AT THE FOREFRONT
UChicago Medicine

Twenty-Fifth Annual Primary Care Orthopaedics Course

Department of Orthopaedic Surgery and Rehabilitation Medicine

25TH ANNUAL PRIMARY CARE ORTHOPAEDICS

A REVIEW OF BASIC AND CURRENT CONCEPTS

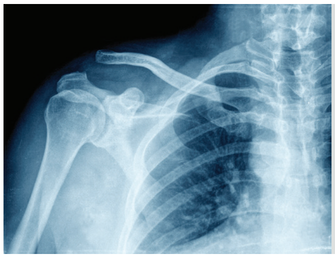
COURSE DIRECTORS

Sherwin S.W. Ho, MD
Professor of Orthopaedic Surgery

Michael J. Lee, MD
Professor of Orthopaedic Surgery

JUNE 5–7 2019

MILLENNIUM KNICKERBOCKER HOTEL
Crystal Ballroom



25TH ANNUAL PRIMARY CARE ORTHOPAEDICS

A REVIEW OF BASIC AND CURRENT CONCEPTS

Millennium Knickerbocker Hotel

June 5–7, 2019

DESCRIPTION

Primary care, urgent care, and emergency room physicians, along with other healthcare providers, are often on the front line in the initial care and management of orthopaedic problems. This course is intended to enhance the participants' knowledge base regarding common orthopaedic problems and increase their confidence in managing these issues in order to improve patient care.

TARGET AUDIENCE

This activity is designed for primary care physicians, nurse practitioners, physical therapists, occupational therapists, athletic trainers, and other health professionals interested in the diagnosis and management of common orthopaedic injuries and illnesses.

LEARNING OBJECTIVES

At the conclusion of this activity, participants will be able to:

GENERAL SESSIONS

- *Describe how to diagnose common patient problems in the following orthopaedic areas: trauma, spine, foot and ankle, pediatrics, sports medicine, upper extremity, and adult hip and knee;*
- *Distinguish patient issues that need to be referred to an orthopaedist from those best treated by a primary caregiver;*
- *Explain how to safely manage orthopaedic problems that are appropriately treated by a primary caregiver;*
- *Name key elements of the orthopaedic physical examination;*
- *State the most appropriate imaging modalities of common orthopaedic problems;*
- *Develop strategies to efficiently maximize the value of orthopaedic services through an interdisciplinary, team-based approach to patient care.*

ELECTIVE WORKSHOPS

- *Demonstrate how to conduct a physical exam of the hand, wrist, shoulder, spine, hip, knee, ankle and foot;*
- *Interpret orthopaedic x-rays and MRIs to diagnosis orthopaedic problems in patients;*
- *Identify techniques to properly administer both common and less common, musculoskeletal injections.*

ACCREDITATION AND CREDIT DESIGNATION

PHYSICIAN CREDIT

The University of Chicago Pritzker School of Medicine is accredited by the Accreditation Council for Continuing Medical Education to provide continuing medical education for physicians.

The University of Chicago Pritzker School of Medicine designates this live activity for a maximum of 22.75 *AMA PRA Category 1 Credits*™. Physicians should claim only the credit commensurate with the extent of their participation in the activity.

AMERICAN ACADEMY OF FAMILY PHYSICIANS CREDIT

This Live activity, 25th Annual Primary Care Orthopaedics, with a beginning date of 06/05/2019, has been reviewed and is acceptable for up to 22.75 Prescribed credit(s) by the American Academy of Family Physicians. Physicians should claim only the credit commensurate with the extent of their participation in the activity.

NURSING CREDIT

The University of Chicago Medicine is an approved provider of continuing nursing education by the Ohio Nurses Association, an accredited approver by the American Nurses Credentialing Center's Commission on Accreditation. (OBN-001-91) (OH-355, 7/1/2019)

This live activity is designated for a maximum of 22.75 continuing nursing education units.

PHYSICAL THERAPIST & OCCUPATIONAL THERAPIST CREDIT

The University of Chicago Medical Center is a licensed continuing education provider with the Illinois Department of Financial and Professional Regulation for Physical Therapy, license # 216-000030. All participants will be provided with a certificate of attendance. This course is approved for 22.75 continuing education hours for licensed therapists (PT, PTA, OT, or COTA) in Illinois. The University of Chicago Medical Center has not applied to any other state for therapist CE credit. Participants will need to do this individually through their jurisdiction outside of Illinois.

ATHLETIC TRAINER CREDIT

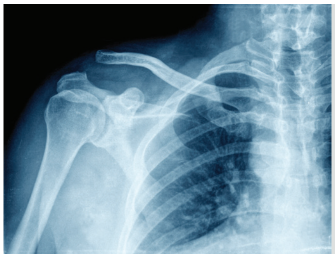
The University of Chicago is recognized by the Board of Certification, Inc. to offer continuing education for Certified Athletic Trainers. This program has been approved for a maximum of 22.75 hours of Category A continuing education.

AMERICAN BOARD OF INTERNAL MEDICINE MOC PART II CREDIT

Successful completion of this CME activity, which includes participation in the evaluation component, enables the participant to earn up to 14.75 MOC points in the American Board of Internal Medicine's (ABIM) Maintenance of Certification (MOC) program. Participants will earn MOC points equivalent to the amount of CME credits claimed for the activity. It is the CME activity provider's responsibility to submit participant completion information to ACCME for the purpose of granting ABIM MOC credit.

OTHER HEALTHCARE PROFESSIONS CREDIT

Other healthcare professionals will receive a Certificate of Participation. For information on the applicability and acceptance of Certificates of Participation for educational activities certified for *AMA PRA Category 1 Credit*™ from organizations accredited by the ACCME, please consult your professional licensing board.



EDUCATIONAL GRANTS/COMMERCIAL SUPPORT

Educational grant funding has been generously provided by:

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We would also like to thank our exhibitors:

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WEDNESDAY MEAL SPONSOR

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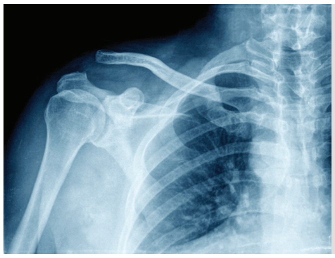

DISCLOSURE DECLARATIONS

As a provider accredited by the ACCME, The University of Chicago Pritzker School of Medicine asks everyone who is in a position to control the content of an education activity to disclose all relevant financial relationships with any commercial interest. This includes any entity producing, marketing, re-selling, or distributing health care goods or services consumed by, or used on, patients. The ACCME defines “relevant financial relationships” as financial relationships in any amount, occurring within the past 12 months, including financial relationships of a spouse or life partner that could create a conflict of interest. Mechanisms are in place to identify and resolve any potential conflict of interest prior to the start of the activity.

Additionally, The University of Chicago Pritzker School of Medicine requires Authors to identify investigational products or off-label uses of products regulated by the US Food and Drug Administration at first mention and where appropriate in the content.

COURSE FACULTY

The following individuals have disclosed no relevant financial relationships:

Irsk Anderson, MD
Jovito Angeles, MD
Aravind Athiviraham, MD
Tessa Balach, MD
Robert Bielski, MD
Derrick Brown, PA-C
Tuan Bui, MD
George Chiampas, DO, CAQSM, FACEP
Megan Conti Mica, MD
Annie Detrick
Douglas R. Dirschl, MD
Michelle S. Gittler, MD
Rex Haydon, MD, PhD
David S. Howes, MD
Kelly Hynes, MD
Carrie Jaworski, MD
Wonyong Lee, MD
Kimberly Martin, DNP
Daniel Mass, MD
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Lindsey Plass, PT, DPT
Christopher Stoj, MA
Jason A. Strelzow, MD
Christopher M. Sullivan, MD, MPH
Brian C. Toolan, MD
Sara Wallace, MD
Jennifer Moriatis Wolf, MD

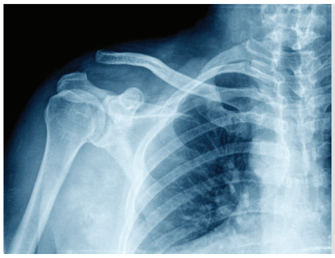
Sherwin S.W. Ho, MD has served as a consultant for Zimmer/Biomet and received grant support from Smith & Nephew, DJ Ortho, and Breg

Michael J. Lee, MD has served as a consultant for STRYKER Spine, DePuy Synthes Spine, and Globus Medical.

Lewis Shi, MD has served as a consultant for Depuy.

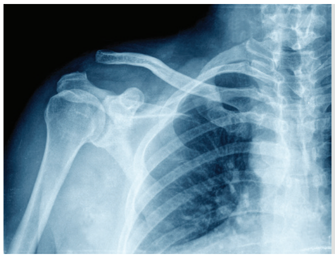
G. Scott Stacy, MD has no relevant financial relationships to disclose. Dr. Stacy will discuss the intra-articular injection of gadolinium contrast agents. Gadolinium contrast agents have not been approved for intra-articular injection by the Food and Drug Administration. Intra-articular administration of gadolinium contrast agents, therefore, represents an unapproved use of an approved drug. Intra-articular administration of gadolinium contrast agents is currently considered safe and FDA approval is not required for use on an individual patient.

The staff of the Center for Continuing Medical Education have no financial relationships to disclose.



DISCLAIMER

The views expressed in this activity are those of the individual speaker. It should not be inferred or assumed that they are expressing the views of any pharmaceutical or product/device manufacturer, provider of commercial services, or The University of Chicago. The drug selection and dosage information presented in this activity are believed to be accurate. However, participants are urged to consult the full prescribing information on any agent(s) presented in this activity for recommended dosage, indications, contraindications, warnings, precautions, and adverse effects before prescribing any medication. This is particularly important when a drug is new or infrequently prescribed.



CONFERENCE FACULTY

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Chairman, Department of Orthopaedic Surgery
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Focus: Physiatry

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Focus: Shoulder and Elbow

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Focus: Foot and Ankle

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Clinical Associate in Orthopaedic Surgery
Focus: Adult Joint Reconstruction

Jennifer Moriatis Wolf, MD
Professor of Orthopaedic Surgery
Focus: Hand Surgery

GUEST SPEAKERS

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Medical Director, Community and Sports Event Preparedness Management
Director of CCARES
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Carrie Jaworski, MD
Clinical Assistant Professor, Department of Family Medicine
Director of Primary Care Sports Medicine,
NorthShore University Health System

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and Pediatrics
Emergency Medicine Residency
Program Director Emeritus
Department of Medicine

Irsk Anderson, MD
Assistant Professor,
Section of General Internal Medicine

CONFERENCE AGENDA

WEDNESDAY, JUNE 5, 2019

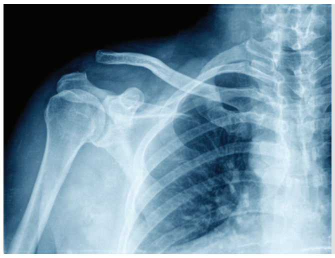
6:15 am	**REGISTRATION AND CONTINENTAL BREAKFAST**
7:00	**Welcome and Introduction** Sherwin S.W. Ho, MD
	SESSION 1: RADIOLOGY IN ORTHOPAEDICS
7:15	**Orthopaedic Radiology** G. Scott Stacy, MD
	SESSION 2: ORTHOPAEDIC TRAUMA
7:45	**Adult Lower Extremity Fractures** Jason A. Strelzow, MD, FRCSC
8:15	**Adult Upper Extremity Fractures** Jovito Angeles, MD
8:45	**Things Not To Miss** Rex Haydon, MD, PhD
9:15	**SPOTLIGHT LECTURE** **Is it Fractured or Broken?** Jason A. Strelzow, MD, FRCSC
9:45	**Q & A** G. Scott Stacy, MD, Jovito Angeles, MD, Rex Haydon, MD, PhD, and Jason A. Strelzow, MD, FRCSC
10:00	**REFRESHMENT BREAK**
	SESSION 3: ADULT SPINE
10:30	**Adult Cervical and Thoracic Spine** Michael J. Lee, MD
11:00	**Adult Lumbar Spine** Michael J. Lee, MD
	SESSION 4: FOOT AND ANKLE
11:30	**Adult Foot** Brian C. Toolan, MD
12:00 pm	**Adult Ankle** Kelly Hynes, MD
12:30	**Q & A** Michael J. Lee, MD, Brian C. Toolan, MD, and Kelly Hynes, MD
12:45	**LUNCH PROVIDED FOR AFTERNOON WORKSHOP ATTENDEES**
	CONCURRENT WORKSHOPS:
1:30-2:30	**A. Lower Extremity Splinting** Kelly Hynes, MD, Jason A. Strelzow, MD, FRCSC, and Brian C. Toolan, MD **B. Reading Orthopaedic X-Rays & MRIs** G. Scott Stacy, MD **C. Spine Exam** Michelle S. Gittler, MD, and Michael J. Lee, MD
2:30-3:30	**D. Foot and Ankle Exam** Kelly Hynes, MD, and Brian C. Toolan, MD **E. Reading Orthopaedic X-Rays & MRIs** G. Scott Stacy, MD **F. Spine Exam** Michelle S. Gittler, MD, and Michael J. Lee, MD
3:30-4:30	**G. Large Joint Injection** Sherwin S.W. Ho, MD **H. Foot and Ankle Exam** Kelly Hynes, MD and Brian C. Toolan, MD **I. Collaborative Care of the Pre-operative Patient** Kimberly Martin, DNP, APN-C
4:30	**ADJOURN**

THURSDAY, JUNE 6, 2019

6:45 am	**CONTINENTAL BREAKFAST**
	SESSION 5: ADULT HIP AND KNEE
7:45	**Degenerative Knee Problems** Tessa Balach, MD
8:15	**Degenerative Hip Problems** Sara Wallace, MD
8:45	**Q & A** Tessa Balach, MD, and Sara Wallace, MD
	SESSION 6: ADULT UPPER EXTREMITY
8:55	**Acute Hand and Wrist Injuries** Daniel Mass, MD
9:25	**Subacute & Chronic Hand/Wrist Problems** Daniel Mass, MD
9:55	**Lateral Elbow Pain: Tennis Elbow and Beyond** Jennifer Moriatis Wolf, MD
10:25	**Q & A** Daniel Mass, MD, and Jennifer Moriatis Wolf, MD
10:40	**REFRESHMENT BREAK**
	SESSION 7: PAIN MANAGEMENT AND THE NATIONAL OPIOID EPIDEMIC
11:10	**Adult Shoulder** Lewis Shi, MD
11:40	**SPOTLIGHT LECTURE** The Law of Unintended Consequences In Orthopaedic Surgery: The Next Big Opportunity for Us and Our Patients Douglas R. Dirschl, MD
12:10 pm	**Q & A** Lewis Shi, MD, and Douglas R. Dirschl, MD
12:25	**LUNCH PROVIDED FOR AFTERNOON WORKSHOP ATTENDEES**
	CONCURRENT WORKSHOPS:
1:30-2:30	**J. Shoulder Exam** Sherwin S.W. Ho, MD **K. Upper Extremity Splinting** Jennifer Moriatis Wolf, MD, and Lewis Shi, MD **L. Small Joint Injection** Daniel Mass, MD
2:30-3:30	**M. Shoulder Exam** Lewis Shi, MD, and Sherwin S.W. Ho, MD **N. Small Joint Injection** Daniel Mass, MD **O. Hand/Wrist Exam** Jennifer Moriatis Wolf, MD
3:30-4:30	**P. Rehab Techniques for Patients with FAI Syndrome & Labral Tears** Lindsey Plass, PT, DPT, OCS **Q. Large Joint Injection** Sherwin S.W. Ho, MD, and Lewis Shi, MD **R. Hand/Wrist Exam** Jennifer Moriatis Wolf, MD, and Daniel Mass, MD
4:30	**ADJOURN**

FRIDAY, JUNE 7, 2019

6:45 am	**CONTINENTAL BREAKFAST**
	SESSION 8: SPORTS MEDICINE
7:15	**Sports Shoulder Injuries** Sherwin S.W. Ho, MD
7:45	**Athlete's Hip** Sherwin S.W. Ho, MD
8:15	**Common Adult Sports Knee Injuries** Aravind Athiviraham, MD
8:45	**Q & A** Sherwin S.W. Ho, MD, and Aravind Athiviraham, MD
9:00	**Re-thinking our Approach to PT for the Complex Hip** Lindsey Plass, PT, DPT, OCS
9:30	**SPOTLIGHT LECTURE** **Importance of Emergency Action Plans in Sport** George Chiampas, DO, CAQSM, FACEP
10:00	**REFRESHMENT BREAK**
	SESSION 9: PEDIATRIC ORTHOPAEDICS
10:30	**Pediatric Sports Injuries** Carrie Jaworski, MD
11:00	**Developmental Disorders of the Hip** Robert Bielski, MD
11:30	**Pediatric Bone and Joint Infections** Robert Bielski, MD
12:00 pm	**Developmental Lower Extremity Problems** Christopher M. Sullivan, MD, MPH
12:30	**Pediatric Spinal Deformity and Infections** Christopher M. Sullivan, MD, MPH
1:00	**Q & A** Carrie Jaworski, MD, Robert Bielski, MD, and Christopher M. Sullivan, MD, MPH
1:15	**LUNCH PROVIDED FOR AFTERNOON WORKSHOP ATTENDEES**
	CONCURRENT WORKSHOPS:
2:00-3:00	**S. Knee Exam** Aravind Athiviraham, MD, and Carrie Jaworski, MD **T. Hip Exam** Sherwin S.W. Ho, MD
3:00-4:00	**U. Knee Exam** Aravind Athiviraham, MD, and Carrie Jaworski, MD **V. Hip Exam** Sherwin S.W. Ho, MD
4:00	**CONFERENCE ADJOURNED**



Orthopaedic Radiology

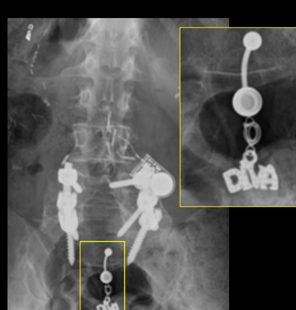
G. Scott Stacy, M.D.
University of Chicago Medicine
Department of Radiology
June 5th, 2019

Disclosure Information
25th Annual Primary Care Orthopaedics
G. Scott Stacy, MD

- I have no financial arrangements to disclose.
- I will discuss the following off label use in my presentation:
  - I plan to discuss the intra-articular injection of gadolinium contrast agents. Gadolinium contrast agents have not been approved for intra-articular injection by the Food and Drug Administration. Intra-articular administration of gadolinium contrast agents, therefore, represents an unapproved use of an approved drug. Intra-articular administration of gadolinium contrast agents is currently considered safe and FDA approval is not required for use on an individual patient.

Radiographs

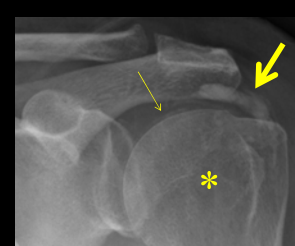
- 5 basic densities:
  - Metal
  - Calcification
  - Soft tissue & fluid
  - Fat
  - Gas



AP Lumbar Spine

Radiographs

- 5 basic densities:
  - Metal
  - Calcification
  - Soft tissue & fluid
  - Fat
  - Gas



AP Shoulder

Radiographs

- 5 basic densities:
  - Metal
  - Calcification
  - Soft tissue & fluid
  - Fat
  - Gas

Lateral Ankle

Radiographs

- 5 basic densities:
  - Metal
  - Calcification
  - Soft tissue & fluid
  - Fat
  - Gas

Lateral Ankle

Radiographs

- 5 basic densities:
  - Metal
  - Calcification
  - Soft tissue & fluid
  - Fat
  - Gas

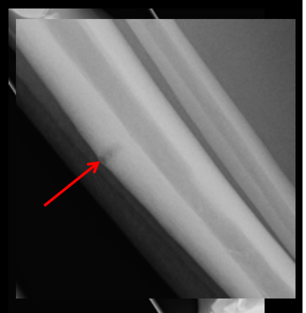
Lateral Femur

General Suggestions for Ordering Radiographs:

- In general, radiographs should be ordered before other (more expensive) tests
  - May be sufficient for demonstrating pathology
  - May show pathology better than other modalities
  - This recommendation has been recently challenged for certain clinical scenarios (e.g., suspected knee internal derangement in young patients)
- In general at least 2 views should be ordered, with few exceptions (e.g., pelvis, hand for bone age), but proper evaluation of certain bones/structures may require *more* than 2 views

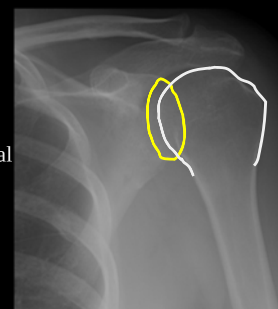
Minimum of 2 Views Appropriate for…

- Long bones:
  - Arm, forearm, thigh, leg
- "Proximal" joints:
  - Shoulder
    (scapula, clavicle, AC joint)
  - Hip
- "Middle" joints:
  - Elbow
  - Knee (patella)



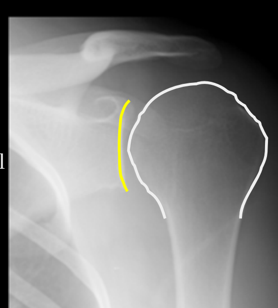
Shoulder

- AP view
  - Neutral
  - Grashey
- Additional view
  - Trans-scapular "Y" lateral
  - Axillary view



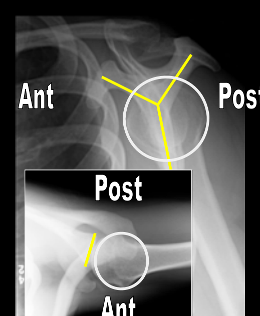
Shoulder

- AP view
  - Neutral
  - Grashey
- Additional view
  - Trans-scapular "Y" lateral
  - Axillary view



Shoulder

- AP view
  - Neutral
  - Grashey
- Additional view
  - Trans-scapular "Y" lateral
  - Axillary view



Hip

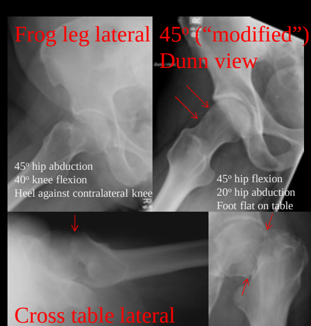
- AP view
  - Hip
  - Entire pelvis (for comparison of the hips)
- Lateral view of symptomatic hip

Hip

- AP view
  - Hip
  - Entire pelvis (for comparison of the hips)
- Lateral view of symptomatic hip

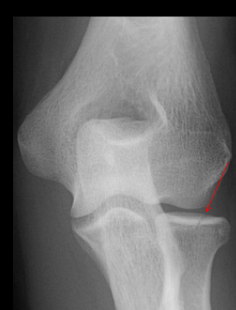
Hip

- AP view
  - Hip
  - Entire pelvis (for comparison of the hips)
- Lateral view of symptomatic hip



Elbow

- AP
- Lateral

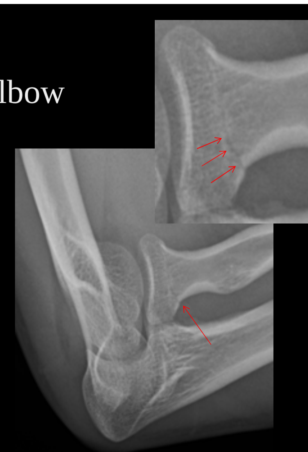


Elbow

- AP
- Lateral

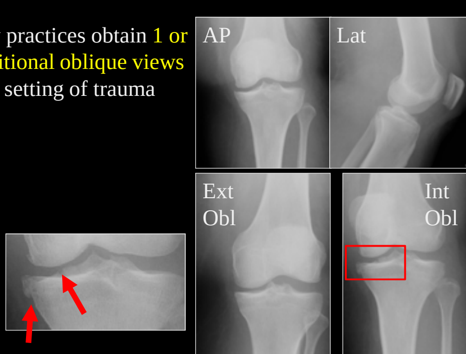
Elbow

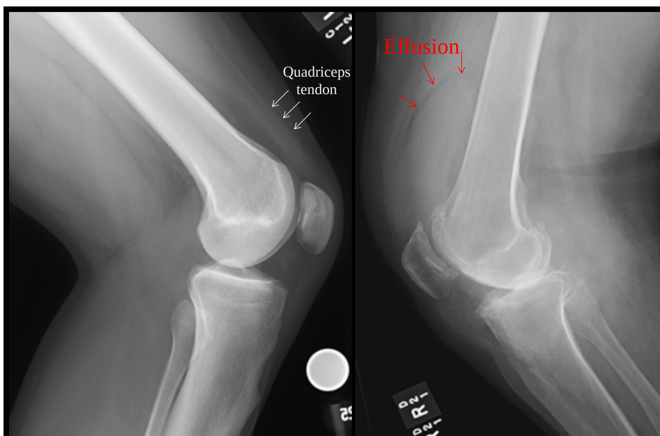
- AP
- Lateral
- Radial head view for trauma patients

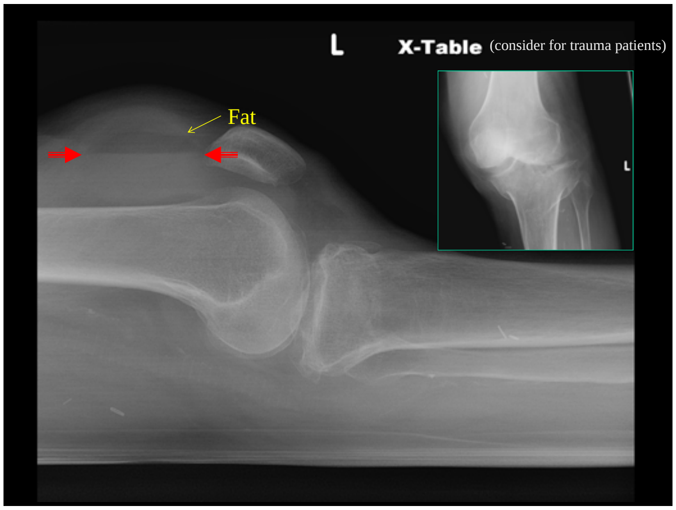


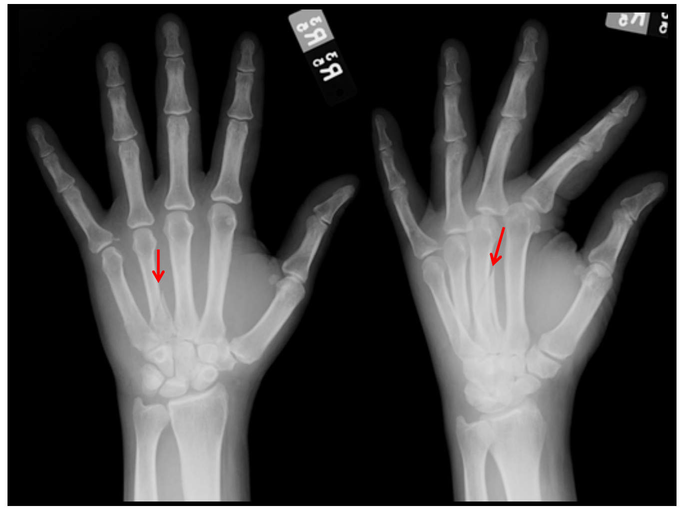
Elbow & Knee

- Many practices obtain 1 or 2 additional oblique views in the setting of trauma









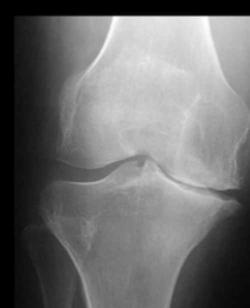
3 Views (Frontal, Lateral, & 1 Oblique) Are Appropriate For…

- The distal extremities
  - Fingers, hands, wrists
  - Toes, feet, and ankles

Oblique View of Foot

Weight-bearing Views

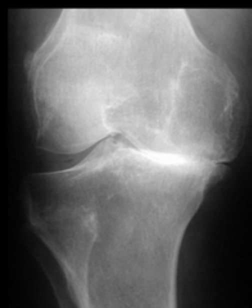
- Weight-bearing views are appropriate in certain circumstances to evaluate
  - Alignment
  - Osteoarthritis
  - Scoliosis



Non-Weight-Bearing

Weight-bearing Views

- Weight-bearing views are appropriate in certain circumstances to evaluate
  - Alignment
  - Osteoarthritis
  - Scoliosis



Weight-Bearing

What About the Spine?

- Cervical spine:
  - Routine exam: lateral, AP, & open-mouth odontoid view (for dens)
  - Optional:
    - Oblique views – for pedicles and neural foramina
    - Flexion/extension views – for instability

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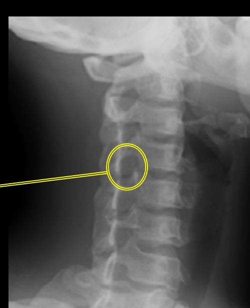

What About the Spine?

- Lumbar spine:
  - Standard exam: AP/lat
  - Optional:
    - Coned lateral view for L/S junction
    - Oblique views for “Scottie dogs” & facet joints
    - Flex/ext views for abnormal motion

What About the Spine?

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    - Oblique views for “Scottie dogs” & facet joints
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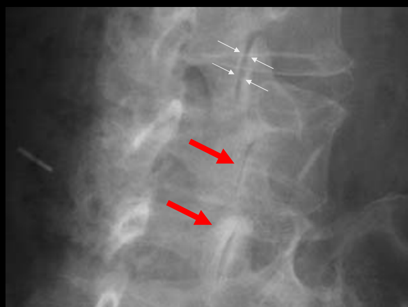
Spondylolysis

- Defect (fracture) of the pars interarticularis (neck of Scottie dog) between articular facets
- Typically occurs in adolescents
- Usually due to chronic stresses (seen in gymnasts, dancers, springboard divers)

Facet Joint Osteoarthritis



Computed Tomography

- X-ray tube and detectors rotate in relationship to the patient
- Computer-assisted reconstructions of body tissues are displayed as thin “slices”

Computed Tomography

- Advantages over conventional radiography:
  - Presents internal structures without superimposition of overlying anatomy
  - Differences in tissue types can be delineated

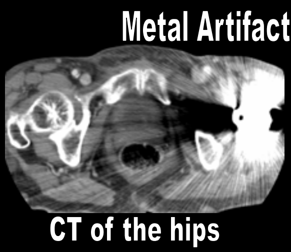
Other Practical Applications of Computed Tomography

- Useful for evaluating:
  - Cortical bone (e.g., for thin fracture lines, cortical destruction)
  - Complex fractures
  - Anatomy of complex joints / joint alignment
  - Loose bodies in joint
  - Tumors that are mineralized or arise in flat bones

Ankle CT, sagittal reformat

Computed Tomography

- Disadvantages:
  - Cost
  - Metal / motion artifacts (less of an issue with newer scanners)
  - Cannot detect subtle marrow or soft tissue pathology
  - Ionizing radiation (2-10 mSv); limit use in kids



When Should A CT Scan Be Ordered (Following Radiographs)?

- To <u>confirm a fracture</u> not seen on radiographs (EXCEPTIONS: MRI is preferred to exclude 'occult' fractures of the proximal femur)
- To evaluate the degree of <u>displacement of fracture</u> fragments or the <u>extent of complex fractures</u>
- To confirm a <u>stress fracture of the sacrum</u> (sacral stress fractures mimic neoplasms on MRI and sometimes on bone scan)

When Should A CT Scan Be Ordered (Following Radiographs)?

- To confirm <u>intra-articular loose bodies</u>
- To analyze some <u>bony deformities</u> (e.g., tarsal coalition)
- To analyze <u>cortically-based lesions</u> (e.g., osteoid osteoma)
- To confirm <u>calcification</u> in bone or soft tissue masses
- To analyze lesions in <u>flat bones</u> (e.g., scapula, sternum) or in soft tissues of chest/abdominal wall (better detail / less motion artifact than MRI)

When Should A CT Scan Be Ordered WITHOUT RADIOGRAPHS?

- Suspected acute cervical spine trauma in patients who do NOT satisfy "low risk" criteria (e.g., NEXUS, Canadian C-Spine Rules) for cervical spine injury
  - Should include sagittal and coronal reformatted images
  - CT (not radiography) should be the primary screening study in adults and older children (age 16 years and older)
  - Time-effective and cost-effective

Canadian C-Spine Rules for NO IMAGING

- Absence of high-risk factors
  - Age >65 years
  - Dangerous mechanism (fall >3ft, high speed MVC…)
  - Paresthesias in extremities
- Low-risk factors which allow safe assessment of ROM
  - Simple rear end MVC
  - Sitting position in ED
  - Ambulatory at any time
  - Delayed onset of neck pain
  - Absence of midline cervical tenderness

NEXUS Criteria (Low Risk)

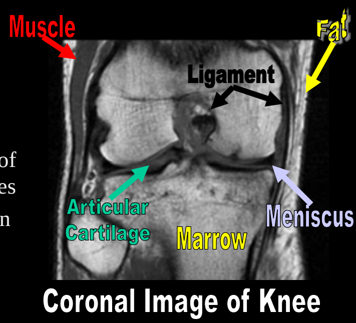
- No midline cervical tenderness
- No focal neurologic deficits
- No intoxication or indication of brain injury
- No painful distracting injuries
- Normal alertness

Magnetic Resonance Imaging

- Uses magnetic fields and radiofrequency pulses to obtain a reconstructed image
- Contrast between different tissues is due to the number of protons in the tissues and the rate at which they recover from stimulation by a radio pulse in the presence of a magnetic field

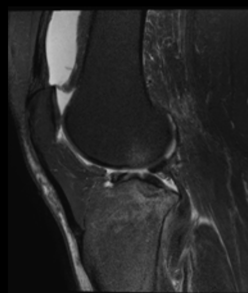
Magnetic Resonance Imaging

- Advantages
  - Excellent soft tissue contrast resolution
  - Excellent depiction of marrow abnormalities
  - No ionizing radiation



Magnetic Resonance Imaging

- Useful for evaluating
  - Marrow edema/lesions
  - Cartilage (+/- intraarticular contrast)
  - Tendons, ligaments, muscles
  - Determining extent of bone and soft tissue tumors/infection



Sagittal image of knee

Magnetic Resonance

- Disadvantages
  - Poor cortical detail
  - Cost
  - Motion / metal artifacts
  - Long exam
  - Some patients contraindicated (e.g., those with pacemakers, aneurysm clips, claustrophobia, etc.)

Sagittal Image of Ankle

MRI – Magnetic Field Strengths

- Magnetic field strengths:
  - Low (0.1 – 0.5T)
  - Medium (0.5 – 1.0T)
  - High (1.5 T)
  - Ultrahigh (3.0T or greater)

  Field strength definitions "blurry"
- "Open" MRI (lower field strengths):
  - Reduced signal, fat suppression
  - BUT reduced claustrophobia, artifacts

When Should An MRI Examination Be Ordered (Following Radiographs)?

- To evaluate soft tissue structures such as:
  - Ligaments, tendons, & muscles
  - Cartilage (articular cartilage, meniscus, glenoid/acetabular labrum)
  - Spinal cord in cases of neuropraxia or neurologic deficit following injury, potential ligamentous injury (no established criteria for distinguishing significant from inconsequential abnormalities), or for chronic spine pain (disc disease)
  - Soft tissue masses (detection & follow-up)
  - Certain joint processes (arthritis)

When Should An MRI Examination Be Ordered (Following Radiographs)?

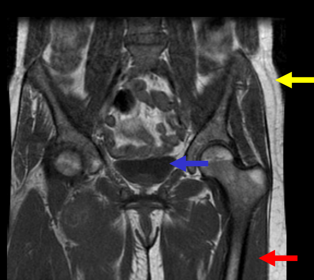
- To evaluate bone marrow, e.g.:
  - To confirm or exclude a fracture (especially of the proximal femur > scaphoid, distal radius)
  - To confirm, evaluate or follow extent of marrow abnormalities (e.g., stress fracture, bone contusion, infection or tumor)
  - To search for osteochondral defects or other osseous causes of chronic pain
  - To confirm osteonecrosis if radiographs are normal or equivocal
  - To rule out bone metastases in pregnant patients

MRI F.A.Q.s

- Q: What is the difference between T1 and T2-weighted images?
- A1: Very very complex physics
- A2: T1-weighted images and T2-weighted images emphasize the brightness of different tissues

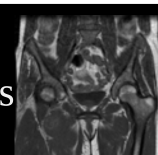
T1-Weighted Images

- Fat is brighter than muscle and fluid
- Good for anatomy, not sensitive for pathology

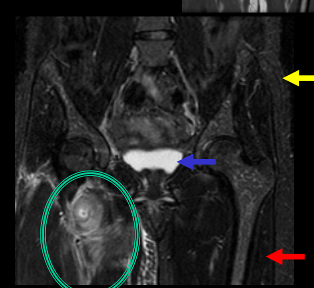


Pelvis, Coronal

T2-Weighted Images



- Fluid is brighter than soft tissue (especially if the image is "fat suppressed" which intentionally makes fatty tissue dark in an effort to emphasize pathology)
- Pathology (trauma, tumor, infection, etc) → edema
- Edema is bright (fluid)
- Sensitive for pathology



Pelvis, Coronal

On Both T1- AND T2-Weighted Images…

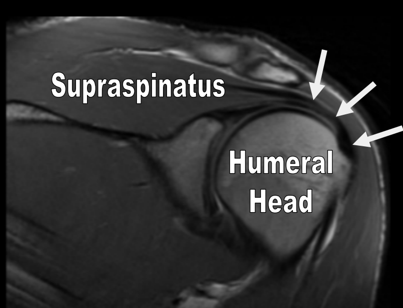
- Structures that are normally dark are:
  - Cortex of bone
  - Tendons
  - Ligaments
  - Fibrocartilage: menisci & labra
- Increased signal (i.e., "brightness") in these structures is usually bad

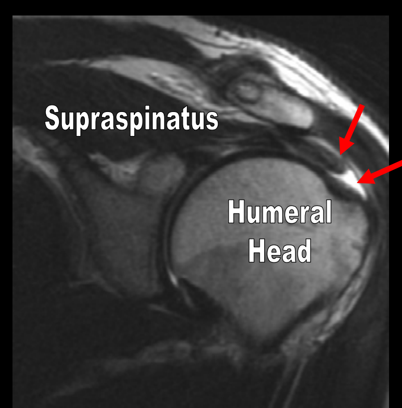
Sagittal Image of Knee

A Soft-Tissue Abnormality Should Be Suspected If You See…

- Abnormal signal (brightness) within a structure that should be dark (typically seen with meniscal tears or partial thickness tendon tears)
- Discontinuity of a structure (typically seen with full-thickness tendon tears)
- Abnormal thickness of a structure (often seen with partial tendon tears or degenerative tendinosis)
- Non-visualization of a structure (often seen with ligament tears)

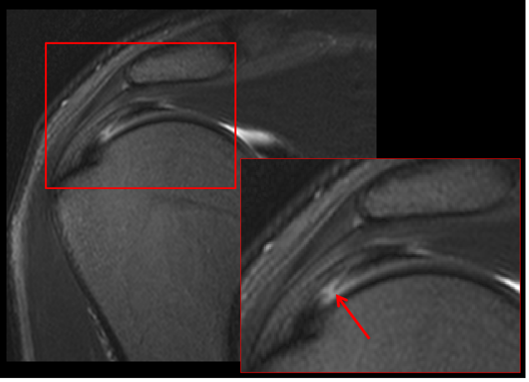
Normal Supraspinatus – ***Coronal*** Oblique Image





T2-weighted image

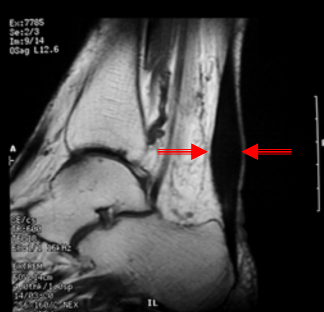
Partial Thickness Rotator Cuff Tear



Normal Achilles Tendon

Sagittal Image of Ankle

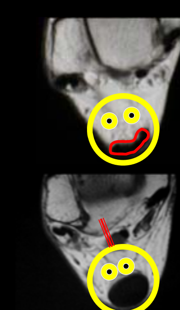
Achilles Tendinosis

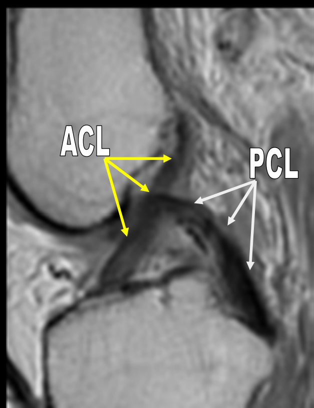


Sagittal Image of Ankle

Achilles Tendinosis - MRI

- Transverse plane:
  - Normal Achilles tendon: concave or flat anterior border
  - Abnormal Achilles tendon: convex anterior border





Sagittal Image of Knee

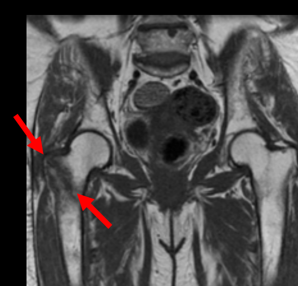
Sagittal Image of Knee

Bone on MRI

- Cortex is always dark
- Marrow is usually similar in brightness to subcutaneous fat (marrow is predominantly fatty in adults)
  - Bright on T1
  - Intermediate (not as bright as fluid) on T2
  - Dark on "fat suppressed" images

Abnormal Marrow

- Becomes dark on T1-weighted images
- Becomes bright on T2-weighted images, especially if fat suppressed



Coronal Image of Hips

Causes of Abnormal Marrow Signal

- Trauma
  - Fractures, stress fractures
  - “Bone bruises” - “microfractures” where bone hits bone (e.g., posterolateral tibia hits lateral femoral condyle during an ACL tear)
- Osteonecrosis
- Osteomyelitis
- Tumor
- Other causes (red marrow, reactive marrow)

MRI F.A.Q.s

- Q: Do I (the referring clinician) have to specify which images I want?
- A: No. The radiologist does that (for MRI and CT).
- BUT… The images that the radiologist selects will depend on the history that is given and the pathology suspected (e.g., some MRI protocols designed to look for injuries are NOT designed to evaluate tumors or osteomyelitis)

MRI F.A.Q.s

- Q: When should I (the referring clinician) order an MRI (or CT) examination with intravenous contrast?
- A: For injury, rarely
- A: To evaluate suspected tumor, infection
- *If uncertain, ask your radiologist!*
- *Identify patients at risk for renal function impairment (history of renal disease, diabetes mellitus, hypertension requiring medical therapy, age > 60); avoid Gd if eGFR <30 ml/min/1.73m²*

MRI F.A.Q.s

- Q: When should I (the referring clinician) order an MRI (or CT) examination with intra-articular contrast?
- A: When you want to evaluate very small intra-articular structures (e.g., the glenoid or acetabular labrum, intrinsic wrist ligaments)
- A: Usually ordered by orthopaedic surgeon or sports-medicine physician

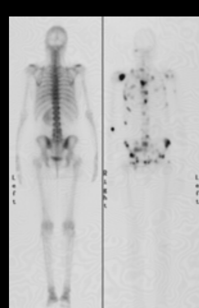
T1-weighted image of the shoulder after intra-articular contrast injection

Bone Scan

- Radiopharmaceutical ("tracer") is injected intravenously and absorbed by bone
- Tracer emits gamma radiation that is measured by a scintillation camera

Bone Scan

- Advantages:
  - Very sensitive for detecting bone pathology that results in changes in regional blood flow to bone or in osteoblastic activity
  - Ability to image entire skeleton



Bone Scan

- Useful for evaluating:
  - Metastases
  - Reflex sympathetic dystrophy
  - "Occult" trauma
    - Stress fracture*
    - Shin / thigh splints*
  - Osteomyelitis not seen on radiographs*

**MRI often preferred*

Lateral views of the legs

Bone Scan

- Disadvantages
  - Imaging 2-4 hours after injection of tracer
  - Only grossly localizes abnormality
  - Not specific
  - Additional imaging often needed
  - Physes in children are normally “hot” and may obscure pathology
  - Ionizing radiation: 2-6 mSv

Ultrasonography

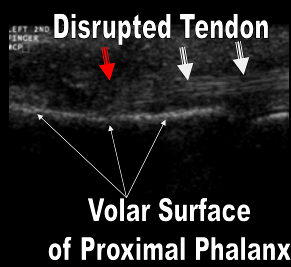
- Uses high frequency sound waves to produce images
- Images are produced by recording reflections (echoes) of ultrasonic waves directed into the body

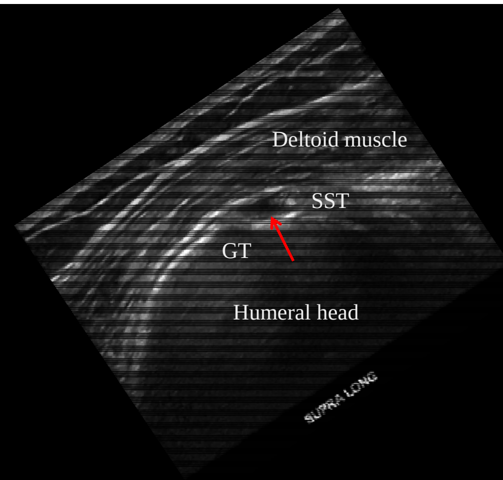
Ultrasonography

- Advantages
  - “Real-time” dynamic evaluation of joint structures
  - Easy comparison with opposite (normal) side
  - No ionizing radiation
  - Relatively portable
  - Relatively inexpensive (compared to CT, MR)
- Disadvantages
  - Operator dependent
  - Bone not well visualized (barrier to sound waves)

When Should An Ultrasound Examination Be Ordered?

- To evaluate some tendons: rotator cuff, ankle, etc.
- To evaluate intra-articular and peri-articular fluid collections & masses (e.g., popliteal cyst versus aneurysm)
- To evaluate the infant hip (to confirm or exclude developmental dysplasia, between 2wks & 6mos)





Final Thoughts…

- Although there are numerous imaging modalities, each of which may provide valuable information to the clinician, a good history and physical examination remain the cornerstones of accurate diagnosis
- Conventional radiographs should be ordered before other (more expensive) tests, with few exceptions
- If additional imaging is necessary, use your friendly radiologist as a consult to determine which test is best for your patient
- Supply your friendly radiologist with pertinent clinical history, or even a differential diagnosis

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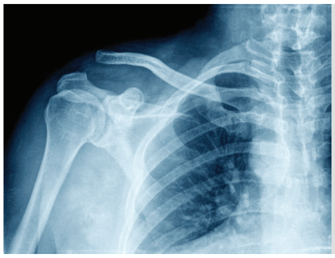


Adult Upper Extremity Fractures

Jovito Angeles, MD

ADULT UPPER EXTREMITY FRACTURES

Jovy G. Angeles, M.D.
Assistant Professor
Upper Extremity & Microvascular Surgery
Department of Orthopaedic Surgery & Rehabilitation Medicine

- I have not received financial support
- I will not discuss off label drug use nor investigational use in my presentation

LEARNING OBJECTIVES

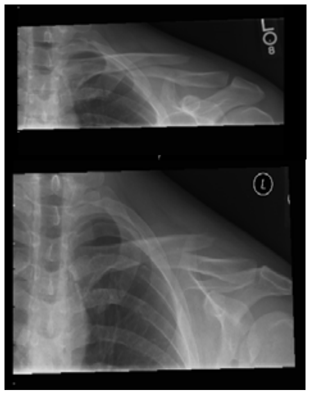
At the end of this session, participants will
1. Be familiar with the most common patterns and clinical presentation of upper extremity fractures
2. Know the typical physical exam findings of common UE fracture
3. Know the appropriate radiographic and imaging studies for diagnosing common UE fractures
4. Know when surgical or non-surgical treatment is appropriate for a given UE fracture

OVERVIEW OF UPPER EXTREMITY FRACTURES

- Clavicle
- Shoulder
- Humerus
- Elbow
- Forearm
- Distal Radius

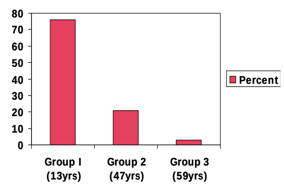
Clavicle Fractures

- Epidemiology
  - 2.6% - 12% of all fractures
  - 44% - 66% of fractures about the shoulder
  - 80% occur at middle 3rd of clavicle
- Anatomy
  - Ossifies at 5th wk gestation, l
  - Last to fuse at 22 – 25 years
  - Middle 3rd → vulnerable to fracture
  - Medial 3rd protects neurovascular structures and lung
  - Distal 3rd have attachments to the coracoclavicular ligaments



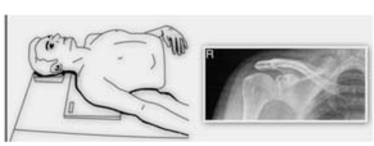
Clavicle Fractures

- Mechanism
  - Fall onto shoulder (87%)
  - Direct blow (7%)
  - Fall onto outstretched hand (6%)
- Trimodal distribution



Clavicle Fractures

- Clinical Evaluation
  - Inspect,palpate for deformity/abnormal motion
  - Thorough neurovascular exam
  - Auscultate the chest for signs of lung injury/pneumothorax
- Radiographic Exam
  - AP chest radiographs.
  - Clavicular 45deg A/P oblique view
  - Traction views may be used as well

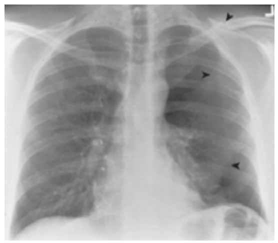


Clavicle Fractures

- Classification of Clavicle Fractures
  - Type I: Middle Third (80%)
  - Type II: Distal Third (15%)
  - Type III: Medial Third (5%)

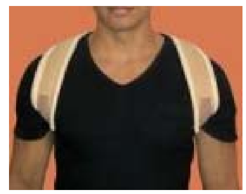
Clavicle Fracture

- Associated Injuries
  - Up to 9% of patients
  - Brachial Plexus Injuries
    - » Traction more common
    - » Penetrating (rare)
  - Vascular Injury
  - Rib Fractures
  - Scapula Fractures
  - Pneumothorax



Clavicle Fracture

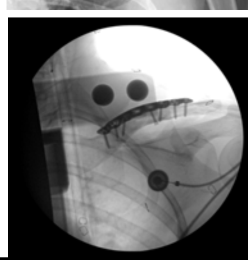
- Closed Treatment
  - Sling immobilization for usually 3-4 weeks with early ROM encouraged
  - Heals in 4-6 weeks



Clavicle Fracture

Operative intervention
- Fractures with neurovascular injury
- Fractures with severe associated chest injuries
- Open fractures
- Group II, type II fractures
- Nonunion

Operative treatment Outcomes
- *Altamini, et al (J Bone Joint Surg-Am, 2008)*
- Multicenter, prospective RCT comparing ORIF (67 px) vs. non-surgical tx (65 px)
- Operative group had
  - Faster union
  - Less malunion
  - Better functional scores
  - Better satisfaction rating
  - Hardware related complications (9 px's)



Shoulder Dislocations

Shoulder Dislocations

- Epidemiology
  - Anterior: Most common
  - Posterior:
    - » May have no obvious deformity
    - » Uncommon, 10%,
    - » May occur in Electrocutions & Seizures
  - Inferior (Luxatio Erecta): Rare, hyperabduction injury
- Clinical Evaluation
  - Examine Axillary nerve (deltoid function, no sensation over lateral shoulder)
  - Examine Musculocutaneous nerve (biceps function and anterolateral forearm sensation)

Shoulder Dislocations

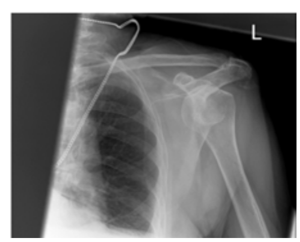
- Radiographic Evaluation
  - True AP shoulder
  - Axillary
  - Scapular Y
  - Stryker Notch View (Bony Bankart)

Shoulder Dislocations

- Anterior Dislocation Recurrence Rate
  - Age 20: 80-92%
  - Age 30: 60%
  - > Age 40: 10-15%
- Look for Concomitant Injuries
  - Bony: Bankart, Hill-Sachs Lesion, Glenoid Fracture, Greater Tuberosity Fracture
  - Soft Tissue: Subscapularis Tear, Rotator Cuff Tear (older pts with dislocation)
  - Vascular: Axillary artery injury (older pts with atherosclerosis)
  - Nerve: Axillary nerve, Brachial plexus

Shoulder Dislocations

- Anterior Dislocation
  - Traumatic
  - Atraumatic (Congenital Laxity)
  - Acquired (Repeated Microtrauma)

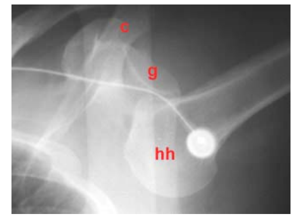


Shoulder Dislocations

- Posterior Dislocation
  - Adduction/Flexion/IR at time of injury
  - Electrocution and Seizures→overpull of subscapularis and latissimus dorsi
  - Reduce with traction and gentle anterior translation

Shoulder Dislocations

- Inferior Dislocations
  Luxatio Erecta
  - Hyperabduction injury
  - Arm presents in a flexed posture
  - High rate of nerve and vascular injury
  - Reduce with in-line traction and gentle adduction

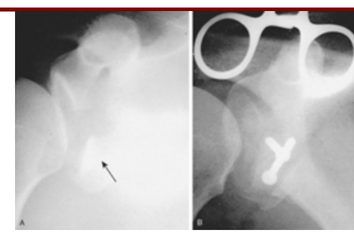


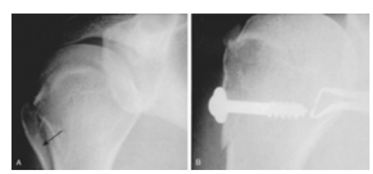
Shoulder Dislocation

- Treatment
  - Nonoperative treatment
    - » Closed reduction should be performed after adequate clinical evaluation and appropriate sedation
  - Reduction Techniques:
    - » Traction/countertraction
    - » Hippocratic technique
    - » Stimson technique
    - » Milch Technique
    - » Scapular manipulation

Shoulder Dislocations

- Postreduction
  - Post reduction films are a must to confirm the position of the humeral head
  - Pain control
  - Immobilization for 7-10 days then begin progressive ROM
- Operative Indications
  - Irreducible shoulder (soft tissue interposition)
  - Displaced greater tuberosity fractures
  - Glenoid rim fractures bigger than 5 mm
  - Elective repair for younger patients

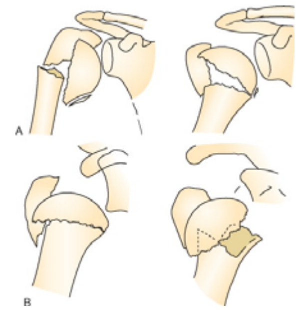




Proximal Humerus Fractures

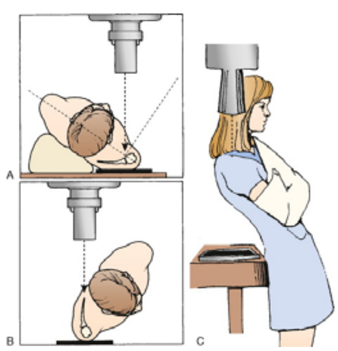
Proximal Humerus Fractures

- Epidemiology
  - Most common fracture of the humerus
  - Higher incidence in the elderly, thought to be related to osteoporosis
  - Females 2:1 greater incidence than males
- Mechanism of Injury
  - Most commonly a fall onto an outstretched arm from standing height
  - Younger patient typically present after high energy trauma such as MVA



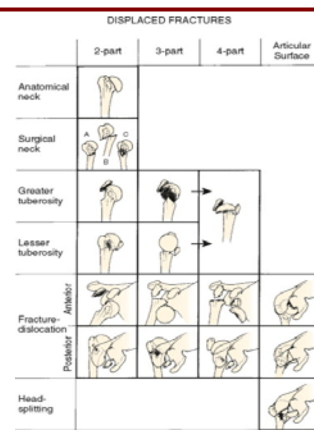
Proximal Humerus Fractures

- Clinical Evaluation
  - Patients typically present with arm held close to chest by contralateral hand
  - Pain and crepitus elicited on palpation
  - Careful neuro exam focusing on Axillary Nerve
- Radiographs
  - May need Shoulder focused and Full Humerus views



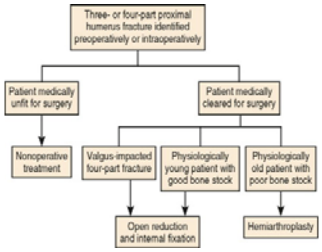
Proximal Humerus Fractures

- Neer Classification
  - Four parts
    - » Greater and lesser tuberosities,
    - » Humeral shaft
    - » Humeral head
  - A part is displaced if >1 cm displacement or >45 degrees of angulation is seen

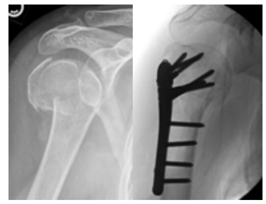


Proximal Humerus Fractures

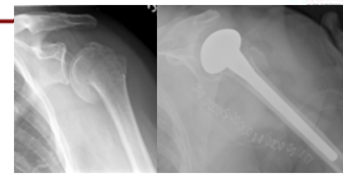
- Treatment
  - Minimally displaced fractures
    - » Sling immobilization, early motion
  - Two-part fractures-
    - » Anatomic neck fractures
      - Likely require ORIF
      - High incidence of osteonecrosis
    - » Surgical neck fractures
      - Non-surgical if stable
      - ORIF if displaced
  - Three-part fractures
    - » Unstable (muscle forces)
    - » Displaced fx → ORIF
  - Four-part fractures
    - » Displaced or unstable→ ORIF or hemiarthroplasty
    - » High rate of Avascular Necrosis (13-34%)



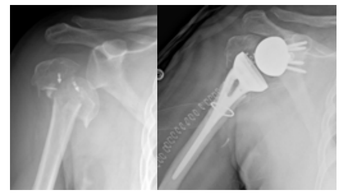
Proximal Humerus Fractures



PLATES & SCREWS



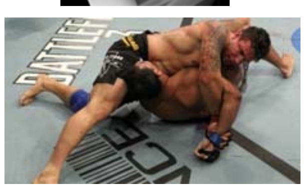
HEMIARTHROPLASTY



REVERSE TOTAL SHOULDER ARTHROPLASTY

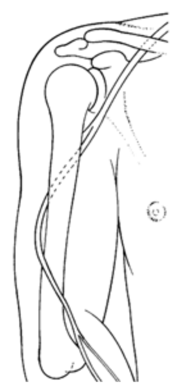
Humeral Shaft Fractures

- Mechanism of Injury
  - Direct trauma - MVA
  - Indirect trauma - fall on an outstretched hand
  - Fracture pattern
    - » Compressive- proximal or distal humerus
    - » Bending- transverse shaft
    - » Torsional- spiral shaft
    - » Torsion and bending- oblique with a butterfly fragment



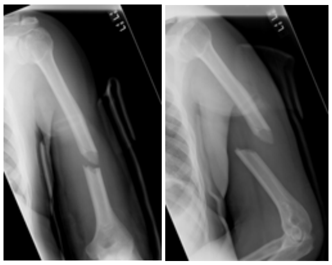
Humeral Shaft Fractures

- Clinical evaluation
  - History and PE
  - Presentation: Pain, Swelling, Deformity, Limitation of Motion
  - Neurovascular evaluation- Radial Nerve



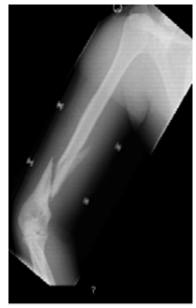
Humeral Shaft Fractures

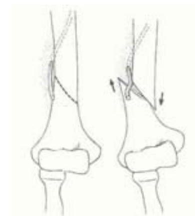
- Radiographic evaluation
  - AP and lateral views of the humerus
  - Traction radiographs - for hard to classify secondary to severe displacement or a lot of comminution



Humeral Shaft Fractures

- Holstein-Lewis Fractures
  - Distal 1/3 fractures
  - May entrap or lacerate radial nerve as the fracture passes through the intermuscular septum

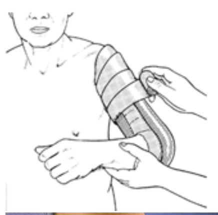




Holstein-Lewis fracture.
Reproduced by permission from A Holstein and GB Lewis, *Journal of Bone and Joint Surgery* 45A:1382, 1963.

Humeral Shaft Fractures

- Conservative Treatment
  - Establish union with acceptable alignment
  - >90% of humeral shaft fractures heal with nonsurgical management
  - Acceptable alignment
    - » 20 - 45 degrees of anterior angulation, 30 degrees of varus angulation 3 - 5 cm of shortening
  - May use coaptation splint, functional brace or hanging arm cast
  - Periodic follow up xrays to monitor alignment
  - Healing time: 6-8 weeks



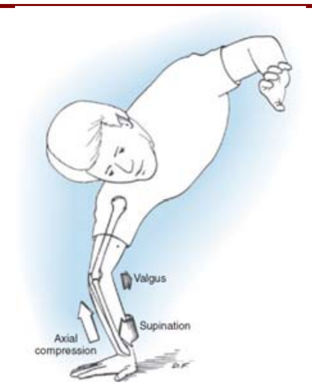
Humeral Shaft Fractures

- Treatment
  - Operative Treatment
    - » Indications
      - inadequate reduction
      - nonunion,
      - associated injuries
      - open fractures,
      - segmental fractures,
      - associated vascular
      - nerve injuries
    - » Implants used
      - Plates and screws
      - Intramedullary nails
      - External fixators

Elbow Fracture/Dislocations

Elbow Dislocations

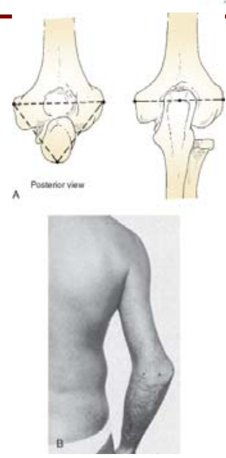
- Epidemiology
  - 11% - 28% of injuries to the elbow
  - Posterior dislocations most common
  - Highest incidence in the young 10-20 years and usually sports injuries
- Mechanism of injury
  - Fall on outstretched hand or elbow resulting in force to unlock the olecranon from the trochlea
  - Posterior dislocation following hyperextension, valgus stress, arm abduction, and forearm supination
  - Anterior dislocation from direct force to the posterior forearm with elbow flexed



(Redrawn from O'Driscoll, S. W., Morrey, B. F., and Korinek, S., and An, K. N.: Elbow subluxation and dislocation: A spectrum of instability. Clin. Orthop. Relat. Res. 280:186, 1992.)

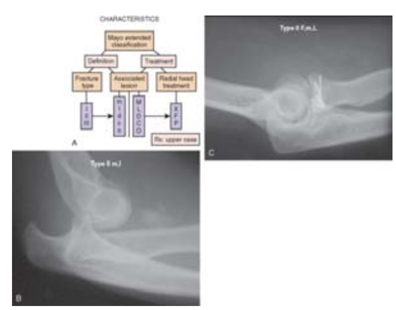
Elbow Dislocations

- Clinical Evaluation
  - Patients present guarding the injured extremity
  - Gross deformity and swelling
  - Careful NV exam in important and should be done prior to radiographs or manipulation
  - Repeat after reduction
- Radiographic Evaluation
  - AP and lateral elbow films should be obtained both pre and post reduction
  - Careful examination for associated fractures



Elbow Dislocations

- Associated injuries
  - Radial head fx (5-11%)
  - Treatment
    - » Stable, undisplaced-
      - Conservative
    - » Unstable, displaced
      - Attempt ORIF vs. radial head replacement



A suffix m is used if a medial collateral ligament injury is suspected or proven, but this has questionable impact on elbow stability. A capital M is used if there is an impact on stability, enough to warrant treatment. For lateral ligament injuries, l and L is used respectively. The same is done to document associated fractures to the ulna (U, u) or humerus (H, h). The suffix P is used to indicate that some sort of procedure was performed (Fig. 24-7); x for excision and F for ORIF.

Elbow Dislocations

- Associated injuries
  - Coronoid process fractures (5-10%)

Elbow Dislocations

- Associated injuries
  - Medial or lateral epicondylar fx (12-34%)

Elbow Fracture/Dislocations

- Treatment
  - Posterior Dislocation
    - » Closed reduction under sedation
    - » Reduction:
      - Elbow flexed while providing distal traction
    - » Post reduction management
      - Posterior splint with the elbow at 90 degrees
    - » Open reduction for severe soft tissue injuries or bony entrapment
  - Anterior Dislocation
    - » Closed reduction under sedation
    - » Reduction:
      - Distal traction to the flexed forearm
      - Dorsally direct pressure on the volar forearm
      - Anterior pressure on the humerus

Elbow Fracture/Dislocations

- Healing Time
  - 6 weeks
  - Immobilize for ~ 2 weeks then start ROM's

Forearm Fractures

Forearm Fractures

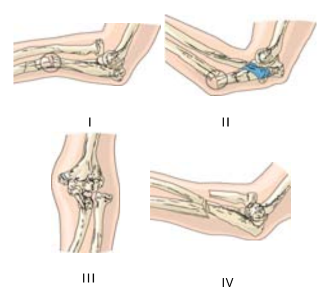
- Epidemiology
  - Highest ratio of open to closed than any other fracture except the tibia
  - More common in males than females, most likely secondary mva, contact sports, altercations, and falls
- Mechanism of Injury
  - Commonly associated with direct trauma, missile projectiles, bending or torsion force

Forearm Fractures

- Clinical Evaluation
  - PE: gross deformity pain, swelling, and loss of function at the hand/wrist
  - Evaluate radial, median, ulnar nerve functions
  - Evaluate radial, ulnar nerve pulses
  - Tense compartments, unrelenting pain, and pain with passive flexion/extension of digits →suspicion for compartment syndrome
- Radiographic Evaluation
  - AP and lateral radiographs of the forearm
  - Always evaluate the joint above and below

Forearm Fractures

- Ulna Fractures (Associated Injury)
  - These include nightstick and Monteggia fractures
  - Monteggia denotes a fracture of the proximal ulna with an associated radial head dislocation



Forearm Fractures

- Associated Injuries
  - Galeazzi fracture – distal radius fracture with distal radioulnar joint disruption
  - Reverse Galeazzi -fracture of the distal ulna with disruption of radioulnar joint
- Mechanism
  - Usually by direct or indirect trauma, such as fall onto outstretched hand
  - Galeazzi fractures -from direct trauma to the wrist or fall onto outstretched hand with pronation
  - Reverse Galeazzi results from fall with hand in supination

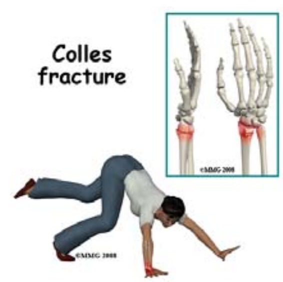
Forearm Fractures

- Treatment
  - Nondisplaced Fractures
    - » May be treated with long arm cast
    - » Will require frequent follow up with xrays
  - Displaced Fractures
    - » Treatment of choice: ORIF with plates and screws
- Healing time
  - 6 weeks

Distal Radius Fractures

Distal Radius Fractures

- Epidemiology
  - Most common fracture of the upper extremity
  - Common in younger and older patients
  - Result of direct trauma such as fall on out stretched hand
  - Increasing incidence due to aging population
- Mechanism of Injury
  - Most commonly a fall on an outstretched extremity with the wrist in dorsiflexion
  - High energy injuries may result in significantly displaced, highly unstable fractures

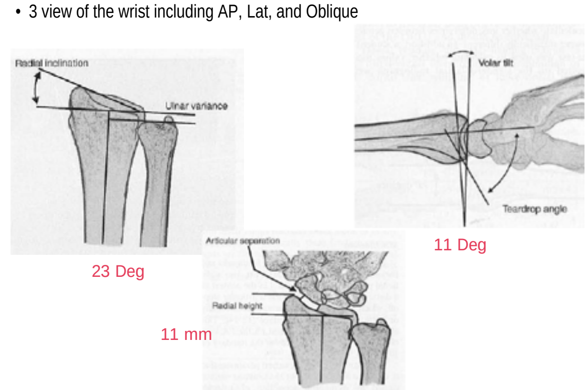


Distal Radius Fractures

- Clinical Evaluation
  - Gross deformity of the wrist with variable displacement of the hand in relation to the wrist
  - Typically swollen with painful ROM
  - Ipsilateral shoulder and elbow must be examined
  - NV exam -median nerve for acute carpal tunnel compression syndrome

Distal Radius Fractures

- Radiographic Evaluation
- 3 view of the wrist including AP, Lat, and Oblique

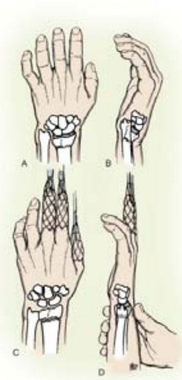


Distal Radius Fractures

- Eponyms
  - Colles Fracture
    - » Combination of intra and extra articular fractures of the distal radius with dorsal angulation (apex volar), dorsal displacement, radial shift, and radial shortenting
    - » Most common distal radius fracture caused by fall on outstretched hand
  - Smith Fracture (Reverse Colles)
    - » Fracture with volar angulation (apex dorsal) from a fall on a flexed wrist
  - Barton Fracture
    - » Fracture with dorsal or volar rim displaced with the hand and carpus
  - Radial Styloid Fracture (Chauffeur Fracture)
    - » Avulsion fracture with extrinsic ligaments attached to the fragment
    - » Mechanism of injury is compression of the scaphoid against the styloid

Distal Radius Fractures

- Treatment
  - Displaced fractures require an *attempt* at reduction.
    - » Hematoma block-10ccs of lidocaine or a mix of lidocaine and marcaine in the fracture site
    - » Apply traction to wrist in fingertraps with a traction weight
    - » Reproduce the fracture mechanism and reduce the fracture
    - » Place in sugar tong splint or a bivalved cast



Distal Radius Fractures

- Operative Management
  - » For the treatment of intraarticular, unstable, malreduced fractures
  - » Open fractures must go to the surgery for I&D and fixation

Distal Radius Fractures

- Healing time
  - Typically, 6 weeks
  - Mobilization may begin sooner
    - » If stable through fixation after surgery
    - » If callus seen on xray if treated with cast
- THINK FRAGILITY FRACTURE!!
  - Screen, establish baseline BMD (DEXA)
  - Fall prevention/precautions
  - Treat osteoporosis

THANK YOU

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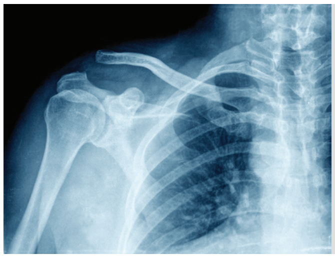
(773)398-5240



Things Not To Miss

Rex Haydon, MD, PhD

Things Not To Miss ....

Rex Haydon

THE UNIVERSITY OF CHICAGO MEDICINE & BIOLOGICAL SCIENCES

Disclosures: Rex Haydon

- I do not receive financial support or compensation from any company.
- I will not discuss any off label use of any product

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Overview

- Open Fractures
- Native Joint Dislocations
- Compartment Syndrome
- Spinal Cord Compression/Cauda Equina
- Septic Athritis
- Necrotizing Infections

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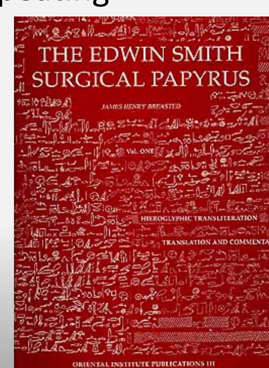
History Repeating

- Edwin Smith Papyrus:
  - 1300 BC translation of a text from 3000 BC
  - 48 Medical Cases
- Translated by Henry Breasted at University of Chicago in 1930



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Case 37: Closed vs. Open Fractures

Case 37, a fracture of the humerus with a rupture of the overlying tissue.

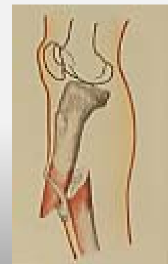
“If thou examinest a man having a break in his upper arm,
over which a wound has been inflicted, (and) thou findest that
that break crepitates under thy fingers.

A case with which to contend, according to the following:
Thou shouldst make for him two splints of linen; thou
shouldst bind it with ymrw; (and) thou shouldst treat it afterwards
[with] grease, honey, (and) lint every day until thou
knowest that he has reached a decisive point.”

A second case is also described with a more serious wound
“piercing through to the interior of his injury”
A case not to be treated.

Not All Open Fractures Are Created Equally

- Inside → Outside
- Outside → Inside



OPEN FRACTURES: GUSTILO-ANDERSON CLASSIFICATION

- Type I
  - Small wound, clean, low energy
- Type II
  - Moderate wound, minimal soft tissue damage, low-moderate energy
- Type III
  - Severe skin wound, extensive soft tissue damage, high energy

Expanded Version of the Gustilo Classification System of Open Fractures[a]

	Fracture Type				
Feature	I	II	IIIA	IIIB	IIIC
Wound size, cm	<1	>1	>1	>1	>1
Energy	Low	Moderate	High	High	High
Contamination	Minimal	Moderate	Severe	Severe	Severe
Deep soft tissue damage	Minimal	Moderate	Severe	Severe	Severe
Fracture comminution	Minimal	Moderate	Severe/ segmental fractures	Severe/ segmental fractures	Severe/ segmental fractures
Periosteal stripping	No	No	Yes	Yes	Yes
Local coverage	Adequate	Adequate	Adequate	Inadequate	Adequate
Neurovascular injury	No	No	No	No	Yes
Infection rate	0%-2%	2%-7%	7%	10%-50%	25%-50%

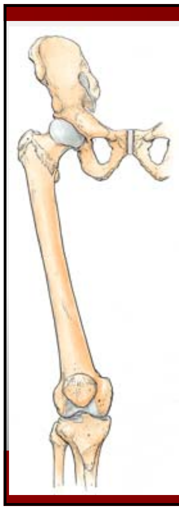
[a] *Data from Gustilo et al,[3] Gustilo and Anderson,[10] and Gustilo et al.[11]*

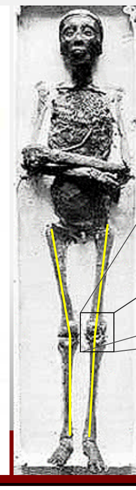
HOW BAD ARE THEY?

- Type III
  - A —> 4% sepsis —> 0% amputation rate
  - B —> 52% sepsis —> 16% amputation rate
  - C —> 42% sepsis —> 42% amputation rate

- up to 9.1% compartment syndrome in open #’s

Gustilo RB, Mendoza RM, Williams DN Problems in the management of type III (severe) open fractures: a new classification of type III open fractures. J Trauma. 1984 Aug;24(8):742-6
Blick SS, Brumback RJ, Poka A, Burgess AR, Ebraheim NA. Compartment syndrome in open tibial fractures. *J Bone Joint Surg Am.* 1986





King Tutankhamun

- **18th Dynasty**
- **Reign: 1333 – 1324 BC**

- **Died at approximately 18-19 years of age of unknown cause**

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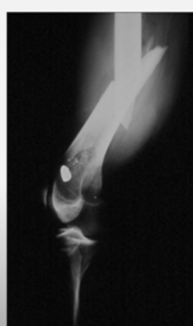
Fractures from GSW: Open or Closed?



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Native Joint Dislocations:

Case 34: Bilateral Sterno-clavicular Joint Dislocations

Tomb of Ipwy: 1200 BC

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Presentation and Evaluation

- Mechanism
  - Often high energy, but some may occur with low energy
  - Specific mechanisms vary considerably by joint
- Assessment
  - Notable deformity centered on a joint with pain
  - Detailed neurovascular exam
  - Look for associated injuries

Treatment

- Prompt if not Immediate Reduction
  - Traction, traction, traction
  - Appropriate analgesia/sedation
- Stabilize in reduced position (splint, traction, ex-fix)
- Post-reduction Assessment:
  - Repeat neurovascular exam (ABI's)
  - X-rays
  - Secondary Survey

Knee Dislocation: Emergency!

Knee Dislocation:
Do you really need xrays to tell it is dislocated?

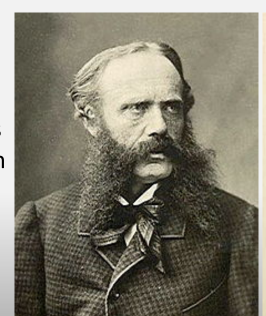
Vascular injury after Knee Dislocation

Vascular Exam: Concern for Injury

- Vascular injury
  - ABI less then .9
  - Asymmetric ABI
  - Obvious clinical findings
  - Mostly will observe them
- ABI
  - Systolic reading in both arms
  - Average the values
  - Systolic reading of the DP or PT
  - DP or PT systolic / average of the brachial systolic

Acute Compartment Syndrome (ACS)

- Richard Von Volkmann (1830-1889)
- In 1881, he describes it as cause of forearm contractures
- One of the few true orthopaedic emergencies



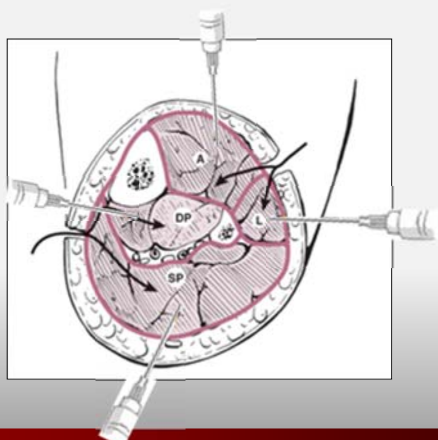
Causes of Acute Comparment Syndrome

- Fractures…MOST COMMON (75%)– open or closed
- Direct trauma/muscular crushing injuries
- Prolonged compression/ overly constrictive dressings or casts
- Intra-compartmental hemorrhage
- Circumferential burns
- Reperfusion (remember tourniquet & positioning)
- Prolonged operative positioning
- Intra-osseous infusion

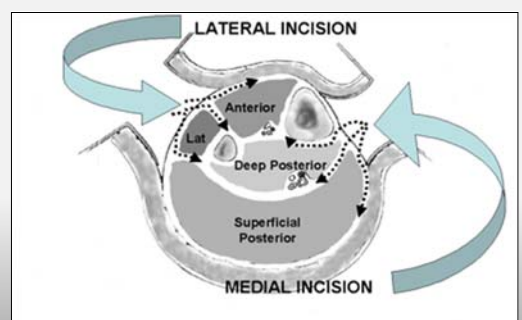
Diagnosis

- **P**ain out of proportion to injury
- **P**ain increasing despite treatment
- **P**ain with passive stretch of compartment
- **P**ain with active motion of involved muscles
- Tight/tense compartment on **p**alpation
- Tachycardia and hypertension are indirect signs
- *"TOO LATE SIGNS":*
  - *Paresthesias, Paralysis, Pulselessness, and pallor*

Ulmer, J Orthop Trauma, 16: 572



Treatment



Sequelae

- **Contracture**
  - Pain
  - Loss of function
  - Volkman's / Claw toes
- **Medical Complications**
  - Rhabdomyolysis
  - Renal Failure

Missed tibial compartment syndrome = amputation

Case 32: Spine Injury with Neurologic Deficit

Examination: If thou examinest a man having a dislocation in a vertebra of his neck, shouldst thou find him unconscious of his two arms (and) his two legs on account of it, while his phallus is erected on account of it, (and) urine drops from his member without his knowing it; his flesh has received wind; his two eyes are bloodshot; it is a dislocation of a vertebra of his neck extending to his backbone which causes him to be unconscious of his two arms (and) his two legs. If, however, the middle vertebra of his neck is dislocated, it is an emissio seminis which befalls his phallus.

Diagnosis: Thou shouldst say concerning him: "One having a dislocation in a vertebra of his neck, while he is unconscious of his two legs and his two arms, and his urine dribbles. An ailment not to be treated."

Causes of Cord Compression

- Trauma/Fracture
- Tumor/Neoplastic Conditions
- Herniated Nucleus Pulposus (disk)
- Severe Spinal Stenosis
- Infection/abscess
- Hemorrhage

Diagnosis

- **Progressive neurologic deficit**
- **History of Trauma or Cancer**
- **Back/Neck Pain**
- **Bowel/Bladder Dysfunction**
- **Saddle Paresthesia (Cauda Equina)**
- **Examination:**
  - **Complete neurologic examination**
  - **Rectal tone**
  - **Bulbocavernosus reflex**

Ulmer, J Orthop Trauma, 16: 572

Imaging

- If there is any question, image the entire spine
  - Examination may not be sufficient to determine level of compression
- Xrays: Low sensitivity, but can detect gross abnormalities
- MRI vs CT
  - MRI preferred but can be longer examination
  - CT is often done in trauma setting, but may lack sufficient detail
  - CT myelogram can be considered for those in whom MRI is contra-indicated

Ulmer, J Orthop Trauma, 16: 572

Treatment

- Urgent Work-Up
- Prompt recognition of the underlying pathology
- Surgical decompression/stabilization as indicated
- Steroids/Medical treatment
- Prognosis is generally poor by highly variable and dependent on the underlying cause and time to treatment

Ulmer, J Orthop Trauma, 16: 572

Septic Arthritis/Pyogenic Athritis

Presenting Symptoms

- Progressively worsening joint pain/swelling
- Refusal to bear weight through affected joint
- Holding the joint in the position associated with the lowest intracapsular pressure
- Fever
- Large joint effusion
- Erythema may or may not be present

Ulmer, J Orthop Trauma, 16: 572

Work-Up

- X-rays: rarely helpful
- MRI: may show associated osteomyelitis, but not usually very helpful
- ESR/CRP: usually extremely elevated
- Joint Aspiration if clinical concern is high:
  - Do not aspirate through erythema
  - Do not aspirate a joint with an implant
  - Contact Orthopaedics when in doubt, and call before attempting to aspirate difficult-to-access joints (eg. hip)

Synovial Fluid Analysis

Arthritis Type	Appearance	Viscosity	White cells/mm^3	Crystals	Biochemistry	Culture
Normal	Clear yellow	High	Few	-	As per plasma	-
Septic arthritis	Purulent	Low	>>50,000	-	Glucose low	+
Tuberculous arthritis	Turbid	Low	<2000	-	Glucose low	+
Rheumatoid arthritis	Cloudy	Low	>2000	-	-	-
Gout	Cloudy	Normal	>2000	Urate NBF	-	-
Pseudogout	Cloudy	Normal	>2000	Pyrophosphate PBF	-	-
Osteoarthritis	Clear yellow	High	<2000	Often +	-	-

Septic Hip in Children: Kocher clinical predictors

- History of fever (oral temp > 38.5 C)
- Inability to bear weight on affected limb
- ESR > 40
- WBC > 12

- Septic hip was found in:
  - 1.2% of patients with 1/4 criteria
  - 40% of patients with 2/4 criteria
  - 93% of patients with 3/4 criteria
  - 99.6% of patient with 4/4 criteria

Treatment: Septic Arthritis

- Urgent surgical drainage of affected joint
- IV antibiotics, directed at the causative organism
- Conversion to oral antibiotics (timing determined based on response to IV abs) and close observation

- Long term sequelae: Chondrolysis, arthritis and osteomyelitis

Case 47: Shoulder Wound with Gangrene/Necrotizing Infection

First examination: If thou examinest a man having a gaping wound in his shoulder its flesh being laid back and its sides separated, while he suffers with swelling (in) his shoulder blade, thou shouldst palpate his wound, shouldst thou find its gash separated from its sides in his wound, as a roll of linen is unrolled, (and) it is painful when he raises his arm on account of it, thou shouldst draw together for him his gash with stitching.

First diagnosis: Thou shouldst say concerning him: "One having a gaping wound in his shoulder, its flesh being laid back and its sides separated while he suffers with swelling in his shoulder blade. An ailment which I will treat."

Third examination: If however, thou findest that his flesh has developed inflammation form that wound which is in his shoulder, while that wound is inflamed, open, and its stitching loose, thou shouldst lay thy hand upon it. Shouldst thou find inflammation issuing from the mouth of his wound at thy touch, and secretions discharging therefrom are cool like wenesh-juice.

Third diagnosis: Thou shouldst say concerning him: "One having a wound in his shoulder, it being inflamed, and he continues to have fever from it. An ailment with which I will contend."

Presenting Symptoms

- Local signs of infection that progress
  - Erythema/induration
  - Skin necrosis/blistering
  - SQ crepitation
- Systemic signs:
  - Fever
  - SIRS symptoms
  - Mental status changes
  - Elevated blood glucose
  - Multi-organ failure

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Work-Up

- **General/complete examination (not just MSK)**
- **X-rays/Axial Imaging of the local site**
- **Labs: CBC, CMP, CRP/ESR**

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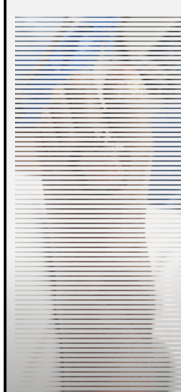
Ulmer, J Orthop Trauma, 16: 572

LRINEC SCORE



Laboratory Risk Indicator for Necrotizing Fasciitis			
CRP (mg/dL)	<15		0
	≥15		4
WBC (per mm³)	<15		0
	15-25		1
	>25		2
Hemoglobin (g/dL)	>13.5		0
	11-13.5		1
	<11		2
Sodium (mEq/L)	≥135		0
	<135		2
Creatinine (mg/dL)	≤1.6		0
	>1.6		2
Glucose (mg/dL)	≤180		0
	>180		1
Composite Score	Score < 6	Low Risk	
	Score 6-7	Intermediate	
	Score ≥ 8	High Risk	

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General Principles Regarding MSK Infections

- **Anatomic site**: predicts local mobidity
  - Septic arthritis: chondrolysis, joint degeneration
  - Cellulitis/Necrotizing Infection: skin/limb loss
  - Osteomyelitis: bone loss, instability, pain
- **Host factors/response**: predicts threat to life and/or distant organs
  - SIRS/Sepsis
  - Multi-system organ failure
  - Death

General Treatment Principles

- Prompt broad spectrum antibiotic treatment
  - obtain cultures 1st if possible
  - tailor abx to organism after sensitivities
- Surgical debridement
  - Decompress “pus under pressure”
  - Remove devitalized tissue
  - leave wounds open or leave drain

General Evaluation Principles

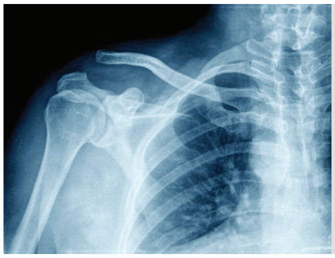
- Assessment tools/rubrics are useful but may under/over-estimate risk
- Evaluate the patient in the context of modifying host factors
- Team approach to patient assessment/care

Museum of Surgical Science: Hall of the Immortals

Things not to miss ….

- Open Fractures
- Native Joint Dislocations
- Compartment Syndrome
- Spinal Cord Compression/Cauda Equina
- Septic Athritis
- Necrotizing Infections

Thank-you



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Adult Cervical and Thoracic Spine

Michael J. Lee M.D.
Associate Professor Orthopaedic Spine Surgery
Dept. Orthopaedic Surgery and Rehabilitative Medicine

Disclosure

- Stryker Spine- Consulting
- Depuy Synthes - Consulting

Cervical Spine

Radiculopathy
Myelopathy

33 y o male
works as orthopaedic surgery resident
left arm pain

History

- 4 weeks
- Pain – neck going down left arm into hand (long finger)
- Feels weak
- Painful motion
- No treatment

Differential Dx?

- Radiculopathy?
- Myelopathy?
- Shoulder pathology with referred pain?

Radiculopathy

- Dermatomal
- Myotomal
- Decreased Reflexes

- "Pain shooting down the arm"

Myelopathy

- Increased Clumsiness
- Decreased Dexterity
- Balance Problems
- Bowel/Bladder

- "Just keep dropping things"

Shoulder pathology

- Generally, pain in the shoulder with Range of Motion
- Abduction
- Internal, External Rotation
- Flexion Extension

Physical Exam

Physical Exam

- Neurological
  - Sensory
  - Motor
  - reflex
- L'hermitte's sign
- Spurling's sign
- Shoulder Exam - ROM

Radiculopathy

- Dermatomal
- Myotomal

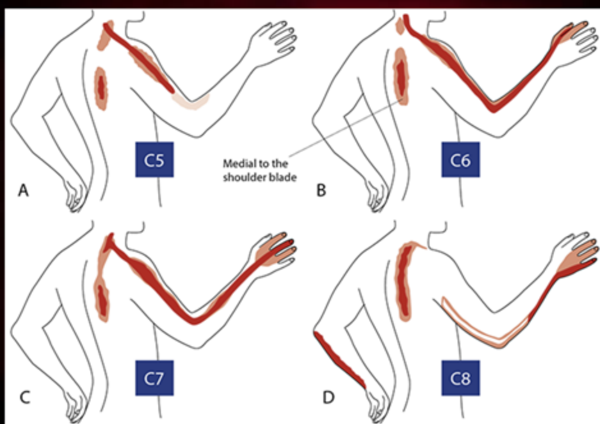


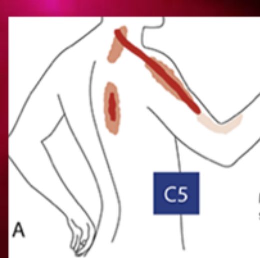
Table 3. Cervical And Lumbosacral Dermatomes And Myotomes.

Spinal level	Key sensory area for dermatomal testing	Myotome
C5	Radial antecubital fossa	Elbow flexors (biceps*, brachialis, and brachioradialis*)
C6	Thumb	Wrist extensors (extensor carpi radialis longus and brevis)
C7	Middle finger	Elbow extensors (triceps*)
C8	Little finger	Finger flexors* (distal phalanx—flexor digitorum profundus)
T1	Ulnar antecubital fossa	Hand intrinsics (interossei)
L2	Mid-anterior thigh	Hip flexors (iliopsoas)
L3	Medial femoral condyle	Knee extensors* (quadriceps)
L4	Medial malleolus	Ankle dorsiflexors (tibialis anterior)
L5	Dorsal second/third toe web space	Long toe extensors (extensor hallucis longus)
S1	Lateral heel	Ankle plantar flexors* (gastrocnemius, soleus)

* Commonly tested reflexes

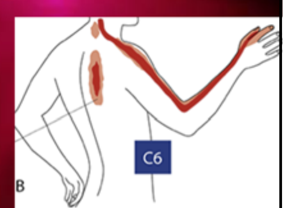
C5

- Myotomal
  - Deltoid – shoulder abduction
  - Some Biceps - elbow flexion
- Dematomal
  - shoulder
- Reflex
  - Biceps (C5, C6)



C6

- Myotomal
  - Wrist extendors
  - Biceps - elbow flexion
- Dematomal
  - Lateral arm, forearm
  - Index and Thumb
- Reflex
  - Biceps (C5, C6)
  - Brachioradialis (C6)

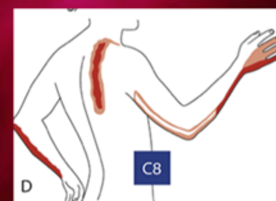


C7

- Myotomal
  - Triceps– elbow extension
  - Wrist Flexion
- Dematomal
  - Into Long Finger
- Reflex
  - Triceps

C8, T1

- Myotomal
  - Grip–
  - Finger Abduction
- Dematomal
  - Small, ring finger



Radiculopathy

- Spurling's sign
- Arm on the head sign

Myelopathy

- Decreased diffuse sensation
- Balance problems
- Spastic
  - Hyperreflexic
  - Long tract signs
    - Hoffman's
    - Clonus

Myelopathy

L'Hermitte's Sign

Not sensitive

Originally described for MS

Clinical Impression?

- Shoulder pathology
  - PT, Injections, Surgery
- Radiculopathy
  - PT, Injections, Surgery
- Myelopathy
  - Observation, Surgery

Imaging

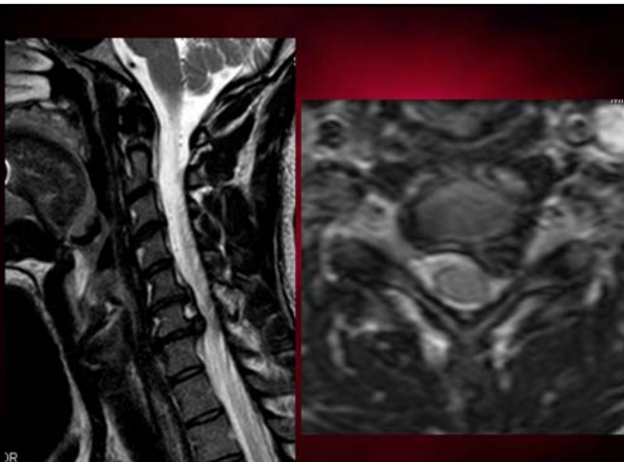
Next?

- CT – bony anatomy
- MRI- soft tissue anatomy

- Treatment
  - NSAIDs, PT (traction)
  - Epidural steroid injection
  - Surgery

- PT, NSAIDs, modify ADLs x 6 weeks

- 6 weeks later, still having pain
- Now what?



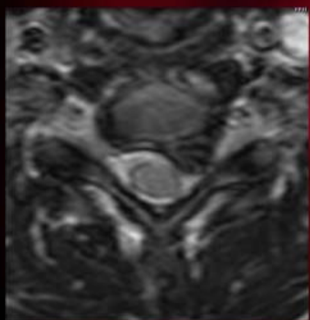
C-67 HNP; C7 radiculopathy

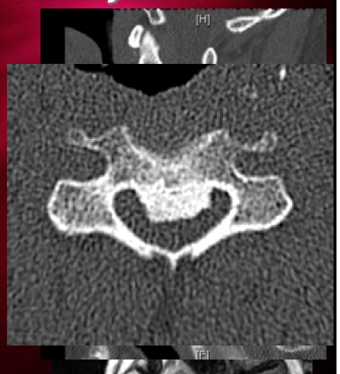
- Now what?

- Epidural steroid injection

- Surgery

Epidural Steroid Injection



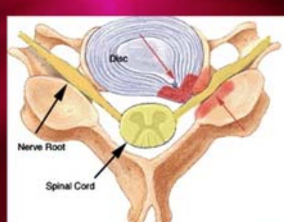


Surgery options

- ~~Anterior cervical discectomy~~
- Anterior cervical discectomy fusion
- Posterior foraminotomy +/-discectomy
- Anterior cervical disc replacement

Posterior foraminotomy

- Advantages
  - No fusion- healing
  - Minimal invasiveness
- Disadvantages
  - Prone position
  - Difficult set up
  - Difficult procedure
  - Residual neck pain



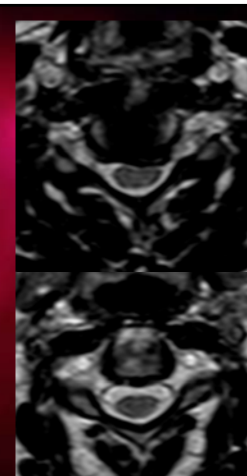
ACDF

- Advantages
  - Easy to do!
  - Direct decompression
  - Addresses neck pain?
- Disadvantages
  - Fusion - healing
  - Adjacent segment degeneration
  - Cost

Cervical Disc Replacement

- Advantages
  - No fusion
  - Excellent results
- Disadvantages
  - Long term results
  - Osteolysis?
  - Not yet proven to prevent adjacent seg degeneration
  - Cost?

39 y o woman
left arm pain
s/p C67- ACDF 10 years ago



THE JOURNAL OF BONE & JOINT SURGERY

JB&JS

Radiculopathy and Myelopathy at Segments Adjacent to the Site of a Previous Anterior Cervical Arthrodesis*

HILIBRAND, ALAN S. MD; CARLSON, GREGORY D. MD; PALUMBO, MARK A. MD; JONES, PAUL K. PHD; BOHLMAN, HENRY H. MD

Volume 81-A(4), April 1999, pp 519-528

Hilibrand et al…

- Incidence & prevalence of adjacent segment disease
  - Incidence ca. 2.9% / year for 10 yrs after surgery
    - K-M Analysis = ca. 25.6% of pts undergoing ACDF would have adjacent segment disease within 10 yrs
      - 95% C.I. = 20% - 32%

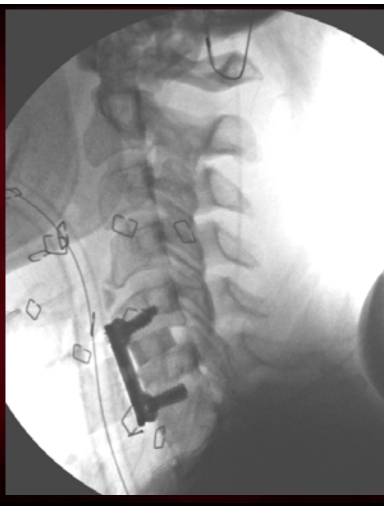
Which is more likely to develop adjacent segment disease?

Hilibrand et al….

Adj seg disease significantly more likely following 1 level ACDF than if multiple levels were done

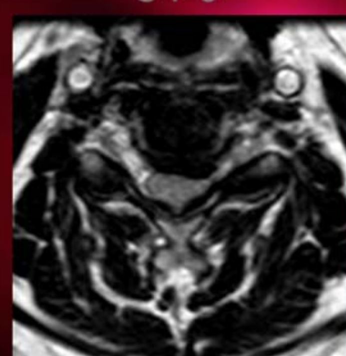
Most likely after ACDF at C5/6 or C6/7

"…symptomatic adjacent-segment disease is the result of progressive spondylosis…"

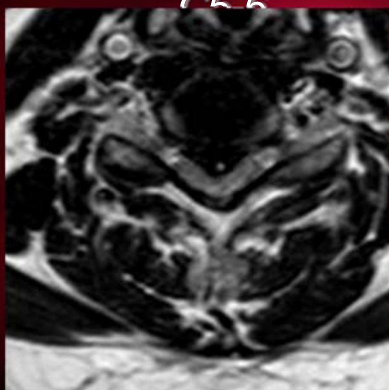


Myelopathy

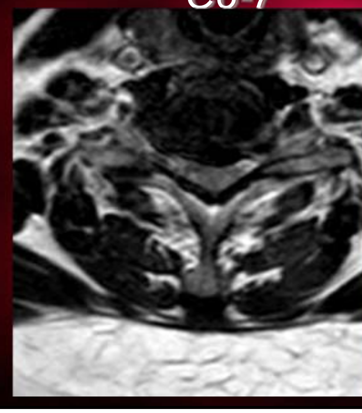
C4-5



C5-6



C6-7



Different from Radiculopathy!!

- Will not get better with non op treatment
- Usually surgical indication
- Decompression and stabilization

Surgical options

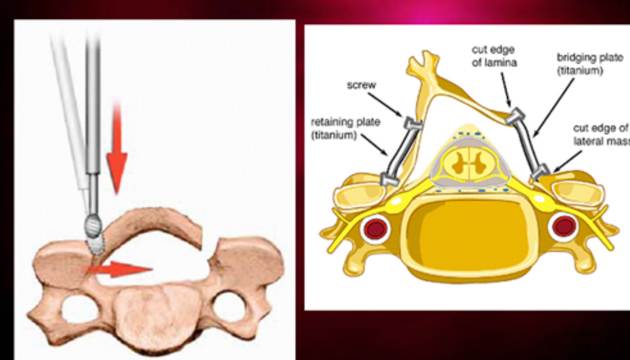
- Anterior decompression (discectomy or corpectomy) and fusion
- ~~Posterior laminectomy alone~~
- Posterior laminectomy and fusion
- Posterior laminaplasty

Anterior decompression

Posterior laminectomy

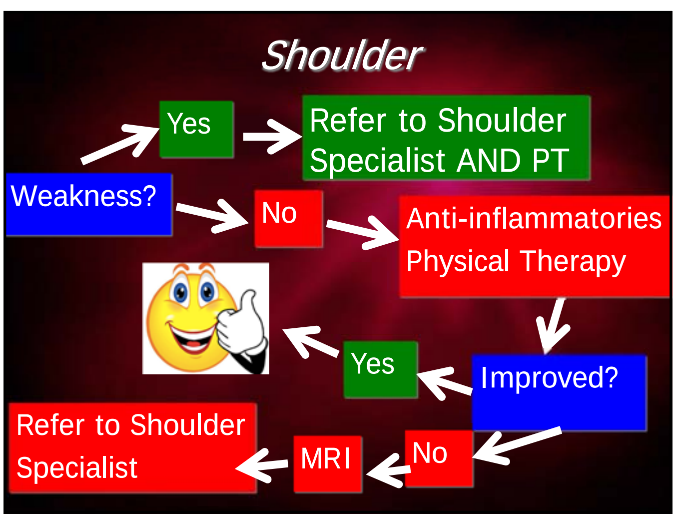
Posterior laminectomy and fusion

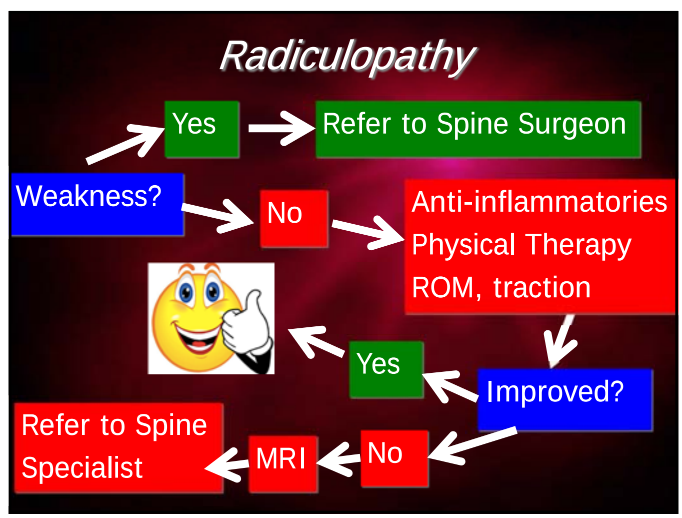
Laminaplasty




Laminaplasty


Shoulder/Arm pain
Shoulder
Radiculopathy
Myelopathy


Shoulder
Weakness?
Yes
Refer to Shoulder Specialist AND PT
No
Anti-inflammatories
Physical Therapy
Improved?
Yes
No
MRI
Refer to Shoulder Specialist


Radiculopathy
Weakness?
Yes
Refer to Spine Surgeon
No
Anti-inflammatories
Physical Therapy
ROM, traction
Improved?
Yes
No
MRI
Refer to Spine Specialist

Myelopathy

Myelopathy

MRI
CT Myel0gram

Refer to Spine Surgeon

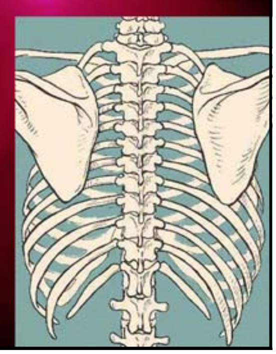
Red Flags!

- Neurological Deficit
- Weakness- Significant
- Bowel and Bladder Incontinence
- "Progressive neurological deficit"

The Thoracic Spine

Thoracic Pathology

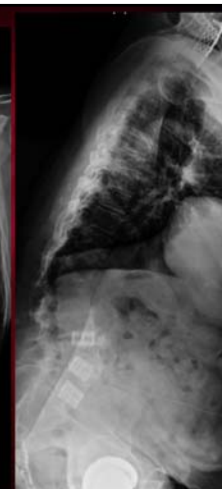
- Less Common
- Less motion pathology
- No easily testable motor function (exception T1)



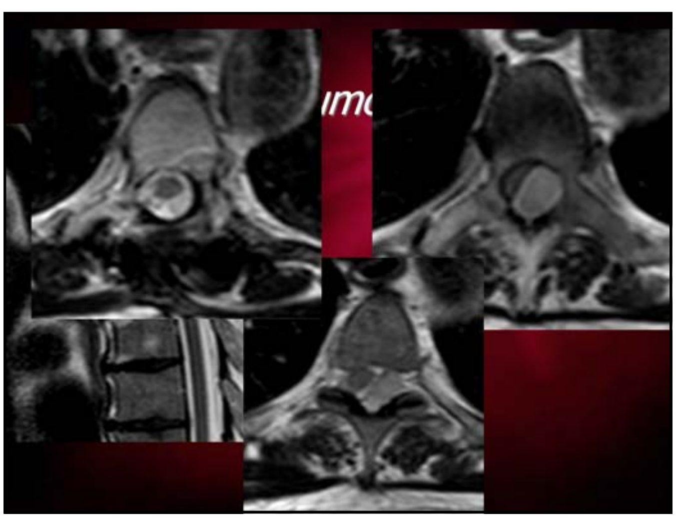
Disc Herniation & Stenosis

- Much less common, but still occurs

Deformity

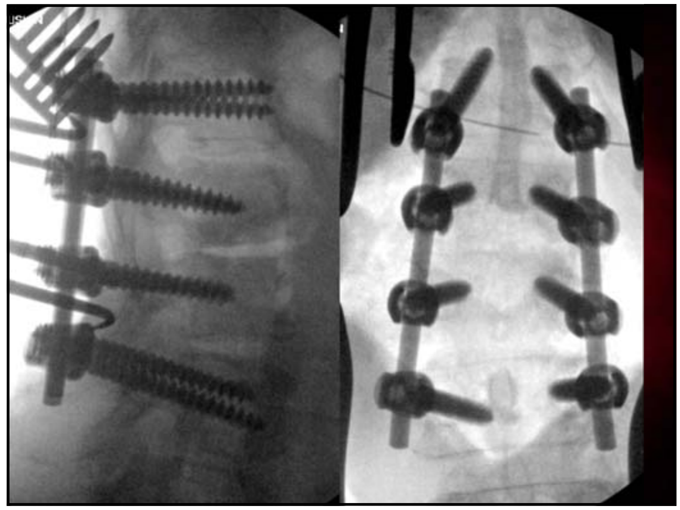



Tumor




Infection

1-15-15



Radiology Reports

- Reference of “normal” MRI is healthy 25 year old person
- Majority of people will have some MRI ‘abnormality’ – without Symptoms!
- Correlation with Clinical Presentation

Radiology Report

- Majority of report may simply be NORMAL age related changes.

Thank you

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Low Back Pain and the Spine

Michael J. Lee M.D.
Professor Orthopaedic Spine Surgery
Dept. Orthopaedic Surgery and Rehabilitative Medicine

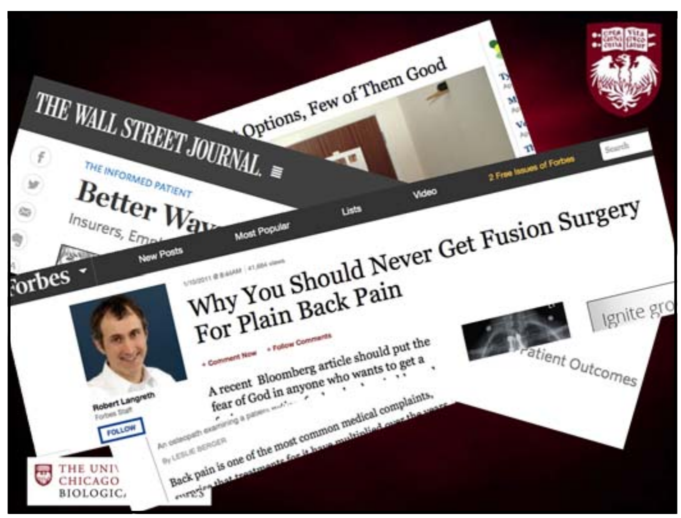
- Disclosure

- AOSpine – speaker/faculty
- Depuy Synthes - Consultant
- Stryker Spine –Consultant
- Globus Medical-Consultant
- Grand Rounds-Consutant

Surgical Treatment Options for Low Back Pain 2

Low back pain…..

Presentation Title 3



Low Back pain- symptom, not a disease!

- Diagnose
  - Xray, CT, EMG, MRI
- Treat
  - Physical therapy, Injection, Surgery
  - Acunpuncture, Chiropractic care

Where Surgery Has a Role for Low Back Pain

Low Back Pain Causes

- Spondylolysis
- Fracture
- Spondylolisthesis
- Deformity
- Tumor
- Infection
- Disc degeneration
- Facet arthrosis
- Muscle Spasm
- other
- Stenosis
- Disc Herniation

LBP & Spondylolysis

- Pars Fracture
- Spondylolysis
- Can be Asymptomatic!

LBP & Spondylolysis

- Pars Fracture
- Spondylolysis
- Can be Asymptomatic!

LBP and Fracture

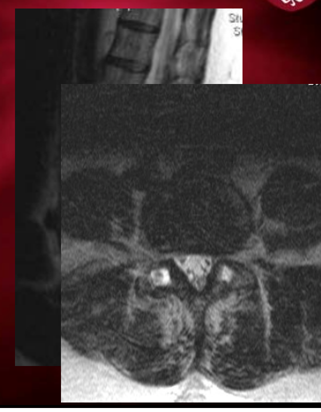
- MVA
- Burst Fracture at T12
- Neurologically intact
- Initially treated non operatively

LBP and Fracture

- 1 v
- Ur
- W

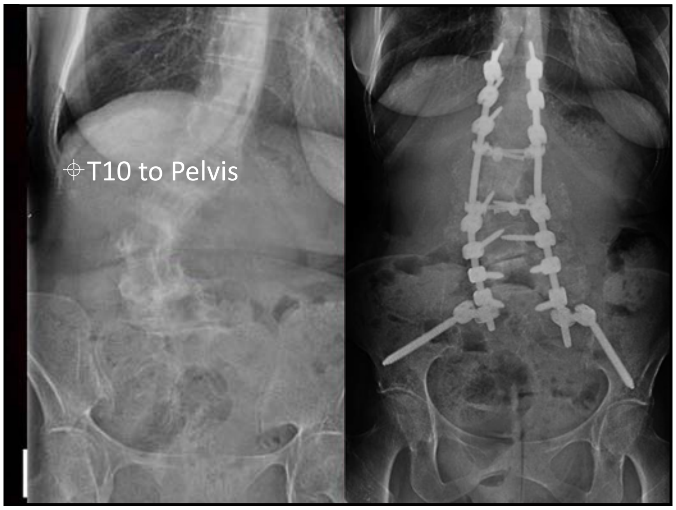
LBP and Spondylolisthesis

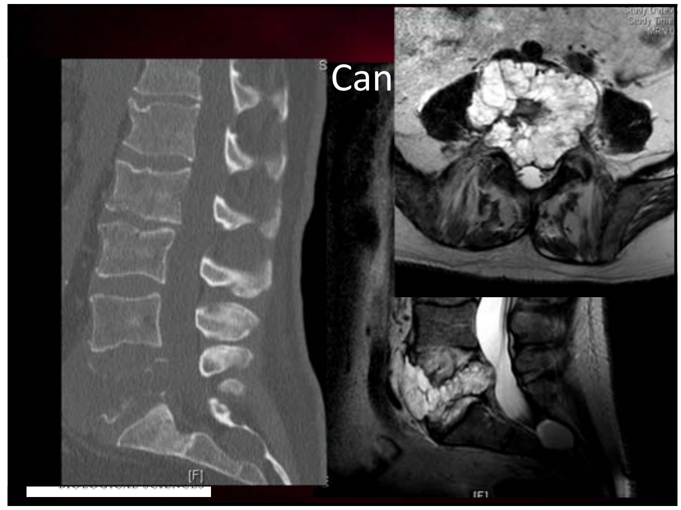
- 54 y o woman
- Back and Leg pain



LBP and D

- 65 year old woman with severe low back pain and posture problems





- 72 year old male with 5 months of progressively worsening back pain
- Developed left sided foot drop
- Gait abnormality
  - 7 seconds per step
  - With assistance

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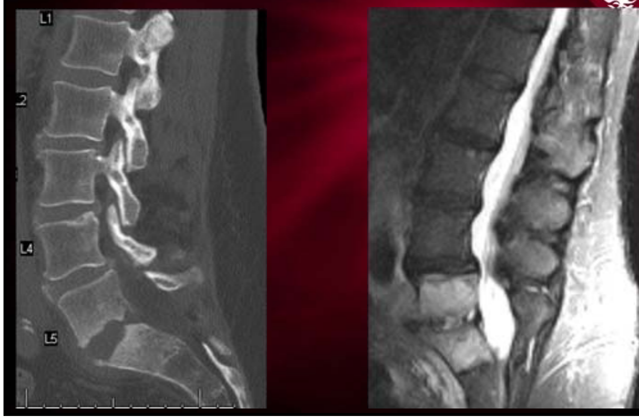
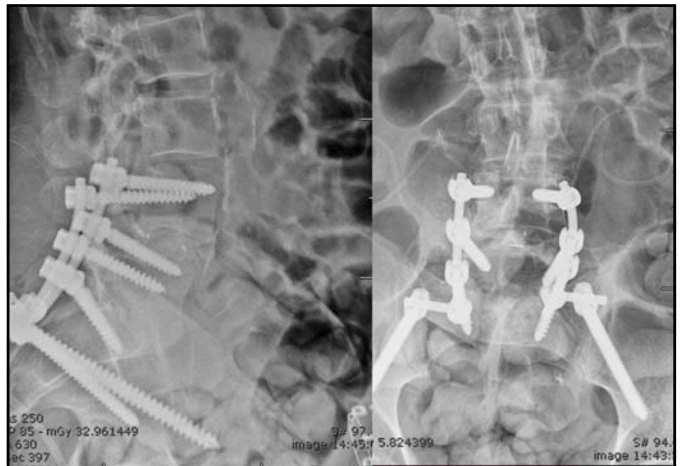
10/14





Low Back Pain Causes

- Spondylolysis
- Fracture
- Spondylolisthesis
- Deformity
- Tumor
- Infection
- Disc degeneration
- Facet arthrosis
- Muscle Spasm
- other
- **Stenosis**
- **Disc Herniation**

Where Surgery has a role: for leg pain and MAYBE Back pain

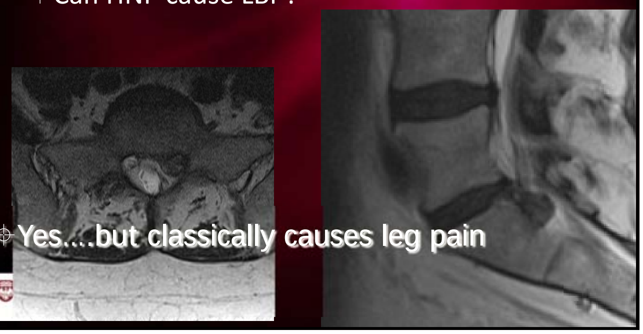
LBP - Stenosis

- Can Stenosis cause LBP?

- Yes….but classically causes leg pain and neurogenic claudication

LBP – Herniated disc

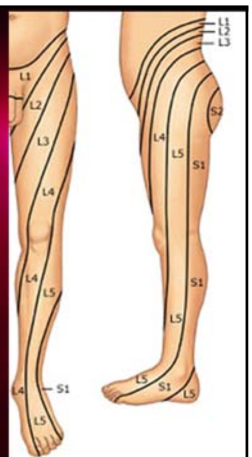
- Can HNP cause LBP?



- Yes….but classically causes leg pain

Leg pain

- Nerve root pain (Radiculopathy)
  - Buttock pain- Thigh pain- Lower leg pain- Foot pain
    - S1 Posterior thigh- Posterior lower leg- sole of foot
    - L5 Lateral thigh – Lateral Lower leg- lateral foot- big toe
    - L4 Anterior thigh – Anterior medial lower leg- dorsum of foot
    - L3, L2, L1 anterior thigh – does not go past knee



Leg pain

- HIP pain
  - Groin pain- anterior thigh pain
  - Pain with rotation of hip

Surgery for Lumbar Stenosis & HNP

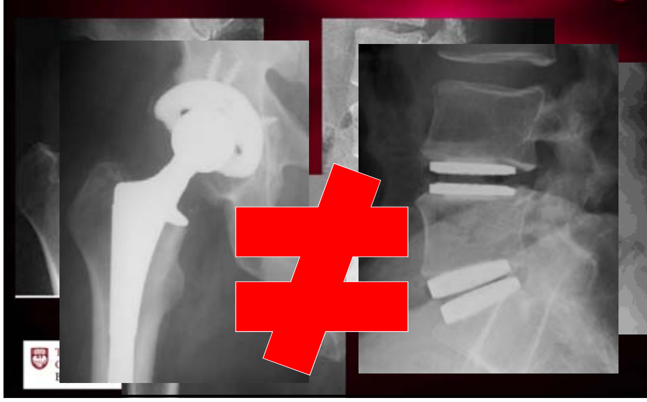
- Primary Goal: Leg pain, Walking Tolerance, Standing Tolerance
- Discectomy/Laminectomy NOT Fusion
  - (No screws or rods)
- What about Back Pain?
  - Not the goal
  - May not get better with surgery
  - (If it DOES get better, I will take credit)

Where the role for Surgery is Controversial

Low Back Pain Causes

- Spondylolysis
- Fracture
- Spondylolisthesis
- Deformity
- Tumor
- Infection
- Disc degeneration
- Facet arthrosis
- Muscle Spasm
- other
- Stenosis
- Disc Herniation

Is Back Pain Like Hip Pain?



Discogenic Pain

- Black Disc Disease
- Pain with flexion
- Cannot tolerate sitting
- Better standing

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Discogenic Pain- Diagnosis?

- Pain?
  - Everybody has Back Pain
- Abnormal MRI?
  - Everybody has an abnormal MRI
- Discogram?
  - No clinical value

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Surgical Treatment for Discogenic Pain

Low Back Pain Causes

- Spondylolysis
- Fracture
- Spondylolisthesis
- Deformity
- Tumor
- Infection

- Disc degeneration
- Facet arthrosis
- Muscle Spasm
- other

- **Stenosis**
- **Disc Herniation**

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Low Back Pain Causes

- Spondylolysis
- Fracture
- Spondylolisthesis
- Deformity
- Tumor
- Infection
- Stenosis
- Disc Herniation

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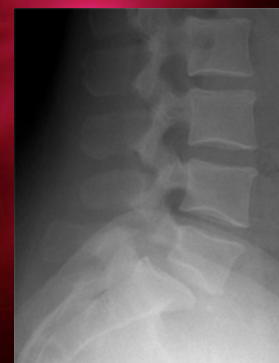
What do I tell patients?

- 54 y o male with low back pain
- No leg pain
- Failed PT and other non op treatments
- How much of their back pain will get better with surgery?



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Low Back Pain Causes

- Spondylolysis
- Spondylolisthesis
- Deformity
- Stenosis
- Disc Herniation
- Remember!
- These can be asymptomatic!

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Low Back Pain Causes

- Spondylolysis
- Fracture
- Spondylolisthesis
- Deformity
- Tumor
- Infection

100%

- Disc degeneration
- Facet arthrosis
- Muscle Spasm
- other

0%

- Stenosis
- Disc Herniation

0%

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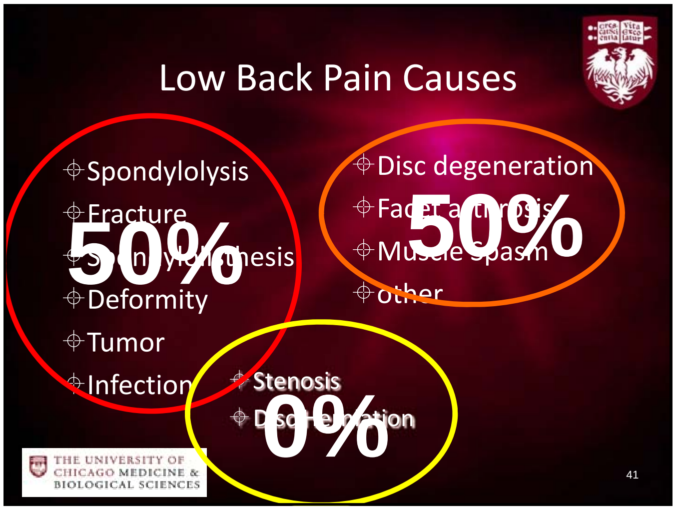
Low Back Pain Causes
Spondylolysis
Fracture
Spondylolisthesis
Deformity
Tumor
Infection
50%
Disc degeneration
Facet arthrosis
Muscle Spasm
other
50%
Stenosis
Disc Herniation
0%
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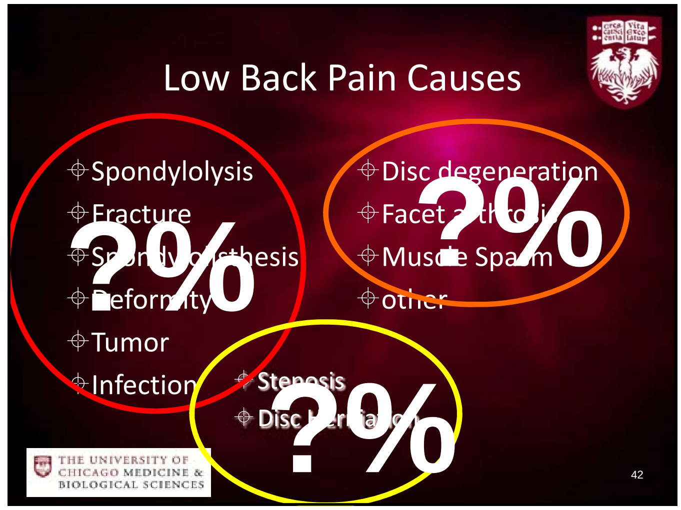
Low Back Pain Causes
Spondylolysis
Fracture
Spondylolisthesis
Deformity
Tumor
Infection
?%
Disc degeneration
Facet arthrosis
Muscle Spasm
other
?%
Stenosis
Disc Herniation
?%
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42


I'll be there between 9 AM and 5PM
Comcast
43

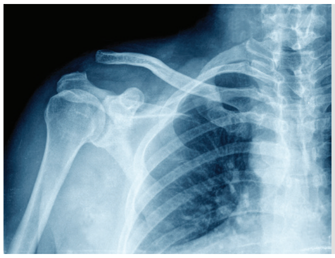

ck pain,
mplete

Low Back Pain Causes

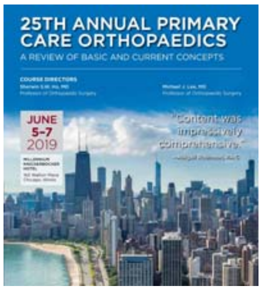
- Spondylolysis
- Fracture
- Spondylolisthesis
- Deformity
- Tumor
- Infection
- Disc degeneration
- Facet arthrosis
- Muscle Spasm
- other
- **Stenosis**
- **Disc Herniation**

Crescat Scientia Vita Excolatur

Thank you



Adult Foot
Brian C. Toolan, MD



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Adult Foot

Brian C. Toolan, MD
Professor, Orthopaedic Surgery
Foot & Ankle

25th Annual Primary Care Orthopaedics Course

25th Annual PCOC
Brian C. Toolan, MD
Disclosure

I have no financial relationships to disclose

I will not discuss off-label/investigational use

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Adult Foot: Injury and Disease 2

Common Injuries - Forefoot

Toe (Phalanx)

Metatarsal neck

Stress Fractures

Fifth metatarsal

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Adult Foot: Injury and Disease 3

Toe (Phalanx) Fractures

Stubbing injury

Buddy taping?

Roomy Shoe
Stiff Sole

Less tolerance for
Hallux fracture

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Adult Foot: Injury and Disease 4

Metatarsal Neck Fractures

Landing on tiptoes

Stiff shoe/CAM

ORIF if displaced
Dorsal or Plantar

Check for angulation

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Soft Tissue Management

RIICE Therapy

Reactive edema from dependency and activities

Irritation from rubbing in shoes

Sausage toes for 3-6 months
Set expectations early

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Metatarsal Stress Fractures

Insidious Onset

Prodrome – pain & swelling after activity

Noticed with change in routine

Look for associated pathology

Check 25 OH Vitamin D level

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Metatarsal Stress Fractures

Signs of healing combined with fracture

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Fifth Metatarsal Fractures

"Pseudo" Jones
(The Good)

Jones
(The Bad)

Diaphyseal Stress
(The Ugly)

Dancer's fracture
(Look bad, Do well)

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"Pseudo" Jones Fracture

Tuberosity fracture
(styloid process - base)

Avulsion mechanism
Peroneus Brevis
Lateral Band Plantar Fascia

Readily heal - WBAT

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Jones Fracture

Tuberosity/shaft junction
Intermetatarsal joint

10% nonunion rate

Athletes get surgery

Treat with caution - NWB

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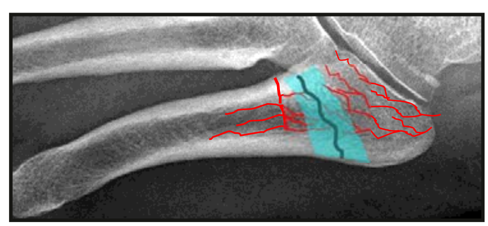
Intraosseous Blood Supply



Nutrient Artery & Intramedullary Branches
Metaphyseal Arteries
Watershed Zone

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Diaphyseal Stress Fracture

Chronic overload

Look for cavus foot

Notorious for refracture

Dancer's Fracture

Oblique distal shaft

Rotational Injury

Stops hurting before Radiographic healing

Common Injuries - Midfoot

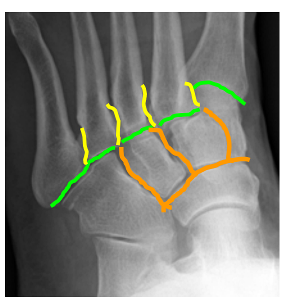
Lisfranc Injuries
Tarsometarsal Fracture-Dislocations

<u>Joint Complex</u>

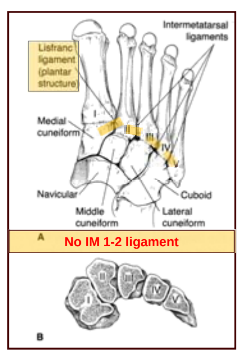
Tarsometatarsal

Intermetatarsal

Intertarsal



Tarsometatarsal Joint Complex



Forms Two Arches
Medial Longitudinal
Transverse

Second TMTJ
Keystone
Mortise

Significant Injury

More than a "sprain"
Dislocation of arch

<u>Mechanisms of Injury</u>
Direct: High-energy / crush
Indirect: Low-energy / bend
Non contact ER-Pronate twist


Plantar Bruise

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These injuries require surgery
ORIF vs. Arthrodesis

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Common Injuries - Hindfoot

Fractures of the Calcaneus
Joint Depression
Tongue
Anterior Process

Fractures of the Talus
Neck
Lateral & Posterior Process

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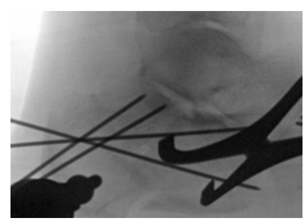
Joint Depression

<u>Axial Load</u>
Falls / MVA
Depress Facet Fragment

Serious soft tissue injury
Wait to fix - swelling



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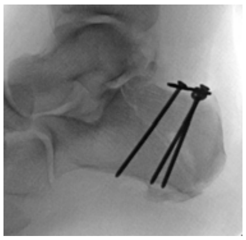
Tongue-Type

Eccentric Achilles Contraction
Tuberosity Avulsed +/- into joint
Beware: posterior heel bruise



Anterior Process Fracture

Inversion injury

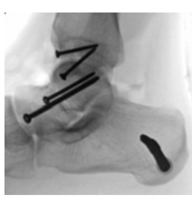
Avulsion fracture
Bifurcate ligament

Unresolved
“sprain”

Delay in diagnosis

Talar Neck Fractures

<u>Axial Load + DF</u>
High energy injury
Extruded Body



Complications

Avascular Necrosis
Arthritis
Rigid Deformity

Talar Process

Low Energy Injuries
Impaction
Distraction

Lateral process
Posterior process

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Talar Process

Low Energy Injuries
Impaction
Distraction

Lateral process
Posterior process
Os Trigonum

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Common Diseases

Hallux Valgus & Hammertoes
Hallux Rigidus
Posterior Tibial Tendon Dysfunction
Pes Cavus
Haglund's Syndrome
Plantar Fasciitis

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Hallux Valgus - Early

Prominent "Bunion"

Hallux Pronation

Crowds Second Toe

Painful Hammertoe

Fifth toe rubs

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Hallux Valgus - Late

Bunion worsens as valgus worsens

2nd toe crossover
MTPJ2 dislocates

Hallux MTPJ hurts

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Hallux Valgus - Progression

Forefoot Splays as Arch Flattens

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Initial Treatment

Support arch
Stabilize & Load MT1

Posted orthotic
Physical therapy
Appropriate shoewear

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Hallux Valgus - Surgical Treatment

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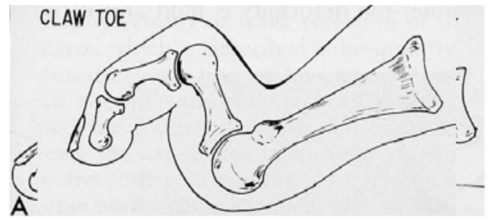
Hammertoes/Metatarsalgia

Curled toes

<u>Painful calluses</u>
Dorsal: PIPJ
Plantar: MT Head

<u>Plantar fullness</u>
"bunched sock"
"pebble"

Hammertoes/Metatarsalgia



Fat pad migration
Metatarsal head driven down
Callus formation

Initial Treatment

Offload metatarsal head
Appropriate shoewear
Physical therapy

Hallux Rigidus

Painful, stiff & swollen

Dorsal "bunion"

Rubs in shoes

Avoids toe-off

Background

Females > Males

Most common condition of MTPJ 1

1 in 40 over age 50 develop condition

80% ultimately develop bilateral HR

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Variable Natural History

Benign course w/o symptom progression

Xrays progressed but not symptomatic

Once symptomatic
50% success with conservative care

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XR Findings

Joint Space Narrowing
Wide, Flat MT head
Dorsal Osteophyte
Subchondral Cysts
Sclerosis

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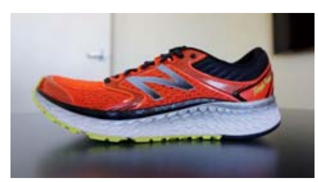
Nonoperative Management

NSAIDs

Injection(s)

Carbon fiber insoles

Forefoot rocker shoes



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Surgery - Cheilectomy or Arthrodesis

Posterior Tibial Dysfunction-Flatfoot

Medial/lateral "ankle" pain
Loss of arch
"Falling out of my shoes"

Etiology

Acute Trauma
Tear/Rupture

Chronic Attrition
Overuse

Chronic Inflammation
Immune or Mechanical

Single Heel Rise Test

“Too Many Toes” Sign

Initial Treatment

Rest & immobilize

Physical therapy

Orthotics or brace

Surgical Treatment

Pes Cavus (High-Arched Foot)

Lateral foot pain

Plantar calluses

“Weak ankles”

Avoid uneven ground

Etiology

Muscle/tendon imbalance

Neuromuscular spasticity

Sequelae of hindfoot malunions

Natural History

Instability

Stress fracture

Ankle tilts

Rigid Arthritis

Initial Treatment

Orthotics or bracing

Physical therapy

Proper shoes

Surgical Treatment - Reconstruction

Plantar Heel Pain/Plantar Fasciitis

Sharp a.m./start-up pain

Achy p.m. pain

Activity change

Etiology

Increased arch strain (tension)

Increased plantar fascia strain

Fat pad atrophy

Rheumatologic disease

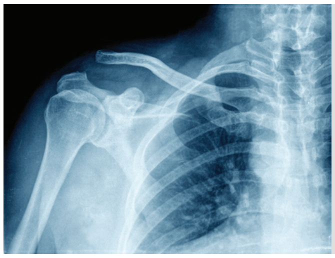
Initial Treatment

Reduce inflammation

Physical therapy

Night splint/orthotic

Avoid steroid injections



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ADULT ANKLE

Kelly Hynes, MD, FRCSC

Associate Professor

Lower Extremities; Foot & Ankle Surgery

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Disclosures

I have nothing to disclose.

Learning Objectives

1. Review common bony and soft tissue conditions of the adult ankle.
2. Develop treatment algorithms for common ankle pathologies.
3. Learn about the options of ankle arthroplasty and fusion in ankle arthritis.

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Outline

1. Anatomy Overview
2. Ankle sprains
3. Ankle Instability
4. Peroneal tendon pathology
5. Achilles tendon ruptures
6. Achilles tendonitis
7. Ankle Arthritis

THE UNIVERSITY OF CHICAGO *Orthopaedic Surgery and Rehabilitation Medicine*

Anatomy

- Ankle = *Tibiotalar joint* or *Talocrural joint*
- Less commonly affected by arthritis than other major joints
- Primarily a 'rolling' joint – not much rotation or sliding

(Image from: Y. De Brucker et al, 2014)

Anatomy

- Distal end of tibia is **plafond** (ceiling)
- Plafond + malleoli = **mortise**
- **Syndesmosis** is greek for "to bind together"
- **Incisura** – lateral groove in the tibia into which the fibula fits

Ligament	Insertion	FYI
Anterior talofibular (ATFL)	Lateral mall to neck of talus	Resists anterior translation (most common injured)
Calcaneofibular (CFL)	Peroneal tubercle of calcaneus	2nd most common injured. Deep to peroneal tendons.
Posterior talofibular (PTFL)	Lateral tubercle of posterior process of talus	Rarely torn

Deltoid Ligament (4 parts)	Originates on Medial Malleolus
Superficial:	From anterior colliculus of MM to:
a) Anterior tibiotalar	Anteromedial talus
b) Tibionavicular	Navicular tuberosity
c) Tibiocalcaneal	Sustenaculum tali
Deep:	From posterior colliculus of MM to:
Posterior tibiotalar	Medial talus

Fig. 1

Introduction

- Cartilage has more cross-linking and higher tensile strength than knee
- Any change to ankle congruency can lead to accelerated degeneration
- Doesn't take much to 'tip the scales'

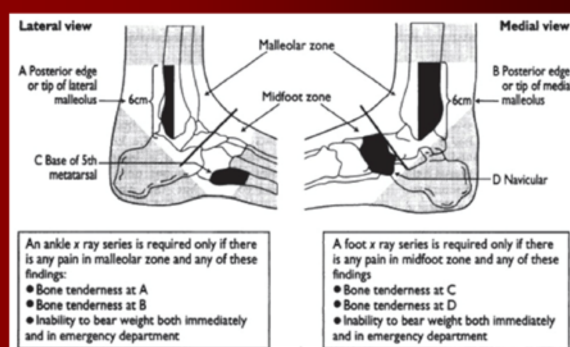
Ankle Sprains

- **Most common** reason for missed athletic participation.
- 85% of sprains involve lateral ligaments
- 50-75% CFL
- Usually a twisting injury
- Often able to partially bear weight immediately

Ankle Sprains – Associated injuries

- **OCL**
- **Peroneal tendon injury**
- **Deltoid injury**
- **CRPS**
- **5th metatarsal fracture**
- **Anterior process calcaneus #**

Ottawa Ankle Rules



Ottawa ankle rules for use of radiography in acute ankle injuries (adapted from Stiell et al)*

Ankle Sprains - Treatment

Grade	Findings	Treatment
1	No ligament disruption, minimal ecchymosis and swelling	Elevation, activity restrictions, ice, compression, PT
2	Stretch without tear	Elevation, activity restrictions, ice, compression, **immobilization in a boot/splint, PT**
3	Complete tear	Elevation, activity restrictions, ice, compression, **immobilization in a boot/splint, non-weight bearing period PRN, PT**

Chronic Ankle Instability

- Chronic instability in 10-20%
- Complaints:
  - Uneven ground
  - Recurrent instability
  - Pain

Table 2

Factors Contributing to Chronic Ankle Instability[2]

Mechanical
- Pathologic laxity
- Arthrokinetic restriction
- Synovial changes
- Degenerative changes

Functional
- Impaired proprioception
- Impaired neuromuscular control
- Impaired postural control
- Strength deficits

Chronic Ankle Instability

- Look out for:
  - Hindfoot varus
  - Peroneal tendon injuries
  - Ligamentous laxity

Instability - Treatment

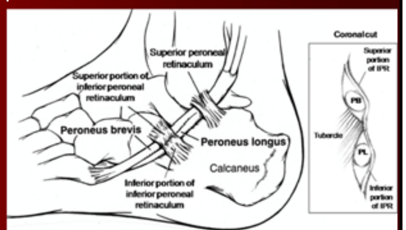
- Peroneal strengthening
- Balance reflex training
- External bracing

- Surgical only when non operative has failed

- Bottom line: Functional treatment and rehabilitation

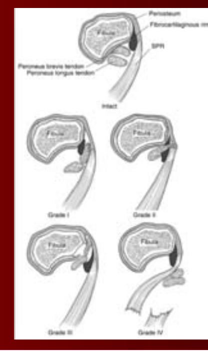
Peroneal Tendons

- Shared synovial sheath 2.5-3.5 cm proximal to tip of fibula
- Hypovascular zone for both at tip of fibula
- 28% eversion is PB
- 35% eversion is PL
- PL plantarflexes the 1st MT
- Both are active stabilizers



Peroneal Tendons

- Tendonitis
- Tendon tears
- Instability



Peroneal Tendon – History

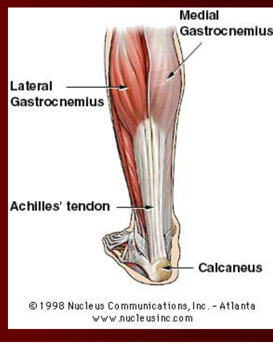
- Lateral ankle pain
- History of sprain (30%)
- Posterolateral swelling
- Sensation of instability (43%)
- Ankle sprain pain not resolving

Peroneal Tendon – Treatment

- NSAIDS
- Immobilization
- PT
- Bracing
- Lateral wedge orthosis can off load
- Better for tendonitis than established tear
- NOT AS EFFECTICE FOR INSTABILITY

Achilles Tendon - Anatomy

- Largest tendon in the body
- Gastrocnemius & Soleus Tendons
- Spans **3** joints
- Inserts = middle 1/3rd of calcaneus tuberosity
- Supinate/inverts



Achilles Tendon Rupture

- Patients feel 'they have been kicked in the back of the leg'
- **Op vs. Non-op**
- Splint in plantar flexion
- Functional rehabilitation protocol

Achilles Tendon Rupture

Timeframe	Weight bear Status	Orthosis	Range of Movement
0-2 weeks	Non-weightbearing	Moonboot/Cast with 3 heel wedges (30 deg equines)	Fixed in plantarflexion only
2-4 weeks	Touch weightbearing	Moonboot with 2 heel wedges (15-20 deg plantarflexion)	15-20 deg to full plantarflexion
4-6 weeks	Touch weightbearing	Moonboot with 1 heel wedge (5-10 deg of plantarflexion)	5-10 deg to full plantarflexion
6-8 weeks	Touch weightbearing	Moonboot in neutral	0 to free plantarflexion
8weeks – 3 months	As tolerated	Moonboot	0 to free plantarflexion
>3 months	As tolerated	Normal shoe	Passive range of movement, never assisted dorsiflexion

Achilles Tendinopathy

Classification of Chronic Achilles Tendon Dysfunction[3]

Disorder	Pathology
Paratenonitis	Inflammation of the peritendinous structures, including the paratenon and septum
Tendinosis	Asymptomatic degeneration of tendon without inflammation, with regional focal loss of tendon structure
Paratenonitis with tendinosis	Inflammation of the peritendinous structures along with intratendinous degeneration
Retrocalcaneal bursitis	Mechanical irritation of the retrocalcaneal bursa
Insertional tendinosis	Inflammatory process within the tendinous insertion of the Achilles tendon

Achilles Tendinopathy

Pain during rest or activity at, or above, the heel

Start-up
End of work-out

Different types:
1) Acute, subacute or chronic
2) Insertional or non insertional

Achilles Tendinopathy

- **Physical Therapy**
- Daily home exercises
- Heel lift (temporary)
- Night splint
- Short immobilization period
- NSAIDS
- Average 3-6 months for resolution with treatment
- NO INJECTIONS

Achilles Tendinopathy

- **70% success Non-op**
- **If pain not improving, consider operative referral**

Ankle Arthritis

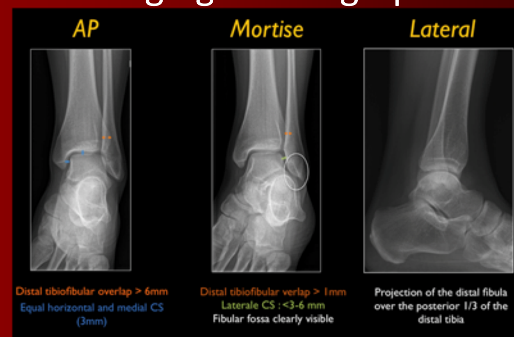
- POST TRAUMATIC!! (70 – 78%)
- Inflammatory arthropathy (12%)
- Chronic instability
- Hemophilia
- Malalignment/deformity

Varus arthritis from instability

History

- Activity related ankle pain
- Walking uneven ground
- Can be episodic
- History of trauma/instability?
- Bilateral?
- Hemophilia?
- Neuropathy/Diabetes?
- Specific location of pain

Imaging - Radiographs



Mortise view – leg is internally rotated 35 degrees relative to beam

(Image from: Y. De Brucker et al, 2014)

Imaging - Findings

- Previous hardware?
- Fracture malunion?
- Joint narrowing
  - Concentric vs. nonconcentric
- Osteophytes
- Translation of joint
- Other joints involved Cysts in talus
- Avascular necrosis

(Schaefer, K., et al, JBJS 2010)

Non-operative Treatment

- *NSAIDS*
- *Assistive devices (i.e. cane)*
- *Weight loss*
- Shoe modifications
- Bracing
- Steroid injections
- Viscosupplementation

Shoewear Modifications

- Rocker bottom shoes
  - Decrease effective range of motion through tibiotalar joint
  - Over the counter and custom options

Bracing

- Eliminate ankle motion
  - Pre-fabricated non articulating ankle foot orthosis (AFO)
  - Custom AFO
- Off-load the ankle
  - Patella tendon bearing AFO

From drdenizdogan.com

Steroid Injections (1)

- Can be diagnostic + therapeutic
- Periodic injections can be very effective at managing pain
- Typically every 3 or more months as needed

Operative Indications

- Failed non-operative management
- Adequate support/planning for 6-12 weeks of limited mobility
- If Diabetic, HBAIC </= 7.0
- Smoking cessation (wound and nonunion risk)

Joint-Preserving Surgery

- Debridement, chondroplasty, resection of osteophytes
- Can be done arthroscopically or open
- Well aligned ankle with early disease
- Isolated anterior impingement
- Can exacerbate global ankle pain if arthritis already moderate to severe or non-focal

Arthrodesis or Arthroplasty? – TOUGH DECISION!!

- Must engage the patient in the decision-making process
- Need to consider:
  - medical comorbidities
  - Age
  - activity level
  - Pre-operative range of motion
  - Contraindications for arthroplasty?

Arthroplasty Contraindications

- Charcot arthopathy
- Active infection
- Peripheral vascular disease
- Talar osteonecrosis
- Severe malalignment

Arthroplasty - outcomes

- Excellent short and medium term pain and function scores
- 10 year survival 75-90%
- Age > 55 years and BMI < 30 have improved outcomes

Arthroplasty - complications

- Aseptic loosening
- Malalignment
- Instability
- Infection
- Stress fractures
- Periprosthetic fracture
- Persistent pain
- Heterotopic ossification (25%)

Laflamme et al., 2012

Arthrodesis - approach

- Many approachs
  - Lateral transmalleolar
  - Anterior
  - Posterior
  - **Arthroscopic-assisted

  - Position: 5 degrees valgus, 5 -10 ER, posterior translation

Arthrodesis fixation

- Compression screws (percutaneously/ mini-open placement)
- Anatomically designed plates
- Intramedullary rod (includes subtalar joint)
- External ring fixator

hss.edu

Weigh the Pros and Cons…

- Arthroplasty
  - Preservation of (some) ankle ROM
  - Improved gait and walking speed
  - **Higher revision/ repeat surgery rate (1/14)**
  - Limited durability Reduced adjacent joint disease
- Arthrodesis
  - Lack of motion
  - Gait asymmetry
  - Reliable pain relief
  - Low reoperation rate
  - **Durable**
  - **Increased adjacent joint disease (clinically significant?)**

Better served with fusion…

- High impact activities/ labourer
- Young (<50 years)
- Any infection history
- Severe deformity
- High risk for wound complications
- Significant medical comorbidities

Summary

- Broad range of pathology
- Rare that surgery is the 1st treatment choice

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Questions?

Thank you

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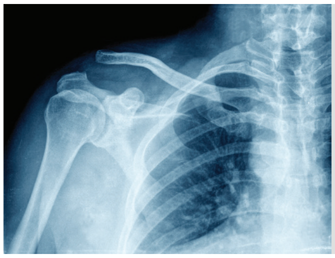

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Evaluation and Management of Degenerative Knee Conditions

Tessa Balach, MD
Associate Professor, Orthopaedic Surgery

Disclosure

- I have no financial relationships to disclose.
- I will not discuss off label use or investigational use in my presentation.

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Knee Osteoarthritis

- Nearly ½ of adults develop knee arthritis
- Cause of disability in 1 out of 5 people
- Approximately 700,000 knee replacements
- By 2030, knee replacement surgeries are projected to grow 673% to 3.5million procedures/year

AAOS A Nation in Motion

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Overview

- Evaluating a patient with a painful knee
- Radiographic Evaluation
- Treatment algorithm
- When to refer for joint replacement
- Anesthetic choices
- Expected post-operative timeline
- Commonly asked questions

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Evaluating your patient with a painful knee

History

- Location of pain:
  - Hip: Groin pain, thigh pain, buttock pain
    - Be weary of lateral hip pain (Trochanteric Bursitis)
    - Anterior thigh pain can be from the hip
    - Be aware of "referred pain"
  - Knee: Medial and lateral joint line pain
    - Isolated anterior knee pain in women can represent patellofemoral disease
    - Meniscal tears: acute joint line pain and mechanical symptoms (locking, catching, clicking)

History

- Is the problem acute or chronic?
- Exacerbating activities
- Mechanical symptoms (giving way, locking)
- Pain affecting activities of daily living or work
- Back Pain and Radicular symptoms (spine)
- History of trauma
- ACL tears and meniscal tears increase risk for OA
- Fractures
- History of previous surgery

Physical Exam

- Have patients wear shorts
- Knee Exam
  - Overall alignment (varus/valgus)
  - Gait
  - Neurologic exam
  - Vascular exam
  - Effusion
  - Range of motion (active and passive)
  - Joint line tenderness
  - Ligamentous stability
  - Patellofemoral crepitus/tracking

Physical Exam

- Palpate other areas to rule out other sources of pain
  - Iliotibial band
  - Pes anserine or trochanteric bursitis
- Assess for a Baker's cyst
  - Sign of DJD

Imaging Studies

Knee X-rays

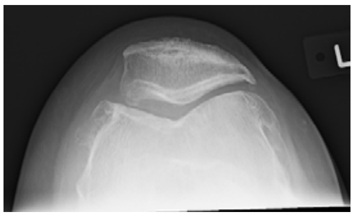
- Standing AP, Flexion, Lateral and Skyline View
  - Non-weightbearing views less helpful in assessing joint space narrowing

Knee X-rays

- Rosenberg 45º Flexion WB views bring posterior condyles into view which is involved earlier in the degenerative process

Knee X-rays

- Skyline view provides excellent assessment of patellofemoral joint



Other Studies

- *For degenerative knee conditions, weight bearing knee x-rays are sufficient*
- MRI
  - Identification of ligamentous or meniscal pathology
  - Minimal / no arthritis
  - Suspected bone or soft tissue tumor
  - i.e. a patient with moderate to severe OA would be expected to have degenerative meniscus changes; this would not alter treatment
- CT Scan
  - Suspected bone tumor
  - Fracture

Differential Diagnosis

- Knee:
  - Knee arthritis
  - Osteoarthritis vs inflammatory vs post-traumatic
  - Patellofemoral disease
  - ITB Syndrome
  - Pes Bursitis
  - Baker’s cyst
  - Osteonecrosis (SONK)

Differential Diagnosis

- Non-knee
  - Stress Fracture
  - Hip arthritis
  - Spinal pathology
  - Vascular disease

Patellofemoral Disease

- Anterior knee pain
- Patellar chondromalacia/arthritis
- May have patellar maltracking (J sign)
- Tender on the medial and lateral facet of patella
- Patellar crepitus/grind
- Treatment:
  - PT: VMO strengthening
  - Patella sleeve: can use but no evidence for or against
  - Surgery: depends on underlying problem (instability vs OA)

Iliotibial Band Syndrome

- Tenderness over lateral femoral epicondyle
  - Iliotibial band inserts at Gerdy's tubercle laterally
- Treatment: Predominantly non-surgical
  - Activity modification / rest
  - NSAIDS
  - Steroid injection
  - Physical Therapy
    - Stretching
    - Strengthening
    - Modalities

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Pes Anserine Bursitis

- Tenderness over pes anserine
  - Pes (sartorius, gracilis, and semitendinosis) inserts medial to tibial tubercle.
- Treatment: Predominantly non-surgical
  - Activity modification / rest
  - NSAIDS
  - Steroid injection
  - Physical Therapy
    - Stretching
    - Strengthening
    - Modalities

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Baker's Cyst

- Distended synovial lined bursa
  - Posteromedial between medial head of gastrocnemius and semimembranosus
- Knee effusion will find path of least resistance
- Can rupture and/or be mistaken for DVT
- Treatment
  - Address underlying pathology
  - Anti-inflammatory
  - Steroid injection
  - Can aspirate cyst under US guidance (but high chance of recurrence)
  - Treat underlying problem (OA or meniscal tear)

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Osteoarthritis

Radiographic OA Grading: Kellgren & Lawrence

GRADE	NARROW	SPURS	SCLEROSIS	DEFORMITY
1	Minimal	Lipping	None	None
2	Visible	Small	Some	Mild
3	Obvious	Moderate Multiple	Moderate	Visible
4	Bone on bone	Large	Severe	Obvious

Rheumatoid/Inflammatory Arthritis

Treatments

Non-operative Treatments

- **Anti-inflamatories**
- **Anti-inflamatories**
- **Anti-inflamatories**
- Weight reduction
- Activity Modification
  - Low impact activities (swimming)
- Assistive Devices
  - Cane, Walker
  - Wheelchair (avoid!)

Non-operative Treatments

- Physical Therapy
  - Focused on Quadriceps strengthening
- Glucosamine and Chondroitin (uncertain benefit)
- Physical Therapy can make symptoms worse in advanced arthritic joints.
- Offloader brace

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Non-operative Treatments

- Steroid Injection
  - Provides temporary relief
  - Can be repeated every 3-4 months
- Viscosupplement Injection
  - No clear benefit vs corticosteroid injection
    - Current AAOS guidelines do not recommend its use
  - Potential risk of inflammatory/allergic reaction (pseudosepsis)

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Corticosteroid Injections

- Pain improvement range from 3-12 weeks
- Can be done supine or sitting with knee bent over edge of table
- Blood glucose typically peaks between 4-8 hrs after injection
- My mixture:
  - 2mL 0.5% marcaine, 2mL 1% lidocaine, and 1mL triamcinolone 40mg/1mL.
    - 1 ½ inch long, 21 gauge needle
- Risks:
  - Incomplete relief of symptoms
  - Septic arthritis (1/10,000)
  - intra-articular calcifications
  - Cutaneous atrophy or depigmentation (~2%)

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Surgical Treatments

Surgical Treatments

- Knee arthroscopy
- Re-alignment osteotomy
- Knee fusion
- Uni-compartmental knee replacement
- Bi-compartmental knee replacement
- Total knee replacements

Knee arthroscopy

- No role for knee arthroscopy, debridement and/or lavage in the setting of moderate to severe degenerative changes in the knee
  - Moseley JB: Arthroscopic Lavage or Debridement Did Not Reduce Pain More Than Placebo Did In Patients With Osteoarthritis. N Engl J Med. July 2002
  - Finnish Degenerative Meniscal Lesion Study (FIDELITY) Group. Arthroscopic partial meniscectomy versus sham surgery for a degenerative meniscal tear. N Engl J Med. 2013 Dec 26;369(26):2515-24.
  - Khan et al: Arthroscopic surgery for degenerative tears of the meniscus: a systematic review and meta-analysis. CMAJ. 2014 Oct 7;186(14):1057-64.

Re-alignment Osteotomy

- Indicated in younger patients (<50 yrs old)
  - Laborers, athletes
- Only certain amount of deformity can be corrected
- Other compartment needs to be healthy enough to tolerate extra load
- Patients weighing >80 kg are at increased risk for failure

Re-alignment Osteotomhy

- Can trial an unloader brace pre-operatively to assess potential effectiveness
- Buys 5-10 years of time but will need TKA
- Conversion to TKA can be challenging

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Unicompartmental Knee Replacement

- Indicated for patients with isolated unicompartmental disease
- Pain localizes to affected compartment
- No significant deformity
- Weight <80 kg

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Unicompartmental Knee Replacement

- Benefits:
  - Less blood loss
  - Less morbidity
  - Faster recovery
  - Preservation of normal kinematics compared to TKA
- Risks:
  - Degenerative disease can progress in other compartments necessitating revision to total knee

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Bi-compartment replacement

- Replaces medial and patello-femoral compartments
- Indicated for young patients to delay TKA
- Preserves more normal knee kinematics
- Fairly new device and long term data not available.

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Total Knee Replacement (TKA)

- Tried and True
- Longest history
- Reliable outcomes

History

- Total knee arthroplasty began its evolution in the 1960's
- Early knees were hinges with metal-metal articulation and poor metallurgy.
- Many early failures
    - Infection
    - Loosening
    - Metal synovitis

History

- Based on the success of the hips, Dr. John Insall and Chitranjan Ranawat (New York), designed the modern total condylar knee replacement with metal-on-polyetheylene articulation

History

- Modern Total Knee Replacements
    - Excellent long term survivorship (15-20 yrs)
    - Designed has changed very little over during that timeframe.

History

- Modern Total Knee Replacements
  - TKAs are expected to last 15-20 years based on technology from a decade ago
  - With appropriate patient selection, excellent satisfaction rate (>85-90%)

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Decision Making

- Failed non-operative treatment
  - Duration of non-operative treatment widely varies
- Pain that affects quality of life most important indication
  - What activities do they enjoy doing that they can no longer do because of knee pain?
  - How far can they walk?
  - How are ADLs affected?
- Elective procedure
  - Patient will let you know when they are ready for surgery

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Decision Making

- Need to be medically optimized
  - BMI <35
  - HgA1C <7
  - Smoking cessation
- Preoperative functional status highly correlates with postoperative functional status

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TKA Outcomes

- Knee replacements dramatically improve patient's quality of life.
- High patient satisfaction
  - Hawker et al. JBJS 1998
  - 85% satisfaction rate and improved quality of life.
  - Scuderi and Insall JBJS 1998.
  - 15 year follow-up
  - 90% rated as good to excellent results

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- you have a 90-95% chance that your joint will last 10 years, and a 80-85% that it will last 20 years

Complications

- Infection
- DVT/PE
- Stiffness
- Wear
- Loosening

Preoperative Evaluation

- Medical optimization
- Subspecialist evaluations
- Dental visit
- Pre-Anesthesia Visit
  - Labs: CBC, BMP, PT/PTT, UA and urine culture.
  - ASA Stratification
- Total Joints Educational Class
- Preoperative physical therapy visit
  - Give an assistive device (cane/crutches/walker)
  - Teach expected post-operative exercises in PT

Type of Anesthesia

- Reviewed pre-operatively
- Options:
  - Neuraxial
    - Spinal
    - Epidural
  - Femoral-Sciatic Block
  - General Anesthesia

Post-operative Care

- VTE Prophylaxis
  - DVT around 1-10%
    - was as high as 40-60% when no prophylaxis was used
  - PE around 0.2% to 2%.
  - Fatal PE around 0.2%.
  - Options include
    - ASA and mechanical prophylaxis (SCD)
    - LMWH
    - oral factor Xa inhibitor
    - Warfarin

Post-operative Care

- Antibiotics x 24 hrs
- Start Physical Therapy POD #0 or POD #1
- Immediate post-op concerns:
  - Post-op fevers often due to atelectasis.
  - Tachycardia: if no explanation (fever, pain, or blood loss) r/o PE with spiral CT.
  - MS changes: consider post-op medications or fat emboli (commonly at 48-72 hrs post-op).
  - Acute Tubular Necrosis: often due to drop in intra-operative pressures. Fewer pressure issues with the more common use of uncemented prosthesis (cement monomers in circulation can cause drop in BP).
  - Cardiac events: related to cardiac risk and intra-operative blood pressure.

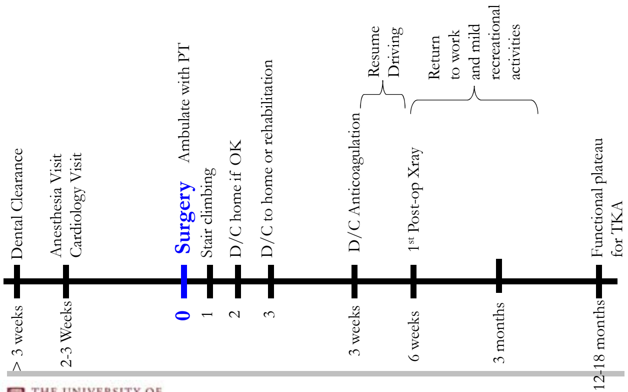
Pain Management

- Multi-modal peri-operative pain management
  - Pre-operative medications
    - Opioid medication
    - Anti-inflammatory
    - gabapentin
  - Intraoperative medications
    - Periarticular injection
  - Post-operative medications and therapies
    - Opioid medications
    - Anti-inflammatory
    - gabapentin
    - Peripheral nerve blocks

My practice

- Spinals for TKAs
- Peripheral nerve block if neuraxial anesthesia contraindicated
- VTE PPX
  - Low risk: ASA
  - Coumadin

TKA Expected Timeline



Commonly Asked Questions

- When can I return to work?
  - Sedentary: 4 - 8 weeks
  - Active: 3 months
- When can resume driving?
  - MacDonald JBJS 1988 (now outdated data with less invasive surgeries)
    - Lt. hip 8 wks
    - Rt. Hip 12 wks
    - Lt. Knee 4-6 wks
    - Rt. Knee 6-8 wks

Commonly Asked Questions

- When can I resume athletic activities?
  - > 6 weeks for low impact (ie. golf or doubles tennis); > 3 months for more demanding activities.
  - Biking (earlier for stationary bike)
  - Swimming is good low impact exercise.
  - Lifetime restriction: high impact activities
    - Running
    - Jumping

Commonly Asked Questions

- Should I have dental prophylaxis?
  - Controversial
  - My recommendation is "yes, forever"
  - Amoxicillin 2000mg 60 minutes prior to procedure
  - If allergic: Clindamycin 900mg 60 minutes prior to procedure
- Will I set off the metal detector at the airport?
  - Yes
    - 90% will set off metal detectors
  - Elect for x-ray scanner

Minimally Invasive Surgery (MIS)

- Gains for MIS surgery is only short term.
- Better functional score achieved earlier.
- The difference is in the first 6 weeks after surgery.
- At 1 year, no difference between groups.
- In general, our incisions have become less invasive than they were couple of decades ago because of better instrumentation
- Patients also like smaller incisions because of cosmesis.

Modern Trends in Knee Replacement Surgery

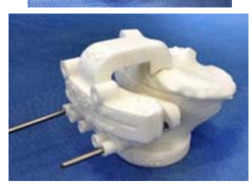
- Minimally Invasive Surgery
- Patient Specific Instrumentation
- Navigated / Robotic Assisted Surgery

Minimally Invasive Surgery (MIS)

- Smaller incisions
- Less dissection
- Improved instrumentation
- Sparing the quadriceps tendon in TKA
- Improved post-operative pain management

Patient Specific Instrumentation

- Goals:
  - Improved component positioning
  - Improved outcome
  - Improved patient satisfaction
- CT scan
  - Plan alignment of cuts
- 3D printed cutting guides



Ann Transl Med. 2016 Apr; 4(7): 126.

Navigated / Robotic Assisted Surgery

- Goals:
  - Improved component positioning
  - Improved soft-tissue balancing
  - Improved outcomes
  - Improved patient satisfaction
- CT Scan
  - Plan alignment of cuts and components
- Navigation Assisted Surgery
  - Register bony landmarks to computer guidance to guide surgeon in making bony cuts
- Robotic Assisted Surgery
  - Builds on navigation techniques
  - Robotic arm with saw attached to make bony cuts

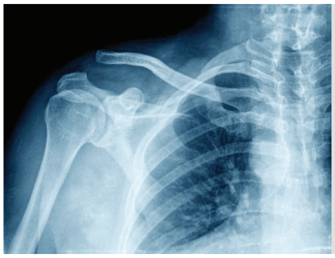
Summary

- Exhaust non-surgical treatments first
- Goal is to relieve pain and improve quality of life
- Time appropriate referral for joint replacement
  - Depends on patient: is knee pain affecting their quality of life?
  - Are they medically optimized (BMI, blood sugar, smoking cessation)?
  - Pre-operative functional score is predictive of post-operative functional score
- Faster recovery compared to a decade ago
  - Improved peri-operative pain management
  - Less invasive surgery, better instrumentation
- Knee replacements are good and reliable surgeries

Useful Links

- www.aaos.org
  American Academy of Orthopaedic Surgeons
- www.arthritis.org
  Arthritis Foundation
- www.aahks.org
  American Association of Hip and Knee Surgeons

Thank you!



Degenerative Hip Problems

Sara Wallace, MD

Top 10 Myths about Hip Arthritis

Sara Shippee Wallace, MD MPH
Adult Reconstruction
Department of Orthopaedic Surgery

06.06.19

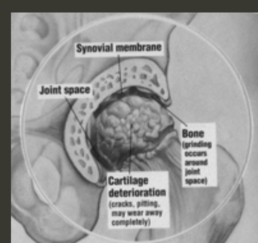
Disclosures

- None

Overview

- Arthritis
- Common causes of hip arthritis
- Top 10 myths
- Hip replacement today
- Questions

Arthritis



Arthritis

(Bartley, Palit et al. 2017)

Arthritis

A syndrome
- Osteoarthritis
- Inflammatory arthritis
- Osteonecrosis
- Post-traumatic arthritis
- Developmental dysplasia

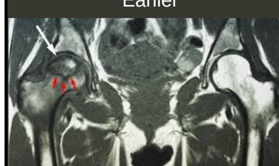
Osteonecrosis (AVN)

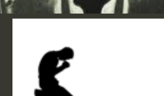
(Baig and Baig 2018)

Osteonecrosis (AVN)

Earlier

Later





Rheumatoid / Inflammatory Arthritis

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Rheumatoid / Inflammatory Arthritis

DRUG	DOSING INTERVAL	CONTINUE/WITHHOLD
Methotrexate	Weekly	Continue
Sulfasalazine	One or twice daily	Continue
Hydroxychloroquine	One or twice daily	Continue
Adalimumab	Weekly or q 2 weeks	Week 2 or 3
Etanercept	Weekly or twice weekly	Week 2
Infliximab	Every 4,6, or 8 weeks	Week 5, 7 or 9
Azathioprine	Once or twice daily	Depends on severity of disease

2017 American College of Rheumatology/ American Association of Hip and Knee Surgeons Guideline for the Perioperative Management of Antirheumatic Medication in Patients With Rheumatic Diseases Undergoing Elective Total Hip or Total Knee Arthroplasty (Goodman, Springer et al. 2017)

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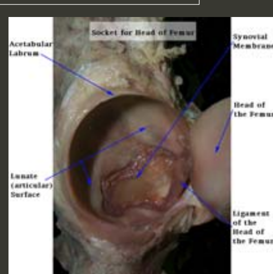
Hip Dysplasia



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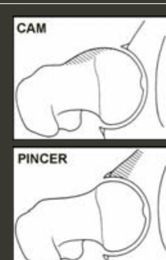
Femoroacetabular Impingement (FAI)



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Osteoarthritis

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Osteoarthritis

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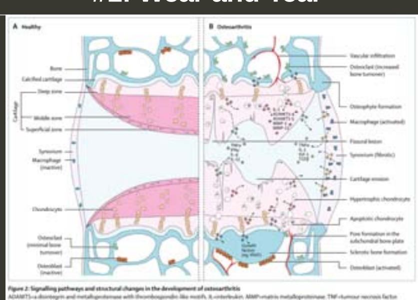
#1: Wear and Tear



(Bartley, Palit et al. 2017)

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#2: Buttock Pain

(Nakamura, Oinuma et al. 2013)

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#2: Buttock Pain

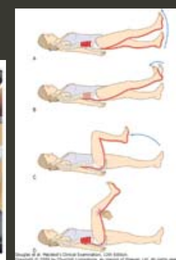
(+) Stinchfield Test

It's the hip!

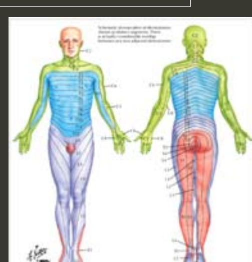
#2: Buttock Pain

(-) Stinchfield Test

Not the hip!



#3: Knee Pain



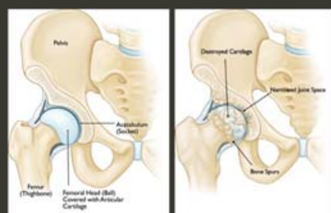
(Emms, O'Connor et al. 2002)

#3: Knee Pain

Hip rotation is painful?

It's the hip!

#4: Can’t you just clean it out?



(Hunter and Bierma-Zeinstra 2019)

#4: Can’t you just clean it out?

(Hevesi, Krych et al. 2018)

#5: Imaging/The Role of MRI

#5: Imaging/The Role of MRI

Osteonecrosis
Occult fracture (rare)

(Sen 2009)

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#6: It's Bone-on-Bone

- Never "have to have hip replaced"

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#6: It's Bone-on-Bone

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#7: Injections

"What about stem cells?"


Stem Cell Centers in the United States: Patients Should Proceed with Caution

By: William M. Mihalko, MD, PhD; S. Raymond Golish, MD, PhD, MBA; and J. Tracy Watson, MD


U.S. FOOD & DRUG

FDA Warns About Stem Cell Therapies

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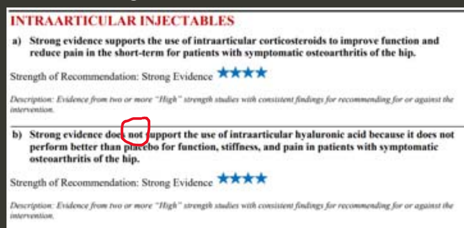
#7: Injections

"What about the gel?"



INTRAARTICULAR INJECTABLES

a) **Strong evidence supports the use of intraarticular corticosteroids to improve function and reduce pain in the short-term for patients with symptomatic osteoarthritis of the hip.**

Strength of Recommendation: Strong Evidence ★★★★

Description: Evidence from two or more "High" strength studies with consistent findings for recommending for or against the intervention.

b) **Strong evidence does not support the use of intraarticular hyaluronic acid because it does not perform better than placebo for function, stiffness, and pain in patients with symptomatic osteoarthritis of the hip.**

Strength of Recommendation: Strong Evidence ★★★★

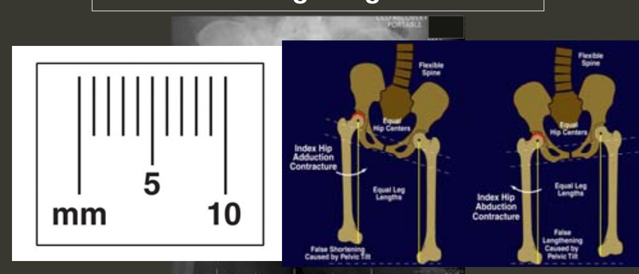
Description: Evidence from two or more "High" strength studies with consistent findings for recommending for or against the intervention.

AAOS.org. Management of Osteoarthritis of the hip evidence-based clinical practice guidelines. 2017.

#7: Injections

#8: Leg Lengths

#8: Leg Lengths



#9: Opioids

Small gain

Side effects

Risk for addiction and overdosage

(Ackerman, Zomer et al. 2018)
(Deveza, Hunter et al. 2018)
(Inacio, Cashman et al. 2018)

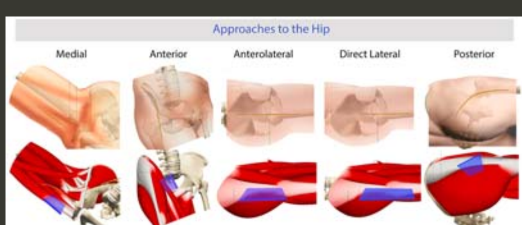
#9: Opioids

ACR conditionally recommends:

- Acetaminophen
- Oral NSAIDs
- Tramadol
- Intra-articular steroid injections

(Hochberg, Altman et al. 2012)

#10: The Anterior Approach



(Orthobullets.com)
(Massin 2016)

#10: The Anterior Approach

- Slight differences in early recovery in some studies
  - E.g. Time to discontinue walker use 10 vs 15 days
- No differences at 2 months, 1 year
- No difference in PROs
- No difference on x-rays
- No difference in complications (dislocation risk similar)

(Taunton, Trousdale et al. 2018)

- Nerve dysfunction (2.8%)
- Higher rate of intraoperative femur fracture (1.3% - 2.3%)
- Higher rate of femoral revision surgery within 12 months (1.2% to 2.1%)

(De Geest, Fennema et al. 2015)

(Lee and Marconi 2015)

#10: The Anterior Approach

Are hip precautions necessary???

Maybe not…

Barnsley, Barnsley et al. 2015,
Kornuijt, Das et al. 2016,
van der Weegen, Kornuijt et al. 2016
Peters, Tijink et al. 2015
...

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Hip Replacement

THE LANCET
Volume 370, Issue 9597, 27 October–2 November 2007, Pages 1508-1519

Review

The operation of the century: total hip replacement

Prof Ian D Learmonth FRCS, Claire Young FRCS, Prof Cecil Rorabeck FRCS

Show more

https://doi.org/10.1016/S0140-6736(07)60457-7 Get rights and content

***IDL is a consultant for DePuy International and has received research funding from DePuy, Stryker, Endoplus, and Zimmer. CR has been a consultant for Smith & Nephew.
(Learmonth, Young et al. 2007)

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Hip Replacement

Lifetime risk of undergoing hip replacement at age 50:

- Women 11.6%
- Men 7.1%

(Culliford, Maskell et al. 2012)

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Hip Replacement

"Highly crosslinked polyethylene liner"

"Porous coating"

"Dual mobility technology"

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Hip Replacement

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Questions?

THANK YOU

Sara Wallace
Hip and Knee Replacement
DCAM 4B
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Cell: 708-805-6065

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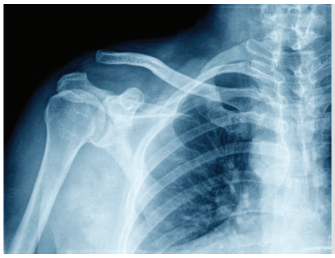


Evaluation and Initial Treatment of Acute Hand Injuries

Daniel P. Mass MD
Professor of Orthopaedic and Plastic Surgery
University of Chicago
Chicago, Il

- I have no financial relationships to disclose
- I will not discuss off label use/or investigational use in my presentation

One third of all Orthopaedic injuries seen in the ER are hand injuries

A good knowledge of functional anatomy helps perform a painfree evaluation of a patient

EMERGENCY ROOM	OPERATING ROOM
Superficial lacerations	Deep/ contaminated wounds
Nailbed injuries	Amputations
Fingertip avulsions (<1cm)	Fingertip avulsions (>1cm)
Extensor tendon injuries (not at wrist)	Flexor tendon injuries
Superficial infections	Nerve injuries
Minor Burns	Deep infections
	Major trauma

THE FIRST PHYSICIAN TO TREAT A PATIENT INFLUENCES THE OUTCOME!

HEMOSTASIS

- **Pressure dressing**
- **Elevation**
- **Tourniquet**

NEVER CLAMP A BLEEDER

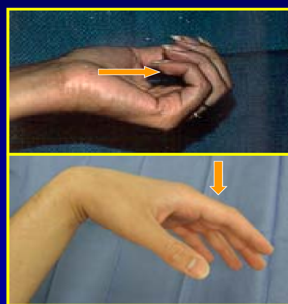
HISTORY

INCLUDE

- What happened?
- How it happened?
- Environment

EXAM

Tendons: Tenodesis Effect



What is injured now?

What is injured now?

EXAM

Vessels:

- Capillary Refill
- Allen’s Test
- Digital Allen’s Test

EXAM

Nerves:
- Sweat Test
- Wrinkle
- 2 Point Discrimination

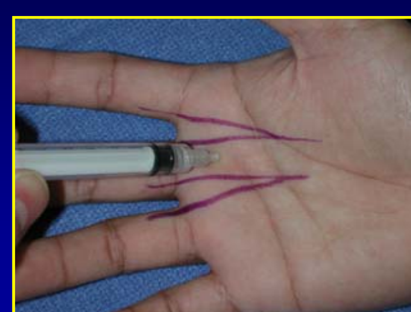
EXAM

Bones / Joints:
- X-rays in 2 Planes

Diagnostic Tests

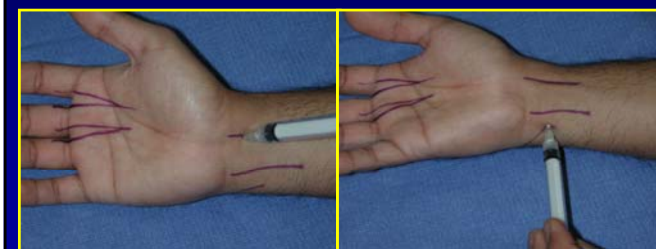
- X-ray
- Wound culture
- Exploration of wound

Digital Block



Wrist Block

- Median Nerve
- Ulnar Nerve



Wrist Block

- Dorsal Radial Sensory
- Dorsal Ulnar Sensory

WOUND CARE

Irrigate:

Don’t soak- Hand is dependent

No Betadine - tissue toxic

WOUND CARE

Clean Wounds: less than 8 hours old -

Loose closure

A few skin sutures

Do not close in layers

WOUND CARE

Do not close

- Contaminated wounds
- Open wounds greater than 8 hours old
- Human or animal bites

WOUND DRESSING

Non-adherent dressing

Wet gauze - acts as a wick

Bulky dressing

Splint:

- Wrist - 20 deg Dorsiflex
- MP - 90 deg Flex
- IP - Neutral
- Thumb - Palmar Abd

BAD SPLINTS

BAD SPLINTS

MEDICATION

Tetanus prophylaxis
Antibiotics
Pain medication

INSTRUCTIONS

Elevation
Return Appointment

NAILBED INJURIES

- Associated with distal phalanx fractures
- Subungual Hematoma less than 30%:
  - Lance with hot paperclip - 2-3 holes
- Zinc oxide ointment on nail to keep draining

NAILBED INJURIES

- Nailbed laceration or >30% hematoma
  - Remove nail
  - Repair nailbed
    - 7-0 chromic
    - Dermabond
  - Replace nail or use nail substiture

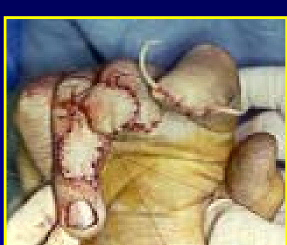
Fingertip Avulsion

- Wounds < 1cm:
  - Clean
  - Allow to heal secondary

Fingertip Avulsion

- Wounds > 1 cm
- Requires skin graft and flaps

Fingertip Avulsion



FLEXOR TENDON INJURIES

- Evaluate with tenodesis
- Explore wound
- Close wound loosely
- Splint

FLEXOR TENDON INJURIES

- Primary Repair: 1-5 days
- Delayed Primary Repair: up to 3 weeks
- If nerves injured

FLEXOR TENDON INJURIES

All flexor tendon repairs must be performed in the operating room

EXTENSOR TENDON INJURIES

- Distal to metacarpal neck the tendon do not retract
- Can be repaired in the emergency room
  - 4-0 Nylon mattress sutures
- 4 weeks of immobilization
  - wrist extended and MP's 20 deg, IP's free

EXTENSOR TENDON INJURIES

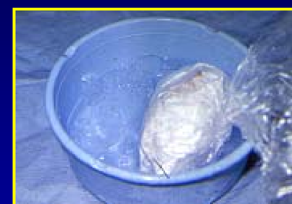
- Proximal injuries retract
- Require the operating room

AMPUTATIONS

Single digit amputation in adults - except for the thumb - are not replanted

AMPUTATIONS

- Cool amputated part in Ringer's soaked gauze
- Place into a plastic bag
- Float on ice water
- Transport quickly



AMPUTATIONS

6 Hr limit on revascularization if muscle involved

DO NOT PROMISE REATTACHMENT

INFECTIONS

- Cellulitis
- Abscess
- Bites
- Paronychia
- Felon
- Suppurative Flexor Tenosynovitis

CELLULITIS

- Streptococcus Infection
- Spreads rapidly in 24 hrs
- Dx signs:
  - Lymphangitis
- Rx:
  - Immobilization
  - IV Nafcillin - if significant lymphangitis
  - Dicloxacillin at home

ABSCESS

- Usually Staphalococcus infections
- Developes within 72 Hrs
- Dx Signs:
  - localized pain
  - redness
  - local swelling
- Rx:
  - Surgical Drainage
  - Antibiotics - Cephalosporins vs Clindomycin

BITES

- Human bites including clenched - fist have a mixed flora which includes anaerobes and Eckenella Corredens
- Infection develop rapidly

- Dx signs:
  - localized pain
  - redness
  - swelling
- Rx:
  - Drainage in OR
  - Immobilization
  - Antibiotics -
    - Augmentin or Cefoxitin

BITES

- Animal bites include the anaerobe Pasturella Multocida
- Dx signs:
  - Localized pain
  - Redness
  - Swelling
- Rx:
  - Immobilization
  - Antibiotics
    - Unasyn IV
    - Augmentin

FELON

- Extremely painful pulp space infection
- Usually staphlococcus
- Develops at the volar tip of the finger

FELON

- Rx:
  - ER drainage at sight of pointing
  - Silvadene and soaks tid
  - Antibiotics
    - 1st Gen Cephalosporins

PARONYCHIA

- Common nailfold infection
- Usually Staphlococcus
- Dx signs:
  - Pain
  - Redness
  - Swelling at nail fold

PARONYCHIA

- Early Rx:
  - silvadene,
  - warm soaks TID
  - cephalosporin
- Late Rx:
  - I&D of nailfold under digital block
  - silvadene
  - soak
  - cephalosporin

SUPPURATIVE FLEXOR TENOSYNOVITIS

- **Flexor sheath infection that can rapidly lead to tendon necrosis**
- **SURGICAL EMERGENCY**

SUPPURATIVE FLEXOR TENOSYNOVITIS

- **KANAVEL'S SIGNS**
  - **Exquisite tenderness over the flexor sheath**
  - **Slight PIP flexion**
  - **Exquisite pain on passive extension of the finger**
  - **Fusiform swelling of the finger**
    - **MP to mid distal phalanx**

Tendonitis, Common Hand Masses, and Compression Neuropathies

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- I have no financial relationships to disclose
- I will not discuss off label use/or investigational use in my presentation

Tendonitis / Tenosynovitis

- Trigger finger
- DeQuervain's stenosing tenosynovitis

Trigger Finger

- Catching and Locking of the PIP Joint
  - Worst in the AM
- Palmar Pain at the MP Joint
- Palmar nodule can often be palpated

Trigger Finger

Trigger Finger

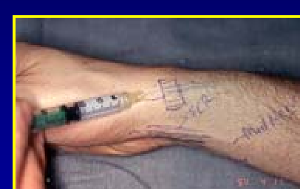
- Associated with DeQuervain's and CTS
- Conservative Rx:
  - Tendon sheath injection
- Surgery

DeQuervain's

- Pain and catching on radial side of wrist
  - Worst in the AM
- Common in the post-partum year
- + Finkelstein's test
  - Thumb MP flexion with wrist in ulnar deviation

DeQuervain's

- Ddx:
  - Basilar Joint Arthitis
  - Radial Neuritis
- Conservative Rx
  - Tendon sheath injection
  - Thumb spica splint
  - NSAID
- Surgery



Hand Masses

- Ganglions
- Mucous Cysts

Ganglions

- Dorsal Wrist
  - Pain and Unsightliness
  - Rx:
    - Ignore
    - Bible
    - Aspiration
    - Surgery

Ganglions

- Volar Wrist
  - Pain and Unsightliness
  - Rx:
    - Ignore
    - Surgery (Do not aspirate)

Ganglions

- Flexor tendon sheath
  - Mass in palm
  - Pain with grip
  - Rx:
    - Aspirate if central
    - Surgery if under neurovascular bundle

Mucous Cysts

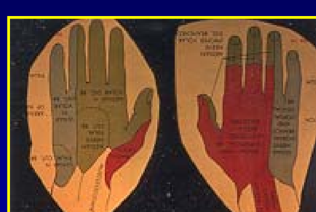
- **Degenerative Cysts from the DID Joint**
  - **Unsightly**
  - **Deforms Nail**
  - **Thins Skin**
  - **Rx:**
    - **Observe**
    - **Surgery**

Nerve Compression Syndromes

- **Carpal Tunnel Syndrome**
- **Cubital Tunnel Syndrome**

Carpal Tunnel Syndrome

- Symptoms
  - Wakes at night
  - Numbness and Tingling Radial 3 1/2 fingers
  - Weakness of Opposition



Carpal Tunnel Syndrome

- **Symptoms**
  - **Occurs with gripping as Driving**
  - **Progresses to complete Numbness and loss of Opposition**

Carpal Tunnel Syndrome

Carpal Tunnel Syndrome

- Diagnostic Tests
  - Phalen's Test
  - Durkin's Compression Test
  - Tinel's
  - Blood Tests
  - X-rays
  - EMG/NCV
  - Injections

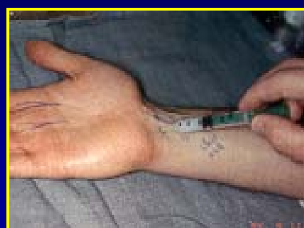
Carpal Tunnel Syndrome

- Causes
  - Acute Trauma
  - Fluid Retention
    - Pregnancy
    - Thyroid Disease
    - Dialysis
  - Repetitive Stress
- Differential Diagnosis
  - Inflammatory Arthritis
  - Pronator Tunnel Syndrome
  - Thoracic Outlet Syndrome
  - Cervical Disc

Carpal Tunnel Syndrome

- Treatments
  - Rest
  - Splinting
  - NSAIDs
  - Vit B-6
  - Job Modification
  - Injection of Steroids
  - Surgery
    - Open CTR
    - Endoscopic CTR

Carpal Tunnel Syndrome

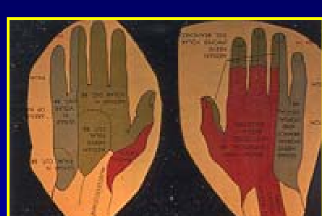


Carpal Tunnel Syndrome

- Surgery
  - Open CTR

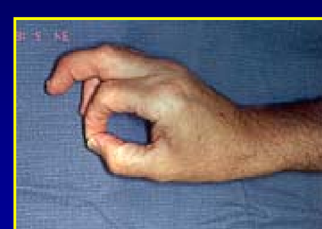
Cubital Tunnel Syndrome

- Symptoms
  - Wakes at night
  - Numbness and Tingling Ulnar 1 1/2 fingers
  - Weakness in pinch and Abd/Add of fingers



Cubital Tunnel Syndrome

- Symptoms
  - Occur with elbow flexion
  - Progress to complete numbness and loss of pinch



Cubital Tunnel Syndrome

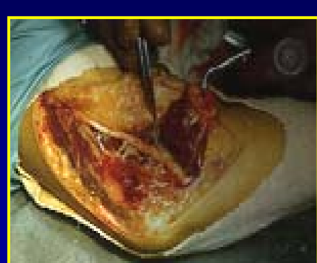
- Diagnostic Tests
  - Elbow flexion test
  - Nerve compression
  - Tinel' s
  - Blood tests
  - X-ray (Cubital Tunnel view)
  - EMG/NCV
  - Injections

Cubital Tunnel Syndrome

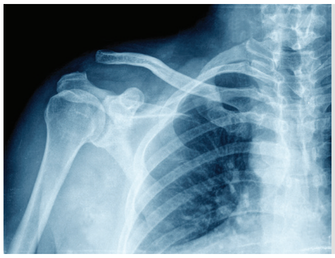
- Causes
  - Acute Trauma
  - Rheumatoid Arthritis
  - Fluid Retention
    - Pregnancy
    - Thyroid Disease
    - Dialysis
- Differential Diagnosis
  - Inflammatory Arthritis
  - Ulnar Tunnel Syndrome
  - Thoracic Outlet Syndrome
  - Cervical Disc

Cubital Tunnel Syndrome

- Treatment
  - Rest
  - Splinting
  - NSADs
  - Vit-B
  - Job Modification
  - Injection of Steroids
  - Surgery - Ulnar Nerve Transposition



THANK YOU



Lateral Elbow Pain: Tennis Elbow and Beyond

Jennifer Moriatis Wolf, MD

THE UNIVERSITY OF CHICAGO MEDICINE & BIOLOGICAL SCIENCES

Lateral Elbow Pain: Tennis Elbow and Beyond

Jennifer Moriatis Wolf, MD
Professor, Department of Orthopaedic Surgery

Disclosures

- Research supported by a grant from the American Foundation for Surgery of the Hand
- Salary – Deputy Editor of Journal of Hand Surgery, Elsevier Updates Editor
- I will discuss off-label use of botulinum toxin

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Background – Lateral Elbow Pain

- The most common problem – 'tennis elbow'
  - Up to 3% of population affected over lifetime
  - 3.4/1000 population incidence in one study
    - Sanders et al, AJSM, 2015
  - Male: female ratio approximately equal incidence
  - Most common in 30-50 year age group
- Originally known as 'lawn tennis elbow'
  - First described in 1800s - *Morris, J Bone Joint Surg Br, 1864*
- 'Can't pick up my coffee cup' without pain
- No pain at rest – generally
- No loss of motion

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Lateral vs. Medial Epicondylitis

- Lateral epicondylitis much more common
  - 6:1 incidence   Shiri et al, Am J Epidemiol, 2006
  - More ADLs done with hand in 'power grip' position

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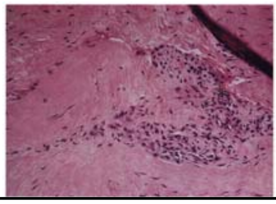
Basic Science of Lateral Epicondylitis

- Tendinosis/tendinopathy – degenerative overuse of tendon origin
- Microscopic tissue studies:
  - o Extensor carpi radialis brevis tendon invaded by immature fibroblasts, vascular buds
  - o "Angiofibroblastic tendinosis"
    - » Nirschl RP, Ashman ES; Clin Sports Med, 2001
- Not inflammatory!



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Differential Diagnosis

- Lateral
  - o Radial tunnel syndrome – PIN compression
  - o Elbow fracture or LUCL sprain
  - o Elbow arthritis
- Medial
  - o Ulnar nerve compression, snapping, neuritis
  - o Snapping medial triceps
  - o UCL sprain or tear

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Differential Diagnosis

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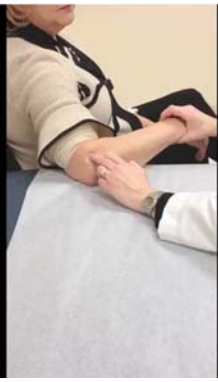
Examination of the Lateral Elbow



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Workup

- Diagnosis – based primarily on exam
- Radiographs – typically negative
  - o Findings on Xray changed treatment in only 2/294 cases   Pomerance, J Shoulder Elbow Surg, 2002
- MRI – signal change in ECRB
  - o Read as partial tear most commonly
    - Steinborn et al noted signal change in 6/11 asymptomatic contralateral elbows in patients with lateral elbow pain   Eur Radiol, 1999
  - o Used when question of other or concomitant diagnosis

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Treatment Perspective

- **Do we need to do anything??**
- 'Wait-and-see' group did as well, at 1 year, as steroid injection and therapy groups   Smidt et al, Lancet 2002
- Ring - 'medicalization' of tennis elbow
  - o Upper extremity outcomes scores correlated with depression scales   Lindenhovius et al, J Hand Surg, 2008
- Recent study showed positive phrasing improved patients' ability to cope with LE symptoms, compared to negative phrasing   Lee et al, J Shoulder Elbow Surg, 2014

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Disease of aging? Expected and normal?

- Szabo RM "…we should do everything possible to encourage a sense of health and wellness that will decrease pain intensity and limit disability while waiting for this self-limited disorder to resolve"
  - J Hand Surg Am, 2013
- Allows us to educate patients about this evidence
  - o Assure them that use of their elbow will not damage the elbow structurally
  - o Minimally invasive treatment or no treatment may do just as well

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Conservative Measures

- Splints
  - o Forearm band
  - o Wrist splint
- Therapy
  - o Eccentric stretch, massage, strengthening
  - o Neck and shoulder - postural
  - o Ultrasound
  - o Iontophoresis
    - Struijs PA, et al. Am J Sports Med, 2004
    - Martinez-Silvestrini JA et al.. J Hand Ther, 2005
    - Van De Streek et al, Prosthet Orthot Intl, 2004
    - D'Vaz AP, et al Rheumatology , 2006
    - Nirschl RP, et al. Am J Sports Med 2003

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Injections - Evidence

- Corticosteroid
- Autologous Blood/whole blood
- Platelet Rich Plasma (PRP)

LIMITED DATA

- Botulinum toxin
  - o Randomized controlled multicenter trial in Germany showed significant effect compared to placebo at 4 months Placzek et al, J Bone Joint Surg, 2012
  - o Use in lateral elbow is off-label
- Prolotherapy
  - o Hypertonic glucose or saline injection – thought to 'irritate' the area and induce healing

Corticosteroid Injections

- Pain relief in short term – average 6 weeks
  - o Significantly better short term outcomes (<= 6 weeks) with corticosteroid injection in pain, function, grip strength in meta-analysis of 13 RCTs; no effect on pain in intermediate or long term outcomes (>6 weeks and up to 1 year)
    - » Smidt et al, Pain, 2002
- Lindenhovius et al – compared corticosteroid to lidocaine only (placebo) in 64 subjects in a randomized blinded trial
  - o NO difference between groups up to 24 weeks measured by DASH and VAS pain scores
    - – Lindenhovius et al, J Hand Surg, 2008

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Autologous Whole Blood Injections

- First reported by Edwards and Calandruccio
  - 22/28 patients with lateral epicondylitis who had failed multiple other treatments – relieved completely of pain after 1 or 2 autologous blood injections J Hand Surg , 2003
- Randomized blinded trial comparing blood to steroid and saline showed improvement in all groups at 6 months using DASH and pain VAS
  - o No superiority of one type of injection over any other Wolf et al, J Hand Surg, 2011

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Autologous Blood Injections

- Recent randomized controlled trial compared AB to steroid in 60 patients
  - o Steroid superior at 6 weeks
  - o At 6 months – 90% of AB group and 47% of CS group completely relieved of pain

  Dojode et al, Bone Joint Res, 2013
- Meta-analysis/review of randomized trials showed significant difference favoring
  - o Steroids up to 6 weeks
  - o Autologous whole blood 8-24 weeks and in medium term followup in general Tsikopoulos et al, Phy Ther Spor, 2016

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Platelet Rich Plasma (PRP) Injections

- Theory – concentrated solution of growth factors including platelet-derived growth factor (PDGF) – allowing area of tendinopathy to 'heal'
  - RCT in Netherlands compared PRP to steroid injection in 100 patients Peerbooms et al, AJSM, 2010, 2012
  - 73% vs. 49% success by VAS and DASH at 1 year ($p<0.001$) and 2 years
- Recent RCT also noted PRP superior to lidocaine control at 6 months Mishra et al, AJSM, 2013
- Comparison of autologous blood vs PRP in randomized trial in 76 patients showed no differences at 12 months
  - Mayo, VAS, PRTEE scores Raeissadat , BMC Sports Med, 2014
- Comparison of steroid vs autol blood vs PRP in systematic review showed better short-term outcomes with steroid, and equivalent long term outcomes with ABI vs PRP Hauck et al, Ortho J Sports Med, 2019

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NEW DATA

- Israeli study of recombinant type I collagen scaffold mixed with platelet rich plasma injected for lateral epicondylitis
- Safety study in 40 patients followed at 6 months and 1 year
- No adverse events
- Grip improved from 28kg to 36 kg on average
- Patient-Rated Tennis Elbow Evaluation score improved by 59%
- Ultrasound appearance of extensor origin was improved
- Farkash et al, J Shoulder Elbow Surg, 2019

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Ultrasonic Percutaneous Tenotomy ('Tenex')

- Treatment with a device that performs ultrasonic 'ablation' of the tendon origin by debriding and suctioning tissue under ultrasound guidance
- Only papers supporting this are published by the inventors
- Initial series of 19 patients at the Mayo clinic treated prospectively with decreased VAS and DASH at 12 months Barnes et al, JSES, 2015
- Seng et al – followed 20 patients for 3 years and showed sustained pain relief, strength, and improved function Am J Sports Med, 2016

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Surgical Treatment of Tennis Elbow

- Open debridement of the ECRB – "Nirschl procedure"
- Arthroscopic release/debridement/excision of plica
- Denervation
- Percutaneous release
  - Ultrasonic – 'Tenex'

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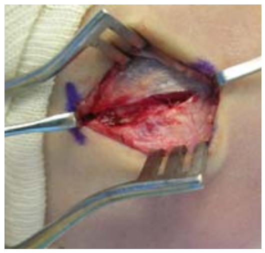
Open Debridement of Tendon Origin

- Described by Nirschl and Pettrone in 1979
  - o Debride devitalized tissue at ECRB origin
  - o Good results in their series – 80-90% of patients had pain relief and satisfaction
- However, no Level I or II studies of this technique – primarily retrospective studies
  - o Nirschl RP, Pettrone FA, J Bone Joint Surg, 1979
  - o Dunn et al, AJSM, 2008
  - o Schipper et al, AJSM, 2011



Arthroscopic Treatment

- Szabo et al: Retrospective comparison of percutaneous, open, and arthroscopic release of the extensor origin
  - o All patients had significant improvement in pre- and post-op Andrews-Carson scores
  - o * no difference between groups J Shoulder Elbow Surg. 2006
- Grewal et al: noted good to excellent outcomes in retrospective study in 36 pts with high occupational demands/heavy laborers
  - Workers compensation patients didn't respond as well as non-WC
  - 30/36 reported improvement J Hand Surg, 2009

Open vs Arthroscopic Comparison

- Kwon et al – compared 29 patients treated with open Nirschl procedure to 30 patients treated arthroscopically
  - o Noted similar improvements in both groups at 2 year followup – qDASH and pain VAS
  - o Small but significant measure of superiority of open Nirschl for pain with hard work

JSES, 2017

Denervation

- Described by Wilhelm and Dellon
  J Hand Surg Br, 1996; PRS, 2009
- Sectioning the deep cutaneous branches of posterior cutaneous nerve that consistently innervate the epicondyle
- Retrospective review of 26 patients, 30 elbows treated surgically
  - o Showed 80% good or excellent results at 28 month followup
  - o Decrease of pain VAS from 7-8 to 1.7 & improved grip Rose et al, J Hand Surg, 2013

Release of Tendon Origin

- Grundberg described percutaneous release in 31 elbows, with resolution in 29/31 CORR, 2000
- Panthi et al demonstrated good or excellent outcomes in 84% of a prospective cohort of 50 patients Curius, 2017
  - o Used an 18 gauge needle to percutaneously release the origin

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Failed or Recalcitrant Tennis Elbow

- Morrey et al described a cohort of 73 patients who presented after failed surgery for tennis elbow
  - o Half had posterior interosseous nerve compression
  - o Other half had unrecognized ligamentous or capsular insufficiency
    - – JSES, 1992

- Case for radial tunnel syndrome as the cause of tennis elbow that doesn't resolve or respond to conservative management

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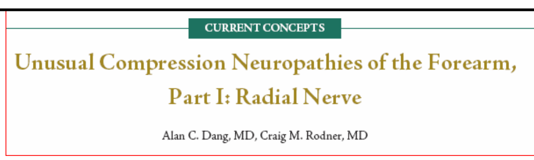
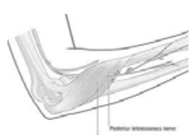

CURRENT CONCEPTS

Unusual Compression Neuropathies of the Forearm, Part I: Radial Nerve

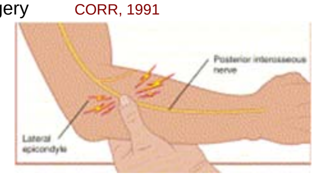
Alan C. Dang, MD, Craig M. Rodner, MD

- Radial tunnel syndrome – 'diagnosis of exclusion'
- Overlap with lateral epicondylitis
  - Often the diagnosis after failed lateral epicondylitis surgery
  - Pain in the proximal third forearm
  - *Complaint of pain waking patient at night*



Workup

- Physical examination
  - o Tenderness at proximal forearm – mobile wad
  - o ?Pain with resisted MF extension
- MRI and EMG typically negative
- Diagnostic steroid injection
  - o Described previously by Linscheid et al
  - o Response to injection predicted positive response to surgery CORR, 1991



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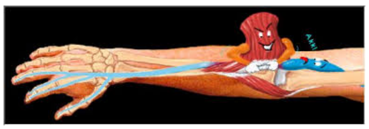
Limited Literature

- Moss & Switzer, J Hand Surg, 1983
  - o Theory that radial tunnel represented failed tennis elbow diagnosis or surgery
  - o Series of 15 patients (9 of which had had previous tennis elbow surgery – mean of 2.3 years of symptoms
    - Failed steroid injections, long arm splinting, NSAIDs
    - Underwent anterior decompression of PIN
  - o 14/15 complete symptom resolution at 26 month followup
- Lawrence et al – J Hand Surg Br, 1995
  - o 29 patients, 30 PIN decompression
  - o 70% good to excellent, fair in 13%, poor in 17% at 2 years



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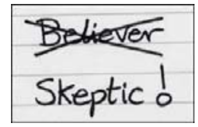
Myth? Many are not believers



- De Smet et al, Acta Orthop Belg, 1999
  - o Retrospective study of 19 patients, 20 PIN decompressions for radial tunnel
  - o 75% good to excellent using Roles & Maudsley criteria
    - Pain, motion, activity
  - o However, only 40% stated that they were satisfied
    - Primarily due to residual pain
  - o 'cast some doubt on the role of compression of PIN in pathogenesis of chronic lateral elbow pain'
  - o **Is radial tunnel syndrome a myth?

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Study of Diagnostic/Therapeutic Injection for Radial Tunnel Syndrome

- Study population – 40 subjects
  - 27 women
  - 13 men
- 31/40 diagnosed with concurrent lateral epicondylitis (78%)
- Prospectively enrolled after clinical examination consistent with radial tunnel
- Underwent single corticosteroid injection at site of maximal tenderness
- Showed resolution of symptoms in 75% at one year
- 10/40 had transient pain relief, with recurrence, and went on to surgical release

- Marchese et al, HAND, 2018

My algorithm for radial tunnel syndrome

- Needs to be a part of differential diagnosis
  - Especially in patients with longstanding complaints or pain waking them at night
- Unusual to see motor weakness – but can happen
- Trust my physical exam
  - No EMG
  - No MRI unless I am suspicious of a mass
- Trust my diagnostic injections
- If patient gets even a week of relief, this is a positive sign that they'll do well with surgery

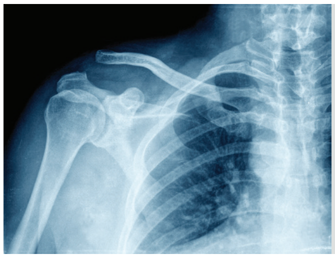
Failed tennis elbow surgery – other causes

- Destabilization of the elbow joint
  - o Overaggressive debridement which damages the lateral collateral ligament
  - o Subsequent posterolateral rotatory instability (PLRI) can cause pain and later arthritic degeneration
  - o Kalainov and Cohen reported 3 cases
    - JBJS Am, 2005
- Posterolateral rotatory instability (PLRI) has also been reported with multiple steroid injections and soft tissue attenuation

Bottom Line

- What do I do when someone with lateral elbow pain comes in for evaluation?
- Discuss the evidence
- Make sure this is not radial tunnel syndrome
- Tell them that tennis elbow often takes 1-2 years to resolve – with or without intervention
- Reassure them that damage is not occurring
- Offer them stretching/observation first +/- therapy
- 2nd line
  - o Autologous blood injection for epicondylitis
  - o Diagnostic steroid for radial tunnel
- Surgery is my last option

THANK YOU!



Adult Shoulder Injuries
Lewis Shi, MD

Adult Shoulder Injuries

Lewis L. Shi MD
Primary Care Orthopaedic Course
June 6, 2019

Disclosure

- Primary Care Orthopaedic Course
- Lewis L. Shi, MD
- I have the following financial relationships to disclose:
  – Consultant for Depuy Johnson/Johnson
- I will not discuss off label use or investigation use in my presentation

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Algorithm for shoulder pain

Adult patient with shoulder pain
↓
History
↓
Physical examination
↓
Imaging
↓
Differential diagnosis
↓

Glenohumeral Instability	Adhesive Capsulitis	Rotator Cuff	Glenohumeral Osteoarthritis
<35yo, sports, hx of dislocation/ subluxation, apprehension	35-50yo; decreased ROM, progressive pain/stiffness, PMHx trauma or DM	>45yo; weakness, impingement signs, night pain	>50yo, decreased ROM, progressive pain, crepitus, x-ray findings, RA

History

- Age
- Mechanism of injury
  - Trauma
  - Overuse
  - Insidious
- Chronic vs. Acute Pain

Symptoms

- Activity pain
  - Sports
  - Overhead
  - ADL's
- Radiating pain
- Night pain

History

- Loss of ROM?
- Loss of Strength?
- Rest Pain
- Previous treatments
  - Medical
  - Surgical
  - Alternative

Physical Examination

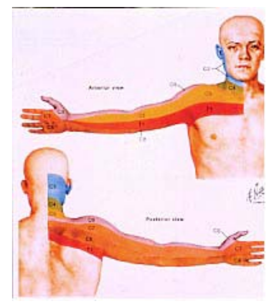
Focus

- Cervical Spine
- Atrophy
- Biceps and AC joint
- Range of Motion
- RC strength and impingement
- Apprehension and instability

Physical Examination

Cervical spine

- Radicular nature with Spurling's
- First component of exam
- Non-specific pain or trapezial pain non-diagnostic



Physical Examination

Atrophy

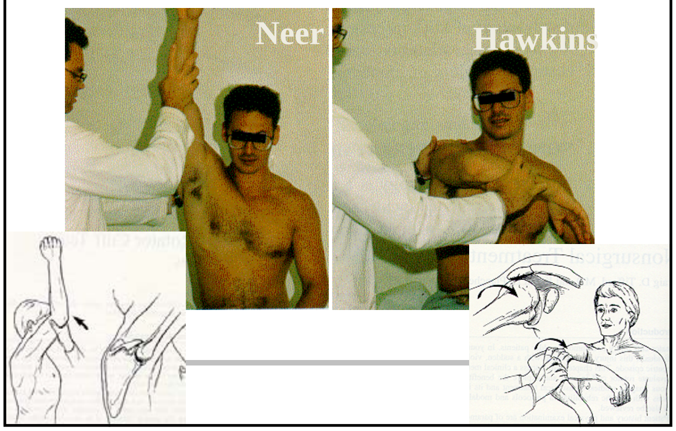
- View posteriorly
- Both tactile than visual

Physical Examination

Range of Motion

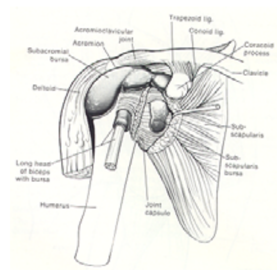
- Active and Passive
- Compare to contralateral
- FF and ABD
- ER at 0° and 90°
- IR at 90°

Impingement Signs & Test



RCT and Impingement

- RC tendinitis and bursitis are always present together
- With many cases, biceps may also be inflamed

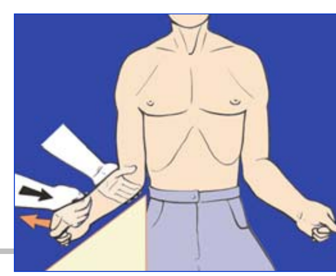


Rotator cuff strength

- Supraspinatus
- Jobe's test
  - 90 ° abduction
  - 30 ° anterior flexion
  - Internal rotation

Rotator cuff strength

- infraspinatus



Rotator cuff strength

- Subscapularis
  - belly press
  - lift off
  - bear hug

AC joint

- Pain may radiate down to front of shoulder to elbow
- Pain with palpation over joint reproduces symptoms

Shoulder Instability

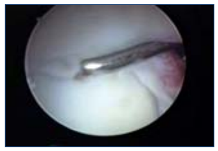
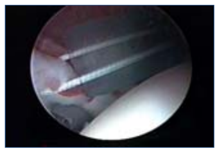
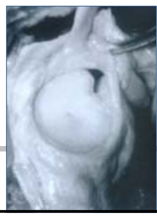
- Extremely challenging exam in conscious patient

Instability

- Assess for ligamentous laxity
- Hyperextension – elbow, knee, thumb

Labral Tears

- Unreliable exam findings
- Complaints of pain with throwing
- Often “deep” in shoulder

Scapular winging

Winging – serrantus anterior palsy


Imaging

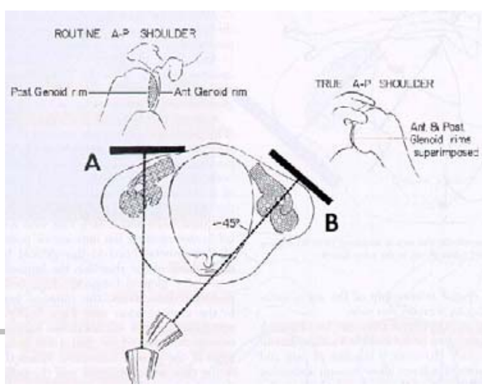
Basic Principles

- Always obtain plain films prior to MRI
- Clinical evaluation and x-ray are all that is needed in most cases

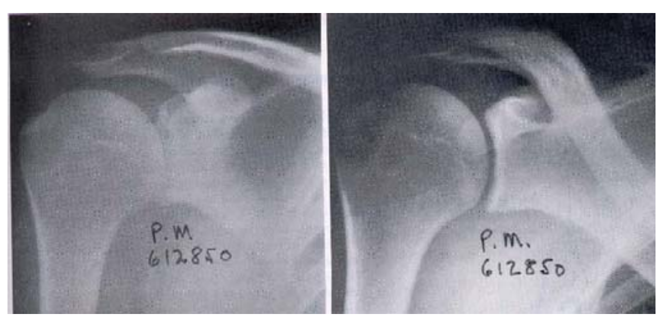
Shoulder xray series

- True AP
- Scapular “Y” lateral
- Axillary lateral

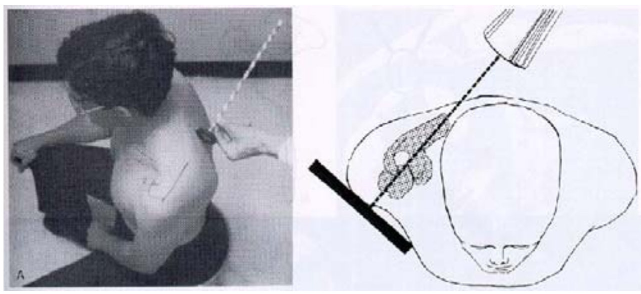
True AP



True AP

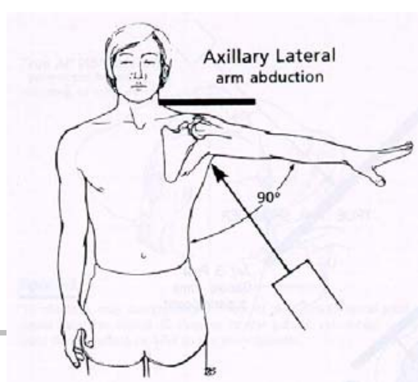


Scapular "Y" Lateral



Scapular "Y" Lateral

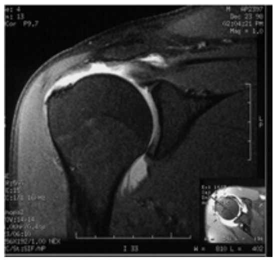
Axillary Lateral



Axillary Lateral

MRI

- Only if it changes treatment algorithm
- MRI vs. MR arthrogram



Glenohumeral Instability	Adhesive Capsulitis	Rotator Cuff	Glenohumeral Osteoarthritis
<35yo, sports, hx of dislocation/ subluxation, apprehension	35-50yo; decreased ROM, progressive pain/stiffness, PMHx trauma or DM	>45yo; weakness, impingement signs, night pain	>50yo, decreased ROM, progressive pain, crepitus, x-ray findings, RA

My treatment algorithm

- Activity modification/NSAIDs
- Physical therapy
- Corticosteroid injection
- Surgery

Physical Therapy

Restore motion

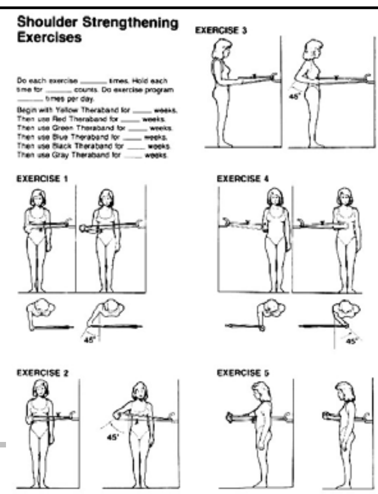
⇩

Restore strength

⇩

Restore function

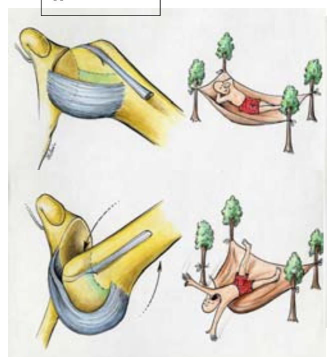
Home based program

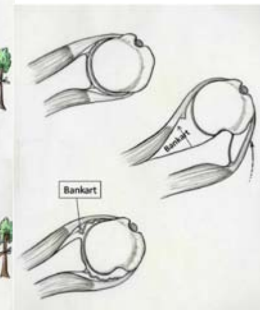


Steroid Injection

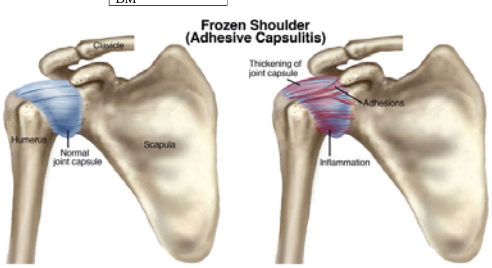
- Subacromial – approaches
  - If concerned about a RCT, do not inject
- Glenohumeral – OA, frozen shoulder
  - guidance
- AC joint
- Long head of biceps

Glenohumeral Instability
<35yo, sports, hx of dislocation/ subluxation, apprehension





Adhesive Capsulitis
35-50yo; decreased ROM, progressive pain/stiffness, PMHx trauma or DM



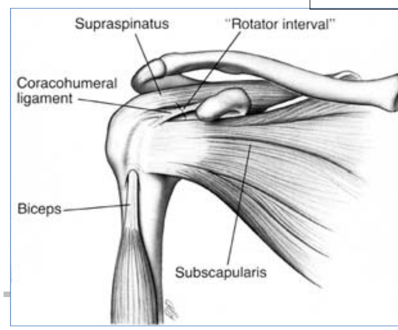
Frozen shoulder treatment

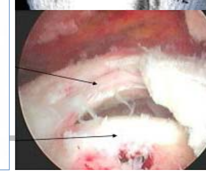
- NSAIDs
- Physical therapy
- Glenohumeral steroid injection under guidance
- Physical therapy revisited
- Surgery – arthroscopic capsular release

Frozen shoulder treatment

- Glenohumeral steroid injection under guidance

Rotator Cuff
>45yo; weakness, impingement signs, night pain





Treatment of rotator cuff tears

- NSAIDs, Physical therapy, Subacromial injection
- Majority of rotator cuff tears do not need surgical treatment

J Shoulder Elbow Surg (2013) 22, 1371-1379

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Journal of Shoulder and Elbow Surgery
www.elsevier.com/locate/ymse

Effectiveness of physical therapy in treating atraumatic full-thickness rotator cuff tears: a multicenter prospective cohort study

John E. Kuhn, MD, MS*, Warren R. Dunn, MD, MPH, Rosemary Sanders, BA, Qi An, MS, Keith M. Baumgarten, MD, Julie Y. Bishop, MD, Robert H. Brophy, MD

Results: The cohort consists of 452 patients. Patient-reported outcomes improved significantly at 6 and 12 weeks. Patients elected to undergo surgery less than 25% of the time. Patients who decided to have surgery generally did so between 6 and 12 weeks, and few had surgery between 3 and 24 months.
Conclusion: Nonoperative treatment using this physical therapy protocol is effective for treating atraumatic full-thickness rotator cuff tears in approximately 75% of patients followed up for 2 years.

Treatment of rotator cuff tears

J Shoulder Elbow Surg (2016) 25, 1303–1311

ELSEVIER

Journal of Shoulder and Elbow Surgery
www.elsevier.com/locate/ymse

SHOULDER

2013 Neer Award: predictors of failure of nonoperative treatment of chronic, symptomatic, full-thickness rotator cuff tears

Results: Of the 433 subjects in this study, 87 underwent surgery with 93% follow-up at 1 year and 88% follow-up at 2 years. The median age was 62 years, and 49% were female patients. Multivariate modeling, adjusted for the covariates listed previously, identified patient expectations regarding physical therapy ($P < .0001$) as the strongest predictor of surgery. Higher activity level ($P = .011$) and not smoking ($P = .023$) were also significant predictors of surgery.
Conclusion: A patient's decision to undergo surgery is influenced more by low expectations regarding the effectiveness of physical therapy than by patient symptoms or anatomic features of the rotator cuff tear. As such, patient symptoms and anatomic features of the chronic rotator cuff tear may not be the best features to use when deciding on surgical intervention.
Level of evidence: Level I; Prospective Cohort Study; Prognosis Study

A Prospective Evaluation of Survivorship of Asymptomatic Degenerative Rotator Cuff Tears

Jay D. Keener, MD, Leesa M. Galatz, MD, Sharlene A. Teefey, MD, William D. Middleton, MD, Karen Steger-May, BA, Georgia Stobbs-Cucchi, RN, Rebecca Patton, MA, and Ken Yamaguchi, MD

Investigation performed at the Shoulder and Elbow Service, Department of Orthopaedic Surgery, Washington University, St. Louis, Missouri

Background: The purpose of this prospective study was to report the long-term risks of rotator cuff tear enlargement and symptom progression associated with degenerative asymptomatic tears.

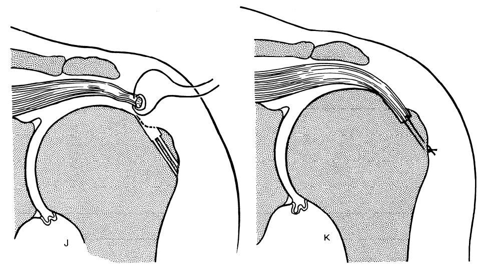
Methods: Subjects with an asymptomatic rotator cuff tear in one shoulder and pain due to rotator cuff disease in the contralateral shoulder enrolled as part of a prospective longitudinal study. Two hundred and twenty-four subjects (118 initial full-thickness tears, fifty-six initial partial-thickness tears, and fifty controls) were followed for a median of 5.1 years. Validated functional shoulder scores were calculated (visual analog pain scale, American Shoulder and Elbow Surgeons [ASES], and simple shoulder test [SST] scores). Subjects were followed annually with shoulder ultrasonography and clinical evaluations.

Results: Tear enlargement was seen in 49% of the shoulders, and the median time to enlargement was 2.8 years. The occurrence of tear-enlargement events was influenced by the severity of the final tear type, with enlargement of 61% of the full-thickness tears, 44% of the partial-thickness tears, and 14% of the controls ($p < 0.05$). Subject age and sex were not related to tear enlargement. One hundred subjects (46%) developed new pain. The final tear type was associated with a greater risk of pain development, with the new pain developing in 28% of the controls, 46% of the shoulders with a partial-thickness tear, and 50% of those with a full-thickness tear ($p < 0.05$). The presence of tear enlargement was associated with the onset of new pain ($p < 0.05$). Progressive degenerative changes of the supraspinatus muscle were associated with tear enlargement, with supraspinatus muscle degeneration increasing in 4% of the shoulders with a stable tear compared with 30% of the shoulders with tear enlargement ($p < 0.05$). Nine percent of the shoulders with a stable tear showed increased infraspinatus muscle degeneration compared with 28% of those in which the tear had enlarged ($p = 0.07$).

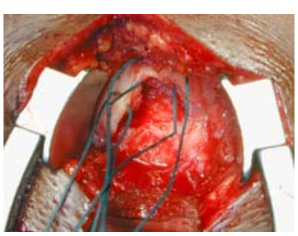
Conclusions: This study demonstrates the progressive nature of degenerative rotator cuff disease. The risk of tear enlargement and progression of muscle degeneration is greater for shoulders with a full-thickness tear, and tear enlargement is associated with a greater risk of pain development across all tear types.

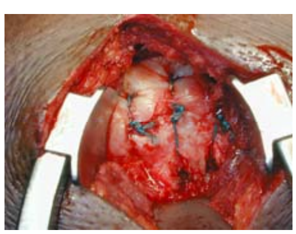
Level of Evidence: Prognostic Level II. See Instructions for Authors for a complete description of levels of evidence.

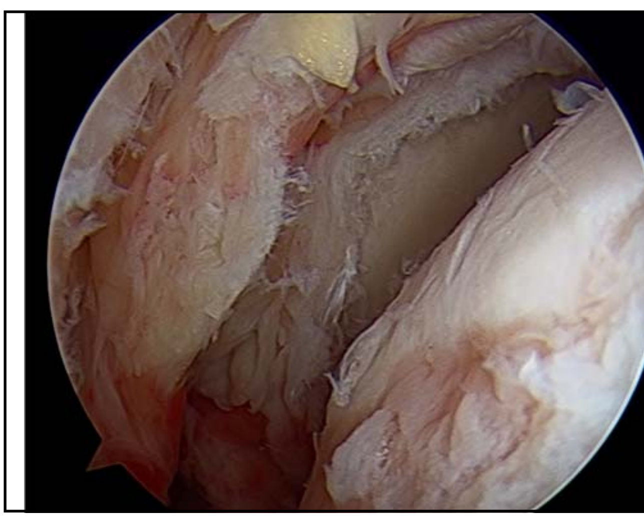
Surgical treatment of rotator cuff tears

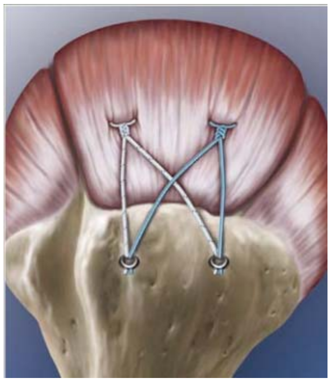


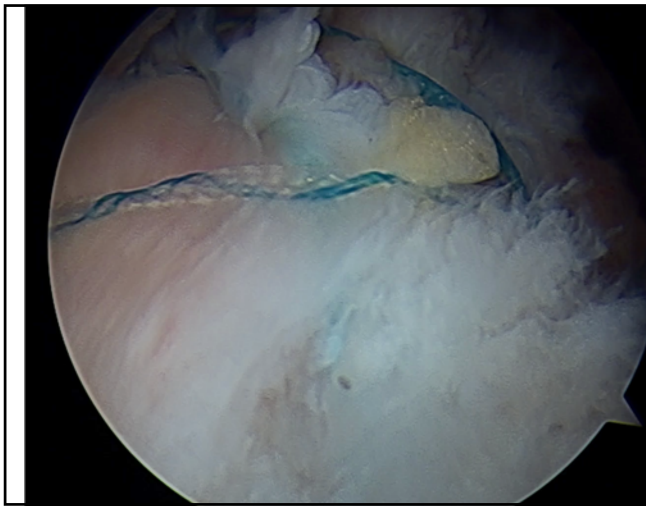
Rotator Cuff Repair









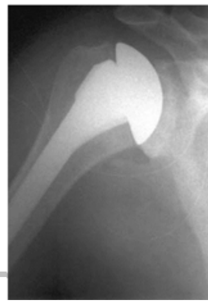


Glenohumeral Osteoarthritis

>50yo, decreased ROM, progressive pain, crepitus, x-ray findings, RA

Glenohumeral Arthritis

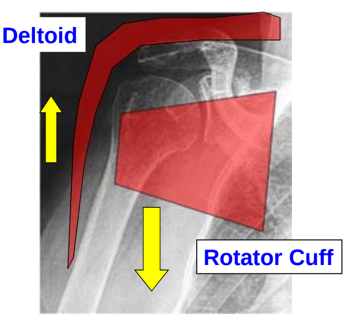
Total shoulder replacement—“anatomic solution”

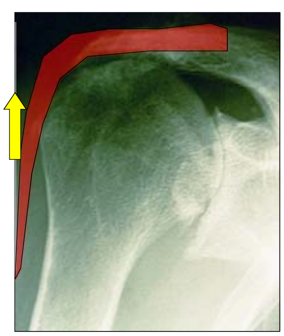


Glenohumeral Instability	Adhesive Capsulitis	Rotator Cuff	Glenohumeral Osteoarthritis
<35yo, sports, hx of dislocation/ subluxation, apprehension	35-50yo; decreased ROM, progressive pain/stiffness, PMHx trauma or DM	>45yo; weakness, impingement signs, night pain	>50yo, decreased ROM, progressive pain, crepitus, x-ray findings, RA

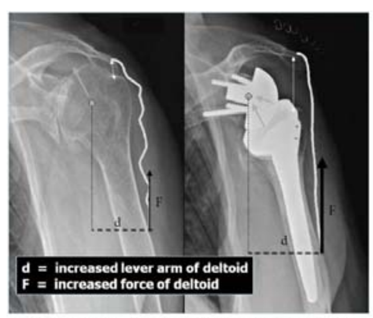
Cuff tear arthropathy
Irreparable rotator cuff tear and GH arthritis

Cuff tear arthropathy

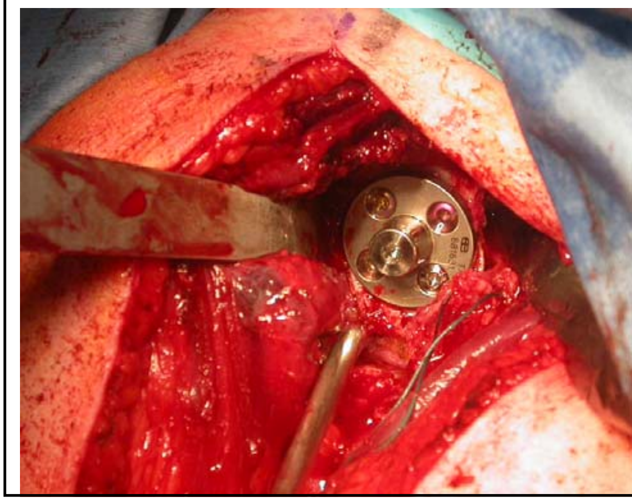




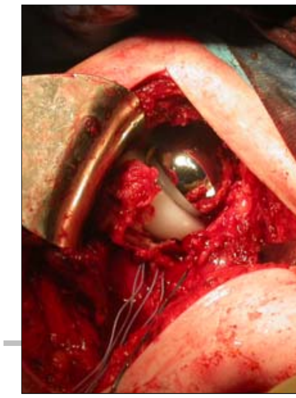
Reverse shoulder arthroplasty



In a patient with a massive irreparable rotator cuff tendon tear, the ball moves upward out of the socket and the fulcrum for rotation is lost. The deltoid is weak as it has a short lever arm. A reverse prosthesis brings the point of rotation lower and gives back a fixed fulcrum that allows for a longer lever arm of the deltoid to raise the arm, since the socket can now rotate around the ball.
(Courtesy of Dr. Pascal Boileau)



Final Components



Summary

Adult patient with shouldersa pain

↓

History

↓

Physical examination

↓

Imaging

↓

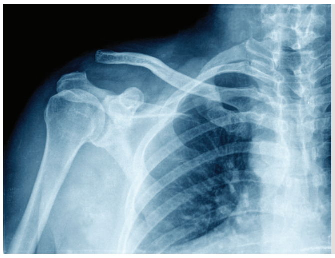
Differential diagnosis

Glenohumeral Instability	Adhesive Capsulitis	Rotator Cuff	Glenohumeral Osteoarthritis
<35yo, sports, hx of dislocation/ subluxation, apprehension	35-50yo; decreased ROM, progressive pain/stiffness, PMHx trauma or DM	>45yo; weakness, impingement signs, night pain	>50yo, decreased ROM, progressive pain, crepitus, x-ray findings, RA

Thank you

LewisShi@uchicago.edu

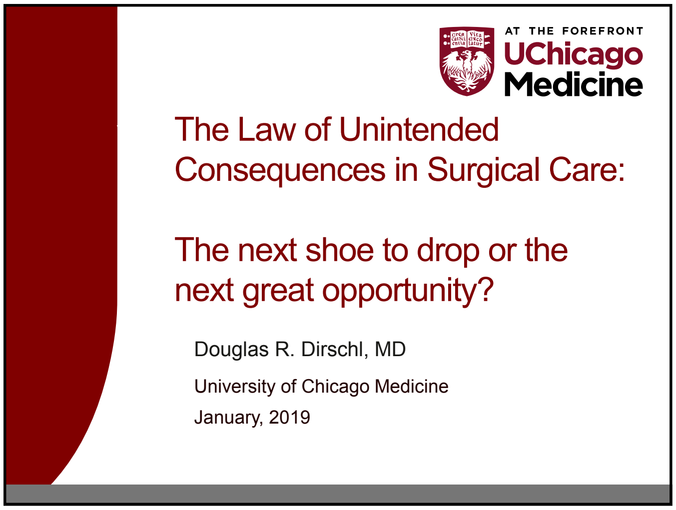
http://shoulder.uchicago.edu

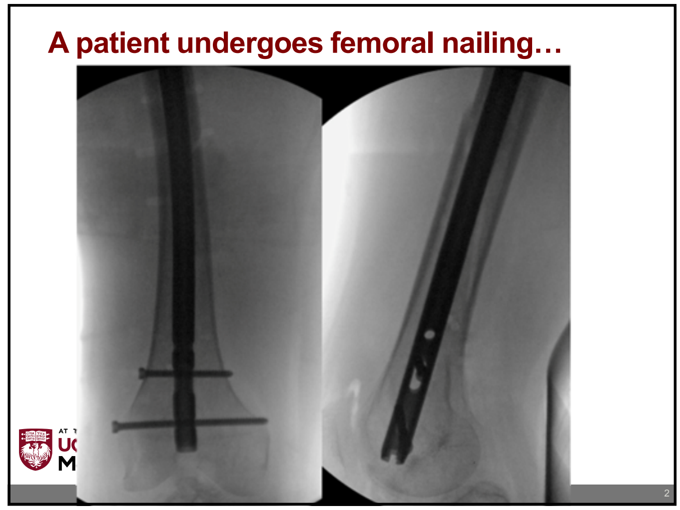


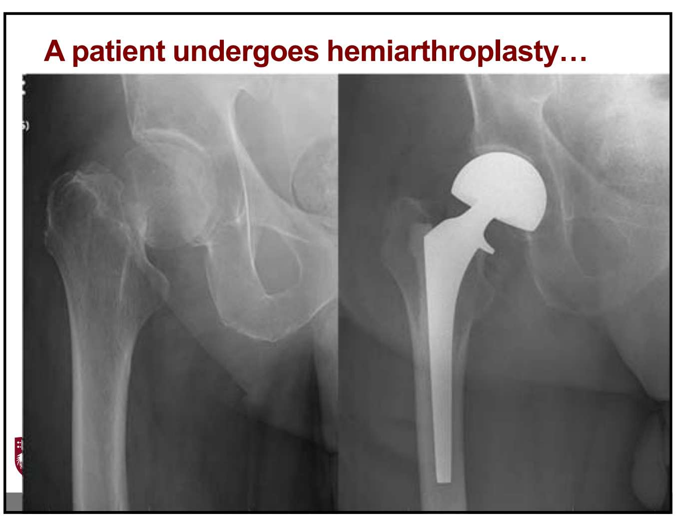
SPOTLIGHT LECTURE:

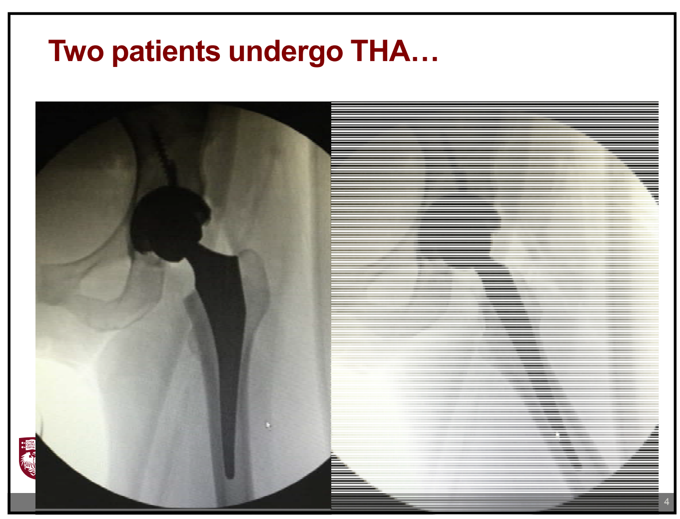
The Law of Unintended Consequences In Orthopaedic Surgery The Next Big Opportunity for Us and Our Patients

Douglas R. Dirschl, MD

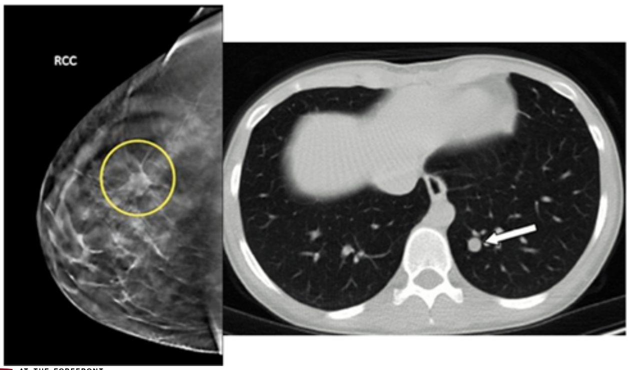








A patient undergoes a mastectomy…



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Where is the commonality in these cases?

- A surgeon performed an intervention that was medically appropriate and did so successfully following modern surgical guidelines and techniques
- There was an adverse outcome
- The adverse outcome was not related to the surgery

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Where is the commonality in these cases?

- In each case, the surgery led to a physiologic response in the patient that was a contributing (perhaps causative) factor to the adverse outcome
- It is possible that these adverse outcomes may be both predictable and preventable
- Understanding this and developing and taking preventative measures may be the next great opportunity for our profession

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Stated more broadly….

- ALL surgical interventions induce physiologic responses from patients
- The magnitude and duration of the patient's physiologic response is variable
- The effects of the physiologic response can compromise outcomes
- Hypothesis/prediction:

the patient's physiologic response to surgery is a key factor influencing outcomes and will become the predominant variable driving variance in outcomes

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Adversity or opportunity?

- Our interventions are responsible for inducing the physiologic response and for the outcome that results (the next shoe to drop)
- The next frontier in optimizing outcomes will be to to better understand, predict, and manage the patient's physiologic response (the great opportunity)
- Let's pursue the opportunity!!

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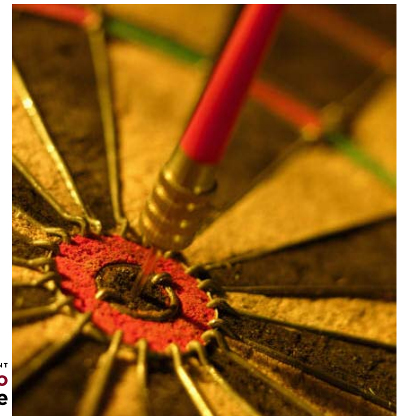
Let's look a bit more deeply at our examples…



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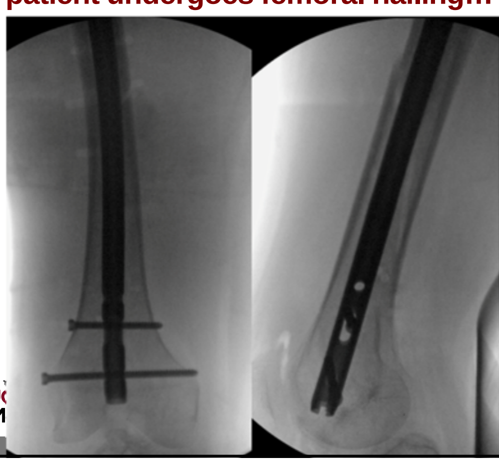
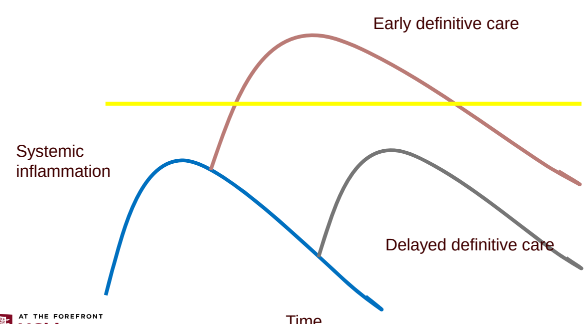
A patient undergoes femoral nailing…



The 'second hit' phenomenon



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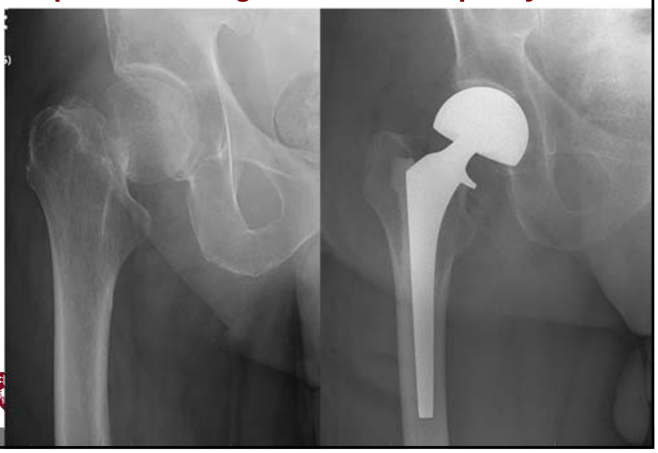
A patient undergoes hemiarthroplasty…



Fact: hip fracture patients have OP…

- BMD in patients sustaining a hip fractures is much lower than that of age- and sex-matched controls.
- Results (z-score):
  - femoral neck (FN)
    - **-2.08 ± 0.11**

J Orthop Trauma 1995 9; 470-475

… and the youngest have the worst

Age	FN z-score
50s	-3.10
60s	-2.29
70s	-2.06
80s	-1.70
90+	-2.40

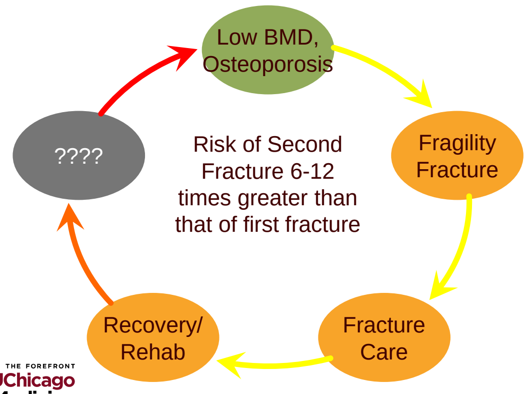
J Orthop Trauma 1995 9; 470-475

Fact: They lose even more bone!

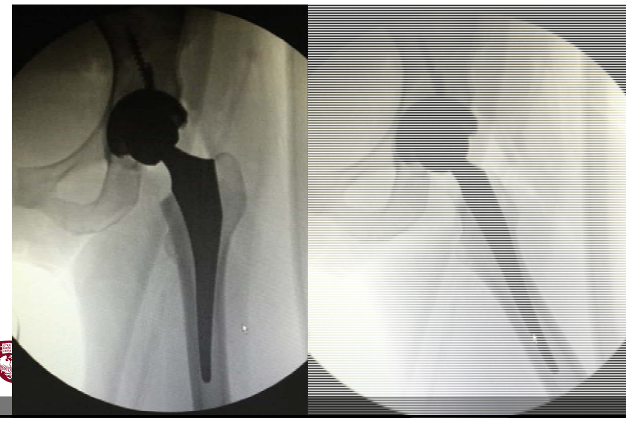
- In the year following a hip fracture, loss of BMD from the femoral neck occurs at a rate 5 times that expected in the postmenopausal population
- Mean loss of bone mineral:
  - femoral neck-5.4 ± 1.5%
- Loss independent of age and sex
- Loss not correlated with baseline BMD

Bone 1997: 20:79-82

Consequence? The Fragility Fracture Cycle

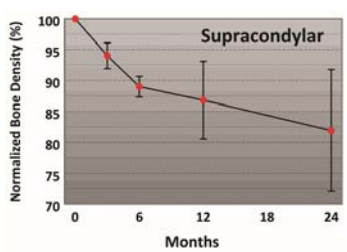


Two patients undergo THA…



Rapid femoral bone loss after TKA

- Meta-analysis
- 11 Studies
- Serial DXA after TKA
- Europe/ Asia



Rapid 18-20% loss
Does not normalize

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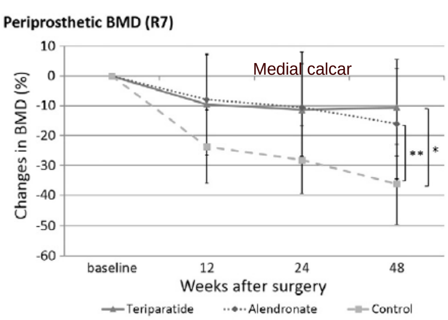
The same is true after THA… and it can be prevented!

- RCT
- 48 Patients THA
  - Alendronate
  - Teriparatide
  - Placebo
- BMD 1-48 wk
  - 7 Regions



Kobayashi, J Arthroplasty 2016

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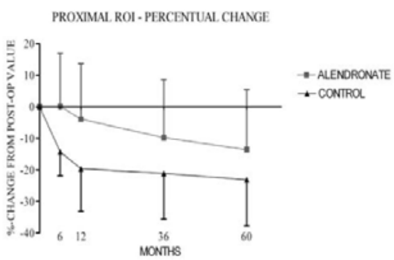
…another study reports similar results…

- 20% decrease BMD proximal femur at 60 months
- Bone loss reduced by 50% in alendronate group



Tapaninen, Scand J Surg 2010

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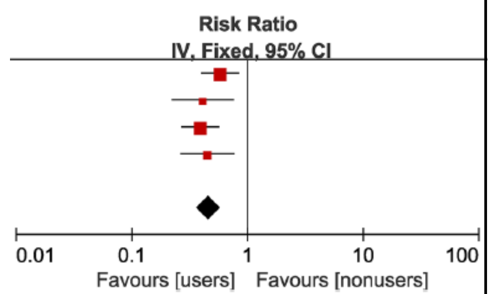
Bisphosphonates reduce rate of revision surgery

- 4 Studies THA
- Risk ratio 0.46
- 54% reduction



Teng, 2015

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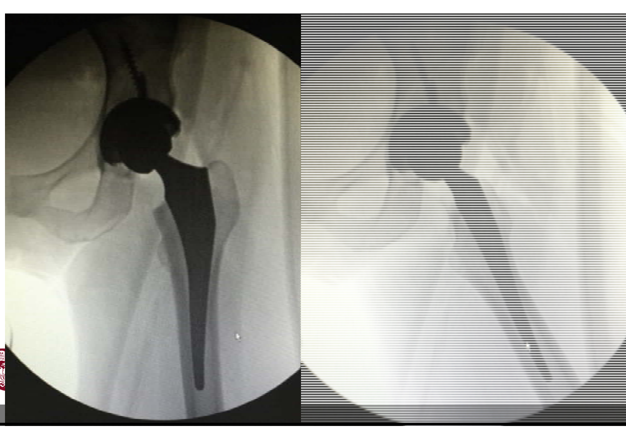
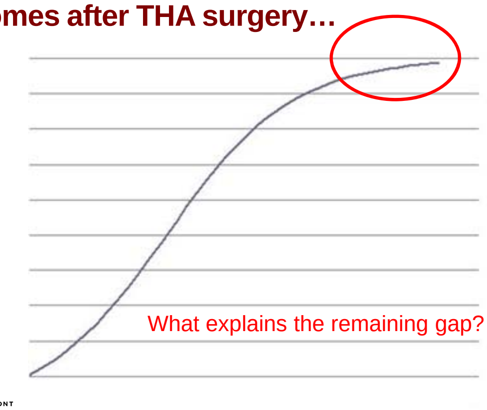
Two patients undergo THA…



Outcomes after THA surgery…



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Adverse Local Tissue Reaction?

- More than the presence of 'cement disease', 'polyethylene disease', 'metallosis', pseudotumor
- M1/M2 ratio
- IL-4
- Patient's genome, autoimmunity, overall immune response

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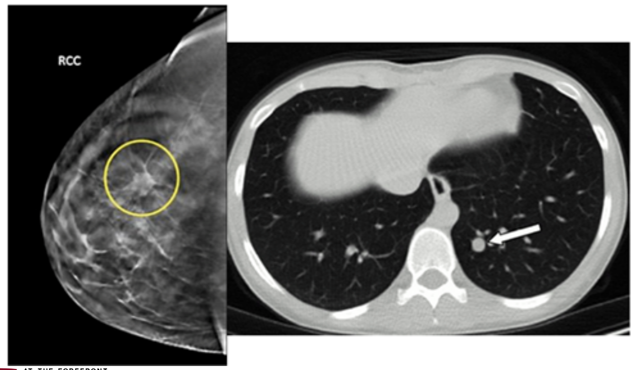
A patient undergoes a mastectomy…



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Something happens around the time of surgery to accelerate metastatic activity…

- Patients have micro-metastases, which the body's immune system has rendered inactive
- Surgery induces an inflammatory response:
  - Angiogenesis
  - Prostaglandin release (PGE_2)
  - Immune deficiency (T-cells, NK cells)

Exit from dormancy to growth and detection

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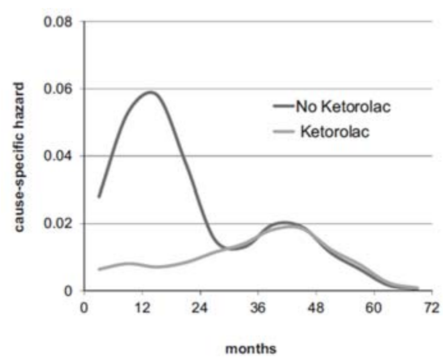
This response can be blunted by ketorolac or diclofenac…



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Fish oil too?

- Omega 3 FFA have been studied in a variety of settings for their anti-inflammatory effect
  - Military medicine
  - Trauma
  - Colorectal surgery
  - BMD and bone strength
  - Breast cancer

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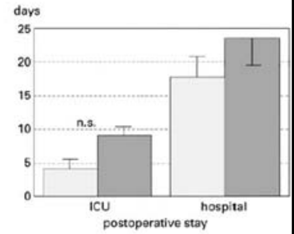
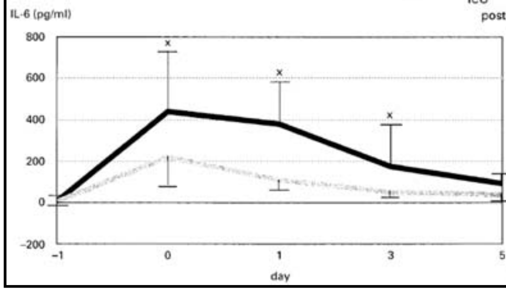
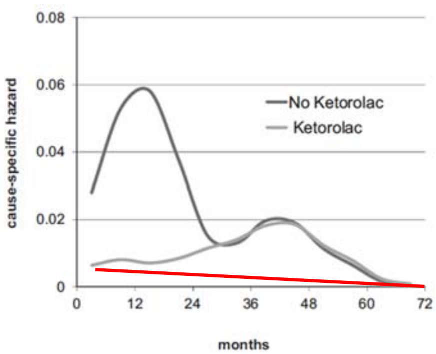
Fish oil too?





This response can be blunted by ketorolac or diclofenac…



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Where is the commonality in these cases?

- In every case, surgery leads to a physiologic response in the patient that was a contributing (perhaps causative) factor to the adverse outcome
- It is probable that these adverse outcomes may be both predictable and preventable
- Understanding this and developing and taking preventative measures is the next great opportunity for our profession

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What if we choose to dig deeper?

- Basic/Translational Science;
  - Molecular/cell biology
  - Genomics
  - Radiomics
- Clinical Science:
  - Observational studies
  - Databases and big data

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What if we choose to intervene?

- Pre-operative characterization/optimization
  - Bone health
  - Inflammation
- Peri-operative management
  - Bone active agents
  - NSAIDs (ketorolac/diclofenac)
  - Omega 3 fatty acids
  - IL-4?
  - ???

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The 'biologic' era in our profession…

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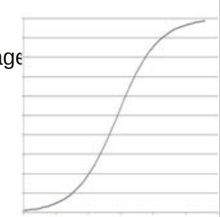
What we can be/do…

- Leverage clinical programs for even greater gain
  - Education
    - Scale
    - Environment
    - Inquiry/Innovation
  - Scholarship
    - Culture of inquiry
    - Population health
    - Value of musculoskeletal care
    - BIG ideas/topics that can engage
      - Clinicians
      - Scientists
      - Collaborators



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Thank You!

THE UNIVERSITY OF CHICAGO

Common Adult Sports Knee Injuries

Aravind Athiviraham, MD
Assistant Professor
Department of Orthopedic Surgery
University of Chicago

June 7, 2019

Disclosures

- I have no financial relationships to disclose
- I will not discuss off label use or investigational use in my presentation

Objectives

- History and physical exam of a patient with a knee injury
- Differential diagnosis in a patient with knee complaints
- Non-operative and operative management modalities for common knee sports injuries

History

- Age
- HPI (location, quality, severity, timing, duration, context, modifying factors, associated symptoms)
- Swelling? (rapid vs. gradual)
- Locking or Catching?
- Difficulty with stairs or sitting for prolonged periods?
- Buckling/Giving Way?
- Difficulty weight bearing?

History

- Prior Tests and Evaluations?
- Prior Injuries?
- Medical History (Gout, Pseudogout, Rheumatoid Arthritis, etc)
- Medications?
- Injections?
- Physical Therapy?
- Past Surgeries? (What type? When? Result?)
- Other Treatments?

Physical Exam

- Gait
- Inspection/Palpation (Scars, Atrophy, Alignment, Swelling, Crepitus, Tenderness)
- ROM
- Stability:
  - ACL (Lachman, Pivot, Drawer)
  - PCL (Reverse Pivot, Drawer, Sag)
  - Varus Joint Opening (0 and 30 degrees)
  - Valgus Joint Opening (0 and 30 degrees)
  - PLC (Dial test at 30 and 90 degrees)
- Strength
- Neurovascular
- Special Tests (i.e. McMurray's, Patellar Apprehension, Ober's, etc)

LACHMAN TEST

PIVOT SHIFT

McMURRAY'S TEST

VALGUS STRESS

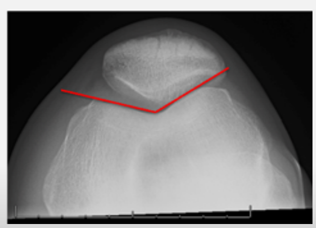
Radiographs

Standing AP

Skier's View

Always get weight bearing films!

Radiographs



Merchant

Lateral

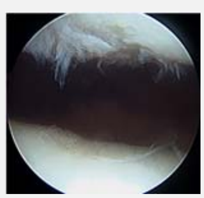
Differential Diagnosis by Symptoms

Traumatic Effusion	Locking/Catching	Instability
ACL	Meniscus Tear	ACL
Patellar dislocation	Loose bodies	MCL
Meniscus tear		Less Common:
Osteochondral defect		PCL
PCL		LCL
		Posterolateral Corner

Patellar Tendonitis

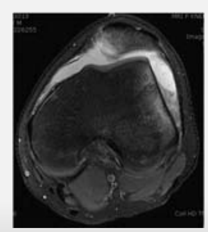
- History:
  - Teenage males during growth spurt
  - Anterior knee pain worse with going down stairs or running
- Exam:
  - Patellar tendon tenderness
    - inferior pole patella
  - Pain with resisted knee extension
- Studies:
  - Not indicated
- Non-op management:
  - NSAIDS, PT, patellar strap, activity modification

Patellofemoral Syndrome



- History:
  - Anterior knee pain with prolonged sitting ("theater sign")
  - Pain with stairs
  - Associated with running
  - More common in women
- Exam:
  - Patellar crepitus, mild effusion, patellar grind sign, "J" sign
- Studies:
  - Not indicated
- Non-op management:
  - NSAIDS, PT, knee sleeve, activity modification, injections
- Operative management:
  - Rarely indicated

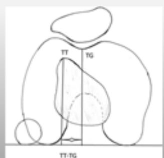
Patellar Instability

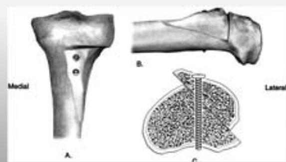


- History:
  - Giving-way episode
  - Twisting of torso with a planted foot
  - Usually patella dislocates laterally
- Exam:
  - Patellar apprehension
  - Effusion
  - J Sign
  - Ligamentous laxity
- Studies:
  - X-rays
  - MRI – loose bodies, chondral injury, meniscus tears, trochlear dysplasia
- Non-op management:
  - 1st time dislocation, without loose body
  - NSAIDS, PT, bracing

Patellar Instability

- Operative Indications:
  - Loose bodies, meniscus tears, significant chondral injury
  - Failure to respond to conservative measures
  - Recurrent dislocations
- Operative Options:
  - MPFL imbrication
  - MPFL reconstruction
  - Tibial tubercle osteotomy (if TT-TG > 20 mm)





Extensor Mechanism Ruptures

- History:
  - Sudden pop in front of knee
  - Inability to extend knee
  - Patellar - < 40 y/o, Quad - > 40 y/o
- Exam:
  - Palpable gap
  - Inability to actively extend knee ="extensor lag"
- Studies:
  - X-rays
  - +/- U/S or MRI may assist in more equivocal cases
- Non-op management:
  - None
- Operative management:
  - Open repair within 2 weeks of injury

Pes Anserine Bursitis

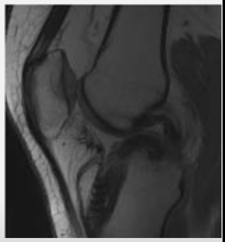
- History:
  - Pain at pes anserinus insertion
  - Worse with repetitive flexion and extension
- Exam:
  - Tenderness and localized swelling along pes bursa
- Studies:
  - Not indicated
- Non-op management:
  - NSAIDs, PT, injections

Iliotibial Band Tendonitis

- History:
  - Runners or cyclists with lateral knee pain
- Exam:
  - Tenderness at lateral femoral epicondyle (LFE) ~ 3 cm proximal to joint line
  - Noble test
    - Knee extended from 90 of flexion to full extension with direct pressure on LFE
    - Positive test= pain at 30 degrees of knee flexion over LFE
- Studies:
  - Not indicated
- Non-op management:
  - NSAIDs, PT, activity modification

Meniscus Tears

- History:
  - Acute – sudden twisting injury
  - Chronic – degenerative
  - Pain and swelling with locking or catching
- Exam:
  - Joint line tenderness with mild effusion
  - McMurray's test
- Studies:
  - X-rays, MRI
- Non-op management:
  - Chronic, degenerative tears without mechanical symptoms
  - NSAIDs, PT, injections
- Operative indications:
  - Acute injuries in younger patients
    - Potentially repairable
  - Mechanical symptoms
  - Failure of conservative measures
  - Concomitant procedures

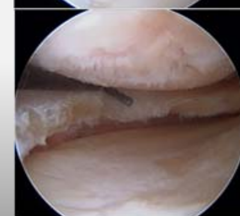


Meniscus Tears

- Patient age – 69 y/o
- Chronicity of tear – >1 year
- Quality of meniscal tissue - poor
- Location of tear – red-white
- Type of tear - degenerative

↓

Meniscectomy



Meniscus Tears

- Patient age – 14 y/o
- Chronicity of tear – <6 weeks
- Quality of meniscal tissue - Excellent
- Location of tear – red-white
- Type of tear - Vertical

↓

Meniscal Repair

Osteochondritis Dessicans

- History:
  - Vague, poorly localized knee pain
  - Recurrent effusions
  - Locking or catching if have a loose body
- Exam:
  - Tenderness, effusion, quad atrophy
- Studies:
  - X-rays, MRI
- Non-op management:
  - Skeletally immature: NSAIDs, crutches, PT
- Operative management:
  - Adults
  - Children with detached/unstable lesions
  - Failure of conservative measures

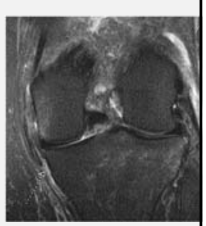
ACL Tears

- History:
  - Noncontact deceleration forces (ie cutting, pivoting)
  - Hears or feels a "pop"
  - Swelling within two hours of injury
- Exam:
  - Joint effusion with limited range of motion
  - Lachman's and pivot shift tests
- Studies:
  - X-rays, MRI
- Non-op management:
  - If dictated by low activity level or inability to comply with postoperative rehab
- Operative management:
  - High activity level patients
    - Concern of persistent instability and/or articular cartilage/meniscal injury
  - "Pre-hab" first to normalize ROM

ACL Tears

MCL Tears

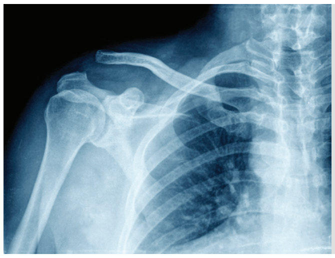
- History:
  - Collision with valgus stress on the knee with medial sided pain
- Exam:
  - Medial sided tenderness with localized swelling
  - Valgus stress testing at 0 and 30 degrees
- Studies:
  - Not necessary for low grade
  - X-rays, MRI
- Non-op management:
  - NSAIDs, PT, hinged brace, crutches (until painless WB and no limp)
  - Return to sport dictated by good endpoint with valgus stress without pain
- Operative indications:
  - Rare for isolated
  - Concomitant injuries (ie multi-ligamentous, meniscus)
  - Persistent instability



Conclusion

- A focused history and physical exam are important in working up a patient with knee pain
- Understanding the differential diagnosis by factors such as pain location, age, and symptoms can help facilitate develop an effective treatment plan for a patient
- Patients benefit from a team approach from all health care professionals involved

Thank You



Re-thinking our Approach to PT for the Complex Hip

Lindsey Plass, PT, DPT, OCS

Re-thinking our approach to the complex hip

Lindsey Plass, PT, DPT, OCS

- Northwestern University, DPT 2012
- Board Certified Orthopaedic Clinical Specialist
- Graduate of 2015 Johns Hopkins Hospital and George Washington University Orthopaedic Physical Therapy Residency
- Current American Academy of Orthopaedic Manual Physical Therapists Fellow in Training

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[EDITORIAL]

Significant Knowledge Gaps Between Clinical Practice and Research on Femoroacetabular Impingement: Are We on the Same Path?

JOANNE L. KEMP, PT, PhD
La Trobe Sport and Exercise Medicine Research Centre, La Trobe University, Bundoora, Australia.
MAY ARNA RISBERG, PT, PhD
Division of Orthopaedic Surgery, Oslo University Hospital, Oslo, Norway; Department of Sports Medicine, Norwegian School of Sport Sciences, Oslo, Norway.

Femoroacetabular impingement (FAI) is the abnormal osseous contact between the femur (cam impingement) and/or acetabular rim (pincer impingement) during end-range hip motions. The morphology typically seen in FAI has been found in both asymptomatic and symptomatic individuals. An international consensus statement has provided some clarity around the diagnosis of FAI syndrome.[7] In particular, the statement highlighted that FAI syndrome was not a diagnosis based on radiology findings alone, but also on symptoms and clinical findings. However, the consensus statement did not ex-

have great difficulty with sports and physical activity participation when compared to age-matched controls. The population with FAI syndrome is heterogeneous, from

derstanding has created some confusion in clinical practice and in research. In some cases, the same terminology has been used interchangeably for cam-type deformities and FAI syndrome, such that asymptomatic people with cam-type deformity may have undergone treatment for FAI syndrome. At the other extreme, some argue that FAI syndrome does not exist and that treatment is unnecessary.

There are significant knowledge gaps regarding treatment of FAI syndrome.

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Disclosure:

I ♥ HIP

I have no relevant financial relationships to disclose.

I will not discuss off label use or investigational use in my presentation.

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3

Northwestern University Feinberg School of Medicine
Physical Therapy and Human Movement Sciences

JOHNS HOPKINS MEDICINE

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4

What I'd like you to remember from today…

- FAI is common and not always a problem
- Treat the whole person, not just the image
- Pay attention to mental health
- Words matter
- Promote lifelong exercise for successful management

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This is a picture of a runner.
She has FAI and a right hip labral tear.
Here she is running the last 400 m of the 2017 Chicago Marathon.

Yes, she is smiling.
Yes, that is me.
No, my hip is not bothering me!

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"Some of the best PTs I know, have used a personal struggle to make them a better clinician."

–Jane Sullivan, NUPTHMS Professor

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The Warwick Agreement on femoroacetabular impingement syndrome (FAI syndrome): an international consensus statement

D R Griffin,[1,2] E J Dickenson,[1,2] J O'Donnell,[3,4] R Agricola,[5] T Awan,[6] M Beck,[7] J C Clohisy,[8] H P Dijkstra,[9] E Falvey,[10,11] M Gimpel,[12] R S Hinman,[13] P Hölmich,[9,14] A Kassarjian,[15,16] H D Martin,[17] R Martin,[18,19] R C Mather,[20] M J Philippon,[21] M P Reiman,[20] A Takla,[3,22,23,24] K Thorborg,[14] S Walker,[25] A Weir,[9,26] K L Bennell[23]

The Warwick Agreement on femoroacetabular impingement syndrome has been endorsed by the following 25 clinical societies: American Medical Society for Sports Medicine (AMSSM), Association of Chartered Physiotherapists in Sports and Exercise Medicine (ACPSEM), Australasian College of Sports and Exercise Physicians (ACSEP), Austian Sports Physiotherapists, British Association of Sports and Exercise Medicine (BASEM), British Association of Sport Rehabilitators and Trainers (BASRaT), Canadian Academy of Sport and Exercise Medicine (CASEM), Danish Society of Sports Physical Therapy (DSSF), European College of Sports and Exercise Physicians (ECOSEP), European Society of Sports Traumatology, Knee Surgery and Arthroscopy (ESSKA), Finnish Sports Physiotherapist Association (SUFT), German-Austrian-Swiss Society for Orthopaedic Traumatologic Sports Medicine (GOTS), International Federation of Sports Physical Therapy (IFSPT), International Society for Hip Arthroscopy (ISHA), Groupo di Interesse Specialistico dell'A.I.F.I., Norwegian Association of Sports Medicine and Physical Activity (NIMF), Norwegian Sports Physiotherapy Association (FFI), Society of Sports Therapists (SST), South African Sports Medicine Association (SASMA), Sports Medicine Australia (SMA), Sports Doctors Australia (SDrA), Sports Physiotherapy New Zealand (SPNZ), Swedish Society of Exercise and Sports Medicine (SFAIM), Swiss Society of Sports Medicine (SGMS/SGSM), Swiss Sports Physiotherapy Association (SSPA).

Aim: reach an international multidisciplinary agreement on the diagnosis and management of FAI syndrome

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What is FAI syndrome?

FAI syndrome is a motion-related clinical disorder of the hip with a triad of symptoms, clinical signs and imaging findings. It represents symptomatic premature contact between the proximal femur and the acetabulum.
Level of agreement: mean score 9.8 (95% CI 9.6 to 10).

- ‘FAI syndrome’ introduced to reflect central role of patients’ symptoms to the disorder
- Positive clinical signs and imaging findings

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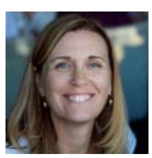
“The more I know, the more I know I don’t know”-Marcie Harries Hayes, 2015 CSM

- Not distinct disorders
- Bony structure is highly variable
- No published guidelines
- Alpha angle
- 42 degrees considered normal
- “abnormal” ranges from 45-75
- Ceiling effect with outcome measures
  - Area for development
- Combination of bony morphology and mechanical loading



Washington University in St. Louis
School of Medicine
Physical Therapy

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Maybe it is…

- Hip flexor strain
- Piriformis syndrome
- Iliopsoas tendonitis
- Groin strain
- Apophysitis
- “Growing pains”
- Iliopsoas bursitis
- Snapping hip syndrome
- Femoral neck stress fracture
- Femoral nerve entrapment
- Athletic pubalgia
- Iliopectineal bursitis
- Adductor tendonitis
- Septic arthritis
- Avascular necrosis

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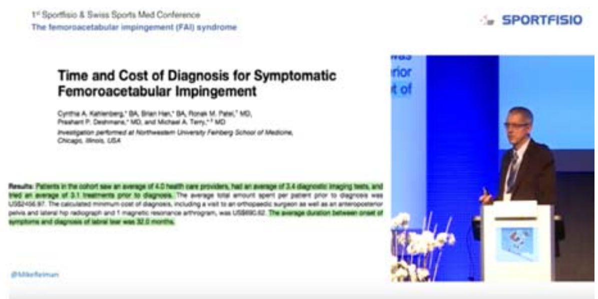

Mike Reiman, PT, PhD, MEd, SCS, ATC, FAAOMPT, CSCS

DUKE SPORTS MEDICINE

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Need for more research…

- What factors contribute to FAI becoming symptomatic (FAI syndrome)?
- Hip muscle strength
- Hip ROM
- Gait-pattern
- Size of CAM
- Type of physical activity/sport

- In the presence of CAM and /or pincer morphology, who will progress to hip OA later in life?

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FORCe: FAI and OsteoaRthritis Cohort Study. NHMRC funded study to investigate risk factors of disease progression

Project FORCe

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[VIEWPOINT]

Femoroacetabular Impingement Surgery Is on the Rise—But What Is the Next Step?

"We have a vision of how the surgical candidate and the subsequent determination
of treatment success can be elucidated.
1. Abandon the "self-evident" philosophy.
(a) Stop accepting surgery as the automatic gold standard treatment for FAI. The surgical excitement for FAI must be tempered. The surgery threshold must be raised. This challenge to current treatment should include a more stringent examination of both surgical and conservative interventions (eg, comparisons between them and comparisons of each against sham interventions).
(b) Stop accepting morphology as pathology.
Our patients deserve to know the actual prevalence and consequences of FAI, and that the true benefit of surgery is currently unknown.
2. Reform the current indiscriminate surgical decision-making process, choosing a process instead based on:
(a) A conservative treatment-first philosophy. Patients should undergo a trial of conservative treatment prior to surgery unless contraindicated;
(b) Diagnostic accuracy of currently utilized clinical and radiographic surgical indicators; and
(c) An evidence-informed framework. A concerted effort involving clinical, academic, and research experts is suggested to balance current best evidence with sound clinical reasoning, providing conscientious, sound suggestions for the examination and subsequent treatment of future patients with FAI.
3. Bolster basic science studies examining FAI. Concentrated efforts should be undertaken focusing on FAI mechanisms, other potential pain contributors, and potential future consequences of FAI.
4. Improve and standardize reporting of outcomes. Minimum reporting standards should be developed and implemented for future trials with respect to the examination and treatment of FAI.
As researchers and clinicians treating patients with FAI, we wholeheartedly support dedicated research funding and prevention guidelines for patients with pathological FAI. We believe, though, that it is important not to convince two thirds of the population that they have a pathologic condition, when clearly they do not."

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@mattgmking1

How common are other imaging findings?

Review

What is the prevalence of imaging-defined intra-articular hip pathologies in people with and without pain? A systematic review and meta-analysis

Joshua J Heerey,[1] Joanne L Kemp,[1] Andrea B Mosler,[2] Denise M Jones,[1] Tania Pizzari,[1] Richard B Souza,[3] Kay M Crossley[1]

Josh Heerey
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Permission to share from Matt King
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LA TROBE UNIVERSITY Sport and Exercise Medicine Research Centre

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How common are other imaging findings?

Finding	Symptomatic People	Asymptomatic People
Labral Tears	62% (MRA)	54% (MRI)
Cartilage Deficits	64% (MRA)	12% (MRI)
Lig Teres Tears	2-80 %	2-24%
Synovitis	1-49%	0-24%
Herniation Pits	5-53%	5-43%
Bone Marrow Oedema	11-68%	2-20%

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Journal of Science and Medicine in Sport
journal homepage: www.elsevier.com/locate/jsams

Original research

95% prevalence of abnormality on hip MRI in elite academy level rugby union: A clinical and imaging study of hip disorders

Garreth Farrell[a], Frank McGrath[b], Brian Hogan[b], Mark Logan[b], Karl Denvir[a], Brendan O'Connell[a], Ellevyn Irwin[c], Conor Gissane[d], Fiona Wilson[c,*]
[a] Leinster Rugby, Newstead Building A, UCD, Ireland
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Keywords:
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Hip-injury
Radiology

ABSTRACT
Objectives: To identify the prevalence of hip disorders in elite level academy rugby union players using clinical and radiological investigation comparing findings to active controls.
Design: Cross-sectional, controlled study.
Methods: Participants were assessed clinically using validated questionnaire (HAGOS) and physical testing procedures. Active ROM of all hip movements were measured using a goniometer and hip-specific clinical tests including the FABER and the Thomas test examined functional hip motion. Physical tests were compared to age, gender and activity matched controls. The rugby-playing participants underwent dedicated non-arthrographic 3 T MRI imaging of the hip in axial oblique, sagittal and coronal planes to assess anatomical abnormality.
Results: The rugby cohort had significantly reduced ROM of internal/external rotation, extension and FABER scores compared to the controls. Symptoms were reported by 65% of rugby players (HAGOS symptom score <89.3) versus 15% in controls. There was a 95% prevalence of abnormality on MRI (19 of 20 players); 80% of the elite rugby players had labral pathology, 55% had a cam deformity (45% left sided 30% right-sided) and 25% had either unilateral or bilateral chondral wear.
Conclusions: The prevalence of abnormality on MRI of the hip is high in rugby players at 95% of study participants. The percentage reporting symptoms was lower at 65% of the cohort although this was significantly higher than (non-rugby) matched controls at 15% of participants. Rugby players demonstrated significantly reduced ROM of the hip compared to controls. Further prospective research is required to investigate the long term sequelae of these findings.

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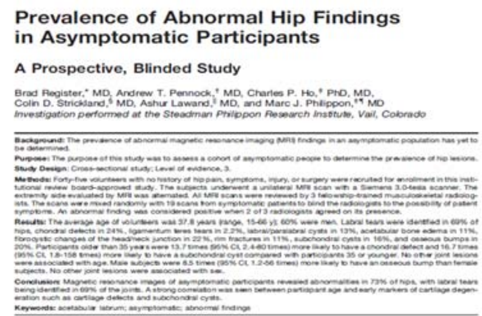
Imaging for hip-related groin pain: don't be hip-notised by the findings

Kieran O'Sullivan,[1,2] Ben Darlow,[3] Peter O'Sullivan,[4] Bruce B Forster,[5] Michael P Reiman,[6] Adam Weir[2,3]

Awareness of femoroacetabular impingement (FAI) syndrome, acetabular labral tears and chondral lesions as potential causes of hip-related groin pain has increased considerably due to advances in imaging and arthroscopic surgery. Consequently, hip imaging and surgery rates have grown rapidly.[1] However, there is no strong evidence of improved clinical outcomes with arthroscopic interventions. Although imaging findings are only diagnostic for FAI syndrome when they exist *together with clinical signs and symptoms*, imaging remains the main criterion for FAI surgery.[2] Most patients (71%) are willing to undergo surgery based solely on their physician's recommendation.[3] We question whether such reliance on imaging can be justified. Does it have risks (eg, radiation, downstream testing, costs) and may it lead to suboptimal management of hip-related groin pain?



Prevalence of Abnormal Hip Findings in Asymptomatic Participants

A Prospective, Blinded Study

Brad Register,* MD, Andrew T. Pennock,† MD, Charles P. Ho,‡ PhD, MD, Colin D. Strickland,§ MD, Ashur Lawand,|| MD, and Marc J. Philippon,‡¶ MD
Investigation performed at the Steadman Philippon Research Institute, Vail, Colorado

Background: The prevalence of abnormal magnetic resonance imaging (MRI) findings in an asymptomatic population has yet to be determined.

Purpose: The purpose of this study was to assess a cohort of asymptomatic people to determine the prevalence of hip lesions.

Study Design: Cross-sectional study; Level of evidence, 3.

Methods: Forty-five volunteers with no history of hip pain, symptoms, injury, or surgery were recruited for enrollment in this institutional review board–approved study. The subjects underwent a unilateral MRI scan with a Siemens 3.0-tesla scanner. The extremity side evaluated by MRI was alternated. All MRI scans were reviewed by 3 fellowship-trained musculoskeletal radiologists. The scans were mixed randomly with 19 scans from symptomatic patients to blind the radiologists to the possibility of patient symptoms. An abnormal finding was considered positive when 2 of 3 radiologists agreed on its presence.

Results: The average age of volunteers was 37.8 years (range, 15-66 y); 60% were men. Labral tears were identified in 69% of hips, chondral defects in 24%, ligamentum teres tears in 2.2%, labral/paralabral cysts in 13%, acetabular bone edema in 11%, fibrocystic changes of the head/neck junction in 22%, rim fractures in 11%, subchondral cysts in 16%, and osseous bumps in 20%. Participants older than 35 years were 13.7 times (95% CI, 2.4-80 times) more likely to have a chondral defect and 16.7 times (95% CI, 1.8-158 times) more likely to have a subchondral cyst compared with participants 35 or younger. No other joint lesions were associated with age. Male subjects were 6.5 times (95% CI, 1.2-56 times) more likely to have an osseous bump than female subjects. No other joint lesions were associated with sex.

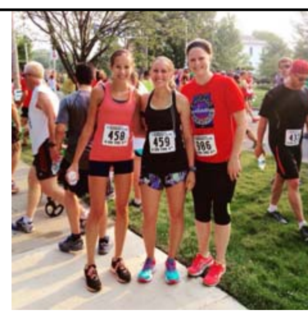
Conclusion: Magnetic resonance images of asymptomatic participants revealed abnormalities in 73% of hips, with labral tears being identified in 69% of the joints. A strong correlation was seen between participant age and early markers of cartilage degeneration such as cartilage defects and subchondral cysts.

Keywords: acetabular labrum; asymptomatic; abnormal findings

Conclusion: Magnetic resonance images of asymptomatic participants revealed abnormalities in 73% of hips, with labral tears being identified in 69% of the joints. A strong correlation was seen between participant age and early markers of cartilage degeneration such as cartilage defects and subchondral cysts.

Keywords: acetabular labrum; asymptomatic; abnormal findings

FAI is common and not always a problem



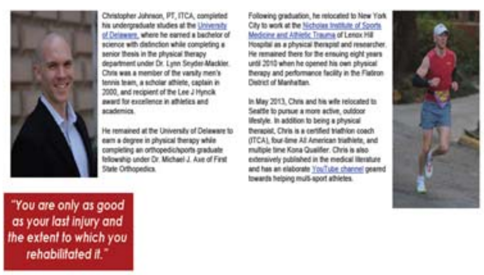
3 friends
and 3 labral tears…
and each finished the
2018 Chicago Marathon

Respect the image,
but treat the person and their symptoms

- CAM morphology is seen in high % of asymptomatic athletes
- High prevalence of all MRI defined pathologies in asymptomatic individuals… 1 in 2 individuals without pain have labral tears
- Higher prevalence of cartilage defects in people with pain

Photo permission from Chris Johnson PT, ITCA @zerenPT

Special thanks to…



"My philosophy has been shaped by my background as a clinician, researcher, and performance coach in addition to my experiences as a lifelong, multi-sport athlete. During the early part of my athletic career, I sustained various injuries and underwent a handful of surgeries, which ultimately stemmed from poor load management. Consequently, I found myself in physical therapy on numerous occasions. Thankfully, I fell under the care of skilled and caring clinicians. After completing the rehab process, I consistently returned to sport at a higher level relative to my pre-injury status, while feeling mentally stronger. My approach to physical therapy and performance coaching is grounded in working with every client on an individualized basis. I work tirelessly to anticipate and address the needs of my clients while providing evidence grounded solutions. ***Through effective communication, empathy, accountability, and creating the ideal ecosystem, most folks are able to rebound from injury and overcome pain to reclaim their quality of life and athletic prowess***."

–Chris Johnson PT, ITCA

Ecosystem loads

Physical | Emotional
Lifestyle | Financial
Fear | Sleep

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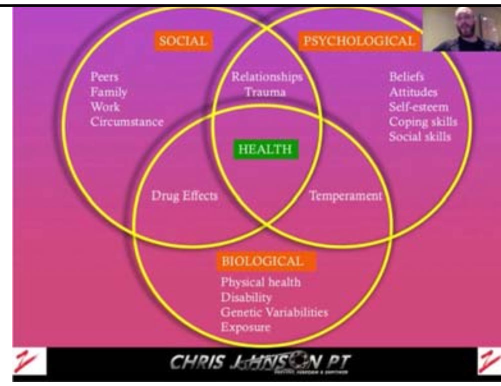

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- What is the patient doing outside of the biomedical realm?
- What is their general fitness?
- What is their understanding of their situation?
- What is the most advanced level activity that they can do with confidence?
- What is their _locus of control?

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Multi-disciplinary team

Patient

- Physical therapist
- Athletic trainer
- Coach
- Nutritionist
- Medical doctors
- Mental health professional

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Predictors of Hip Pain and Function in Femoroacetabular Impingement

A Prospective Cohort Analysis

Robert W. Westermann,*†‡ MD, T. Sean Lynch,§ MD, Morgan H. Jones,† MD, MPH,
Kurt P. Spindler,† MD, William Messner,† PhD, Greg Strnad,† MS, and James Rosneck,† MD
Investigation performed at the Cleveland Clinic Foundation, Cleveland, Ohio, USA

Background: Validated patient-reported outcome measures (PROMs) of hip pain and function at the time of arthroscopy could be predictors of the final outcome. Little is known about how patient factors or pathologic intra-articular findings relate to hip pain or function at the time of surgery for those presenting with femoroacetabular impingement (FAI).
Purpose: To evaluate all patient and operative factors that contribute to hip pain and dysfunction in patients with FAI.
Study Design: Cross-sectional study; Level of evidence, 3.

- Although imaging is essential for Dx for FAI, it is a poor predictor of pain & function
- Patient factors, including mental health, activity level, sex, & smoking, are more predictive of baseline hip pain and function than are intra-articular findings during hip arthroscopy for FAI

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The Journal of Arthroplasty

Joint Preservation

Preoperative Symptoms in Femoroacetabular Impingement Patients Are More Related to Mental Health Scores Than the Severity of Labral Tear or Magnitude of Bony Deformity

Conclusion: **Symptom severity was significantly more related to mental health status than either the size of labral tear or FAI deformity.** Patients with low MCS had significantly worse preoperative pain and self reported function, and a greater prevalence of concomitant chondral lesions. Future studies are necessary to determine if earlier surgical treatment or preoperative psychological and/or pain coping interventions may improve outcomes for those with low MCS.

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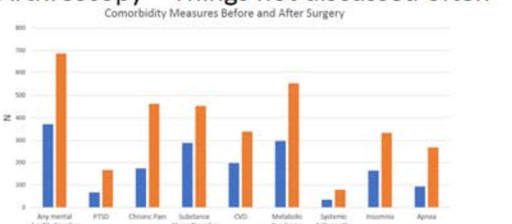
@mattgmking1

Hip Arthroscopy – Things not discussed often



(Rhon et al BJSM 2018)

Permission to share from Matt King
PhD Candidate| Physiotherapist (B.Physio,Hons, A.P.A.M.)
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Comorbidities in the first 2 years after arthroscopic hip surgery: substantial increases in mental health disorders, chronic pain, substance abuse and cardiometabolic conditions

Daniel I Rhon, Tina A Greenlee, Bryant G Marchant, Charles Dennis Sissel, Chad E Cook

ABSTRACT

What are the findings?

How might they impact clinical practice in the future?

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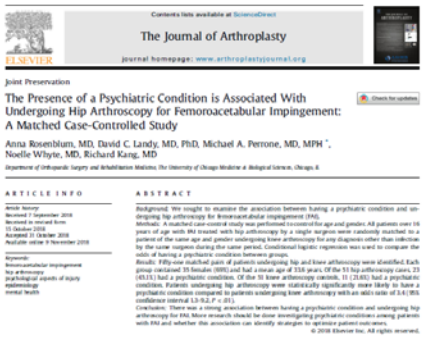

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Joint Preservation

The Presence of a Psychiatric Condition is Associated With Undergoing Hip Arthroscopy for Femoroacetabular Impingement: A Matched Case-Controlled Study

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ABSTRACT

Background: We sought to examine the association between having a psychiatric condition and undergoing hip arthroscopy for femoroacetabular impingement (FAI).
Methods: A matched case-control study was performed to control for age and gender. All patients over 16 years of age with FAI treated with hip arthroscopy by a single surgeon were randomly matched to a patient of the same age and gender undergoing knee arthroscopy for any diagnosis other than infection by the same surgeon during the same period. Conditional logistic regression was used to compare the odds of having a psychiatric condition between groups.
Results: Fifty-one matched pairs of patients undergoing hip and knee arthroscopy were identified. Each group contained 35 females (69%) and had a mean age of 33.6 years. Of the 51 hip arthroscopy cases, 23 (45.1%) had a psychiatric condition. Of the 51 knee arthroscopy controls, 11 (21.6%) had a psychiatric condition. Patients undergoing hip arthroscopy were statistically significantly more likely to have a psychiatric condition compared to patients undergoing knee arthroscopy with an odds ratio of 3.4 (95% confidence interval 1.3-9.2, $P < .01$).
Conclusion: There was a strong association between having a psychiatric condition and undergoing hip arthroscopy for FAI. More research should be done investigating psychiatric conditions among patients with FAI and whether this association can identify strategies to optimize patient outcomes.

Patients undergoing hip arthroscopy were **significantly more likely** to have a psychiatric condition compared to patients undergoing knee arthroscopy

Conclusion: There was a **strong association between having a psychiatric condition and undergoing hip arthroscopy for FAI**. More research should be done investigating psychiatric conditions among patients with FAI and whether this association can identify strategies to optimize patient outcomes.

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Treat the whole person, not just the image

Pay attention to mental health

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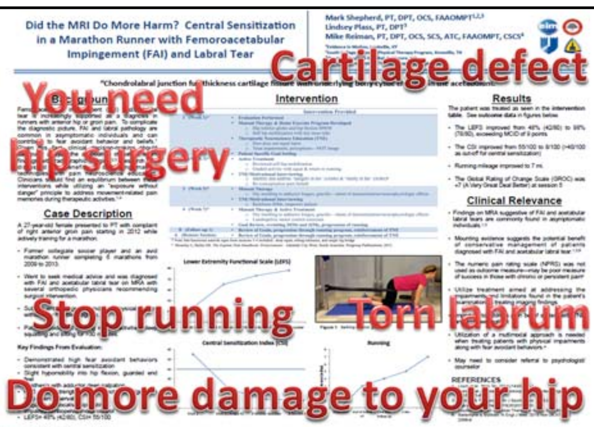

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Words matter.

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Phases of physical therapy

- Phase 1 – protect healing tissues through activity modifications
- Phase 2 – return the patient to pain-free community ambulation without gait compensations or irritation
- Phase 3 – re-establish neuromuscular control through strength and endurance training to return to full function and sports progression
- Phase 4 – Return to high level sports or function
- **Phase 5- Lifelong maintenance home exercise program**

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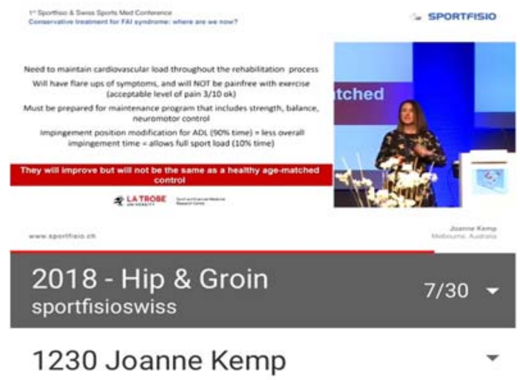

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Final take home message

Does FAI matter?

Yes! For affected people, impact on activity, sport, QOL is enormous, with increased risk of end stage hip OA and THA

How can we treat it?

Surgical and non-surgical options. Neither have level 1 evidence yet to support effectiveness. Surgery no longer funded.

Best practice physiotherapy treatment should target known impairments to optimise joint loads and improve outcomes

Permission from **Dr. Joanne Kemp**
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Thank you.

Thank you very much.

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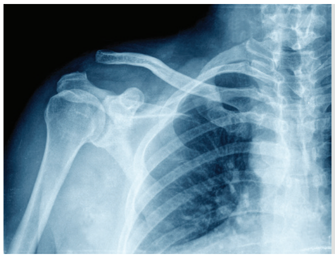

University of Chicago 25th Annual Primary Care Orthopedics Course

Course Directors:
Sherwin Ho, MD
Michael Lee, MD

Millennium Knickerbocker Hotel
Chicago, IL
June 5-7, 2019

Shoulder (and Elbow) Problems in Sports

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Director, Sports Medicine Fellowship
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Disclosure Information for Dr. Ho

- I have the following financial relationships to disclose:
  - Speaker's Bureau, honoraria and royalties for: *Zimmer-Biomet Sports Medicine*
  - Grant/Research support from: *Smith and Nephew, DJ Ortho, and Breg*
- I will not discuss off label use and/or investigational use in my presentation

Introduction

- Sports activities test the limits of shoulder and elbow
- However, the causes of shoulder pain that are seen in sports can also be seen in non-sports activities, e.g., work, accidents, etc.

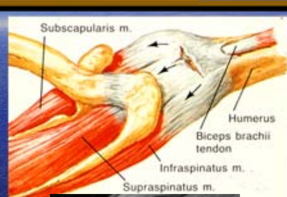
Shoulder Injuries in Sports

Overuse	Traumatic	Post-traumatic
• Rotator cuff injuries • Biceps tendon injuries • Labral tears • Distal clavicle osteolysis	• Glenohumeral jt dislocations • AC jt sprains • Clavicle fxs • Pectoralis major tears	• Glenohumeral jt instability • AC jt arthritis • Peri-scapular injuries

Shoulder: *Overuse Injuries*

Rotator Cuff Injuries

- Most common cause of shoulder pain in athletes and non-athletes
- Associated with <u>capsular laxity</u> in athletes
- Biomechanics of impingement:
  - *Classic* vs. *Internal*



Classic Impingement

- Charles Neer: "Impingement Syndrome"
  - Rotator cuff <u>fatigue</u> with overuse
  - Deltoid <u>overpowers</u> the rotator cuff: muscle imbalance
  - Results in <u>impingement</u> of the rotator cuff against acromion above
  - Once impingement develops, continued overhead activities worsens and perpetuates <u>cuff fatigue</u>, <u>impingement</u> and <u>cuff damage</u> *(downward spiral!)*
  - Acromion overgrowth occurs (bone spur) which worsens impingement

Internal Impingement in Sports

- G. Walsch/F. Jobe, 1992: mechanism of rotator cuff injury in throwers
- Impingement of undersurface of rotator cuff against glenoid labrum
- Requires external rotation > 135º
- *Often have both types!*

Classic Impingement: Presentation

- Pain with overuse of shoulder/rotator cuff
- Pain is deep (subdeltoid) and at deltoid insertion
  a) initially during sports/work activity
  b) then with any arm elevation
  c) then pain @ rest/noc

Classic Impingement: Physical Findings

- Neer's impingement sign (modified)
  - Forward shoulder elevation w/ scapula stabilized
- Hawkin's impingement sign
  - Shoulder elevation, internal rotation, adduction

Classic Impingement: Physical Findings

- Jobe's Test:
  - "Empty can test"
  - Supraspinatus pain, weakness
  - Resisted shoulder elevation w/ arms internally rotated (thumbs down), in scapular plane

Capsular Laxity: Physical Findings

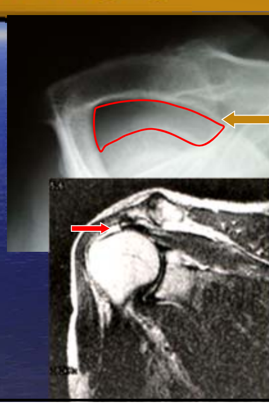
- Jobe's Relocation Test:
- Anterior capsular laxity: causing impingement in athletes
- Supine, maximal shoulder elevation
- Pain increased with manual anterior subluxation, reduced with manual reduction

Internal Impingement Exam

- Modified Jobe's Relocation Test: used to diagnose *Internal impingement*
  - Patient supine: shoulder abducted and externally rotated 90°
  - Manual anterior subluxation increases pain
  - Posterior reduction reduces pain

Rotator Cuff: Imaging

- X-rays:
  - AP and Y-scap lateral (outlet view)
  - Grade acromial shape (I,II,III)
  - r/o DJD, bone spurs
- MRI: study of choice (closed better than open, >1.5 Tesla)
  - "Black is good, white is bad"

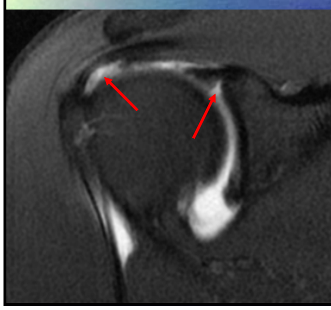


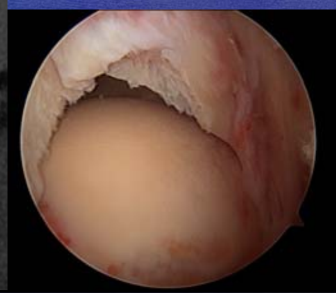
Rotator Cuff: Management

- Most cases of tendinitis and impingement get better w/ "R&R:" (rest and rehab)
  - ice, nsaid's
  - +/- injections
- Refer if no improvement after 6-8 weeks, and/or rotator cuff tear suspected

Rotator Cuff: Management

- Arthroscopy: remove subacromial spur and repair tears





Biceps Tendinitis, Tears

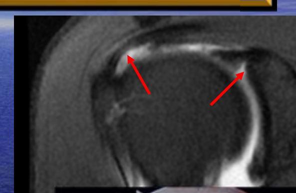
- Long head of biceps functions as part of the rotator cuff
- Complete tears in older pts lead to “Popeye” deformity
- Surgery for full strength

Biceps Tendinitis, Tears

- Speed’s test for biceps tendinitis
  - Reproduces > pain than either O’Brien’s or Jobe’s tests
  - Resisted forward flexion of shoulder w/ arm in supination
- Yergason’s test (“you’re guessing”): resisted supination with elbow @ 90°

Glenoid Labral Tears: SLAP lesions

- Caused by repetitive shoulder subluxation, traction, or trauma (fall on outstretched arm)
- Difficult diagnosis:
  - O’Brien’s test
  - Pain Provocation test
- MRA with gadolinium
- Arthroscopic evaluation to confirm/treat SLAP tear



R shoulder of a 40 y/o male MD/ volleyball player w/ SLAP and Pasta tears

Glenoid Labral Tears and SLAP lesions: treatment

- RC strengthening can help prevent subluxation and sxs.
- Arthroscopic surgery to confirm diagnosis and repair tears

Distal Clavicle Osteolysis

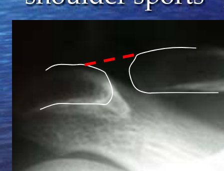
- Weight lifters: bench press
- TTP; pain with adduction
- Osteolysis on x-ray
- Rest, nsaids, injections (x2)
- Surgical resection for non-responders

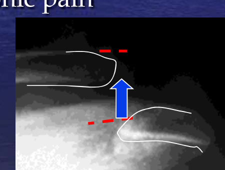
Shoulder Injuries in Sports

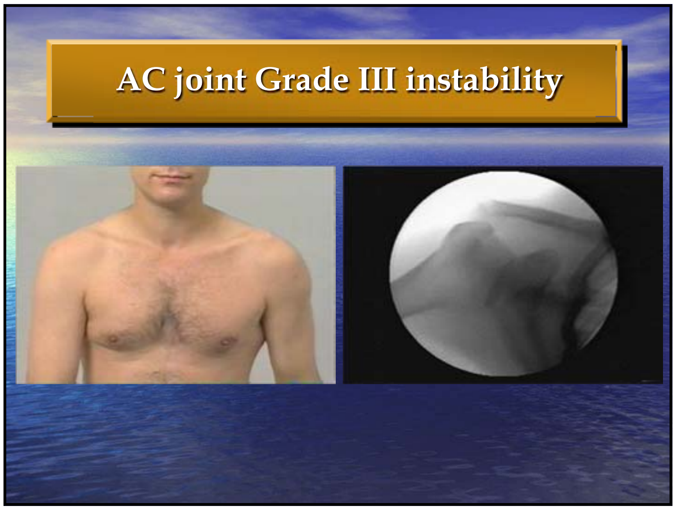
- **Traumatic Injuries**

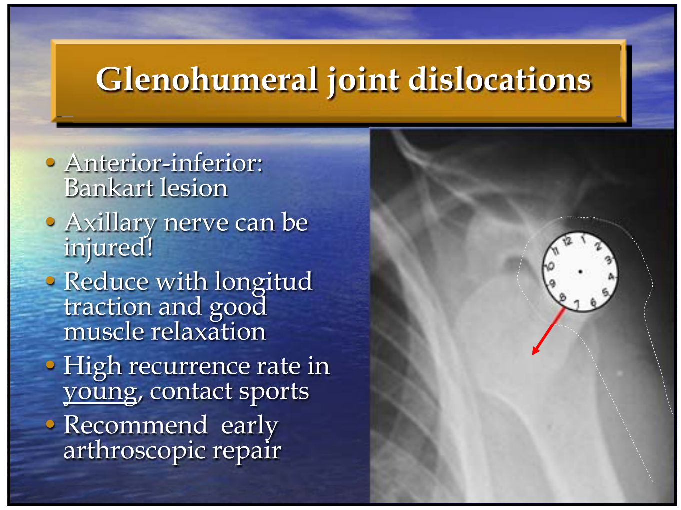
AC joint sprains/dislocations

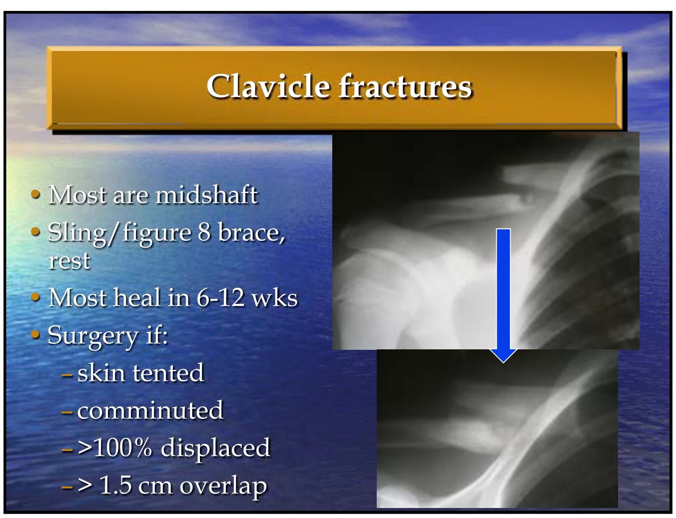
- Fall directly on shoulder
- Pain with shoulder adduction
- X-rays: Gr I, II, III
- Conserv rx. for most
- Refer: >100% displ, cosmesis, "shoulder sports", chronic pain











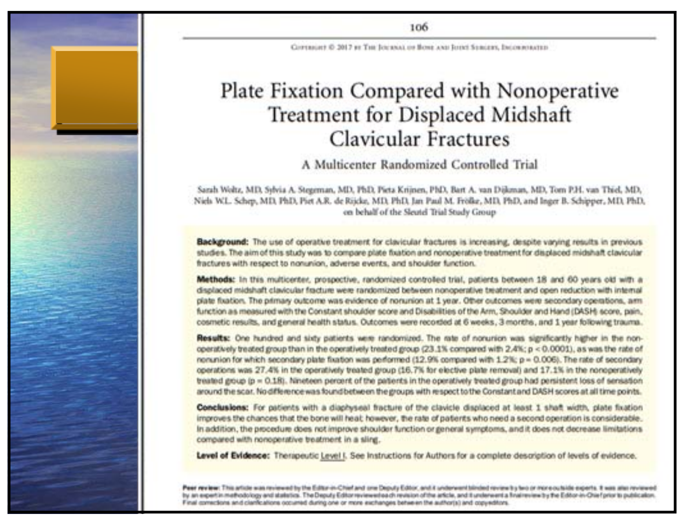


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Plate Fixation Compared with Nonoperative Treatment for Displaced Midshaft Clavicular Fractures

A Multicenter Randomized Controlled Trial

Sarah Woltz, MD, Sylvia A. Stegeman, MD, PhD, Pieta Krijnen, PhD, Bart A. van Dijkman, MD, Tom P.H. van Thiel, MD, Niels W.L. Schep, MD, PhD, Piet A.R. de Rijcke, MD, PhD, Jan Paul M. Frölke, MD, PhD, and Inger B. Schipper, MD, PhD, on behalf of the Sleutel Trial Study Group

Background: The use of operative treatment for clavicular fractures is increasing, despite varying results in previous studies. The aim of this study was to compare plate fixation and nonoperative treatment for displaced midshaft clavicular fractures with respect to nonunion, adverse events, and shoulder function.

Methods: In this multicenter, prospective, randomized controlled trial, patients between 18 and 60 years old with a displaced midshaft clavicular fracture were randomized between nonoperative treatment and open reduction with internal plate fixation. The primary outcome was evidence of nonunion at 1 year. Other outcomes were secondary operations, arm function as measured with the Constant shoulder score and Disabilities of the Arm, Shoulder and Hand (DASH) score, pain, cosmetic results, and general health status. Outcomes were recorded at 6 weeks, 3 months, and 1 year following trauma.

Results: One hundred and sixty patients were randomized. The rate of nonunion was significantly higher in the nonoperatively treated group than in the operatively treated group (23.1% compared with 2.4%; $p < 0.0001$), as was the rate of nonunion for which secondary plate fixation was performed (12.9% compared with 1.2%; $p = 0.006$). The rate of secondary operations was 27.4% in the operatively treated group (16.7% for elective plate removal) and 17.1% in the nonoperatively treated group ($p = 0.18$). Nineteen percent of the patients in the operatively treated group had persistent loss of sensation around the scar. No difference was found between the groups with respect to the Constant and DASH scores at all time points.

Conclusions: For patients with a diaphyseal fracture of the clavicle displaced at least 1 shaft width, plate fixation improves the chances that the bone will heal; however, the rate of patients who need a second operation is considerable. In addition, the procedure does not improve shoulder function or general symptoms, and it does not decrease limitations compared with nonoperative treatment in a sling.

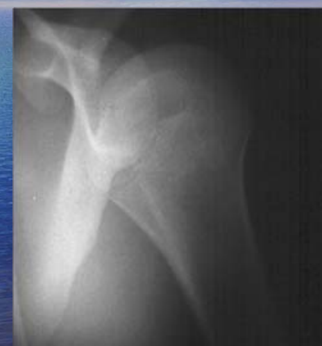
Level of Evidence: Therapeutic Level I. See Instructions for Authors for a complete description of levels of evidence.

Peer review: This article was reviewed by the Editor-in-Chief and one Deputy Editor, and it underwent blinded review by two or more outside experts. It was also reviewed by an expert in methodology and statistics. The Deputy Editor reviewed each revision of the article, and it underwent a final review by the Editor-in-Chief prior to publication. Final corrections and clarifications occurred during one or more exchanges between the author(s) and copyeditors.

Pectoralis major tendon ruptures

- Ruptures at humerus insertion, muscle retracts medially
- Weight lifters: bench press, steroids
- Diagnosis often missed: compare axillary "web"
- Surgical repair recommended, even if dx delayed

Post-traumatic problems

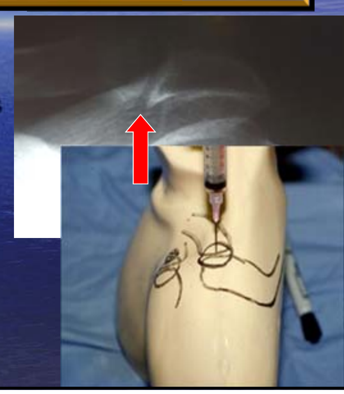


Chronic glenohumeral joint instability

- Due to chronic Bankart lesion or capsular laxity or both
- +Load and Shift test
- Rehab: strengthen rotator cuff (dynamic stabilizers)
- Surgical repair
  - recurrent instability
  - high demand/stress
  - contact sports

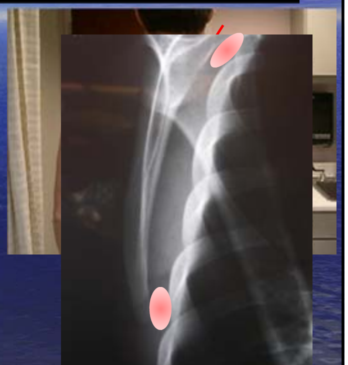
AC joint arthritis

- More common after Grade I, II sprains
- Corticosteroid injections (1 cc of kenalog 10) help
- Surgery for cont'd sxs.



Scapular injuries

- Winged Scapula: long thor. n./serratus ant. mm. weakness
- Snapping Scapula: scap-thor. bursitis (sup-med or inf scapula)
- Suprascapular n. palsy: RC atrophy
- Cervical disc dis.: C5-6, C6-7; refer'd pain to med. scapula



Thank You

Elbow Injuries in Sports

Medial	Lateral	Posterior	Anterior
• Golfer's elbow • UCL tears • Ulnar nerve injuries	• Tennis elbow • Capitellum injuries • Radial head fxs	• Triceps tendonitis • Olecranon impingm't • Olecranon fxs • Posterior dislocations	• Distal biceps tendon ruptures

Elbow

- **Medial Injuries**

Golfer's Elbow: medial epicondylitis

- Wrist flex/pron: throwing, golf, tennis
- Tender @ med epic
- Pain: w/ wrist flex/pron
- Rest, protect (strap, wrist splint), NSAID, nitroderm patch, injection, surgery

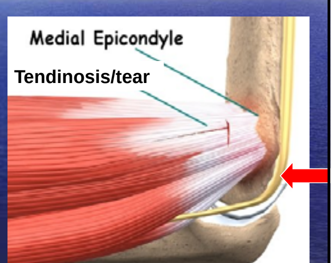
Medial collateral ligament tears

- "Tommy John injury":
  - Baseball: "valgus extension overload" - acute on chronic
- Moving valgus test reproduces pain
- MRI arthrogram dx
- Partial tears: rest/rehab
- Surgery: throwers, cont'd pain

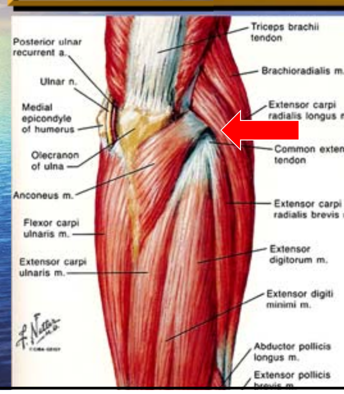
(vs. Little Leaguer's Elbow: bony/ apophyseal injury)

Ulnar nerve injuries: cubital tunnel syndrome, subluxation

- Valgus overload, repetitive flexion (stretching, entrapment
- Paresthesias; +Tinel's sign
- Palp sublux of n. w/ flexion
- Tx: Limit throwing & elbow flexion
- Surgery: ulnar n. transposition



Elbow



- Lateral Injuries

Tennis elbow: lateral epicondylitis

- Tendinitis/tears of ECRB: repetitive wrist extensions, gripping
- Tender @ lateral epicondyle: pain with wrist extension, grip,
- Pain on resisted wrist extension, middle finger extension
- Rest, protect (volar wrist splint or counterforce brace), NSAID's
- Exercises, injections (PRP vs. steroids), surgical (arthroscopic) decompression

Capitellum injuries: OCD, osteochondrosis (Panner's)

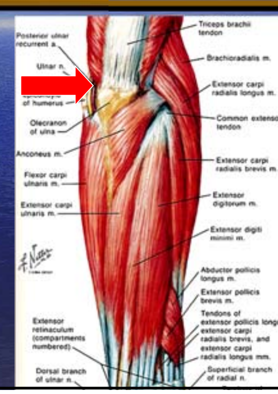
- Valgus extension overload in teenage throwers
- Tender @ capitellum: pain with valgus stress
- MRI if x-rays (-), for grading
- Rest, rehab for Panner's disease (5-12y), or osteochondritis dissecans (OCD, >13y) grades 1 or 2
- Surgery for OCD grades 3 or 4 (completely separated, chronic)

Radial head fractures

- Fall On OutStretched Hand (FOOSH) injury
- Swelling, effusion @ soft spot of elbow
- Supination painful, difficult
- X-rays if suspicious: look for "sail sign" on lateral view
- Surgery if displaced, >1/3 of head; sling if not

Elbow

- Posterior



Triceps tendinitis and bone spurs, loose bodies

- Repetitive extension: throwing, wt lifting, golf, basketball
- Olecranon spurs, loose bodies: traction/impaction acute fxs., stress fxs.
- Rest, rehab, protect, surgery to excise

Olecranon: bursitis, fxs.

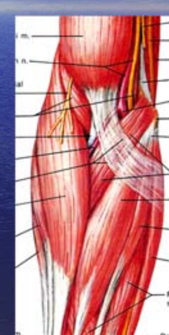
- Direct blow: swollen, tender
- X-ray: surgery to r/o fxs
- Elbow pad: aspirate when chronic, or suspect infection (refer)
- Post-traumatic: “rice bodies”

Elbow dislocation

- Hyperextension, elbow locked
- Reduce: extension + traction
- Protect in sling/brace: early motion

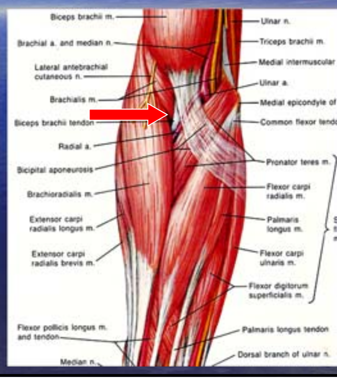
Elbow

- Anterior



Biceps tendon (distal) rupture

- Wt lifting (curls, steroids); fall
- Biceps/anterior elbow: swollen, + ecchymosis, pain with supin.
- MRI
- Refer early for surgical repair



Thank You

Rotator Cuff Exercises: General Instructions

- 3-5 workouts/wk.
- Warm-up
- Stretch
- Strengthening/ resistance training
- Stretch/cool down
- Ice

Supraspinatus: 2-5# weights or elastic bands, arms extended, forward in scapular plane, internal rotation. 2 sets of 10-20 reps.

Rotator Cuff Stretching

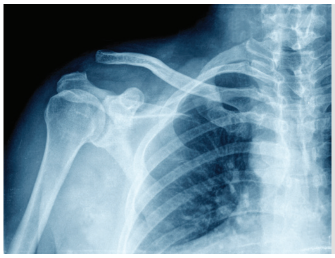
- Minimum 30 seconds each
- Ext. Rot.: hands behind head
- Int. Rot.: hands behind back
- Adduc: arm across chest

Rotator Cuff Strengthening

- Supraspinatus: shoulder elevation + int. rot., in scapular plane
- Subscapularis: int. rot.
- Infraspinatus/t. minor: ext. rot.

Online Resources

- Orthobullets
- Wheeless
- AAOS website



Athlete's Hip

Sherwin S.W. Ho, MD

University of Chicago 25th Annual Primary Care Orthopedics Course

Course Directors:
Sherwin Ho, MD
Michael Lee, MD

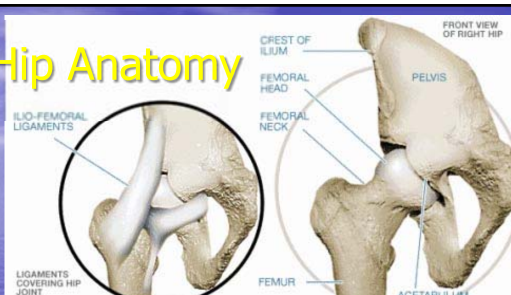
Millennium Knickerbocker Hotel
Chicago, IL
June 5-7, 2019

The Athlete's Hip 2019

Sherwin Ho, MD
Professor of Orthopaedic Surgery

University of Chicago Medicine

Basic Hip Anatomy



- Femoral Head and Neck, Acetabulum:
  - Ball and Socket, diarthrodial joint
- Labrum: like a gasket that deepens the acetabulum
- Capsule surrounds joint
- Bursae overlie tendon insertions of greater and lesser trochanters

Common active hip problems by location

- Anterior Hip Pain (Groin Pain)
  - Femoral Acetabular Impingement (FAI)
  - Labral tears
  - Chondral lesions/chondromalacia
  - Extra-articular: Iliopsoas tendinitis (internal snapping)

Common active hip problems by location

- Lateral Hip Pain
  - Typically extraarticular sources of hip pain
  - Greater trochanteric bursitis (GTB)
  - Iliotibial band syndrome (external snapping)
  - Gluteus medius tears
    - "Rotator cuff of the hip"

Common active hip problems by location

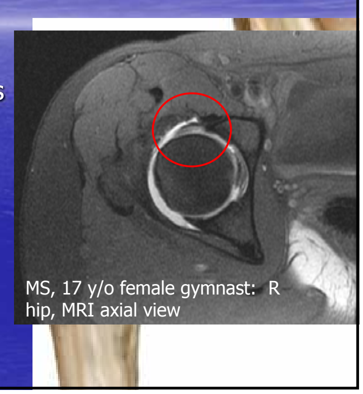
- Posterior Hip Pain
  - Proximal hamstring tendinitis/tears
  - Sacroiliitis
  - Posterior labral tears (uncommon)
  - Greater trochanteric bursities (ITB tendinitis)
  - Referred pain: sciatica
  - Piriformis syndrome
    - piriformis tendinitis, strains
    - sciatic notch

Femoral Acetabular Impingement (FAI)

- Most common cause of overuse hip/groin pain
- Associated with repetitive hip flexion + rotation
- Clicking, snapping, catching, popping
- "C" sign: sign of intra-articular source of hip pain
  - Pts grip hip from front and back with hand

Key Anatomy of the Hip Joint

- The Anterior-Superior Quadrant (ASQ) is where the majority of intraarticular hip injuries occur:
  - R hips: 12-3 o'clock
  - L hips: 9-12 o'clock
- Key structures:
  - Femoral neck
  - Acetabulum and labrum
  - Anterior Capsule
  - Iliopsoas tendon



MS, 17 y/o female gymnast: R hip, MRI axial view

FAI

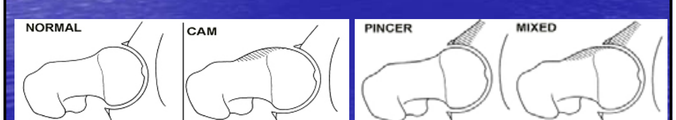
- FAI can be caused by *overuse* (excessive, repetitive hip flexion) in hips with *normal bony anatomy*
- ..and in hips with *abnormal bony anatomy*, during routine use

Key Biomechanics of FAI: hip flexion

- *We live our lives with our hips flexed*
- Imbalance between hip flexion/adduction >>> extension/abduction
- Tight anterior structures/flexors/ adductors
- Weak post structures/extensors/ abductors (*decelerators!*)

Types of FAI: CAM vs. Pincer vs. Mixed

- Cam > Mixed > Pincer
- Impingement occurs with hip flexion > 90°



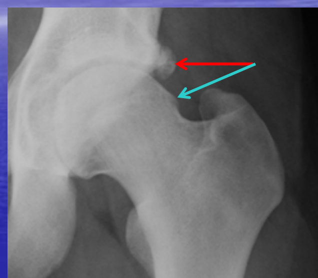
FAI: Peel Back lesions

- At limits of hip flexion, femoral neck hinges/impinges on acetabular rim/labrum
- Labral tears occur as labrum is pushed into joint, against articular cartilage:
  - Peel back chondral injuries – DJD

JB: 17 y/o F softball player with bilateral labral tears

FAI: Bony lesions

- Bony overgrowth: CAM and pincer deformities develop over time



ND: 30 y/o male softball player and weight lifter w Combined Impingement lesion

FAI: Iliopsoas tendon impingement

- Iliopsoas tendon rubs/snaps over anterior hip joint
- Present in most FAI hips
- Capsule impinged between iliopsoas tendon and femoral head/labrum/rim
  – RX: stretching, flexibility, injection,
  – Surgical lengthening

Snapping Hip Syndromes

- Greater trochanteric bursitis (External)
  – ITB syndrome
  – Post-traumatic vs. overuse
  – Tight ITB rubs/snaps over GT
  – RX: stretch, NSAID's, injection,
  – surgical decompression

The Hip Exam: ROM, forced flexion test

CB,18 y/o elite male basketball player w/ 6 mos of L hip pain

Hip Exam: Anterior Impingement Test

Iliopsoas Test (Circumduction Test): *Snapping Hip Syndrome (Internal)*

Circumduct hip to reproduce iliopsoas tendon over anterior hip joint

Hip Exam: ROM and Anterior Impingement test, Circumduction test

The Focused Hip Exam: Anterior Superior Quadrant

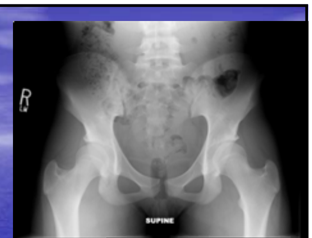
- ROM: flexion, IR/ER @ 90, abduction
- FADIR test (Flexion, ADduction, Int Rot
- Dynamic FABER test (Flexion, ABduction, Ext Rot)
- Figure 4, knee to table height:
  - anterior capsule contrac.
- SLR against resistance (10 sec): iliopsoas test

Focused Hip Exam: Greater Trochanteric Bursal pathology

- External Snapping Hip Syndrome, GT Bursitis, ITB Syndrome
  - GT bursa and gluteus medius tendon impinged between ITB and GT
- Exam:
  - Palpate GT
  - ITB snap test
  - Ober's test

Work Up

- AP Pelvis (standing)
- Shoot through lateral
  - Frog lateral OK, easier
- Evaluate for CAM and Pincer lesions
- DJD, loose bodies, etc.



XL: 28 y/o F former professional dancer

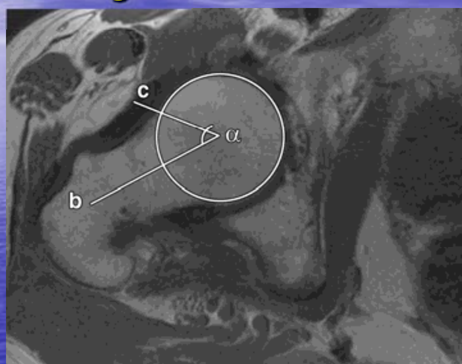
Radiographic Signs

- CAM impingement:
  - pistol-grip deformity
  - α angle > 50 degrees
  - femoral head-neck offset less than eight millimeters
- Pincer impingement:
  - coxa profunda (abnormally deep socket)
  - protrusio acetabuli (femoral head protrudes into pelvis)
  - acetabular retroversion (cross-over sign or "figure-8", produced by prominent anterior rim)

Radiographic Hip Measurements

- Center Edge Angle
  - Measurement of hip dysplasia (shallow acetabulum)

Alpha Angle

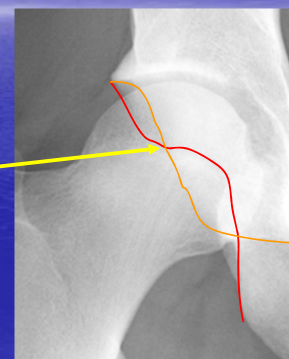


Nouh, M. R. et al. Am. J. Roentgenol. 2008;190:1260-1262

AJR

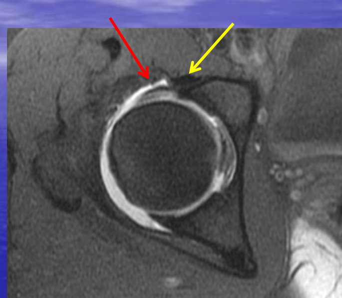
Pincer Lesion: Cross-over sign

- Cross-over sign (AP): Acetabular retroversion (pincer)
- Posterior wall sign (AP): Coxa profunda (pincer)



MRI Arthrogram for FAI: Gold standard

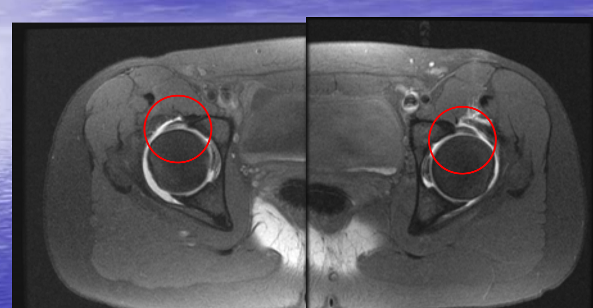
- MRI arthrogram with gadolinium
  - Add Kenalog 40 in patients over 40 with early DJD +/- labral tear (diagnostic and therapeutic)
- Labral tears
- CAM and Pincer lesions
- Chondral lesions?



JB: 17y/o F softball player w/ bilat labral tears, R hip MRI axial T2

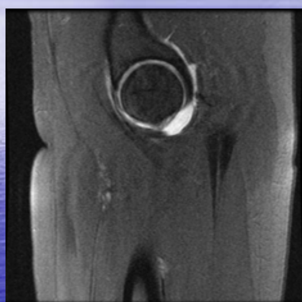
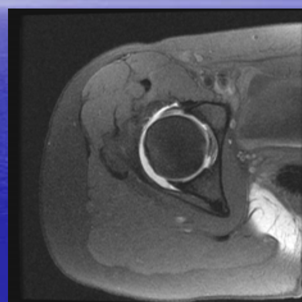
(Dr. Ho's MRI Rule: Black is good, white is bad")

MRI Arthrogram in FAI



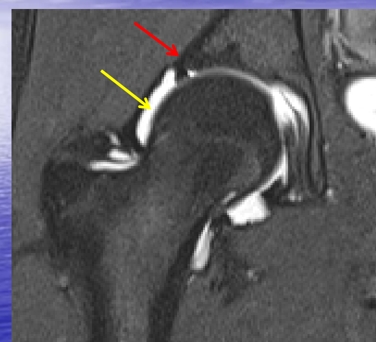
17 y/o F softball player w bilateral labral tears

MRI Arthrogram in FAI

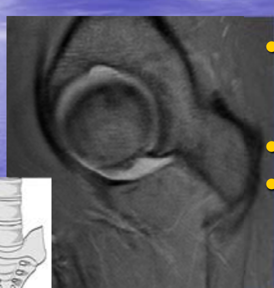
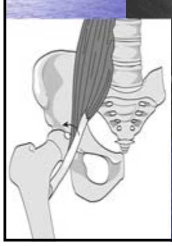
17 y/o F softball player: R hip labral tear, + iliopsoas snap

MRI Arthrogram in FAI



MS: 15 y/o female Level 10 gymnast with bilateral labral tears and CAM lesions
Coronal T2

Role of the Iliopsoas in FAI

- MS: 15 y/o female Level 10 gymnast w/ bilateral labral tears
- Sagittal T1
- Location of Iliopsoas
  - Directly anterior to anterior labrum and femoral head
- + Iliopsoas snap test

Non-surgical treatment of FAI and related problems

- Since FAI is caused by excessive *flexion, adduction, and internal rotation,* leading to *anterior capsular and iliopsoas contractures…*
- …treatment goal is to *stretch anterior hip structures*
- Strengthen opposing muscles: *hip extensors**, external rotators, abductors*
- <u>**Eccentric strengthening of hamstrings/gluteus!!!</u>

Physical Therapy RXN for FAI and related problems

- ROM/flexibility exercises:
  - Stretch anterior hip structures (ant capsule and iliopsoas)
  - Lunges, figure-4 and butterfly stretches, ITB
- Strengthening exercises:
  - Strengthen Hip Extensors (gluteus maximus, hamstrings): *Eccentric strengthening*
  - Hip abductors, (Gluteus medius, tensor fascia lata)
  - Hip external rotators (piriformis)

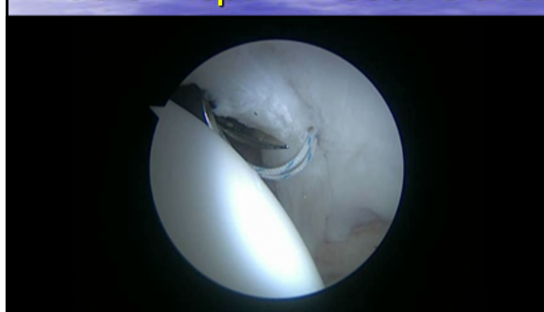
Additional non-surgical treatment

- Add anti-inflammatory rx:
  - NSAID's (5 days on, 2 days off)
  - Modalities (ice, ultrasound, etc)
  - Corticosteroid injections: intraarticularly via ultrasound or fluoroscopic imaging
  - Pain from iliopsoas tendinitis, capsulitis, early arthritis

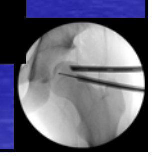
Arthroscopic Treatment of FAI and related problems

- Repair labral tears
- Chondroplasty +/- microfracture for associated peel-back chondral lesions
- Decompress bony lesions (CAM/pincer/ acetabular ossicles)
- Release (lengthen) iliopsoas at musculotendinous junction (slide)
- Release anterior capsule (capsular contracture)

Labral Repair w Suture anchors



JB, 17 y/o F softball player: L hip

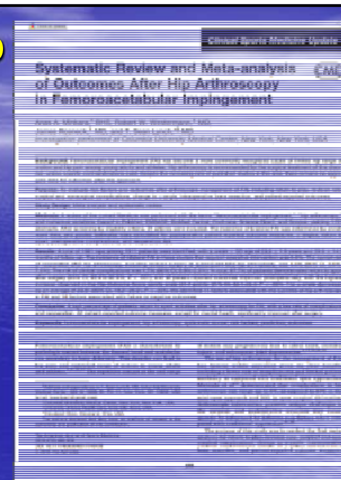


Femoral Neck Osteoplasty/ decompression

JB, 17 y/o F softball player: L hip

Outcomes of Hip Arthroscopy

- AJSM, Feb., 2019
- Meta-analysis of 1981 hips in 1911 pts
- 87.7% returned to sports
- 1.7% complication rate
- 5.5% re-operation rate



Clinical Sports Medicine Update

Systematic Review and Meta-analysis of Outcomes After Hip Arthroscopy in Femoroacetabular Impingement

Lateral Hip Pain: Trochanteric Pain Syndrome

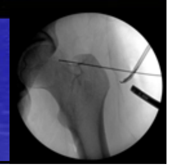
- ITB syndrome:
- Greater Trochanteric Bursitis
- Gluteus medius/minimus tears
- Dx: MRI

Lateral Hip Pain: Trochanteric Pain Syndrome

- Physical therapy to stretch ITB, strengthen g. medius
- Inject bursa
- Arthroscopy to resect portion of ITB, repair gluteus medius/minimus if torn

Hip Bursoscopy: Greater Trochanteric Bursa

- Release ITB: excise area directly over greater trochanter
- Excise bursal tissue
- Repair tears of gluteus medius



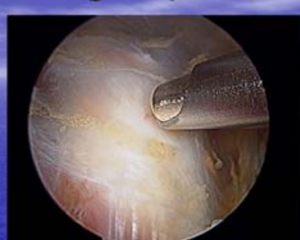
JB, 17 y/o F softball player: L hip

Posterior Hip Pain: Hamstring Tears

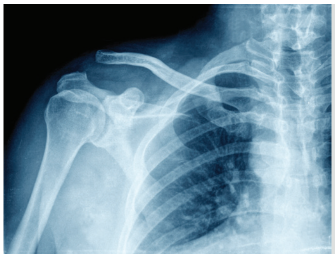
- Acute tears: Hip flexion + knee extension: water skier's hamstring
- Echymosis, swelling, tenderness along proximal hamstring
- Weakness
- Pain with sitting
- X-rays: occas avulsion fx in youth
- MRI for diagnosis
- Physical therapy/injections for partial tears
- Surgery if no improvement > 6 mos

Arthroscopic Hamstring Repair

- Endoscopic debridement and repair of proximal hamstring tears



Thank You for Your Attention



Pediatric Sports Injuries

Carrie A. Jaworski, MD, FACSM
Director, Division of Primary Care Sports Medicine & Fellowship Director
University of Chicago- NorthShore University HealthSystem

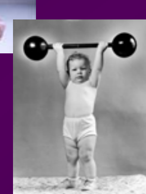
Disclosure

- I have no financial arrangements that require disclosure
- I will not discuss unapproved or off label products or their uses

The Scope

- Increasing numbers of children active in organized sports programs in the US
  - 30 million
  - 7.9 million high school athletes in 2017-18
- As these numbers increase, so has the number of sports-related injuries
  - 2.8 million emergency dept visits/yr
  - $1.8 billion /yr

There are also more sports…



- "Classic" sports
  - Football, basketball, soccer
- Newer sports
  - Lacrosse, parkour skateboarding
- Recreational activities
  - Bicycling, playground, hiking and climbing

…and there are more girls playing sports!

- Adolescent girls are fastest growing segment of kids participating in organized sports
- Title IX -1972
  - From 300,000 high school female athletes in 1972 to 3.4 million in 2018

Benefits of sports

- Goal setting
- Success and failure
- Positive correlation with academic performance
- Decreased risky behaviors
- Teaches importance of PA for a lifetime
- Disease prevention

Why do kids play sports?

1. Having fun
2. Improving skills
3. Develop fitness/exercise
4. Being with my friends
5. Experiencing thrills and excitement
6. Being on a team
7. Opportunities for personal accomplishment
8. Staying in shape
9. Doing something I'm good at
10. Winning

Ewing & Seafeldt, 1996

Why do kids quit sports?

1. Not having fun
2. Too much pressure from parents and peers
3. Too much emphasis on winning
4. Concerns about coaching
5. Not getting enough playing time

By age 15, 75% of kids in organized sports have dropped out…

Ewing & Seafeldt, 1996

Sport Readiness

- Sports can build self-esteem and confidence
  - Can backfire if not physically ready
  - Expose kids to a wide variety of activities early on
- Motor skill development should match demands of the activity
- Children reach readiness at different times

Sport Readiness

- Age 4 – Only 20-30% of kids proficient in throwing and catching.
- Fundamental skills not acquired until early elementary school
  - Throwing, catching, kicking, running, jumping, hopping, skipping and striking
- Before age 6, most not ready for organized sports

Age appropriate activities

- Early Childhood – (2-5 years)
  - Focus on fundamental skills
  - Poor vision and balance
  - Emphasize fun
  - Limit instruction
  - Avoid competition
  - Running, swimming, tumbling, throwing, catching

Age appropriate activities

- Middle Childhood – (6-9 years)
  - Begin to master transitional skills = combining fundamental skills
  - Visual system almost mature
  - Short attention span
  - Difficulties with direction of moving objects
  - Best to do sports with few variables
  - Minimal competition
  - Entry-level soccer, baseball, tennis gymnastics

Early Sport Specialization

- Has become the societal "norm"
  - Not recommended for most
  - Results in overuse injuries and burnout
  - Limits motor skill development
- Need to assess physical, developmental and emotional maturity to handle such

Limit hours per week to less than years old

DiFiori JP, Benjamin HJ, Brenner J, et al. Overuse Injuries and Burnout in Youth Sports: A Position Statement from the American Medical Society for Sports Medicine. Clin J Sport Med 2014;24:3–20

Intrinsic Risk Factors for Burnout in Young Athletes

- Perfectionism
- Need to please others
- Nonassertiveness
- Unidimensional self-conceptualization (focusing only on one's athletic involvement)
- Low self-esteem
- High perception of stress (high anxiety)

Extrinsic Risk Factors for Burnout in Young Athletes

- Little personal control in sport decision making
- Critical/negative performance evaluations
- Demanding performance expectations – self imposed or by others
- Extremely high training volumes
- Extremely high time demands
- Frequent intense competition
- Inconsistent coaching

Gender Differences

- Sex-based differences in aerobic capacity and muscle strength don't occur until puberty
- Young boys and girls can safely participate in co-ed sports
- After puberty, most opt for single-gender sports

Pediatric Thermoregulation

- Children more susceptible to issues
- Due to a larger body surface area to body mass ratio than adults
- Higher heat production per kg body weight
- Sweat rate is lower in children
- Dehydration exacerbates temperature rise more in children

Weightlifting & Children

- Supervise for correct technique
  - Correct equipment size and adjustment
- < 3 d/wk, < 90 min
- Low weight, high reps
  - Gradual progression
- Good starting point for obese adolescents

Children and Risk of Injury

- Motor skills and performance not fully developed
- Improper fit or lack of protective equipment
- Greater surface area to body mass ratio
- Disproportionately larger heads
- Growth plates susceptible to injury

Epidemiology of Pediatric Sports Injuries

- Bicycling STILL has highest percentage of injury in kids overall
  - Bike = 13.7%
  - Walk/hike/march = 12.1%
  - Basketball = 9.6%
  - Football = 7.5%
- Upper extremity fractures more common
- Children ages 0-21 (NHIS)
  - Males:Females 2:1
  - Injury rate 25/100

Epidemiology of Pediatric Sports Injuries

Figure 2.1 Injury Diagnosis by Type of Exposure, High School Sports-Related Injury Surveillance Study, US, 2015-16 School Year

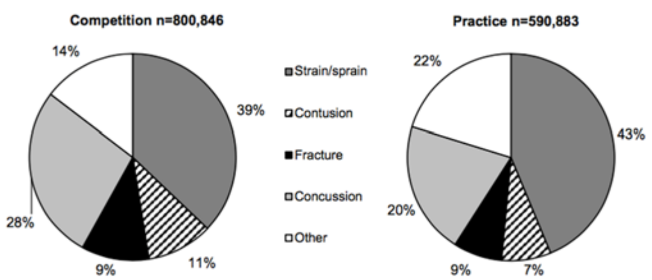


Table 2.3 Demographic Characteristics of Injured Athletes by Sex, High School Sports-Related Injury Surveillance Study, US, 2015-16 School Year*

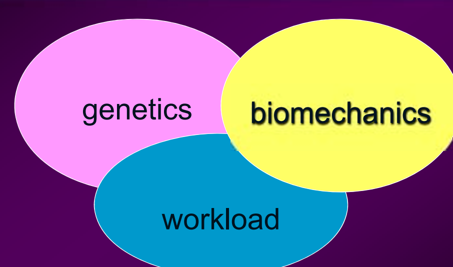
	Male n= 924,686	Female n= 424,969
Year in School		
Freshman	22.5%	27.5%
Sophomore	25.5%	27.9%
Junior	22.3%	24.0%
Senior	29.7%	20.6%
Total†	**100.0%**	**100.0%**
Age (years)		
Minimum	12	13
Maximum	19	19
Mean (St. Dev.)	15.9 (1.3)	15.7 (1.3)
BMI		
Minimum	15.2	15.8
Maximum	53.2	42.9
Mean (St. Dev.)	24.7 (4.5)	22.1 (3.2)

*All remaining analyses in this chapter present data weighted to provide national injury estimates.
†Throughout this chapter, totals and n's represent the total weighted number of injury reports containing a valid response for the particular question. Due to a low level of non-response, these totals are always similar but are not always equal to the total number of injuries.

Pediatric Concussions

- Pediatric brain takes longer to recover
- More difficult to discern symptoms
- Academic issues can be multi-factorial
- Newest guidelines advise ACTIVE recovery

Factors Contributing to Overuse Injuries



Ref: Reider; Sports Medicine and the School Age Athlete
Courtesy of Holly Benjamin

Pathophysiology

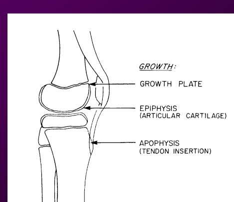
- Intrinsic factors
  - Growth
  - Anatomic alignment
  - Muscle-tendon imbalance
  - Flexibility
  - Conditioning

Pathophysiology

- Extrinsic factors
  - Training errors
  - Environment
  - Equipment
  - Coaches

Pediatric Orthopedics 101

- Radiologic Pearls
  - Growth plates can mimic fractures
  - Get comparison views
  - Know common ossification centers
- Females reach skeletal maturity by 18-19
- Males by 21-22



Pediatric Ortho 101

- Long bones
- Diaphysis = Shaft
  - Can bend through plastic deformation
  - Fracture through one end = Greenstick
  - Complete fracture
- Metaphysis = Flared end, cortex is thin in children
  - Axial load can cause buckle or torus fracture
- Epiphysis= Contributes to long bone formation & joint surface
  - Injury can impair bone growth and cause arthritis

Pediatric Bones

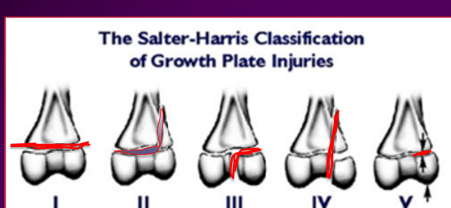
- Periosteum is thick
- Bows rather than fractures
- Results in faster healing
  - Greenstick fracture
  - Torus/buckle

Salter-Harris Fractures

- I = Through the physis (Sublux)
- II = Through physis and metaphysis (Above)
- III = Through physis and epiphysis (Lower)
- IV = Through metaphysis and epiphysis (Through)
- V = Crush injury to physis

- I and V hardest to see on x-ray
- Need to monitor growth
- Risk increases with increasing number
- Degree of deformity and amt of remaining growth also need to be considered

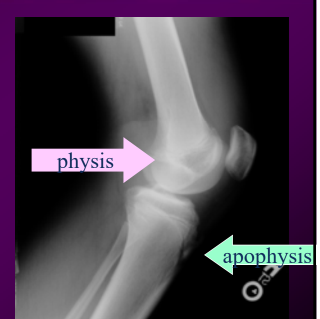
"SALT-R"



Adapted from: http://www.niams.nih.gov/health_info/Growth_Plate_Injuries/graphics/growth-plate.jpg

Pediatric Bones

- Physis = Cartilaginous growth plate
  - Weakest structure in growing skeleton
- Apophysis = Growth center that serves as the attachment for a major tendon group
  - do not = growth disturbance



Apophysis	Associated Muscle	Age at Appearance of Apophysis (yrs)	Age at Fusion of Apophysis (yrs)
Ant Superior Iliac Spine	Sartorius	13-15	16-18
Anterior Inferior Iliac Spine	Quadriceps	13-15	16-18
Iliac Crest	Obliques, IT band	13-15	21-25
Ischium	Hamstrings	13-15	20-22
Tibial Tubercle	Patellar tendon	12-13	15-17
Calcaneus	Achilles tendon, plantar fascia	7-9	12-14
Fifth Metatarsal	Peroneal brevis	7-9	12-14
Medial Epicondyle	Common flexor tendon	8-10	13-15

Adopted from the Care of the Young Athlete, 2011

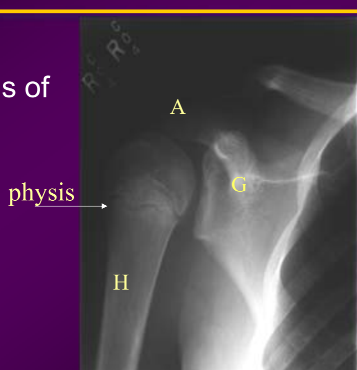
Case 1: Shoulder Pain-Baseball

- 12 yr old RHD baseball pitcher with a 1 mo. hx shoulder pain w/ pitching
- Recent loss of velocity noted
- Grew 4 inches last 6 months
- TTP at proximal humerus
- DIAGNOSIS??

Courtesy of Holly Benjamin

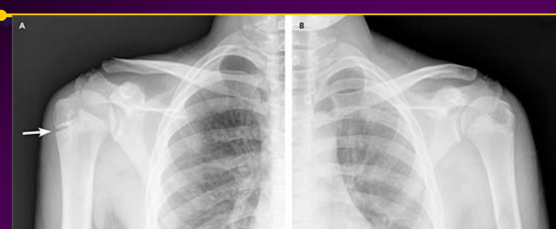
Differential Diagnosis

- Stress fracture
- Osteochondrosis of the physis
- Instability
- Impingement syndrome
- Labral injury
- Neoplasm



Courtesy of Holly Benjamin

Little Leaguer's Shoulder



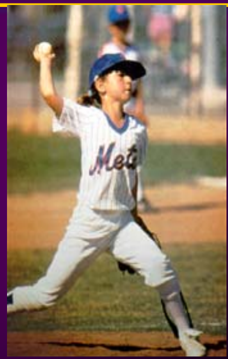
- Stress fracture of the proximal humeral physis
- Usually boy pitchers between age 11-13
  - Other overhand sports e.g., tennis, swimming, volleyball
- Improper mechanics, increase in frequency of pitching, breaking pitches (curveballs, sliders)

Little Leaguer's Shoulder

- Assess for excessive throwing
  - Extra practice
  - Multiple leagues
  - Other throwing sports
- No throwing usually for 8-12 weeks
- Preseason conditioning
- Correction of poor technique
- Most return to previous competitive level

Case 2: Elbow Pain Thrower

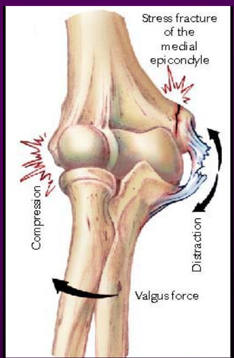
- A 13 year-old RHD baseball pitcher with 1 mo hx of medial elbow pain
- Activity related + loss of pitch velocity
- She denies any acute injury, numbness, tingling, clicking/locking
- She wants clearance to pitch. Can she?



Courtesy of Holly Benjamin

Differential Diagnosis

- Apophysitis
- Medial epicondylar avulsion fx
- Tendonitis (flexor/pronator)
- UCL injury
- Neuritis (ulnar)
- Neoplasm
- Infection
- Osteochondrosis (lateral)
- Osteochondritis (lateral)



Courtesy of Holly Benjamin

Little Leaguer's Elbow

- Apophysitis of the medial epicondyle in athletes 9-12 yoa
- Repetitive throwing causes chronic traction stress on the medial epicondyle, causing
  - cartilage swelling
  - irregular ossification
  - avulsion

Imaging

- Low threshold for x-rays
  - AP, lateral, obliques with comparison and/or stress views
  - Further imaging may be required (MRI, CT)
- Radiographs
  - Up to 85% normal
  - Physeal widening
  - Medial epicondyle avulsion

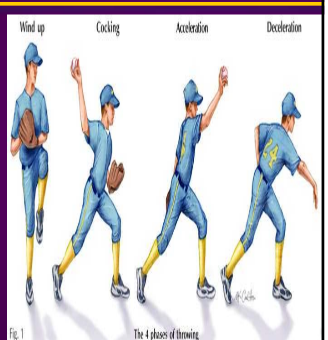
Treatment

- 4-6 weeks of rest from throwing
  - avoid weights & resistance exercises
  - flexibility and core strengthening
- NOTE: recommend *early referral*
- Complications include chronic instability, weakness, ↓ ROM, deformity, delayed union, avulsion

Courtesy of Holly Benjamin

Treatment

- Prevention
  - Warm-up [5-10 min]
  - Flexibility
  - Strength: "core" + arm
- Biomechanics
  - Pitch types + counts
- Interval throwing program
  - Age specific
  - 2-3 mos off in a row



Courtesy of Holly Benjamin

USA Baseball/MLB Pitch Smart Pitch Count Recommendations

Pitch Count Limits and Required Rest Recommendations

It is important for each league to set workload limits for their pitchers to limit the likelihood of pitching with fatigue. Research has shown that pitch counts are the most accurate and effective means of doing so. See required rest recommendations below.

Age	Daily Max (Pitches in Game)	0 Days Rest	1 Days Rest	2 Days Rest	3 Days Rest	4 Days Rest	5 Days Rest
7-8	50	1-20	21-35	36-50	N/A	N/A	N/A
9-10	75	1-20	21-35	36-50	51-65	66+	N/A
11-12	85	1-20	21-35	36-50	51-65	66+	N/A
13-14	95	1-20	21-35	36-50	51-65	66+	N/A
15-16	95	1-30	31-45	46-60	61-75	76+	N/A
17-18	105	1-30	31-45	46-60	61-80	81+	N/A
19-22	120	1-30	31-45	46-60	61-80	81-105	106+

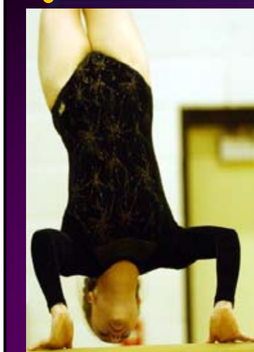
https://www.mlb.com/pitch-smart/pitching-guidelines

Case 3: Wrist Pain in a Gymnast

- 12 yr old RHD level 6 gymnast with 3 month hx of wrist pain
- Pain worse with weight-bearing and wrist extension
- No swelling, clicking, trauma, etc.
- Diagnosis?

Courtesy of Holly Benjamin

Gymnast's Wrist: Distal Radial Physeal Injury

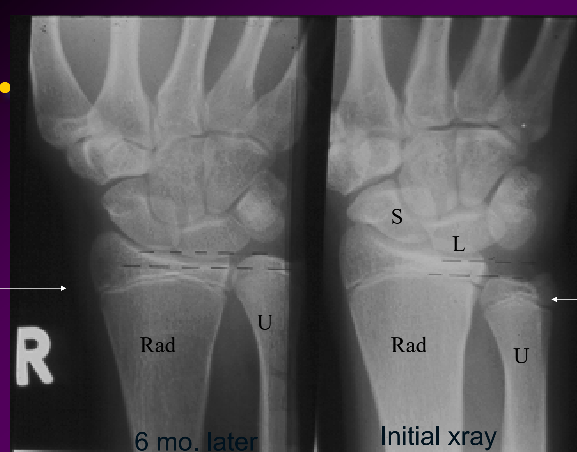


- Weightlifters & gymnasts
- Repetitive stresses => sclerosis
- Exam => TTP distal radius or pain w/ axial loading
- Complications
  - Premature growth plate closure
  - Ulnar overgrowth & impingement

Courtesy of Holly Benjamin

Gymnast's wrist

Courtesy of Holly Benjamin

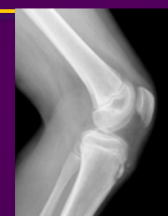


Courtesy of Holly Benjamin

Case 4: Knee Pain: Basketball

- 13 yr old with 3 month history of unilateral anterior knee pain and swelling
- Pain is activity related
- No trauma, no locking
- Exam: TTP tibial tubercle

Osgood-Schlatter disease



- Apophysitis of the tibial tubercle
  - most common pediatric overuse injury
  - occurs in 20% of young athletes
  - 15-60% bilateral
  - girls between ages 8-13 years
  - boys between ages 10-15 years.

Treatment

- Reassure: self-limiting
- Ice knee pre/post exercise
- Hamstring/quadriceps stretching
- +/- NSAIDS
- Pads, counterforce bracing, taping
- Participation as tolerated

Other Apophysitis…

- Sever's Disease
- Sinding-Larsen Johannson Disease- Inferior Patella
- Iselin's Disease- Confused with 5^{th} MT fx
- Ischium, Ilium, Navicular, Subcapital

Sever's Disease

- Apophysitis of the calcaneus
- Affects both boys and girls between ages 8-13 years,
- Most common in soccer, basketball, and gymnastics
- Repetitive heel impact and traction stress from the Achilles tendon and plantar fascia
- Pain bilateral in 60%

Sever's Treatment

- Reassure
- Self-limiting
- Flexibility
- Strengthening
- Heel lifts +/- orthotics
- Icing
- +/- NSAIDS

Courtesy of Holly Benjamin

OSD versus SLJ

Courtesy of Holly Benjamin

Case 7: Adolescent Hip Pain

- 16 yo male recreational athlete running at full effort
- Heard & felt a 'pop' in his right groin 10/10 pain
- Seen in ED given crutches and motrin but no diagnosis
- In clinic NWB,
- Right inner thigh / groin
  - No significant ecchymosis or edema
  - No scar or signs of trauma
  - No palpable defect
  - Significant TTP at mid inner thigh

Courtesy of Holly Benjamin

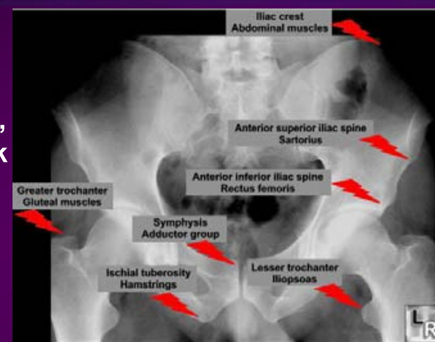
Differential Diagnosis – Adolescent Hip Pain

- Slipped Capital Femoral Epiphysis
- Apophyseal injury (Apophysitis / Avulsion Fx)
- Adductor strain
- Hip flexor strain
- Transient synovitis
- Labral tear
- Capsulitis or hip impingement

Courtesy of Holly Benjamin

Apophysitis of the Pelvis

- Poorly localized hip, groin, or buttock pain
- Acute or insidious pain
- Tx: R & R

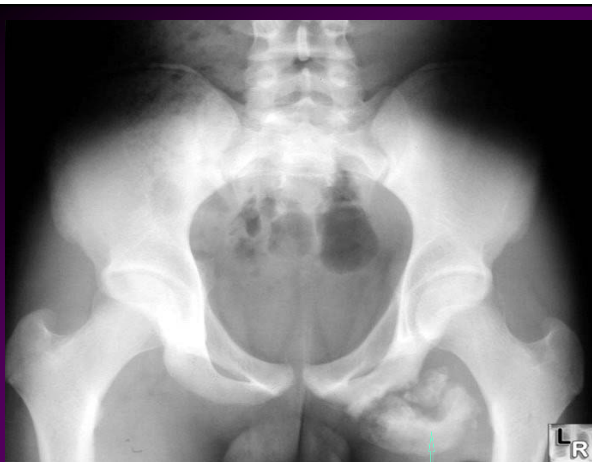


Courtesy of Holly Benjamin

Hip Avulsion Fracture Sites

Apophysis	Associated Muscle	Appearance of Apophysis (yrs)	Fusion of Apophysis (yrs)
Ant Superior Iliac Spine	Sartorius	13-15	16-18
Anterior Inferior Iliac Spine	Quadriceps	13-15	16-18
Iliac Crest	Obliques, IT band	13-15	21-25
Ischium	Hamstrings	13-15	20-22

Courtesy of Holly Benjamin



Courtesy of Holly Benjamin

Osteochondritis Dessicans

- Developmental, or sometimes traumatic, condition where blood supply is diminished to a portion of the articular surface of growing joint
- Tends to occur during periods of rapid bony growth
- Can have features of both an acute injury and overuse injury

OCD Lesions

- Patella and Femoral Condyle usually without history of overuse
  - 75% of lesions occur in the knee
  - 85% of knee lesions affect the medial femoral condyle
  - Notch view on x-ray to demonstrate lesion (bent knee)

OCD lesions

- Capitellum and Talus usually occur with repetitive trauma (pitching, handsprings)
  - Capitellum age 11-16
  - Lateral elbow pain from chronic compression
  - Talus is ankle sprain that doesn't get better

OCD Lesions

- MRI to grade lesion
- Grades I-IV
- Grades I-II stable
- Grades III and IV unstable
- Unstable lesions referred to ortho
- Stable lesions are to modify activity and rest from sport for 6-8 weeks
- PT to maintain strength
- Goal is Pain-free ADLs
- Follow at 3 month intervals

Osteonecrosis

- Often a missed diagnosis
- Avascular necrosis
- Kohler's Disease-

Other Cartilage Injuries

- Freiberg's Infarction
  - second metatarsal most commonly affected
  - girls 13 years and older
- Kienbock's Disease
  - trauma can disrupt blood flow to lunate
  - Young adults ages 15 and up

Back Pain in Young Athletes

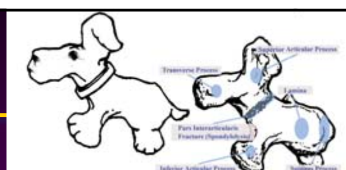
- Spondylolysis
  - occurs in ~6 percent of the general population but contributes to nearly 50% of cases of back pain in athletes
  - Due to repetitive hyperextension
  - Dance, gymnastics, weightlifting, volleyball, diving and football
  - Defect of the pars interarticularis
  - Most commonly at L4-5 level

Spondylolysis

- Presenting sx: Activity-related back pain, Progresses to pain at rest.
- Exam: Bony tenderness, Limited forward flexion/hamstring tightness, + pain with hyperextension and + Stork sign

Spondylolysis

- Diagnosis: If sx > 3 weeks, x-ray may be +
  - Look for “scotty dog”
  - If sx acute, consider bone scan with SPECT
  - CT of affected area to “stage” lesion (debatable)
  - MRI being used – to rule out other etiologies of pain.



Spondylolysis

- Treatment: Controversy exists over best approach, Maintain pain-free activity, PT, analgesics. ? Bracing
- Return to play: Asymptomatic or evidence of healing. Can take up to 12 mos.
- Can have bony healing or fibrous union
- Can have spondylolisthesis if bilateral lesions

Prevention

- Limit the volume and intensity of training and competition for young athletes
- Discourage specialization in a single sport at an early age
- Ensure high quality coaching and adult leadership
- Encourage the maintenance of a balanced lifestyle

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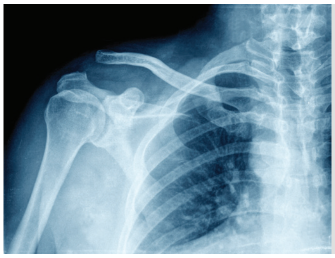
Thank you!



Developmental Disorders of the Hip
Robert Bielski, MD

THE UNIVERSITY OF CHICAGO

Developmental Disorders of the Hip

Robert Bielski, MD
University of Chicago
Comer Children's Hospital

- I will not discuss any project or procedure in which I or member of my family has a financial interest.
- I do not receive financial support or compensation from any company.
- I will not discuss any off label use of any product

Developmental Dysplasia of the Hip

- Risk factors for DDH
- Exam of the newborn in DDH
- Exam of the older infant and toddler in DDH

Imaging for DDH

- Who gets imaging?
- When is the best time to get imaging?
- What imaging should be done?
- Who should be referred to orthopedics?

Basic treatment of DDH

- Birth to 6 months
- 6 to 12 months
- 1 year to 2 years
- Greater than 2 years

CLINICAL CASES (PRE TEST)

Clinical scenario 1

History

- In office, you see a 2 wk old female
- She is Ortolani and Barlow positive
- Your next step is????

Options

- Double diaper
- Referral to orthopedics
- Hip xray
- Hip ultrasound

Clinical scenario 2

History

- You see a 16 month old male with complaint from mom that he has been limping on left side since he started walking 3 mos ago. You find a 1 cm limb length discrepancy. Your next step???

Options

- Hip ultrasound
- Hip xray
- 1 cm shoe lift
- Referral to physical therapy

Clinical scenario 3

History

- At well baby visit at 9 months, your hip exam shows decreased hip abduction on left hip. Ortolani and Barlow are negative. Galeazzi is negative. Next step should be?????

Options

- Hip xray
- Hip ultrasound
- Recheck in 3 months
- Double diapers
- Pavlik Harness

Clinical scenario 4

History

- You see a 1 month old male in the office with a right sided hip click. Ortolani, Barlow, and Galeazzi are normal. This is third baby for mom. It was an uncomplicated pregnancy and a vaginal, vertex delivery. Next step????

Options

- Hip ultrasound
- Referral to orthopedics
- Repeat exam in 1 month
- Hip xray
- Double diaper

Clinical scenario 5

History

- You see a 1 month old white male in the office with a right sided hip click. Ortolani, Barlow, and Galeazzi are normal. This is first baby for mom. It was an uncomplicated pregnancy with a C section for breech presentation. Next step????

Options

- Hip ultrasound
- Referral to orthopedics
- Repeat exam in 1 month
- Hip xray
- Double diaper

HIP DYSPLASIA

- 1 IN 1000 BIRTHS HAS FRANK DISLOCATION
- 1 IN 100 CHILDREN HAS SOME EVIDENCE OF HIP INSTABILITY
- HAVE A HIGH INDEX OF SUSPICION

HIP DYSPLASIA

- Less Common in African American children
- Common in white and Hispanic children

RISK FACTORS

- FIRST BORN
- FEMALE
- BREECH
- FAMILY HISTORY
- OLIGOHYDRAMNIOS
- LARGE FOR GESTATIONAL AGE

Factors that lead to decreased fetal movement increase risk of DDH

- FIRST BORN
- BREECH
- OLIGOHYDRAMNIOS
- LARGE FOR GESTATIONAL AGE

RISK FACTORS—THE SIX F'S

- FIRST BORN
- FEMALE
- FANNY FIRST, FEET FIRST
- FAMILY HISTORY
- FLUID
- FAT

OTHER IMPORTANT FACTS

- ~20% of infants with torticollis have hip dysplasia
- Flipside: many infants with dysplasia have torticollis—easy to miss when they are in Pavlik harness

- Associated with metatarsus adductus (~10%)

THE HIP EXAM

- TO DO AN ADEQUATE EXAM
  - The baby must be on a firm flat surface
  - The baby must be relaxed
  - The diaper should be off

Modesty does not help the hip exam!

PHYSICAL FINDINGS

- ORTOLANI**
- BARLOW**

Key findings in newborn

- GALEAZZI
- DECREASED HIP ABDUCTION

Key after 4 months of age

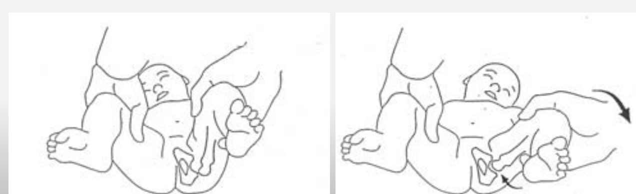
- THIGH FOLDS

ORTOLANI TEST

- Both legs flexed to 90 degrees at the hip and knee
- Thumb on medial thigh
- Fingers on gr trochanter
- Both hips abducted simultaneously
- Lift the femur up by the trochanter

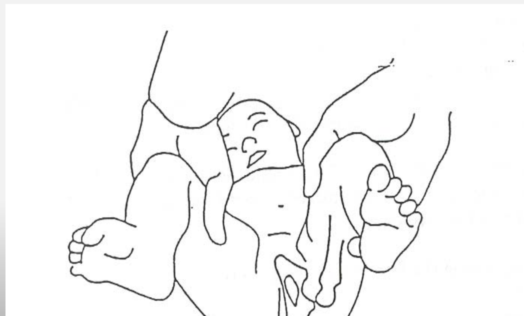
ORTOLANI TEST

- A clunk is felt as the femoral head reduces into the acetabulum



From: Pediatric Orthopaedics in Primary Care
Tolo and Wood, 1993

ORTOLANI TEST



From: Pediatric Orthopaedics in Primary Care
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ORTOLANI TEST

From: Pediatric Orthopaedics in Primary Care
Tolo and Wood, 1993

BARLOW EXAM

- Essentially the opposite of the Ortolani
- The hip is pushed out of the acetabulum by backward pressure

BARLOW

- The hand holds the contralateral hip in slight abduction to hold the pelvis steady.

BARLOW

From: Pediatric Orthopaedics in Primary Care, Tolo and Wood, 1993

THE UNIVERSITY OF CHICAGO
Department of Orthopaedic Surgery

BARLOW

From: Pediatric Orthopaedics in Primary Care, Tolo and Wood, 1993

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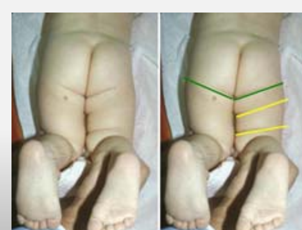
Asymmetric thigh creases



- An unreliable physical finding for hip dysplasia
- By itself, probably does not warrant imaging or referral.

From hipdysplasia.org

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Department of Orthopaedic Surgery

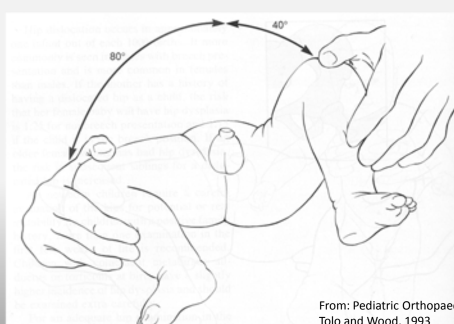
Changing Exam

- As many as 50% of Barlow positive hips (dislocatable) will have a normal exam 2 weeks later, even without treatment.
- Ligamentous laxity in newborn due to estrogen and relaxin.

PHYSICAL EXAM AFTER 4 MOS

- At this age, the femoral head may be stuck and will not reduce into the acetabulum, therefore Ortolani and Barlow tests may be negative.(though you should still test)
- THE MOST IMPORTANT SIGN BECOMES <u>DECREASED HIP ABDUCTION.</u>

PHYSICAL EXAM AFTER 4 MOS



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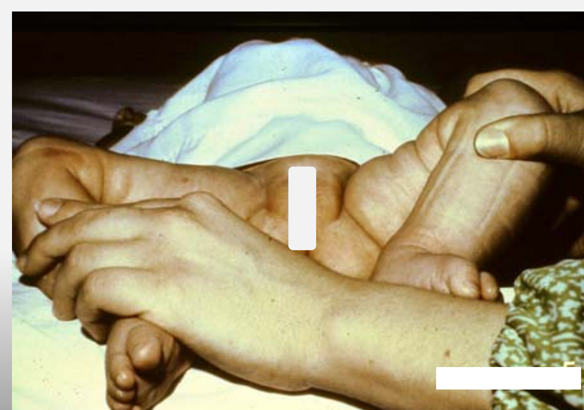
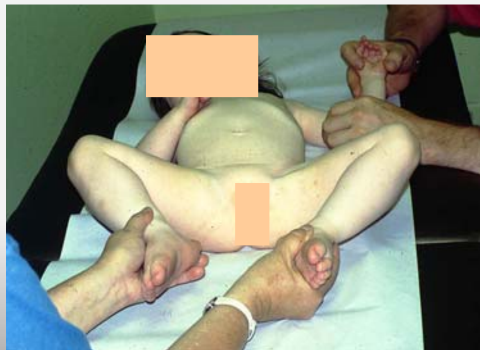
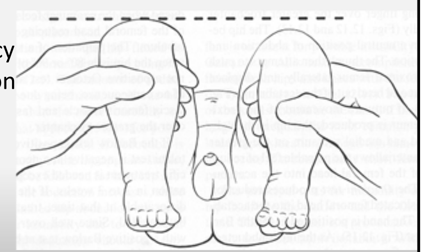


Easily missed if the diaper is on or you rush exam



GALEAZZI SIGN

- Apparent limb length discrepancy due to hip position
- USUALLY SHOWS UP > 6 MOS.



From: Pediatric Orthopaedics in Primary Care, Tolo and Wood, 1993

Exam in the walking age child

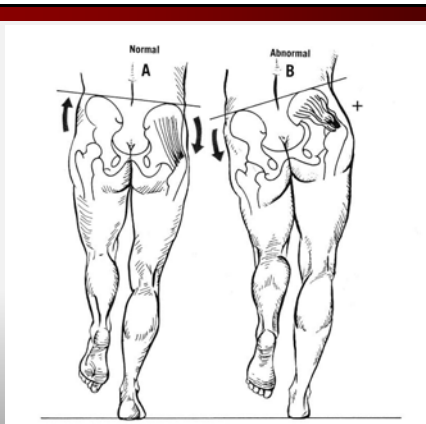
- Ortolani and Barlow will be negative (normal)
- Galeazzi sign will be positive
- Abduction will be decreased
- Patient has a trendelenburg gait.

Presenting symptoms can be vague

- Limping on one side
- Toe walking on one side
- Leg length discrepancy
- Waddling gait

- <u>“I don’t know what’s wrong with my kid. He just walks funny”</u>

- ALWAYS check the hip



From dartmouth.edu

Beware the bilateral dislocated hip in children > 6mos of age

- May be <u>very</u> difficult to pick up on exam.

BILATERAL DDH

- Difficult to diagnose in walking child
  - Ortolani neg
  - Barlow neg
  - Galeazzi neg
  - Abduction <u>symmetric</u>

3 YEAR OLD WITH LIMP

BILATERAL DDH

- PATIENT WADDLES OR “WALKS FUNNY”
- 3 yo female presents with outtoeing for 2 years.
- Only physical finding was a waddling gait and decreased hip abduction on BOTH sides

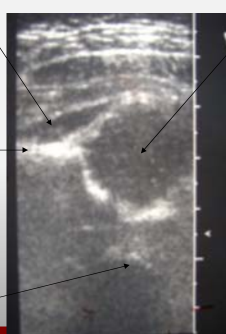
IMAGING FOR DDH. WHAT AND WHEN?

IMAGING STUDIES
BIRTH TO 4 MONTHS

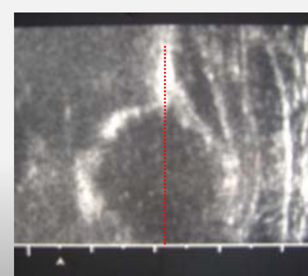
- The femoral head does not ossify until 4 to 6 months
- Therefore ultrasound is the superior modality

XRAY IN 3 MONTH OLD

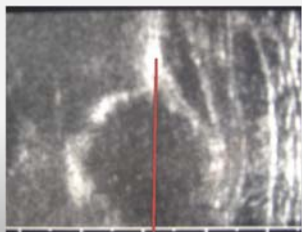
ULTRASOUND



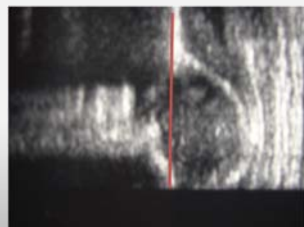
ROTATE THE IMAGE
Becomes an AP of the hip



Normal hip

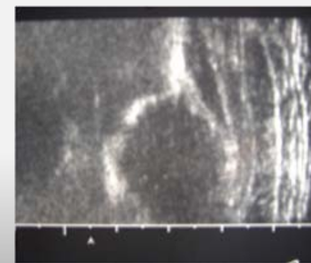


Subluxated hip



The big question—who gets imaged?

- The literature can be confusing, but...
- Universal screening is NOT recommended
- Serial physical exams are still the standard
- “high-risk” infants should be screened.
- But what defines high risk?



What are AAP recommendations?

- The recommendations have changed slightly over the past 15 years

“Hips must be examined at every well baby visit (2000)”

- 2-4 days
- 1 month
- 2 months
- 4 months
- 6 months
- 9 months
- 12 months

You should document your exam!

Early detection of developmental hip dysplasia: synopsis of the AAP Clinical Practice Guideline. (Goldberg Ped in Review 2001)

Newborn group	Risk of a Positive Exam (Ortolani or Barlow) per 1,000
All males	4.1
All females	19.0
Positive family history-males	9.4
Positive family history-females	44.0
Breech presentation--males	26.0
Breech presentation--females	120.0

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~1 in 8!

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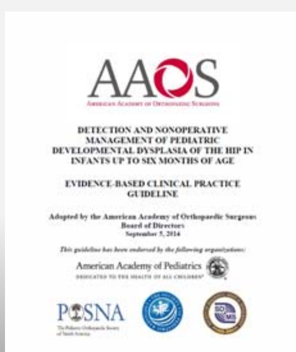
2014 AAOS/AAP GUIDELINES


AAOS

DETECTION AND NONOPERATIVE MANAGEMENT OF PEDIATRIC DEVELOPMENTAL DYSPLASIA OF THE HIP IN INFANTS UP TO SIX MONTHS OF AGE

EVIDENCE-BASED CLINICAL PRACTICE GUIDELINE

Adopted by the American Academy of Orthopaedic Surgeons Board of Directors September 5, 2014

This guideline has been endorsed by the following organizations:

American Academy of Pediatrics

POSNA

389 pages long

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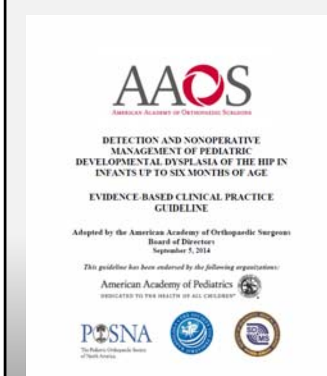
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POSNA

- ONLY 2 RECOMMENDATIONS WERE GIVEN WITH MODERATE STRENGTH OF LITERATURE SUPPORT

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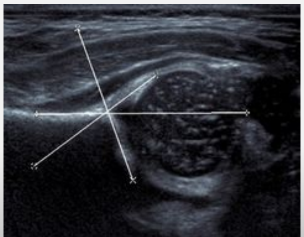
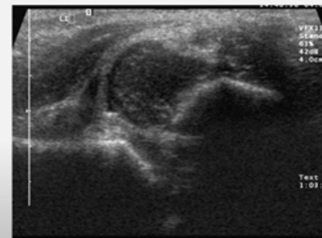
Moderate recommendation #1



- Universal ultrasound screening of newborn infants is NOT supported.

Moderate recommendation #2



- Perform an imaging study before 6 months in infant with 1 or more risk factors
  - Breech
  - Family history
  - History of clinical instability

Early detection of developmental hip dysplasia: synopsis of the AAP Clinical Practice Guideline. (Goldberg Ped in Review 2001)

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All males	4.1
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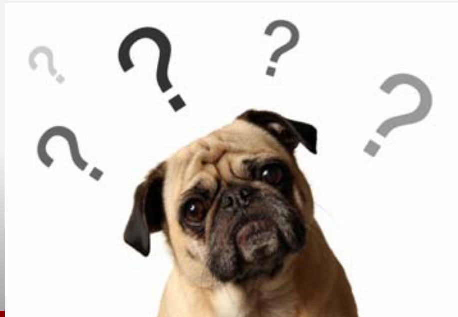
Positive family history-females	44.0
Breech presentation--males	26.0
Breech presentation--females	120.0

6 months???

- Ugh…

So you've decided to image the baby…

When should you get the ultrasound?



When should you image?

- If it is a NORMAL exam, but you are screening for dysplasia(risk factors):
  - 4 to 6 weeks (I prefer 4)
- If the exam is ABNORMAL (Ortolani or Barlow positive): see ortho or get an ultrasound at 7 to 10 days
- If you think the hip is loose, but not clunking:????????????

ULTRASOUND TIMING

- TOO SENSITIVE the first few days of life
- BEST at 4 to 6 weeks
- EXCEPTION:
  - The Ortolani or Barlow positive hip—they need referral/treatment immediately (you can probably skip the ultrasound)

- If you tell your orthopaedic surgeon your patient has a dislocatable hip and they can't see it for a couple of weeks….

Who gets imaged?

- Murkier
  - The baby whose hip feels “loose” but is not clunking
  - The “hip click”

Who gets imaged?

- REMEMBER: 50% of barlow positive hips have a normal exam at 2 weeks even without treatment.
- STICK TO YOUR GUNS. If you think it was clunking, work it up!!!!!

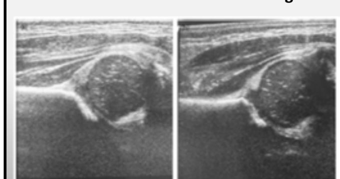
Keep examining the patient the first year of life, and document!

Late presenting dislocation of sonographically stable hips
David P. Gwynne Jones[a], John D. Dunbar[b] and Jean-Claude Theis[a]

JPO Br 2006

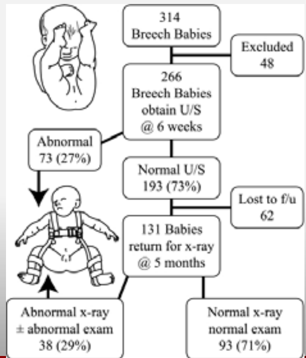
Barlow positive hip at birth

Normal physical exam at 16 days. Ultrasound shows normal coverage



Hip dislocated at 7 months of age

Is ultrasound screening for DDH in babies born breech sufficient?



- Mubarak J Child Ortho 2009
- 29% of breech babies with nl. u/s at 5 weeks had abnormal xrays at age 5 mos!

Final recommendations

- Screen all neonates for hip dysplasia with physical examination, and at every well baby visit in first year. Document your findings.
- Use ultrasound to define anatomy in patients with an abnormal exam up to 4 -6 months. Xrays after 6 months
- Use ultrasound **screening** in patients who are high risk.(Breech, family history)

What about swaddling?

Leodonnan.com

50 years ago

Dr. Salter found a 10 fold increase in DDH in Canadian Indian families who used the traditional cradleboard!

HIP DYSPLASIA—BASIC TREATMENT

Early diagnosis and treatment is best!

- The femoral head and acetabulum need each other to develop into a perfectly round sphere and a perfect, matching cup
- The longer the hip is out, the more difficult it is to restore sphericity.

HIP DYSPLASIA-TREATMENT

- BIRTH TO SIX MONTHS:
  – THE PAVLIK HARNESS.
  – Keeps hips flexed and abducted, similar to the Ortolani position, easing the femoral head into the acetabulum

PAVLIK HARNESS

- WORN FOR 6 TO 12 WEEKS
- 95% SUCCESS RATE IF TREATMENT INITIATED IN FIRST TWO WEEKS OF LIFE

24/7 UNTIL THE HIP IS STABLE
PLACED ON BARE SKIN

OTHER ABDUCTION OPTIONS

- VON ROSEN SPLINT
  - VERY POPULAR IN EUROPE
- DOUBLE OR TRIPLE DIAPERS
  - ONLY AS A TEMPORIZING MEASURE

Catch it early! After 6 months it gets harder.

7 month old female

TREATMENT 6 TO 12 MONTHS

- Closed reduction of hip with spica cast. 3 to 4 months in a cast

DDH > 12 Mos.

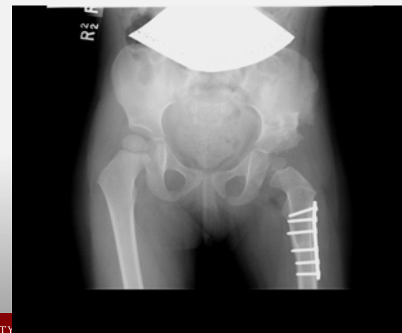
- Many hips need open procedures to put the hip back in after one year of age.
- The older the patient, the less likely the hip will ever be normal, even if surgery goes well!

21 month old with walking on tip toe on one side only.

2 1/2 yo female

- Recently immigrated from Mexico
- Walks with limp
- Leg is short

2 ½ mos post op



5 yo female

- Limping on right since she started walking
- Advised she will grow out of it.

Legal Implications of missed DDH

- Failure to diagnose a dislocated hip is one of the most common SUCCESSFUL lawsuits brought against primary care physicians.
- Remember, if an infant is a female breech, 1 in 8 will have an abnormal exam!

These statements won't help you:

- " I always examine the hips"
- " If the hip exam is normal, I don't always mention it in my notes"
- " The baby had a normal ultrasound at 6 weeks, so you don't have to keep checking"

BACK TO OUR CASES…

Clinical scenario 1

History

- In office, you see a 2 wk old female
- She is Ortolani and Barlow positive
- Your next step is????

Options

- Double diaper
- Referral to orthopedics
- Hip xray
- Hip ultrasound

Clinical scenario 2

History

- You see a 16 month old male with complaint from mom that he has been limping on left side since he started walking 3 mos ago. You find a 1 cm limb length discrepancy. Your next step???

Options

- Hip ultrasound
- Hip xray
- 1 cm shoe lift
- Referral to physical therapy

Clinical scenario 3

History

- At well baby visit at 9 months, your hip exam shows decreased hip abduction on left hip. Ortolani and Barlow are negative. Galeazzi is negative. Next step should be?????

Options

- Hip xray
- Hip ultrasound
- Recheck in 3 months
- Double diapers
- Pavlik Harness

Clinical scenario 4

History

- You see a 1 month old male in the office with a right sided hip click. Ortolani, Barlow, and Galeazzi are normal. This is third baby for mom. It was an uncomplicated pregnancy and a vaginal, vertex delivery. Next step????

Options

- Hip ultrasound
- Referral to orthopedics
- Repeat exam in 1 month
- Hip xray
- Double diaper

Clinical scenario 5

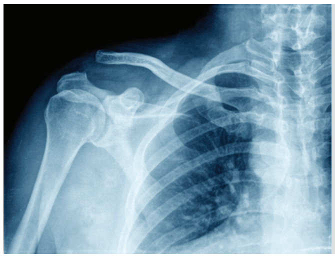
History

- You see a 1 month old white male in the office with a right sided hip click. Ortolani, Barlow, and Galeazzi are normal. This is first baby for mom. It was an uncomplicated pregnancy with a C section for breech presentation. Next step????

Options

- Hip ultrasound
- Referral to orthopedics
- Repeat exam in 1 month
- Hip xray
- Double diaper

Thank you.



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Pediatric Bone and Joint Infections

ROBERT J. BIELSKI, MD

- I will not discuss any project or procedure in which I or member of my family has a financial interest.
- I do not receive financial support or compensation from any company.
- I will not discuss any off label use of any product

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Overview

- Toxic synovitis versus septic hip
- Septic arthritis in other joints
- Osteomyelitis, diagnosis and treatment
- The implications of MRSA infections

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THE ACUTE PAINFUL HIP
Toxic synovitis versus septic hip

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TOXIC SYNOVITIS

- An acute effusion of the hip that typically follows a viral infection.
- Only half of families will recall a recent illness.
- Children are usually able to do some weight bearing, but not always.
- The fluid in the hip is inflammatory, not infectious.

SEPTIC HIP

- An acute bacterial infection of the hip
- Symptoms tend to be more severe
  - Higher temp
  - Pain is intense
  - Children tend to hold hip in a rigid flexed abducted externally rotated position.

CLINICAL PRESENTATION

- PRESENTATION MAY BE SIMILAR
  - HIP PAIN
  - REFUSAL TO BEAR WEIGHT
  - FEVER
  - PAIN WITH ROTATION OF THE HIP

- If you are sending patient to the ER/hospital for workup PLEASE, PLEASE
  - Make them NPO
  - Mobilize radiology/ER

WORKUP

- X rays: Rarely helpful
- WBC
- Sed rate
- CRP
- Ultrasound (depends on skill of ultrasonographer)
- MRI: almost always requires sedation

“CLASSIC” DIFFERENCES

	TOXIC SYNOVITIS	SEPTIC HIP
WBC	NORMAL	NORMAL
SED RATE	NORMAL	ELEVATED
TEMP	NORMAL	ELEVATED
LOG ROLL	PAINLESS	PAINFUL
WT BEAR	YES/NO	NO

Other causes—more common in MRSA era

- Psoas abscess
- Lyme disease
- Other pelvic pyomyositis
- Pelvic or femoral osteomyelitis

“Kocher criteria”--Septic arthritis algorithm

- KOCHER et al JBJS 1999
- 27 year review of 282 patients with work up for septic hip vs. transient synovitis

Kocher clinical predictors

- History of fever(oral temp >38.5 degrees)
- Inability to bear weight
- ESR > 40
- WBC >12
  - 93% had septic hip with 3 predictors, 99.6% for all 4 predictors
- If 0 predictors—0% incidence, 1 predictor, 1.2% incidence

Validation study—Kocher(JBJS 2004)

- If 3 of 4 predictors were positive, 72.8% had a septic hip
- If all 4 predictors were positive, 93% had a septic hip

- **Luhmann et al (JBJS 2004)—only 59% had a septic hip with all 4 variables met

Factors Distinguishing Septic Arthritis from Transient Synovitis of the Hip in Children

A Prospective Study

By Michelle S. Caird, MD, John M. Flynn, MD, Y. Leo Leung, MD, Jennifer E. Millman, BA, Joann G. D'Italia, CWOCN, CRNP, and John P. Dormans, MD

- Added CRP (> 20) to evaluation
- 53 pts prospectively evaluated.
- All had hip aspiration for poss septic joint
- 5 factors - 98% septic
- 4 factors - 93% septic
- 3 factors - 83% septic

Improving Diagnostic Efficiency: Analysis of Pelvic MRI Versus Emergency Hip Aspiration for Suspected Hip Sepsis

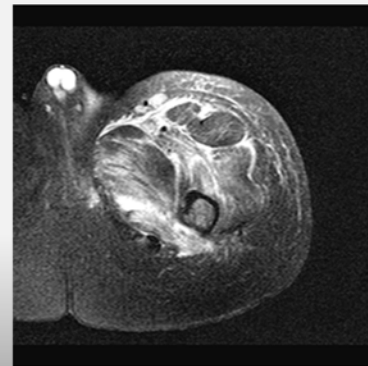
Hilton P. Gottschalk, MD, Molly A. Moor, MPH,* Abd R. Muhamad, MD,† Dennis R. Wenger, MD,* and Burt Yaszay, MD**

- JPO 2014
- 53 PTS HAD ASPIRATION PRIOR TO MRI: 36 HAD A SEPTIC HIP
  - 11/36 NOT IMPROVING AFTER WASHOUT. 9 OF THOSE 11 HAD MORE PATHOLOGY SEEN ON MRI (OSTEO, ABSCESS, ETC)
- 77 PATIENTS HAD MRI FIRST
  - 35/77 HAD A SEPTIC HIP, BUT 11 OF 35 ALSO HAD OSTEO
  - 18/77 HAD OSTEOMYELITIS, NO SEPTIC HIP
  - 9/77 NEEDED NO SURGERY (CELLULITIS, ETC)
  - 9/77 HAD TRANSIENT SYNOVITIS
  - 5/77 HAD ABSCESS THAT NEEDED DRAINAGE

Improving Diagnostic Efficiency: Analysis of Pelvic MRI Versus Emergency Hip Aspiration for Suspected Hip Sepsis

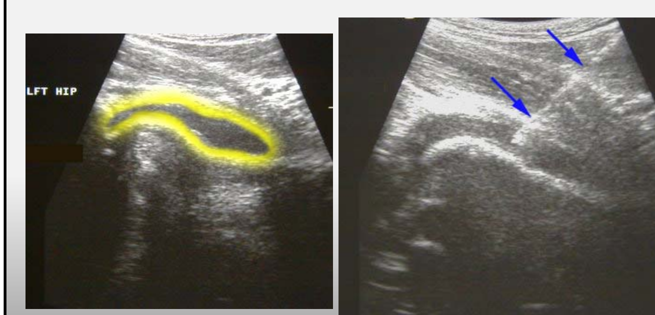
Hilton P. Gottschalk, MD, Molly A. Moor, MPH,* Abd R. Muhamad, MD,† Dennis R. Wenger, MD,* and Burt Yaszay, MD**

- JPO 2014
- LAB VALUES AND FEVER WERE SIMILAR IN BOTH GROUPS
- REFUSAL TO BEAR WEIGHT MORE COMMON IN ASPIRATION GROUP
- CONCLUSION: EARLY MRI CAN PREVENT SOME TRIPS TO OR, AND CAN DECREASE REOPERATION RATE (I.E. SURGEON CAN ADDRESS ALL ISSUES AT ONCE.)
- THE FLAW: HOW LONG WILL IT TAKE TO DO AN MRI. DO YOU WANT TO LEAVE A HIP FULL OF PUS WAITING?



- The gold standard in differentiating these two conditions is ASPIRATION of the hip joint.
- The most important finding on aspiration is the <u>cell count and differential</u>.
  - > 50-80K WBCs.
  - > 90% polys.

Ultrasound guided hip aspiration



TREATMENT—SEPTIC HIP

- EMERGENT surgical drainage of the hip
- IV antibiotics
  - There is no role for antibiotics alone in a septic hip
- Timing of conversion to oral antibiotics is controversial.

TREATMENT—TOXIC SYNOVITIS

- Rest
- NSAIDS
- Children are often markedly better after aspiration. If the hip is not aspirated they will usually be dramatically improved after 1 to 2 doses of NSAIDs.

Sepsis in other joints

- Knee, ankle most commonly seen.
- Principles are similar: Aspiration of joint when joint sepsis is suspected.

- Arthrotomy
- Arthroscopy
- Aspiration

  - Which is best for the septic joint?

- HIP—ALWAYS arthrotomy
- KNEE—Arthrotomy, Arthroscopy, Multiple aspirations -- all viable
  - Multiple aspirations may be difficult for pt. and probably not appropriate for MSSA or MRSA
- ANKLE—Arthrotomy, aspirations
  - Similar pros and cons

What is the evidence for multiple aspirations?

- Most of the data is from older papers, with less virulent organisms

JAAOS 2009 Copley

Pediatric Musculoskeletal Infection: Trends and Antibiotic Recommendations

- "It is recommended that septic arthritis be treated with surgery, either open or arthroscopic"
- "(joints other than the hip)..have been successfully treated in our practice by aggressive high volume lavage in the E.R. with two large bore needles, through which the fluid is allowed to flow until clear (approx. 2 Liters)."

Arthroscopic lavage

Can be done in the ER or ICU under sedation if patient cannot go to OR.

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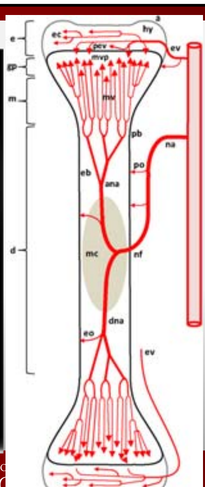
Osteomyelitis

Adults rarely get hematogenous osteomyelitis unless immunocompromised.

Why are children susceptible?



- Circulation in pediatric bone is different than adult bone, because children have a growth plate at the end of each long bone.

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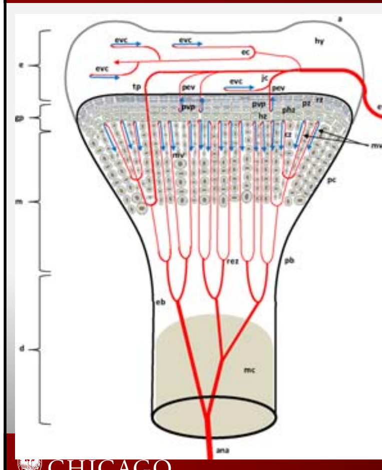

- Bacteria spread hematogenously and can exit the bloodstream through the perorations in the endothelium at the tips of the metaphyseal vascular plexus.

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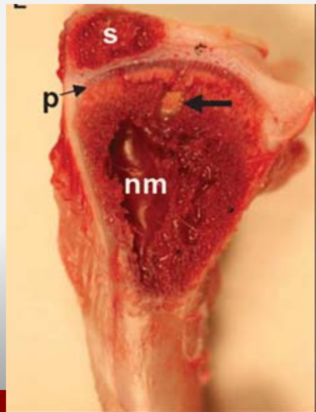

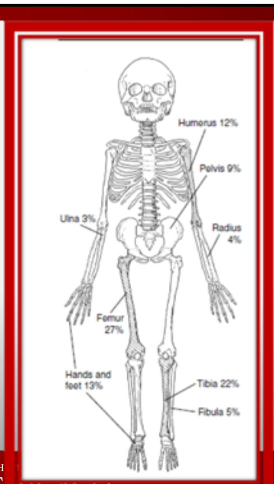

- 2/3 of acute hematogenous osteo cases in children occur in the femur, tib/fib, and humerus.

MOST COMMON ORGANISMS

- Staph aureus
- Strep pneumoniae
- Haemophilus influenza (disappearing)
- Kingella kingae (more common in Middle East)
- Salmonella (sickle cell)
- Pseudomonas (puncture wounds of foot)

Presenting symptoms

- Increasing pain
- Fever
- Limp
- Swelling
- Erythema is a LATE finding
- Patients may have symptoms for days or weeks before presenting (cases to follow)

Rarely this dramatic

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Labs

- WBC—often normal
- CRP and ESR are much more helpful.

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Imaging studies

- X-ray (often normal)
- Ultrasound—may help find soft tissue abscess
- CT scan—not nearly as helpful as MRI, sometimes a quick substitute.
- Bone scan—not specific-doesn’t define anatomy.
- MRI—Sensitive and fairly specific, but difficult to obtain in the younger child, requiring sedation.

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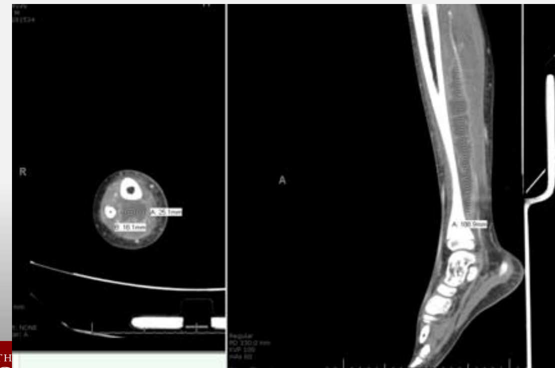
- "MRI with and without contrast may be the most useful imaging study in the evaluation of pediatric musculoskeletal infection."
  – Copley, JAAOS 2009
- If you can't image the patient, get them somewhere they can.

CT can be useful in some cases if MRI not feasible due to sepsis/NPO status



IMAGING-MRI

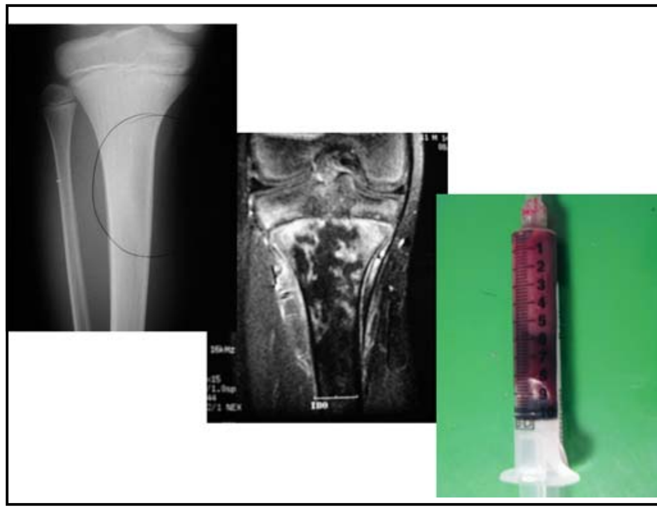
- Everyone gets an MRI, preferably before surgical decompression.
- Image the entire length of the bone at some point.
- If patient is not improving or labs are not improving, repeat the MRI. Remember, despite debridement and antibiotic, there is probably ongoing bone and tissue destruction.

Recovering an organism

- Blood culture (only positive 33-50%)
- Bone aspiration (positive in 2/3 of cases)

Old rules

- Surgery was only needed with
  - Evidence of bone destruction
  - Presence of intraosseous pus.



LATE 1990s

- COMMUNITY STRAINS OF MSSA BEGAN TO ACQUIRE THE STAPHYLOCOCCAL CASSETTE CHROMOSOME mec (SCCmec) THAT ENCODES THE METHICILLIN RESISTANCE GENE, mecA

Changing Patterns of Acute Hematogenous Osteomyelitis and Septic Arthritis

Emergence of Community-associated Methicillin-resistant Staphylococcus aureus

Sandra R. Arnold, MD, MS,* David Elias, MD,† Steven C. Buckingham, MD,* Eddie D. Thomas, MD,†§ Eduardo Novais, MD,‡¶ Alexandre Arkader, MD,‡∥ and Cassandra Howard, MD**

JPO 2006

- Reviewed cases from 2000 to 2004
  - Osteomyelitis
  - Septic joints
- Incidence jumped from 2.6/1000 to 6.0/1000 admissions
- In 2000, 4% of cases were MRSA
- By 2004, 40% of cases were MRSA

Arnold et al JPO 2006

- 71% of MRSA cases had subperiosteal abscess (38% in MSSA)
- 91% of MRSA cases required surgical debridement (62% in MSSA)

Community-associated Methicillin-resistant *Staphylococcus aureus* in Acute Musculoskeletal Infection in Children: A Game Changer

- JPO 2009
- 27 pts with MRSA infections
- 12 needed ICU stay
- 4/12 required ECMO support, 5 /12 required vasopressors

Community-associated Methicillin-resistant *Staphylococcus aureus* in Acute Musculoskeletal Infection in Children: A Game Changer

- 8/27 had DVT
- 7 pts with resp compromise. 7/7 had DVT
- <u>ALL 27</u> required surgical intervention, 16 of 27 required multiple debridements
- Blood cultures remained positive for days after initiation of AB, other sites became seeeded.
- Length of stay was > 30 days in 56% of pts.!

Comparative Severity of Pediatric Osteomyelitis Attributable to Methicillin-Resistant Versus Methicillin-Sensitive *Staphylococcus aureus*

John J. Hawkshead III, MPH, Nimesh B. Patel, MD,† Russell W. Steele, MD,‡ and Stephen D. Heinrich, MD, MS§*

- STUDIES FROM U.S. ARE NOW SHOWING RATES OF MRSA INFECTION FOR MUSCULOSKELETAL INFECTIONS BETWEEN 53 TO 68%
- NOT JUST MRSA VS. MSSA
- THE IMPORTANCE OF PVL

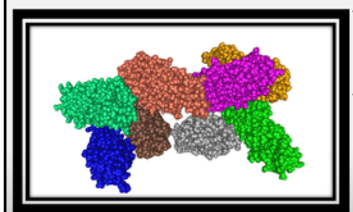
The Role of Panton-Valentine Leukocidin in *Staphylococcus aureus* Musculoskeletal Infections in Children

Nicole Ritz, MD, PhD,† and Nigel Curtis, MD, PhD**

Ped Inf Dis J
May 2012

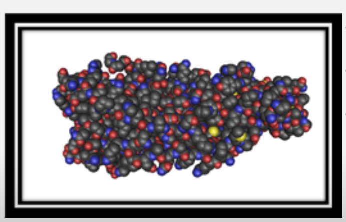
WHY ARE MRSA INFECTIONS SO AGGRESSIVE AND DESTRUCTIVE?

PANTON-VALENTINE-LEUKOCIDIN



- An exotoxin that causes death of PMNs by lysing cell walls.
- Commonly seen in ca-MRSA, but becoming more frequent in MSSA as well.
- CA-MRSA in U.S. is different from MRSA seen in Europe

WHEN PVL IS PRESENT



- LONGER DURATION OF FEVER
- HIGHER MAX CRP
- HIGHER MAX ESR
- HIGHER RATE OF
  – ABSCESS
  – PNEUMONIA
  – DVT
  – INTERVENTIONS

PVL AND DVT

- Rates are probably higher than reported
- DVT usually forms near site of infection

DEEP VENOUS THROMBOSIS

- Doppler studies may not be enough, as DVT may be in the groin or pelvis.
- High risk patients may need MRI or CT with contrast to look for thrombus.

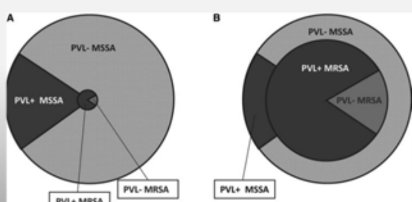
CLINICAL IMPORTANCE

- Patients are sicker at time of presentation: more likely to go into shock
- They have many more associated complications: DVT/PE
- There will be much more bone destruction
- They will stay bacteremic for days

- PVL is more common in MRSA (74 to 100%) than in MSSA (9-46%)
- But concentration of PVL is the same between PVL positive MSSA and PVL positive MRSA

A=Europe, Africa

B=U.S.



CLINICAL IMPORTANCE

- PATIENTS ARE SICKER AT TIME OF PRESENTATION: MORE LIKELY TO GO INTO SHOCK
- THEY HAVE MANY MORE ASSOCIATED COMPLICATIONS: DVT/PE
- THERE WILL BE MUCH MORE BONE DESTRUCTION
- THEY WILL STAY BACTEREMIC FOR DAYS

Review from 2014

The NEW ENGLAND JOURNAL *of* MEDICINE

REVIEW ARTICLE

Edward W. Campion, M.D., *Editor*

Acute Osteomyelitis in Children

Heikki Peltola, M.D., and Markus Pääkkönen, M.D.

NEJM 2014-Good AB summary, but…!

Table 1. Antibiotic Treatment for Acute Osteomyelitis in Children.*

Antibiotic	Dose	Maximal Daily Dose	Bone Penetration	Reference
	mg/kg/day		%	
Empirical treatment				
First-generation cephalosporin, if prevalence of MSSA in community >90%	≥150 administered in 4 equal doses	2–4 g	6–7	Dose: Peltola et al., Peltola et al.; extent of bone penetration: Tetzlaff et al.
Antistaphylococcal penicillin (cloxacillin, flucloxacillin, dicloxacillin, nafcillin, or oxacillin), if prevalence of MSSA in community >90%	≤200 administered in 4 equal doses	8–12 g	15–17	Dose: Jagodzinski et al.; extent of bone penetration: Tetzlaff et al.
Clindamycin, if prevalence of MRSA in community ≥10% and prevalence of clindamycin-resistant S. aureus <10%	≥40 administered in 4 equal doses	Approximately 3 g	65–78	Prevalence of microorganisms: Liu et al.; dose: Peltola et al., Liu et al., Peltola et al.; extent of bone penetration: Feigin et al.
Vancomycin, if prevalence of MRSA in community ≥10% and prevalence of clindamycin-resistant S. aureus ≥10%	≥40 administered in 4 equal doses	Dosing adjusted according to trough level, with a target of 15 to 20 μg per milliliter	5–67	Prevalence of microorganisms: Liu et al.; dose: Liu et al.; extent of bone penetration: Landersdorfer et al.
Linezolid, if no response to vancomycin	30 administered in 3 equal doses	1.2 g for no more than 28 days	40–51	Dose: Kaplan et al., Chen et al.; extent of bone penetration: Landersdorfer et al.
Alternatives for specific agents				
Ampicillin or amoxicillin for group A beta-hemolytic streptococcus, *Haemophilus influenzae* type b (beta-lactamase–negative strains), and *S. pneumoniae*	150–200 administered in 4 equal doses	Approximately 8–12 g	3–31	Dose: Peltola et al.; extent of bone penetration: Landersdorfer et al.
Chloramphenicol, if safer agents not available or affordable	75 administered in 3 equal doses	2–4 g	39	Dose: Krogstad; extent of bone penetration: Summersgill et al.

~~biopsy remain unanswered. Conservative treatment is effective in up to 90% of cases of acute osteomyelitis if it is diagnosed early in the course of the illness.[38,42] In a series of 68 patients up to~~

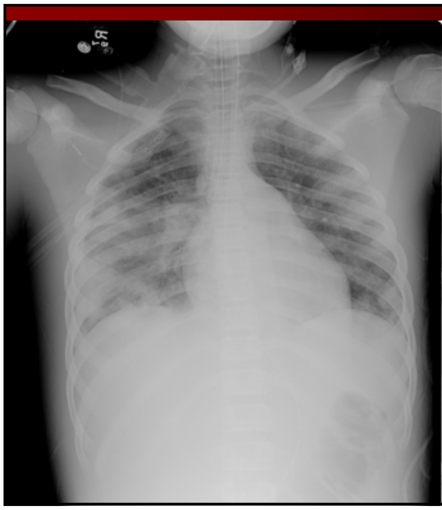
- The authors reference articles from 1982 and 1987 here. These are NOT appropriate for the current era.
- Surgical intervention is the norm, not the exception, in 2016

AA STUDY YOUR IMAGES

Goals of surgery--acute

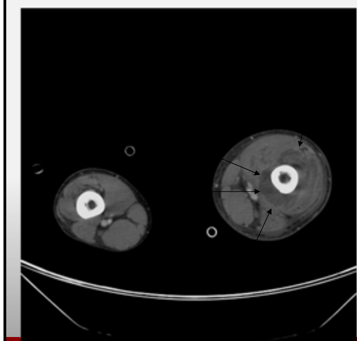
- Decrease septic load
- Decompress any trapped infected material
- Remove non viable bone and soft tissue that is readily accessible

- 15 year old male presents in sepsis with swollen thigh, foot, hand, multiple septic pulmonary emboli.
- Had been seen at local ER a few days earlier with knee effusion. Returned to another ER 2 days later with increased pain, fever, difficulty breathing.



- MRSA pneumonia

- Intubated 30 minutes after arrival to UC
- ARDS/ MRSA pneumonia
- Massive femoral DVT
- CRP 271
- Mult blood cx. Pos.for MRSA



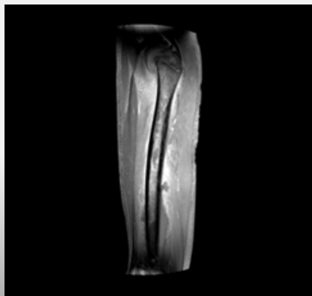
- CT scan of thigh on nite of presentation

- Knee, thigh, hands, foot all debrided within hours of admission
- Pt intubated and unstable for 1 week: too unstable to be moved to OR.
- Repeat debridement and irrigation with pulse lavage done in ICU with OR team
- 4 debridements in first week

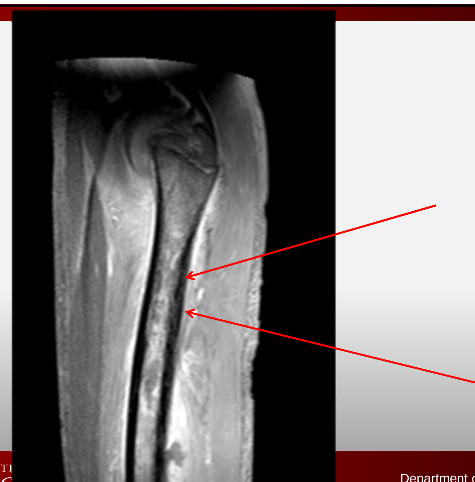
Pus under pressure from knee arthrotomy

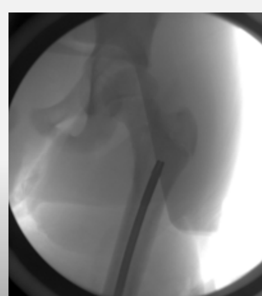
Ortho Problem

1. Septic Left Knee-~150cc of pus in knee
2. Massive Abscess down left thigh –distal 2/3 of femur ringed by halo of pus. Hundreds of cc of pus evacuated.
3. Bilateral deep hand infections requiring washout
4. Septic MTP joint of foot
5. Both hips aspirated: clear



- Representative cut of femur with osteo changes
- Hip aspirated on night of first debridement- normal
- 4 days later develops septic hip





6 mos. After presentation

3 years post infection

MANY LESSONS FROM 1 CASE

- IN SHOCK AT TIME OF PRESENTATION
- THE EXTENT OF OSTEOMYELITIS COULD ONLY BE APPRECIATED WITH A FULL LENGTH MRI
- METASTATIC INFECTION: SEEDING OTHER JOINTS DURING THE FIRST WEEK
- SEPTIC PULMONARY EMBOLI
- REQUIRED AGGRESSIVE MULTIPLE DEBRIDEMENTS TO CLEAR INFECTION
- NEGATIVE PRESSURE WOUND DRESSINGS TO CONTROL SOFT TISSUE, PLASTIC SURGERY VITAL IN MANAGEMENT AND CLOSURE

IMAGING

- ALMOST EVERYONE GETS AN MRI, PREFERRABLY BEFORE SURGICAL DECOMPRESSION.
- IMAGE THE ENTIRE LENGTH OF THE BONE AT SOME POINT.
- IF PATIENT IS NOT IMPROVING OR LABS ARE NOT IMPROVING, REPEAT THE MRI. REMEMBER, DESPITE DEBRIDEMENT AND ANTIBIOTIC, THERE IS PROBABLY ONGOING BONE AND TISSUE DESTRUCTION.
- IF PATIENT IS UNRESPONSIVE, IMAGE THE HIPS AGAIN AS WELL.

BB

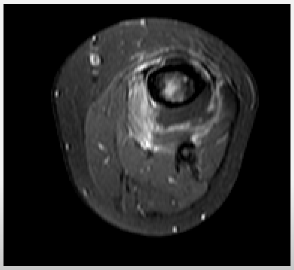
- 9 YO FEMALE PRESENTS TO PRIMARY CARE OFFICE WITH 3 DAYS OF KNEE PAIN
- PAIN INCREASE OVER NEXT WEEK, UNABLE TO WALK
- RECHECKED 7 DAYS LATER WITH NORMAL XRAYS

BB in ER day 12

- CRP 242
- ESR 103
- WBC 21.1
- Blood cultures MRSA positive for 5 consecutive days

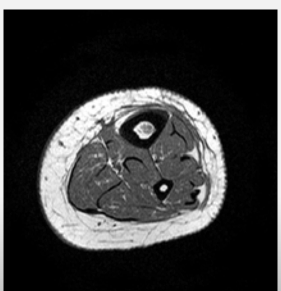
Normal x-rays 12days after onset

BB—MRSA infection



BB

BB 18cm below physis



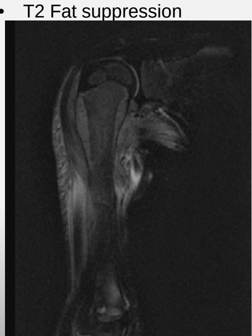
BB 3wks post op

CC

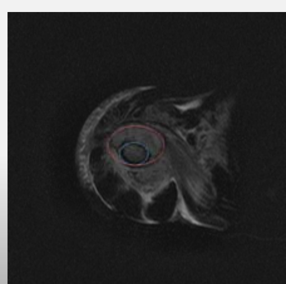
- 2 yo with hx of Otitis and ruptured TM 6 days PTA
- On amoxicillin tid for OM
- Not using shoulder for 3 days after fall while playing
- Temps to 104
- Slight decrease in po intake

- MRSA on blood cultures
- CRP 224
- WBC 14.1 (normal)
- Blood cultures stay positive for 3 days

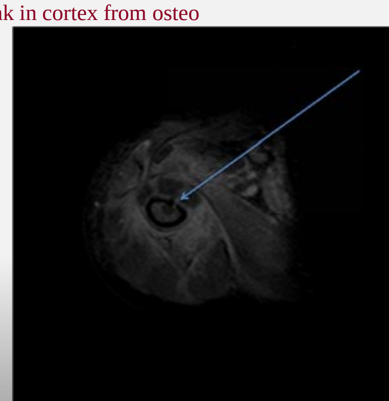
- T2 Fat suppression

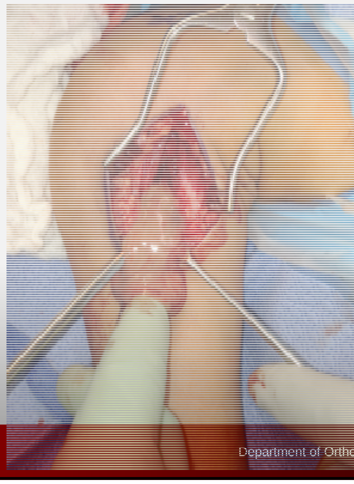


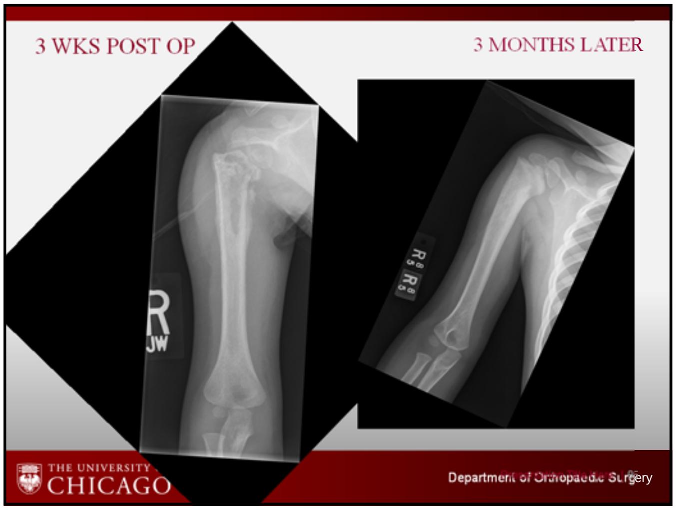
- T1



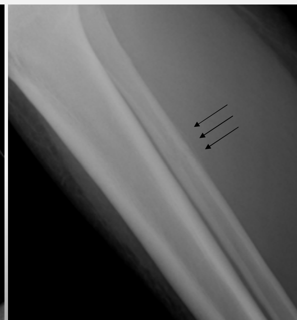
Break in cortex from osteo

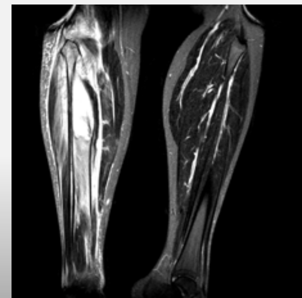


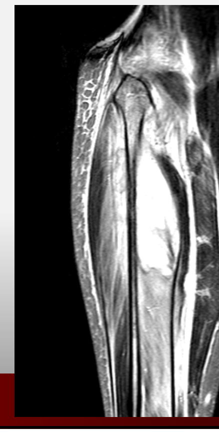




- 16 yo female with a week of increasing pain in right calf with swelling and fever.
- CRP is 256





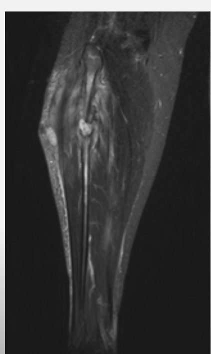


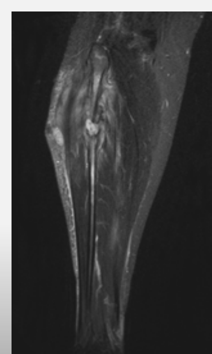
Deep abscess cavity--MSSA

Fibula drilled

1 month s/p debridement

- Patient failed to follow up for 2 months.
- Returned with pain and swelling
- Stopped taking antibiotics when she felt better





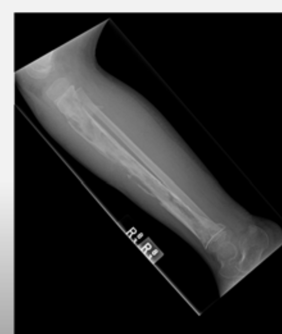
3 Y.O. FEMALE

DRESSER LANDS ON LEG

XRAYS NEG AT LOCAL ER

LEG CONTINUES TO SWELL. SEEN 2 WKS LATER, CASTED

CAST REMOVED. LEG BLISTERED AND SWOLLEN



MRSA infection

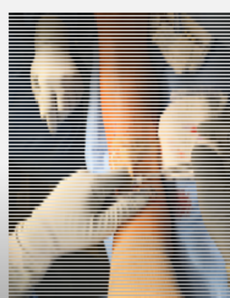
18 mos post debridement/flap

- Osteomyelitis runs the whole length of shaft.
- Violates the proximal physis.

Take home lesson from case

- Beware the patient who is splinted for a “hairline fracture” and is having increased pain, especially if they are having a fever as well!

9 yo starts having ankle pain. Splinted in ER for possible fx. Pain increases and patient becomes febrile.



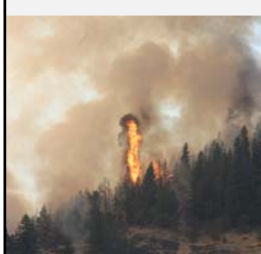
Team Approach is Vital!

- Get everyone involved early

- Intensive Care
- Infectious Disease
- Plastic Surgery
- Radiology

- Communication with family is vital!
- Must discuss risk of shock and mortality
- Tell them to expect multiple trips to the OR and a long hospital stay.
- Discuss DVT and pneumonia
- Tell them of possibility of distant joints and bones becoming involved.

- "You must have him on the wrong antibiotic. He is not getting better!"



SURVEY THE PATIENT DAILY

- MAKE SURE THE FAMILY AND PATIENT ARE AWARE.

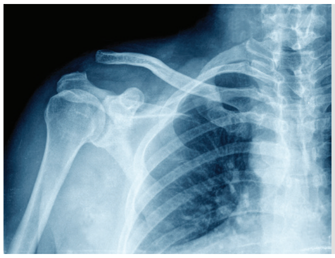
PERSISTENT BACTEREMIA → FURTHER SPREAD OF INFECTION → NEW BONE AND JOINT INVOLVEMENT

SUMMARY

- AGGRESSIVE BONE AND JOINT INFECTIONS ARE BECOMING MORE COMMON
- ALTHOUGH MRSA IS THE CULPRIT IN MANY OF THESE CASES, IT IS NOT THE WHOLE STORY
- THESE INFECTIONS DEMAND EARLY, AGGRESSIVE TREATMENT AND CONSTANT VIGIL
- INFECTIONS AND THEIR ASSOCIATED MORBIDITIES ARE BEST HANDLED WITH A MULTIDISCIPLINARY TEAM
- RECURRENCES ARE NOT UNCOMMON
- KEEP THE FAMILY INFORMED AND INVOLVED

THE UNIVERSITY OF CHICAGO
MEDICINE & BIOLOGICAL SCIENCES

THANK YOU.



THE UNIVERSITY OF CHICAGO MEDICINE
Comer Children's Hospital

Developmental Lower Extremity Problems in Children

Christopher M. Sullivan,M.D.,M.P.H.
PCOC June 2019

Disclosure Information

Primary Care Orthopaedics Course 2019

Christopher M. Sullivan,M.D.,M.P.H.

- I have no financial relationships to disclose.
- I will not be discussing any off label uses and/or experimental devices in this talk

Intoeing

- Important to rule out
  - DDH(Developmental dislocated Hip)
  - Clubfeet
  - Cerebral Palsy
  - Blount's disease (tibia vara)

Intoeing

- Common Diagnoses
  - Increased Femoral anteversion
  - Internal Tibial Torsion
  - Metatarsus adductus

Intoeing

- Common Diagnoses
  - Increased Femoral anteversion

    Rotation through upper femur

    “W” sitting is easier for patient

    Internal rotation greater than external rotation

    Usually outgrow by age 9 years

Intoeing

- Increased Femoral anteversion

“W” sitting

Intoeing

- Increased Femoral anteversion

  Internal rotation greater than external rotation

Intoeing

- Common Diagnoses
  - Internal Tibial Torsion

    Rotation through tibia

    Thigh foot axis is internal

    “Bimalleolar angle”

      Adult normal 10 degrees external

      Child can be 10 degrees internal

Internal tibial torsion

Thigh foot axis is internal

Internal tibial torsion

"Bimalleolar angle"

Adult normal 10 degrees external

Child Can be 10 degrees internal

Intoeing

- Common Diagnoses
  - Metatarsus adductus
    - Forefoot adduction
    - Hindfoot supple
    - Benign condition
    - Different from clubfoot because dorsiflexion normal

Intoeing

- Metatarsus adductus

Forefoot adduction

Dorsiflexion normal

Clubfoot

Dorsiflexion

Toe-walking

- DDX
  - Short Achilles tendon(tight Gastoc-Soleus muscle)
  - Cerebral Palsy(spasticity)
  - Habitual or idiopathic toe-walking

Toe-walking

- Important to Rule out
  - Cerebral Palsy
    - Developmental delay, hyperreflexia
    - Need PT, OT, Speech therapy

Toe-walking

- Achilles tendon contracture
- Can’t reach ground with heel
- Need to address
  - Exercises
  - Stretch casting
  - Surgery

Toe-walking

- DDX
  - Short Achilles tendon(tight Gastoc-Soleus muscle)
  - Cerebral Palsy
  - Habitual or idiopathic toe-walking

Angular deformities

- Genu varum >> bowlegs
- Genu valgum >>knockknees

Angular deformities

- Important to rule out
  - Blount’s disease
  - Rickets

Angular deformities

- Physical exam
  - Line up legs with knees pointed straight ahead
    - Measure gap between knees for bowleg
    - Measure gap between ankles for knock-knees

Angular deformities

- Physical exam
  - Line up legs with knees pointed straight ahead
    - Measure gap between knees for bowleg
    - Measure gap between ankles for knock-knees

Bowlegs

- DDX
  - Apparent Bowlegs
  - Physiologic Bowlegs
  - Blount's Disease
  - Rickets

Bowlegs

Apparent Bowlegs
- Wide based gait in early walking
- Internal tibial torsion exagerates
- Not much real bow

Bowlegs

Physiologic Bowlegs
- Babies often born bowlegged
- Maximum bow at 18 months
- Resolves by 30 months

Bowlegs

Physiologic Bowlegs
- Babies often born bowlegged
- Maximum bow 18 months
- Resolves by 30 months

Bowlegs

Blount’s Disease (Tibia Vara)
- Progressive
- Unilateral or bilateral
- Associated with ITT

Bowlegs

Blount’s Disease (Tibia Vara)
- Progressive
- Unilateral or bilateral
- Associated with Internal Tibial Torsion(which may get worse)
- Bowing in proximal tibia due to suppression of growth medially
- Usually requires surgery(osteotomy or stapling)

Bowlegs

Blount’s Disease (Tibia Vara)

- Usually requires surgery(osteotomy or stapling)

Bowlegs

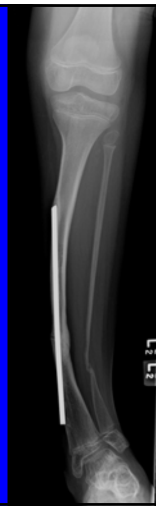
Rickets

- Renal disease
- Vitamin D metabolism problem
- Dx: Widened growth plates
- Rx: Correct defect
  - +/- Osteotomy

Rickets

Bowlegs

- Congenital bowing of tibia
- Pseudarthrosis of tibia(non healing)
- Associated with Neurofibromatosis



Genu valgum

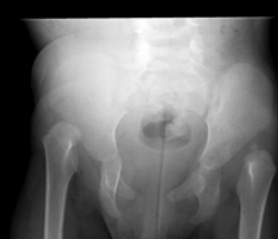
- Physiologic
- Usually no pain, incoordination or arthritis
- Associations
  - Rickets
  - Renal disease
  - Tumor
  - Fracture
  - infection

Leg Length Discrepancy

- Important to R/O
  - Developmental Dislocated Hip
  - Cerebral Palsy with adduction contracture
  - Hip contracture
  - Scoliosis

Developmental Dislocated Hip

Spectrum from dislocation to dysplasia



Leg Length Discrepancy

- Fractures
  - Short
    - Healed up wrong position
    - Damage to growth plate
  - Long
    - Stimulation of growth

Leg Length Discrepancy

- Infection- damage to growth plate or stimulation

Leg Length Discrepancy

- Tumor
  - Osteochondromas

Leg Length Discrepancy

Blount’s disease

Leg Length Discrepancy

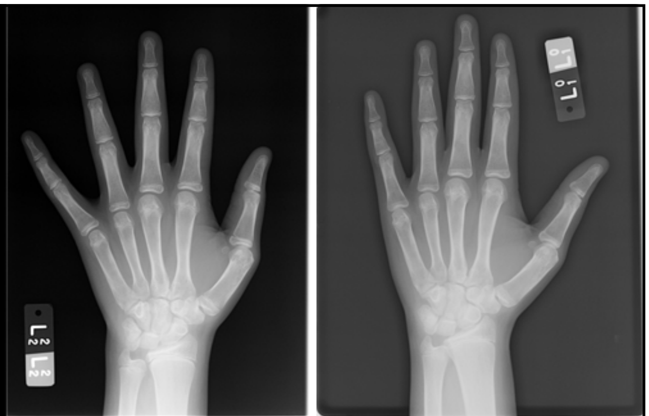
- Congenital
  - Hemihypertrophy
    - Associated with Wilm's tumors
    - Neurofibromatosis
  - Hemimelia
    - Absent part of a bone

Sequelae of Septic Hips

Leg Length Discrepancy

- Important to R/O
  - Developmental Dislocated Hip
  - Cerebral Palsy with adduction contracture
  - Hip contracture
  - Scoliosis

- Scanogram



- 10yr 10mo 11yr 9mo
- Left Hand for Bone age

Limping

- DDx
  - Infection
  - Fracture(trauma)
  - Avascular necrosis of hip
  - Leg length discrepancy
  - Slipped Capital femoral epiphysis
  - Other(tumor, CP,foot problems,etc)

Limping

- DDx
  - Infection
    - Septic hip most urgent dx to r/o
    - CRP or ESR
    - Staph most common

Limping

- DDx
  - Fracture(trauma)
    - Younger child cannot give history
    - Look for occult fracture

Limping

- DDx
  - Avascular necrosis of hip
    - May start as painless limp
    - Lose abduction and internal rotation
    - Adduction contracture makes leg seem short

Limping

- DDx
  - Avascular necrosis of hip
    - Idiopathic is Legg Calve Perthes disease
    - Steroids-JRA,Asthma
    - Sickle cell disease

Limping

Slipped Capital femoral epiphysis

3 weeks to several months of symptoms

Trendelenberg gait

Leg seems short

Patient usually heavy

Pain in thigh OR hip OR knee

If acute, presents like fracture

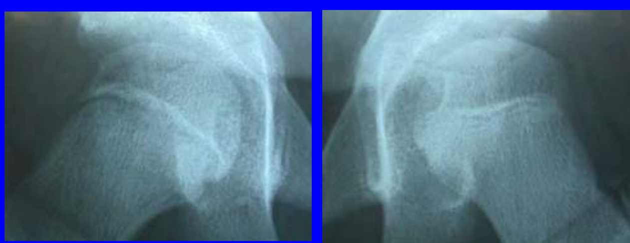
Limping

Slipped Capital femoral epiphysis

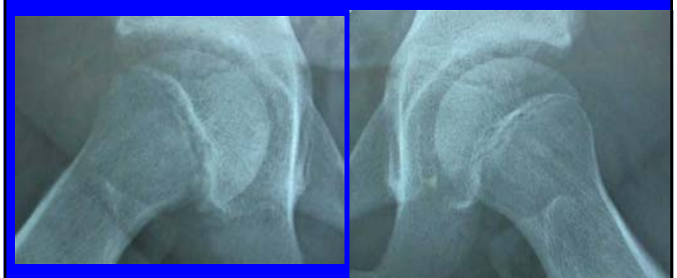
Physical exam--Limited Internal rotation

Xrays—(AP and Lateral views) confirm Dx

SCFE



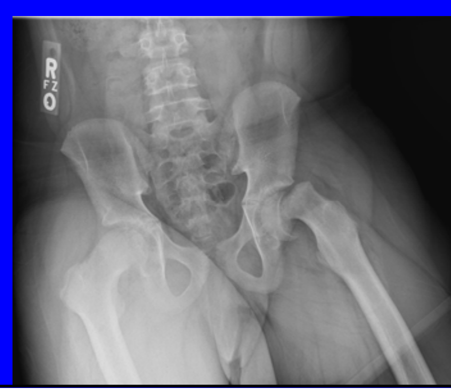
SCFE



Limping

- Slipped Capital femoral epiphysis
  - Treatment is pinning across growth plate(physis)

Unstable SCFE



Limping

- DDx
  - Infection
  - Fracture(trauma)
  - Avascular necrosis of hip
  - Leg length discrepancy
  - Slipped Capital femoral epiphysis
  - Other(tumor, CP,etc)

Knee Pain

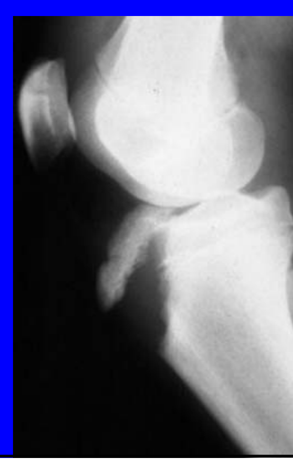
- DDx
  - Osgood Schlatter's disease
  - Jumpers knee
  - Fractures
  - Osteochondritis dessicans
  - Patellar dislocation
  - Chondromalacia patella
  - Medial collateral ligament tears
  - ACL/meniscal tears

Knee Pain

- DDx
  - Osgood Schlatter's disease
  - Jumpers knee

Knee Pain

- Fractures
  - Distal femur
  - Proximal tibia
  - Tibial tubercle
  - Tibial spine
  - Medial collateral ligament tear



Knee Pain

- Osteochondritis dessicans

Knee Pain

- Patellar dislocation
- Chondromalacia patella

FOOT

- Pes Plano Valgus
  - Flexible
    - Ligament laxity
    - Easily reduces manually
    - Benign
  - Rigid
    - Peroneal spastic flatfoot-will not reduce
    - Evaluate for tarsal coalition
    - Becomes painful and progresses at age 9-11

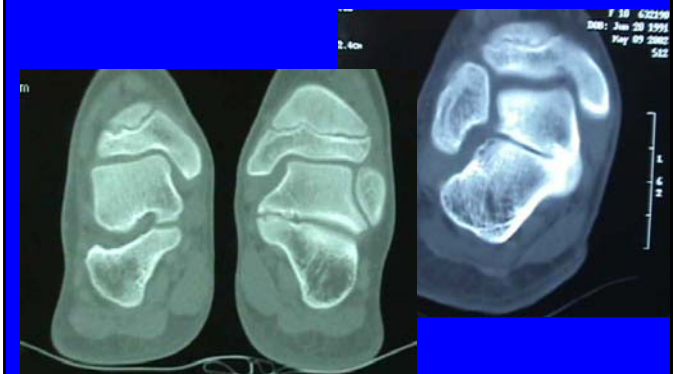
FOOT

- Pes Plano Valgus
  - Flexible
    - Ligament laxity
    - Easily reduces manually

Tarsal Coalition

- Abnormal boney connection between tarsal bones
- Loss of arch
- foot everted
- externally rotated

Tarsal Coalition



University of Chicago Comer Children’s Hospital

Thank You

THE UNIVERSITY OF CHICAGO MEDICINE
Comer Children's Hospital

Spinal Deformity and Infections in Children

Christopher M. Sullivan, M.D.,M.P.H.

PCOC June 2019

Disclosure Information

Primary Care Orthopaedics Course 2019

Christopher Sullivan,M.D.,M.P.H.

- I have no financial relationships to disclose.
- I will not be discussing off label or experimental devices or drugs

Scoliosis Concerns

- Back pain
- Will the other organs get "squished"?
- Does exercise/PT help?
- Does Chiropractic help?
- Does the backpack cause/make it worse?

Scoliosis Concerns

- Does exercise/PT help?
  - Schroth method in combination with bracing has some proponents

Scoliosis   Concerns

- Does Chiropractic help?   Not been shown
- Does the backpack cause/make it worse?
  - Not known, but difficult to sort because all kids carrying
  - Incidence is not thought to be increasing

Scoliosis

- Organs usually move out of way due to gradual increase in deformity
- Lungs may get compromised due to restriction of rib movement in curves >75 degrees

Scoliosis Back pain

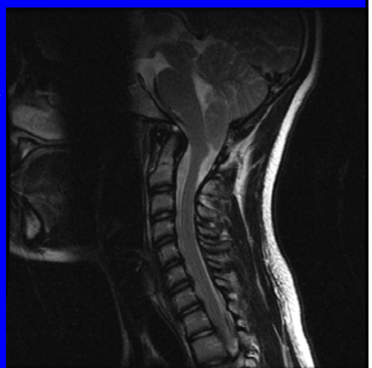
- Back pain not thought to be increased from scoliosis
- Some painful conditions may cause scoliosis(discitis, spondylolysis, Chiari malformations, syrinx, etc)

Scoliosis

- Spondylolysis

Scoliosis

- Chiari malformation
- Cerebellum extruded down foramen magnum



SCOLIOSIS

- Frontal Plane Curvature

KYPHOSIS

- Sagital Plane Curvature

When is scoliosis not really scoliosis?

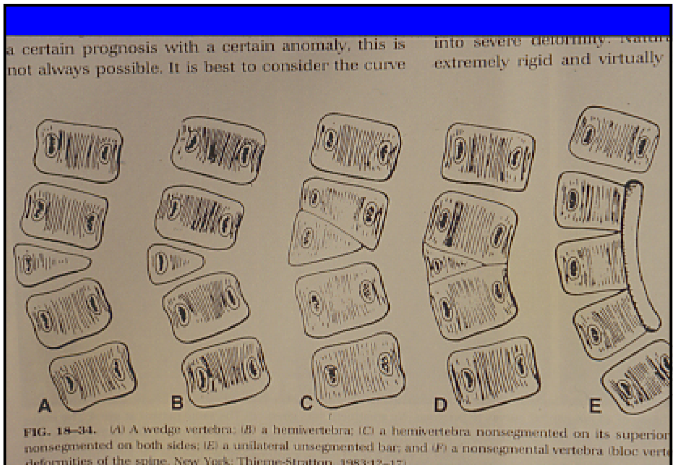
- Leg length discrepancy
- Contractures of the hip

SCOLIOSIS

- CONGENITAL
- NEUROMUSCULAR
- IDIOPATHIC

CONGENITAL SCOLIOSIS

- Abnormal formation
- Hemivertebrae
- Failure of segmentation
- Multiple combinations



a certain prognosis with a certain anomaly, this is not always possible. It is best to consider the curve

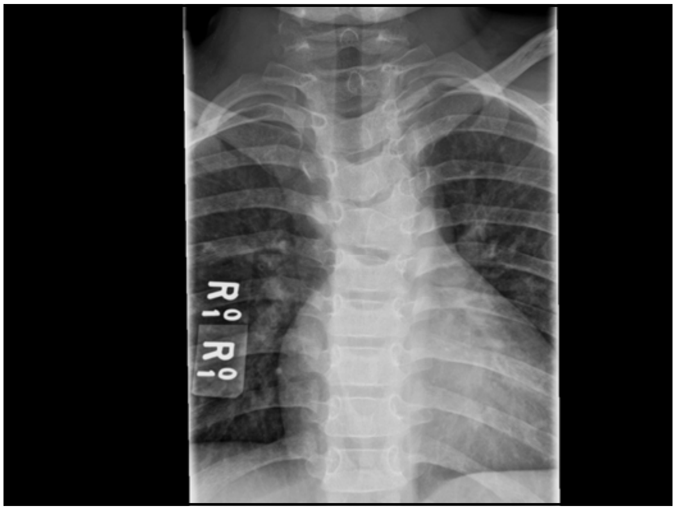
into severe deformity. ... extremely rigid and virtually

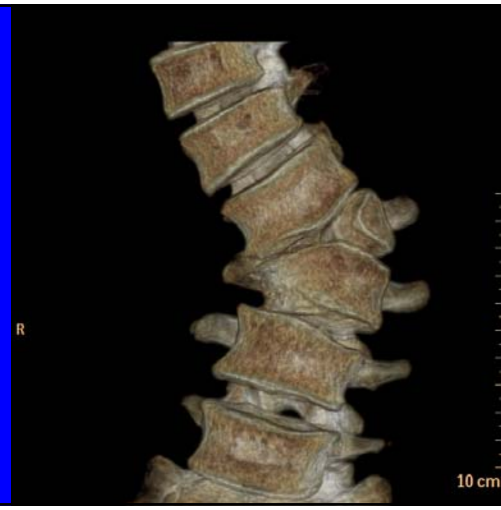
FIG. 18–34. (A) A wedge vertebra; (B) a hemivertebra; (C) a hemivertebra nonsegmented on its superior ... nonsegmented on both sides; (E) a unilateral unsegmented bar; and (F) a nonsegmental vertebra (bloc verte... deformities of the spine. New York: Thieme-Stratton, 1983:12–17)

Congenital scoliosis

Associated with

- Klippel Feil(cervical)
- Kidney formation anomalies
  - Absent
  - Horseshoe
  - Duplicated ureters
- Cardiac anomalies





Congenital Scoliosis

- Hemivertebra with extra rib

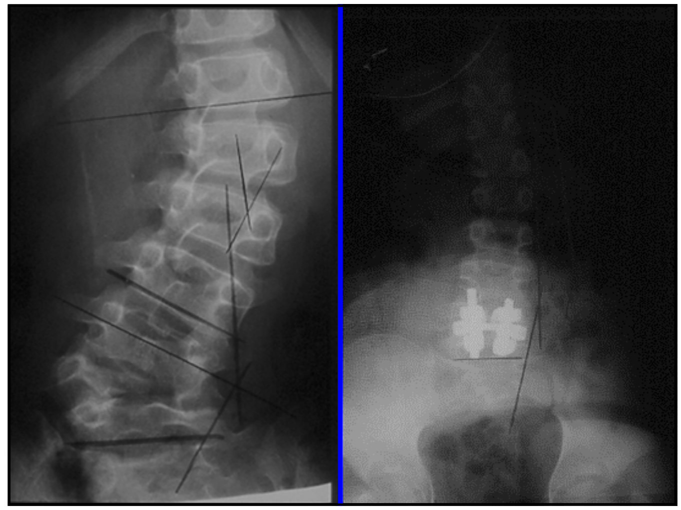
- Lipomeningocoele
- Increased distance between pedicle suggests intra-canal pathology

CONGENITAL SCOLIOSIS Diagnosis

- Trunk alignment deformity
- May have less rib rotation
- Hairy patch or dimple above gluteal cleft
- Klippel feil syndrome (cervical fusions)
- May have associated intra-canal pathology

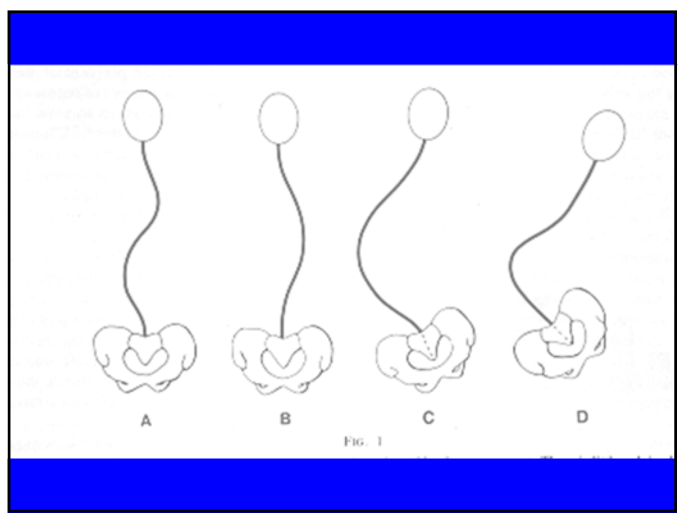
CONGENITAL SCOLIOSIS Treatment

- Refer to Specialist(Peds Ortho or Spine)
- 50-75% need for Rx
- Usually Surgical



NEURMUSCULAR SCOLIOSIS

- Scoliosis associated with other condition
- Main problem is usually sitting ability



NEURMUSCULAR SCOLIOSIS
Most common causes

- Cerebral Palsy
- Myelomeningocoele(Spina Bifida)
- Neurofibromatosis
- Paralytic
  – traumatic (gun shot, MVA,etc)
  – tumors
  – TB

CEREBRAL PALSY

- Nonambulators are at risk
- Dislocated hips association
- Problems with sitting
- Long severe curves

MYELOMENINGOCOELE

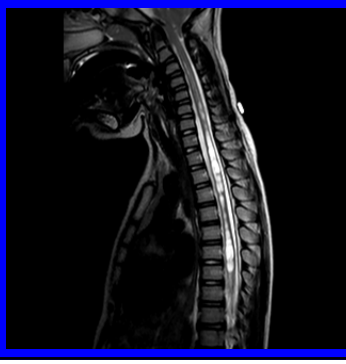
- Upper level lesions
- Tethered spinal cord
- Dimples, hairy patches, neuro deficits

Tethered spinal cord

- 14 month old
- 40 degree curve

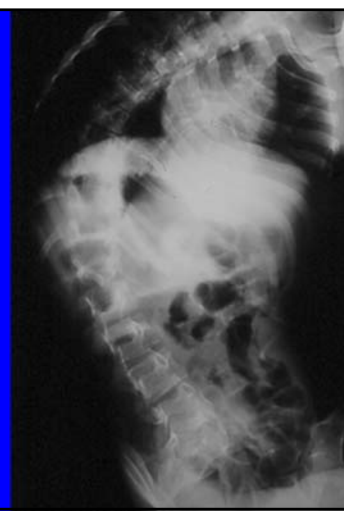
Tethered spinal cord w/wo Syrinx

- Atypical curves
- Young patients
- MRI spinal cord survey to diagnose

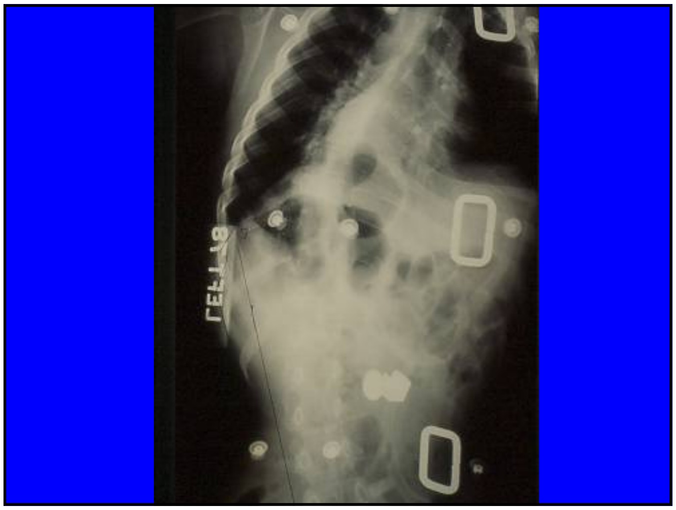


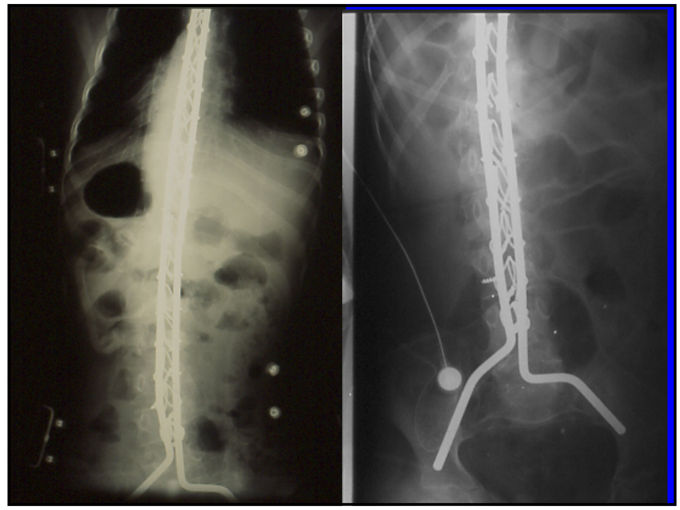
NEURMUSCULAR SCOLIOSIS Treatment

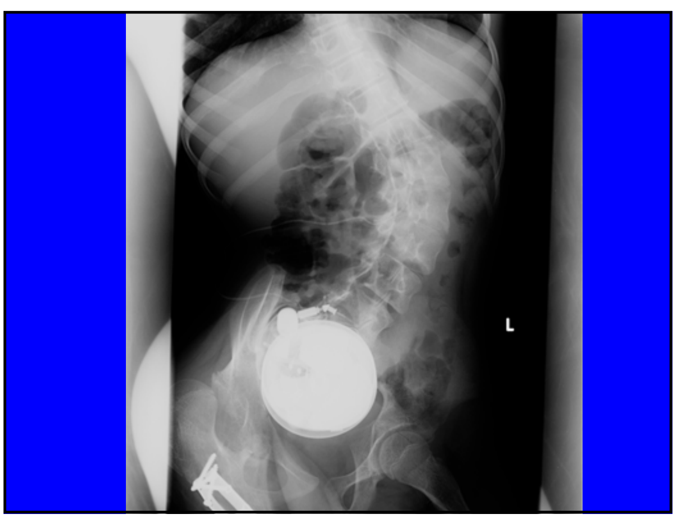
- Bracing with TLSO (ThoracoLumbarSacral Orthosis)
- Surgery if progresses



- Cerebral Palsy example
- Unbraced curve 90degrees



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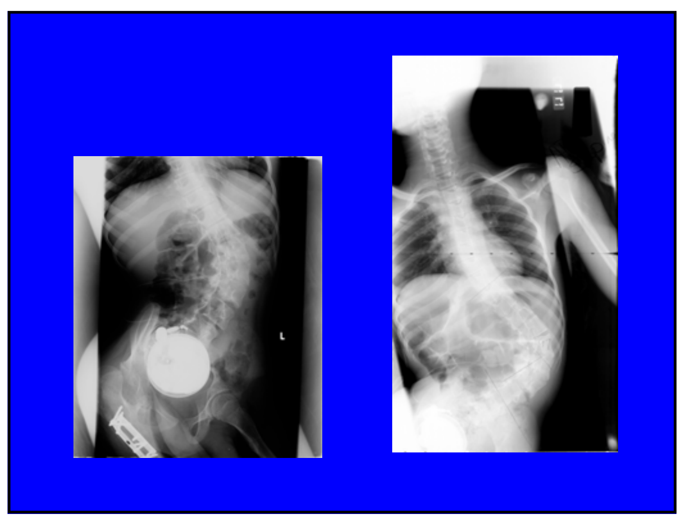
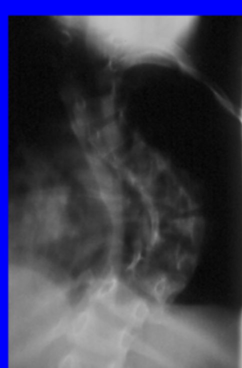


- Duchenne's Muscular Dystrophy

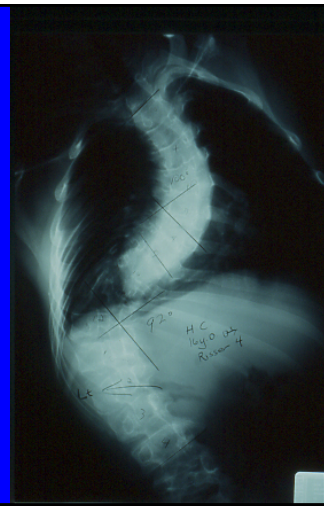
NEUROFIBROMATOSIS

- Aggressive curve
- With or without tumor



PARALYTIC

- Growing spine with loss of muscle control
  - Traumatic spinal cord injury
  - Polio
  - Spinal cord tumor



- Polio

IDIOPATHIC SCOLIOSIS

- Onset around age 9
- M=F in mild curves
- F:M 9:1 in progressive curves
- Usually not painful
- Sometimes family History
- Etiology still unknown, but evidence building for genetic factors

IDIOPATHIC SCOLIOSIS Diagnosis

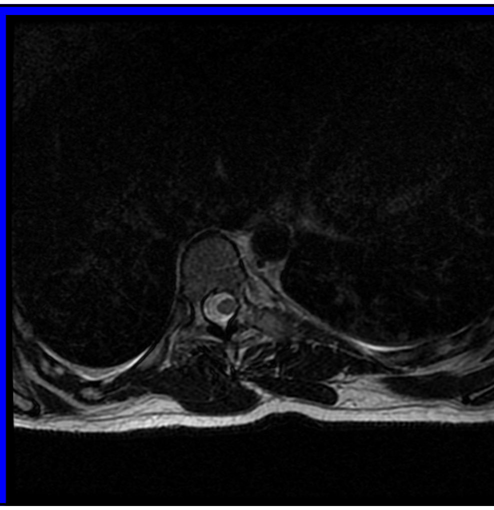
- Rib prominence
- Trunk asymmetry
- Radiographs confirm and quantify
- Growth spurt most vulnerable time for progression
- Use of Scoliometer for screening

IDIOPATHIC SCOLIOSIS
Scoliometer

- Curvature associated with spine rotation
- Distorts rib cage as spine rotates
- Rib asymmetry basis for screening
- Scoliometer one method for documentation of rib “hump”

IDIOPATHIC SCOLIOSIS
Scoliometer

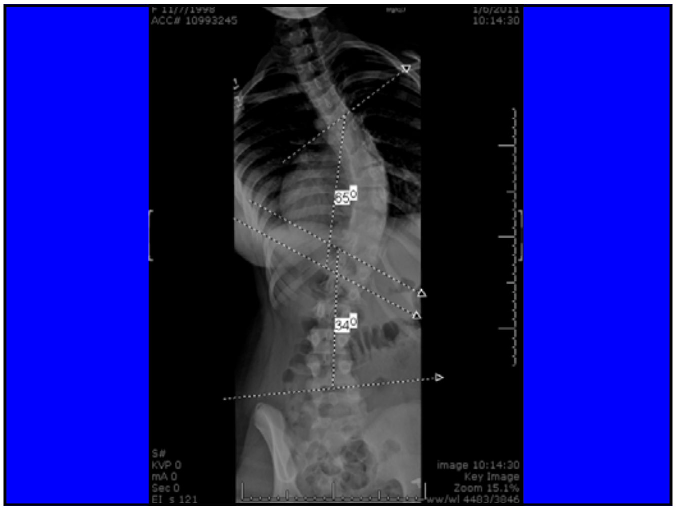
- Reading of 5 degrees on Scoliometer can be as much as 20 degrees on the “Cobb Method”
- Treatment is initiated at 20 Degrees or more of Cobb angle
- Less curve would be observed and followed only

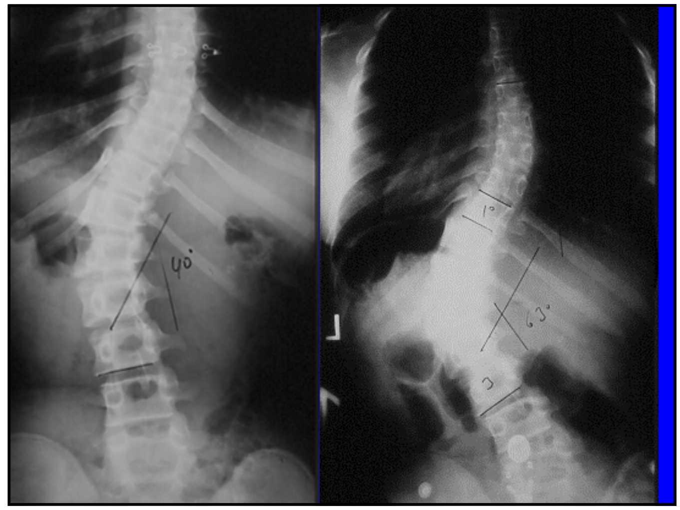


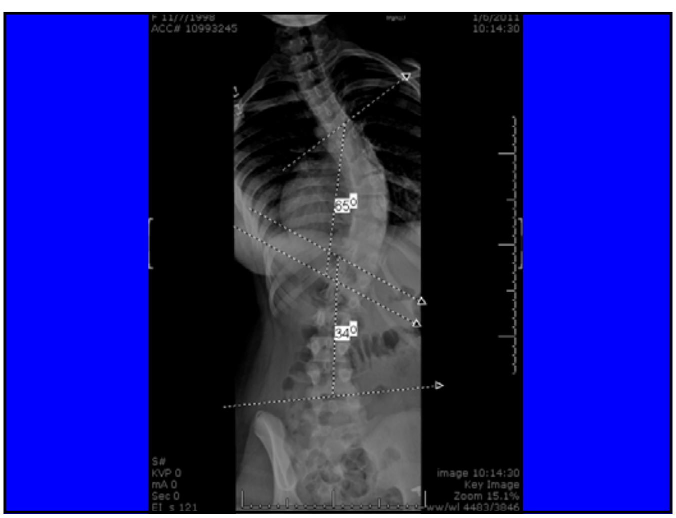
Scoliometer

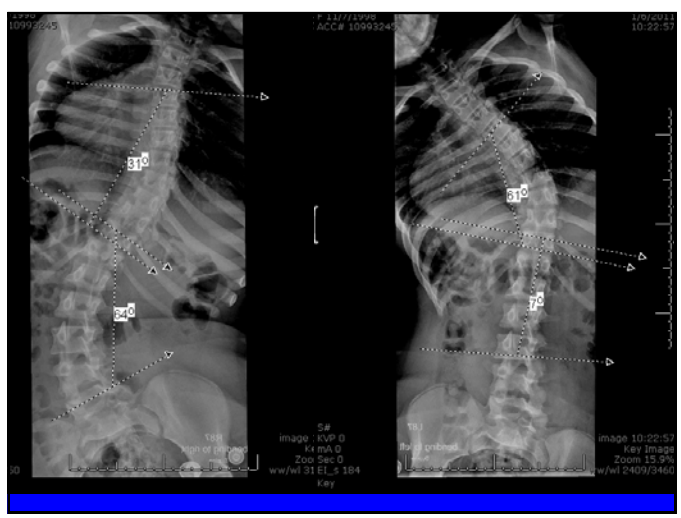
IDIOPATHIC SCOLIOSIS Diagnosis

- Cobb Angle
- AP radiograph
- Greatest tilt between vertebae in each curve


65°
34°


40°


65°
34°


31°
64°
61°
7°

IDIOPATHIC SCOLIOSIS
Prognosis

- Earlier onset, greatest risk of progression
- At end of growth:
  - if curve < 40 degrees, unlikely to progress
  - if curve > 50 degrees, Highly likely to progress

IDIOPATHIC SCOLIOSIS
Treatment

- Observation
- Bracing
- Surgery

IDIOPATHIC SCOLIOSIS
Observation

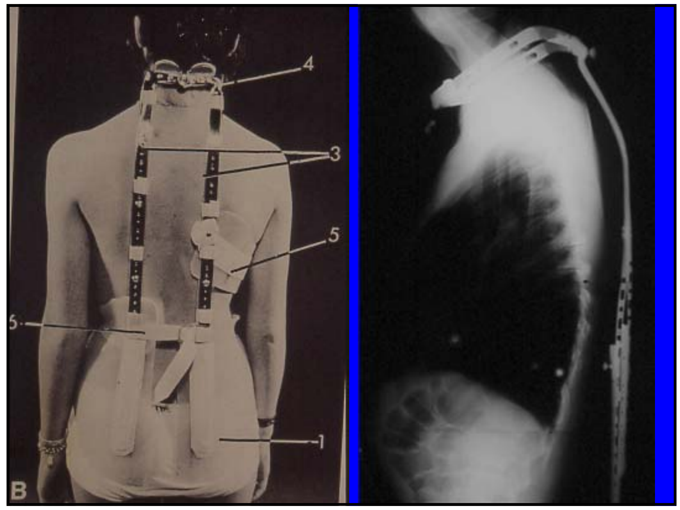
- Curves under 20 degrees
- Curves under 40 degrees if growth completed

IDIOPATHIC SCOLIOSIS
Bracing

- Curves 20 to 40 degrees and growth remaining
- Thoraco-Lumbar-Sacral Orthosis (TLSO)

IDIOPATHIC SCOLIOSIS
Types of Braces

- Milwaukee Brace
- Underarm brace full time(Boston,Leon, Rosenberger,etc.)
- Charleston nightime bending brace



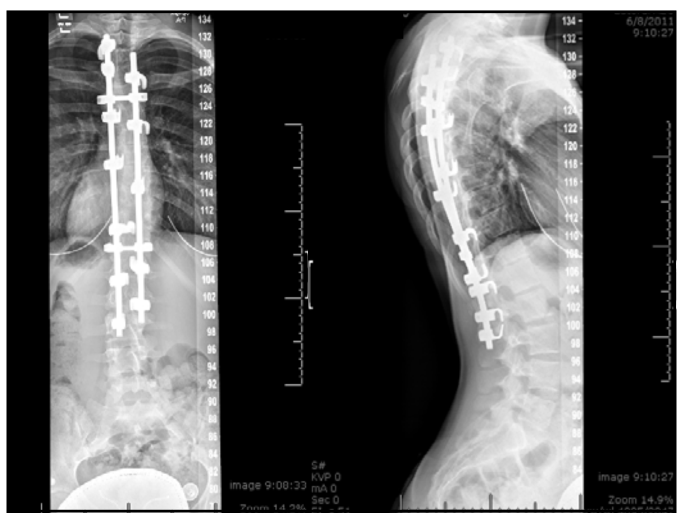
Nightime bending brace

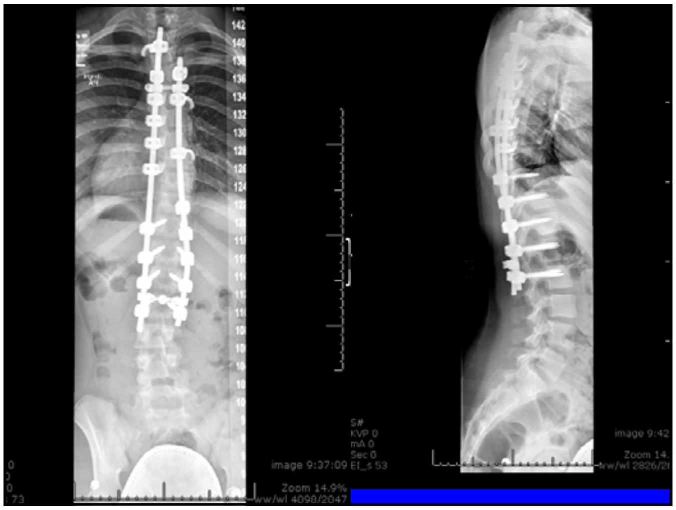
IDIOPATHIC SCOLIOSIS Surgery

- Curves over 50 degrees continue to progress after skeletal maturity
- Curves over 70 degrees get pulmonary function changes which may be irreversible

IDIOPATHIC SCOLIOSIS Spinal Fusion

- Fusion of 8 to 12 vertebrae into one long spinal bone
- Usually done from posterior with rods (PSF)
- Sometimes done through the chest on anterior part of spine(ASF)
- Sometimes combined anterior and posterior
- Expect 50% correction of curves





OFFICE MANAGEMENT OF SCOLIOSIS

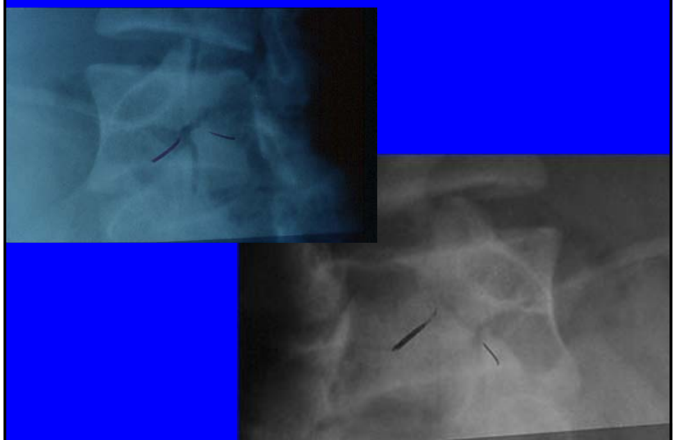
- Check base of spine on newborns and young children
- Screening exams on children 5th through 8th grade with routine exams
- Scoliometer reading above 5 degrees should be referred
- Treatment with brace or surgery best left to specialist.

BACK PAIN IN CHILDREN DDX

- Traumatic
- Structural(Scheurman’s Kyphosis, spondylosysis)
- Infection
- Tumor
- Other.

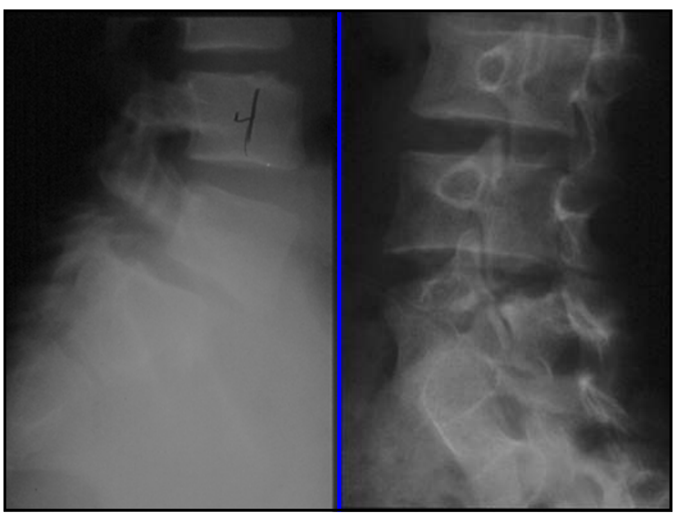
BACK PAIN IN CHILDREN Traumatic or structural

- Spondylolysis
  - Back pain
  - Defect in pars interarticularis
  - Common in gymnasts and weight lifters
- Dx:
  - Radiographs - obliques of lumbar spine
  - Bone scan
- Rx: Restrict activities>>brace>>surgery



BACK PAIN IN CHILDREN
Traumatic or structural

- Spondylolisthesis
  - Displacement of posterior elements
  - Stretches nerves
  - Flat back
  - Hamstring spasms
- Dx Lateral view
- Rx: Restrict activities>> surgery.

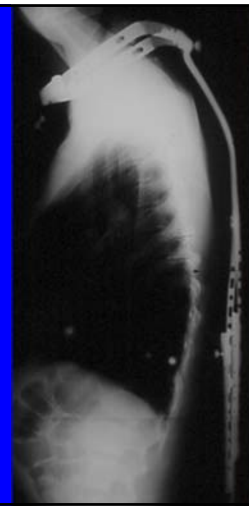


Spondylolisthesis

- Incomplete L5 Fracture with Grade 1 Spondylolisthesis

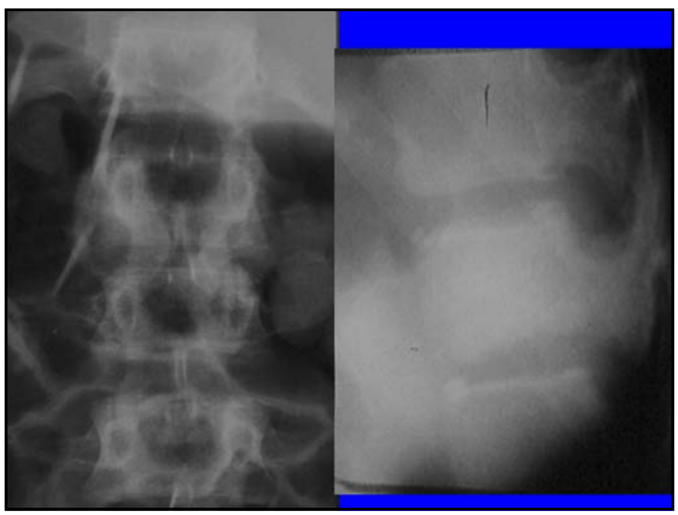
BACK PAIN IN CHILDREN
Traumatatic or structural

- Scheurmann’s disease
  - Pain in thoracic spine
  - Kyphosis on exam
  - Usually stiff on exam
- Dx Lateral view of Thoracic spine
- Rx: Extension exercises
- >>Milwaukee brace>> surgery.



BACK PAIN IN CHILDREN
Diskitis

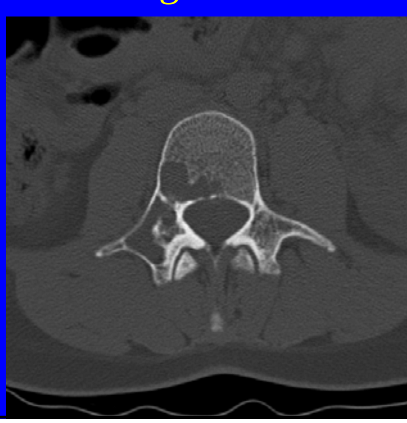
- Disk space infection
- May be chronic
- Usually staph
- Dx
  - High ESR or CRP
  - + bone scan or MRI
- Rx: Usually responds to antibiotics.



BACK PAIN IN CHILDREN
Tumor

- Osteoid osteoma - rare
  - Night pain
  - responds to NSAIDs (ASA, Motrin, naprosyn, etc.)
- Ewing sarcoma - more rare
- Dx:
  - Radiograph
  - Bone Scan
  - possible MRI.

Benign Tumor



BACK PAIN IN CHILDREN
Initial work-up

- Physical exam
  - Guarding, range of motion
  - Neuro changes
  - Fevers, systemic signs
- ESR or CRP
- Radiographs according to PE and location of pain

BACK PAIN IN CHILDREN
Initial work-up

- Radiographs
- If suspect Spondyloysis then AP, Lat and 2 obliques of LS Spine and Spot lateral L5-S1
- If Scheurmann's kyphosis suspected then lateral of Thoracic spine

BACK PAIN IN CHILDREN
Initial workup

- If Dx not found, consider short course of NSAIDs, refer if not improved
- If pt sick or Neurologic changes then refer immediately

Thank You

TWENTY-FIFTH ANNUAL
25
PRIMARY CARE ORTHOPAEDICS COURSE

AT THE FOREFRONT
UChicago Medicine