstra, A.(2005). The Validity of the Stages of Change Model in the Adoption of the Self-Management Approach in Chronic Pain. *Clinical Journal of Pain.* 21 (1), January/February 2005.

Drummond PD1, Finch PM1, Birklein F1,2, Stanton-Hicks M3, Knudsen LF4,5,6. Hemisensory disturbances in patients with complex regional pain syndrome. Front Neurol. 2017 Apr 10;8:142.

Duong, S., Bravo, D., Todd, K.J. et al. Treatment of complex regional pain syndrome: an updated systematic review and narrative synthesis. Can J Anesth/J Can Anesth (2018) 65: 658. https://doi-org.laneproxy.stanford.edu/10.1007/s12630-018-1091-5

Ek JW, van Gijn JC, Samwel H, van Egmond J, Klomp FP, van Dongen RT. Pain exposure physical therapy may be a safe and effective treatment for longstanding complex regional pain syndrome type 1: a case series. Clinical Rehabilitation 2009; 23: 1059–1066.

Eric Z Herring, Leonardo A Frizon, Olivia Hogue, Jay U Mejia, Richard Rosenquist, Robert B Bolash, Andre G Machado, Sean J Nagel, Long-term Outcomes Using Intrathecal Drug Delivery Systems in Complex Regional Pain Syndrome, Pain Medicine, Volume 20, Issue 3, March 2019, Pages 515–520

Feinberg SD, Feinberg RM. Functional Restoration & Complex Regional Pain Syndrome, in Practical Pain Management, September 2008.

Feinberg SD, Feinberg RM, Gatchel RJ. Functional Restoration and Chronic Pain Management. Critical Reviews in Physical and Rehabilitation Medicine 20(3): 221-235 (2008).

Feinberg, S.D., Gatchel, R., Stanos, S., Feinberg, R., & Johnston-Montieth, V. “Interdisciplinary Functional Restoration and Pain Programs” in *Comprehensive Treatment of Chronic Pain by Medical, Interventional, and Integrative Approaches*: The AMERICAN ACADEMY OF PAIN MEDICINE Textbook on Patient Management. March 2013 (Springer Science+Business Media).

Flor, H., Fydrich, T., & Turk, D.C. (1992). Efficacy of multidisciplinary pain treatment centers: A

meta-analytic review. *Pain.* 4: 221-230.

Gatchel, R.J (2006). *Clinical Essentials of Pain Management* (2nd edition). Washington, DC, American Psychological Association.

Gatchel, R.J., Peng, Y.B., Peters, M.L., Fuchs, P.N., Turk, D.C. (2007). The biopsychosocial approach to chronic pain: scientific c advances and future directions. *Psychological Bulletin.* 133 (4): 581-624.

Gobeleta C, Waldburgerb J, Meier J The effect of adding calcitonin to physical treatment on reflex sympathetic dystrophy Pain 48, 2, February 1992, Pages 171-175

Grunert, BK, Devine, CA, Sanger, JR, Matloub, HS, Green, D. (1990). Thermal self-regulation for pain control in reflex sympathetic dystrophy syndrome. Journal of Hand Surgery. 1990; July 15(4): 615-618.

Harden RN, Oaklander AL, Burton AW, et al. Complex regional pain syndrome: practical diagnostic and treatment guidelines, 4th edition. Pain Med 2013; 14(2): 280-229.

Hölzel, B.K., Carmody, J., Vangel, M., Congleton, C., Yerramsetti, S.M., Gard, T., Lazar, S.W. (2001). Mindfulness practice leads to increases in regional brain gray matter density. *Psychiatry Research: Neuroimaging*, 191 (1): 36.

Jänig W, Baron R. Complex regional pain syndrome: mystery explained? Lancet Neurol. 2003 Nov;2(11):687-97.

Lofland K Biofeedback for CRPS: Why Haven't I Tried That? - RSDSA. In: RSDSA. https://rsds.org/biofeedback-for-crps-why-havent-i-tried-that/.

Maaike Dirckx,1 Marco W. J. Schreurs,2 Marissa de Mos,1 Dirk L. Stronks,1 and Frank J. P. M. Huygen1 The Prevalence of Autoantibodies in Complex Regional Pain Syndrome Type I Pain. 2018 Sep;159(9):1824-1832.

Macedo L, Smeets R, Maher C, Latimer L and McAuley JH. Graded Activity and Graded Exposure for Persistent NonSpecific Low Back Pain: A Systematic Review. *J. Physical Therapy*. June 2010 vol. 90 no.6. 860-879.

Maihofner C, Baron R, DeCol R, Binder A, Birklein F, Deuschl G, Handwerker HO and Schattschneider J. The motor system shows adaptive changes in complex regional pain syndrome. *Brain*, 130 (2007), pp. 2671–2687.

Massimo Varenna, Silvano Adami, Maurizio Rossini, Davide Gatti, Luca Idolazzi, Francesca Zucchi, Nazzarena Malavolta, Luigi Sinigaglia, Treatment of complex regional pain syndrome type I with neridronate: a randomized, double-blind, placebo-controlled study, Rheumatology, Volume 52, Issue 3, March 2013, Pages 534–542, https://doi-org.laneproxy.stanford.edu/10.1093/rheumatology/kes312

McCabe C.S., Haigh R.C., Ring E.F, Halligan P.W, Wall P.D and Blake D.R. A controlled pilot study of the utility of mirror visual feedback in the treatment of complex regional pain syndrome (type 1). Rheumatology, 42 (2003), pp. 97–101.

Melzack, R. From the gate to the neuromatrix. Pain. 1999 Aug;Suppl 6:S121-6.

Melzack, R., Wall, P. Pain Mechanisms: A New Theory *Science*: 150, 171-179, 1965.

Merskey H., Bogduk N. Classification of chronic pain: Descriptions of Chronic Pain Syndromes and Definitions of Pain Terms. IASP Press, 2nd ed. (1994).

Morley, S., Eccleston, C., & Williams, A. (1999). Systematic review and meta-anlaysis of randomized controlled trails of cognitive behavioral therapy and behavioral therapy for chronic pain adults, excluding headache. *Pain*, 80, 1-13.

Oaklander AL, Rissmiller JG, Gelman LB, et al. Evidence of focal small-fiber axonal degeneration in complex regional pain syndrome-1 (Reflex sympathetic dystrophy). Pain 2006; 120:235-43.

Pain. 2003 May;103(1-2):199-207.

Parsons LM., Integrating cognitive psychology, neurology and neuroimaging. Acta Psychol (Amst). 2001 Apr; 107(1-3):155-81.

Pleger B, Ragert P, Schwenkreis P, Förster AF, Wilimzig C, Dinse H, Nicolas V, Maier C and Tegenthoff M. Cortical Re-Org & Loss of Tactile Discrimination. NeuroImage 2006. Aug 15; 32(2):503-10.

Prochaska, J.O., DiClemente, C.C., & Norcross, J.C. (1992). In search of how people change: Applications to addictive behaviors. *American Psychologist*, 47, 1102-1114.

Prochaska, J.O., Norcross, J.C., DiClemente, C.C. (1994). *Changing for Good.* New York: William Morrow.

Ramachandran VS, Rogers-Ramachandran D, Cobb S. Touching the phantom limb. Nature, 377 (1995), pp. 489–490.

Salter M and Cheshire L. Hand Therapy: Principles and Practice by Maureen Salter, Lynn Cheshire. Reed Educational and Professional Publishing. 2000

Sandroni P1, Benrud-Larson LM, McClelland RL, Low PA. Complex regional pain syndrome type I: incidence and prevalence in Olmsted county, a population-based study. Pain. 2007 May;129(1-2):12-20.

Satteson ES, Harbour PW, Koman LA, Smith BP, Li Z. The risk of pain syndrome affecting a previously non-painful limb following trauma or surgery in patients with a history of complex regional pain syndrome. Eur J Pain. 2010 May;14(5):510-3.

Seitz RJ, Hoflich P, Binkofski F, Tellmann L, Herzog H and Freund HJ. Role of the premotor cortex in recovery from middle cerebral artery infarction. *Arch Neurol*, 55 (1998), pp. 1081–1088.

Sigtermans M, van Hilten JJ, Bauer M, Arbous M, Marinus J, Sarton E, Dahan A Ketamine produces effective and long-term pain relief in patients with Complex Regional Pain Syndrome Type 1.Pain. 2009 Oct;145(3):304-11. doi: 10.1016/j.pain.2009.06.023. Epub 2009 Jul 14.

Stalnacke, B.M. (2011). Life satisfaction in patients with chronic pain relation to pain intensity, disability, and psychological factors. *Neuropsychiatric Disease and Treatment*; 7: 683-689.

Stanos S, Houle TT. Multidisciplinary and Interdisciplinary Management of Chronic Pain. Phys Med Rehabil Clin N Am. 2006 May;17(2):435-450.

Thomas Keef & Stephen Keef (2019) The Efficacy of Vitamin C in the Prevention of Complex Regional Pain Syndrome After Distal Radius Fractures: A Synthesis, Journal of Pain & Palliative Care Pharmacotherapy, DOI: 10.1080/15360288.2019.1598530

Turk, D.C. & Melzack, R. (2001). Handbook of pain assessment (2nd ed.). New York: Guilford Press.

Turk, D.C., & Monarch, E.S. (2002). Biopsychosocial perspective on chronic pain. In D.C. Turk & R.J. Gatchel (Eds.), *Psychological approaches to pain management: A practitioner's handbook* (2nd ed., pp. 3-29). New York: Guilford Press.

Turk, D., Swanson, K., and Tunks E. (2008). Psychological Approaches in the Treatment of Chronic Pain Patients-When Pills, Scalpels, and Needles are Not Enough. *Canadian Journal of Psychiatry.* 53(4): 213-223.

van Rijn MA, Marinus J, Putter H, Bosselaar SR, Moseley GL, van Hilten JJ. Spreading of complex regional pain syndrome: not a random process. Scand J Pain. 2017 Jan;14:84-88.

Woods MP. Asmundson GJ. Evaluating the efficacy of graded in vivo exposure for the treatment of fear in patients with chronic back pain: a randomized controlled clinical trial. Pain. 136(3):271-80, 2008 Jun.

ACPA Resource Guide
To Pain Medication and Treatments

American Chronic Pain Association

ACPA Resource Guide

To

Chronic Pain Management

An Integrated Guide to
Medical, Interventional, Behavioral,
Pharmacologic and Rehabilitation Therapies

2019 Edition

American Chronic Pain Association
P.O. Box 850
Rocklin, CA 95677
Tel 800-533-3231
Fax 916-652-8190
E-mail ACPA@theacpa.org
Web Site http://www.theacpa.org

Copyright 2019 American Chronic Pain Association, Inc.
All rights reserved. No portion of this book may be reproduced without permission of the American Chronic Pain Association, Inc.

Table of Contents

A STATEMENT FROM THE ACPA BOARD OF DIRECTORS **5**
INTRODUCTION **6**
OVERVIEW OF CHRONIC PAIN TREATMENT **8**
WHAT DOES SUCCESSFUL PAIN TREATMENT LOOK LIKE? **8**
PAIN TYPES, SOURCES & CLASSIFICATION **9**
PAIN IN SPECIAL POPULATIONS **10**
Pain in Pregnancy **10**
Pain in Children **10**
Pain in Older Persons **11**
MAJOR TYPES OF INTERVENTIONS FOR PAIN **13**
FUNCTIONAL RESTORATION APPROACHES & PROGRAMS **13**
SELF-DIRECTED INTERVENTIONS **15**
Self-Care, Self-Management, Self-Development **15**
ACPA Groups **15**
Classes in Chronic Pain & Chronic Disease Self-Management **16**
ACTIVE INTERVENTIONS – DELIVERED BY PROFESSIONALS **17**
Information Therapy: Reconditioning the Brain **17**
Reconditioning the Body: Exercise and Body Awareness **18**
Pilates **19**
Yoga **19**
Feldenkrais **21**
Postural Re-Training **21**
Alexander Technique **22**
Brain Motor & Sensory Retraining **22**
Graded Motor Imagery **22**
Desensitization **22**
Sensory Re-education **23**
Virtual Reality **23**
Functional Activity Training **23**
Personal Goal Attainment Program **23**
PSYCHOLOGICAL & BEHAVIORAL APPROACHES **25**
Cognitive Behavioral Therapy for Pain (Pain-CBT) **26**
Acceptance and Commitment Therapy (ACT) **27**
Motivational Interviewing **28**
Fear Avoidance Therapy **28**
Stress-reducing Interventions **29**
Art & Music **30**
Biofeedback **30**
Hypnosis **30**
Reconditioning Brain and Mind **31**
COMPLEMENTARY, ALTERNATIVE & INTEGRATIVE MEDICINE (CAM) **34**
PHYSICAL MODALITIES – NONINVASIVE INTERVENTIONS **39**
INVASIVE INTERVENTIONS **44**
MEDICATIONS **53**
How Medications for Pain Can Help & Harm **53**
If Medications Are Not Relieving Pain **56**
Warning about Internet Medication Purchases **57**
Biosimilar and Interchangeable Medications **58**

American Chronic Pain Association
Copyright 2019

Medication Identification 59
Medication Side Effects, Drug Allergies & Drug Interactions 60
Clinical Trials 63
Medication Assistance Programs 63
MEDICATION TYPES FOR THE TREATMENT OF PAIN 64
Non-Opioid Pain Relievers 65
Opioid Pain Relievers and Their Safe Use 75
OTHER MEDICATIONS 108
Antidepressants 108
Antiepileptic (Anticonvulsant) Drugs 116
Sodium Channel Blocking & Oral Antiarrhythmic Agents 118
Topical Pain Relievers 119
Compounded Medications 123
Medications & Sleep Hygiene 124
Muscle Relaxants 130
Botulinum Toxins 131
NMDA Inhibitors (Including Ketamine) 132
Low-Dose Naltrexone (LDN) 133
Antihypertensive & Adrenergic drugs, Bisphosphonates, Thalidomide & Calcitonin 133
Medications for Migraine 136
NOT RECOMMENDED FOR CHRONIC PAIN 138
TAPERING/WEANING OFF PAIN MEDICATIONS (INCLUDING OPIOIDS) 142
SELF-MEDICATION: ALCOHOL, TOBACCO, MARIJUANA, AND ILLICIT SUBSTANCES 145
THE EFFECTS OF CIGARETTE SMOKING ON PAIN 146
INTERNET PAIN-MANAGEMENT RESOURCES 150
FINAL COMMENTS 151

Copyright 2019

Contributors & Reviewers

Written, reviewed & updated yearly by Senior Author & Editor Steven Feinberg, MD, MPH, with special thanks to the following Contributors and Reviewers.

Steven Feinberg, MD, MPH, is a practicing pain medicine physician in Palo Alto, California, and is an Adjunct Clinical Professor at Stanford University School of Medicine.

Vladimir Bokarius, MD, PhD, is Board Certified in Psychiatry and Pain Medicine. He also holds a degree of Master in Oriental Medicine. He is the Medical and Research Director of Comprehensive Care Consultants and Medical Director of Center for Occupational Health.

Jennifer Christian, MD, MPH is Board Certified in Occupational Medicine. In her clinical practice, she cares for working age patients with persistent distressing and disabling symptoms despite prolonged medical or surgical treatment. She is also President of Webility Corporation which serves as a catalyst for positive change in workers' compensation and disability benefits systems.

Rachel Feinberg, DPT, PT, is Chief Physical Therapist and Director of the Feinberg Medical Group Functional Restoration Program in Palo Alto, California.

Cheryl Hayes, PharmD, MBA, MJ, BCPS, is a clinical pharmacist for HealtheSystems.

Joseph Hayes, MD, MPH, PRIUM Medical Director.

Donna Kalauokalani, MD, MPH, is Board Certified in Anesthesiology and Pain Management. She serves as Medical Director for Folsom Pain Management, and Mercy San Juan Hospital Pain Management Services. She is currently President of the American Chronic Pain Association.

Mel Pohl, MD, FASAM, is a Board-Certified Family Practitioner. He is the Chief Medical Officer of Las Vegas Recovery Center (LVRC).

Special thanks to Yvonne Selden for her editing assistance.

Copyright 2019

A STATEMENT FROM THE ACPA BOARD OF DIRECTORS

Since 1980, the American Chronic Pain Association (ACPA), a non-profit, tax exempt organization, has offered a support system for people with chronic pain through education in pain management skills and self-help group activities. To learn more about the ACPA and how to become a member, please visit our web site at https://www.theacpa.org or call the National Office at 800-533-3231.

The American Chronic Pain Association (ACPA) advocates a multi-modal strategy for addressing chronic pain. The ACPA focuses on pain management skills and self-help strategies that individuals can use in conjunction with modalities discussed with and approved by their health care professionals.

The ACPA considers the use of medication and other treatments to be a matter for individuals to determine in conjunction with their health care professionals. The ACPA takes no position on medical treatment choices. Thus, information the ACPA provides in this resource guide about medical care is educational and informative only.

The ACPA Resource Guide to Chronic Pain Management combines practical clinical experience and the most recent scientific information presented in an easy to read format for consumers and professionals. Input comes from many sources, including from individuals, from industry sources, some of which support the ACPA with grants. Dr. Feinberg, Senior Author and Editor, receives no funds from industry. As lead author, Dr. Feinberg receives input from many sources but takes full responsibility for the content of this Guide. Dr. Feinberg and the ACPA welcome input regarding any recommended changes, additions or deletions.

Copyright 2019

INTRODUCTION

The ACPA believes that people with chronic pain benefit from being well informed about their treatments. This knowledge may relieve the fears that can interfere with receiving maximum benefits from carefully and appropriately selected treatments. Education can also prevent unrealistic expectations that lead to disappointment with no benefit or even a bad outcome from treatment.

This Guide is not meant to serve as medical advice for medical conditions or guidance regarding treatment needs. Remember that the best source of information about one's health and treatment needs is through open dialogue with a qualified health care professional.

With the emerging and ever-increasing growth of the Internet, information is now available on almost every topic. Finding information is easy, but finding reliable, understandable and factual information that answers your questions is NOT so easy.

The information in this ACPA Resource Guide to Chronic Pain Management covers general information compiled from multiple sources. It is updated yearly and includes web links for certain medications and treatments and relevant Internet sites of interest. For medications, generic names are primarily listed with brand names in parentheses.

Unfortunately, there are risks (some serious) associated with certain treatments for chronic pain; especially invasive interventions as well as medications. There is also the potential of missing benefit from avoiding some chronic pain treatments. The best approach is for people with pain to ask questions about the benefits and risks or side effects when they are about to embark on any treatment approach or new medication. How often is this treatment effective -- compared to other options? Does the risk justify the possible benefit? How do the risks and benefits compare with those of other treatment options?

Although this ACPA Resource Guide covers many medications and treatments, the topics covered are not exhaustive. This Guide is primarily written for an audience of adults. See the section on Special Populations for basic advice for pregnant women, children, and older persons. If something is not mentioned in this Guide, that does not imply that it is not useful. Contact the ACPA with comments, corrections, or recommendations for topics to be covered in future updates and editions at https://theacpa.org/Contact/.

The best advice the ACPA can offer is to discuss all treatment and medication questions with a health care professional! In this Guide, this term includes physicians, prescribing advanced practice nurses, nurse practitioners, physician assistants, and others who do not prescribe medications but provide other health care services including psychologists, pharmacists, physical and occupational therapists and others. Practitioners of complementary and integrative health approaches may also be helpful in their areas of specialty.

Copyright 2019

The ACPA considers the use of medication and other treatments to be a matter for individuals to determine in conjunction with their health care professionals. The ACPA takes no position on medical treatment choices. Thus, information the ACPA provides in this Resource Guide about medical care is educational and informative only.

Copyright 2019

OVERVIEW OF CHRONIC PAIN TREATMENT

It's hard to know how to move forward once chronic pain has changed your life. It often seems like all you need is the right medication or treatment to take away the pain to increase your function. But sometimes that is not enough – especially in the case of chronic pain. Realistically, some treatments will provide substantial pain relief, while some will provide no benefit, and unfortunately, some can worsen your condition and pain. Perhaps the best to expect is that medication, injections or surgery will hopefully provide partial benefit, perhaps 25 or 30 percent pain relief.

WHAT DOES SUCCESSFUL PAIN TREATMENT LOOK LIKE?

Imagine a car with four totally flat tires, going nowhere. That's what life can look like for someone whose life has been totally changed by chronic pain. Medical treatment only puts air in one of our tires. We still have three flat tires and can't move forward. The ACPA's definition of "successful" treatment of a person with chronic pain is that the person has learned how to independently self-manage his/her condition in a way that allows life to continue, maximizing participation in everyday life activities, minimizing discomfort and side effects, and avoiding other bad consequences of treatment. Note: This does not mean that the person will be pain free but rather will be able to manage pain, get back on track, and lead a productive, satisfying, and happy life.

So, it is important to ask what else we need to fill our other three tires so that we can resume our life's journey. Unlike traditional medicine where the "patient" is a passive participant, living a full life with pain requires that the person take an active role in the recovery process. The individual needs to work with his or her health care providers to get what is needed to fill up the other three tires. Biofeedback, physical therapy, counseling, pacing of daily activities, nutritional counseling, a support group, life coaching, mindfulness practices, and a host of medical modalities are a few examples of the ways we can fill those other tires.

For each person, the combination of therapies and interventions needed may differ, based on individual need. It is the responsibility of the person in pain to decide whether any particular health care professional has actually helped them get their "car of life" moving forward again -- and if not, to make a change.

Once we have all four tires filled, it is our responsibility to maintain our car. We would not take our car back to the dealer and ask them to fill it up with gas or wash our windshield. That is our responsibility---to take good care of our car. We take it in for inspections and if something goes wrong, we go to a professional. It's the same with our wellness. You see, pain management is much more than one simple modality. It takes a team effort, with the person with pain taking an active role, to live a full life in spite of chronic pain. Go to *A Car With Four Flat Tires* at the ACPA web site at http://www.theacpa.org/pain-management-tools/videos/support/ to watch a short educational video narrated by ACPA Founder and CEO, Ms. Penney Cowan.

Copyright 2019

PAIN TYPES, SOURCES & CLASSIFICATION

Many pain specialists recommend that the term "chronic pain" should be referred to as "persistent pain" – which can be continuous or recurrent and of sufficient duration and intensity to adversely affect a person's well-being, level of function, and quality of life. This document continues to use the term "chronic pain" given its universal acceptance.

Acute pain is characterized as being of recent onset, transient, and usually from an identifiable cause.

Chronic (or persistent) pain can be described as ongoing or recurrent pain, lasting beyond the usual course of acute illness or injury healing, more than 3 to 6 months, and which adversely affects the individual's well-being. Another definition for chronic or persistent pain is **pain that continues when it should not**. The International Association for the Study of Pain defines pain as a negative sensory and emotional experience. As such, the definition recognizes the important role of processes in the nervous system and brain (both neurological and psychological) in the experience of pain. Therefore, the nervous system and brain are very important therapeutic targets.

Chronic pain is classified by pathophysiology (the functional changes associated with, or resulting from disease or injury) as nociceptive (due to ongoing tissue injury) or neuropathic (resulting from damage to the nervous system – the brain, spinal cord, or peripheral nerves). The experience of pain can be due to either nociceptive and neuropathic changes or both -- but it is *always combined with the brain's reaction* to incoming information, including the brain's interpretation of what that incoming information means, what the brain learns as a result, and the responses it generates.

Central pain syndrome is a neurological condition caused by a process that specifically affects the central nervous system (CNS), which includes the brain, brainstem, and spinal cord. The disorder occurs in people who have or who have experienced strokes, multiple sclerosis, Parkinson's disease, brain tumors, limb amputations, brain injuries, or spinal cord injuries. It may develop months or years after injury or damage to the CNS. This also includes conditions such as chronic headaches, fibromyalgia, and Complex Regional Pain Syndrome (CRPS). In central pain syndromes, pain feels as though it is emanating from a specific place in the body, but the sensation is actually being generated by the nervous system and brain.

Continuous pain is pain that is typically present for approximately half the day or more.

Flare-up pain (the term break-through pain was coined to refer to cancer-related flare-ups) can be described as a transitory increase in pain in someone who has relatively stable and an adequately controlled level of baseline pain. It may be caused by changes in an underlying disease including treatment, or involuntary or voluntary physical actions such as coughing or getting up from a chair or other changes in activity level. It can also be caused by stress and emotions such as anxiety, anger, fear, or worry. Activity imbalance—doing too much or too little—can also flare pain.

Copyright 2019

PAIN IN SPECIAL POPULATIONS

Pain in Pregnancy

In January 2015, the U.S. Food and Drug Administration provided an FDA Drug Safety Communication: FDA has reviewed possible risks of pain medicine use during pregnancy – see http://www.fda.gov/Drugs/DrugSafety/ucm429117.htm.

The following is an abstracted summary:

> The U.S. Food and Drug Administration (FDA) is aware of and understands the concerns arising from recent reports questioning the safety of prescription and over-the-counter (OTC) pain medicines when used during pregnancy. As a result, we evaluated research studies published in the medical literature and determined they are too limited to make any recommendations based on these studies at this time. Because of this uncertainty, the use of pain medicines during pregnancy should be carefully considered. We urge pregnant women to always discuss all medicines with their health care professionals before using them.
>
> Severe and persistent pain that is not effectively treated during pregnancy can result in depression, anxiety, and high blood pressure in the mother. Medicines including nonsteroidal anti-inflammatory drugs (NSAIDs), opioids, and acetaminophen can help treat severe and persistent pain. However, it is important to carefully weigh the benefits and risks of using prescription and OTC pain medicines during pregnancy.
>
> Pregnant women should always consult with their health care professional before taking any prescription or OTC medicine. Women taking pain medicines who are considering becoming pregnant should also consult with their health care professionals to discuss the risks and benefits of pain medicine use.

Pain in Children

Chronic pain is a significant problem in the pediatric population, conservatively estimated to affect 20 to 40 percent of children and adolescents around the world. The most common chronic pain conditions in children and adolescence are musculoskeletal pain, headaches, and abdominal pain. They may experience physical and psychological pain and their families may experience significant emotional distress and social consequences as a result of pain and associated disability. Research suggests that the family dynamic and how parents respond to their child's pain can have a significant impact on the course of the child's pain and on their function. One of many resources is the book "Conquering Your Child's Chronic Pain: A Pediatrician's Guide for Reclaiming a Normal Childhood" by Lonnie K. Zeltzer, MD, and Christina Blackett Schlank.

Copyright 2019

Childhood pain brings significant direct and indirect costs from health care utilization and lost wages due to parents taking time off work to care for the child. In addition, longitudinal studies provide convincing evidence to suggest that childhood chronic pain predisposes the continuation of pain later in life and the development of new forms of chronic pain in adulthood (from Assessment and Management of Children with Chronic Pain, A Position Statement from the American Pain Society (January 4, 2012) http://americanpainsociety.org/uploads/about/position-statements/Pediatric_Pain_Policy.pdf). In addition, resources to help adolescents with pain was created by the ACPA and is accessible via dedicated website: www.growingpains.org.

Pain in Older Persons

The likelihood of experiencing chronic pain increases with age. An estimated 65% of US adults over the age of 65 report suffering from pain and up to 30% of older adults report suffering from chronic pain. The US Centers for Disease Control and Prevention estimates 15% of Americans over the age of 65 use a prescription pain relief drug. Older adults are more likely to have additional health problems that can cause or complicate chronic pain. Mobility and balance issues, common in older adults, both may impact their ability to engage in daily therapeutic exercise. While medications are certainly an important part of treating chronic pain, use in older persons is fraught with potential problems. Physical rehabilitation and other interventional therapies, which may include targeted injections and acupuncture, can be helpful to reduce pain, increase strength and physical function, and decrease the need for medications. In fact, the medical literature is full of studies showing the advantage of regular physical exercise in older adults. Additionally, psychological supports including relaxation techniques, mindfulness practices, and positive self- talk should always be considered for managing pain in elderly people. Finding a support group for people with chronic pain is also most beneficial.

In addition to chronic pain, older adults are more likely to have multiple medical conditions and to be taking multiple medications. Medication risks are greater for an individual when multiple medications are taken, and it is important to discuss all medications (including over-the-counter or herbal/homeopathic medications with your health care provider). Certain medications carry greater risks than others, especially when used in combination. Some older individuals may be more sensitive to medications, more likely to experience side effects, and more likely to be using multiple drugs with the associated risk of interactions between the drugs.

In general, 30 percent of hospital admissions among the elderly may be linked to an adverse drug-related event or toxic effect from opioids and sedatives (i.e., a tranquilizer). Nearly one-third of all prescribed medications are for persons over the age of 65 years. Unfortunately, many adverse drug effects in older adults are overlooked as age-related changes (general weakness, dizziness, and upset stomach) when in fact the person is experiencing a medication-related problem.

When using medications, they should be initiated at a low dose and adjusted slowly to optimize pain relief while monitoring and managing side effects. Multi-modal analgesia, which is the careful use of multiple pain-relieving drugs together, can be seen as potentially advantageous. Combining smaller doses of more than one medication may minimize the dose-limiting adverse effects of using a particular single drug. This statement is not meant to endorse certain drug combinations such as opioids with benzodiazepines which we know are hazardous.

Copyright 2019

The American Geriatrics Society (http://www.americangeriatrics.org) provides guidance on the topic of *Pharmacological Management of Persistent Pain in Older Persons* at the following website:
https://www.nhqualitycampaign.org/files/AmericanGeriatricSociety-PainGuidelines2009.pdf

This organization also offers patient-level information on medications for pain, and identifies medications with risks that may be greater than their benefits for people age 65 and older (also known as the *Beers Criteria for Potentially Inappropriate Medication Use in Older Adults*) at the following website: http://www.healthinaging.org/medications-older-adults/

The National Library of Medicine also offers information on a wide range of topics about chronic pain, including non-pharmacologic treatment alternatives, at the following website: https://medlineplus.gov/chronicpain.html

The Gerontological Society of America has a publication, *Addressing the Societal Burden of Opioid Misuse: Focus on a Balanced Approach to Older Adults with Chronic Pain*, which could be obtained by adding it to your cart for free at:
https://www.geron.org/online-store/gsa-products/product/10-from-publication-to-practice-addressing-the-societal-burden-of-opioid-misuse-focus-on-a-balanced-approach-to-older-adults-with-chronic-pain

The following infographic is from the NIH Pain Consortium:
https://painconsortium.nih.gov/sites/default/files/aging_and_chronic_pain_infographic_508.pdf

Copyright 2019

MAJOR TYPES OF INTERVENTIONS FOR PAIN

Passive interventions are treatments that can be received without any active participation by the person with pain. The physician or therapist delivers the treatment and the person with pain simply needs to be present. Massage, acupuncture, medications, injections and surgery are examples of passive interventions.

Active interventions require the person with pain to exert energy – to use their mind and/or body as part of the treatment. Active treatment requires the person with pain to be engaged, to participate and do things, to interact with the therapist or instructor -- or even to carry out the intervention or treatment independently (at home or outdoors by themselves). Yoga is an example of an active intervention. As a general rule, studies have shown active treatments to be more effective than passive ones over the long run.

Self-directed interventions can be carried out independently by the person with pain. By definition, self-care and self-management techniques are active interventions. Self-directed interventions do not require supervision by a health care professional beyond initial instruction. Self-directed activities may occur solo or in a class environment. Examples of self-care techniques for reducing pain include progressive relaxation exercises, mindfulness meditation and distracting oneself with pleasurable activities. Examples of self-management of chronic conditions include yoga, physical reconditioning, and competently managing complex medication regimens on a daily basis.

Functional restoration is a whole person approach to relieving pain and distress with the goal of restoring the person with pain's ability to engage in life in meaningful ways. Functional restoration refers to a unique philosophy and approach to medical care that focuses not just on the biology (injury/illness and associated pathology) but also on the individual as a whole person in the context of their life -- including its psychological and social aspects.

- *Interdisciplinary care or programs* means the involvement of several health care professionals (physician, pharmacist, psychologist, physical therapist, occupational therapist) providing coordinated services and communication at the same facility.

- *Multidisciplinary care or programs* involves the same kinds of practitioners providing services and communication as interdisciplinary care -- but the practitioners are in different locations. Coordination among practitioners is often challenging in multi-disciplinary programs.

FUNCTIONAL RESTORATION APPROACHES & PROGRAMS

The process of functional restoration enables an individual to acquire the skills, knowledge, and behavioral changes necessary to assume or re-assume primary responsibility for his/her physical as well as emotional well-being. Functional restoration thereby empowers the individual to achieve

Copyright 2019

maximum functional independence, to have the capacity to regain or maximize activities of daily living, and to return to vocational and avocational activities.

Fundamental elements of a functional restoration approach include assessment of the person's dynamic physical, functional, and psychosocial status. This is followed by a treatment plan that includes directed conditioning and exercise, physical and occupational therapy, cognitive behavioral therapy, patient/family education, and counseling, functional goal setting, ongoing assessment of participation, compliance, and complicating problems, and progress toward achievement of goals. Put all together, this is called a biopsychosocial approach.

Functional restoration treatment team members act as educators, de-emphasizing passive and/or palliative therapies, while emphasizing independent self-management. There should be a shift of health and well-being responsibility from the health care professionals and therapists to the person.

A functional restoration approach can include a more comprehensive adjustment of medications focusing on decreasing and/or eliminating unnecessary analgesic use, integrating adjunctive medications, focusing on improving mood, and sleep quality. The overlying goal is to coordinate appropriate interventions for the specific purpose of supporting the individual's effort to reach and maintain maximum functional improvement; institution of preventive measures, expectation management, education for relapse prevention, proper activity and work pacing, ergonomic accommodation; and when appropriate, transitional return to gainful employment with as little disruption to the work site and coworkers as possible.

Functional restoration involves objective measures of physical performance that guide treatment progression. At the same time, physical and occupational therapists, psychologists, nurses, and case managers provide education on pain management, coping skills, return to work issues, and fear-avoidance beliefs ("it hurts when I move, so I better not move"). They often use a cognitive behavioral therapy (CBT) approach consistent with the biopsychosocial view of chronic pain/disability. Additional psychological interventions may include acceptance and mindfulness interventions.

Ultimately, successful individuals with chronic pain take control of and re-engage in life activities and have achieved mastery over when and how to access the medical community in a way that is most beneficial for them. The goal is a mitigation of suffering and return to a productive life despite having a chronic/persistent pain problem.

While the functional restoration approach is a philosophy, there are coordinated functional restoration programs which involve an integrated team of professionals providing intensive, coordinated care, which may include pain specialist physicians/health care professionals, physical therapists, occupational therapists, psychologists, vocational counselors, nurses, and case managers providing individualized treatment in a structured setting.

These programs can be part-time or full-time but involve the individual with a chronic pain problem treated at a center where the physician, psychologist and physical therapist are based at that location. Services are coordinated 4-6 hours a day, 3-5 days a week for 4-6 weeks. These

Copyright 2019

programs focus on medication optimization, education, emotional stability and physical reactivation with a goal of better pain management and return to functional and life activities including work.

SELF-DIRECTED INTERVENTIONS

Self-Care, Self-Management, Self-Development

Information is power. Several effective self-care techniques to manage pain symptoms and reduce distress exist. So do techniques for self-management of chronic medical conditions, and techniques for self-management of nutrition, sleep, and general wellness. Most physicians and other healthcare professionals do not have the time to teach these self-directed treatments (or are unaware of them), but self-directed interventions are a very good way to regain a sense of independence and maximize over-all well-being and quality of life.

In addition, living with chronic pain sometimes creates challenges and life predicaments that are bigger than a person is accustomed to dealing with -- which makes pain and distress even harder to bear. It is important to recognize when this type of problem is due to lack of the knowledge or skills required to cope effectively with a particularly trying situation. In these situations, self-development is the ideal solution. Gaining knowledge and techniques for coping will strengthen skills and build the confidence needed to deal with the situation more effectively. Many psychologists and other mental health providers are trained to teach these self-development methods.

Self-management includes the systematic application of education and supportive interventions often suggested by health care professionals to increase patients' skills and patients' confidence in managing their health problems, including regular assessment of progress and problems, goal setting, and problem-solving support. It is clear that patients who develop these skills and who have confidence to deal effectively with chronic pain, experience pain differently. Becoming more active and independent results in better outcomes in chronic pain treatment.

Resources to support self-care and self-management run the gamut from simple online tools, websites, print materials, and videos to local and virtual support groups. The ACPA provides information for many of these resources at https://theacpa.org/.

ACPA Groups

A significant part of being involved in your recovery is being involved with your peers. ACPA groups welcome anyone who is living with an ongoing pain problem. The goal of an ACPA group is to provide support, validation, and education in basic pain management and life skills. Groups are facilitated by group members themselves and the success of the group is a shared responsibility. ACPA groups do not focus on symptoms or provide treatment of any kind. Rather, they are a means for people to share what they have learned and to encourage others to create more satisfying lives. Hear members' thoughts about the value of the kind of peer support offered by ACPA groups at https://theacpa.org/about-us/support-groups/.

Copyright 2019

Classes in Chronic Pain & Chronic Disease Self-Management

Another self-management treatment pathway involves structured educational self-management programs. Two widely acclaimed self-management programs include the Chronic Pain Self-Management Program and the Chronic Disease Self-Management Program. Both group educational programs consist of 6 classes (meeting once weekly) with each class lasting 2.5 hours. Research has shown these programs improve outcomes for participants. The class leaders in these structured programs all use the same manual, so participants receive the same information in every city and state where the program is being delivered. The programs are peer-led by persons with lived experience who have received their trainer certification. The programs are designed to help people living with chronic pain and medical conditions live better lives by learning how to self-manage symptoms and various life factors. The Chronic Pain Self-Management Program was initiated in 2015 and is currently available in nine states in the U.S. and in Canada and availability is rapidly expanding.

In some areas, the courses are delivered for a fee, but many closed payer systems, state and municipal public services, and health care centers offer one, or both, of these self-management programs to their members **free of charge**. Check with your health care organization, or you may search online to learn about local chronic pain self-management programs. If you wish to conduct an online search, include “Chronic Pain Self-Management Program” plus your city (or nearby cities) or healthcare organization. You can do the same search for the Chronic Disease Self-Management Program.

Copyright 2019

ACTIVE INTERVENTIONS – DELIVERED BY PROFESSIONALS

Active interventions delivered in concert with a professional get the individual with pain involved in learning and making positive changes that allow them to increase function and reduce pain. Active interventions help people change their lives in ways that create lasting benefits with the lowest risks.

Active interventions can be divided into two main groups: those that educate and retrain the body and those that educate and retrain the brain and mind. However, since pain is always the result of interactions and communications between body, brain, and mind, and they cannot actually be entirely separated, most of the active interventions below address both to some degree.

Following is a list of treatment options that fit within the concept of active interventions delivered in concert with a professional. Some require a clinician's involvement and others only an experienced practitioner. The list is not mutually exclusive so utilizing more than one, in combination or in sequence, might prove beneficial. Trial and error might be required to select the most appropriate treatment(s) that reduce risk but improve the level of activity and function. The primary goal is to find what works for the individual.

Information Therapy: Reconditioning the Brain

Number one should be education of the patient and the family -- as soon as the pain has been identified as chronic. However, today many persons with chronic pain and their practitioners often think of education last, after medications, passive therapy, other invasive interventions, and surgery. Without careful and thorough education about their situation, many patients have ended up with incorrect ideas or false beliefs that get in the way of their rehabilitation and actually increase their pain and disability.

Patients need and deserve information in easy-to-understand terms about the nature of chronic pain, how it gets started and perpetuated, and the best and most effective ways to treat it. Information is power. New facts often change the way both patient and family see the problem and their situation and open up opportunities for action.

No treatment plan is complete without addressing issues of individual and/or group education as a means of facilitating self-management of symptoms and prevention. It is critically important for persons with chronic pain to actually become well-informed about it.

Early topics should include helping a person understand that they may not end up "fixed" but rather, that they will discover they can manage their pain, which will reduce the suffering and distress that go along with it.

It can be helpful to think of chronic pain similar to other chronic diseases such as diabetes. A person needs to manage his or her diabetes and prevent it from getting worse and causing other

Copyright 2019

problems. Diabetes is not quickly cured or fixed. The same is true for chronic pain. Further education on chronic pain should also include understanding that pain is not "all in your head" (but it surely affects your brain) and that an active approach that focuses on the whole person is the most effective way to treat chronic pain.

Once pain becomes chronic, a safe level of activity should be defined as clearly as possible. Many times, the only guidelines a person may hear are restrictions given right after the injury or surgery. For example, rest immediately after surgery may be beneficial. In the case of chronic pain, however, prolonged rest can contribute to additional problems, such as deconditioning, increased stress, and additional pain problems. As the tissues heal after an injury, many restrictions can be lifted, and a person can safely return to higher levels of activity. Unfortunately, it is also common that patients have either been told incorrect information or have misinterpreted education from a past health care provider. Many health care providers lack experience in assessing or treating chronic pain. Inconsistent information can be confusing. Phrases like, "the back of an 80-year-old man" or "you will end up in a wheelchair if you sneeze," can keep a person fearful and disabled.

Reconditioning the Body: Exercise and Body Awareness

For most people with chronic pain, the main thrust of an effective pain treatment program is to keep them as physically active as possible. The human body is designed to be used. Inactivity can actually make pain worse over time, despite the temporary relief that often accompanies it. Gradual but continual advancement of activity levels is recommended.

There is strong evidence that regular physical activity and therapeutic exercise programs are beneficial for persons with chronic pain. They restore flexibility, strength, endurance, function, and range of motion, and can decrease discomfort. In addition, active exercise, particularly walking, has positive effects on brain chemicals. It usually improves mood and has been recognized as one of the most effective treatments for depression. Also, research has shown that walking and other appropriate exercises are usually the best treatments for chronic low back pain.

The American College of Sports Medicine has started a global health initiative called Exercise is Medicine. Their focus is to encourage health care providers to include physical activity when designing any treatment plan.

After consultation with a health care professional and/or physical therapist, a therapeutic exercise program should be initiated at the start of any chronic pain treatment program. Therapeutic exercise can be classified to include 1) range-of-motion exercises; 2) stretching; 3) strength training; and 4) cardiovascular conditioning. Such programs should emphasize education, independence, and the importance of an on-going self-directed exercise regimen.

Aquatic therapy or exercise may be beneficial for individuals who have other medical problems or conditions that make weight-bearing exercise inadvisable, or for those whose pain or weakness limits them from participating in even a low-level land program. The buoyancy of water can provide decreased stress on weight-bearing joints. After gaining strength and flexibility in the water, the person should transition, at least in part, to a land-based exercise program. Many times,

Copyright 2019

an individual's aquatic program can serve as an ongoing part of their long-term maintenance exercise program.

Persons with chronic pain can become discouraged when their pain temporarily increases due to therapeutic exercise, and they will sometimes terminate treatment too early before achieving maximal benefit. A flare-up of pain with exercise should be expected even with safe exercise, but can also be due to poor body mechanics, guarded or stiff movement, high levels of demand on an injured site, or compensatory movements. It is important to have a health care professional who is knowledgeable about treating chronic pain assist not only with setting up a graded and careful exercise program, but also with distinguishing new symptoms that may signify problems from the "good" discomfort that normally goes along with an increasing exercise program.

Pilates

Pilates is a method of exercise performed on a mat or using special apparatus that consists of low-impact and endurance movements. Pilates is named for its creator, Joseph Pilates, who developed the exercises in the early 1900s. The Pilates method emphasizes the breath, core strength and stabilization, flexibility and posture. Improving these areas can be beneficial when learning to manage chronic pain. Mat work may be too challenging as a starting point for people with chronic pain. Because it lacks the support associated with the Reformer and the Trapeze table (exercise machines used in Pilates), mat work can result in excessive strain to the body resulting in a poor movement. Appropriate modifications and simplifications to mat exercises do exist, which can be incorporated into a home program.

Yoga

Yoga creates a greater sense of health and well-being by emphasizing mindful practice, breath awareness, and proper body alignment. Yoga helps to manage chronic pain through movements that increase flexibility, strength, and relaxation. People with chronic pain should begin with a gentle, slow-paced class where props are available for support. Benefits of a regular yoga practice include improved sleep and reduced stress and anxiety. Studies have shown that yoga is beneficial for fibromyalgia, among other pain conditions.

Working with a Yoga Therapist on a one-to-one basis is an excellent way to experience the benefits of yoga in a safe environment and with a professional who is trained to modify different poses for specific conditions.

These styles of yoga are good for beginning students:

- Viniyoga refers to a therapeutic style of yoga that adapts the practice to the unique conditions and needs of each individual. It emphasizes repetitive movement combined with breath work. Although all yoga is therapeutic, Viniyoga's emphasis on the individual's physical needs makes it especially so.

Copyright 2019

- Iyengar Yoga utilizes straps, blocks, and chairs as props to assist participants in the precise alignment of their poses. Because of this assistance, Iyengar is an ideal style of yoga for beginners or those suffering from chronic pain. Unlike 'flow yoga," Iyengar poses are held in order to focus on safe alignment and to build endurance.

- Yin Yoga focuses on the body's connective tissue, ligaments, and joints as opposed to the muscles. Yin Yoga is practiced on the floor, and most poses are either sitting or reclining. To affect change in the connective tissue, poses are held for time – sometimes up to 10 minutes. Although challenging, Yin Yoga has a deeply soothing effect on the nervous system and for that reason is more relaxing than Iyengar Yoga.

- In Restorative Yoga, the body is supported in the poses by a variety of props. This encourages passive stretching and deeper awareness of the breath. Because of their passive nature, restorative poses are often held for up to 20 minutes.

- Hatha Yoga has come to represent a gentle, basic yoga classes with no flow between poses. However, Hatha actually describes any kind of yoga in which poses are done. Therefore, before participating in a Hatha Yoga class, it is important to clarify what type of Yoga will be taught.

- Therapeutic Yoga combines restorative yoga, breath work, and meditation techniques to bring the body into a greater sense of balance and reducing stress. What makes this type of Yoga Therapy unique is that the instructor has the skills to prescribe specific poses or breathing techniques for specific conditions. The instructor may build a program ranging from gentle to a more vigorous program depending on the individual's needs. Group classes can be designed for those with particular therapeutic needs.

These styles of yoga require strength and endurance:

- Ashtanga Yoga is characterized by constant movement, or flow, from one posture to another. It is vigorous and fast-paced, earning it the nickname of "Power Yoga." The focus is on deep breathing during each pose.

- Vinyasa is similar to Ashtanga Yoga in its emphasis on flowing through postures, particularly Surya Namaskar (Sun Salutation). The goal of Vinyasa is to improve coordination, strength, and balance by following the sequence of active poses.

- Bikram or "hot" Yoga literally refers to the fact that the practice studio is heated to 104 degrees Fahrenheit. The practice consists of 26 poses that are repeated twice. The intense sweat produced is thought to purify the body. This type of yoga should not be attempted without permission of your physician.

- Kundalini Yoga focuses on purifying the emotions, the mind, and the body while placing emphasis on the effects of breathing in each pose. Chanting mantras and meditation are

Copyright 2019

common practices of Kundalini. The word Kundalini refers to an energy, which is said to reside at the base of the spine. The intention of Kundalini practice is to release this energy.

Feldenkrais

The Feldenkrais Method® uses gentle movement and directed attention to improve ease and efficiency of movement, increase range of motion, and improve flexibility and coordination. This method is based on the principle of becoming aware of one's habitual movement patterns through movement sequences. The Feldenkrais Method is taught through Functional Integration® and Awareness Through Movement®. Functional Integration is a hands-on approach in which the practitioner subtly positions the client through gentle touching and cueing to allow improved positioning and movement. Awareness Through Movement classes use verbal instruction to guide the participant through movement sequences. Chronic pain can lead to guarded and stiff movement and Feldenkrais can be used to allow improved ease of movement and body awareness.

Postural Re-Training

There is considerable debate regarding the link between posture and spinal pain and much of the research indicates that there is either a weak correlation or no correlation between posture and pain. However, most clinicians believe that poor posture is a risk factor to spinal pain and maintaining good posture can benefit other structures of the body. Many rehabilitation programs focus on improving posture. Below are three common methods.

The Egoscue approach focuses on posture therapy and claims to get to the root of your chronic pain by returning your body to proper alignment, function, and balance. Egoscue uses a series of gentle exercises and stretches to return musculoskeletal balance and symmetry back to the body.

The Gokhale Method focuses on regaining healthy posture and movement to help restore the body's structural integrity. This approach emphasizes correcting positioning in everyday movement rather than periodic exercise sessions.

Global Postural Reeducation (GPR) is an approach based on the idea that the muscular system can face shortening resulting from genetic factors and body type, behavioral, and psychological factors. Treatment includes a thorough analysis and observation of a person's individual anatomy, physiology, and their presentation of symptoms and the consequences of such symptoms. GPR focused on each individual body, as a whole, with the understanding that the true cause of a problem could arise from a different part of the body. Part of the philosophy is that there are different series of interconnected muscles (or muscle chains) that have specific roles in function. GPR makes use of a series of specific postures adapted to each patient according to the chain of muscles that are affected while taking into account the whole body. The ultimate goal of this approach is to improve postural symmetry, which is believed to reduce pain and disability.

Copyright 2019

Alexander Technique

The Alexander Technique is a method that teaches how to find an improved balance in one's body by releasing unnecessary tension and changing inefficient habits of movement. The philosophy of this technique includes bringing attention to tensions throughout the body that have previously gone unnoticed, and that these tensions are very often the root cause of many common ailments. It is not a series of treatments or exercises, but rather a reeducation of the mind and body. The Alexander Technique allows one to become aware of balance, posture, and coordination while performing everyday actions.

Brain Motor & Sensory Retraining

Research has shown that there are altered connections and reorganization of the brains of those who suffer from chronic pain, although it is not clear whether these changes are a consequence of the chronic pain or they may have led to the pain becoming chronic. Treatment of chronic pain includes techniques called graded motor imagery, desensitization, and sensory re-education which focus on brain re-training. A brain motor and sensory exercise program can help you re-develop healthy nerve connections and brain organization. Certain pathways in the brain are activated when the brain needs to recognize a body part (sensory) and before and during a movement of that body part (motor). The goal of these treatments is to reorganize the brain and its pathways to diminish pain and sensitivity.

Graded Motor Imagery

Graded motor imagery is a set of rehabilitation processes used to treat pain and movement problems related to an altered nervous system. The three different treatment techniques include limb laterality training, motor imagery exercises, and mirror therapy. These techniques are delivered sequentially or individually.

People suffering from chronic pain often lose the ability to identify left or right images of their painful body parts. Limb laterality training includes viewing photographs of left or right body parts in a variety of postures focused on improving speed and accuracy. Motor imagery involves thinking about a movement but not actually performing that movement. By imagining movements, similar areas of the brain are used as would be used when the person performs the same movement. This technique is commonly used in competitive sports training. Mirror therapy involves movement of the limb inside a mirror-box such that visual feedback of the affected hand is replaced with that of the (reflected) unaffected hand. Mirror therapy is thought to reconnect motor output and sensory feedback and active pre-motor cortices. Mirror therapy has been found to be effective for CRPS and phantom limb pain in particular.

Desensitization

With chronic pain, a painful area can become more sensitive (hypersensitivity) than expected and the area of sensitivity can become bigger over time. Light touch, pressure, warm or cold temperatures, vibration and even the contact of the clothes on the skin can be painful. Desensitization is a treatment to slowly reduce the hypersensitivity of the affected area by introducing normal types of touch and temperature. A desensitization program provides frequent but short periods of stimulation to the affected area. The stimuli may consist of smooth to rough textures/fabrics, heat or cold, light or deep pressure and vibration. Desensitization programs progress gradually from

Copyright 2019

stimulation that produce the least painful response to the most painful. The course may take several days to several months, depending on the level of hypersensitivity.

Sensory Re-education

The ability of the brain to recognize the affected body part and its sensations is affected. Sensory re-education helps to adapt the brain's response to injured areas to normalize object shape, size, texture, and location. The brain is retrained for constant touch compared to moving touch, where on the skin the touch is actually occurring and what direction the touch is moving in. Treatment may incorporate unaffected areas using the same procedure so that the sensation on the two sides may be compared.

Virtual Reality

Although still in the early stages of research and development, scientists started looking at the power of virtual reality to ease suffering more than 20 years ago. Researchers don't know exactly how virtual reality impacts pain. One theory is that it provides a powerful distraction from pain. Another theory suggests that virtual reality could affect the "gating" system of how pain is transmitted to the brain and processed by the brain. Some have proposed that it can help interfere with how pain is processed in the brain and/or central nervous system. Virtual reality is also being used for Mirror Visual Feedback therapy based on the theories of mirror box therapy that is thought to affect the sensory maps in the brain. Virtual Reality is not readily accessible to most people yet and is now mostly limited to researchers who are conducting clinical trials for treating chronic pain or in select hospital settings.

Functional Activity Training

Chronic pain can limit even the simplest daily activities as well as the ability to perform higher-level work activities. A successful active program focuses on increasing the ability to perform functional tasks. For example, this could mean being able to perform household tasks or return to work again. Being more independent leads to a higher quality of life. Functional activity training is just as important as performing a daily exercise program. Lifting, carrying, pushing, pulling, reaching, bending, finger dexterity, and gripping/grasping are all examples of functional movements that are used on a daily basis. Functional Activity Training also includes the ability to tolerate sitting and standing for long periods of time. It is helpful to think of practicing daily activities similar to performing exercises. It is important to first determine the current ability to perform this task. Each task is then practiced with appropriate pacing of activity, flare management, and slow progression. Recreational activities are included in this category. The ability to perform a higher level of recreational activities serves many purposes including exercise, socialization, time utilization, and general enjoyment.

Personal Goal Attainment Program

One approach is the Personal Goal Attainment Program (PGAP) which consists of a series of 10 face-to-face or telephonic sessions with a trained PGAP provider, most often a vocational rehabilitation consultant, occupational therapist or physical therapist. The purpose of the program is for the individual with chronic pain to identify specific daily activities that are important or meaningful but have been given up due to the pain – and then gradually and safely restore them. In the process, confidence increases, and negative thinking and fears recede. The program was

Copyright 2019

developed by a psychologist at McGill University and has been shown to be very effective in reducing fear avoidance, catastrophic thinking and perceived injustice – and facilitating return to work. Referral is made by the treating physician. An interview and administration of screening questionnaires during an evaluation session determines eligibility for the program. The number of certified PGAP providers varies from community to community.
See https://www.pgapworks.com/en/index.php.

American Chronic Pain Association
Copyright 2019

PSYCHOLOGICAL & BEHAVIORAL APPROACHES

Chronic pain can impact every corner of a person's life, not just their physical functioning. The longer the pain condition lasts, the more emotional and mental distress a person tends to feel. This distress can make pain worse over time and decrease functioning. Chronic pain is best treated by the biopsychosocial model, which addresses the emotional, mental, and social aspects of pain as well as the physical.

Mental health care is an essential component of the multidisciplinary team. These interventions lead to less stress, more positive behaviors and a focus on functioning rather than cure.

Choosing to engage in a multidisciplinary approach and focus on managing pain rather than curing it is not "giving up." On the contrary, it is letting go of the illusion of being pain-free and simply choosing to live life to the fullest and find ways to thrive, despite pain. With the right mindset and coping strategies, a life with pain can still be a life full of hope and joy.

Pain Psychology

The International Association for the Study of Pain (IASP) defines pain as a negative sensory and emotional experience. As such, psychology is built into the definition of pain. Psychological experiences (e.g., stress, anger, depression, anxiety, worry about pain, over-focusing on pain) will increase pain intensity, whereas happiness, joy, love, and relaxation have been shown to provide pain relief. Pain psychology recognizes that every person can benefit from learning information and skills they can use to reduce their pain and suffering, even while other pain treatments are being pursued. In fact, some research suggests that the combination of medical, physical, and psychological pain treatments can provide best results.

Living in constant pain can be emotionally distressing and result in depression and anxiety or can worsen existing mental disorders. This does not mean that the person in pain is weak, but rather is having an understandable reaction to a stressful situation. Other psychological factors that impact pain and functioning include, but are not limited to, life stress, fear of movement and reinjury, avoidance behaviors, lack of motivation, sleep disturbance, poor social support, substance abuse and negative thinking patterns. Treatment of chronic pain in the biomedical model neglects to address the psychological and social issues that can worsen chronic pain.

Pain Psychology is the cutting edge of where psychology meets medicine. Utilizing a combination of Cognitive Behavioral Therapy, relaxation strategies, and education, Pain Psychology can help empower a person to manage their pain more independently by helping them understand their neurological gates in the central nervous system. The foundation of Pain Psychology is the Biopsychosocial Model, which treats the patient as a "whole" and not as an injured body part. Often individuals are relieved when exposed to the Biopsychosocial model because they have only been offered few, typically not helpful, tools to help them cope with the emotional and mental distress they have been experiencing. It is important to remember that Pain Psychology is not meant to "cure" the patient, but rather provide strategies to maximize one's ability to participate

Copyright 2019

in valued life activities that are most meaningful to them.

TREATMENT APPROACHES

Cognitive Behavioral Therapy for Pain (Pain-CBT)

Cognitive Behavioral Therapy is a common form of psychological treatment for many different problems, such as depression, anxiety or eating disorders. Pain-CBT is a specific form of CBT designed to address the common mental, emotional, and behavioral concerns that individuals with chronic pain face.

Pain-CBT provides foundational education on the role of the mind in the experience and treatment of pain, including the relationships between thought patterns, emotion, actions, and pain. Key CBT skills include learning to identify the negative thoughts/behaviors that serve to worsen pain and establishing different thought patterns that serve to reduce distress, calm the nervous system, reduce pain, and lead to better health choices. These are interventions that patients can learn to do independently. Once the individual understands how to help themselves feel better mentally and emotionally, it is easier to make healthier choices that support good pain control.

CBT also addresses core underlying beliefs that may be serving to keep an individual stuck in feeling hopeless or out of control with their pain. As such, negative beliefs can impact the functioning of an individual living with chronic pain and prevent them from engaging in active rehabilitation.

1. Sinister beliefs are when a person believes that pain is indicative of tissue damage. This belief is associated with fear, which keeps people from engaging in activity that may be beneficial, although physically uncomfortable.

2. Disability beliefs are when a person believes his or her pain is disabling them. The more disabled a person thinks he or she is, the more disabled the person will act. The person is not exaggerating or lying about the condition, but just perceives him or herself as very disabled and acts accordingly.

3. Reliance on medication or a medical intervention. If someone believes that only a medical intervention will cure them, then they will put their effort into seeking medical interventions and not into trying self-management techniques. They may also experience high levels of distress when their medications are unavailable or treatment they believe will cure them is not authorized. Often people become depressed or anxious when their surgeries or treatments fail.

4. Catastrophic beliefs are when people believe an event or situation is a disaster. For example, a patient may think of a pain flare as an indication that their condition is worsening rather than a temporary elevation in pain levels.

Copyright 2019

These types of pain beliefs can trigger emotional distress, such as sadness, anxiety, fear, hopelessness, or anger. As such, it's important to address such pain beliefs to best ensure a good response to medical treatment, and engagement in self-management principles.

Pain-CBT is the best-studied psychological treatment for pain and is considered the gold-standard because of decades of accumulated evidence showing benefit for people living with chronic pain. Pain-CBT is typically delivered in person or telephonically by trained mental health professional, pain psychologist or health psychologist in individual or group format. To locate a qualified therapist, consider utilizing the "find a CBT Therapist" tool at the website for the Association for Behavioral and Cognitive Therapies (http://www.abct.org/Home/) or the "Find a Psychologist" link at the American Psychological Association website at (http://www.apa.org/helpcenter/index.aspx).

Brain imaging studies show that pain-CBT works, in part, by decreasing attention to pain. It's common for people to ruminate on pain and to worry about it, and unfortunately these experiences serve to increase distress and amplify pain processing in the nervous system. Through CBT, people learn skills to better control pain-related distress—and stress caused by other life factors. Without the right understanding and skills, it's easy for pain and stress to cause people to react in ways that end up being unhelpful. For instance, most physicians could tell you that their patients engage in negative behaviors that harm their health. This may include smoking, lack of exercise, or poor eating habits. Most people know these habits are not healthy; but they probably do not understand what triggers them to engage in these harmful behaviors. Human beings are always acting on their thoughts, many of which become patterned over time—for better or for worse!

While pain-CBT is an appropriate treatment for pain, it can also be used to treat the psychological factors that impact pain including depression, anxiety, and sleep disturbance. In fact, pain-CBT often includes content on addressing sleep problems and factors that contribute to low mood. A combination of education, behavioral modification, and the changing of thinking patterns can help alleviate these psychological issues, resulting in improved functioning. Leaving psychological symptoms untreated can be costly. For example, a patient may be too depressed to be motivated in physical therapy and will be unlikely to benefit from other interventions until the depression is under control. Patients may also be taking higher doses of medication to cope with psychological distress, which can put them at risk for prolonged use, polypharmacy, addiction or substance abuse.

Acceptance and Commitment Therapy (ACT)

Acceptance and Commitment Therapy (pain-ACT) is a variant of pain-CBT. Like pain-CBT, pain-ACT includes education about pain, relaxation skills training, and some meditative elements shown to improve pain control. Unlike pain-CBT, pain-ACT emphasizes non-reactivity to negative thoughts as a way to diffuse their ability to amplify pain and distress. ACT guides participants toward acceptance of one's available choices and committing oneself to doing what will move them closer to attaining valued goals. Rather than "fighting against the pain" participants are guided to develop positive, attainable goals (that honor current physical limits) that are consistent with their values. Importantly, pain-ACT emphasizes engagement in activities with pain present, rather than waiting for pain to subside. Such an approach can help individuals reclaim their control over pain.

Copyright 2019

Locate an ACT therapist anywhere in the world:
https://contextualscience.org/civicrm/profile?gid=17&reset=1&force=1

Motivational Interviewing

Motivational interviewing is a counseling method that helps people resolve ambivalent feelings to find the internal motivation they need to change their behavior. It is a practical, empathetic, and short-term process that takes into consideration how difficult it is to make life changes.

Motivational interviewing is often used to address addiction and the management of chronic health conditions such as diabetes, heart disease, chronic pain, and asthma. This intervention helps people become motivated to change the behaviors that are preventing them from making healthier choices. It can also prepare individuals for further, more specific types of therapies. Research has shown that this intervention works well with individuals who start off unmotivated or unprepared for change. Motivational interviewing is also appropriate for people who are angry or hostile. They may not be ready to commit to change, but motivational interviewing can help them move through the emotional stages of change necessary to find their motivation.

The process includes a motivational interviewer encouraging patients to talk about their need for change and their own reasons for wanting to change. The role of the interviewer is mainly to evoke a conversation about change and commitment. The interviewer listens and reflects back the patient's thoughts so that the patient can hear their reasons and motivations expressed back to them. Motivational interviewing is generally short-term counseling that requires just one or two sessions, though it can also be included as an intervention along with other, longer-term therapies.

Fear Avoidance Therapy

Many people avoid activity after an injury due to the fear this will cause more pain and/or additional injury. Immediately after an injury, this fear is natural and helps to remind us to avoid further damaging the area. For example, immediately following an ankle injury, you avoid further pain and therefore do not put weight on the ankle. If you have just sprained your ankle, this is a good idea so that it can heal itself. However, once the pain becomes chronic, avoidance is not beneficial and can lead to physical de-conditioning, loss of flexibility, loss of muscle strength and an increase in pain. Therefore, this fear can prevent or delay recovery.

Unfortunately, people who have higher levels of fear tend to avoid more activity than normal and tend to focus more on the amount of pain they have when they attempt daily activity. Healthcare providers unknowingly contribute to this fear with messages such as "Don't do an activity that is painful", "You have the back of a 90-year-old" or "If you fall, you can be paralyzed". Reducing or eliminating pain-related fear can be a powerful intervention for those with chronic pain.

The Fear-Avoidance Model of Musculoskeletal Pain (FAM) describes how the pain experience can lead to negative thoughts, fear, avoidance, disability, depression and physical disuse. It states that in some situations, an individual connects specific movements with harmful consequences. These movements are considered threatening and cause fear, muscle tension, anxiety and thoughts of having more pain. Avoiding painful movement leads to short term positive outcomes including

Copyright 2019

a reduction in pain and a decrease in muscle tension and anxiety. However, in the long term, avoidance has negative consequences.

Treatment to overcome fear avoidance includes awareness of the patient's current beliefs regarding their pain, education, repeated exposure to activities that have been avoided, setting short and long-term goals and taking an active role in recovery. It can be helpful to learn the difference between pain sensations and tissue damage. Instruction on safe positioning, safe activity and appropriate progression of activity are important. Relaxation, breathing and meditation skills can be useful since an increase in pain with a higher level of activity is common. This type of treatment is often performed with both a psychologist and physical therapist, either separately or in a co-treatment session.

Stress-reducing Interventions

Often people dealing with chronic pain feel that their mind and body are at war with each other and this causes stress for the individual. Modern medicine has known for some time that stress can be harmful for the body. It increases heart rate, breathing rate, blood pressure, releases stress hormones, and impacts the digestive system. Short term stress is not necessarily harmful, but long-term stress, like the stress associated with living with chronic pain, can negatively impact the mind and body. Stress reduction is a critical component to pain management. There are numerous stress reduction mind-body interventions including relaxation, meditation, guided imagery, biofeedback, hypnosis, and art and music. These treatments can be used individually or as part of Cognitive Behavioral Therapy.

Many people feel that they are relaxing when they are sitting in front of the TV, but active relaxation takes effort and time. Active relaxation strategies can harness the mind in order to harness the body. The mind is a powerful tool and being able to relax it at will is one of the most important skills a person with chronic pain can learn.

ACPA offers a five-minute relaxation video. This five-minute relaxation exercise can help you let go of physical stress and begin to reduce your sense of suffering. The relaxation video can be found at http://www.theacpa.org/pain-awareness/september-is-pain-awareness-month/relaxation-video/.

Mindfulness-based Stress Reduction (MBSR)

There are a variety of meditative practices; the most studied one for chronic pain being mindfulness-based stress reduction (MBSR). It is a variant of meditation that has been applied to stress reduction and created by biologist Jon Kabat-Zinn. In recent years, studies have found that patients who used MSBR reduced medication use, increased their activity levels, and felt increases in self-esteem. A 2016 study published in the Journal of the American Medical Association revealed that MBSR effectively reduced chronic pain in people with chronic low back pain and did so equally as effective as structured 8-week CBT. It is thought that MBSR works by helping decrease attention to pain and pain-related distress, thereby dampening pain processing the nervous system. MSBR cultivates a greater awareness of the relationship between the mind and body. This awareness can highlight, in a non-judgmental manner, how our negative thinking and emotions adversely impact our actions and our health. This technology is an excellent supplement to CBT, but also a treatment intervention on its own. For more information on Mindfulness, read *"Mindfulness for Beginners: Reclaiming the Present Moment-and Your Life,"* by Jon Kabat-Zinn.

Copyright 2019

The University of California (UCLA) Mindful Awareness Research Center offers free on-line guided meditations available in English and Spanish at the following web site: http://marc.ucla.edu/mindful-meditations.

Relaxation and Guided Imagery

Another way to relax the mind is to use guided imagery. This technique uses the imagination to take the mind to a relaxing place, such as the beach or the forest. Imagery can also be used to increase self-confidence by helping patients imagine themselves being successful at a task or reaching their goals. This technique of visualizing success has often been used by sports psychologists to help athletes improve their performance.

Art & Music

Art and music are creative forms of expression and have been used for some time in psychotherapy to help people express their thoughts and feelings. While these creative tools can help chronic pain patients maintain their emotional stability, they can also impact them biologically. Art and music stimulate the healing process by helping to decrease stress and release neurotransmitters that can decrease the experience of pain. Engaging in creative activity can release endorphins, which are the body's natural pain killers. Many people, when engaged in the creative arts, report that they are less aware of their pain. Research suggests that listening to music during medical and minor surgical procedures can reduce pain and anxiety – and it is free. Art and music are excellent tools for any pain management plan and can be personalized to the taste and preferences of the individual. See additional resource at https://theacpa.org/pain-management-tools/the-art-of-pain-management/

Biofeedback

The above strategies can help the psychological components of stress, but there are also strategies that target the biological components of stress. Stress has several biological features, like increased heart rate and muscle tension. Biofeedback uses feedback from sensors and a computer to give information about the body's stress response and then teaches the patient to control the stress response. This may involve consciously relaxing muscles or changing breathing. Biofeedback has been particularly helpful for headaches and chronic pain, which often causes increased pain due to muscle tension and fatigue.

Hypnosis

Hypnosis is a state of deep relaxation that involves selective focusing, receptive concentration, and minimal motor functioning. A National Institutes of Health Technology Panel found strong support for the use of hypnosis for the reduction of pain. Individuals can be taught to use hypnosis themselves (self-hypnosis), and the use of self-hypnosis can provide pain relief for up to several hours at a time.

Copyright 2019

Reconditioning Brain and Mind

Social Isolation and Building Social Support

One of the biggest negative impacts of chronic pain is social isolation. Individuals may stop making plans out of fear of having to cancel on late notice again. Relationships may grow distant, particularly if one is unable to work. When someone has an acute injury, their support system is quick to offer help. However, when the pain does not resolve in a few months, the support system starts to become strained and dwindles. Friends and family return to their lives and the person in pain feels like he or she is struggling alone. Also, being in pain can be an emotional roller coaster and this can negatively impact communication with loved ones, which strains relationships.

Building social support is an important pathway to improving quality of life and reducing the impact of pain.

There are many ways to build support.

1. Communicate and reach out to others. It is important to start with expressing feelings, needs, and desires. Often, we assume others know what we need or want, and we become frustrated when they don't give it to us. One must be careful to not assume and start by expressing themselves clearly.
2. Reach out to new communities, such as support groups (see ACPA Support Groups at https://theacpa.org/about-us/support-groups/), neighbors, churches or other religious organizations. This can be challenging at first but can really be beneficial. One must be careful when choosing a structured chronic pain support group. Some groups can feel negative depending on the format and it is important to find groups that highlight successes and strengths and explores coping. These groups can be in person or online.
3. Health care team members can also be part of your support system. This includes doctors, nurse case managers, and mental health practitioners.
4. Join an online pain support group. You can participate in discussions and receive social support from your own home.
5. Join a pain treatment group or health class, such as pain-CBT, pain-ACT, an arthritis water exercise group, a senior center stretching class, or gentle yoga for people with medical concerns.

Interrupting Learned Neural Circuits

Sometimes the brain itself may be the source of pain although the pain feels like it is coming from the body. For example, research has shown that the identical parts of the brain light up on functional MRI whether a person is experiencing the emotion of grief (a "broken heart") or chest pain due to angina. Other studies have shown that acute pain lights up the parts of the brain that correspond to the injured body part on functional MRI. But just a few months later, that person's pain will no longer be lighting up that same part of the brain; it will now be lighting up the brain areas related to memory and emotion. Chronic pain of this sort is thought to be due to "learned neural pathways" or "learned pain circuits" in the brain – sort of like the repetitive sound of a scratched CD.

The Psychophysiological Disorders Society is an association of practitioners committed to

Copyright 2019

relieving symptoms due to stress-induced medical conditions. They help individuals with hard- to-explain chronic pain identify the connection between their pain and suppressed traumatic memories or emotions -- and then disconnect those experiences from their brain's pain circuits by using a variety of mind-body techniques. This approach has been particularly effective for people who had very difficult childhoods. Complete relief of pain and full return of function are possible. See for example the following web site: www.ppdassociation.org/.

Finding a Mental Health Therapist

There are a number of mental health therapists who offer psychotherapy for persons with chronic pain and who are specially trained and licensed by the state in which they practice.

- Psychiatrists have a Doctor of Medicine or Osteopathy (MD, DO) and provide psychiatric medical care services which includes diagnosis, treatment and prescription of medications.

- Psychologists have a Doctor of Philosophy (PhD) in Clinical Psychology or Counseling Psychology or Doctor of Psychology (PsyD) and specialize in human behavior and emotional health. They have training in working with individuals, couples, and families and do so either in group or individual sessions. They can also administer and interpret psychological tests. They have expertise in dealing with most emotional and behavioral problems. In some states, psychologists can prescribe medications for emotional problems.

- Social Workers have Masters Degrees (MA or MS) and are sometimes called Licensed Clinical Social Workers (LCSW). They receive specialized training in how people function in their environment and solve personal and family problems. Some also have experience in case management and can assist in finding government and local resources in the community that meet the needs of people with pain.

- Masters-Level Counselors have Masters Degrees (MA or MS) in either clinical or counseling psychology. They are sometimes called Licensed Marriage & Family Therapists or Licensed Professional Counselors. They have specialized training in dealing with individuals and families particularly in relationship problems.

It is important for the public to realize that few doctoral and masters programs offer courses in Pain Psychology and not all providers who treat chronic pain are focused on improving functioning. Some providers are simply offering support during difficult transitions while others are inadvertently reinforcing negative behaviors. The most common example is that a mental health provider may discourage a chronic pain patient from engaging in a certain activity because it is uncomfortable and distressing. A provider trained in Pain Psychology focuses on teaching skills so that the patient can engage in more activity, ask for support when they need it, and set realistic goals for themselves. In order to find a provider who is truly trained in Pain Psychology, it is important to ask them four questions:

1. Do they have the special expertise or training in chronic pain?
2. Do they understand the biopsychosocial model?
3. Are they trained in cognitive behavioral therapy and mindfulness?

Copyright 2019

4. Are they familiar with working with multidisciplinary teams? A good indication of this would be that the provider is associated with a functional restoration program or they are part of a clinic that includes biopsychosocial interventions.

Conclusion

Chronic pain can impact every corner of a person's life, not just their physical functioning. The longer the pain condition lasts, the more emotional and mental distress a person tends to feel. This distress can make pain worse over time and decrease functioning. Chronic pain is best treated by the biopsychosocial model, which addresses the emotional, mental, and social aspects of pain as well as the physical. A mental health practitioner is an essential component of the multidisciplinary team. These interventions lead to less stress, more positive behaviors and a focus on functioning rather than cure.

Choosing to engage in a multidisciplinary approach and focus on managing pain rather than curing it is not "giving up." On the contrary, it is letting go of the illusion of being pain-free and simply choosing to live life to the fullest and find ways to thrive, despite pain. With the right mindset and coping strategies, a life with pain can still be a life full of hope and joy.

Copyright 2019

COMPLEMENTARY, ALTERNATIVE & INTEGRATIVE MEDICINE (CAM)

Complementary and Alternative Medicine (CAM) includes a diverse group of healing systems, practices, and products that are typically considered allopathic medicine, although some have proven scientific validity and have become mainstream (e.g., acupuncture, meditation, hypnosis, yoga, certain herbal preparations, etc.). Other CAM approaches have strong followers, but their "proof" of value is really anecdotal rather than based on scientific fact.

In fact, what is considered to be CAM changes continually, as those therapies that are proven to be safe and effective become adopted into conventional health care and as new approaches to health care emerge.

Complementary medicine and alternative medicine are different from each other. Complementary medicine is used together with conventional medicine while alternative medicine is used in place of conventional medicine. Integrative or integrated medicine combines treatments from conventional medicine and CAM for which there is some high-quality evidence of safety and effectiveness. Always check with your health care provider or pharmacist as drug interactions can occur with many alternative or "natural" medications.

The reader is referred to the following Internet websites for further information.

The National Center for Complementary and Integrative Health (NCCIH) (http://nccam.nih.gov) is part of the National Institutes of Health (NIH) and is the lead agency for scientific research on CAM. Go to https://nccih.nih.gov/health/integrative-health for Complementary, Alternative, or Integrative Health: What's In a Name?

The Mayo Clinic published an article for healthcare practitioners (Mayo Clin Proc. 2016;91(9):1292-1306), *Evidence-Based Evaluation of Complementary Health Approaches for Pain Management in the United States*. This article examines the clinical trial evidence for the efficacy and safety of several specific approaches including acupuncture, manipulation, massage therapy, relaxation techniques including meditation, selected natural product supplements (chondroitin, glucosamine, methylsulfonylmethane, S-adenosylmethionine), Tai Chi, and yoga as used to manage chronic pain and related disability associated with back pain, fibromyalgia, osteoarthritis, neck pain, and severe headaches or migraines. The article is available on the Internet at:

http://www.mayoclinicproceedings.org/article/S0025-6196(16)30317-2/pdf

Copyright 2019

Traditional Chinese Medicine (TCM)

Traditional Chinese Medicine (TCM) originated in ancient China over five millennia ago. It is a medical philosophy built around the theory that diseases are caused by an imbalance of vital energy flow (Qi). Qi is thought to circulate around the body via multiple channels (meridians), predicating optimal functioning of all organs and tissues. Many additional concepts inform diagnosis and treatment, such as those of Blood, Yin and Yang, and Jing, among others. Such theories were recorded in writing and passed down generations for thousands of years, resulting in a robust theoretical and empirical framework of medical thought. Many of TCM's major concepts bear some correlation to contemporary Western notions about the physiological basis of bodily functioning. For more information on TCM's origins and approach, please visit https://nccih.nih.gov/health/whatiscam/chinesemed.htm and https://www.tcmworld.org/.

TCM is a complete medical system that can be used independently of any other system. Its principal modalities are as follows:

Herbs

The most important and powerful modality in TCM is herbal treatment, which corresponds to the pharmacological approach in modern medicine. Thousands of herbs and hundreds of animal materials, along with minerals, constitute TCM's pharmacopeia. These are combined in complex formulas and used to treat disease on an individual basis. A number of these compounds are used to treat chronic pain, and are dispensed in tea, pill, or topical form, as each case demands. They are prescribed by certified TCM practitioners. Practitioners' certification is regulated either by state or nationally and can be confirmed here: http://www.nccaom.org.

Acupuncture and Acupressure

The flow of Qi along meridians is thought to be modulated by application of specific points on these meridians. Classically, there are 362 points located along 14 meridians. They can be mapped using a specific, three-dimensional coordinate system. Meridian points are then stimulated, alone or in groups, using thin metal needles (acupuncture or needling), fingertips (acupressure), heat (moxibustion), cold (cryotherapy), electricity (with or without needles), or other stimuli. Typically, four to twelve points are stimulated per session, with sessions lasting from five to sixty minutes. A full course of treatment consists of ten to twenty sessions. These have traditionally been held daily, although contemporary American treatment more commonly takes place three times a week. There are multiple acupuncture techniques outside of TCM that have been derived from its system, although these have less empirical evidence of effectiveness than TCM.

Acupuncture has been gaining popularity in the United States since the 1970s, and, in wake of increasing acceptance by both the public and medical professionals, it is now covered by many insurance policies. In the field of chronic pain medicine, there is a strong body of research supporting the efficacy of acupuncture for headache, osteoarthritis, and musculoskeletal conditions, such as neck and lower back pain.

The National Library of Medicine website (https://medlineplus.gov/acupuncture.html) provides general information on acupuncture, including a link to locate a certified practitioner.

Copyright 2019

Moxibustion

An important modality of treatment in TCM consists of applying heat to meridian points, either in combination with needles or by itself. This is known as moxibustion. Cigars made of different herbs, small cones of fine sawdust, electrical heating devices or lasers can all be used to provide a steady flow of heat and thereby enhance or substitute the effects of acupuncture in harmonizing Qi flow. Moxibustion is often used to treat chronic pain or insomnia, and for relaxation.

Cupping

Cupping is a TCM treatment modality in which cups are placed on the skin to create suction. Traditionally, cups were made of wood, clay or horn; glass or plastic cups are used today. In cupping, a vacuum is created within the cup by setting a flammable substance on fire inside of it and then allowing it to cool, or by using a rubber pump. The underlying tissue is, in result, sucked partway into the cup. Small blood vessels are broken by the vacuum suction, and cupping causes light bruising around the circumference of the cup. The cups may be placed over acupuncture needles, on their own, or moved around to provide vigorous massage of large body areas. Cupping is used to regulate Qi flow and help with pain, inflammation, blood flow, and relaxation. There is limited research on cupping, and its benefits in alleviating pain have not been proven. Some believe that cupping has no scientific basis.

Gua Sha

Gua Sha is a TCM treatment modality involving scraping areas of skin with plates, traditionally made of horn, usually together with application of herbal oil. Scraping causes light bruising and is thought to promote Qi flow and help with chronic pain, inflammation and circulation. As with cupping, the benefits of Gua Sha have not been proven, and some believe that it has no scientific merit.

Tui Na

Tui Na is a combination of massage, mobilization and manipulation techniques. It is widely used in TCM in treatment of musculoskeletal disorders but has no wide recognition by Western conventional medicine.

Tai Chi

Tai Chi was developed in China as an ancient martial art and is practiced for both defense training and health benefits today. It has gained popularity worldwide as an exercise form and for health enhancement. In this context, Tai Chi refers to a sequence of choreographed slow, soft flowing movements with the body that incorporate a straight spine, abdominal breathing, and a natural range of motion. Each specific movement corresponds with either the inhalation or exhalation of a deep, gentle breath. The slow movement and weight bearing required by Tai Chi contributes to musculoskeletal strength and joint flexibility, while the meditative focus of Tai Chi improves concentration and mindfulness, thus improving mood, and functions of the immune and autonomic nervous systems. In recent years, Tai Chi has received increased attention from researchers worldwide looking for alternative and complementary approaches to treating chronic pain. Research studies has suggested that Tai Chi can provide benefit for pain from osteoarthritis, osteoporosis, and

Copyright 2019

low back pain with practice longer than five weeks. Other studies have found benefits of Tai Chi in postherpetic pain in herpes zoster, rheumatoid arthritis, and stroke. It has not yet been conclusively demonstrated that Tai Chi is superior at chronic pain control when compared to other active treatments. Tai Chi is not generally associated with significant adverse events.

Qigong

Qigong is another systematized form of movement, breathing, and mindfulness, cultivated in ancient China, and used today for health, longevity, and martial arts training. It seeks to harness and balance *qi*, or 'life energy' by coordinating slow movements similar to those of Tai Chi with deep breathing and a meditative state of mind. It, too, has been explored as an alternative or complementary therapy in the relief of pain. It has been recognized as a "standard medical technique" in China since 1989 and is included in the medical curriculum of some universities there, used in treatment not just of pain but hypertension, coronary artery disease, diabetes, fatigue, insomnia, myopia, and a host of other chronic conditions. Medical research, while promising, does not conclusively demonstrate whether Qigong can be helpful in chronic pain however more research is needed.

Nutrition

Diet, including use of dietary herbs, is an important and inseparable part of TCM. TCM practitioners with an oriental background generally hold an advantage over other providers in that they are intimately familiar with the nutritional products through lifetime cultural exposure rather than learned use of nutritional products in a classroom setting.

FINDING A Specialist in Traditional Chinese Medicine

Traditional Chinese Medicine originated largely as a holistic system of preventive medicine, with multiple treatment modalities as described above. In the United States it is regulated on a state and national level. Multiple schools offer a master's degree in TCM or oriental medicine and a few offer a doctoral level, which is more important for continuous research in the field rather than in clinical training. Upon completion of master course, many states offer a licensing examination in acupuncture, which includes theory of TCM, diagnosis and multiple treatment modalities other than just acupuncture. The National Certification Commission for Acupuncture and Oriental Medicine (NCCAOM®) is a non-profit organization established in 1982. The NCCAOM is the only national organization that validates entry-level competency in the practice of acupuncture and oriental medicine through professional certification. Most of the states either require or use NCCAOM certification/examination. In California. state acupuncture license is mandatory for practice. Alabama, Oklahoma and South Dakota have no acupuncture practice act. The best way to find a practitioner in TCM is through state boards or NCCAOM websites. http://www.nccaom.org

The American Academy of Medical Acupuncture (AAMA) is the professional society of physicians (MDs and DOs) in North America who have incorporated acupuncture into their traditional medical practice. The AAMA was founded in 1987 by a group of physicians who represented both East Asian and Euro-American styles of acupuncture. https://www.medicalacupuncture.org/

The American Board of Medical Acupuncture (ABMA) was formally established on April 26,

Copyright 2019

2000. The ABMA has been created as an independent entity within the corporate structure of the American Academy of Medical Acupuncture. The ABMA has a separate, independent Board of Trustees with full responsibility for the direction and operation of the ABMA. The mission of the American Board of Medical Acupuncture is to promote safe, ethical, efficacious medical acupuncture to the public by maintaining high standards for the examination and certification of physician acupuncturists as medical specialists. http://www.dabma.org/

Copyright 2019

PHYSICAL MODALITIES – NONINVASIVE INTERVENTIONS

Passive therapy (those treatment modalities that do not require energy expenditure on the part of the patient) can provide short-term relief during chronic pain flare-ups and is directed at controlling symptoms such as pain, inflammation, and swelling. Passive therapies may be useful over the short term but have limited benefit for chronic pain conditions overall.

Heat & Cold

Using cold (cryotherapy) or heat (thermotherapy) are inexpensive self-treatment approaches with minimal risks. While there are some individuals that find cold helpful for chronic conditions, it is mostly utilized for acute injuries when there are damaged superficial tissues that are inflamed, hot and swollen. Heat is more helpful for chronic muscle pain, contractures and spasm.

Cold treatment reduces inflammation by decreasing blood flow. It is usually applied within 48 hours after an injury. Heat treatment promotes blood flow and helps muscles relax. Alternating heat and cold may help reduce exercise-induced muscle pain. Heat and cold therapy modalities are often used despite prevalent confusion about which modality (heat vs cold) to use and when to use it. Most recommendations for the use of heat and cold therapy are based on empirical experience, with limited evidence to support the efficacy of specific modalities. There is limited evidence from randomized clinical trials supporting the use of cold therapy following acute musculoskeletal injury and delayed-onset muscle soreness. There is limited overall evidence to support the use of topical heat in general; heat-wrap therapy providing short-term reductions in pain and disability in patients with acute low back pain; and significantly greater pain relief of delayed-onset muscle soreness than does cold therapy. https://www.ncbi.nlm.nih.gov/pubmed/25526231

Therapeutic Massage

Therapeutic massage is different than the relaxing massage you may receive at the spa. The therapists use their knowledge of anatomy and physiology along with different manual techniques including but not limited to cross-fiber massage, friction massage, myofascial release, and trigger point therapy.

Soft tissue mobilization is a form of manual physical therapy where the physical therapist uses hands-on techniques on the muscles, ligaments and fascia with the goal of breaking adhesions. The goal of soft tissue mobilization (STM) is to break up inelastic or fibrous muscle tissue such as scar tissue, move tissue fluids, and relax muscle tension. This procedure is commonly applied to the musculature surrounding the spine and consists of rhythmic stretching and deep pressure.

Myofascial Release is a hands-on technique that involves applying gentle sustained pressure into

Copyright 2019

the myofascial connective tissue to release restrictions. The idea is that the gentle pressure over time will allow the fascia to elongate. Myofascial Release Treatment is performed directly on skin without oils, creams or machinery. This enables the therapist to accurately detect fascial restrictions and apply the appropriate amount of sustained pressure to facilitate release of the fascia.

While most therapists will use only their hands, tools or instruments can be used with therapeutic massage. The Graston Technique is when a tool is used to perform a specialized form of massage/scraping of the skin.

Active Release Therapy (ART®) is a patented and specific set of hand techniques that combine soft tissue mobility with movement. The role of ART is to reestablish proper motion between muscles and fascia while reducing fibrous adhesions or scar tissue. This scar tissue can also compress nerves and cause trigger points. The provider uses his or her hands to evaluate the texture, tightness and movement of muscles, fascia, tendons, ligaments and nerves. The goals of ART include restoring normal mobility and gliding between muscular tissue and nerves. It can also help push joint fluid throughout the body and stimulate the lymphatic system**,** which helps lower inflammation.

Ultrasound

Ultrasound therapy is using ultrasonic waves or sound waves of a high frequency to stimulate tissues in the body. Ultrasound is applied using a round-headed wand or probe that is placed on a patient's skin. The ultrasonic waves are caused by the vibration of crystals within the head of the wand/probe. The sound waves that pass through the skin cause a vibration of the local tissues. Ultrasound gel is used in order to reduce friction and assist in the transmission of the ultrasonic waves. Ultrasound can also be applied under water. When done properly, ultrasound is not painful. Ultrasound is thought to improve healing through increases in tissue relaxation, local blood flow, and scar tissue breakdown. Phonophoresis is when ultrasound is used to help deliver topical medication. The medication gel is applied to the skin, and then the ultrasonic energy forces the medication through the skin.

Although ultrasound is a common modality used in physical therapy treatment, the evidence does not support the use of ultrasound as an effective treatment for pain.

Iontophoresis

Iontophoresis is a method of delivering medication using electrical stimulation. The electrical current is used to push ionized drugs through the skin's outermost layer. Different medications can be used depending on the purpose of the treatment. Iontophoresis is thought to decrease inflammation, decrease pain, decrease muscle spasm, decrease swelling and edema, reduce calcium deposits in the body and manage scar tissue. Iontophoresis is administered in a physical therapy clinic or the patient wears a small battery-operated patch for 24 hours.

Copyright 2019

Paraffin (wax)

A paraffin treatment uses warm oil-based wax most commonly used on the hands, elbows and feet to provide deep heat therapy. Liquefied paraffin wax is very efficient at absorbing and retaining heat. The affected body part is dipped into the paraffin and then removed to allow the paraffin to harden. This is repeated multiple times. The body part is then covered to maintain its heat. Paraffin provides the benefits of heat including increased blood flow, increased muscle flexibility and decreasing joint stiffness. Paraffin treatments also smooth and soften dry, chapped, rough and scaly skin. It can be helpful for chronic skin disorders such as eczema and psoriasis. Home units are available although one should always use paraffin wax heater which has automatic heat controller to maintain appropriate temperatures.

Infrared Light Therapy

Infrared Light therapy delivers light energy safely through the skin. The human eye can see a spectrum of light wavelengths. Light at longer wavelengths are no longer visible to the human eye and are called infrared. The longer the wavelength, the deeper it can penetrate into the body. Infrared Light therapy is thought to increase blood circulation, stimulate healing and reduce inflammation.

Spinal Traction & Spinal Decompression

Spinal Traction simply means providing a pulling force that provides a stretch to the spine. Traction is thought to decrease the intradiscal pressure to promote retraction of the herniated disc which would decrease the pressure on the adjacent nerve. However, muscles surrounding this area can contract as the body attempts to protect itself against the stretch, eliminating the benefit. Traction can be performed manually or with a machine. Spinal decompression claims to use computer-controlled force to achieve gradual and calculated increases in traction forces and angles to the spine that creates a vacuum action within the disc. The computerized decompression table continuously monitors spinal resistance and adjusts forces accordingly. The goal of treatment is to create a negative intradiscal pressure to promote repositioning of the herniated disc material and to cause an influx of healing nutrients and other substances into the disc.

Spinal Traction and Spinal Decompression have not been proven effective in treatment of pain. There is moderate evidence that home-based patient-controlled traction may be a noninvasive conservative option, if used along with other evidence-based conservative care.

Taping

Kinesiotape (KT) was originally developed to provide support for musculoskeletal structures without overly restricting them like other taping methods. Kinesiotape is made up of cotton fibers with polymer elastic strands and is lightweight with heat-sensitive acrylic adhesive. Clinicians that use the tape believe that it can improve blood and lymph flow, provide soft tissue and muscle support, allow for beneficial muscle activation and provide joint protection. Kinesiotape can be

Copyright 2019

applied in a variety of patterns on different body parts. The tape can remain on the skin for 3 to 5 days.

Despite the fact that the brightly colored Kinesiotape has been widely seen on Olympic and professional athletes, the scientific evidence for its use remains low. Kinesiotape may have a small beneficial role in improving strength, range of motion and fluid circulation in certain injured individuals, but multiple systematic reviews have found insufficient evidence to support the use of Kinesiotape for those following injury or those with chronic musculoskeletal pain.

Non-Elastic or Corrective Taping, often called McConnell Taping technique named after physical therapist Jenny McConnell who developed it, is characterized by tape with a combination of minimal elasticity and a high adhesive. Due to the highly adhesive backing of the tape (usually called Leukotape), a protective tape (usually called cover roll tape) is applied on the skin first. This type of taping technique is much more rigid and is used for structural support or alignment. McConnell taping is most frequently used for taping of the knee however the research is inconclusive for its benefit.

Manipulation & Mobilization

Spinal Manipulative Therapy (SMT) is a therapeutic intervention performed for what is described as “restricted joint(s)” in the spinal column.

Spinal manipulation is a historically recognized therapeutic intervention that has been employed in various cultures for thousands of years. In modern time, the procedure is utilized by Doctor of Chiropractic (DCs), Doctors of Osteopathy (DOs), and physical therapists (PTs). Chiropractors prefer the term "adjustment" whereas physical therapists apply the word "mobilization." Adjustment is described as a more specific type of SMT, often provided to address a specifically identified biomechanical fault.

Manipulation and mobilization are two types of manual (hands-on) therapies that include a wide array of different techniques and schools of thought. Traditional manipulation involves high force, high velocity, and low amplitude action (HVLA) forces with focus on moving a targeted, fixated or restricted joint(s). In general, mobilization involves assisted low force, low velocity movement often directed to one or more compromised vertebral segments and typically uses long lever arms to deliver the force. The term adjustment is commonly used a synonym for manipulation.

The effects of spinal manipulation include relief of acute and chronic back pain, improved spinal motion, and affecting the nervous system mostly at the local spinal level. There are research studies which support the benefits of SMT.

Overall, studies have shown that spinal manipulation can provide relief from acute and chronic low back and neck pain. SMT can be as effective, or more effective, than conventional medical treatments. In 2007 Guidelines, the American College of Physicians and the American Pain Society include spinal manipulation as one of several treatment options for practitioners to consider using when pain does not improve with self-care. Research studies have shown that spinal manipulation can be a more effective treatment for chronic back pain than bed rest, traction, topical

Copyright 2019

gels, or no treatment; some studies show superiority of SMT over acupuncture, physiotherapy, and school for low back pain.

Electrical Stimulation Devices (external)

Electrotherapy represents the therapeutic use of electricity and is another modality that can be used in the treatment of pain.

Transcutaneous electrotherapy is the most common form of electrotherapy in which electrical stimulation is applied to the surface of the skin. The earliest devices were referred to as TENS (transcutaneous electrical nerve stimulation) and are the most commonly used.

Interferential Current Stimulation (ICS) allows for deeper penetration of tissue, whereas TENS is predominantly a cutaneous or superficial stimulus. Interferential current is proposed to produce less impedance in the tissue, and the intensity provided is supposed to be more comfortable. Because there is minimal skin resistance with the interferential current therapy, a maximum amount of energy goes deeper into the tissue. It also crisscrosses, as opposed to the linear application of the TENS. This crisscrossing is postulated to be more effective because it serves to confuse the nerve endings, preventing the treated area from adjusting to the current.

Pulsed Electromagnetic Field Therapy (PEMF or PEMT) is a non-invasive treatment that creates micro-currents in the body's tissues through time-varying or pulsed electromagnetic fields. All cells produce electromagnetic fields and every organ in the body produces its own signature bioelectromagnetic field. As low frequency pulsed electromagnetic current passes through the body, it stimulates the electrical and chemical processes in the tissues. Therapeutic PEMFs are specifically designed to positively support cellular energy, resulting in better cellular health and function. PEMFs are believed to work to 1) Reduce pain, inflammation, and the effects of stress on the body; 2) Improve energy, circulation, blood and tissue oxygenation; 3) Improve tissue regeneration; 4) Accelerate repair of bone and soft tissue; and 5) Increase endorphin and serotonin release. Treatment times are typically 10-30 minutes and multiple areas can be treated at one time.

Diathermy uses high-frequency electric current to produce heat deep inside a targeted tissue. It can reach areas as deep as two inches beneath the skin's surface. The diathermy machine does not apply heat directly to the body. Instead, the waves generated by the machine allow the body to generate heat from within the targeted tissue. There are three main types of diathermy: shortwave, microwave, and ultrasound. Shortwave diathermy uses high-frequency electromagnetic energy, microwave diathermy uses microwaves and ultrasound diathermy uses sound waves. Heat is generated by the vibration of the tissue. This promotes blood flow into the area. Treating injuries with heat can increase blood flow which can accelerate healing. Treatment can also make connective tissue more flexible, minimize inflammation and reduce the incidence of edema, or fluid retention. There are risks to using Diathermy and you should consult a physician before use.

Copyright 2019

INVASIVE INTERVENTIONS

In general, interventions are meant to facilitate improved function and should be viewed as part of an overall rehabilitation treatment strategy combining behavioral and physical medicine approaches to pain management.

Dry Needling

Dry needling is a technique that uses a "dry" needle (meaning one that doesn't release any medication). The needle is inserted through the skin into trigger points in muscle tissue. Trigger points can be tender to the touch and touching a trigger point may cause pain to other parts of the body. Dry needling is used to release the trigger points to relieve pain and tension or improve motion. Dry needling is also thought to normalize abnormal motor end plates (the sites that transmit nerve impulses to muscles). Dry needling can produce minor bleeding and some soreness but is a safe procedure when performed by a trained professional. Dry needling is not the same thing as acupuncture, a practice based on traditional Chinese medicine and performed by acupuncturists.

Trigger Point Injections

Trigger point injections are given to individuals with a myofascial pain syndrome, a regional painful muscle condition. These injections may provide short-term benefit only but are curative for some individuals.

A trigger point is a discrete focal tenderness located in a palpable taut band of skeletal muscle, which produces a local twitch in response to stimulus to the band. Trigger points may be present in up to 33-50 percent of the adult population. Myofascial pain syndrome is a regional painful muscle condition with a direct relationship between a specific trigger point and its associated pain region. These injections may occasionally be necessary to maintain function in those with myofascial problems when myofascial trigger points are present on examination.

Intra-Articular Steroid Injections

Invasive therapeutic interventions for osteoarthritis include steroid injections into the joint. Intra-articular steroids are effective for short-term (one to three weeks) pain relief but do not seem to improve function or provide pain relief for longer time periods. The number of steroid injections should be limited secondary to associated side effects including fat necrosis, loss of skin pigmentation, skin atrophy, avascular necrosis of the femoral head, Cushing's disease, and in some cases, acceleration of joint degeneration. Following a steroid injection, the treated joint should be rested (limit its use) for a minimum of 24 hours in order to prolong and to improve effects on function and pain control.

Copyright 2019

Viscosupplementation

Viscosupplementation may be used for osteoarthritis (OA) of the knee. Viscosupplementation involves injecting lubricating substances (hyaluronic and hylan derivatives) into the knee joint. Proponents argue that viscosupplementation restores the lubrication of the joint, and as a result, decreases pain and improves mobility.

There are differences of medical opinions regarding use of viscosupplementation.

The American Academy of Orthopedic Surgeons (AAOS) does not recommend using hyaluronic acid for treatment of patients with symptomatic osteoarthritis of the knee (http://www.orthoguidelines.org/guideline-detail?id=1214).

The American College of Occupational and Environmental Medicine (ACOEM) states Intraarticular knee viscosupplementation injections are not recommended for treatment of moderate to severe knee osteoarthrosis based on a review of scientific evidence-based medicine research.

The American Medical Society for Sports Medicine (AMSSM) recommends the use of hyaluronic acid for patients above the age of 60 years with knee osteoarthritis. AMSSM feels that based on the response to those over 60, the evidence is moderate for those under 60. (http://journals.lww.com/cjsportsmed/Fulltext/2016/01000/AMSSM_Scientific_Statement_Concerning.1.aspx).

The American College of Rheumatology 2012 Recommendations for the Use of Nonpharmacologic and Pharmacologic Therapies in Osteoarthritis of the Hand, Hip, and Knee regarding the use of intraarticular hyaluronate injections states they are conditionally recommended in patients who had an inadequate response to initial therapy. http://www.rheumatology.org/Portals/0/Files/ACR%20Recommendations%20for%20the%20Use%20of%20Nonpharmacologic%20and%20Pharmacologic%20Therapies%20in%20OA%20of%20the%20Hand,%20Hip%20and%20Knee.pdf

Intraarticular hyaluronic acid treatment for knee osteoarthritis (OA) has a good safety profile and a moderately beneficial effect on symptoms similar to that observed with other pharmacologic modalities such as nonsteroidal anti-inflammatory (NSAIDs), according to a review by an international task force convened by the European Society for Clinical and Economic Aspects of Osteoporosis and Osteoarthritis (ESCEO).

Obviously, there is some controversy, but some orthopedists feel that viscosupplementation may provide some benefit short-term (weeks to months) for treatment of knee osteoarthritis; but the improvements in pain and function are not long-lasting.

Copyright 2019

Implantable Devices: Spinal Cord Stimulation & Implantable Drug Delivery System

For selected individuals with chronic pain, the health care provider may suggest an implantable device, such as a neurostimulator (also called a spinal cord stimulator) or a medication pump. A pain specialist is the best source for information regarding these devices, but the ACPA provides a video series with some basic information at https://theacpa.org/pain-management-tools/videos/conditionstreatments/

SPINAL CORD STIMULATION (SCS)

Neurostimulation therapy is delivered with a small device implanted under the skin, typically in the abdomen or buttock area. The neurostimulator generates mild electrical signals that are delivered to an area near the spine. The impulses travel from the device to this spinal area over thin insulated wires called leads.

Medical researchers are still investigating exactly how SCS controls pain and are considering multiple theories. The originally proposed mechanism of action of SCS is the "gate control theory." This theory states that by providing a pleasant vibratory and touch sensation via the SCS system, pain signals that reach the brain are decreased.

The current SCS devices are programmable via a remote control that allows the patient to adjust the therapy within certain limits to help them receive the best pain relief each day, depending on his or her activity level or changes in pain during the day. It is not uncommon for patients being considered for a SCS to have a psychological evaluation as part of the overall evaluation process. The purpose of this psychological evaluation is to see if the person has any emotional or other difficulties that may adversely affect the surgery or recovery and to ensure the person has realistic expectations and goals for what can be achieved with the therapy. During the psychological evaluation, the person can expect to be asked questions about how the pain is currently affecting sleep, mood, relationships, work, and household and recreational activities. Some are also asked to complete paper-and-pencil tests. The results of this evaluation should be shared with the person with pain and the referring physician who will consider all the information to determine if SCS is an appropriate option.

Two stages are involved in SCS implantation. In both stages, a physician, guided by an x-ray, places a lead into the epidural space located within the bony spinal canal. The first stage is the trial phase, which provides information to predict the success of permanent implantation.

During the trial phase, one or two leads are placed via an epidural needle in the appropriate position. This is an outpatient procedure done under light sedation. Once the lead is in position, it is tested to see if the patient's painful area is covered with a tingling sensation (paresthesia). It is important that the patient is alert during the insertion and testing of the lead so he or she can inform the health care professional if the lead is in the appropriate position.

The lead is programmed with a computer. The patient then goes home for 3 to 5 days. He or she has an external power source and remote control that allows him or her to control the amount of

Copyright 2019

stimulation being received. During the trial, the patient should keep an activity record to determine if the treatment is helpful in relieving pain and improving function. At the end of the trial, the patient returns to the physician's office to discuss the results and have the lead removed.

Together, the health care professional and the patient decide whether or not to advance to permanent implantation. In this stage, the lead is again placed and implanted underneath the skin with a power source the size of a pacemaker battery. Either a rechargeable or non-rechargeable power source is implanted. For the non-rechargeable systems, the battery cannot be recharged and needs replacement every several years with a minor surgical procedure. The rechargeable system needs recharging when the power source runs low. While it typically lasts longer (up to 9 years) than a conventional system, eventually it will need to be replaced with a minor surgical procedure when it can no longer be recharged in a reasonable period of time. The SCS recipient goes home with a remote-control and battery charger (if they have a rechargeable battery). The patient is instructed to limit activity for about 12 weeks to allow for healing. Occasional re-programming will be needed to optimize coverage of the painful area.

The reader should understand that this discussion of SCS systems is limited. These devices are invasive and costly, and their use is limited to selected individuals as a treatment alternative for specific conditions after consideration of the risks, after failure of a reasonable trial of less invasive methods and following a successful temporary trial. There is some literature to suggest that in carefully selected patients, despite the initial cost, there may be long-term cost savings after a few years related to a reduction in the use of medications and other medical care services.

When utilized, spinal cord stimulation should be part of an overall rehabilitation treatment strategy combining behavioral and physical medicine approaches to pain management. Effectively treating pain by implanting an SCS system requires a responsive, long-term relationship between the person with pain and his or her health care professional. A significant advantage of a SCS system is that it is a reversible and nondestructive treatment option.

An important consideration is that the ability to obtain subsequent spinal imaging (such as an MRI) may be compromised after implantation of an SCS system. While some SCS systems are safe to use with MRI, others are not. Patients should discuss current and potential needs for MRI with their health care professional to ensure that they are being treated with a system that will meet their needs.

As with most treatments for chronic pain, it is important for the patient and health care provider to have realistic expectations regarding treatment, with the goal being pain reduction and control rather than complete elimination. It is also important for people with SCS to involve themselves in a multidisciplinary treatment plan if they are to get the best results. In appropriately selected individuals, SCS treatment can be a viable tool in a treatment plan and can significantly reduce pain and associated limitations.

In general terms, spinal cord stimulation is primarily suited to certain neuropathic and ischemic (loss of oxygenated blood flow) pain states. Currently, conditions that can respond favorably to

Copyright 2019

SCS treatment include:

- Failed back surgery syndrome with radicular symptoms
- Complex regional pain syndrome (previously known as reflex sympathetic dystrophy or RSD and causalgia)
- Peripheral neuropathic pain
- Peripheral vascular disease
- Ischemic heart disease

SCS has been proven to be effective for many of these conditions with lasting results in terms of pain relief, pain medication reduction, and improvement in quality-of-life indices and satisfaction scores. Although SCS can also be quite effective in relieving ischemic pain due to peripheral vascular disease and even coronary artery disease, these are currently not FDA-approved indications.

Potential complications that may occur include lead migration or fracture and infection. Lead migration after implantation may require revision surgery to regain appropriate coverage. An infection of any kind requires an immediate assessment by the physician. An unrecognized and untreated infection around the hardware can progress to more serious complications such as an epidural abscess or meningitis. There may also be limited access to imaging with MRI after implantation of such devices. More information available on ACPA website video or at https://theacpa.org/pain-management-tools/videos/conditionstreatments/

IMPLANTED INTRATHECAL DRUG DELIVERY SYSTEMS (PAIN PUMPS)

Unlike medications that circulate through the body and in the bloodstream, programmable intrathecal (injection into the sheath surrounding the spinal cord) drug delivery systems release medication directly into the fluid surrounding the spinal cord, which may lead to fewer or more tolerable side effects, and in some instances, is the only route possible for certain drugs.

Intrathecal Drug Delivery is an FDA-approved pain therapy for people who have not had success with other chronic pain treatments and meet the criteria for implantation. Intrathecal therapy has been used in long-term pain management for carefully selected patients with failed back surgery syndrome, complex regional pain syndrome, spinal stenosis, osteoporosis with compression fractures, pancreatitis, phantom limb pain syndrome, peripheral neuropathies, and in cancer pain.

With Programmable Intrathecal Drug Delivery Therapy:

- Pain medication is delivered via a drug pump directly to the fluid around the spinal cord in an area called the intrathecal space.
- The drug pump is connected to a thin, flexible tube called a catheter.
- Both the pump and the catheter are surgically implanted under the skin.
- Pain medication is dispensed according to instructions programmed by the physician, which allows noninvasive changes in dose and drug infusion patterns.

Copyright 2019

The reader should understand that this discussion of programmable, targeted implanted drug delivery systems is limited to a general overview. More information can be found in the anesthesia and pain medicine literature.

These systems are invasive and costly, and their use is limited to select individuals who find oral opioids beneficial but cannot tolerate the side effects and as a treatment alternative for specific conditions after consideration of the risks, after failure of a reasonable trial of less invasive methods and following a successful temporary trial. There is some literature to suggest that in carefully selected patients, despite the initial cost, there may be long-term cost savings after a few years related to a reduction in the use of oral medications and other medical care services.

A psychological evaluation of the person being considered for an intrathecal pump is usually recommended as part of the overall evaluation process. These are often done by a psychologist or psychiatrist. The purpose of the evaluation is to see if the person with pain has any emotional or other difficulties that may adversely affect the surgery or recovery and to ensure the person has realistic expectations and goals for what can be achieved with the therapy. During the psychological evaluation, the person with pain will be asked questions about how the pain is currently affecting sleep, mood, relationships, work, and household and recreational activities. Some may also be asked to complete paper-and-pencil tests. The psychologist or psychiatrist should share the results of this evaluation with the person with pain and with the referring physician who will consider all the information to determine if an intrathecal pump is an appropriate option.

A decision to proceed with an implanted drug delivery system should include:

- Failure of a reasonable trial of other conservative treatment modalities (medication, surgical, psychological, or physical);
- Intractable pain secondary to a disease state with objective evidence of pathology;
- Documentation that further surgical intervention is not indicated;
- Psychological evaluation has been obtained and evaluation states that the pain is not primarily psychological in origin and that benefit can be anticipated with implantation despite any psychiatric comorbidity;
- No contraindications to implantation exist such as body size too small to hold the pump; presence of spinal anomalies that may complicate the implantation and fixation of a catheter; the pump cannot be implanted 2.5 cm or less from the surface of the skin; or, presence of known or suspected meningitis, ventriculitis, skin infection, bacteremia, and septicemia;
- A life span of at least 3-6 months; and
- If the above criteria are met, a successful temporary trial of spinal (epidural or intrathecal) medications must be achieved prior to implantation as defined by a significant reduction in pain and improved function and associated reduction in oral pain medication use.

Opioids (e.g., morphine) are the most common medications delivered by intraspinal infusion. Other medications (e.g., bupivacaine, clonidine, and baclofen) may be added to opioids, particularly in patients with nerve injury pain states (neuropathic pain).

Copyright 2019

Just as when one is taking opioids orally or transdermally, the doses of intraspinal opioids should be limited to the lowest possible dose required to achieve pain relief and increased function, as complications can occur with any dose of opioids regardless of the route of delivery.

As with any opioid, constipation, urinary retention, nausea, vomiting, and pruritus (itchiness) are typical early adverse effects of intrathecal morphine and are readily managed symptomatically. Other potential adverse effects include amenorrhea, loss of libido, edema, respiratory depression, and technical issues with the intrathecal system with component failure and need for replacement.

Intrathecal Drug Delivery is an invasive treatment and risks of implantation can include infection, bleeding, headache, allergic reaction, spinal fluid leakage and paralysis.

High doses of intrathecally-administered morphine or opioid mixtures, including compounded drugs, have uncommonly been linked to the development of a chronic inflammatory or granulomatous mass (an abnormal tissue growth) at the tip of the catheter that can compress the spinal cord or associated nerve roots. Thus, vigilance is important just as is the case when one is taking opioids orally or transdermally. Patients on intraspinal morphine therapy should be monitored carefully by their health care professional for any new neurological symptoms because inflammatory mass can, in some cases, lead to neurological impairment, including paralysis. Even though a direct cause and effect relationship has not been established, the dose of continuously-administered intrathecal morphine should be limited to the lowest possible dose to achieve pain relief and increased function, as complications can occur with any dose of opioids regardless of the route of delivery.

Apart from morphine, chronic intrathecal infusion of preservative-free, sterile ziconotide solution is approved for the management of severe, chronic pain. Ziconotide (Prialt®) is a non-opioid analgesic reserved for patients who are refractory to or who cannot tolerate intrathecal morphine. Typical side effects include dizziness, nausea, vomiting, and states of confusion. Other potential adverse effects include psychosis, convulsions, rhabdomyolysis (muscle breakdown), and problems with the intrathecal infusion system. These side effects can be prevented entirely or may be well managed by raising the dose very slowly to achieve the right level of pain relief with the least amount of drug.

The only drugs that have been approved by the FDA for continuous intrathecal use with implanted intrathecal delivery devices include ziconotide, morphine, and baclofen.

The FDA has recently advised that other medications (e.g., hydromorphone, bupivacaine, fentanyl, clonidine and compounded medications) are not approved for use in intrathecal pumps may increase risks of adverse effects and pump device failure.[1]

[1] FDA alerts doctors, patients about risk of complications when certain implanted pumps are used to deliver pain medications not approved for use with the devices https://www.fda.gov/NewsEvents/Newsroom/PressAnnouncements/ucm625840.htm?utm_campaign=112718_PR_FDA%20warns%20about%20risks%20of%20using%20off-label%20medications%20in%20implanted%20pumps&utm_medium=email&utm_source=Eloqua

Copyright 2019

Epidurals, Nerve & Facet Blocks & Radiofrequency Ablation (Rhizotomy)

An epidural steroid injection involves the injection of steroid into the epidural space in the cervical spine (neck) or lumbar spine (low back). Sometimes, a local anesthetic (numbing medicine) may be injected with the steroid. The epidural space is located in the spine just outside of the sac containing the spinal fluid. Epidural steroid injections are often provided to individuals with herniated discs, degenerative disc disease, or spinal stenosis who have associated nerve pain in the arm or leg.

The steroids are injected into the epidural space in order to reduce inflammation in and surrounding the spinal nerve roots and adjacent tissues. By reducing inflammation and compression, the level of pain may be decreased. Epidurals are most useful in patients with acute nerve pain from the above conditions. A majority of individuals (80 to 90 percent) with acute low back pain and associated nerve pain will recover spontaneously within three months, therefore, these injections should be viewed as a way to facilitate earlier pain relief and return to function. These injections have not been demonstrated to provide long-term successful pain relief for people suffering solely from chronic (long-standing) back pain or chronic nerve pain.

Epidurals rarely provide long lasting benefit but may be useful in these chronic pain conditions to manage a flare-up. Some people who have residual pain after the first injection may receive a second epidural steroid injection. However, individuals who do not receive any relief from the first injection are unlikely to benefit from a second injection. Furthermore, the number of steroid injections per year should be limited in order to avoid side effects that may occur including osteoporosis (weakening of the bones) and avascular necrosis (bone cell death often seen in the hip). Diabetic patients receiving epidural steroids should monitor their blood sugars closely following the procedure since an elevation can occur.

Nerve and facet blocks use a combination of local anesthetic and steroid for diagnostic purposes to identify pain generators. These blocks can also be used therapeutically to "block" a painful condition. Unfortunately, these procedures do not provide lasting benefit and are best used as part of an overall treatment plan to relieve discomfort temporarily while the patient engages in an active rehabilitation program.

Radiofrequency ablation (rhizotomy) or lesioning involves inserting a probe to destroy the nerve that supplies the facet joint. The facet joint, a small joint that connects the back portion of the spine, can become arthritic and cause neck or back pain. Facet joints allow bending and twisting movements in the back and neck. These movements can be very painful and may limit daily activities in an individual with facet joint disease. People with lumbar (low back) facet joint syndrome often complain of hip and buttock pain, low back stiffness, and pain that is made worse by prolonged sitting or standing. People with cervical (neck) facet joint syndrome often complain of neck pain, headache, and/or shoulder pain. In addition, they will often have pain when they rotate or bend their neck.

Copyright 2019

In order to determine if facet joints are responsible for neck or back pain, medial branch blocks are performed. A medial branch block is a block that is performed under fluoroscopy (x-ray), and local anesthetic (numbing medicine) is injected on the nerves that supply the facet joint in the back or neck. Following the procedure, patients are asked to keep a pain diary in order to record any pain relief, the amount of pain relief, and for how long pain relief lasts. Based on the response to this block, it can be determined if the person is a candidate for medial branch radiofrequency ablation (rhizotomy). Patient selection is imperative for achieving successful results.

Following radiofrequency ablation, patients are often asked to resume physical therapy for flexibility and strengthening exercises. Radiofrequency usually blocks the signal for a prolonged period of time (six months to a year). Eventually, the nerve grows back and can allow the pain signal to be transmitted again. If this happens, the procedure can be repeated. This procedure often does not relieve all back pain, but it relieves the pain associated with facet joint arthritis.

Denervation of the spinal muscles is possible with rhizotomies, thus repeated rhizotomies can cause atrophy of these muscles and lead to other untoward effects.

As with any procedure, there are certain risks involved which should be discussed with a treating physician. In order to achieve optimal results, it is important that these interventions be incorporated into a multidisciplinary treatment plan.

Copyright 2019

MEDICATIONS

How Medications for Pain Can Help & Harm

The use of analgesics (pain relievers) and other medications is a common method of chronic pain treatment. Pain medications can be helpful for some patients with chronic pain, but they are not universally effective. It is important to remember that each person may respond in a different manner to any medication.

Many people with chronic pain can manage adequately without medications and can function at a near-normal level. Others find that their overall quality of life, in terms of comfort and function, is improved with medications.

The use of any treatment, including medications, is judged by efficacy – does the benefit exceed the risk/harm? When all is said and done, is the individual better off for having undergone the treatment? This is not as simple as it sounds. For example, a medication may be successful in partially providing pain relief but may have a side-effect such as weight gain or mild loss of mental sharpness – Whether the side-effect is worth the benefit is totally individual specific.

It is important also to understand that even the most potent medications used for pain rarely completely eliminate pain but rather, may reduce its severity. As such, medications are rarely adequate alone and should be considered as an optional part of a comprehensive approach to pain management and functional improvements.

While medications can help relieve symptoms, they also can cause unpleasant side effects that at a minimum can be bothersome and at their worst can cause significant problems including death. These side effects can often be avoided or at least managed with the help of a health care professional.

It is important that the health care professional be aware of all prescription medications, over-the-counter (OTC) medications, and fitness, nutritional and herbal supplements that are being taken for general health or for pain or other medical conditions to ensure these are being taken appropriately and safely and that they do not interact with other prescribed medications or therapies. Some substances and drugs may cause serious side effects if they are combined with other medications. Even OTC and herbal preparations have possible side effects and the potential to cause serious interactions with other nonprescription and prescription medications and with each other. These include various OTC supplements and vitamins, homeopathic remedies, items grown in a home garden or bought in a store, and other "substances" such as caffeine, alcohol, tobacco, grapefruit (especially dangerous in combination with a benzodiazepine medication), and even marijuana and illicit drugs.

Copyright 2019

It is strongly advised that all current medications in the original bottles or boxes or tubes and other items that are active (including non-prescribed medications, vitamins and supplements) be taken to any appointments with the health care professional. It is essential that the health care professional be told about all substances that are being taken (even if they are not legal) or if obtained from someone other than the prescriber. Even medications that may be used only occasionally such as cough and cold medications can have significant medication interactions.

People with any medical condition including pain should keep a list of all their medications in their wallet or purse. This list will be useful in an emergency.

All opioid medicines and other controlled substances should be locked (in medication safe or other locked compartment) to prevent diversion or unintended intake by children or others.

All medications should be safely disposed of when no longer needed.

The U.S Drug Enforcement Agency (DEA) sponsors National Prescription Drug Take Back Days; local communities may also hold their own take back program. The DEA website (https://www.deadiversion.usdoj.gov/drug_disposal/takeback/index.html) provides information regarding dates, times and locations for this program.

Please discuss questions regarding drug disposal with your pharmacist. Some pharmacies have mail-back programs and disposal kiosks for unused medicines.

The FDA website also provides comprehensive guidance to dispose of medications at home (https://www.fda.gov/ForConsumers/ConsumerUpdates/ucm101653.htm)

The FDA recommends two ways to dispose of medicine, depending on the drug.

Disposing of medicines in household trash: Prescription and over-the-counter (OTC) drugs, liquids, drops, patches, creams, and inhalers can be thrown into your household trash.

Medications should be mixed with something undesirable, such as used coffee grounds, dirt, or cat litter. This makes the medicine less appealing to children and pets and unrecognizable to someone who might intentionally go through the trash looking for drugs.

This mixture should be placed into something you can close (a re-sealable zipper storage bag, empty can, or other container) to prevent the drug from leaking or spilling out before placing in the garbage.

The FDA also advises to scratch out all your personal information on the empty medicine vials to protect your identity and privacy prior to disposal.

Flushing medicines: Because oral and patch formulations of opioid medications could be especially harmful to others, there are specific directions to immediately flush them down the sink

Copyright 2019

or toilet when they are no longer needed. The FDA provides a list of these medications at the following website:
https://www.fda.gov/Drugs/ResourcesForYou/Consumers/BuyingUsingMedicineSafely/EnsuringSafeUseofMedicine/SafeDisposalofMedicines/ucm576167.htm

Individuals who take medications should know what medications they are taking, why they are taking them, when they are taking them, how they are to take them, which should be taken every day, and which should be taken just when needed. Optimal pain relief depends on knowing how much and how often each medication should be taken and whether to take the medication before, with, or after meals or at bedtime. Medications can be confusing, especially if taken for more than one condition. The type of medication and dose may vary depending on the medical condition, body size, age, and any other medications that are taken. It is important to understand the potential side effects of the medications and how these can be prevented or managed effectively. Because of the possibility of interactions between drugs, some medications should not be taken together or should be taken at different times during the day to avoid unwanted reactions. This information can be obtained by reading the labels on the medication containers and/or asking the health care professional or pharmacist. If you are already taking prescription medications, do not take any OTC medication without consulting your health care professional.

The ACPA has a MedCard for keeping track of medications which can be found at
https://www.theacpa.org/wp-content/uploads/2017/08/acpa_wallet_card2906.pdf

The FDA also offers "My Medicine Record" which can be completed and updated on-line at the following website:
https://www.fda.gov/downloads/AboutFDA/ReportsManualsForms/Forms/UCM095018.pdf.

A Drug Interactions Checker is available at http://www.drugs.com/drug_interactions.php. Any concern for drug interactions should be discussed with your pharmacist or health care provider.

The label on the medication bottle may show a brand name (for example, Tylenol®) or the generic name (for example, acetaminophen) or both. It is often less expensive to buy medications by their generic name rather than by the brand name. The health care professional can be asked to prescribe generic rather than brand-name drugs to hold down the cost of prescription medications. The color and shape of the pill may be different, but FDA-approved generic drugs are considered to be interchangeable with brand name drugs. Generic drugs are required to show the same quality and effectiveness as brand name drugs before they are approved by the FDA. Any noticeable differences in the response to a drug if switching from one drug to another or a brand drug to a generic drug should be discussed with a health care professional. It is essential that the dose and directions written on the medication label be followed. The dose should not be changed without consulting the health care professional and medications that have been prescribed for someone else should never be taken.

Copyright 2019

If Medications Are Not Relieving Pain

Successful treatment can reduce a person's distress and restores health, function, and well-being so he or she can resume full participation in everyday life (although adjustments may need to be made).

If an individual has been taking pain medicine every day for a long time and it doesn't seem to reduce pain and allow the person to be more functional, the treatment plan should be re-evaluated. Often a treatment is unsuccessful because it needs to be changed.

It is important to periodically evaluate the big picture and ask how life is going overall. Even if months or years have passed, people with pain should tell their health care professionals whether they have regained the ability to engage in and enjoy everyday life activities. If not, it is time to discuss how to change the treatment plan. A minor tweak may be all that is needed but often bigger changes such as a more comprehensive approach may be required.

There are many other methods for pain relief besides pain medications. Symptoms can usually be greatly relieved by learning and strengthening self-care skills. Although some self-care methods can be self-taught, they often require instruction and supervision by an experienced peer or professional at the beginning.

Multidisciplinary pain programs and organizations like the ACPA teach many specific self-care techniques that can help to reduce pain. Mastering them may allow the person with pain to find relief and minimize the things that often make pain worse, such as stress, inactivity, uncertainty, feeling powerless, being out of shape, lack of sleep, boredom, fear, and anger, which are all normal human reactions to pain and life disruption.

According to scientific studies, there are several non-invasive medical treatments that often work as well or better than pills, patches, injections, and surgery. These treatments usually have fewer side effects, are less hazardous, and are more likely to restore a satisfying everyday life. A health care professional may be able to prescribe these treatments to help relieve the pain while the patient learns the self-care approaches that can help get life back on track.

Changing or discontinuing medications should always be done under the direction of a health care provider because it can be dangerous as well as uncomfortable to stop some medications too rapidly and without medical supervision. This is particularly true in those taking high doses or more than one medication. See the next section on "Tapering/Weaning Off Pain Medications."

Copyright 2019

Warning about Internet Medication Purchases

Buying medication over the Internet may seem like a good way to save money, but up to 96 percent of online drugstores don't meet U.S. pharmacy laws or practice standards. Standards for protecting the public are available from the National Association of Boards of Pharmacy (NABP - http://www.nabp.net/).

Internet sites may purport to be legitimate or in a country with drug laws comparable to the United States (e.g., Canada) but may (a) not be located in that country; (b) be located in that country but dispense prescriptions from another country that has no comparable law; (c) not handle and store medicines in a manner that maintains potency and shelf life; or (d) purchase medicines from dubious sources, including knowingly or unknowingly selling counterfeit medicines that may contain amounts of the expected pharmaceutical ingredients that vary from those stated, may contain other unnamed pharmaceutical ingredients, may contain no active pharmaceutical ingredients, or may contain toxic chemicals or microbial contaminants.

Patient Tips for Safe Medication Purchasing*

1. Purchase all medications from state-licensed pharmacies located in the United States.
2. When purchasing medications from online pharmacies, perform the following checks:
    a. Ensure that the retailer is in good standing and is licensed to dispense medications in the United States. A pharmacy's status can be verified by contacting the appropriate state board of pharmacy or the National Association of Boards of Pharmacy (NABP) at http://www.nabp.net or calling 1-847-391-4406.
    b. Examine the site to see if it has posted the Verified Internet Pharmacy Practice Sites (VIPPS) Accreditation Program seal of approval. The NABP established VIPPS to ensure that online pharmacies meet all appropriate state and federal regulatory and licensing requirements for proper operation. A list of VIPPS approved pharmacies can be found at http://www.vipps.info.
    c. All legitimate online pharmacies will:
        i. Make available a licensed pharmacist to answer any medication related questions you may have.
        ii. Require a prescription from a physician or other licensed health care professional who can prescribe medications.
        iii. Provide accurate contact information for customer inquiries.
    d. Notify the FDA about problematic websites at http://www.fda.gov/Safety/ReportaProblem/ucm059315.htm.
3. Be familiar with all your medications, especially their physical characteristics such as size, color, shape, smell, hardness, taste, or texture. Speak with your pharmacist immediately if anything appears suspicious after refilling a medication.
4. Be observant for any altered or open medication containers, variations in packaging, raised or hazy printing, flat printing (instead of imprinting or embossing), missing expiration dates or lot numbers on the package, or sticky residue on the container. All are signs of potential package tampering.
5. Carry a list of all medications you currently take (prescription, over-the-counter, herbal, dietary, and vitamin) with you when you visit your doctor or pharmacist so that they can screen for appropriate use and drug-drug interactions. Keep this list on your person at all times.
6. Be proactive. If you have questions about your medications, ask your pharmacist or physician.

Copyright 2019

* Federal Food and Drug Administration (FDA):
  - Buying Medicines Over the Internet: Available at http://www.fda.gov/drugs/resourcesforyou/consumers/buyingusingmedicinesafely/buyingmedicinesovertheinternet/default.htm
  - Buying Prescription Medicine Online: A Consumer Safety Guide. Available at http://www.fda.gov/Drugs/ResourcesForYou/ucm080588.htm

Biosimilar and Interchangeable Medications

Biological products are regulated by the Food and Drug Administration (FDA) and are used to diagnose, prevent, treat, and cure diseases and medical conditions.

There are two new types of biological products - biosimilar and interchangeable.

A reference product is the single biological product, already approved by FDA, against which a proposed biosimilar product is compared.

Biosimilars are a type of biological product that are licensed (approved) by FDA because they are highly similar to an already FDA-approved biological product, known as the biological reference product, and have been shown to have no clinically meaningful differences from the reference product.

An interchangeable biological product, in addition to meeting the biosimilarity standard, is expected to produce the same clinical result as the reference product in any given patient.

Biosimilars have no clinically meaningful differences in terms of safety and effectiveness from the reference product to which they were compared. In addition, a biosimilar needs to have the same mechanism of action as the reference product to which it was compared, which means it will work in the same way as the reference product.

The FDA will only approve a biosimilar product if it has the same mechanism of action, route of administration, dosage form, and strength as the reference product. Additionally, a biosimilar can only be approved for the indications and conditions of use that have been previously approved for the reference product.

A biosimilar product can be prescribed by a health care provider in place of the FDA-approved reference product. The health care professional must write the specific name of the product on the prescription if they want to prescribe the biosimilar.

An interchangeable biological product may be substituted for the reference product by a pharmacist without the intervention of the health care provider who prescribed the reference product. That means the patient may receive the interchangeable instead of the reference product, even if the health care provider writes the prescription for the reference product.

Copyright 2019

For more information about Biosimilar or Interchangeable Products, go to:
https://www.fda.gov/Drugs/DevelopmentApprovalProcess/HowDrugsareDevelopedandApproved/ApprovalApplications/TherapeuticBiologicApplications/Biosimilars/ucm580419.htm

Medication Identification

It is always very important to be able to visually identify medications. If a pill cannot be identified, it is best to contact a pharmacist for assistance.

Pill identification resources can be used to confirm that the medication is correct. The most definitive tool for identifying a pill is the imprint code that can be on one or both sides of the pill.

Drugs.com has a Drug Pictures Database at:
http://www.drugs.com/pill_identification_drug_picture.html

Drugs.com also has a Pill Identifier at http://www.drugs.com/pill_identification.html where there is a Pill Identification Wizard. After clicking on "I Agree," the drug name, imprint(s), shape, or color can be typed in.

DailyMed provides trustworthy information about marketed drugs in the United States. DailyMed is the official provider of FDA label information (package inserts). This website provides a standard, comprehensive, up-to-date, look-up and download resource of medication content and labeling found in medication package inserts. The website can be found at http://dailymed.nlm.nih.gov/dailymed/index.cfm.

The National Library of Medicine of the National Institutes of Health provides the following PILLBOX website and can be used to find rapid identification and reliable information regarding medications. Pillbox's image explorer is a photo album for pills. The website can be found at https://pillbox.nlm.nih.gov/index.html.

Copyright 2019

Medication Side Effects, Drug Allergies & Drug Interactions

Consumers and health care professionals can now go to a single web page on the U.S. Food and Drug Administration's website to find a wide variety of safety information about prescription drugs titled Postmarket Drug Safety Information for Patients and Providers at http://www.fda.gov/Cder/drugSafety.htm.

MEDICATION SIDE EFFECTS

Every person is unique in how they respond to a particular medication. Side effects are not uncommon but can usually be managed or tolerated. However, some side effects may be harmful to health or even life-threatening. It is important to notify a health care professional of any medication side effects.

When taking any medicine, it is important to be aware of any change in the body and to tell a health care professional if something unusual happens.

It may be hard to know if an adverse reaction is caused by a medical problem or by a medicine. The health care professional will want to know all medications that are being taken, when the symptoms started, and whether they are different from other symptoms that have occurred from an illness.

The following are some common adverse drug reactions that might be noticed (this list is not all-inclusive):

- Skin rash
- Itchiness (pruritus)
- Headache
- Dry mouth
- Easy bruising or bleeding
- Edema (swelling)
- Stomach distress - pain, nausea/vomiting
- Diarrhea or constipation
- Drowsiness
- Confusion, mental/behavioral changes
- Anxiety
- Breathing difficulties
- Abnormal heartbeat
- Increased blood pressure
- Urinary retention

DRUG ALLERGIES

Drug allergies should be documented appropriately in the medical record and should include a description of the reaction. Some medications can trigger an immune response in individuals with a drug allergy. In other cases, as in a type of reaction to drugs such as aspirin or niacin, allergy-like symptoms may occur but do not involve the immune system. Like many other allergies, a drug

Copyright 2019

allergy can cause a range of responses from a mild rash to life-threatening effects on many body systems.

When reviewing drug allergy information with the health care professional, it is important to differentiate drug intolerance or side effects (e.g., stomach upset) from true allergic reactions.

Some pain medicines such as opioid analgesics (e.g., morphine and meperidine) can stimulate histamine release that may seem like an allergic reaction. Common symptoms include lightheadedness, dizziness, a fast heart rate, facial flushing, sweating, or itching. In some cases, the symptoms can be treated with an antihistamine and the opioid analgesic can be continued. If symptoms are severe, an opioid that is not associated with histamine release or a non-opioid alternative may be substituted.

Allergic reactions to drugs can occur within hours or days to as much as three weeks after drug treatment is started. The person with an allergy may experience itching, welts, swelling, and wheezing. An uncommon effect of drug allergy is a life-threatening reaction called anaphylaxis, which is a severe whole-body allergic reaction. Symptoms of anaphylaxis develop very quickly, usually in a matter of minutes. Symptoms may include abdominal pain or cramping, anxiety, confusion, difficulty breathing, dizziness, hives/itchiness, nausea/vomiting, skin redness, slurred speech, and wheezing.

It is important to notify the health care professional immediately or possibly seek emergency medical help depending on the symptoms.

More information about drug allergies can be found at the Mayo Clinic web site at

http://www.mayoclinic.org/diseases-conditions/drug-allergy/basics/definition/CON-20033346

Other sources of information include emedicinehealth at
https://www.emedicinehealth.com/search/emh/allergies

or on the American Academy of Allergy, Asthma & Immunology (ACAAI) website at

http://acaai.org/allergies/types/drug-allergies

DRUG INTERACTIONS

A drug interaction occurs when the amount or the action of a drug is altered by the administration of another drug or multiple drugs. It is wise for individuals to try to use the same pharmacy for all their prescriptions so that the pharmacist can screen health information and current medications to prevent drug interactions. Drug interactions will be discussed in later sections that are more drugs specific.

Copyright 2019

OFF-LABEL MEDICATION USE

Prescription medications are often used for conditions not listed on their FDA-approved labels. This is called off-label use of the medication. It is legal for health care professionals to use a medication "off-label," but the insurer, health plan, or pharmacist may question its use as recommended by the health care professional. Ask the health care professional to explain that the medication is being prescribed off-label and for what reason.

A medication is used off-label when the health care professional prescribes that medication for a medical use or a diagnosis other than the one that received FDA approval or for a dose or dosing schedule that differs from the approved label. Off-label prescribing is a commonly used and accepted medical practice. These medications do have FDA approval, but for a different use. For example, health care professionals frequently prescribe FDA-approved anticonvulsant medications for persons who do not have seizures, but who may have nerve related pain or an antidepressant to help with sleep; or prescribe an antihistamine to reduce anxiety.

Medications can have more than one effect. Because of this, a medication may be used for a variety of unrelated conditions. For example, aspirin is used to reduce inflammation and pain in arthritis but is also used as a blood thinner to prevent heart attacks. Thus, it may be confusing to think of aspirin as an "arthritis" or "pain" medicine alone.

Similarly, many of the medicines used to treat chronic pain were originally designed and marketed for unrelated conditions such as seizures, irregular heartbeat, and depression. The fact that a health care professional recommends such a medication for pain treatment does not mean that the person with pain has epilepsy or some other condition. The same is true with antidepressants; the fact that they are prescribed for chronic pain does not mean that the health care professional has made a diagnosis of depression.

The FDA (http://www.fda.gov) allows medications to be sold and advertised for specific conditions where data prove the drug is safe and effective for its intended use. Once on the market, medications can be prescribed for off-label usage for any condition, particularly those with clinical data supporting effectiveness. The process of obtaining FDA-approval for another use of the medication can be costly, so a company may not be able to fund research studies to prove all the uses for a medication. This approval issue is especially true if the medication is no longer protected by a patent and other companies can sell it.

Further discussion about off-label medication use can be found at
https://www.fda.gov/forpatients/other/offlabel/default.htm

and on WebMD at
http://www.webmd.com/a-to-z-guides/features/off-label-drug-use-what-you-need-to-know

Copyright 2019

Clinical Trials

Clinical Trials (see http://clinicaltrials.gov for more information) are health-related medical research studies in human beings that follow a pre-defined plan. Choosing to participate in a clinical trial is an important personal decision. It is often helpful to talk to a physician or other health care professional, family members, or friends about deciding to join a trial. The results of the clinical trial may lead to new treatments or therapies becoming available for many people coping with chronic pain.

Information about Learn About Clinical Studies can be found at http://clinicaltrials.gov/ct2/about-studies/learn

The Clinical Trials Transformation Initiative (CTTI) is a public-private partnership to identify practices that will increase the quality and efficiency of clinical trials at http://www.ctti-clinicaltrials.org/ states that it is "Here to identify and promote practices that will increase the quality and efficiency of clinical trials."

Medication Assistance Programs

There are many programs that help people in need get access to their prescription medicines at a savings or even for free. There are more than 475 public and private patient assistance programs offering access to over 2,500 brand name and generic medications for free or at a low cost. Pharmaceutical companies offer nearly 200 of these programs. To learn about programs that might be able to help you, you can either try visiting the website of the pharmaceutical company that makes your medicine. Alternatively, you can also visit the following websites which provide links to the assistance programs available for many medicines. You will need to enter in the name of your medicine and answer a few other questions, and then you will be connected to the programs that might be able to help you.

- The Partnership for Prescription Assistance. https://www.pparx.org/
- NeedyMeds: http://www.needymeds.org/

Copyright 2019

MEDICATION TYPES FOR THE TREATMENT OF PAIN

There are four major types of medications used in the treatment of chronic pain:

1. **Non-opioids:** Aspirin (ASA), nonsteroidal anti-inflammatories (NSAIDs), and acetaminophen.

2. **Opioids:** Examples of opioids include but are not limited to morphine, codeine, hydrocodone, oxycodone, and methadone. Tramadol and tapentadol are considered opioids since they are biochemically similar and work on the same receptors.

3. **Adjuvant analgesics:** Medications originally used to treat conditions other than pain but may also be used to help relieve specific pain problems; examples include some antidepressants and anticonvulsants.

4. **Other:** Medications with no direct pain-relieving properties may also be prescribed as part of a pain management plan. These include medications to treat insomnia, anxiety, depression, and muscle spasms.

Some medications are available over-the-counter (OTC) without a prescription, and some require a prescription.

Prescription medications are lawfully available only from a licensed professional. The individual should only use medication that was prescribed for him or her by such a professional.

Do not use, buy, or sell prescription drugs from family members, friends, or others. Not only is it dangerous to your health and life, but also you could face criminal prosecution for possessing prescription drugs without a prescription. Illegal distribution of prescription drugs, including sharing, is a Federal drug violation, punishable by up to five years in Federal prison. The consequences are more severe if the illegal distribution leads to injury or death. Federal law makes it illegal for any person who does not have a license to write prescriptions to sell or give a prescription drug to another person (21 U.S.C. § 841(a)).

Copyright 2019

Non-Opioid Pain Relievers

The two most common types of non-opioid pain relievers are acetaminophen and NSAIDs, including aspirin. These non-opioid analgesic pain relievers are effective for pain and fever. Aspirin and NSAIDs are also indicated for pain that involves inflammation, whereas acetaminophen does not have anti-inflammatory activity.

These non-opioid pain relievers can be purchased without a prescription over-the-counter (OTC) but also are included in many combination prescription pain relievers.

Acetaminophen is an active ingredient found in more than 500 OTC and prescription medicines, including pain relievers, as well as for pain relief and fever reduction in cough suppressant and cold medication combinations.

NSAIDs are common medications used to relieve fever and minor aches and pains. They are found in over 900 medications; both OTC and via prescription. They include aspirin, naproxen, and ibuprofen. They can be found alone and in many OTC combination medicines taken for colds, sinus pressure, and allergies. They act by inhibiting an enzyme that helps make specific chemicals in the body responsible for pain and inflammation.

Over-the-Counter Medicines

OTC drugs are those drugs that are available to consumers without a prescription. A trip to the local drug store reveals numerous tablets, suppositories, patches, sprays, creams, lotions, and ointments, all with claims of providing pain relief.

The following article is from the FDA: **Educational Resources: Understanding Over-The-Counter Medicine** can be found at

https://www.fda.gov/Drugs/ResourcesForYou/Consumers/BuyingUsingMedicineSafely/UnderstandingOver-the-CounterMedicines/ucm277845.htm.

The following Internet Link provides a good patient education handout regarding over-the-counter pain relievers to minimize toxicity:

https://www.getreliefresponsibly.com/know-your-pain-medicines
The traditional OTC pain group currently includes aspirin (e.g., Bayer®), acetaminophen (e.g., Tylenol®), naproxen (e.g., Aleve®), ibuprofen (e.g., Advil®, Motrin®IB), and various combinations. Most analgesic OTC drugs are based on one of these FDA-approved ingredients. Many manufacturers add other ingredients in an effort to tailor the medication to particular symptoms. For example, a pain reliever, such as acetaminophen, and an antihistamine, such as diphenhydramine (e.g., Benadryl®, Dramamine®, Sominex® and others) may be combined and sold as a nighttime pain and cold medication because the antihistamine induces drowsiness. Adding a decongestant makes a medication marketable for sinus problems.

Copyright 2019

When using OTC drugs, be aware that the brand name is often specific to the manufacturer and may not indicate the product's active ingredients. Look for active ingredients, usually listed by generic name, on the label. For example, this will provide information that Tylenol® PM not only contains acetaminophen but also contains diphenhydramine hydrochloride.

Some OTC medications are labeled "extra strength." This usually indicates that the item contains more amounts (e.g., milligrams) of drug per dosage unit (e.g., tablet) than the standard product by the same manufacturer.

The key to the effective use of OTC medications is to understand the drug(s) that is/are taken and the maximum safe dosage of all ingredients. This requires reading the medication label and/or discussing OTC medications with the health care professional or a pharmacist before taking them, especially if prescription medications are also taken. The selected OTC medication should contain an appropriate amount of the drug needed to treat the symptom(s) and should not include medications or ingredients that are not needed.

OTC medications rarely cause significant health problems when used occasionally. In certain situations, however, they can be dangerous. This is especially true if used in combination with prescription medications or in dosage amounts that are higher than recommended.

OTC pain medications can be useful and effective. Even though they are considered safe enough to be dispensed without a prescription, remember they are real medicines. There is often a mistaken belief that because the medication can be obtained without a prescription, it is safe under all circumstances of use and without potential for harm. Nothing could be further from the truth.

Further information about OTC medicines is provided by the American Academy of Family Physicians at:
http://familydoctor.org/familydoctor/en/drugs-procedures-devices/over-the-counter.html.

The following is a link to a patient education video on over the counter pain relievers; including safely taking and storing pain medications. https://www.youtube.com/watch?v=jE0-_r2APdc

The Safety of Non-Opioid Pain Relievers

"The Food and Drug Administration (FDA) advises consumers to follow directions when using common pain and fever reducers. **Using more than recommended can cause serious injury**." The active ingredients, acetaminophen and NSAIDs, are safe and effective when the label directions or the advice from a health care professional or pharmacist are followed. This is especially important when taking both OTC medications and prescription medications. "Using Acetaminophen and Nonsteroidal Anti-inflammatory Drugs Safely" can be found at http://www.fda.gov/Drugs/ResourcesForYou/Consumers/BuyingUsingMedicineSafely/UnderstandingOver-the-CounterMedicines/SafeUseofOver-the-CounterPainRelieversandFeverReducers/ucm164977.htm

Copyright 2019

Nonsteroidal Anti-Inflammatory Drugs

The NSAIDs (aspirin, ibuprofen, naproxen, and others) have a host of potential side effects. They can cause toxicity when taken for a prolonged period or when taken in excess, but even low or regular dose or short-term therapy is not without risk.

NSAIDs can cause gastric distress. They can reduce the stomach's protective mucous layer and natural protection against irritation of the stomach lining from stomach acid. They can cause serious gastrointestinal (GI) adverse events including inflammation, bleeding, ulceration, and perforation of the esophagus, stomach, small intestine, or large intestine, which can be fatal. These serious adverse events can occur at any time, with or without warning symptoms, in patients treated with NSAIDs. Only one in five patients who develop a serious upper GI adverse event on NSAID therapy is symptomatic. The risk of bleeding increases with age, dose, use with certain medications (such as warfarin), and duration of use.

NSAIDs also may cause kidney failure in people with damaged kidneys, liver disease, and certain other conditions such as high blood pressure. Use with diuretics, commonly called "water pills," can increase this danger. Finally, the use of these medications has been associated with increased risk of cardiovascular disease (CVD), particularly in patients with risk factors for CVD or a prior history of CVD. The risk of heart attack or stroke can begin in the first week of NSAID use and the risks may increase with longer NSAID use and higher prescription doses. Individuals with any of these conditions should check with their health care professional before taking any NSAID medication. The following ACPA video on this topic may be helpful; view at https://www.theacpa.org/pain-management-tools/videos/conditionstreatments/.

The American Heart Association (AHA) recommends health care professionals change their approach to prescribing pain relievers for patients with or at risk for heart disease. Research in the AHA journal *Circulation* found that heart attack survivors who take NSAIDs face a significantly increased risk of a second heart attack or death.

There are 2 types of NSAIDs; selective and nonselective inhibitors.

The cyclooxygenase-2 (COX-2)-selective inhibitors are NSAIDs that can be prescribed and have a lower risk of gastrointestinal (GI) side effects with short-term use. The only agent of this type currently available in the United States is celecoxib (Celebrex®), which is more expensive than most of the generic nonselective NSAIDs and has not been definitively proven to provide better pain relief. Although celecoxib is associated with a lower risk for developing a stomach ulcer when taken for less than 6 months, serious stomach ulceration can still occur without warning with this drug. This is especially true if taking a daily aspirin – even if low dose – for protection of the heart. As with other NSAIDs, individuals who take celecoxib should be monitored for this serious side effect. Additionally, all NSAIDs are associated with potential kidney effects and heart (cardiovascular) complications, especially when taken for prolonged periods. Remember also that when acetaminophen (Tylenol®) is used in combination with NSAIDs, there may be an increased risk of developing kidney problems. This effect is usually only seen with long-term use.

Copyright 2019

While the increased risk of cardiovascular events, such as stroke and myocardial infarction, associated with COX-2 inhibitors has been well established, data are emerging that demonstrate similar risk increases associated with NSAIDs that are not selective for COX-2. Currently, data show that celecoxib 200 mg or less per day does not seem to increase the risk of cardiovascular events any more than the risk associated with traditional (nonselective) NSAIDs used at prescription doses. Discussing the risk-benefit ratio of NSAIDs with a health care professional is advised. The risk of experiencing adverse events or side effects with NSAIDs increases with the duration of use and the dose. Therefore, it is often recommended that these medications be used for the shortest period and at the lowest dose required to achieve therapeutic improvement. Individuals taking aspirin for its ability to protect the heart should consult with their health care professional or pharmacist prior to utilizing non-ASA NSAIDs on a long-term basis. The regular use of non-ASA NSAIDs inhibits aspirin's ability to protect the heart.

In order to improve the side effect profile of NSAIDs, topical NSAIDs have been developed and approved by the FDA. It is important to discuss the use of any topical medications with your health care professional, especially if you are also prescribed oral medications as taking both is duplicative therapy and may increase the risk of side effects.

Diclofenac Products*****: Diclofenac Gel (Voltaren® 1% Gel) has been approved for the treatment of chronic pain associated with osteoarthritis in joints close to the skin surface. In 2007, a topical NSAID patch containing diclofenac (Flector®) was approved by the FDA for the treatment of acute pain due to minor strains, sprains, and contusions. In 2009, the FDA issued an advisory that transdermal and topical patches that contain metal, which includes Flector®, need to be removed prior to MRI procedures. A topical solution of diclofenac sodium 2% (Pennsaid®) is approved for the treatment of signs and symptoms of knee osteoarthritis. Topical delivery of any NSAID products reaches lower medication blood levels compared to their oral counterparts, but still hold the same package insert warnings related to potential bleeding, heart, stomach, and kidney adverse events.

***Warning:** All Diclofenac products are not recommended as first line analgesics due to an increased risk profile for cardiovascular events (heart attack and stroke) and for increased risk of liver dysfunction (use has resulted in liver failure and death). With the lack of data to support superiority of oral diclofenac over other oral NSAIDs and the possible increased liver and cardiovascular risk associated with its use, alternative analgesics and/or non-pharmacological therapy should be considered.

Intravenous (IV) formulations of the NSAIDs ibuprofen (Caldolor®) and ketorolac (Toradol®) are given most often in the inpatient setting to manage short-term moderate-to-severe pain in adults; ketorolac may also be given intramuscularly (IM). IV ibuprofen is approved also for reduction of fever in adults. In November 2010, IV acetaminophen (Ofirmev®) was FDA approved for the management of mild-to-moderate pain, severe pain with adjunctive opioid analgesics, and reduction of fever in adults and children two or more years old. Similar to the IV NSAIDs, IV acetaminophen is administered in an inpatient setting for short-term pain management and helps reduce the amount of opioid medication needed to manage pain. The FDA has approved dosages of up to 4,000 mg per day of IV acetaminophen. The side effect profile for IV acetaminophen is the same as other acetaminophen dosage forms: headache, agitation, nausea, vomiting, and constipation. Injection site reactions such as redness and swelling may occur with any of the IV non-opioids.

Copyright 2019

Acetaminophen

Acetaminophen (the ingredient in Tylenol® and a number of other OTC pain and cold remedies) can be toxic to the liver, especially with heavy alcohol use or in those with liver problems, even at fairly low doses. The FDA also issued a warning for rare, but possible skin reactions: Stevens-Johnson syndrome (SJS) and toxic epidermal necrolysis (TEN), and acute generalized exanthematous pustulosis (AGEP).

Since acetaminophen is contained in many prescriptions, individuals need to pay close attention to their total daily dose of acetaminophen.

The current recommendations are that self-treating users take only the recommended maximum daily dosage of 3,000 mg. Patients may take a higher daily dosage— up to 4,000 mg—if their health care professional instructs them to do so. The maximum daily dosage may be decreased for patients who consume alcohol or for those with elevations in liver enzymes.

For FDA Acetaminophen Information, go to
http://www.fda.gov/Drugs/DrugSafety/InformationbyDrugClass/ucm165107.htm

Acetaminophen is an ingredient in many OTC and prescription medicines. Here are some - *but not all* - of the most common *OTC and prescription drugs* that contain acetaminophen. The amount of acetaminophen varies in combination products and it is important to note the amount of acetaminophen in each tablet so that accurate accounting of daily dosage can be made. Acetaminophen is in more than 600 prescription and over-the-counter medicines. When used as directed it's safe and effective but taking too much can lead to liver damage. Therefore, it is important to know your dose. http://www.knowyourdose.org/

Examples of Prescription Drugs with Acetaminophen*****

- Acetaminophen and Butalbital (**Axocet®**)
- Acetaminophen and Codeine Phosphate Oral Solution and Tablets (**Tylenol® with Codeine**)
- Acetaminophen, Isometheptene, and Dichloralphenazone Capsules (**Midrin®**)
- Butalbital, Acetaminophen and Caffeine Tablets (**Esgic®, Fioricet®, Zebutal®**)
- Hydrocodone Bitartrate and Acetaminophen Tablets, Capsules, Elixir **(Lorcet®, Lortab®, Vicodin®, Vicodin ES®, Vicodin HP®, Norco®, Zydone®, Hydrocet®, Anexsia®**)
- Oxycodone and Acetaminophen Tablets, Capsules, Elixir (**Percocet®, Endocet®, Roxicet®, Tylox®**)
- Tramadol and Acetaminophen Tablets (**Ultracet™**)

Examples of OTC Drugs with Acetaminophen

- **Backaid®** Maximum Strength Backache Relief
- **Benadryl®** Allergy and Sinus Headache Caplets
- **Contac®** Day or Night Cold/Flu Caplets

American Chronic Pain Association
Copyright 2019

- **CVS**® 8 Hour Acetaminophen Extended-Release Caplets/Cold and Flu Relief – Day- or Night-time Softgels/Infants' Non-Aspirin Suspension Drops/Non-Aspirin Children's Suspension/Non-Aspirin Extra Strength Gelcaps or Caplets/Sinus Headache Decongestant Caplets
- **Duane Reade**® Acetaminophen Tablets, Caplets, or Geltabs/Children's Acetaminophen Elixir/Extra Strength Acetaminophen Gelcaps, Geltabs, Caplets, or Tablets/Extra Strength Acetaminophen PM Caplets or Gelatin Caplets/Infant's Acetaminophen Drops
- **Excedrin**® Aspirin-Free Tension Headache/ Quicktabs Fast Dissolving Pain Reliever Tablets
- **FeverAll**® Infants' or Children's Acetaminophen Suppositories
- **HealthLine**™ Acetaminophen Caplets Extra Strength
- **Inholtra**® Caplets with Acetaminophen
- **Legatrin**® Advanced Formula PM Pain Reliever-Sleep Aid Caplets
- **Pamprin**® Cramp Caplets/Multi-Symptom Caplets Maximum Strength
- **Percogesic**® Analgesic Acetaminophen Caplets Extra Strength/Analgesic Acetaminophen Tablets/Aspirin-Free, Pain Reliever, Fever Reducer Tablets
- **Premsyn**® PMS Maximum Strength Premenstrual Syndrome Relief with Acetaminophen
- **Rite Aid**® Children's Acetaminophen, Non-Aspirin, Oral Suspension Liquid/Complete Allergy-Sinus-Headache Caplets/Extra Strength Acetaminophen/Extra Strength Acetaminophen PM/Infants' Acetaminophen, Non-Aspirin, Suspension Drops/Non-Aspirin, Non-Drowsy Sinus Formula Geltabs Pain Reliever Nasal Decongestant
- **Robitussin®** Robitussin Cold, Cough and Flu, Multi-Symptom Cold, Nasal Congestion, Cold+Flu Daytime, Cold+Flu Nighttime
- **Sudafed**® Sinus & Cold Liquid Capsules
- **Theraflu** Packets Severe Cold
- **Triaminic**® Cold, Cough and Fever
- **Tylenol**® 8 Hour Extended Relief/Allergy Sinus - Day or Night; Caplets, Gelcaps or Geltabs/Arthritis Pain Caplets/Chewable Tablets/Children's Cold Plus Cough Liquid/Children's Soft-Chews/Cold - Day or Night; Caplets or Gelcaps/Extended Release Caplets or Geltabs/Flu Gelcaps Day and Night/Infant Cold Drops/Junior Strength Soft-Chews or Chewable Tablets/Nighttime Liquid Severe Cold and Flu/PM Extra Strength/Severe Allergy Sinus - Day or Night/Sore Throat Maximum Strength Adult Acetaminophen Liquid
- **Vicks**® DayQuil LiquiCaps Non-Drowsy/DayQuil LiquiCaps or Liquid/NyQuil LiquiCaps or Liquid

Walgreens® Arthritis Pain Relief Extended-Release Caplets/Extra Strength Acetaminophen Caplets, Tablets, Gelcaps or Geltabs/Extra Strength PM Gelcaps or Caplets/Regular Strength Acetaminophen Tablets

Please visit the U.S. National Library of Medicine, MedlinePlus for an in-depth discussion about acetaminophen. This website for a comprehensive list of OTC and prescription medicines that contain acetaminophen: https://medlineplus.gov/druginfo/meds/a681004.html#brand-name-1.

Copyright 2019

NON-OPIOID ANALGESIC DRUGS & THEIR USES

The following chart summarizes the uses and cautions that apply to many of the non-opioid analgesic medications now on the market.

Medications (Generic) and Brand Names*	May Be Useful for	Pros	Cons	Comments
Aspirin Bayer® Bufferin® & other **Salicylates**	Headache, muscle ache, fever, menstrual cramps, arthritis pain, and inflammation. May reduce the risk of heart attack and stroke.	Anti-inflammatory; inexpensive.	May irritate stomach. Inhibits platelets and can cause prolonged bleeding. Can precipitate asthma in aspirin-sensitive patients.	May cause Reye's syndrome in children and teenagers and should not be used during viral syndromes; may be harmful for women in late pregnancy, people with kidney or liver disease, asthma, high blood pressure, or bleeding disorders.
Acetaminophen FeverALL® Tylenol®	Headache, muscle ache, backache, fever, and arthritis pain (especially osteoarthritis).	Gentler to the stomach than NSAIDs; does not promote bleeding (or protect against heart attack and stroke).	Does not reduce inflammation; may be less effective than aspirin for soft tissue pain.	May be harmful for those who drink alcohol heavily. Long term use or excessive dosing may be harmful for people with kidney or liver disease. May increase bleeding time in individuals receiving anti-coagulation therapy.
Ibuprofen Advil® Motrin®	Headache, muscle ache, fever, sprains, menstrual cramps, backache, and arthritis pain.	Stronger and generally longer lasting than aspirin.	May irritate stomach. Increased risk of serious gastro-intestinal adverse events. Serious risk of cardiovascular events.	May be harmful for people with kidney or liver disease, asthma, bleeding disorders, or those who drink alcohol heavily or are taking cardio-protective aspirin.

Copyright 2019

Medications (Generic) and Brand Names*	May Be Useful for	Pros	Cons	Comments
Ketoprofen Orudis® Oruvail®	Headache, muscle ache, fever, menstrual cramps, cold or flu aches.	Helps reduce inflammation. Gentler to the stomach than aspirin.	May irritate stomach. Increased risk of serious gastrointestinal adverse events. Serious risk of cardiovascular events.	May be harmful for people with kidney or liver disease or those who drink alcohol heavily. Not recommended for children without a health care professional's supervision.
Naproxen Sodium Aleve® (OTC) Anaprox® Naprelan® Naprosyn®	Headache, muscle ache, fever, menstrual cramps, backache, arthritis pain, and inflammation.	Stronger and generally longer lasting than aspirin for menstrual cramps, toothache, and inflammation.	May irritate stomach. Increased risk of serious gastrointestinal adverse events. Serious risk of cardiovascular events.	Cons and comments are similar to ibuprofen. Not recommended for children without a health care professional's supervision.
Meloxicam Mobic® Vivodex®	Arthritis pain	Associated with less risk of ulcers vs. other NSAIDs.	May irritate stomach. Increased risk of serious gastrointestinal adverse events. Serious risk of cardiovascular events.	Generally well-tolerated but still need to be concerned about GI side effects.
Celecoxib (a COX-2 Inhibitor) Celebrex®	Muscle aches, joint pain, arthritis pain, and inflammation.	Helps reduce inflammation; less stomach irritation vs. other NSAIDs.	May irritate stomach. Increased risk of serious gastrointestinal adverse events. Serious risk of cardiovascular events.	Generally well-tolerated but still need to be concerned about GI side effects. No effect on bleeding time. Use caution with sulfa allergies and celecoxib.

Other NSAIDs include the following:

- Diclofenac (Cataflam®, Voltaren®, Zipsor®, Zorvolex®, others) – see comments below
- Diflunisal (Dolobid®)
- Etodolac (Lodine®, Lodine® XL)
- Fenoprofen (Nalfon®)
- Flurbiprofen (Ansaid®)

Copyright 2019

- Ibuprofen (Caldolor®) - NSAID available intravenous for acute pain and fever
- Indomethacin (Indocin®, Indocin® SR, Tyvorbex®)
- Ketorolac (Toradol®, others) – Oral, intranasal and injectable – 5-day use only in adults
- Mefenamic acid (Ponstel®)
- Nabumetone (Relafen®)
- Oxaprozin (Daypro®)
- Piroxicam (Feldene®)
- Sulindac (Clinoril®)
- Tolmetin (Tolectin®)

***** Brand names are the trademarked property of the medication's manufacturer.

Diclofenac Warning: All oral diclofenac products are not recommended as first line analgesics due to increased risk profile for cardiovascular events (heart attack and stroke) and for increased risk of liver dysfunction (use has resulted in liver failure and death). With the lack of data to support superiority of diclofenac over other NSAIDs and the possible increased hepatic and cardiovascular risk associated with its use, alternative analgesics (pain medications) and/or non- medication therapy should be considered.

Gastrointestinal (GI) Protective Medications

As mentioned earlier, the NSAID medications can increase the risk of ulcers and other stomach and digestion problems. Often people are prescribed an additional medication to help protect their GI system, sometimes called cytoprotective medications, which are medications that protect cells from noxious chemicals or other harmful stimuli.

Taking antiulcer agents along with an NSAID pain medication is recommended for individuals who will benefit from an NSAID but also have a high GI risk factor profile. Individuals considered being at elevated risk include those with a history of prior GI bleed/uncomplicated ulcer or H. pylori infection, the elderly, diabetics, cigarette smokers, and those with concurrent use of aspirin (including low dose), corticosteroids, or anticoagulants (blood thinners). Long-term NSAID treatment increases the risk among those most susceptible, although anyone can potentially develop an adverse effect at any time.

There are four commonly used antiulcer drug types:

- Proton pump inhibitors (PPIs): esomeprazole (Nexium®), lansoprazole (Prevacid®), dexlansoprazole (Dexilant®), omeprazole (Prilosec®), pantoprazole (Protonix®), and rabeprazole (Aciphex®). PPIs are more effective and longer lasting acid inhibitors than H2 receptor antagonists. There is an increased risk in individuals over 50 years of age of hip, wrist, and spine fractures amongst PPI users. Some scientific studies show evidence linking PPIs with cardiovascular disease. There has been concern expressed regarding increased risk of gastrointestinal infection due to decreased acid production.

- H2 receptor antagonists (H2RAs): famotidine (Pepcid®), nizatidine (Axid®), ranitidine (Zantac®), and cimetidine (Tagamet®). They are still used for treatment and maintenance therapy of peptic ulcer disease, treatment of gastroesophageal reflux disease, and management of dyspepsia. However, they achieve less acid suppression than proton pump

Copyright 2019

inhibitors. Many of the studies on H2 blockers show that they have negligible value in the protection of the gastric mucosa.

- Misoprostol (Cytotec®) - a prostaglandin analog which is effective in preventing NSAID–induced ulcers but has no established role for healing ulcers. Prostaglandins increase the contraction ability in the uterus, so females should not take misoprostol if pregnant or planning to become pregnant. More specifically the FDA states that misoprostol tablets should not be used for reducing the risk of NSAID-induced ulcers in women of childbearing potential unless the patient is at high risk of complications from gastric ulcers associated with use of the NSAID or is at high risk of developing gastric ulceration.

- Antacids containing aluminum and magnesium hydroxide or calcium carbonate (TUMS®) and sucralfate (Carafate®) have not been proven in the treatment of peptic ulcers. Sucralfate (Carafate®) works via interactions with hydrochloric acid found in the stomach and digestive tract. The combination forms a paste-like substance, which forms a protective coating that acts locally to protect the stomach and gastrointestinal tract lining.

Copyright 2019

The Opioid Dilemma

In any acute pain situation, opioids are not always necessary but with severe trauma and immediately post operatively, short-term use of opioid medications (3-5 days) is appropriate although side effects are most problematic when initiating treatment. With that said, some people though are more susceptible to misuse and abuse when started on opioids.

Prolonged use of opioids past a few weeks increases the possibility, over time, of adverse reactions such as dependence or even addiction, gastrointestinal distress including constipation, internal organ problems, balance troubles, hormone problems, sexual dysfunction, and memory and concentration problems. Furthermore, it has been shown that if opioids are used for more than 8 days, 13.5% will be on opioids at 1 year; 30% of persons taking opioids for more than 31 days are on them at 1 year. After prolonged use, an increase in pain sometimes occurs that is thought to be due to opioids causing changes in the peripheral and central nervous systems over time, a phenomenon referred to as opioid-induced hyperalgesia.

Regarding the treatment of chronic pain, considerable controversy exists about the use of opioids for long-term treatment. While there remains a place in the treatment of pain with opioids, **the weight of scientific evidence suggests caution against the widespread use of opioids, noting problems with tolerance, loss of benefit with time, and escalating usage despite decreasing function and increasing side-effects in some individuals, as well as the possibility of developing addiction for others**.

The use of opioids (or for that matter any treatment) for a small and highly selected group of patients; makes sense, when the benefits outweigh the risks and negative side effects. Benefit is suggested when there is an increase in the person's level of functioning, a reduction or elimination of pain complaints, a more positive, hopeful attitude, and when side effects are minimal or controllable.

Opioids are not harmless drugs. The dilemma with the long-term use of opioids is that while opioid treatment may be prescribed to reduce pain and improve function, the treatment may result, at times, in just the opposite. Use of opioids can increase adverse events and drive polypharmacy when medications are added to treat side effects.

A physician who is considering prescribing opioids as well as the person who is deciding whether or not to use this treatment for pain relief, should not just consider the risks vs. benefits of these medications. They should ask themselves whether they are at higher risk (factors include cigarette smoking, misuse with other drugs, strong family history, environmental exposure, history of sexual abuse) for misuse, abuse, or addiction than others. They should look at the bigger picture and compare the risks and benefits of opioids to those of other treatments, many of which are safer and as or more effective for chronic pain.

Copyright 2019

In the opioid naïve person (someone new to opioid use), the use of opioids may heighten the risk of **accidental death** from respiratory depression. These risks greatly increase with higher doses and when opioids are taken in combination with other drugs (sedative–hypnotics) that also slow breathing, such as benzodiazepines. In fact, current medical evidence suggests that with rare exception, opioids and benzodiazepines (e.g., Valium, Xanax, Klonopin, and others) should not be prescribed at the same time.

The U.S. Centers for Disease Control (CDC) reports that drug overdose deaths and opioid-involved deaths continue to increase in the United States (https://www.cdc.gov/drugoverdose/index.html). The majority of drug overdose deaths (more than six out of ten) involve an opioid. Since 1999, the number of overdose deaths involving opioids including prescription opioids and heroin (https://www.cdc.gov/drugoverdose/opioids/prescribed.html) quadrupled.

According to the CDC (12/21/18)[2], The 63,632 drug overdose deaths in the United States in 2016 represented a 21.4% increase from 2015; two thirds of these deaths involved an opioid. In 2017, among 70,237 drug overdose deaths, 47,600 (67.8%) involved opioids, with increases across age groups, racial/ethnic groups, county urbanization levels, and in multiple states. From 2013 to 2017, synthetic opioids contributed to increases in drug overdose death rates in several states. From 2016 to 2017, synthetic opioid-involved overdose death rates increased 45.2%. On average, 130 Americans die every day from an opioid overdose.

The FDA's approach to reducing the misuse and abuse of opioids is outlined in FDA's 2018 Strategic Policy Roadmap, which addresses various facets of this complex issue.

The FDA's web page on Opioid Medications can be found at
https://www.fda.gov/Drugs/DrugSafety/InformationbyDrugClass/ucm337066.htm

Further information regarding REMS can be found at:

- **FDA Basics Webinar: A Brief Overview of Risk Evaluation and Mitigation Strategies (REMS)**

  http://www.fda.gov/AboutFDA/Transparency/Basics/ucm325201.htm

- **Approved Risk Evaluation and Mitigation Strategies (REMS)**

  http://www.accessdata.fda.gov/scripts/cder/rems/index.cfm

- **Risk Evaluation and Mitigation Strategy (REMS)**

  http://www.er-la-opioidrems.com/IwgUI/rems/home.action

The FDA is also working in cooperation with other governmental agencies, state professional licensing boards, and societies of health care professionals to increase prescribers' knowledge about appropriate prescribing and safe use of opioids. There is renewed emphasis on home storage

[2] Drug and Opioid-Involved Overdose Deaths — United States, 2013–2017 at
https://www.cdc.gov/mmwr/volumes/67/wr/mm675152e1.htm?s_cid=mm675152e1_e

Copyright 2019

and safe disposal of unused medication to help patients protect their families and others.

The Substance Abuse and Mental Health Services Administration (SAMHSA) provides information about Prescription Drug Misuse and Abuse:

http://www.samhsa.gov/prescription-drug-misuse-abuse

General Opioid Adverse Risks & Side Effects

One out of every two patients taking oral opioids experiences at least one adverse event/effect. Approximately one out of five patients taking oral opioids discontinue use because of an adverse event or an associated side effect.

Prolonged use of opioids may result in problems including hyperalgesia (increased pain sensitivity), hormonal effects (decreased testosterone levels, decreased libido and sex drive, irregular menses, etc.), depression, impaired sleep patterns, and suppression of the immune system. The long-term use of opioids may also impair functional improvement in an individual's recovery from surgery or long-standing musculoskeletal disorders. The prolonged use of opioids usually causes tolerance and physical dependence. As a separate issue, the use of opioids may trigger or worsen substance abuse and addiction.

Common opioid side effects, particularly with higher doses, include:

- Nausea
- Vomiting
- Constipation (opioid induced constipation has a different mechanism of disease than general constipation which is why traditional constipation treatments and medications don't always work)
- Thought and memory impairment
- Drowsiness

Many of these side effects can usually be treated with dose adjustments, wane over time (with the exception of constipation) or can be offset by other alternative medications. There is a risk though of too many additional medications being prescribed (also known as polypharmacy) to treat the opioid side-effects when less opioids may be more appropriate.

Although all doses of opioids carry risks, increasing vigilance (concern) is recommended for doses above 50 mg a day morphine milligram equivalent (MME) as the known risk of adverse events rises while the evidence for increased benefit remains weak.

Remember also that taking opioids does not result in being pain-free but rather the goal should be less pain, more function and either manageable or minimal side effects.

Approximately 40 to 81 percent of individuals taking opioid therapy for non-cancer pain experience **constipation** (fewer than three bowel movements per week) secondary to opioid treatment. Most individuals taking opioid medications will not develop tolerance to opioid-induced constipation. Therefore, an effective preventive bowel regimen including diet changes and a stimulant laxative plus a stool softener will have to be maintained throughout the course of opioid treatment. Even individuals that utilize appropriate laxative therapy often still experience constipation that may impede the appropriate use of opioid pain medication and thus result in

Copyright 2019

higher levels of pain, so attention to and prevention of this side effect is essential.

There are a number of ways to manage constipation through diet. Maximizing fiber intake is critical. Prunes and prune juice can help to overcome constipation because of their high-fiber content. The same is true for pears, peaches, figs, and pineapples. Broccoli, carrots and beans contains a lot of fiber. Another source of fiber is flaxseeds which can be found in bread or added to smoothies. Yogurt contains probiotics which have been shown to help in the digestive process and reduce constipation.

Medications used for constipation include OTC laxatives (pills, suppositories, enemas, etc.) including stimulant laxatives and osmotic laxatives such as polyethylene glycol 3350 (PEG) (MiraLAX).

Bulk forming (fiber) laxatives, such as psyllium, are not recommended for opioid-induced constipation as they can produce colon obstruction.

There are prescription drugs that are utilized for treating opioid induced constipation. These include prescription drugs such as lactulose, lubiprostone (Amitiza®), naloxegol (Movantik™), methylnaltrexone (Relistor®), and naldemedine (Symproic®). For more information on OTC laxatives, please visit Mayo Clinic Site: http://www.mayoclinic.org/diseases-conditions/constipation/in-depth/laxatives/art-20045906?pg=1. For more facts about opioid induced constipation: http://www.theacpa.org/opioid-induced-constipation.

The American Gastroenterological Association has published a Guideline titled: Medical Management of Opioid-Induced Constipation. https://www.gastrojournal.org/article/S0016-5085(18)34782-6/pdf

For more information on opioid-induced constipation, see the following from the American Academy of Pain Medicine, Consensus Recommendations on Initiating Prescription Therapies for Opioid-Induced Constipation at https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4738423/.

Considering current opioid guidelines, one method of treating opioid-induced constipation (OIC) is opioid reduction.

Non-pharmacological interventions that can assist with constipation include: 1) increasing fluid intake, 2) increasing physical activity, and 3) encouraging daily bowel movements at the same time, often after a meal.

Mild nausea is also common with opioid therapy. It can be treated with medications, but if it does not resolve within a few days, a trial of an alternate opioid may be appropriate.

Mild sedation and impaired judgment or coordination also should be anticipated, especially at the beginning of opioid therapy and with significant dose increases. Until tolerance or a baseline is reached, the patient and family need to be warned against driving and the potential for falls. Psychostimulants, while not recommended in current guidelines, are covered by insurance plans, are sometimes used in selected patients to treat sedation but can be habit-forming and have serious side effects. Additionally, psychostimulants can have cardiovascular concerns, along with side effects of anxiety and insomnia.

Copyright 2019

Hormonal Changes: A side effect of long-term opioid use is a decrease in certain hormones, particularly sex hormones. This reduction may cause a loss in "sex drive," sometimes called libido, and erectile dysfunction along with altered menses and infertility. This tends to be associated with using these medications regularly for many months. Low testosterone levels are associated also with weight gain and mood disturbances/depression. Because of hormonal abnormalities (decreased estrogen levels), bone density may be diminished which may result in the risk of fractures. For this reason, some doctors test bone density periodically in both women and men on long-term opioid medications.

Respiratory Depression: A serious side effect, particularly in opioid-naïve individuals (those who have not been taking opioids regularly), is respiratory depression (slowed rate of breathing or loss of urge to breathe). Tolerance to respiratory depression can occur with regular opioid use, but this has been called into question now and it is even thought that respiratory depression may increase with prolonged use contributing to some postoperative respiratory morbidity in people receiving long-term opioid therapy, especially when combined with benzodiazepines and other sedatives preoperatively. Elderly, cachectic or debilitated individuals as a population are at increased risk for respiratory depression. Individuals with chronic obstructive pulmonary disease (COPD), obstructive sleep apnea and those who smoke also have greater risk for respiratory depression.

A genuine **allergy** to opioids is very rare. If an allergy does occur, opioids from another class should be chosen. For example, morphine, hydromorphone, oxycodone, and oxymorphone belong to the same class of opioid. Fentanyl and meperidine (Demerol) belong to a different class.

<u>Summary of Possible Opioid Side Effects</u>

- Central nervous system (CNS)
    - A sense of emotional well-being and euphoria
    - Drowsiness, sedation, and sleep disturbance
    - Hallucinations
    - Potential for diminished psychomotor performance
    - Dysphoria and agitation
    - Dizziness and seizures
    - Aberrant behavior (see addiction definition below)
    - Delirium
    - Depression
    - Cognitive impairment (i.e., memory, attention, decision-making, motor reaction)
    - Hyperalgesia (see definition below)
- Respiratory system
    - Respiratory depression is the most serious adverse effect and may result from toxicity
    - Risk for slowed breathing and death is greatly increased when opioids are taken with benzodiazepines or other CNS depressant drugs or with alcohol. To minimize risks, do not take opioids with benzodiazepines and never consume alcohol with opioids
- Ocular system
    - Constriction of the pupil of the eye
- Gastrointestinal system
    - Constipation, nausea, and vomiting
    - Delayed gastric emptying

Copyright 2019

- Genitourinary
    - Urinary retention
- Endocrine
    - Low testosterone in men and low estrogen in women
    - Reduced fertility in reproductive age women
    - Sexual dysfunction resulting from low hormone levels
    - Hypoglycemia – reported with tramadol and methadone
- Cardiovascular
    - Decreased blood pressure
    - Slowed heart rate
    - Peripheral edema (swelling)
- Musculoskeletal system
    - Muscle rigidity and contractions
    - Osteoporosis
- Skin system
    - Itching is common and not an allergic reaction
- Immune system
    - There are data suggesting that long-term administration of opioids suppresses the immune system. Research is being conducted to determine its clinical significance.
- Pregnancy* & Breast Feeding: When at all possible, avoid opioid use during pregnancy to minimize fetal risks
    - All opioids cross the placenta
    - Neonatal central nervous system depression can occur if opioids are used during labor
    - Neonatal abstinence syndrome can occur in infants born to mothers who are taking regular daily doses of opioids
    - Avoid breastfeeding when taking opioids for chronic pain
    - If an opioid is used during breast feeding, use with caution and only under a health care professional's supervision
    - Timing of opioid dose administration is important for safe opioid use during breast feeding
    - Use of opioids during pregnancy and breastfeeding may result in fetal or newborn toxicity including central nervous system and respiratory depression along with life-threatening neonatal opioid withdrawal syndrome.

*FDA Drug Safety Communication: FDA has reviewed possible risks of pain medicine use during pregnancy – see http://www.fda.gov/Drugs/DrugSafety/ucm429117.htm.

Copyright 2019

CONCOMITANT USE OF OPIOIDS AND CNS DEPRESSANTS

The concomitant use of opioids and other CNS depressants including sedatives, hypnotics, tranquilizers, general anesthetics, phenothiazine, marijuana, other opioids and alcohol can increase the risk of respiratory depression, profound sedation, coma, or death. Physicians are instructed to monitor patients receiving CNS depressants and opioids for signs of respiratory depression, sedation and hypotension. When combined therapy with any of the above medications is considered, the dose of one or both agents should be reduced. The CDC, FDA and National Institute on Drug Abuse (NIDA) all strongly warn against combining the use of opioids and benzodiazepines in order to "avoid potential serious health outcomes."

DEFINITION OF TERMS REGARDING OPIOIDS

Opioid-responsiveness is the ability to achieve pain relief with evidence of improved function without the development of unmanageable or intolerable side effects.

Opioid-induced hyperalgesia (OIH) occurs when continued opioid use causes increased sensitivity to painful stimuli, worsening pain despite increasing doses of opioids, and pain that becomes more diffuse, extending beyond the distribution of pre-existing pain. In other words, opioids can prolong or even increase pain. Research shows that long-term use of large quantities of opioids may interfere with the body's natural pain relievers: the endorphins. Physical activity is thought to promote release of endorphins; thus, it is also possible that opioids could inhibit the body's own mechanism of reducing pain by causing a person to be less active. Additionally, long-term opioid use may cause depression in some patients, which may impede their ability to recover. A mechanism called hyperalgesia increases the brain's sensitivity to pain in some people. An article on this topic, "A Comprehensive Review of Opioid-Induced Hyperalgesia," may be found by visiting http://www.integration.samhsa.gov/pbhci-learning-community/Opioid-Induced_Hyperalgesia_Article.pdf. Under the supervision of a health care professional, weaning and then stopping the opioid reduces this type of pain.

Addiction is one of the primary concerns that limits opioid prescribing. This is a term that requires clarification. Addiction is not the same thing as physical dependence (see below). **Addiction** is a primary, chronic disease of brain reward, motivation, memory, and related circuitry. Dysfunction in these circuits leads to characteristic biological, psychological, social, and spiritual manifestations. This is reflected in an individual **pathologically pursuing reward and/or relief** by substance use and other behaviors. In other words, the individual continues to crave and use the drug, despite harm.

Addiction is characterized by (A, B, C, D, E) the inability to consistently **A**bstain; by impairment in **B**ehavioral control; **C**raving; **D**iminished recognition of significant problems with one's behaviors and interpersonal relationships; and a dysfunctional **E**motional response. Like other chronic diseases, addiction often involves cycles of relapse and remission. Without treatment or engagement in recovery activities, addiction is progressive and can result in disability or premature death. (From the American Society of Addiction Medicine, www.asam.org.)

Opioid Use Disorder is the terminology utilized by the *Diagnostic and Statistical Manual of Mental Disorders*, Fifth Edition (DSM 5) from the American Psychiatric Association. It involves mild, moderate and severe forms based on eleven criteria including negative consequences of use, craving and loss of control. Complete list of criteria can be accessed here:

Copyright 2019

http://www.psychiatrictimes.com/special-reports/opioid-use-disorder-update-diagnosis-and-treatment

In this book, we will utilize the term "addiction" which is, for the most part, interchangeable with "substance use disorder."

Drugs capable of producing addiction do so by interacting with the biochemistry of the brain in such a way that the drug begins to seem essential – one feels a "need" for it as one does for food and water. In the case of pain, the "need" and craving may present as the intense desire to relieve the pain. While the media give the impression that the risk of addiction is inherent to the properties of opioids alone, experts in addiction generally recognize that it results from the interaction of the drug and various hereditary, biological, psychological, and situational factors unique to the individual. The effects of opioids on the brain's reward center are a big part of the problem and shouldn't be discounted.

Addiction should be distinguished from **physical dependence** (see below). **Any person (or animal) that takes sufficient doses of certain types of drugs for a significant length of time can have withdrawal symptoms if the drug is suddenly stopped or reversed by another medicine. This shows the presence of physical dependence but does not constitute addiction.**

Physical dependence is common among people who take opioids, but it is not synonymous with addiction. A person taking opioids can become physically dependent without being addicted. If someone is physically dependent, the drug's effectiveness decreases, often leading to futile increases in dose to gain relief, resulting in potentially dangerous consequences.

There is a risk that addiction will develop in anyone who takes opioids and some people have more risk of developing addiction than others.

When addiction develops, the pain medication has become a liability rather than an asset to the person. An older description of addiction includes four core elements (the four C's):

- **C**ompulsive use and preoccupation with the drug and its supply,
- Inability to consistently **C**ontrol the quantity used,
- **C**raving the psychological effects of the drug, and
- **C**ontinued use despite adverse effects from the drug.

Compulsive use or preoccupation may be demonstrated by taking the drug because it is available (as opposed to taking it exactly as a health care professional has instructed), inappropriate "stocking up," using several different health care professionals/pharmacists to guarantee a supply, and spending scarce resources on the drug.

Other examples of inappropriate use include selling the drug or changing the drug from pill to powder for injection or snorting.

An example of loss of control with pain medication might involve using up a month's supply in a week, causing the person to go without the medication for the rest of the month until it is time for a refill, or the person may look elsewhere to increase the available supply (emergency rooms, other doctors or dentists, friends or family, or illegal sources).

Craving is the desire for the drug in the absence of the drug. Craving may present as an intense

Copyright 2019

desire for a mental effect ("buzz" or "high") caused by a medicine. It may also include an intense desire to relieve pain "at any expense" even though, in the long run, the medicine is not truly helping much at all.

Examples of use despite adverse consequences may consist of smoking despite emphysema, drinking and driving despite convictions for driving under the influence, or using analgesics and tranquilizers despite experiencing adverse effect or the ability to function, mood, and family relationships.

People should be aware that they may become addicted to their opioid pain medications. Risk for addiction is increased in those who have a personal or family history of problems with drugs or alcohol and those who have a history of anxiety, depression, or other emotional conditions. People with a history of adverse experiences (including sexual abuse) during childhood or adolescence as well as adults who have experienced or witnessed trauma (like veterans, first responders and others) are also at risk. Cigarette smoking is also considered a risk factor. The risk of addiction should be discussed with a health care professional prior to taking an opioid for pain treatment.

Similarly, individuals should let their health care professional know if they are concerned about becoming addicted to opioid pain medications. There are many misconceptions that surround the use of opioids for pain relief, and a knowledgeable health care professional can provide accurate information. Signs of which to be aware during opioid treatment include taking more medication than prescribed without checking with a health care professional first, loss of control over the medication, and feelings of craving the medication or taking the medication for the euphoric (mental) effects rather than for pain relief.

Chemical Copers: Chemical copers use their opioids to cope with stress, fear, depression, anxiety, sleeplessness, etc. Some use pain medications to fall asleep, others to relax, still others to get along better with a spouse. Some individuals demonstrate inappropriate medication use but not to the level of addiction and are not likely to display a severity that rises to the level of compulsivity or loss of control. In addition, they are not likely to display behaviors indicative of drug cravings that would convince a clinician to diagnose addiction. A major hallmark of chemical coping is the overly important place in the person's life that is occupied by obtaining drugs for pain and a corresponding inflexibility about non-drug components of care. The use of medications becomes central in the chemical coper's life while other interests become less important. As a result, they often fail to move forward with psychosocial goals and are usually uninterested in or unwilling to treat pain non-pharmacologically; that is, they do not take advantage of other treatment options provided (i.e., functional restoration), including exploring recommendations to exercise or to see psychologists or physical therapists. Further, they remain on the fringe of appropriate use of their medication but are able to comply with their health care professional's opioid agreement enough to avoid being removed from treatment. Chemical copers often self-escalate their medication dosage when they are faced with stress and need to have their prescriptions refilled early. Opioids in general should be avoided in this category of patients.

Physical dependence is a state of adaptation that is manifested by a withdrawal syndrome that can be produced by abrupt cessation, rapid dose reduction, decreasing blood level of the drug, and/or administration of an antagonist. In the short-term management of acute pain, physical dependence usually does not develop because of the limited duration of opioid use. *Physical dependence is not addiction but can occur as a part of the process of developing addiction.*

Withdrawal involves developing signs of illness/discomfort when intake of the substance is abruptly

Copyright 2019

stopped. *Withdrawal is not addiction but can occur in people who are addicted and is characteristic for physical dependence.* Many people who have taken opioids or sedatives for more than a few doses (usually after one or two weeks of steady dosing) will show some tolerance with use and withdrawal on abrupt drug cessation. In addition, numerous drugs can produce tolerance and withdrawal, yet do not produce addiction (e.g., epilepsy medications, some blood pressure drugs). Symptoms of withdrawal to monitor include sweating, goose flesh, runny nose, abdominal cramping, diarrhea, nervousness, agitation, hallucinations, and a fast heartbeat. Tell a health care professional or pharmacist if these or other side effects occur. Obtaining refills on time will prevent withdrawal.

Tolerance is a phenomenon or adaptation of the body, over a period of time, in which one or more effects of a drug diminish with repeated use at the same dose. For example, a person might feel drugged after the first pain pill; but with continued use, a person might require several pills to feel anything including pain relief. With analgesics, the concern is that the individual will build up tolerance to the drug and therefore require more medication to achieve results. Unfortunately, in many cases, increasing doses of medications may lead to increased or intolerable side effects. *Analgesic tolerance is not addiction but does occur in people who are addicted.*

Although questions remain, it is known that tolerance to the different side effects does not develop at the same rate. For example, one rapidly becomes tolerant to the sedating effects of the opioids. It has been shown that people with cancer who take large but stable doses of morphine show little or no sedation. However, if not prevented, they do continue to experience constipation as individuals do not develop tolerance to this side effect.

The real question, of course, is the extent to which tolerance develops to the *analgesic* effects of the drugs; that is, how soon do the drugs lose their ability to reduce pain? This is unclear, and the answer seems to vary in different people and with different types of pain. Some people seem to benefit from the same dose of an opioid for years, while others rapidly require increased doses and still have unsatisfactory relief. Older people with pain may not become tolerant as quickly to the analgesic effects of opioids as younger people with pain. In some patients, a progression of their disease may lead to increased pain signals or to pathology that leads to pain that is not sensitive to opioids. This disease progression can be misinterpreted as opioid tolerance.

Pseudo-tolerance is the need to increase medications such as opioids for pain when other factors are present that may be the underlying cause, such as disease progression, new disease, increased physical activity, prescription of inadequate doses, lack of compliance, change in medication, and drug interactions.

Functional impairment and physical inactivity are additional concerns that make health care professionals reluctant to provide long-term opioid therapy. It is well known that a sedentary life decreases blood flow, impedes healing, decreases muscle tone, and contributes to depression, bone loss, and fatigue. Clearly, some people become inactive and passive on opioids, while others become more active. It may be that some are able to obtain good analgesia without taking enough to produce intoxication, while others are not able to do so.

Drug misuse refers to the intentional or unintentional incorrect use of opioids in a manner other than that prescribed.

Diversion is allowing others to have access to one's prescribed opioids. Diversion can be as simple as sharing one's medications with family members or friends on an occasional basis or can

Copyright 2019

represent a conscious decision to distribute or sell them to others. Another definition of diversion is the intentional removal of a medication from legitimate distribution and dispensing channels for illicit sale or distribution. It is a federal crime to divert opioids from the person for whom they have been prescribed. Opioid diversion has been a major contributor to the steep rise in opioid-related deaths in the U.S.

Copyright 2019

What are Opioids?

Opioid Agonists

Opioids are morphine-like substances. Some forms have been available for centuries to relieve pain. The term opioid is derived from opium, which is an extract from the poppy plant.

Opioids come in naturally occurring, synthetic, and semisynthetic forms. In 1975, it was discovered that the body generates its own (internal or endogenous) opioids (called endorphins, enkephalins, and dynorphins).

Most opioids are agonists, a drug that binds to a receptor of a cell and triggers a response by the cell. An agonist produces an action. It is the opposite of an antagonist, which acts against and blocks an action. The body has opioid receptors that, when occupied by an opioid agonist, create the sensation of analgesia (pain relief).

Opioid medications are sometimes also referred to as narcotics. However, this may be considered a misnomer because, by definition, a narcotic can be anything that induces narcosis or a state of stupor or drowsiness. These effects are essentially, unwanted, secondary effects (i.e., adverse drug reactions) of opioid medications. The primary effect is analgesia. For this reason, the preferred designation is opioids or opioid analgesics.

There are numerous opioids available by prescription (see lists below). Examples include morphine, hydromorphone, fentanyl, methadone, and oxycodone.

All opioids have similar clinical effects that vary in degree from one drug to another. The potency, speed of onset, and duration are unique to each drug. Opioids differ in the typical route of administration, whether injection, skin patch, or in pill form. There are both short- and long- acting opioid formulations. Some are used around-the-clock in scheduled doses, while others are used as needed for intermittent or breakthrough pain.

Opioids should be kept in a secure place in the home to prevent diversion/misuse by family members and visitors.

Opioid Mixed Agonists /Antagonists

Early after the discovery of opioids, the side effects and addictive potential of these medications became apparent. This problem served as the impetus to search for synthetic opioids without side effects and addictive properties. This search led to the discovery of drugs that interact differently with the body's opioid receptors. Additionally, it was discovered that there are four separate receptors: mu (μ), kappa (κ), and delta (δ) and nociceptin/orphanin FQ (NOP).

The mu-receptor is the classic morphine-receptor type and the stimulation of which causes analgesia, respiratory depression, euphoria, and physical dependence. The kappa-receptor produces analgesia through alterations of mood. Stimulation of the kappa-receptor also causes dysphoria.

The discovery of these synthetic opioids led to expanded therapeutic options as well as more

Copyright 2019

understanding of the body's opioid system.

Buprenorphine (e.g., Belbuca™, Buprenex®, Butrans®), is a partial agonist at the mu-opioid receptor and an antagonist at the kappa-opioid receptor. Buprenorphine has a very strong affinity for the mu-receptor but only partially activates it. For this reason, its effects on analgesia, euphoria, respiratory depression and dependence are lower relative to pure mu-agonist. In fact, partial agonists are known for their ceiling on both respiratory depression and analgesia. The ceiling effect for respiratory depression for buprenorphine has not been confirmed although it has not been a problem in clinical practice. The analgesic ceiling effect has been demonstrated with sublingual buprenorphine.

It is believed that patients with opioid addictions have increased kappa-receptor activity that alter the mu-receptor agonistic effects. For this reason, buprenorphine has found significant utility as a treatment for opioid dependence. However, because of its partial agonist properties, its utility may be limited in addicts who were on very high doses of opioids. At very low doses relative to doses for opioid dependence, buprenorphine can be used for chronic pain. In some circumstances, buprenorphine may be used for as-needed use in treating chronic pain but not in treating addiction.

Nalbuphine, is a partial mu-receptor antagonist and a kappa-receptor agonist. Nalbuphine is only available by injection and indicated for moderate to severe pain or as supplemental analgesia during surgery. At lower doses, nalbuphine is equianalgesic to morphine and produces the same degree of respiratory depression. However, doses beyond 30 mg do not produce further respiratory depression or analgesia.

Butorphanol, is similar to nalbuphine in that it is a mu-receptor antagonist and a kappa-receptor agonist. Butorphanol is available by injection for relief of acute pain generally used inpatient. Butorphanol is not generally used for chronic pain. A nasal spray is available that has become popular for the treatment of migraine headaches. Butorphanol is not specifically approved for migraine and is generally recommended as a last line option due to the risk of side effects and potential for abuse.

Pentazocine (Talwin®), is a weak mu-receptor antagonist and a kappa-receptor agonist. Pentazocine injection is indicated for moderate to severe pain and also preoperatively as a supplement to analgesia. Oral tablets are also available and formulated with naloxone to reduce the potential for abuse by injection.

Given their antagonist nature, these medications can reverse the effects (analgesia and side effects) of full agonist opioids, such as morphine, fentanyl, hydromorphone, and oxycodone, and therefore should be used with caution in those taking a full agonist opioid.

Symptoms of withdrawal include sweating, gooseflesh, or goose bumps (a temporary local change in the skin when it becomes rougher due to erection of little muscles, as from cold, fear, or excitement), runny nose, abdominal cramping, diarrhea, nervousness, agitation, hallucinations, and a fast heartbeat. The health care professional or pharmacist should be informed about these symptoms.

Copyright 2019

Opioid Delivery

Opioids are commercially available orally (swallowed by mouth), intravenously, by intramuscular injection (although not recommended), by feeding tube, via nasal spray, transdermally (through the skin), oral transmucosally which includes buccally (absorbed between the gum and inside of the cheek) and sublingually (absorbed under the tongue), via suppository, via an epidural (injection of an anesthetic into the space between the spinal cord and the covering membrane call the dura), and intrathecally (injection into the sheath surrounding the spinal cord, also called "spinal injection" – also see discussion on Implanted Targeted Intrathecal Drug Delivery Systems -"Pain Pumps").

Opioid Dosing

Morphine equivalent dosing, or MED, is a system used to equate different opioids and their varying potencies into a standard morphine equivalent value using a conversion chart created by the Centers for Disease Control and Prevention (CDC). A patient's cumulative daily morphine equivalent dose is an indicator of potential dose-related risks for adverse drug reactions.

Although all doses of opioids carry risks, increasing vigilance is recommended for doses above 50 mg a day morphine equivalent dose (MED) as the known risk of adverse events rises while the evidence for increased benefit remains weak. For example, the CDC opines a MME factor of 1 for morphine, 1.5 for oxycodone, 3 for oxymorphone, and 10 for 41-60 mg/day of methadone (https://www.cdc.gov/drugoverdose/pdf/calculating_total_daily_dose-a.pdf).

Opioid Weaning/Tapering

The ability for opioids to cause physical dependence means that when withdrawn, discomforting physical symptoms occur. To reduce the severity of withdrawal symptoms (e.g., drug craving, anxiety, vomiting/diarrhea, increased heart rate and blood pressure; sweating; tremors, anxiety), discontinuation of opioid therapy should be done through a gradual dose reduction (i.e., wean/ taper).

It is generally recommended to reduce the total daily opioid dose by 10%-20% per week. The rate of reduction should be individualized and is reasonably affected by ancillary or related factors and the length of time the patient has been on opioid therapy.

In theory, the longer a patient has been on opioid therapy, the slower the taper may need to be. Additionally, according to the Centers for Disease Control and Prevention (CDC) Guideline for Prescribing Opioids for Chronic Pain — United States, 2016, tapers may need to be paused and restarted again per patient response and be more gradual once patients reach low dosages.

According to these guidelines, "tapers may be considered successful as long as the patient is making progress".

The idea behind these guideline statements is to allow patients to drive the process of weaning as much as possible because the decision to wean, after years of use, requires a significant commitment from the patient. It is important to consider that opioid weaning is not a discontinuation of care.

Copyright 2019

In many ways, opioid weaning requires as much attention, treatment, and care as opioid initiation.

Collaboration among relevant health providers and psychosocial support is needed to ensure success. While acute withdrawal symptoms may subside, depressive-like symptoms may persist for weeks or months. This is referred to as "protracted abstinence syndrome". Protracted abstinence syndrome presents risk of relapse and continual care may be necessary to manage this risk.

Short-acting, Extended-release and Long-acting Opioid Agonists

Short-acting oral opioids effects only last a short time.

Examples of short-acting opioid and opioid-combination products include:

- codeine
- oxycodone (alone or combined with acetaminophen - Percocet®; combined with aspirin - Percodan®; combined with ibuprofen - Combunox®)
- hydrocodone (combined with acetaminophen - Lorcet®, Lortab®, Vicodin®, Norco®; combined with ibuprofen - Vicoprofen®)
- tramadol (alone or combined with acetaminophen - Ultracet®) - tramadol is not chemically a true opioid biochemically but works similarly to opioids primarily on the same receptors
- hydromorphone (Dilaudid®)
- fentanyl (Actiq®) - not indicated for non-cancer pain
- oxymorphone (Opana®)
- tapentadol (Nucynta®) – (an agonist of the mu receptor but not truly an opioid biochemically)

Short-acting oral opioids, true to their description, exert a rapid-onset but short-lived therapeutic effect. These agents typically start working 15–30 minutes after administration, with peak analgesic effect within 1–2 hours. Sustained pain relief is maintained for only about 3 to 4 hours. They are a potent option for treating acute pain (e.g., from a serious athletic injury or after a root canal) and are usually prescribed for pain that is anticipated to last only a few days.

Because of their short half-life and rapid clearance from the body, short-acting opioids must be taken every 3 to 4 hours. Therefore, these drugs are not ideal for long-term therapy of chronic pain, and there is little medical evidence to support their use in long-term therapy of chronic non-cancer pain. Short-acting opioids may be effective; however, as an initial "trial" therapy in patients with moderate or severe chronic pain who have not previously received opioid treatment. In this case, short-acting agents are used to establish a patient's response and tolerance to opioid therapy and lay the groundwork for long-term dosing of long-acting opioid therapy if, and when, that is prescribed and assuming other non-opioid nonpharmacological therapies are not sufficiently improving function and relieving pain.

In addition to their importance in managing acute pain and initiating therapy for chronic pain, short-acting agents are sometimes used with a long-acting agent during long-term therapy as "rescue medication". Rescue medications are prescribed for addressing flare-ups that occur despite ongoing, long-term analgesic treatment.

Copyright 2019

Immediate-release (IR) opioids are active immediately. Some contain an opioid as the only active ingredient (e.g., morphine, hydromorphone, oxycodone, tramadol[1] and oxymorphone), while others contain a combination of an opioid and a non-opioid such as acetaminophen or ibuprofen.

Long-acting opioids include extended or controlled release formulations (ER, or CR, respectively). The prolonged effects of these agents are due to their long half-lives or extended delivery into the body via controlled-release opioid preparations.

Medical consideration of long-acting opioids is indicated in the management of pain severe enough to require daily, around-the-clock, long-term treatment for which alternative treatment options are inadequate. These are extended or controlled release formulations (ER, or CR, respectively).

Examples of sustained-release opioids include:

- morphine (oral sustained release, e.g., MS Contin®, Avinza®, Kadian®, and extended-release Morphabond ER™)
- oxycodone (oral controlled release, e.g., OxyContin®; Xtampza® ER, oral biphasic release with acetaminophen, e.g., Xartemis® ER)
- oxymorphone (oral extended release Opana® ER)
- hydrocodone (oral extended release Zohydro® ER, Hysingla® ER)
- hydromorphone (oral extended release EXALGO®)
- fentanyl transdermal system (Duragesic®)
- tapentadol (Nucynta® ER)
- buprenorphine transdermal system (Butrans®)

Examples of long-acting opioids include:

- methadone (oral, e.g., Dolophine®, Methadose®)

The prolonged effects of these agents are due to their long half-lives or extended delivery into the body via controlled-release opioid preparations. Because of the extended release of active drug, long-acting opioids can provide prolonged, steady pain relief for 8–12 hours. Long-acting drug preparations are given at regularly scheduled times, such as every 12 hours. For example, hydromorphone EXALGO®) is a once-daily medication with reported sustained blood levels for 18-24 hours. **Methadone can have some very toxic effects including respiratory depression and death if dose elevations are made too frequently.**

Extended-release tablets should be swallowed whole and are not to be broken, chewed, dissolved, or crushed. Taking broken, chewed, dissolved, or crushed slow-release pills can lead to rapid release and absorption of a potentially fatal dose of the drug.

Copyright 2019

Examples of Medical Opioid Agonists	
Codeine (with acetaminophen - Tylenol® with codeine No. 2, No. 3, No. 4)	Codeine is metabolized by the liver to morphine. Some individuals do not have the enzyme required to convert codeine to morphine, and therefore the medication is ineffective. Even though they do not receive benefit, they are still at risk for the associated side effects. Codeine often is associated with higher levels of nausea and vomiting and constipation compared to other opioids. Codeine is contraindicated due to potential life-threatening side effects in children under the age of 12 and postoperatively for children under the age of 18. Codeine should not be used for breastfeeding women.
Dihydrocodeine bitartrate, Aspirin, Caffeine (Synalgos-DC®)	This combination drug of dihydrocodeine, aspirin and caffeine is rarely prescribed in chronic pain states.
Hydrocodone • Hydrocodone alone – Zohydro® ER, Hysingla® ER • With **acetaminophen** – Norco®, Vicodin® • With **ibuprofen** – Reprexain™, Vicoprofen® • With **aspirin** – Lortab ASA, Panasal	Hydrocodone is a short-acting opioid available alone or in combination with other ingredients, and different combination products are prescribed for different uses. Zohydro® ER (2 X day) and Hysingla® ER (1 X day) are extended-release hydrocodone available for chronic pain, in an acetaminophen-free formulation. Some hydrocodone products are used to relieve moderate to severe pain. Hydrocodone products have been reclassified to schedule II http://www.deadiversion.usdoj.gov/fed_regs/rules/2014/fr0822.htm The concomitant use of hydrocodone with CYP3A4 (an enzyme that metabolizes many drugs) inhibitors may result in an increase in plasma concentrations which could increase to prolong adverse drug effects and may cause potentially fatal respiratory depression. In addition, discontinuance of a concomitantly used CYP3A4 inducer may result in an increase in plasma concentration.

Copyright 2019

Examples of Medical Opioid Agonists	
Fentanyl (Actiq® lozenge, Fentora® buccal tablet and ONSOLIS™ buccal film, Abstral® sublingual tablet, Subsys® sublingual spray, Duragesic® transdermal patch, Lazanda® nasal spray, and also Ionsys iontophoretic transdermal system - only approved for use in hospital settings)	There have been reports of death and other serious side effects from overdoses while on fentanyl transdermal patches. Furthermore, patients that have not been on opioids (opioid naïve) should not be initially started on the fentanyl transdermal patch because of the inherent inaccuracies in dosing which can lead to an overdose. Exposure to heat (hot bath, heating pad, hot sun, etc.) can increase the speed of fentanyl release. The directions for using the fentanyl skin patch must be followed exactly to prevent death or other serious side effects from overdose. Do not cut fentanyl patches. It is extremely important that patches be disposed of properly to avoid harm to children/pets. Oral transmucosal fentanyl is available in multiple formulations for the treatment of breakthrough pain in cancer patients receiving opioid treatment and who have become tolerant to it. The FDA warns that serious adverse events, including deaths, can occur in patients treated with oral fentanyl. The deaths that have occurred were due to respiratory depression as a result of improper patient selection, improper dosing, and/or improper product substitution. Actiq® (oral transmucosal fentanyl lozenge on a plastic stick) is absorbed by swabbing the drug-containing lozenge over and under the tongue and between the cheeks and gums. It is contraindicated for acute postoperative pain and migraine headache. Its use should be limited to cancer pain.
Hydromorphone (Dilaudid®, EXALGO®)	EXALGO® tablets are an extended-release oral formulation.
Levorphanol (Levo-Dromoran®)	Levorphanol has the same properties as morphine with respect to the potential for habituation, tolerance, physical dependence, and withdrawal syndrome. It is 11 times as potent as morphine and has a longer half-life. It is not used often due to limited availability.
Meperidine (Demerol®)	Due to its low potency, short duration of action, and unique toxicity (i.e., seizures, delirium, and other neuro-psychological effects) relative to other available opioid analgesics, meperidine has fallen out of favor and is not recommended or typically used in chronic pain states.

Copyright 2019

Examples of Medical Opioid Agonists	
Methadone (Dolophine®, Methadose®)	Although methadone possesses analgesic properties, it must be used carefully and with a great deal of caution. It has a long half-life and can accumulate in the body, which can lead to an overdose. It interacts with a large number of other medications, including OTC drugs. It is strongly recommended that the individual on methadone not use any OTC or herbal medications without the approval of the prescribing health care professional. The addition of other commonly used pain medications (e.g., antidepressants, anticonvulsants, and NSAIDS) can increase the likelihood of methadone negatively influencing the heart's ability to conduct electrical signals properly. Prior to starting methadone, patients should undergo an electrocardiogram to check for any pre-existing heart abnormalities that may contraindicate its use. Methadone can also be associated with the development of central sleep apnea. Benzodiazepines should be utilized with extreme caution by individuals who take methadone, secondary to the synergistic negative respiratory and cardiac effects.
Morphine (Avinza®, Duramorph®, Kadian®, MS Contin®, Oramorph SR®)	Morphine is considered to be the prototypical opioid and is available in many formulations.

Copyright 2019

Examples of Medical Opioid Agonists	
Oxycodone (OxyContin®, Roxicodone®, Oxecta®, Xtampa® ER • Endocet® (containing acetaminophen, oxycodone) • Endodan® (containing aspirin, oxycodone) • Lynox® (containing acetaminophen, oxycodone) • Percocet® (containing acetaminophen, oxycodone) • Percodan® (containing aspirin, oxycodone) • Primlev® (containing acetaminophen, oxycodone) • Roxicet® (containing acetaminophen, oxycodone)	Oxycodone has the same properties as morphine with respect to the potential for habituation, tolerance, physical dependence, and withdrawal syndrome. The concomitant use of oxycodone with CYP3A4 (an enzyme that metabolizes many drugs) inhibitors may result in an increase in plasma concentrations which could increase to prolong adverse drug effects and may cause potentially fatal respiratory depression. In addition, discontinuance of a concomitantly used CYP3A4 inducer may result in an increase in plasma concentration.
Oxymorphone (Opana®)	Oxymorphone has the same properties as morphine with respect to the potential for habituation, tolerance, physical dependence, and withdrawal syndrome.
Tapentadol (Nucynta®, Nucynta® ER)	Tapentadol is a dual mechanism drug with both opioid and antidepressant-like activity. The drug is not a true opioid but binds to opioid receptors and also inhibits the reuptake of the neurotransmitter norepinephrine. The short-acting formulation is approved for acute pain treatment, and the extended-release formulation is approved for the management of continuous severe chronic pain. Tapentadol may have an improved GI side effect profile in comparison with other opioids.

American Chronic Pain Association
Copyright 2019

Examples of Medical Opioid Agonists	
Tramadol* (Ultram®, Ultram® ER)* and tramadol combined with acetaminophen (Ultracet®) is considered a "weak" opioid-like analgesic *In July 2014, the DEA, citing evidence of possible abuse, dependence and diversion, reclassified all meds containing tramadol as Schedule IV controlled substances (those with a recognized medical use and relatively low potential for abuse & dependence), however there are known cases of addiction to Tramadol, so it should be taken with the same precautions as other opioids.	Tramadol is a weak analgesic that acts on the central nervous system in two ways. It binds modestly to opioid receptors and thus produces some analgesia by the same mechanism as opioids. It also affects certain neurotransmitters in the brain to decrease the perception of pain. Tramadol also carries the risk of excessive serotonin activity especially when combined with other serotonin stimulating drugs (such as antidepressants) leading to a serotonin syndrome. While tramadol is considered a weak opioid-like drug, it is not completely free of the risks associated with opioids and may trigger addiction even in those without a history of drug abuse or previous addiction. Tramadol reduces the respiratory rate to a lesser extent than opioids in overdoses and does not cause the sort of GI irritation produced by NSAIDs. Tramadol reduces the threshold for seizures, which may manifest in overdose. Seizures may also be provoked in those with a history of seizure disorders, head trauma, etc., or in those taking other drugs that reduce the seizure threshold such as certain antidepressants. Tramadol is a centrally acting synthetic analgesic, not an NSAID, and thus it has no anti-inflammatory activity. Unlike NSAIDs, tramadol does not have the potential to compromise the efficacy of certain antihypertensive agents (diuretics and ACE-inhibitors). Tramadol should be used cautiously, if at all, in patients with underlying liver and kidney disease. Tramadol can cause hyperglycemia. Due to increased risks for slowed breathing and death, tramadol should not be prescribed for children <18 years of age or breastfeeding women.

Copyright 2019

Examples of Medical Opioid Partial Agonists & Mixed Agonists/Antagonists	
Buprenorphine • Buprenex® injectable (indicated for pain relief/analgesia) • Butrans® Transdermal (indicated for pain relief/analgesia) • Belbuca™ (indicated for pain relief/analgesia) • Sublocade ™ (buprenorphine extended-release) injection, for weekly subcutaneous use (indicated for treatment of adults with moderate to severe addiction (dependence) to opioid drugs (prescription or illegal) • Probuphine (buprenorphine) implant for subdermal administration lasting six months. **Buprenorphine/naloxone** • BUNAVAIL® (buccal film) • Suboxone® (sublingual film) • Zubsolv® (sublingual tablet)	In addition to its use for the treatment of chronic pain, buprenorphine is used to help alleviate unpleasant withdrawal symptoms associated with opioid detoxification and to treat addiction. Maintenance dose is generally in the 4–24 milligram range and higher doses have not been demonstrated to provide any clinical advantage. Butrans® Transdermal as a 20 mcg/hour maximum dose recommended due to risk of QTc interval prolongation. Higher doses are thought to be ineffective for pain control and are not used due to cardiac concerns regarding prolongation of the QTc interval. Although not scientifically validated, some clinicians believe that the "ceiling effect" with buprenorphine offers advantages when compared to other medications used to manage addiction because there is a lower abuse potential, lower level of both physical dependence and withdrawal, and there is possibly a decreased incidence of dose related side effects (this has not been studied for Butrans® Transdermal). If Subutex® is swallowed instead of dissolved under the tongue, the patient may experience no effect due to the poor bioavailability and first pass metabolism of buprenorphine. Buprenorphine/naloxone is a combination drug indicated for the treatment of opioid dependence/addiction. Naloxone is a pure opioid antagonist, meaning it blocks the effects that opioid drugs have on the receptors. Naloxone inhibits and reverses opioid-induced respiratory depression, hypotension, sedation, and analgesia. When given sublingually (under tongue), naloxone has no significant effects on buprenorphine. However, if the sublingual tablet is crushed or injected, naloxone will block the effects of buprenorphine. This characteristic discourages misuse of the formulation. If buprenorphine/naloxone products are swallowed instead of dissolved under the tongue or inside the cheek, the patient may experience no effect due to the poor bioavailability and first pass metabolism of buprenorphine.
Butorphanol (Stadol®, Stadol NS®)	Available in injection or nasal spray formulations but not typically used for chronic pain treatment. Sometimes used in migraine treatment.

Copyright 2019

Clinical Guidelines for the use of Opioids in Noncancer Chronic Pain

Over the last few years, many states as well as the federal government have come out with guidelines for the use of opioids for chronic, non-cancer, pain.

In March 2016, the CDC released a "Guideline for Prescribing Opioids for Chronic Pain." http://www.cdc.gov/drugoverdose/prescribing/guideline.html

Key Steps to Use Opioids Safely

1. **Only receive opioids from one health care provider.**

2. **Notify all prescribers about your opioid use.** Whenever you receive a new prescription from any health care provider, be sure they are aware of your opioid use. Also, immediately alert your opioid prescriber about any new prescriptions.

3. **Keep the health care professional informed.** Inform the health care professional about any past history of alcohol or substance abuse. All patients treated with opioids for pain require careful monitoring by their health care professional for signs of abuse and addiction and to determine when these analgesics are no longer needed.

4. **Follow directions carefully.** Opioids are associated with significant side effects, including drowsiness, constipation, and depressed breathing depending on the amount taken. Taking more than is prescribed could cause severe respiratory depression or death. Side effects should be reported. Do not crush, break, or dissolve pills. This can alter the rate at which the medication is absorbed and lead to overdose and death. Do not suspend treatment abruptly without talking to your doctor.

5. **Reduce the risk of drug interactions.** Do not mix opioids with alcohol, antihistamines, barbiturates, benzodiazepines and other sedatives including some muscle relaxants (e.g., Soma). All of these substances slow breathing and their combined effects could lead to life-threatening respiratory depression.

6. **Prevent theft, diversion, and child access to your opioids by keeping them in a locked safe.** Remember, one pill can kill. Help keep others safe by never storing opioids in the medicine cabinet or where others have access to the medications. The best strategy is to store medications in a locked box. Do not share medications with anyone else. Although you may feel you are helping someone in need, you may cause harm and even death. Sharing opioids is against the law.

7. **Keep track of when refills are needed** to prevent going without medications which can lead to withdrawal. Discuss refill strategies with the prescriber ahead of time. Some p a i n

Copyright 2019

clinics will not fill prescriptions without a visit to the clinic. Other clinics will not fill prescriptions on Friday afternoons or weekends/evenings.

8. **People with memory problems may need extra help with their medications**. Avoid unintentional medication overdoses by helping people with memory problems receive assistance in creating a safe plan for taking medication. Such a plan may include help from family members, home care medication reconciliation, or using time-of-day labeled pill boxes (that are also kept in a locked safe).

Opioids and the Goals of Pain Management

There has been disagreement as to whether the goal of pain management should be to reduce pain or to improve the way people function in their daily lives. The consensus of the members of the American Pain Society is that the primary goal in treating people with chronic pain with opioids is to **increase the level of function** rather than just to provide pain relief.

When people are less uncomfortable, they usually resume activities that they had previously avoided. If a person with pain fails to do this, it suggests that symptom relief has not occurred even though the person may believe that the medications "take the edge off". Clearly, maximizing quality of life entails both factors: minimizing suffering and maximizing function. It is important to understand that the antianxiety and sedative actions of opioids may improve the person's well-being in the short-term, but these effects rapidly develop tolerance and the opioid dose will need to be escalated to achieve the same level of "Well-being". Opioids should be used for analgesia alone and when prescribing them the physician should inquire about the goals of opioid treatment and the limitations of opioid therapy. If reducing anxiety or sedation is desired, more appropriate medications and physical, behavioral therapies should be tried before escalating opioid dose. Additionally, opioids work best for constant pain at rest and less well for movement evoked pain. It is important that people using opioids do not try to elevate the dose of opioids to achieve an effect that would be best served by other treatments. While opioids are very useful medications they are not a complete answer to the reduction of pain and restoration of function.

In many respects the primary goal of pain management is essentially rehabilitation. The person experiencing pain and the family must ask to what end they want to be rehabilitated. What does rehabilitation mean to each of them? Webster defines rehabilitation as "*to restore to useful life through education and therapy".* If a person's goal is solely to reduce pain at the expense of function, then he or she may overlook the more important (and attainable) goal of rehabilitation. The essence of rehabilitation and maintaining wellness is for the person to take an active part in the recovery process.

It is important to mention that taking opioids precludes certain types of employment, even if one is tolerant and does not have side effects. People should be aware of the rules currently put forth by Federal and State authorities and individual employer drug use policies.

If you use opioids to help manage your pain, it's important to take them, store them, and dispose of them properly. Watch this video to learn more. https://www.theacpa.org/pain-management-tools/videos/conditionstreatments/

Copyright 2019

What is the place of opioid pain medication? There is no question about the usefulness of opioids in acute pain and end-of-life pain. We do not yet know when they are most helpful for chronic non-cancer pain. Benefit is suggested when there is a significant increase in the person's level of functioning, reduction/elimination of pain complaints, a more positive and hopeful attitude, and when the side effects can be managed safely. Those who take opioids should not have the expectation of prolonged opioid use without concomitant side effects.

Monitoring Opioid Medication Use

Health care professionals who prescribe opioids are required to monitor for pain and any unusual drug-related behaviors as part of caring for their patients.

The most relevant areas for monitoring have been termed the **Five A's**:

1. **A**nalgesia (pain relief – often measured by a 10-point rating scale).
2. **A**ffect (what is the patient's mood?).
3. **A**ctivities of daily living (physical, psychological, and social functioning).
4. **A**dverse or side effects.
5. **A**berrant or abnormal drug-related behaviors.

Some of the following questions may help clarify how appropriately opioid pain medications are being used and whether they are helping or harming the person's well-being:

- *Is the person's day centered around taking medication?* If so, consultation with the health care professional may clarify long-term risks and benefits of the medication and identify other treatment options.

- *Does the person take pain medication only on occasion, perhaps three or four times per day?* If this is the case, then the likelihood of addiction is low.

- *Have there been any other chemical (alcohol or drug) abuse problems in the person's life?* If so, then it is important to inform the health care professional who will need to take that into consideration when prescribing. Often, people with pain with a history of substance use disorders are not ideal candidates for opioid treatment for pain management because the opioids may trigger recurrent addiction.

- *Does the person in pain spend most of the day resting, avoiding activity, or feeling blue?* If so, that suggests the pain medication is failing to promote rehabilitation. Daily activity is necessary for the body to produce its own pain relievers, to maintain strength and flexibility, and to keep life full and meaningful. Encourage the person with pain to request recommendations from a health care professional for a graduated exercise program.

- *Is the person in pain able to function (work, household chores, and play) with pain in a way that is clearly better than without?* If so, chances are that the pain medication is contributing to wellness. Most people who are addicted to pain medications or other substances do not function well.

Copyright 2019

- *Does the person smoke?* Smoking increases pain and reduces the effectiveness of opioids. Smokers tend to take higher doses of opioids and have greater risks for problems and addiction. Smoking itself is an addictive behavior and; therefore, a clear risk for opioid addiction. ***Opioids should be avoided in smokers.***

The following may be signs that a person is being harmed more than helped by pain medication.

- Sleeping too much or having days and nights confused
- Decrease in appetite
- Inability to concentrate or short attention span
- Mood swings (especially irritability)
- Lack of involvement with others
- Difficulty functioning due to drug effects
- Use of drugs to regress rather than to facilitate involvement in life
- Lack of attention to appearance and hygiene
- Escalation of pain
- Continual dose escalation
- Increasing number of medications prescribed to treat the side effects of opioids

The ACPA Pain Log can be a useful tool for tracking many of the symptoms and impact that pain has on a person. View at https://www.theacpa.org/pain-management-tools/videos/conditionstreatments/

While it is impossible to make generalized guidelines for when to provide opioids on a regular, ongoing basis, the person and his or her family can often help to determine whether these agents are useful. If family members see that the person with pain has lost control of his or her life, is less functional, and is more depressed when taking or increasing the dose of opioids than he or she was before, they should seek help.

Most research suggests that family members over-report their loved one's pain, but they also may be the only ones who can accurately determine whether the person's life, mood, function, attitude, and comfort have changed for the better or worse. The person taking the medication may be so aware of the discomfort produced when they miss doses of pills that they incorrectly conclude that they need the medication. This severe pain may in fact only represent withdrawal due to physical dependence, as opposed to a persistent need for analgesic therapy.

ACPA offers a three-part video series focused on the many challenges that family members experience when living with a person with pain. View at https://www.theacpa.org/pain-management-tools/videos/support/.

Opioid Treatment Agreement

Individuals with pain have an important responsibility with respect to opioids to ensure that both they, as well as others, will be able to have access to opioids in the future. When opioids are prescribed, people with pain are usually requested to formally communicate their agreement with the written therapeutic plan (a.k.a., Opioid Treatment Agreement---sometimes termed an Opioid Contract or Opioid Therapy Plan), and in particular, their understanding that the goal of opioid

Copyright 2019

therapy is not the elimination of pain but rather its reduction to the point where measurable and meaningful increases in function are apparent. This would also include agreeing that they will obtain opioids only from one pharmacy and one medical provider, abstain from using other sedatives without express permission from the health care professional prescribing the opioids, and not engage in activities that would be interpreted as representing misuse or diversion of their medication. The health care professional should clarify what activities would be interpreted as such to ensure a common understanding.

However, violation of an opioid treatment agreement should not be a "zero tolerance policy" where the first violation results in dismissal from care. Instead, it should be the start of a conversation as to why the violation occurred and to offer some counseling. Repeat offenders need to be dealt with – if there are no penalties then it's a useless tool – but if the violation is treated as an immediate disqualification that does not help the patient.

The majority of persons who abuse opioids obtain the drug from friends or family members, often without the knowledge of the person for whom the medication is prescribed. This use of opioids, or sold or purchased illicitly, is unacceptable and would constitute misuse and abuse that would void the opioid treatment agreement and results in discontinuation of prescribed opioids. Further, it is important to take the opioid exactly as prescribed by the health care professional with respect to dose and to timing between doses and talk with the health care professional if a change in the prescription is thought to be needed.

The discussion of safe storage and disposal not only helps to prevent theft and subsequent abuse but also prevents accidental overdose by children, cognitively impaired family members, and pets. Patients should always be aware of how many refills and how many pills remain in their prescription. The goal of the agreement is to ensure that patients and caregivers have clear communication and safe, effective procedures when opioids are used.

A sample Opioid Treatment Agreement Can Be Found at
http://www.acoem.org/uploadedFiles/Public_Affairs/Policies_And_Position_Statements/Guidelines/Library_and_Reference_Material/OPIOID%20TREATMENT%20-%20Reed%20Group%20Guidelines.pdf

An opioid treatment agreement may include random urine drug testing.

Urine Drug Tests (UDT)/Urine Drug Screening (UDS)

Urine drug testing (UDT) or urine drug screening (UDS) is often ordered by the health care professional prior to starting opioids and at random intervals during treatment. UDT is used to check that the medications prescribed are being taken and that non-prescribed and/or illicit drugs are not used. Typically, urine tests include screening for prescription opioids, benzodiazepines, cocaine, heroin, amphetamines, and marijuana.

The first level of drug testing is screening in the doctor's office or in a laboratory using a technique called immunoassay. Immunoassays have three important limitations. First, there is a limit to the number and types of drugs that can be detected. Second, there are specificity limitations because, in the case of amphetamines, barbiturates, benzodiazepines, and opiates, the tests are class-specific rather than drug-specific. The final limitation of drug screening methods is sensitivity.

Copyright 2019

If the screening is positive, the urine is then confirmatory tested under either liquid chromatography (LC) or gas chromatography-mass spectrometry (GC-MS) technology.

Naloxone for Opioid Reversal in Case of Overdose

Opioid overdose is typically reversible through the timely administration of the medication naloxone and the provision of other emergency care. However, access to naloxone and other emergency treatment was historically limited by laws and regulations. In an attempt to reverse the unprecedented increase in preventable overdose deaths, the majority of states have amended those laws to increase access to emergency care and treatment for opioid overdose with naloxone.

In April 2018, the US Surgeon General urged more Americans to individually carry naloxone and be prepared to administer the medication in efforts to prevent future opioid overdoses.[3]

Naloxone may be administered by medical personnel as an injection, by anyone with the Evzio® naloxone auto-injector or Narcan® nasal spray, or as an improvised off-label nasal spray thatmust be assembled from components at the time of use. See the ACPA video: ACPA – Overdose – Aware and Prepared with Naloxone https://naloxone-be-prepared/.

It is now recommended that people who are being prescribed opioids should also be co-prescribed Naloxone to have on hand in case of emergency. Consult with your prescriber about having naloxone available to you in the event of possible accidental overdose and make sure your family and friends are aware of its potential life-saving effect.

For more information about Naloxone, go to https://www.networkforphl.org/_asset/qz5pvn/network-naloxone.pdf); http://stopoverdose.org/ and https://www.projectlazarus.org/naloxone.

[3] Surgeon General's Advisory on Naloxone and Opioid Overdose at https://www.surgeongeneral.gov/priorities/opioid-overdose-prevention/naloxone-advisory.html

Copyright 2019

Herbal Medicines, Supplements & Vitamins

Herbal supplements come from plants and claim to have medicinal properties that can improve health or aid in managing various medical conditions. They may claim that they can cure, treat, or prevent disease but according to FDA regulations, claims for supplements can only reference supporting healthy function of the body and not management of disease states.

Nutraceuticals are nutrient products such as fish oils and megavitamins.

Even though these products may be billed as "natural" on the label, this does not ensure their efficacy, purity, or safety. Manufacturers of dietary supplements can market their products without receiving approval from the FDA. However, the FDA can remove products from the market if they have been proven to pose serious or unreasonable risk to consumers.

Prior to taking supplements or herbal preparations, it is advisable to discuss with your health care provider to determine potential benefit and any risk of drug interactions with other medications.

While there may be proven health benefits for some herbal and nutraceutical products, potentially harmful effects exist for others. Dietary supplements are not standardized, unlike FDA-approved prescription medications. The same ingredients can be found in different products in varying amounts and this can lead to toxic levels that may cause harmful reactions in the body. Herbal remedies and medicinal agents undergo little oversight of safety, efficacy, sterility of production, bio-equivalency, or stability of product life.

Certification symbols, such as a United States Pharmacopeia (USP) symbol, verifies that the product contains the ingredients in stated amounts and strength, is pure, meets limits for contaminants, and disintegrates quickly. The NSF International verifies products for content and label accuracy, purity, contaminants, and manufacturing processes. ConsumerLab.com independently tests supplements for purity and active ingredients.

Possible Benefit of Herbal Supplements for Pain

There are some herbal remedies for which there is some evidence with regards to the management of acute low back pain and osteoarthritis. White willow bark (Salix) extract has been studied in low back pain. A principal ingredient is salicin with salicylic acid as the principal metabolite. This is similar to ingredients in aspirin.

Extract of *Harpagophytum procumbens* (devil's claw root) has been used in Europe to manage musculoskeletal symptoms with some evidence that it may relieve acute low back pain, acute episodes of chronic low back pain, and osteoarthritis. Mild gastrointestinal upset has been reported at higher doses.

There is some evidence that the antioxidant alpha lipoic acid (ALA) significantly and rapidly reduces the frequency and severity of symptoms of the most common kind of diabetic neuropathy. Symptoms decreased include burning and sharply cutting pain, prickling sensations, and numbness. Unfortunately, studies in people with neuropathy due to cancer chemotherapy revealed no benefit.

Copyright 2019

There is also evidence that acetyl-L-carnitine (ALC) not only improves the symptoms of diabetic neuropathy, but also helps regenerate nerve fibers and vibration perception. Unfortunately, studies in people with neuropathy due to cancer chemotherapy revealed no benefit and may have caused worsened neuropathy.

Recently, much attention has been given to glucosamine and chondroitin sulfate. Early research suggested that glucosamine and chondroitin sulfate were effective in improving pain and decreasing functional impairment from symptomatic osteoarthritis. The more recent Glucosamine/Chondroitin Arthritis Intervention Trial (GAIT) implied that glucosamine and chondroitin sulfate did not reduce pain in individuals with knee osteoarthritis, although a small select group of patients with moderate-to-severe osteoarthritis may benefit from treatment. When using glucosamine and chondroitin sulfate, the recommended daily dose is 1500 mg per day. Currently, a majority of studies do not show medical benefit with this supplement. Glucosamine may also worsen insulin resistance.

Coenzyme Q10, or CoQ10 as it is often called, is commonly taken in supplement form to counteract the muscle pain and weakness associated with cholesterol-lowering statin drugs. Whether it is truly beneficial for this purpose is the subject of current studies.

Low levels of Vitamin D are associated with chronic pain in general and with reduced immunity. Low levels of Vitamin B are thought to affect neuropathic pain. Pain may be reduced by optimizing vitamin levels. Vitamin B and D levels can be checked to decide if supplementation is indicated.

Corydalis Yanhusuo (Chinese poppy plant) has been used for centuries in China to treat different types of pain. Some of its components were found to attach to opioid receptors. There is some evidence that it may be beneficial in treatment of low-grade chronic pain.

Curcumin, a compound found in turmeric and ginger roots and spices, is a potent antioxidant. Multiple studies have provided evidence that it is also works as an anti-inflammatory agent.

Many other herbal extracts have been used worldwide for treatment of pain and have anecdotal or low evidence of their effectiveness. Even less is known about their safety alone or in combination with conventional medications.

American Botanical Council website: http://abc.herbalgram.org provides a wealth of information to help in making informed decisions on use of medicinal plants.

Consumer Lab is an independent laboratory that tests the quality of nutritional supplements and posts its results at www.consumerlab.com. It is a third-party verification group that provides certification for nutritional products and supplements that meet its quality standards.

Copyright 2019

WebMD has an article, Can Supplements Help With Pain? At http://www.webmd.com/a-to-z-guides/prevention-15/vitamins/chronic-pain-relief?page=1 and a Vitamins & Supplements search at http://www.webmd.com/vitamins-supplements/condition-1452-Pain.aspx?query.

Cautions regarding the Use of Herbal Preparations, Supplements & Vitamins

All of these OTC products have the potential for toxic side effects and cross reactivity with each other and with prescription medications. Unexpected toxicity or drug interaction from any product or medication may occur due to many variables such as age, gender, nutritional status, other illnesses, and surgery.

Many adverse events from herbal medicines have been reported including hypersensitivity reactions, anaphylaxis (shock), hepatitis, nausea, vomiting, diarrhea, platelet inhibition, lower seizure threshold, elevated digoxin levels, central nervous system depression, skin sensitivity to light, chest pain, electrolyte alterations, low blood pressure, irregular heartbeat, kidney failure, carcinogenicity (may cause cancer), and autoimmune (disease caused by antibodies or lymphocytes produced against substances naturally present in the body) effects. Herbal medicines can affect the ability of blood to clot. Therefore, information on current use of herbal medicines should be provided to the health care professional prior to undergoing any surgery or interventional pain procedure.

The American Society of Anesthesiologists recommends that individuals discontinue or taper off herbal products and nutraceuticals at least two weeks prior to surgery. It is important to carry a list of all medications, including herbals, supplements and vitamins, in your wallet and to consider sharing this list with family members and other caretakers.

Some of the undesirable effects of a few of the more commonly used herbals are shown below.

Possible Adverse Side Effects of Herbal Preparations	
Aloe vera	Nausea, vomiting, diarrhea.
Astragalus	Autoimmune disease.
Belladonna	Atropine side effects of atropine sulfate include dryness of the mouth, blurred vision, sensitivity to light, lack of sweating, dizziness, nausea, loss of balance, and rapid heartbeat.
Chaparral	Hepatitis.
Ephedra – banned in the US due to serious side effects including death	High blood pressure, irregular heartbeat, nervousness, headaches, trouble falling asleep, or even a heart attack or a stroke.
Ginkgo biloba	Excess bleeding.
St. John's wort	Upset stomach, a tired feeling, dizziness, confusion or dry mouth. A sunburn occurs more easily.
Kava products	Sleepiness, a rash, liver injury including hepatitis, cirrhosis and liver failure, or strange movements of the mouth and tongue or other parts of the body.
Garlic	Increased bleeding risk.

The National Institutes of Health (NIH) National Center for Complementary and Alternative Medicine **(**NCCAM) and the National Library of Medicine (NLM) have partnered to create *CAM on PubMed*, a subset of NLM's PubMed.

Copyright 2019

More information on the National Center for Complementary and Alternative Medicine can be found at http://nccam.nih.gov/.

An article entitled Herbal Remedies: Adverse Effects and Drug Interactions at http://www.aafp.org/afp/990301ap/1239.html and a patient handout (Herbal Health Products--What You Should Know at http://www.aafp.org/afp/990301ap/990301e.html) on the American Academy of Family Physicians website.

Medical Foods

At the most fundamental level, medical foods can be viewed as dietary supplements that are marketed for the management of a specific disease. By law, dietary supplements are not allowed to be labeled for a specific disease. Drugs, on the other hand, can be labeled for a specific disease because the FDA requires that the drug developer conduct clinical trials to show that it is indeed safe and effective for the said disease. Since dietary supplements are not required to be tested for safety and efficacy, they can only be claimed to support body functions. Dietary supplements (and many medical foods) are essentially vitamins, minerals, or plant extracts. They are naturally occurring in substances humans may consume as food. As science evolved and knowledge is accumulated about the roles or function of these vitamins and minerals in the body, the idea that drove the evolution of the dietary supplement industry was to extract relevant vitamins and minerals and consume them as supplements to food.

For example, CoenzymeQ10 (CoQ10) also known as ubiquinol is naturally occurring in certain meats and vegetables. Once it was discovered that CoQ10 is used by the mitochondria to produce energy and that certain organs, notably the heart, contain high concentrations of mitochondria it was purported that providing the body with extra CoQ10 would help the heart to perform better. Therefore, the only claim that manufacturers of CoQ10 can make is that it helps support heart function.

Pursuant to the Nutritional Labeling and Education Act of 1990, a special category of medical food was created and resides midway between dietary supplement and drugs. For all intents and purposes, this new category allowed manufacturers of dietary supplements to market their products as medical foods, which can be claimed to treat a specific disease. Unfortunately, there is still little oversight over this class of products and for that reason, the field of chronic pain management has seen capitalization by certain manufacturers purporting their medical food product for the management of chronic pain. Some common examples of medical foods targeted for pain management are presented in the table below:

Product Name	**Ingredients**	**Targeted Condition**
Metanx®	L-methylfolate, vitamin B6 and B12	Neuropathy
Theramine®	Choline Bitartrate • L-Glutamine • 5-Hydroxytryptophan • L-Serine • L-Arginine • Cinnamon bark • GABA • Grape seed extract • Cocoa • Metabromine.	Pain and inflammation
Limbrel®	Scutellaria Baicalensis extract (baicalin), Acacia catechu extract (catechin) • Zinc (citrated zinc bisglycinate)	Osteoarthritis

Copyright 2019

For these products' role in chronic pain management, it is important to consider:

- Medical foods have not been approved by the FDA as safe and effective for the conditions for which they are marketed.
- Medical foods are not currently recommended by any nationally recognized pain guideline.
- Despite the composition of "natural" ingredients, safety (especially long-term safety) is largely unknown.

Many of these products are marketed in comparison to the current alternative medications for pain. Since the risk of current alternatives is well recognized (e.g., addiction with opioids, gastrointestinal bleeding, cardiac injury with NSAIDs), it may be tempting to gravitate towards these products as safer and possibly as effective or non-inferior alternatives to current pain medications.

In the case that medical foods are trialed for chronic pain, people with pain should be counseled to immediately report signs or symptoms that may be associated with an adverse reaction. In the case that medical foods are used in combination with other prescription pain medication as a part of a regimen of medications including opioids, NSAIDs, and skeletal muscle relaxants, prescribers should assess the therapeutic value (i.e., the individual contribution of the medical food to the overall therapeutic outcome). Essentially, does the addition of the medical food contribute to lower pain scores, better function, or reduction of other drugs?

Copyright 2019

OTHER MEDICATIONS

Antidepressants

One of the most common classes of drugs used to treat chronic pain is the antidepressant group. An antidepressant prescribed for pain treatment does not mean that the pain is psychiatric in origin. Antidepressant drugs have been used for many years to relieve pain.

There has been a longstanding association between depression and chronic pain. Not surprisingly, the chemicals (neurotransmitters, such as serotonin and norepinephrine) in the brain and nervous system that play a key role in depression are also believed to be involved in chronic pain.

Some general considerations regarding antidepressants and pain are listed below.

- They do not work for pain only by relieving depression. In fact, they work as well for non-depressed people with pain as for those with depression.

- They do not work equally well for all types of pain. For example, they tend to be helpful for fibromyalgia, headache, and pain due to nerve damage (e.g., diabetic neuropathy) but generally are less helpful for most acute pain, including musculoskeletal sports-type injuries.

- How well they work has little to do with how effective they are as antidepressants. Some very effective antidepressants have virtually no ability to reduce pain.

How Antidepressants May Help

While most people know that pain signals go up the spinal cord to reach the brain, they may not be aware that there are signals coming down the spinal cord that can increase or reduce pain transmission. By increasing levels of chemicals (norepinephrine and serotonin) at nerve endings, antidepressants appear to strengthen the system that inhibits pain transmission.

The antidepressants that increase norepinephrine seem to have better pain-relieving capabilities than those that increase serotonin. This helps to explain why the selective serotonin reuptake inhibitors (SSRIs), such as fluoxetine (Prozac®) and paroxetine (Paxil®), work well for depression but do not have the same ability to control pain. There are also dual acting antidepressants that reduce the reuptake of serotonin and norepinephrine such as duloxetine (Cymbalta®) - that has shown results in the treatment of neuropathic pain and fibromyalgia.

Some antidepressants may be useful in chronic pain because they effectively reduce anxiety and improve sleep without the risks of habit-forming medications. Some people with chronic pain are depressed and treating the depression may also help reduce the perception of pain. Many people with chronic pain find that antidepressants, along with learning other pain management skills, can help them regain control of their lives and keep their pain under control.

Copyright 2019

Antidepressant Side Effects & Potential Hazards

The most common side effects of antidepressants are drowsiness, constipation, dry mouth, urinary retention, weight gain, and blurred vision. Some people experience nightmares or an increased heart rate. While some people experience minimal side effects, for others the side effects can be as bad as the pain. It is worth noting that different antidepressants have different side effects and tolerance to these side effects can develop with use.

Some cause more sleepiness while some cause less. Although some lower sex drive, desire may actually increase as pain, sleep, and mood improve. Some may lower blood pressure while others raise it. Some increase appetite while others do not. Several may cause dizziness.

If a person's pain is helped by an antidepressant but the side effects are troublesome, it may be useful to change medications. Doing so may allow the benefit to be retained while reducing the undesirable side effects.

Some antidepressant drugs, especially those within the tricyclic group, such as amitriptyline (Elavil®), nortriptyline (Pamelor®), and desipramine (Norpramin®), can be fatal in overdose and should only be available and prescribed in limited supply.

The FDA has issued the following warning regarding antidepressant prescription use:

Suicidality and Antidepressant Drugs

Antidepressants increased the risk compared to placebo of suicidal thinking and behavior (suicidality) in children, adolescents, and young adults in short-term studies of major depressive disorder (MDD) and other psychiatric disorders. Anyone considering the use of an antidepressant in a child, adolescent, or young adult must balance this risk with the clinical need. Short-term studies did not show an increase in the risk of suicidality with antidepressants compared to placebo in adults beyond age 24; there was a reduction in risk with antidepressants compared to placebo in adults aged 65 and older. Depression and certain other psychiatric disorders are themselves associated with increases in the risk of suicide. Patients of all ages who are started on antidepressant therapy should be monitored appropriately and observed closely for clinical worsening, suicidality, or unusual changes in behavior. Families and caregivers should be advised of the need for close observation and communication with the prescriber.

Concomitant Use of Opioids and CNS Depressants

The concomitant use of opioids and other CNS depressants including sedatives, hypnotics, tranquilizers, general anesthetics, phenothiazine, other opioids and alcohol can increase the risk of respiratory depression, profound sedation, coma, or death. Physicians are instructed to monitor patients receiving CNS depressants and opioids for signs of respiratory depression, sedation and hypotension. When combined therapy with any of the above medications is considered, the dose of one or both agents should be reduced.

Copyright 2019

Benefits of Antidepressants in Chronic Pain

The optimal role for antidepressants in chronic pain is still being defined as research progresses. The qualities listed below seem clear, however.

- They do not have the potential to cause stomach inflammation and bleeding, as do the ant-inflammatory drugs. The use of antidepressants (e.g., SSRIs) with NSAIDs should occur with caution secondary to a higher risk of GI bleeding.
- They do not seem to interfere with the body's internal pain fighting mechanisms; in that they probably strengthen them by increasing the effects of chemical messengers, such as norepinephrine and serotonin, in the nervous system.
- Many act as sedatives to promote a good night's sleep. Sleep deprivation is often one of the major obstacles in coping with chronic pain. In fact, with severe sleep deprivation, one cannot cope with much of anything.
- They may help to reduce depression.
- They may help to relieve anxiety and panic attacks.
- They may increase the effect of other pain-relieving drugs or analgesics.
- They are non-addictive medications that can be used in pain control and loss of effect tolerance does not occur after the optimal dose for a given person has been determined.
- They have a record of long-term safety and are among the most widely used drugs in medicine.

There is evidence that antidepressants may work at lower doses and blood levels for chronic pain than are required for depression and they may produce responses sooner than the three to five weeks typical for depression treatment. This is not always true, however, and some people require higher doses for maximum pain relief.

Pain States that May Respond to Antidepressants

Postherpetic neuralgia	Migraine & Tension Headache (for prevention)
Diabetic neuropathy	Chemotherapy-induced peripheral neuropathy
Phantom limb pain	Fibromyalgia
Stump / neuroma pain	Irritable Bowel Syndrome
Central pain (following stroke)	Rheumatoid arthritis
Sympathetic dystrophy (CRPS/RSD)	Neuropathic pain
Chronic musculoskeletal pain	Low back pain with radiculopathy

Copyright 2019

Antidepressants Commonly Use for Chronic Pain

Tricyclic Antidepressants (TCAS)

The first class is the tricyclic antidepressants (TCAs) and includes amitriptyline (Elavil®), doxepin (Sinequan®), imipramine (Tofranil®), desipramine (Norpramin®), nortriptyline (Aventyl®, Pamelor®), protriptyline (Vivactil®), trimipramine (Surmontil®), and clomipramine (Anafranil®). Also included are trazodone (Desyrel®), maprotiline (Ludiomil®), and mirtazapine (Remeron®), which are tetracyclic antidepressants (which are structurally different from TCAs and have different side effects).

The TCAs have been used for many years to treat depression. TCAs and related drugs can be roughly divided into those with additional sedative and relaxing properties and those that are less so. Agitated and anxious patients tend to respond best to antidepressants with sedative properties whereas withdrawn individuals and those with less energy will often obtain the most benefit from less sedating antidepressants. This class of antidepressants has been proven to have pain-relieving effects, typically at lower doses than required to treat depression.

The different tricyclic drugs have varied side effects that may sometimes be used to the patient's advantage. For the overweight patient with lethargy and tiredness, the clinician may choose a TCA with more noradrenergic selectivity (e.g., desipramine), which may be activating and can cause some anorexia. Desipramine is considered to have the lowest side effect profile of the TCAs. For others with poor sleep hygiene, the sedating properties of certain TCAs, such as amitriptyline or doxepin, may be helpful.

Some of these drugs, such as amitriptyline (Elavil®), nortriptyline (Pamelor®), and desipramine (Norpramin®), can be fatal in overdose and should only be available and prescribed in limited supply.

Tricyclic antidepressants (TCAs) can have significant anticholinergic effects, which can include confusion, blurred vision, worsening of glaucoma, constipation, dry mouth, light-headedness, and difficulty with urination or loss of bladder control. In older patients with decreased cognitive abilities, the use of a tricyclic antidepressant can lead to significant confusion. Patients with Alzheimer's disease should not be started on TCAs. The American Geriatrics Society 2015 Updated Beers Criteria for Potentially Inappropriate Medication Use in Older Adults was published in October 2015. They include lists of potentially inappropriate medications to be avoided in older adults. The Internet links is
http://onlinelibrary.wiley.com/doi/10.1111/jgs.13702/full.

Also, patients with cardiovascular disease (CVD) should avoid the use of tricyclic antidepressants or be followed closely by a health care professional for cardiac abnormalities that can worsen with their use. In a study published online in December 2010 in the *European Heart Journal*, the authors assessed the association between antidepressant medication use and future risk for CVD. The study suggested TCAs are associated with a 35 percent increased risk for CVD, which is not explained by existing psychiatric illness.

Patients with narrow angle glaucoma should avoid the use of these medications.

Copyright 2019

They may increase appetite and be associated with weight gain. Go to the following web site for further information about TCA toxicity at http://www.emedicine.com/emerg/topic616.htm.

Selective Serotonin and Norepinephrine Reuptake Inhibitors (SNRIS)

The second class includes a number of drugs that are mixed serotonin and norepinephrine reuptake inhibitors or SNRIs. These medications have no cholinergic inhibition and, thus, they are associated with fewer side effects than TCAs. Blood pressure should be monitored in these patients because SNRIs can increase systolic blood pressure.

Duloxetine (Cymbalta®), venlafaxine (Effexor®), desvenlafaxine (Pristiq®), milnacipran (Savella™), and levomilnacipran (Fetzima®) are the SNRIs that are most commonly encountered in association with pain management.

Duloxetine (Cymbalta®) has been approved for management of painful diabetic peripheral neuropathy, fibromyalgia, anxiety disorder, depression, and in 2010 for chronic musculoskeletal pain including osteoarthritis and chronic low back pain.

Milnacipran (Savella™) has been approved for the management of fibromyalgia. Milnacipran more potently inhibits the reuptake of norepinephrine than duloxetine and venlafaxine.

Venlafaxine (Effexor®) has been shown to have therapeutic benefit in the treatment of neuropathic pain. Venlafaxine is available in an extended-release formulation which has a better tolerability profile than the immediate-release formulation.

Some of the side effects associated with SNRIs can include nausea, vomiting, dizziness, sleepiness, trouble sleeping, abnormal dreams, constipation, sweating, dry mouth, yawning, tremor, gas, anxiety, agitation, abnormal vision such as blurred vision or double vision, headache, and sexual dysfunction. Abrupt withdrawal of SNRIs should be avoided (associated with anxiety, vivid dreams and other symptoms).

SNRIs should be used with caution in patients with epilepsy, history of mania, cardiac disease, diabetes, angle-closure glaucoma, concomitant use of drugs that increase risk of bleeding, history of bleeding disorders (especially GI bleeding), disorders of the liver and kidneys, pregnancy, and breast-feeding.

Selective Serotonin Reuptake Inhibitors (SSRIS)

The third class of drugs, the selective serotonin reuptake inhibitors (SSRIs), includes fluoxetine (Prozac®), sertraline (Zoloft®), paroxetine (Paxil®), fluvoxamine (Luvox®), citalopram (Celexa™), escitalopram (Lexapro®), vilazodone (Viibryd®), and vortioxetine (Brintellix®).

Copyright 2019

The SSRIs have fewer side effects and are less sedating than the tricyclic antidepressants. They are effective antidepressants and can be used for headache prevention, but they are less effective and of questionable benefit for other types of chronic pain.

SSRIs have been disappointing for neuropathic pain. Most studies of the serotonin-selective type (non-tricyclic) antidepressants have shown little or no pain relief.

Some of the side effects associated with SSRIs include dry mouth, stomach distress with nausea and vomiting, diarrhea, sweating, poor appetite, dizziness, tremors, drowsiness, anxiety, nervousness, insomnia, headache, increased blood pressure, increased heart rate, increased cholesterol levels, and sexual problems. Abnormal bleeding can occur especially in individuals currently using an NSAID.

SSRIs should be used with caution in patients with epilepsy, history of mania, cardiac disease, diabetes, angle-closure glaucoma, concomitant use of drugs that increase risk of bleeding, history of bleeding disorders (especially GI bleeding), disorders of the liver and kidneys, pregnancy, and breast-feeding.

Norepinephrine Dopamine Reuptake Inhibitors (NDRIS)

A fourth class of antidepressants includes a number of drugs that are norepinephrine-dopamine reuptake inhibitors or NDRIs. They are primarily used in the treatment of depression but are also prescribed for smoking cessation and for the treatment of attention deficit disorder. They are not particularly useful for chronic pain.

The only NDRI that is approved by the Food and Drug Administration for the treatment of depression is bupropion (Wellbutrin®).

Although marketed for different indications, Wellbutrin® (depressant) and Zyban® (smoking cessation) contain the same active ingredient and therefore, should not be taken concurrently without close health care professional supervision.

Other Antidepressants

Trazodone (Desyrel®) was developed for the treatment of depression but is much more frequently used today to alleviate insomnia. It is not commonly used for chronic pain. Some of the most common side effects of trazodone are sedation, dry mouth and dizziness. An extremely rare, but dangerous side effects of trazodone is Priapism – a prolonged painful erection. If it occurs, an admission to emergency department is necessary for a treatment with an antidote.

Mirtazapine (Remeron®) can cause sedation, increased appetite, weight gain, increased cholesterol, dizziness, dry mouth, and constipation.

Copyright 2019

The monoamine oxidase inhibitors (MAOIs) are very rarely used now days and generally not used to treat chronic pain. Those such as phenelzine (Nardil®), tranylcypromine (Parnate®), isocarboxazid (Marplan®), Rasagiline (Azilect®), Safinamide (Xadago®) and selegiline (Eldepryl®) commonly cause weakness, dizziness, headaches and tremor. While the last three are used to treat Parkinson's disease, the other MAOIs are used as antidepressants. They also have many drug-drug and drug-food interactions further limiting their use.

Stopping Antidepressants: Antidepressants should not be stopped abruptly. It may cause anxiety, headaches, nausea, dizziness and burning and sensory disturbances including shock-like electrical sensations. Always consult your health care provider before discontinuing an antidepressant.

Alert: Mixing Antimigraine Drugs & Certain Antidepressants may cause Serotonin Syndrome

Serotonin is a brain hormone that keeps mood stable and appetite in check, as well as serving other functions. More than 50 commonly prescribed medicines (including certain anti-migraine medications and certain drugs to treat depression) boost the amount or effect of serotonin in the body. When two or more drugs that affect serotonin levels are taken, they can increase the amount of serotonin and may lead to bothersome or dangerous, even life-threatening, symptoms.

Antidepressant medications include:

- Selective serotonin reuptake inhibitors (SSRIs; including citalopram, escitalopram, fluoxetine, fluvoxamine, paroxetine, and sertraline)
- Serotonin-norepinephrine reuptake inhibitors (SNRIs; including desvenlafaxine, duloxetine, milnacipran, and venlafaxine)
- Dopamine-norepinephrine reuptake inhibitors (including bupropion)
- Serotonin modulators (including nefazodone, trazodone, and vilazodone)
- Tricyclic antidepressants (TCAs; including amitriptyline, amoxapine, clomipramine, desipramine, doxepin, imipramine, maprotiline, nortriptyline, protriptyline, and trimipramine)

Antimigraine agents

- Triptans (including sumatriptan, rizatriptan, and others)
- Ergot derivatives (including ergotamine and methylergonovine)

Other agents (the following list is not exhaustive)

- Non-opioid
    - Tryptophan
    - Amphetamines
    - Levodopa, carbidopa–levodopa
    - Metoclopramide
    - Valproate

Copyright 2019

    - Carbamazepine
    - Dextromethorphan
    - Cyclobenzaprine
    - Monoamine oxidase inhibitors
    - Lithium
- Opioids
    - Cocaine
    - Pentazocine (Talwin®)
    - Tramadol (Ultram®)
    - Meperidine (Demerol®)
    - Fentanyl (Duragesic®)

Serotonin can cause a variety of symptoms — no one gets all the symptoms at once, but anyone with too much serotonin will have at least a few symptoms. These symptoms can include mental changes such as anxiety, confusion, delirium, hallucinations, headaches, insomnia, mania (constant and sometimes senseless activity without rests), or coma; nerve or muscle symptoms such as tremor (shaking), unsteady coordination, muscle jerks, abnormally jumpy reflexes, jerking eye movements or changes in pupil size, restlessness, or seizures; temperature or vital sign control problems which can include sweating or flushing, fevers, hyperventilation, slowed breathing, a change in heart rhythm, or high or abnormally low blood pressure; and digestive symptoms including abdominal pain, nausea, vomiting, or diarrhea.

Copyright 2019

Antiepileptic (Anticonvulsant) Drugs

Antiepileptic medications have been found to be widely effective in various neuropathic pain conditions.

Several drugs that were developed for the prevention of epileptic seizures (convulsions) have been found to help certain pain conditions. For example, carbamazepine (Carbatrol®, Tegretol®) is approved by the FDA for relieving the pain of trigeminal neuralgia. Gabapentin (Neurontin®) is approved for the management of postherpetic neuralgia (PHN: pain that lasts one to three months after shingles has healed). Pregabalin (Lyrica®) is approved for PHN, painful diabetic neuropathic pain, and fibromyalgia. Nevertheless, most use of antiepileptics for pain is "off label". Some anticonvulsants such as valproic acid and topiramate are indicated migraine prevention.

These medications cause central nervous system sedation and should be used cautiously with opioids.

Although these medications have been thought in the past not to be habit forming, new studies have called this point into question. Regardless, abrupt discontinuation can be hazardous. Antiepileptics should be stopped only after discussing how to do so with a health care professional. Common side effects are drowsiness, peripheral edema (lower extremity swelling), and unsteady gait or poor balance. These symptoms tend to diminish over time.

Gabapentin (Neurontin®) is widely utilized and has proven to be effective in many people for nerve injury or neuropathic pain. Decreased mental alertness can occur especially at higher doses, but this is variable and is person specific. Generic gabapentin is available. Gralise®, a once-a-day gabapentin, is indicated for the management of postherpetic neuralgia (PHN). Gralise® is not interchangeable with other gabapentin products because of differing pharmacokinetic profiles that affect the frequency of administration. There is a difference in individual tolerability and experience of adverse effects with each medication.

A similar drug to gabapentin, pregabalin (Lyrica®), has been found to be effective in postherpetic neuralgia, fibromyalgia, diabetic neuropathy and in neuropathic pain associated with spinal cord injury. Its primary advantage over gabapentin is thought to be pregabalin's longer duration of action, allowing a twice daily dosing and improved absorption; however, there is no evidence that this translates to an increased clinical effect. Pregabalin is not associated with significant drug interactions and can be used over a wide dose range (150 to 600 mg/day). Its side effect profile is similar to gabapentin, and it is generally well tolerated. Side effects are mostly mild-to-moderate and transient, with dizziness and somnolence being the most common. Other adverse effects include dry mouth, peripheral edema, blurred vision, weight gain, and concentration or attention difficulties. Often, gabapentin and pregabalin require a period of time before their effectiveness in treating a person with pain is realized because the medications need to be titrated to the appropriate dose.

The FDA issued a warning on the use of antiepileptics and the risks of suicidal thoughts and suicide. Patients utilizing antiepileptics for pain control should be monitored for any signs and

Copyright 2019

symptoms of suicidal thoughts. There have been scattered reports of misuse of gabapentin and pregabalin for their intoxicating effects.

Decreased mental alertness can be magnified when an antidepressant is taken with an opioid and/or benzodiazepine.

The following table lists antiepileptic (anticonvulsant) but gabapentin and pregabalin are the primary drugs in this class prescribed for chronic pain.

ANTIEPILEPTICS POSSIBLY USEFUL IN CHRONIC PAIN	
Gabapentin* (Neurontin®)	Has proven to be effective in some people for nerve injury or neuropathic pain. Some mental fuzziness possible at higher doses.
Pregabalin* (Lyrica®)	Found to be effective in postherpetic neuralgia, diabetic neuropathy, fibromyalgia, and neuropathic pain from spinal cord injury. Some advantages over gabapentin with twice a day dosing. It is generally well tolerated.
Carbamazepine** (Tegretol®)	Interacts with some other drugs, can affect the liver and white blood cells. Used for trigeminal neuralgia.
Valproic acid** (Depakote®)	Used in headache for prevention or nerve pain. May affect platelets as an adverse effect.
Phenytoin** (Dilantin®)	Stronger evidence supports the use of the above agents over phenytoin. The risk of adverse effects and drug interactions also precludes its regular use.
Lamotrigine (Lamictal®)	May be useful for pain refractory to carbamazepine. Used in trigeminal neuralgia and central pain. Not FDA approved and clinically not recommended for neuropathic pain. May cause dizziness, constipation, nausea, decreased mental awareness, etc.
Tiagabine (Gabitril®)	Used in combination with other anticonvulsant agents in the management of partial seizures. Possibly useful in treating neuropathic pain. Most common side effects include nonspecific dizziness, drowsiness, and difficulty with concentration. Has been associated with new onset seizures and status epilepticus in patients without epilepsy.
Lacosamide (Vimpat®)	Lacosamide is an anticonvulsant. It is not typically used for chronic pain.
Topiramate (Topamax®, Topiragen™)	Generally, well tolerated but sometimes causes confusion, dizziness, fatigue, and problems with coordination and concentration. Minimally useful in treating neuropathic and sympathetically maintained pain. It is also being used as a preventive migraine treatment. Side effects include strange sensations and loss of appetite. May cause secondary angle closure glaucoma and, if left untreated, may lead to permanent vision loss. It may also cause dose-related weight loss and cause or predispose the patient to kidney stones.
Levetiracetam (Keppra®)	Indicated for use as adjunctive therapy in the treatment of partial seizures in adults. It is possibly effective in neuropathic pain.
Oxcarbazepine (Trileptal®)	Indicated for the treatment of partial seizures. Possibly useful in treating neuropathic pain. Probably useful for trigeminal neuralgia.

Copyright 2019

Zonisamide (Zonegran®)	Indicated for use as adjunctive therapy for treatment of partial seizures (or *focal seizures*) in adults with epilepsy. Possibly useful in treating neuropathic pain.

*Only gabapentin and pregabalin are approved by the FDA and have solid evidence of efficacy in general neuropathic pain.

**Carbamazepine, Valproic Acid, and Phenytoin can reach toxic level in blood leading to death and may also cause serious damage to liver, pancreas, and blood cells leading to fatalities. Regular safety blood checks are mandated when taking these three medications, including their blood levels, complete blood count, and liver function test.

Sodium Channel Blocking & Oral Antiarrhythmic Agents

Intravenous lidocaine has strong sodium channel blocking properties and has demonstrated efficacy in several uncontrolled studies on neuropathic pain. Some pain centers use intravenous lidocaine both as a diagnostic tool to assess responsiveness to a subsequent oral sodium channel blocker (e.g., mexiletine, oxcarbazepine, and carbamazepine) as well as a therapeutic tool when delivered in an inpatient setting.

Those anti-arrhythmics with local anesthetic properties are rarely used except in refractory or difficult to treat pain. They are approved for the prevention of disturbances in heart rhythm, but just as they interrupt premature firing of heart fibers, they also diminish premature firing of damaged nerves. This leads to less firing of the nerve and hence less capability of the nerve to trigger pain.

Due to safety concerns, the only anti-arrhythmics that are occasionally used for chronic pain are mexiletine (Mexitil®) and rarely flecainide (Tambocor™) due to possible cardiac side effects. They reduce pain in diabetic neuropathy, post stroke pain, complex regional pain syndrome (CRPS), and traumatic nerve injury.

Mexiletine is chemically similar to lidocaine, an anesthetic. Common side effects of mexiletine include dizziness, anxiety, unsteadiness when walking, heartburn, nausea, and vomiting. Consult a health care professional if pregnant or planning to get pregnant, have a history of heart attack, are a smoker, or take any of the following medications: amiodarone, fluvoxamine, dofetilide (Tikosyn®), bupropion, or sodium bicarbonate. Mexiletine should be taken three times daily with food to lessen stomach irritation. Infrequent adverse reactions include sore throat, fever, mouth sores, blurred vision, confusion, constipation, diarrhea, headache, and numbness or tingling in the hands and feet. Serious symptoms occur with overdose including seizures, convulsions, chest pain, shortness of breath, irregular or fast heartbeat, and cardiac arrest.

Flecainide (Tambocor™) was approved to treat arrhythmias and can slow a fast heart rate. It has also been effective for treating certain painful conditions related to neuropathic pain. Although cardiac side effects with flecainide may be infrequent, they can be catastrophic. An EKG is recommended before treatment is started. This drug should probably not be used for pain management in patients with a history of cardiovascular or heart disease. The health care professional should be made aware of any kidney or liver problems because this may require

Copyright 2019

monitoring of drug levels or a dosage reduction. Flecainide interacts with amiodarone, several antipsychotic and anti-arrhythmic medications, and ranolazine (Ranexa®). Common side effects, which usually occur within the first two to four weeks of therapy, are nausea or vomiting, constipation, headache, dizziness, visual disturbances, edema, and tremor.

Topical Pain Relievers

Creams, gels, sprays, liquids, patches, or rubs applied on the skin over a painful muscle or joint are called *topical pain relievers* or *topical analgesics*. Topical agents have also gained popularity for use in certain neuropathic pain conditions such as diabetic neuropathy, postherpetic neuralgia (PHN), or neuroma pain. They are also prescribed in CRPS states. Many are available over-the-counter without a prescription. They are not particularly effective for deep neuropathic pain or radicular pain.

Topical agents should be distinguished from transdermal medications, which are also applied directly to the skin. Whereas topical agents work locally and must be applied directly over the painful area, transdermal drugs have effects throughout the body and work when applied away from the area of pain (currently available transdermal drugs include fentanyl, buprenorphine, and clonidine; topical drugs include diclofenac and lidocaine with or without tetracaine and prilocaine). Transdermal medication in a patch is absorbed through the skin by the bloodstream over a period of time.

These products should not be applied on wounds, damaged skin, or the face. Lastly, after application, hands should be washed thoroughly to avoid getting these products in sensitive areas such as the eyes.

Salicylates

Some of the OTC topical agents contain salicylates, a family of drugs that reduce inflammation and pain. They come from the bark of the willow tree and are the pain-relieving substances found in aspirin. Small amounts relieve mild pain. Larger amounts may reduce both pain and inflammation. Salicylates decrease the ability of the nerve endings in the skin to sense pain. Large amounts can be absorbed and lead to similar adverse effects as when given orally. The use of topical medications, which include salicylates or aspirin, should not be used for more than 7 days. Salicylates can be absorbed into the blood stream and cause metabolic acidosis.

Counterirritants

Counterirritants (including salicylates), another group of topical agents, are specifically approved for the topical treatment of minor aches and pains of muscles and joints (simple backache, arthritis pain, strains, bruises, and sprains). They stimulate nerve endings in the skin to cause feelings of cold, warmth, or itching. This produces a paradoxical pain-relieving effect by producing less

Copyright 2019

severe pain to counter a more intense one. Some topical pain relievers (counterirritants) are methyl salicylate, menthol, camphor, eucalyptus oil, turpentine oil, histamine dihydrochloride, and methyl nicotinate.

Menthol counterirritants come in various forms such as balms, creams, gels, and patches under several brands such as BenGay®, Icy Hot®, Salonpas®, and Thera-Gesic® for ease of application. The balms, creams, and gels can be applied to the painful area(s) three to four times a day (usually for up to one week). When using the BenGay® patch product, one patch can be applied for up to 8 to 12 hours; if pain is still present, a second patch may be applied for up to 8 to 12 hours (maximum: two patches in 24 hours for no longer than three days of consecutive use). The Salonpas® Pain Relief Patch® (10% methyl salicylate and 3% menthol) is currently the only FDA-approved OTC topical analgesic patch and can be applied up to three to four times/day for seven days; the patch may remain in place for up to 8 hours. It is approved for temporary relief of mild-to-moderate aches and pains of muscles and joints associated with strains, sprains, simple backache, arthritis, and bruises.

Topical prescription NSAIDS still carry some risk of adverse effects (mostly skin irritation). Topical products containing NSAIDs (e.g., diclofenac) are promoted as carrying less risk of side effects versus the oral NSAIDs (e.g., ibuprofen), but they still must be considered. The FDA warning regarding NSAIDs applies to both oral and topical medications – this would constitute duplicative therapy. Also, these products should not be applied on wounds, damaged skin, or the face. Lastly, after application, hands should be washed thoroughly to avoid getting these products in sensitive areas such as the eyes. When removing and discarding used patches, fold the used patches so that the adhesive side sticks to itself. Safely discard used patches where children and pets cannot get to them.

Prescription NSAID topicals are not recommended on larger “joints” of the body such as the back.

Capsaicin (cap-SAY-sin) is the active ingredient in hot peppers, which produces a characteristic heat sensation when applied to the skin (dermal drug delivery). Several studies have suggested that capsaicin can be an effective analgesic in at least some types of neuropathic pain and arthritic conditions (osteoarthritis and rheumatoid arthritis). An adequate trial of capsaicin usually requires four applications daily, around the clock, for at least three to four weeks. Some individuals may experience a burning sensation, which usually lessens within 72 hours with repeated use. Gloves should be worn during application and hands should be washed with soap and water after application to avoid contact with the eyes or mucous membranes.

Copyright 2019

Other Agents & Local Anesthetics

Aspirin in chloroform or diethyl ether, capsaicin (Zostrix®, Zostrix®-HP, Qutenza™), EMLA® (eutectic mixture of local anesthetics; contains lidocaine and prilocaine) cream, and local anesthetics such as the lidocaine patch 5% (Lidoderm®) are topical treatments for neuropathic pain. Of these, the topical lidocaine patch 5% and capsaicin patch are the only FDA-approved treatments for neuropathic pain, and they require a prescription.

Topical anesthetics, such as EMLA® (Eutectic Mixture of Local Anesthetic; contains lidocaine and prilocaine) cream and L.M.X.4® (contains lidocaine 4%), are used primarily prior to painful procedures such as blood draws, lumbar puncture (spinal tap), and wart removal. EMLA® cream may be effective in the treatment of postherpetic neuralgia, ischemic (decreased blood supply) neuropathy, and a variety of other neuropathic conditions.

EMLA® cream is a combination of the local anesthetics lidocaine and prilocaine. This combination results in a relatively constant release of dissolvable local anesthetics that can diffuse through the skin and soft tissue. A thick layer of EMLA® cream is applied to intact skin and covered with an occlusive dressing. The minimal application time to obtain reliable superficial pain relief is one hour. However, the cream may be left on the skin for up to two hours, depending on the degree of the procedure performed. Pain relief can be expected to increase for up to three hours under occlusive dressing and persist for one to two hours after removal of the cream. Side effects to EMLA® cream include skin blanching, redness, and swelling. In younger individuals or in cases in which too much has been applied, negative effects can occur to hemoglobin (red blood cells). Therefore, EMLA® cream should be avoided in individuals less than one month old and in patients with a predisposition to methemoglobinemia (a problem with the red cell). EMLA® cream should also not be applied to broken skin or mucous membranes (e.g., mouth). EMLA® requires a prescription in the U.S.

L.M.X.4® contains 4% lidocaine and is available without a prescription. It has a shorter application time (30 minutes) and a shorter duration of action (30 minutes) than EMLA. It has not been shown to be effective for chronic pain most likely because of its short duration. L.M.X.4® is available OTC in the U.S.

Lidoderm® 5% (lidocaine) patches can be cut to fit over the area of pain. The 5% lidocaine patch is FDA approved for the treatment of a neuropathic pain condition, specifically PHN, and requires a prescription. It measures 10 cm x 14 cm and has a clear plastic backing that must be removed before application of the patch to the skin. The manufacturer states that up to three patches can be applied simultaneously to intact skin for up to 12 hours in any 24-hour period. Generic lidocaine is available in multiple forms (e.g., patch, gel, ointment) and can be less expensive.

Side effects of topical local anesthetics are usually minimal and include localized skin irritation and swelling that generally disappear within two to three hours after the local anesthetic is removed from the skin. As a rule, blood concentrations of topical local anesthetics are well below toxic levels.

Copyright 2019

Potential hazards still exist, however. In 2007, the FDA issued a public health advisory to notify consumers and health care professionals of potential life-threatening side effects associated with the use of topical anesthetics, particularly before cosmetic procedures. At risk are consumers, especially those without the supervision of a health care professional. Issues may arise particularly if the consumer applies large amounts of anesthetics or cover large areas of the skin, leaves these products on for long periods of time, or uses materials, wraps, or dressings to cover the skin after anesthetic application. Application to areas of skin irritation, rash, or broken skin may also increase the risk of systemic absorption. The FDA recommends that if topical anesthetics are needed prior to medical or cosmetic procedures, consumers ask their health care professional for instructions on the safe use of these products, use only FDA-approved products, and use products with the lowest amount of anesthetic while applying the least amount possible to relieve pain.

American Chronic Pain Association
Copyright 2019

Compounded Medications

There are additional topical agent combinations, which can be compounded at a local pharmacy. They can be very expensive. These compounded mixtures are prepared uniquely for each individual but have not passed rigorous scientific study. Any benefit from such compounded creams is anecdotal.

Use of these compounded mixtures is controversial and most insurance companies will not pay for these medications. This topic is included here for educational purposes as some physicians prescribe compounded topical agents.

Compounded medications are not commercially available; rather, they are prescribed by a health care professional and prepared by a pharmacist to meet an individual's unique needs. These compounded medications do not go through the same FDA approval process that is required for commercially available prescription drugs. Therefore, trials may or may not be conducted to determine safety and efficacy. Such studies are not a legal requirement for compounded medications.

The most common compounded TOPICAL medications for pain are topical gels, creams and ointments. They typically contain ingredients such as lidocaine, amitriptyline, ibuprofen, gabapentin, and/or ketoprofen. Opioids, such as morphine, are also compounded for topical administration. The benefit to this type of delivery system is that medication is localized to the area of pain. Lidocaine 5% in PLO gel has been shown in studies to be effective in relieving pain with a minimal enough amount of systemic absorption to alleviate fears of approaching toxic levels.

Topical medications, such as the combination of ketamine (a dissociative anesthetic agent with abuse potential) and amitriptyline (a tricyclic antidepressant), have been proposed as an alternative treatment for neuropathic disorders including complex regional pain syndrome (CRPS). These types of topical medications, in general, are so far unproven. There is one study of topical baclofen, amitriptyline, and ketamine that was shown to be effective in relieving chemotherapy induced peripheral neuropathy. The study has been repeated with mixed results but suggesting more effective treatment for the hands than the feet. To justify continued use of these agents beyond the initial prescription, there should be documentation of effectiveness, including functional improvement, and/or decreased use of other pain medications.

Other compounded agents include those injected into the epidural and spinal canal. An outbreak of meningitis in 2012, secondary to epidural steroids that were compounded, produced much more scrutiny of compounding pharmacies and their quality standards by the FDA and state boards of pharmacy.

Many intraspinal or intrathecal (injection into the sheath surrounding the spinal cord) analgesics need to be compounded for improved pain relief and delivered via intraspinal drug delivery systems or pumps. The best recommendation is to work with a compounding pharmacy that has a history of quality care and can answer questions about stability and sterility of their compounding techniques. Many states now regulate and oversee compounding pharmacies under the state's

Copyright 2019

Board of Pharmacy, thus, compounding pharmacies with active licenses in good standing should be sought out. License standing may be available by searching on the state's Board of Pharmacy website. Prior to using a compounded medication, it is important to know the clear risk vs. benefit and understand whether a commercially available medication might be appropriate.

Medications & Sleep Hygiene

Chronic sleep problems, also known as insomnia, are a significant problem in society and almost a universal issue for persons with persistent or chronic pain. People who have chronic sleep problems may be getting substantially less sleep than is needed for good health.

Sleep problems can be called "chronic" when they last more than three weeks, and these can last for months or years. These sleep disturbances are more serious; sorting them out and restoring good sleep may require the help of a health care professional.

Insomnia is not a disease, but a symptom of a problem; one of which includes pain. Insomnia can be a side effect of many medications. Alcohol and drug abuse or addiction can also interfere with sleep. According to national statistics, at least one half of all instances of insomnia are caused by psychological problems. Waking up too early is common for people who are depressed. Difficulty falling asleep is often caused by anxiety.

Pain is worsened by both the physical and emotional consequences of lack of restful sleep.

When people are deprived of the restful sleep they need:

- They become fatigued and less alert and attentive.
- They are more inclined to irritability and other mood problems that can make relationships with family, friends, and co-workers difficult.
- Their cognitive ability, concentration, and judgment suffer.
- Their ability to perform even simple tasks declines and productivity is sabotaged.
- They can make mistakes resulting in reduced productivity at home and on the job and increasing the opportunity for human error and fatigue-related accidents.

Scientific studies have confirmed that practicing good sleep hygiene is as effective as or more effective than medication treatment in improving the quality and quantity of sleep. It is common for people with persistent pain to believe that they sleep poorly because of pain, which may be true; however, studies demonstrate that it often happens the other way – poor sleep increases pain.

The costs of poor sleep are significant. In addition to the general lack of feeling refreshed both physically and emotionally, there are other consequences of sleep deprivation such as increase in cardiovascular risk. The negative health and economic consequences of poor-quality sleep and sleep deprivation are significant.

Some medications prescribed for chronic pain may disrupt the normal sleep cycle and some may be activating and make quality sleep difficult. Substances, including caffeine, theophylline, and

Copyright 2019

other stimulants, steroids, and some anti-hypertensive and antidepressant medication can precipitate insomnia.

People who snore or have sleep apnea (a condition in which the flow of air into the lungs is repeatedly blocked during the night resulting in periods when they stop breathing while asleep) are likely to have fitful, low-quality sleep often leading to daytime drowsiness. They half-waken several times a night and wake up unrefreshed. Increased weight and obesity are often associated with chronic pain, probably because of decreased activity, the use of certain medications and even depression that can lead to poor dietary habits. Obesity can cause or worsen sleep apnea and people with chronic pain have a tendency to gain weight due to decreased activity. People with sleep apnea may be at increased risk of respiratory depression when sedatives or opioids are used. These medications should be carefully supervised by medical personnel when used in the presence of sleep apnea.

Here are some sleep hygiene tips:

- Limit consumption of caffeine after early afternoon as well as nicotine and alcohol before sleep.
- Avoid late-afternoon naps (any time after 1 or 2 pm), especially greater than 30 minutes.
- Use the bedroom only for sleep-related activities (or sex!).
- Restrict time in bed to sleep hours.
- Limit strenuous exercise before sleep.
- Turn off electronic devices (phones, tablets, computers) while preparing for bedtime - keep these items out of the bedroom.
- Avoid watching action or violence on TV before bed.
- Develop a bedtime routine–have a regular bedtime and wake time every day.
- Develop a meditation and relaxation therapy program before bed as this can reduce physiologic arousal and promote sleep onset.
- Warm milk or mild tea (herbal or decaffeinated) can be soothing.
- Light can be blocked with an eye mask.
- Resolve emotional distress issues whenever possible before going to sleep.
- Decrease bedroom temperature.
- Use a white noise machine.
- Make sure the bed frame and mattress are adequate.
- In general, avoid naps during the day if they are interfering with getting to sleep at night. If a nap is essential, plan this in the late morning or early afternoon.

The NIH has created a brochure, your Guide to Healthy Sleep at http://www.nhlbi.nih.gov/files/docs/public/sleep/healthy_sleep.pdf.

Information on sleep can be found at http://www.cci.health.wa.gov.au/docs/Info-sleep%20hygiene.pdf and http://www.mayoclinic.org/healthy-living/adult-health/in-depth/sleep/art-20048379.

Copyright 2019

Hypnotics (sometimes called sedatives) for Insomnia

Sleep disturbances occur in 50–88 percent of patients experiencing chronic pain. Getting a good night's sleep is critical to the individual with chronic pain and often is hard to obtain. A restful night's sleep provides a number of benefits, including a sanctuary for the pain exhausted brain, extended time for muscle relaxation, and a release of the growth hormone which is necessary for healing damaged tissues of the body and is only released during deep phase of sleep. Not only duration of sleep, but its architecture (going through different phases of sleep throughout the night) is important for overall functioning of the body and reduction of pain. Not only does pain lead to sleep disturbances, though, but disturbed sleep has also been shown to increase pain over both short- and long-term intervals. Additionally, sleep deprivation has been shown to cause enhanced pain sensitivity in healthy individuals, again suggesting a reciprocal relationship between insomnia and pain disorders.

Cognitive behavior therapy (CBT) is recommended for first-line treatment of chronic insomnia. The use of medications (pharmacological therapy) is a reasonable consideration in those who do not respond to CBT.

Various medications may improve sleep. While sleeping pills are commonly prescribed for people with chronic pain, pain specialists rarely, if ever, recommend them for long-term use. Some can be habit-forming and may impair function and memory more than opioid pain relievers. **When combined with opioids, the incidence of adverse-effects, including fatal ones can increase.**

Benzodiazepines: Limitations and dangers of benzodiazepines were discussed above. Medications in this class of sedatives are not recommended as first-line or long-term treatments for chronic insomnia due to their many adverse side effects, including daytime somnolence, cognition and memory impairment, increased risk of falling, respiratory suppression, damaging sleep-architecture, high addiction potentiality, rebound insomnia, and anxiety. All medications in this class are schedule-IV controlled substances. They are, however, useful as short-term insomnia treatments (7-10 days) and include: estazolam (Prosom®), flurazepam (Dalmane®), triazolam (Halcion®) and temazepam (Restoril®). Other benzodiazepines commonly used as off-label medications in treating insomnia include lorazepam (Ativan®), clonazepam (Klonopin®), alprazolam (Xanax®), diazepam (Valium®), and oxazepam (Serax®). The use of these medications in treating insomnia is controversial, and there is no conclusive evidence supporting their use in this context.

Diphenhydramine (Benadryl®): Diphenhydramine is not FDA-approved for treatment of insomnia. Its efficacy is controversial; however, in low doses it is widely used and prescribed as an over-the-counter and prescription sleep aide. Adverse side effects include: sedation, dizziness, constipation, nausea, dry mouth, blurred vision, and weight gain. It may have serious side effects including: urine retention, cardiac arrhythmia, confusion, and bowel obstruction. These side effects can be particularly dangerous in older adults.

Zolpidem (Ambien®) and Zolpidem CR (controlled release): The difference between these two medications lies primarily in their half-lives. They were two of the most commonly prescribed insomnia medications during the first decade of the present century, yet newer hypnotics have

Copyright 2019

since been shown to have better safety profiles, making the latter more popular as insomnia treatments of late, but should be avoided for the same reasons as benzodiazepines. Adverse side effects include somnolence, dizziness, ataxia, amnesia, complex sleep-related behavior (such as sleep walking, sleep cooking/eating, sleep driving), and rebound insomnia.

Zaleplon (Sonata®): Although zaleplon was proven effective and safe for treating insomnia, its use among clinical practices has been limited, primarily because of its ultrashort half-life and should be avoided for the same reasons as benzodiazepines. Adverse side effects include: somnolence, dizziness, ataxia, and amnesia.

Eszopiclone (Lunesta®): Eszopiclone is the best-documented agent in terms of safety for long-term use and has little or no suggestion of increased tolerance, dependence, or abuse. This medication should be avoided for the same reasons as benzodiazepines. Adverse side effects may include: somnolence, amnesia, ataxia, dizziness, and dry mouth and unpleasant taste in mouth.

Melatonin is effective at inducing sleep onset, rather than sleep maintenance. In the USA, melatonin is only available as an over-the-counter supplement and is not approved by the FDA for use in treating insomnia. Moreover, its dosage is not always reliable. Nevertheless, it is widely used and often preferred as a first-line treatment for insomnia due to its low side-effect profile. Common side effects include daytime sleepiness and dizziness.

Ramelteon (Rozerem®): Ramelteon is effective at inducing sleep onset, rather than sleep maintenance. Short-term ramelteon use is associated with improved sleep parameters in patients with insomnia, but its clinical impact is deemed small. That said, as it has a relatively low side-effect profile, ramelteon is often preferred over other hypnotics. Adverse side effects include: somnolence, dizziness, and fatigue.

Suvorexant (Belsomra®): It is FDA approved for treating sleep-onset and -maintenance insomnia. Suvorexant does not induce sleepiness but decreases wakefulness. It remains a schedule-IV federally controlled substance and some concerns about abuse potential has been raised. Adverse effects include: somnolence, confusion, complex sleep-related behaviors, and abnormal dreams.

Sedating Antidepressants

Tricyclic Antidepressants: This class of medications was discussed in an earlier section as pain relievers. In addition, in low doses, tricyclic antidepressants have been used as sleep aids for many years.

Doxepin (Silenor®): In low doses, doxepin is the first and only FDA-approved insomnia medication in its class and it is not a controlled substance. While high doses of doxepin can be dangerous, low doses appear to be safe and have proven effective at inducing sleep with few side effects. Adverse side effects include: somnolence and nausea. Doxepin may be preferred over other sleep aids due to its very low side-effect profile and is especially helpful in treating geriatric patients for whom it is the only approved insomnia medication.

Copyright 2019

Mirtazapine (Remeron®): Mirtazapine is an antidepressant with strong sedating properties, especially in lower doses. It is non-addictive and promotes restoring of sleep architecture. Adverse side effects include: somnolence, increased appetite and weight gain, abnormal dreams, dizziness, dry mouth, constipation, and seizures (rare).

Trazodone (Desyrel®): It is a potent hypnotic and is extensively used among clinical practices in treating insomnia despite its lack of approval from the FDA for use as a sleep medication. As with all antidepressants, it has no addiction potential and restores sleep architecture well. Adverse side effects include: somnolence, dry mouth, orthostatic drop in blood pressure causing dizziness, blurred vision, constipation, priapism (rare), and seizures (rare).

Sedating Antipsychotics

In general, sedating antipsychotics are not recommended for sleep by most guidelines. The FDA Blackbox warning states: 1) increased mortality in elderly patients with dementia-related psychosis and 2) suicidal thoughts and behavior. Warnings: CV events including stroke, neuroleptic malignant syndrome, metabolic changes including hyperglycemia and diabetes, dyslipidemia.

Quetiapine (Seroquel®): Quetiapine is prescribed in low doses as an off-label medication in treating insomnia; however, there are very few studies evaluating its efficacy and safety in this context. Adverse side effects are not commonly reported on low doses of this medication; however, side effects that were mentioned in Antipsychotic section above, like tremors, stiffness, involuntary movements of the body, weight gain, hypertension, elevated cholesterol, and cardiac rhythm alterations cannot be excluded.

Olanzapine (Zyprexa®): Olanzapine has been shown to improve sleep and sleep architecture, however, it is not a commonly prescribed insomnia medication for patients who do not suffer from psychiatric disorders. This is likely due to its notorious metabolic side effects, including weight gain, hypertension, elevated cholesterol and possibility of causing diabetes.

Non-Medication Treatment of Insomnia

Repetitive Transcranial Magnetic Stimulation (rTMS): This procedure uses an electromagnet to generate electric currents that stimulate areas of the brain. It has been used successfully as an adjuvant therapy in treating depression. Promising new research on the use of rTMS in treating insomnia has recently come to light.

Cranial Electrotherapy Stimulation (CES): This has also been shown to yield positive results in the treatment of insomnia. CES uses a small device to send weak electrical pulses to desired areas of the brain. It has been approved by the U.S. Food and Drug Administration for use in treating of anxiety, depression, and insomnia since 1979. It has been shown effective in treating insomnia, with few negative side effects and its use has also been shown to precipitate fast (as little as one week), significant improvements to sleep behaviors.

Copyright 2019

Psychotherapy: Through the years, multiple psychotherapeutic approaches to improve sleep were used. Cognitive-behavioral therapy for insomnia (CBT-I) is a specially designed insomnia-treatment approach, integrating most of the effective techniques to promote sleep. It consists of effective interventions targeting the various factors that cause insomnia. **As it has proved effective in many clinical trials, the American Academy of Sleep Medicine recommends CBT-I as a standard treatment for chronic insomnia.** CBT-I has proved effective in both individual- and group-treatment settings, improving duration and quality of sleep. Although it can be used as self-help, it works best when facilitated by a trained health care provider, usually a psychologist. One of the important parts of CBT-I is sleep hygiene which can be helpful in relieving insomnia while incorporated in daily life.

Meditation: Mindfulness meditation is a process during which one focuses one's attention on the present moment without judgment. Mindfulness practices are often incorporated in relaxation training, a component of CBT-I. Meditation alone is still considered a helpful technique for treating insomnia.

Copyright 2019

Muscle Relaxants

Many drugs have been marketed as muscle relaxants, even though most do not seem to have any direct effect on muscle. Perhaps they should be called "brain relaxants," as they are all sedating, and this may be how they actually work. In the vast majority of cases due to increased sedation, respiratory depression and addiction potential, these medications should not be taken with opioids. If prescribed both classes of medications, be sure to have a discussion with a health care professional about the risks from taking these medications. Also, be sure medications prescribed are from only one health care professional who clearly knows everything being taken.

Sedation is a concern for those who drive, operate machinery, or otherwise are engaged in safety-sensitive jobs. Some also have analgesic (pain reducing) properties. Cyclobenzaprine (Flexeril®, Amrix® extended-release) is chemically similar to the tricyclic antidepressants (TCAs) and may have a similar mechanism. Muscle relaxants have limited efficacy in the treatment of chronic pain but may be used to treat acute flare-ups. There are no studies to support the long-term use of muscle relaxants, especially for low back pain. Also, the long-term use of muscle relaxants for low back pain does not improve functional recovery and can also hinder recovery.

DRUGS USED AS MUSCLE RELAXANTS IN CHRONIC PAIN

Carisoprodol (Soma®) (A scheduled IV controlled substance)	Carisoprodol is a centrally acting skeletal muscle relaxant. It is metabolized to Meprobamate which is a barbiturate like drug that can contribute to abuse potential. Prescribers are advised to avoid Carisoprodol especially in patients taking other controlled substances such as opiates. It may cause physical dependence. It should be avoided in kidney or liver disease. ***Avoid use in chronic pain.***
Cyclobenzaprine (Flexeril®, Fexmid®, Amrix®)	Skeletal muscle relaxant that is structurally similar to the TCAs. Side effects include dizziness, drowsiness, dry mouth, constipation, confusion, and loss of balance. Avoid long-term regular use in chronic pain.
Methocarbamol (Robaxin®)	Skeletal muscle relaxant with sedative properties. Side effects include drowsiness and urine discoloration to brown, black, or green.
Metaxalone (Skelaxin®)	Skeletal muscle relaxant. Use with caution in those with liver disease.
Chlorzoxazone (Parafon Forte® DSC, Lorzone®)	Skeletal muscle relaxant with sedative properties. Use with caution in those with liver disease.
Dantrolene (Dantrium®)	A true muscle relaxant that acts directly on skeletal muscle and produces fewer central adverse effects. Can have significant liver toxicity. The dose should be increased slowly.
Orphenadrine (Norflex™)	A skeletal muscle relaxant with analgesic properties.
Tizanidine (Zanaflex®)	A drug indicated for spasticity associated with multiple sclerosis or spinal cord injury but being used off label for chronic pain. This drug may increase liver enzyme levels. Tizanidine interacts with blood pressure medications and causes low blood pressure.

Copyright 2019

Baclofen (Lioresal® - oral and injectable), Gablofen® - injectable) - Not technically a muscle relaxant - used for painful spasm from muscle spasticity due to spinal cord or nervous system injury	Withdrawal should not be abrupt and can be life-threatening (mainly with intrathecal therapy). Inhibits transmission at the spinal level and depresses the central nervous system. The dose should be increased slowly to avoid the major side effects of sedation and muscle weakness (other adverse events are uncommon). Baclofen is known to be safer for long-term use. It is not typically recommended for non-neurological muscle spasm.

Botulinum Toxins

Botulinum toxins, Botox® (onabotulinumtoxinA), Dysport® (abobotulinumtoxinA), Xeomin® (incobotulinumtoxinA), and Myobloc® (rimabotulinumtoxinB) have been found to be effective in decreasing tone in overactive (hypertonic) muscles, which may be present in a number of chronic pain conditions. A recent review article regarding the treatment of refractory pain by Dr. Jabbari summarizes that botulinum toxins have "established efficacy" to control pain of cervical dystonia, chronic migraine, and chronic lateral epicondylitis (tennis elbow).

The review also found a lower level of evidence and classified botulinum toxin as "probably effective and recommended" for post-herpetic neuralgia (PHN), post-traumatic neuralgia, pain of plantar fasciitis, piriformis syndrome, and pain in total knee arthroplasty; "possibly effective, may be used at discretion of clinician" for allodynia of diabetic neuropathy, chronic low back pain, painful knee osteoarthritis, anterior knee pain with vastus lateralis imbalance, pelvic pain, post-operative pain in children with cerebral palsy after adductor hip release surgery, post-operative pain after mastectomy, and sphincter spasms, and pain after hemorrhoidectomy; "efficacy not proven due to diverse class I and II results" for myofascial pain syndrome and chronic daily headaches; and "negative" for episodic migraine and tension headaches (Pain Med 2011; 12:1594-1606). There appears to be additional pain-relieving properties of botulinum toxin irrespective of muscle relaxation.

Botox®, Dysport®, Xeomin®, and Myobloc® are FDA-approved for the treatment of the postural abnormalities and pain associated with cervical dystonia, also known as torticollis (head tilting, neck pain, and neck muscle spasms). Only one botulinum toxin (Botox® onabotulinumtoxinA) is additionally approved by the FDA to prevent headaches in adults with chronic migraine who have 15 or more days each month with headache lasting four or more hours each day in people 18 years or older, and to treat increased muscle stiffness in elbow, wrist, and finger muscles in people 18 years and older with upper limb spasticity.

The efficacy of botulinum toxins in back, neck, and extremity muscle pain has been studied as an off-label use with mixed results. In some studies, on myofascial pain, botulinum toxin has not been found to be more effective than traditional trigger point injections with local anesthetic or saline.

The dosage units for botulinum toxins are unique to each product and are not interchangeable. In addition, the FDA has specified nonproprietary names for each drug to help prevent medication errors. Many physicians are using botulinum toxins off-label for other painful conditions including types of headache other than chronic migraine treated with Botox®

Copyright 2019

(onabotulinumtoxinA), osteoarthritis of the knee and shoulder and various muscle pain syndromes (myofascial pain), although the evidence for such use is not conclusive.

For treatment of chronic pain conditions, when effective, botulinum toxins typically demonstrate efficacy within 3 to 5 days after intramuscular administration and last for an average of 12 weeks.

Side effects may occur after receiving botulinum toxin (see FDA warning box below). Muscle weakness is one of the most common side effects. Swallowing problems can develop when treating cervical muscle problems, especially with injections into the sternocleidomastoid muscle. Other adverse effects include dry mouth, pain at the injection site, neck pain, headache, and flu-like symptoms. Additionally, adverse effects may include local bruising, generalized fatigue, lethargy, dizziness, and difficulty speaking or hoarseness.

FDA WARNING: DISTANT SPREAD OF BOTULINUM TOXIN EFFECT

Postmarketing reports indicate that botulinum toxin may spread from the area of injection to produce symptoms consistent with botulinum toxin effects. These may include asthenia, generalized muscle weakness, diplopia, ptosis, dysphagia, dysphonia, dysarthria, urinary incontinence, and breathing difficulties. These symptoms have been reported hours to weeks after injection. Swallowing and breathing difficulties can be life threatening and there have been reports of death. The risk of symptoms is probably greatest in children treated for spasticity, but symptoms can also occur in adults treated for spasticity and other conditions, particularly in those patients who have an underlying condition that would predispose them to these symptoms. In unapproved uses, including spasticity in children, and in approved indications, cases of spread of effect have been reported at doses comparable to those used to treat cervical dystonia and at lower doses.

NMDA Inhibitors (Including Ketamine)

Numerous compounds that specifically target mechanisms mediating neuropathic pain such as the N-methyl-D-aspartate (NMDA) receptor complex are currently in clinical trials. NMDA inhibitors appear to help prevent sudden acute pain from progressing into chronic pain. These act by blocking receptors of neurotransmitters that are essential for making long-term memories.

The NMDA antagonists also reduce opioid tolerance and may enhance opioid analgesia.

The utility of these agents has been limited by their significant dose-related side effect profile, which includes lightheadedness, dizziness, tiredness, headache, nervous floating sensation, bad dreams, and sensory changes.

Agents that have clinically relevant NMDA blocking properties include ketamine, amantadine (an anti-influenza medication), memantine (an Alzheimer drug; Namenda™ – but not studied for chronic pain), dextromethorphan (an anti-cough medication), and methadone (an opioid).

Copyright 2019

Memantine and amantadine are weaker NMDA receptor blockers and consequently they are also thought to have fewer CNS side effects.

The basic concept of NMDA antagonism in neuropathic pain remains sound, but there is a strong need for more studies and perhaps development of newer agents with fewer central nervous system side effects.

There has been increasing interest surrounding the use of ketamine in complex regional pain syndrome (CRPS) and pain therapy via the continuous IV infusion of ketamine which has been reported to lead to pain reduction over a number of weeks. However, serious side effects may occur, especially if treatment is repeated including hallucinations, memory defects, panic attacks, nausea/vomiting, somnolence, cardiac stimulation and in a few subjects, liver toxicity. Much of the evidence is anecdotal, but increasing research is suggesting some possible benefit from this therapy although many guidelines do not feel that there is enough evidence to support its use clinically. Reviews of ketamine use for chronic pain and CRPS specifically from 2013 and 2015 concluded that the evidence from available literature is inconclusive and the quality of the research is low with small sample size, lack of blinding or controls and serious methodological flaws.

Because their potential for harm outweighs evidence of limited short-term benefit in patients with CRPS, **NMDA receptor antagonists are not recommended**.

Low-Dose Naltrexone (LDN)

Naltrexone is an opioid antagonist (blocker). Low-dose naltrexone (4.5 mg) is not commercially available, must be purchased from a compounding pharmacy, and its use is off label. While not recommended in most guidelines as studies are inconclusive, it is being prescribed by some pain physicians with anecdotal reports of effectiveness. LDN has a low side effect profile. However, it should never be co-administered with opioids because it is an opioid antagonist.

Antihypertensive & Adrenergic drugs, Bisphosphonates, Thalidomide & Calcitonin

Alpha adrenergic antagonists (e.g., clonidine, lofexidine, phentolamine, phenoxybenzamine, reserpine, dexmedetomidine, and others) have been used clinically for the treatment of CRPS without good evidence from clinical research studies. The rationale for their use is the recognized role of the sympathetic nervous system in CRPS and the theory that blockade will provide pain relief. Oral clonidine has not demonstrated significant efficacy in neuropathic pain and is challenging to use due to its side effect profile. It is more widely utilized in implantable intrathecal (injection into the sheath surrounding the spinal cord) drug pumps for pain.

Clonidine (Catapres®, Catapres-TTS® patch) is a centrally acting alpha-agonist that lowers blood pressure and has also been shown to have pain-relieving properties in sympathetically maintained pain conditions such as complex regional pain syndrome (CRPS). It is available as a tablet for oral

Copyright 2019

administration, as an injectable solution for administration in an epidural or implanted pump, or as a once-weekly patch. As mentioned previously, clonidine may be helpful controlling withdrawal symptoms from opioids.

Side effects can include dry mouth, drowsiness (sedation and somnolence occurs in over 30% of patients), dizziness, and constipation. Transient localized skin reactions can occur with the patch. Clonidine lowers blood pressure and heart rate, thus, it should be used cautiously in patients who have low blood pressure. Safest usage would suggest measuring blood pressure prior to taking a dose of oral clonidine and not taking it for a blood pressure less than 90/60.

Due to the potential for additive affect, special caution must be taken in individuals taking other central nervous system depressant medications (opioids, sedative hypnotics, and benzodiazepines).

Clonidine should not be discontinued suddenly as this can result in symptoms such as nervousness, agitation, headache, and tremor accompanied or followed by a rapid rise in blood pressure. Some individuals can develop an allergy to clonidine with a generalized rash, itching, or swelling. It should be used with caution in patients with severe heart disease, cerebrovascular disease (stroke), or chronic kidney failure. To avoid hypertensive crisis, clonidine should not be used with tricyclic antidepressants (TCAs).

Lofexidine (Lucemyra™) has recently been approved by the FDA for use to treat opioid withdrawal symptoms and can be used in similar fashion to clonidine. Its efficacy appears to be similar to clonidine for the treatment of opioid withdrawal.

Bisphosphonates are a class of drugs used primarily to increase bone mass and reduce the risk of fractures in patients with osteoporosis. There are seven FDA-approved bisphosphonates: alendronate (Fosamax®, Fosamax Plus D™), etidronate (Didronel®), ibandronate (Boniva®), pamidronate (Aredia®), risedronate (Actonel®, Actonel® with calcium), tiludronate (Skelid®), and zoledronic acid (Reclast®, Zometa®). They are more popularly known for treatment and prevention of osteoporosis. For chronic pain, they have been used in the treatment of CRPS in several studies. While the primary mechanism of these agents has been thought to be reduction in pain by preventing the osteoporosis associated with CRPS, other peripheral and central mechanisms may be responsible and deserve investigation. Adverse effects can include gastritis and erosive esophagitis (stomach and esophagus distress), and rarely, damage of the jaw bone (osteonecrosis). In October 2010, the FDA also issued a special alert on the association between the use of bisphosphonates and the risk of atypical fractures of the thigh. Patients are encouraged to consult their health care professionals for new hip or thigh pain.

There has been interest in the drug **thalidomide** due to its immunomodulatory and anti-inflammatory effects. Thalidomide was first introduced in 1957 as a sleep aid and as a treatment for morning sickness. It was subsequently removed from the market due to severe teratogenic side effects and then returned to the market as a treatment for myelodysplastic syndrome and multiple myeloma. Lenalidomide is an analog of thalidomide with similar efficacy but an improved side effect profile. There are reports and studies of both agents for the treatment of chronic pain, especially CRPS. Recent publications however do not support lenalidomide (a thalidomide derivative) use in unselected CRPS cases.

Copyright 2019

Calcitonin is the lesser known of the thyroid's two main hormones. It decreases bone resorption and has direct effects on the kidneys and gastrointestinal tract. It is also thought to have anti-pain effects. Recently, the salmon calcitonin formulation that is nasally inhaled has been more commonly used than injectable calcitonin due to ease of administration. Calcitonin has been used to treat the bone pain associated with compression and sacral insufficiency fractures.

American Chronic Pain Association
Copyright 2019

Medications for Migraine

Migraine headache treatment typically includes one or a combination of abortive (rescue) and/or prophylactic (preventive) agents. Abortive therapy has been revolutionized with the advent of the triptans (serotonin receptor agonists). Triptans narrow (constrict) blood vessels in the brain and relieve swelling. These drugs are used to effectively and quickly relieve headache pain, sensitivity to light and noise, and nausea and vomiting associated with migraines.

Triptans include sumatriptan (Imitrex® – also available by injection or nasal spray, Sumavel® DosePro® – needle-free delivery), zolmitriptan (Zomig® – also available by nasal spray or as orally-disintegrating tablets), naratriptan (Amerge®), rizatriptan (Maxalt® – also available as orally-disintegrating tablets), and almotriptan (Axert™). More recently introduced triptans include frovatriptan (Frova®) and eletriptan (Relpax®).

The most common triptan side effects can include chest pain, feeling a burning sensation, skin tingling, dizziness, nausea and sensation of warmth.

Triptans should not be used by those who have a past history of, or risk factors, for heart disease, high blood pressure, high cholesterol, angina, peripheral vascular disease, impaired liver function, stroke or diabetes.

Preventive agents include beta-blockers, antidepressants, and anti-convulsant medications that are prescribed to be taken on a scheduled basis, whereas abortive therapies are typically used on an as

Copyright 2019

needed basis and are to be taken at the first onset of a migraine. Because of frequent unpleasant and sometimes debilitating side effects, preventive drugs are only prescribed for those whose quality of life is significantly adversely affected. The drugs are started at a low dose, and gradually increased until therapeutic effects develop, the ceiling dose for the chosen drug is reached, or side effects become intolerable.

In 2018, the FDA approved three CGRP drugs (calcitonin gene related peptides) antagonist drugs for prevention of migraine headache: Erenumab-aooe (Aimovig™), Fremanezumab-vfrm (Ajovy™), and Galcanezumab-gnlm (Emgality™). These drugs appear promising in migraine prevention. These drugs are relatively new and their use is best discussed with your healthcare practitioner. There have been concerns raised about the potential for adverse cardiovascular, pulmonary and psychiatric effects and some experts recommend avoiding them for women who are pregnant or likely to become pregnant.

The key to effective treatment, however, is still a combination of avoidance of migraine triggers, stress management and relaxation techniques, and non-medication symptom relief through the use of locally applied heat or cold, massage, hot showers, and rest in a quiet, darkened room. Some people benefit from complementary or alternative therapies such as relaxation techniques, training in self-hypnosis, biofeedback, yoga, aromatherapy, acupuncture, spinal manipulation, and homeopathic remedies. See ACPA Migraine log now available as a phone app download and communication tool:
https://www.theacpa.org/pain-management-tools/communication-tools/phone-apps

Unfortunately, while migraine headaches can now be better controlled, it is unrealistic to expect instant, complete, or permanent pain relief for what is essentially a chronic, recurring disease.

Effective migraine treatment begins with the early recognition that an attack is pending followed by immediate treatment. Migraine sufferers are encouraged to take an active role in managing their headaches by avoiding common triggers, making lifestyle changes, and taking their medication at the first sign of migraine pain.

Botox® was granted approval in 2010 as a preventive treatment option for patients who are diagnosed with Chronic Migraine, a neurological disorder characterized by headaches on 15 or more days per month with headaches lasting four hours a day or longer.

Patients taking certain migraine and antidepressant medications together may be at risk for a dangerous chemical imbalance. Antidepressant medications included in this warning are duloxetine (Cymbalta®), escitalopram (Lexapro™), fluoxetine (Prozac®), paroxetine (Paxil®), sertraline (Zoloft®), and venlafaxine (Effexor®). Migraine drugs include almotriptan (Axert™), naratriptan (Amerge®), sumatriptan (Imitrex®), and zolmitriptan (Zomig®). Serotonin is a brain hormone that keeps our mood stable and our appetite in check, as well as serving other functions. When two or more drugs that affect serotonin levels are taken together, it can increase the amount of serotonin and may lead to bothersome or dangerous symptoms. This is called “serotonin syndrome” in which high levels of the chemical serotonin build up in the brain and cause toxicity.

Please see the discussion about antidepressant medications in this *ACPA Resource Guide to Chronic Pain Management* for more detailed comments about mixing migraine and certain antidepressant medications.

Copyright 2019

Additionally, the U.S. Food and Drug Administration (FDA) has warned that opioids can interact with antidepressants and migraine medicines to cause serotonin syndrome.
https://www.fda.gov/Drugs/DrugSafety/ucm489676.htm

Here are a few web sites about migraine headaches:

- http://www.mayoclinic.org/diseases-conditions/migraine-headache/home/ovc-20202432
- http://www.webmd.com/migraines-headaches/
- http://my.clevelandclinic.org/disorders/migraine_headache/hic_migraine_headaches.aspx

Treximet® is a combination medication for migraine treatment and contains naproxen 500 mg and sumatriptan 85 mg.

Diclofenac potassium powder for solution (Cambia®) is a NSAID drug indicated for the acute treatment of migraine attacks with or without aura in adults 18 years of age or older. Cambia® is not indicated for the prophylactic therapy of migraine.

NOT RECOMMENDED FOR CHRONIC PAIN

Benzodiazepines

Benzodiazepines are listed here under a separate heading but are mentioned frequently throughout this document. **Benzodiazepines are not recommended for chronic pain**. **With rare exception, Benzodiazepines should not be used with opioid medications.**

On August 31, 2016, the U.S. Food & Drug Administration (FDA) provided a warning regarding the concomitant risks from use of opioids with benzodiazepines or other central nervous system (CNS) depressants including alcohol may result in profound sedation, respiratory depression, coma and death. The FDA recommends to physicians 1) reserving concomitant prescribing of opioid and benzodiazepines or other CNS depressants presentation room alterative treatment options are inadequate; 2) limit dosages in durations to the minimum required; and 3) follow patient for signs and symptoms are respiratory depression and sedation.

Most people experience anxiety at one time or another in their lives. Anxiety can present as nervousness or sweaty palms, irritability, uneasiness, feelings of apprehension, tight muscles, and difficulty sleeping. Anxiety is often mild, but if it becomes severe, counseling or medications may be needed. The most widely prescribed drugs for anxiety are benzodiazepines like diazepam (Valium®), lorazepam (Ativan®), clonazepam (Klonopin®), flurazepam (Dalmane®), triazolam (Halcion®), temazepam (Restoril®), and alprazolam (Xanax®). They are also used as muscle relaxants and for insomnia (difficulty sleeping). Their use as sleep aids should be limited to only short term as they do not work well when used continuously each night to produce sleep.

Most benzodiazepines are recognized for causing depression and physical dependence when used for long periods. None of them are recommended for long term use.

Side effects are similar to those of alcohol and include sedation, slurred speech, and gait unsteadiness. Other adverse reactions include chest pain and a pounding heartbeat, psychological

Copyright 2019

changes, headache, nausea, restlessness, vision problems, nightmares, and unexplained fatigue. Alcohol and tobacco should be avoided while taking these drugs. Another major side effect is respiratory depression, particularly when combined with long-acting opioids. Extreme caution should be used when prescribing both opioids and benzodiazepines concomitantly. In fact, this dangerous combination should be avoided. The majority of unintentional overdose occurs when opioids and benzodiazepines are used at the same time.

Because of withdrawal symptoms, these drugs should be discontinued slowly under a health care professional's supervision. Withdrawal reactions may be mistaken for anxiety since many of the symptoms are similar. Without medical supervision, benzodiazepine withdrawal can be associated with seizures or death.

Copyright 2019

Z-Drugs (see page 126, Hypnotics for Insomnia)

Medicines called zaleplon (Sonata®), zolpidem (Ambien®) and eszopiclone (Lunesta®) are commonly called the Z-drugs. Strictly speaking, Z-drugs are not benzodiazepines but are another class of medicine. However, they act in a similar way to benzodiazepines but there is no evidence of differences in effectiveness and safety.

Antipsychotic Medications

This class of drugs is marketed primarily because of its ability to reduce hallucinations and psychotic thinking, although some members of the class are used to treat mood disorders, including depression, insomnia, nausea and migraine.

Commonly used medications in this class include aripiprazole (Abilify™), brexpiprazole (Rexulti®), haloperidol (Haldol®), olanzapine (Zyprexa®), quetiapine (Seroquel®), risperidone (Risperdal®), paliperidone (Invega®), ziprasidone (Geodon®), lurazidone (Latuda®), azenapine (Saphris®), and illoperidone (Fanapt®).

In general, the prescription of anti-psychotic medications is not recommended for chronic pain.

They are sometimes prescribed off label as anti-anxiety or sleep medications in low doses. They are strong drugs and have the potential to cause Parkinson's-like reactions, e.g., tremors, stiffness, or even a permanent neurological condition called tardive dyskinesia (although sometimes reversible when the antipsychotic drug is stopped). In mild cases, this consists of involuntary movements of the mouth and tongue, which is mostly a cosmetic problem; however, in more severe cases there can be severe muscle activity that interferes with ability to function and even to breathe. For these reasons, they are usually considered "last resort" drugs. Toxicity of anti-psychotics is discussed at http://www.emedicine.com/EMERG/topic338.htm.

Central Nervous System (CNS) Stimulants

Side effects from medications prescribed for chronic pain can be bothersome at the least, and if significant enough, may cause the need to discontinue the offending medication. One of these side effects is daytime drowsiness, making it difficult for the individual to function and carry out day to day activities and work.

Rather than give up the benefits of the prescribed medication, some health care professionals will try to treat the side effect of sleepiness and lethargy by prescribing an "activating" medication such as methylphenidate (Ritalin®, Concerta®, and Metadate®), dextroamphetamine (Dexedrine®), modafinil (Provigil®), armodafinil (Nuvigil®), and combination products (Adderall®).

Prescription of these agents is off label. These agents are Class II Controlled Substances which represent a highest addiction potential. While these CNS stimulant drugs may be appropriate for selected individuals, consideration for weaning of the pain medication that is causing the drowsiness is recommended instead of adding a medication to address side

Copyright 2019

effects.

It should be a rare patient who takes medication (with potential side effects) to control the side effects of another medication rather than discontinuing the offending medication. This combination is generally not considered appropriate therapy, as many patients will show improved functionality when the dose of the sedating drug is reduced or discontinued. Adding additional medications adds more risk for the patient.

Methylphenidate (Ritalin®, Concerta®, and Metadate®) is a medication prescribed for individuals (usually children) who have an abnormally high level of activity or attention-deficit hyperactivity disorder (ADHD). It is a central nervous system stimulant. It has effects similar to, but more potent than, caffeine and less potent than amphetamines. It is occasionally used off-label as a stimulant when daytime sleepiness from chronic pain medications is a problem. It may be effective when used appropriately, but it does have potential for abuse. Marked anxiety, tension, and agitation are contraindications to methylphenidate since the drug may aggravate these symptoms. Methylphenidate should be given cautiously to emotionally unstable patients and those with a history of drug dependence or alcoholism, as such patients may increase the dose on their own initiative.

The NIH National Institutes of Drug Abuse has published: DrugFacts: Stimulant ADHD Medications - Methylphenidate and Amphetamines which can be found at http://www.drugabuse.gov/publications/drugfacts/stimulant-adhd-medications-methylphenidate-amphetamines.

Dextroamphetamine (Dexedrine®) is an amphetamine used to treat narcolepsy and attention-deficit hyperactivity disorder in children. In some cases, this drug has been used to treat depression or as an adjunct in the treatment of exogenous obesity.

Modafinil (Provigil®) is approved by the FDA to improve wakefulness in patients with excessive sleepiness associated with narcolepsy, obstructive sleep apnea/hypopnea syndrome, and shift work sleep disorder. While not recommended in current guidelines, it is also being used off-label for persons with chronic pain and excessive daytime sleepiness. It is generally well tolerated, with mild-to-moderate side effects. It reportedly does not affect nighttime sleep. Headaches are the most common reason for discontinuing modafinil. Less frequent side effects include nausea, nervousness, anxiety, insomnia, and cardiovascular adverse reactions including chest pain, palpitations, shortness of breath and transient ischemic EKG changes. Increased monitoring of heart rate and blood pressure may be appropriate when using modafinil. There have been rare cases of serious or life-threatening rash including Stevens-Johnson syndrome and toxic epidermal necrolysis reported in adults and children. Caution should be exercised when Modafinil is given to patients with a history of psychosis, depression, or mania.

Armodafinil (Nuvigil®) is a wakefulness-promoting agent for oral administration. It is indicated to improve wakefulness in patients with excessive sleepiness associated with obstructive sleep apnea/hypopnea syndrome, narcolepsy, and shift work sleep disorder. Headaches are the most common reason for discontinuing armodafinil. This drug carries similar warnings as modafinil (see above).

Copyright 2019

TAPERING/WEANING OFF PAIN MEDICATIONS (INCLUDING OPIOIDS)

In today's health care system, it is sometimes easier to start taking medications than to stop taking them. This can often lead to a person taking multiple and possibly mechanism-overlapping medications. The questions to discuss with a health care professional are: Are the medications actually making a difference? Are they making the person's life better and improving function? Are the benefits worth any side effects and negative effects? In other words, taking pain medications is a choice that each person must make by weighing the benefits vs. the risks.

When the risks appear to outweigh the benefits of taking a pain medication, reducing the dose and ultimately discontinuing the medication should be considered. This is called weaning or tapering particularly when the individual has become dependent on the medication. The term "detoxification" is sometimes used interchangeably but should be limited to cases with opioid addiction.

The goal of tapering/weaning down the dose is to safely discontinue medications that do not seem helpful in reducing pain while allowing the body to adjust while monitoring for negative effects of withdrawal symptoms. Oftentimes, people discover they feel better taking lower doses, fewer medications, or not taking medications at all.

It is best to check with the health care professional before altering the medication regimen by taking less of the medication or stopping it. It is dangerous to abruptly stop taking some medications (sometimes referred to as going "cold turkey"). Because the body develops physical dependence to some medications when they are taken regularly, abrupt withdrawal or too rapid a reduction in the dose of these medications can be very uncomfortable or even hazardous to one's health. It depends on the type of medication, how much, and for how long the medication has been taken.

Some medications may be safe to stop abruptly:

- A medication that is taken for just a few days or only taken once in a while (weekly).
- Medications that are prescribed and only taken when necessary (as needed, not regularly).
- Some medications that do not produce physical dependence (e.g., acetaminophen, nonsteroidal anti-inflammatory drugs [NSAIDs – like aspirin, ibuprofen and others]).

Some medications always require medical supervision when stopped:

- Opioids that have been taken in regular daily doses for several days or longer.
- Benzodiazepines, muscle relaxants, antidepressants, and anticonvulsant medications that have been taken in regular daily doses for several days or longer.
- Barbiturates taken frequently for headache (butalbital).
- Non-benzodiazepine sleeping pills (also referred to as z-drugs) such as zolpidem, zopiclone and eszopiclone.

A sound approach is to talk to a health care professional before making any medication changes or if you have any other questions or concerns. Following are suggestions that can guide the discussion:

Copyright 2019

- Provide the health care professional with a list that includes the following information about all over-the-counter (OTC) and prescribed medications that are being taken:
    - Name of the medication
    - Dose (e.g., "325 mg")
    - Directions on the bottle (e.g., "take 2 tablets by mouth every 6-8 hours as needed for pain")
    - Understanding of why the health care professional prescribed this medication – what it is supposed to do.
    - Actual usage: How often and how much of the medication has the person actually been taking.
    - What has the individual noticed about its effects – the good AND bad effects?
- Take the bottles of all the OTC and prescribed medications to the appointment so the health care professional can see the labels and examine the pills.
- The health care professional should take advantage of every encounter to educate the patients on all their medications. Answer the following questions about each medication, and the person with pain should write down the answers beside the name of each medication during the visit:
    - For what condition is this medication being prescribed?
    - Is the medication essential?
    - If it is essential, how often should it be taken?
    - If the decision is made to stop taking the medication either permanently or for a while, can it be abruptly stopped, or should the dose be gradually weaned down?
    - If the dose should be weaned down:
        - How can this be done safely?
        - How uncomfortable will this process be?
        - What symptoms are danger signs, and which are simply a bother?
        - How long will it take?
    - Are there specific instructions on how to reduce the dose?
    - Will the health care professional help with the weaning process?
    - How often does the person with pain need to see the health care professional during the weaning process?
    - What are the most frequent adverse events that might appear?
    - Which are the interactions one should be aware of (medications, food, etc.)

Weaning off medications may be complicated by the potential for increased levels of pain that may accompany dose reduction but can be done safely under medical supervision. The health care professional determines the rate at which the dose is reduced, and adjustments can be made as necessary. For example, reasonable opioid weaning protocols suggest decreasing pill intake by 10-20 percent per week, as tolerated. Hydration (drinking water), relaxation, and emotional support are all important to enhance the likelihood of success.

Sometimes weaning or discontinuing medication (especially opioids) is most safely accomplished under the close supervision of a specialist (such as a pain or addiction medicine specialist) in a medically-supervised program to prevent complications and severe withdrawal symptoms.

Symptoms of withdrawal from opioids can include:

- worsening of pain
- rapid heart beat
- high blood pressure

Copyright 2019

- sleeplessness
- agitation and anxiety
- stomach cramps, nausea, vomiting, diarrhea
- body aches (flu-like symptoms) and muscle cramps
- runny nose, sweating, tearing, yawning, goose bumps

Prescription medications recommended by your healthcare provider that can help diminish symptoms of opioid withdrawal include:

- Alternative opioids:
    - methadone
    - buprenorphine
- Other drugs to manage withdrawal symptoms during detoxification
    - naltrexone (Vivitrol) – an extended release non-addictive, once-monthly injection to prevent relapse in opioid dependent patients when used with counseling following detoxification.
    - alpha-2 agonists (clonidine) – blood pressure needs to be monitored
    - anti-nausea medications (e.g., ondansetron, metoclopramide)
    - anti-diarrheal (loperamide)
    - muscle relaxants (e.g., tizanidine, cyclobenzaprine, baclofen)
    - stomach relaxants (dicyclomine)
    - anti-inflammatory pain relievers (e.g., ibuprofen, naproxen, others)
    - sleep aids (e.g., trazodone, amitriptyline)
    - anti-anxiety agents (e.g., diazepam, lorazepam) may be used briefly (5-7 days)

On occasion, alternative detoxification with phenobarbital may be offered.

Copyright 2019

SELF-MEDICATION: ALCOHOL, TOBACCO, MARIJUANA, AND ILLICIT SUBSTANCES

ALCOHOL & CHRONIC PAIN

Alcohol is also a drug. Alcohol has no place in the treatment of chronic pain, although some individuals turn to alcohol for relief of their pain. It is important to discuss the use of alcohol with your health care provider, including the amount, frequency, and type of alcohol consumed.

Alcohol can enhance the effects of certain prescription drugs as well as markedly increase potential toxic side effects (i.e., liver damage when used in conjunction with acetaminophen or increased sedation and respiratory depression in conjunction with opioids and other sedating medications, like benzodiazepines and other sleeping medications). The mixture of alcohol and opioids along with sedatives or anti-anxiety drugs can cause death.

Alcohol affects the nervous system as a depressant, not as a stimulant. It depresses normal mental activity and normal muscle function. Short-term effects of an average amount of alcohol include relaxation, breakdown of inhibitions, euphoria, and decreased alertness. Short-term effects of large amounts of alcohol include nausea, stupor, hangover, unconsciousness, and even death. Alcohol increases stomach acid and impairs liver function. Chronic alcoholism frequently leads to permanent damage to the liver. Alcohol also affects the heart and blood vessels by decreasing normal function, leading to heart disease. Bleeding from the esophagus and stomach frequently accompany liver disease caused by chronic alcoholism. Many medications cannot be given to patients with abnormal liver function, thus making it more difficult to treat chronic pain.

The early signs of alcoholism include the prominent smell of alcohol on the breath and behavior changes such as aggressiveness, passivity, decreased inhibitions, poor judgment, depression, and outbursts of uncontrolled emotion such as rage or tearfulness. Signs of intoxication with alcohol include unsteady gait, slurred speech, and poor performance of any brain or muscle function. Signs of severe alcohol intoxication include stupor or coma with slow, noisy breathing, cold and clammy skin, and an increased heartbeat.

The long-term effects of alcohol addiction (alcoholism) include craving, compulsive use and continued use despite harm to family, job, health, and safety. When alcohol is unavailable to persons who are severely addicted, withdrawal symptoms will occur and may be life threatening if not treated immediately. Even with successful treatment, individuals addicted to alcohol may at risk for relapse, suggesting the need for ongoing treatment (such as involvement in 12-step programs, counseling, and family support).

Simply put, alcohol and pain medications are dangerous when mixed together**.**

Additional information is available from the Substance Abuse and Mental Health Services Administration (SAMHSA) at http://www.samhsa.gov/atod.

Copyright 2019

THE EFFECTS OF CIGARETTE SMOKING ON PAIN

Cigarette smoking causes blood vessels to become constricted (due to nicotine); this restricts the amount of oxygen-rich blood flowing to areas of pain. Smoking not only reduces blood flow to your heart but also to other structures such as the skin, bones, and discs. Due to this, the individual may get accelerated aging leading to degenerative conditions. The lack of blood supply caused by cigarette smoke is also responsible for increased healing time after surgery. After back fusion surgery, smoking cigarettes can increase the risk of the fusion not healing properly. Smoking should be avoided both before and after spine surgery. Cigarette smoke triggers the release of pro-inflammatory cytokines, thus increasing inflammation and intensifying pain. Smoking makes the bones weak and increases the prevalence of osteoporosis, spinal degenerative disease, and impaired bone and wound healing. Symptoms of depression are more commonly seen among smokers. Cigarette smoking is also considered a risk factor for misuse of opioid medications and should be considered when prescribing opioids.

Below are some tips to help individuals stop smoking.

Assess readiness to quit smoking and ask a health care professional or pharmacist for help. They will make recommendations, modifications, and develop a treatment plan to optimize success. Even one less cigarette a day is a step in the right direction. Keeping a log may help individuals pinpoint when and why they are smoking. Knowing these triggers can help replace smoking a cigarette with healthier habits.

Smoker's Log:

Cigarettes per day	
Time of each cigarette	
What triggered the craving?	
What were you doing while smoking?	
How did you feel while smoking?	

Nicotine replacement therapy, such as lozenges, gum, or patches, is available.

Some medications can help with the craving of cigarettes that many people experience when they are trying to quit. These medications work by affecting dopamine. Nicotine triggers dopamine release in the brain. Dopamine is a neurotransmitter, a chemical messenger that plays a prominent role in addiction. Dopamine affects movement control, emotional response, and pleasure/pain. It is responsible for the reward pathway and the "feel good" phenomenon experienced when smoking.

Norepinephrine is also a neurotransmitter that sends signals from one neuron to the next. Norepinephrine is similar to noradrenaline and adrenaline and is responsible for constricting and narrowing the blood vessels. It can therefore increase blood pressure. It can also increase blood sugar levels and affect both mood and behavior.

Copyright 2019

Bupropion is an antidepressant (Wellbutrin®); however, it is also used in the smoking cessation process (Zyban®) – i.e., the same medication and they should never be taken together. Bupropion inhibits the reuptake of both dopamine and norepinephrine, increasing their concentrations within the brain. By increasing dopamine, the frequency and severity of nicotine cravings and urges are reduced. Norepinephrine plays a role in alleviating symptoms associated with nicotine withdrawal. Bupropion effects are not fully seen until one week of treatment is complete. Therefore, it is important for patients to start this medication one to two weeks prior to their "quit-date". Side-effects include behavior changes, hostility, agitation, and depression. Seizures may occur; however, they are dose dependent. Less severe, more common side effects include dry mouth, headache, nausea, dizziness, sweating, and insomnia.

Varenicline (Chantix®) mimics nicotine at the receptors in order to aid in smoking cessation. Varenicline is similar in structure to cytosine, a natural compound that has aided in smoking cessation since the 1960s. Varenicline works via two different mechanisms. First, varenicline is effective because it provides partial nicotine effects to help with nicotine withdrawal symptoms. Second, varenicline also binds to nicotine receptors to block nicotine's effect if the person relapses. Duration of therapy is normally 12 weeks. Patients who respond to treatment may receive another 12 weeks of therapy to increase their success rate. Common side effects include nausea, vomiting, insomnia, headache, and abnormal dreams. This is not a benign drug as the FDA warning notes neuropsychiatric adverse events including suicidality. These warnings include changes in mood (including depression and mania), psychosis, hallucinations, paranoia, delusions, homicidal ideation, aggression, hostility, agitation, anxiety, and panic, as well as suicidal ideation, suicide attempt, and completed suicide. These symptoms can occur with and without pre-existing psychiatric disease. Some neuropsychiatric adverse events, including unusual and sometimes aggressive behavior directed to oneself or others, may have been worsened by concomitant use of alcohol.

MARIJUANA

The use of marijuana for pain is controversial. It is allowed by some states for medicinal and now recreational purposes, but overall it is banned for distribution by the United States federal government. At the time of the writing of this *ACPA Resource Guide to Chronic Pain Management*, marijuana is considered a Schedule I drug (high potential for abuse, no legitimate medical use) by the DEA. However, medicinal use has been independently legalized by 44 states and the District of Columbia. Some states have well defined medical cannabis programs (AK, AR, AZ, CA, CO, CT, DE, FL, HI, IL, LA, MA, MD, ME, MI, MN, MT, ND, NH, NJ, NM, NV, NY, OH, OR, PA, RI, VT, WA, WV) while others have limited access for now (AL, GA, IA, KY, MO, MS, NC, OK, SC, TN, TX, UT, VA, WI). In fact, the only states that have not legalized medical marijuana currently are ID, IN, KS, NE, SD, and WY. In addition, there are now eight states (AK, CA, CO, MA, ME, NV, OR, WA) and the District of Columbia that have legalized recreational marijuana in addition to medical marijuana with several others that will likely vote on the issue in 2018. All of this creates a dissonance between federal and state perspectives on the medicinal use of marijuana (cannabis). This dissonance has also created a conundrum for physicians who are trying to do the right thing for their patients but may find themselves in violation of federal regulation.

Copyright 2019

In August 2016, the DEA (with input from the FDA and NIDA) reaffirmed that marijuana will remain a Schedule I drug. There is evidence of some analgesic benefits from marijuana, but there is a great deal of research that needs to still be done and this classification impedes that research.

Some of this is related to the change in public opinion in the U.S. about the value and dangers of marijuana, especially when compared to opioids. According to a February 2017 Quinnipiac poll (https://www.mpp.org/wp-content/uploads/2017/02/Quinnipiac-Poll-Feb-2017.pdf), 59% say marijuana should be legal, 93% say medical marijuana should be legal, and 71% say federal laws should not be enforced. That can be compared to a Gallup poll in 1969 where only 12% said that marijuana should be legal.

A physician cannot legally prescribe medical marijuana with the exception of FDA-approved formulations such as Marinol since their license to prescribe controlled substances is controlled by a federal agency (DEA) that considers marijuana illegal. Some health care professionals may recommend the use of medical marijuana, some will not provide a recommendation but will not object to a patient's use of marijuana with other pain medicines, and some will refuse to prescribe other medications (especially opioids) to individuals who are using marijuana. Some health care professionals take a "don't ask, don't tell" philosophy and do not check for marijuana when doing urine drug testing. Individuals cannot say they are using marijuana recreationally to deal with a medical problem and expect that to comply with the law as specific medical conditions (e.g., seizures, Parkinson's, glaucoma, cancer, "intractable" pain) and procedures (becoming a registered patient, where/how to purchase, pricing) need to be followed. Nevertheless, the use of any substances should be discussed openly and honestly between the person and his or her health care professional.

If the individual is on opioids and/or pain treatment program, the concurrent use of marijuana should be clearly spelled out in the opioid/pain treatment contract. There are typically consequences if this medication appears in UDS and has not been approved by the pain treating physician.

The most well-known active ingredient found in marijuana (THC) may decrease pain and cause euphoria, but can also lead to dependence and addiction in certain individuals and has significant side effects. The cannabidiol (CBD) component of the marijuana plant is thought to have potential effects to reduce pain without providing the psychoactive high associated with THC. CBD is available in a variety of forms, including oils and salves for topical use. No controlled studies have been carried out to date.

Although some states allow the legal use of marijuana for medicinal purposes, which may or may not include pain, there is no high-level scientific research supporting the long-term use of marijuana for chronic pain. In fact, there is good evidence that excessive smoking of marijuana can be harmful (especially in young people). Oral forms of THC in the forms of candies, energy drinks, juices, etc. are being sold at dispensaries. The potency of THC in these oral preparations is extremely high and has created an over-dosing situation (marijuana taken orally can take up to 20-30 minutes to have an effect because it has to be processed by the digestive system).

Copyright 2019

However, in January 2017, the National Academies of Sciences, Engineering and Medicine published a paper that concluded after studying 10,000 scientific abstracts published since 1999 that "found evidence to support that patients who were treated with cannabis or cannabinoids were more likely to experience a significant reduction in pain symptoms" (http://www8.nationalacademies.org/onpinews/newsitem.aspx?RecordID=24625). That means there is now a disagreement within the federal government whether marijuana can help manage pain (or even be considered medicinal).

More frequent marijuana smoking is associated with an increased risk of severe respiratory illnesses, especially chronic bronchitis. Other potential delivery methods include oils, tinctures, vaporizers, and edibles. Use also leads to reduced workplace productivity, as well as impaired judgment, even hours after use. Marijuana intoxication impairs cognitive and psychomotor performance with complex, demanding tasks. Individuals who have used marijuana over long periods of time demonstrate impaired performance on a variety of neuropsychological tests (e.g., attention, memory, and processing complex information), even when not acutely intoxicated. A recent review of the existing medical literature concluded that the use of marijuana at a young age increased the risk of schizophrenia or a schizophrenia-like psychotic illness by approximately three-fold. Emerging evidence suggests a link between more frequent, or severe, marijuana use and anxiety symptoms and disorders.

Since it is a CNS depressant, marijuana's use concomitantly with opioids is of concern. Patients using opioids need to be aware of all prescribed and non-prescribed medications that affect the central nervous system, including marijuana and alcohol, because there may be a synergistic effect that may cause respiratory depression and death.

People who are self-medicating with marijuana may not recognize the presence of marijuana withdrawal symptoms. Marijuana causes physical dependence, and withdrawal symptoms can start as early as hours after smoking marijuana and last for up to a month and include sleep disturbances, substantial anxiety (which can worsen pain), discomfort, lack of appetite, and commonly trigger marijuana craving.

Despite some states allowing medicinal marijuana, it is a federal crime for a health care professional to prescribe a scheduled drug to a person known to be using the drug illegally. It is also important to remember that possessing marijuana when traveling through a state where medicinal marijuana is not allowed could result in being charged with possession of an illegal substance, even if the person is using the drug under the supervision of a physician and has the proper home state documentation. Additionally, an individual can be denied employment or fired if the employer or prospective employer conducts drug screenings as a part of the hiring process or has a 'no-drug tolerance' policy. Also, individuals can be charged with driving under the influence (DUI) if their driving is impaired and they test positive for marijuana, even in states where medicinal marijuana is allowed.

Copyright 2019

Illegal Drugs

Regarding chronic pain treatment (excluding cancer and end-of-life care), health care professionals will not prescribe opioids and other medications to individuals who are known to use illegal "street" drugs (heroin, methamphetamines, cocaine, and others) or to be irresponsible with prescription pain medication. Unfortunately, many people suffering from a substance use disorder such as opioid addiction present to pain clinics in search of medication and may need a different form of assistance. If you or a loved one need assistance with an opioid addiction, call 1-877-927-9043 to speak with someone from the **American Addiction Centers available** 24/7 to discuss treatment options. Prescribing Medication Assisted Treatment for addiction (e.g., Methadone, Buprenorphine) requires special training and licensure.

INTERNET PAIN-MANAGEMENT RESOURCES

There are a number of stand-alone and Internet-based programs to help in the management of pain. The American Chronic Pain Association website can be a great source of information (https://theacpa.org/). This and other pain management programs include ways to track daily pain and activity and can be a useful vehicle to easily summarize progress over time. They can be especially helpful when starting an exercise routine by tracking progress based on frequency and duration of the exercises. These programs can also suggest warm-up and cool-down stretching routines catered for each individual's pain problem. They also can be useful for monitoring medication use and giving helpful reminders throughout the day. A daily food diary can help in identifying healthy and unhealthy eating habits. Smart phone applications (apps) are in development specifically for persons with chronic pain. These programs are useful in identifying important information about the pain, summarizing progress for the health care professional, and offering daily tips and recommendations for improving pain management.

Many things can affect your pain. These can include stress, sleep, money worries, and even the weather. This log can help you track the everyday things that have an impact on your pain.

When you understand what makes your pain worse, you can begin to work on ways to reduce or deal with your pain "triggers."

The more you know about how your body reacts, the more you can be in control. Being in better control can help you be less afraid and better able to manage your pain. We encourage you to fill out a chart at the end of each day or several times a week. You also can print out a report and take it to your doctor visits. It can help you talk more openly with your health care provider so that together you can find ways to improve your quality of life. https://theacpa.org/ wp-content/uploads/2017/08/Pain-Log-Rev-2010-V2.pdf

Back pain can be complex and difficult to describe in the short time you may have with your health care provider. This tool can help you create a detailed picture of your pain---where it is, how it feels, how much it hurts, and what triggers it. Fill it out before your visit, print it, and share it with your provider.
https://theacpa.org/pain-management-tools/communication-tools/tracking-tools/back-pain-map/

Copyright 2019

The beginning journey from patient to person with this workbook is designed to help anyone who has a chronic pain problem gain an understanding of how to cope with the problems that his or her pain creates.

Patient to Person: First Steps
Topics include:
• Understanding Chronic Pain
• Knowing Yourself
• Learning to Live with Others
• Helping Your Body
http://store.theacpa.org/patient-to-person-first-steps-by-penney-cowan-2004.html

FINAL COMMENTS

An essential concept in pain management is that each person is different and will respond differently to situations, interventions, surgeries, and medications.

It is important for the person with pain, family members, and others to avoid quick judgments based on what they hear or read about any particular treatment or medication. The best place to get advice about treatments and medications is from the health care professional assisting the person with pain.

Families need to be good reporters–observant, truthful, and honest about what they see in the person who is provided a certain treatment or who is taking medication. Sometimes the person provided the treatment or taking the medication does not realize the changes that are produced. Family member observations will be helpful to the health care professional.

There is no question that there are many treatment approaches (tools) in the "tool chest" of the treating health care professional or therapist, but they should be used judiciously. Benefit should be based on less pain, more function, and return to everyday activities with the least, manageable side effects possible.

This *ACPA Resource Guide to Chronic Pain Management* only deals with certain treatments and medications, but it is important to understand that there are many other treatment approaches to chronic pain that may not be covered in this document. This document is a work in progress and the ACPA welcomes comments and recommendations.

The ACPA once again reminds readers that this *ACPA Resource Guide to Chronic Pain Management* is not meant to serve as medical advice for pain conditions or treatment or medication needs. The best source of information is health care professionals and therapists who understand the treatment and medication options available to people with chronic pain.

Copyright 2019

REFERENCES: LINKS TO CHRONIC PAIN SITES & RESOURCES

MEDICATION RELATED

1. WebMD: Drugs & Medications A-Z - http://www.webmd.com/drugs

2. PDR.net: Drug Information - http://www.pdr.net

3. Medscape: Drugs - http://www.medscape.com/druginfo

4. FDA: Drugs - http://www.fda.gov/cder/drug/default.htm

5. MedLine Plus: Drugs, Herbals, and Supplements - http://www.nlm.nih.gov/medlineplus/druginformation.html

6. Drugs.com: Drug Information Online - http://www.drugs.com/

7. Drugs and Supplements: http://www.mayoclinic.com/health/drug-information/DrugHerbIndex

8. American Society of Health-System Pharmacists: http://www.safemedication.com/

9. WebMD: http://www.webmd.com/pain-management/guide/pain-relievers

BOOKS

There also are many books on the topic of chronic pain that can be useful. You can go to www.amazon.com and search on chronic pain and a long list of books will come up. There are many good ones, but we can particularly recommend the following:

- Back in Control: A spine surgeon's roadmap out of chronic pain by David Hanscom MD
- The Painful Truth: What Chronic Pain Is Really Like and Why It Matters to Each of Us by Lynn R. Webster MD
- Managing Pain Before It Manages You, Fourth Edition by Margaret A. Caudill MD PhD MPH and MD Herbert Benson
- Living Abled and Healthy: Your Guide to Injury and Illness Recovery by Christopher R. Brigham-MD and Henry Bennett
- The Chronic Pain Workbook by Michael Lewandowski, PhD
- Mindfulness Meditation for Pain Relief by Jon Kabat-Zinn PhD

Copyright 2019

- Conquer Your Chronic Pain by Peter Abaci, MD
- The Pain Antidote: The Proven Program to Help You Stop Suffering from Chronic Pain, Avoid Addiction to Painkillers--and Reclaim Your Life by Mel Pohl and Katherine Ketcham
- Opioid-Free Pain Relief Kit: 10 Simple Steps to Ease Your Pain by Beth Darnall, PhD
- Less Pain, Fewer Pills: Avoid the Dangers of Prescription Opioids and Gain Control over Chronic Pain by Beth Darnall

OTHER REFERENCES

Agency for Healthcare Research and Quality (AHRQ). (2007). *Choosing Nonopioid Analgesics for Osteoarthritis: Clinician Summary Guide: Available at http://informahealth care.com/doi/abs/10.3109/15360280903332237*

American Academy of Family Physicians (AAFP). Herbal Health Products - What You Should Know. Available at *http://www.aafp.org/afp/990301ap/990301e.html*

American College of Rheumatology 2012 recommendations for the use of nonpharmacologic and pharmacologic therapies in osteoarthritis of the hand, hip, and knee. Arthritis Care Res (Hoboken). 2012 Apr;64(4):465-74. Available at http://www.guideline.gov/content.aspx?id=36893

American Pain Society and American Academy of Pain Medicine (2009). *Evidence Review: APS-AAPM Clinical Guidelines for the Use of Chronic Opioid Therapy in Chronic Noncancer Pain*. Available at http://www.jpain.org/article/PIIS1526590008008316/fulltext

Food and Drug Administration (FDA). A *Guide to Safe Use of Pain Medicine*. Available at *http://www.fda.gov/downloads/ForConsumers/ConsumerUpdates/ucm095742.pdf*

Food and Drug Administration (FDA) Center for Drug Evaluation and Research (CDER) maintains a collection of educational materials on topics related to buying and using medicine safely at http://www.fda.gov/Drugs/ResourcesForYou/Consumers/ucm296593.htm

Food and Drug Administration (FDA). *Buying Prescription Medicine Online: A Consumer Safety Guide*. Available at *http://www.fda.gov/downloads/Drugs/EmergencyPreparedness/BioterrorismandDrugPreparedness/UCM133237.pdf*

National Center for Complementary and Alternative Medicine (NCCAM). (2010). What is CAM? Available at *http://www.nccam.nih.gov/health/whatiscam/*

Copyright 2019

PAIN RELATED ORGANIZATIONS, WEB SITES & VIDEOS

The American Chronic Pain Association (The ACPA) at https://theacpa.org/

American Society for Pain Management Nurses (ASPMN) at http://www.aspmn.org/Pages/default.aspx

American Pain Society at http://americanpainsociety.org/

American Academy of Pain Medicine at http://www.painmed.org/

American Academy of Integrative Pain Management http://www.aapainmanage.org/

Guide to Pain Medication and Treatments https://theacpa.org/pain-management-tools/resource-guide-to-chronic-pain-treatments/resource-guide-to-chronic-pain-management/

International Association for the Study of Pain (IASP) at http://www.iasp-pain.org/

Opioid Induced Constipation https://theacpa.org/wp-content/uploads/2017/08/ACPA-Opioid_Constipation_Chart-V4.pdf

Understanding Implanted Devices https://theacpa.org/pain-management-tools/videos/conditionstreatments/

Understanding NSAIDS https://theacpa.org/pain-management-tools/videos/conditionstreatments/

Using Opioids Safely https://theacpa.org/pain-management-tools/videos/conditionstreatments/

Youth Living with Pain www.growingpains.org

PainEDU – http://www.PainEDU.org

painACTION – http://www.painaction.com

Reflex Sympathetic Dystrophy Syndrome Association of America - https://www.rsds.org/

Pain Matters - http://painmatters.com/?utm_source=google&utm_medium=cpc&utm_term=chronic%20pains&utm_campaign=Pain%20Education

The Pain Toolkit http://www.paintoolkit.org/

Maze-Masters - http://www.webility.md/maze-masters/

Take Courage Coaching - http://www.takecouragecoaching.com/

Copyright 2019

Understanding Pain in Less than Five Minutes, and What to Do About It:
https://www.youtube.com/watch?v=C_3phB93rvI

Best Advice for People Taking Opioid Medication
https://www.youtube.com/watch?v=7Na2m7lx-hU

American Chronic Pain Association Videos
https://theacpa.org/pain-management-tools/videos/

Retrain Pain Foundation
https://www.retrainpain.org/

Dr. David Hanscom's website and book:
Back In Control or
www.backincontrol.com

Dr. Howard Schubiner's book and
website: Unlearn Your Pain
https://www.unlearnyourpain.com

Dr. Beth Darnall's Books and website:
https://bethdarnall.com/

Video & website: Tame the Beast
https://www.tamethebeast.org/

Sleepwell Recommends:
https://mysleepwell.ca/cbti/sleepwell-recommends/

Copyright 2019

Steven D. Feinberg, M.D., M.P.H.

Adjunct Clinical Professor, Stanford University School of Medicine
Board Certified, Physical Medicine and Rehabilitation
Board Certified, Electrodiagnostic Medicine
Board Certified, Pain Medicine

Feinberg Medical Group
Feinberg Medical Legal

Functional Restoration Programs
825 El Camino Real
Palo Alto, California 94301
TEL: 650-223-6400
FAX: 650-223-6408
stevenfeinberg@hotmail.com
www.FeinbergMedicalGroup.com

Dr. Steven Feinberg is a physiatrist and pain medicine specialist practicing in Palo Alto. He is an Adjunct Clinical Professor and teaches at the Stanford University Pain Service.

Dr. Feinberg is a past president (1996) of the American Academy of Pain Medicine (AAPM). He served as a California Society of Medicine & Surgery (CSIMS) Year 2001 President. He served from 2009 to 2017 on the Board of Directors of the American Chronic Pain Association (www.theacpa.org) and is senior author of the 2019 ACPA Resource Guide to Chronic Pain Treatment. He is on the Western Occupational and Environmental Medicine Association (WOEMA) Board of Directors. He is a member representing ACOEM on the AMA Pain Care Task Force. He is a member of the California DWC Pharmacy & Therapeutics Committee.

Dr. Feinberg received the 1998 Professional of the Year Award from the California Governor's Committee on Employment of the Disabled. He is the recipient of the 1999 American Academy of Pain Medicine Founders Award. In 2006, he received both the Silver Scalpel Award by CSIMS and the Stanford Pain Management Center Award for Teaching Excellence.

Dr. Feinberg served as Panel Chair for the ACOEM Chronic Pain Guidelines Panel Chapter 2017 Update. He served as a Medical Reviewer for the ACOEM 2014 Opioid Guidelines. He serves on the Reed Group's Medical Advisory Board. He served as a Reviewer for the AMA Guides to the Evaluation of Permanent Impairment, 6th Edition. He is on the AMA Guides Newsletter Advisory Board and the AMA Guides® Editorial Panel. Dr. Feinberg is an Expert Reviewer for the Medical Board of California.

Justin Drake was born and raised in Phoenix, Arizona. He received his Bachelor of Arts degree from the University of Michigan in 2003 where he was a member of the Swimming and Diving Team, twice as Big 10 Champions. Individually, he received All-American Honorable-Mention his last three years in the mile swim. After graduation he spent a year in Chicago watching Cubs games during the day and waiting tables at night. He then moved to Sacramento where he attended University of The Pacific McGeorge School of Law. While in Law School, Mr. Drake was a judicial extern for Hon. Paul A. Katz of the Maricopa County Superior Court and an intern with the Sacramento County Public Defender's office in the Misdemeanor Division. Mr. Drake received the Honors at Entrance Scholarship, Barrister's Scholarship, and was a member of the Dean's list.

Upon graduation from McGeorge and admission the California bar in 2009, Mr. Drake spent several years in civil litigation representing insurance carriers and property owners in personal injury claims and unlawful detainers.

In 2013, Mr. Drake began his workers' compensation practice with a state-wide applicant's firm. Mr. Drake secured a $2.1 million settlement for the applicant in a complex third-party brain injury case. He then transitioned to representation of carriers, third party administrators, and self-insured employers with a state-wide defense firm. He has handled all aspects of workers' compensation litigation including uninsured employers and Labor Code Section 132a and Serious and Willful claims. Mr. Drake takes immense pride in finding the most expeditious and cost-effective solutions for his clients.

When away from work Mr. Drake enjoys being outside with his family, building and riding bicycles, and home improvement projects.

E-mail: jdrake@cca-law.com
Phone: (916) 787-2329