Hand and Wrist Diagnosis and Imaging
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Disclosure

- Neither I, Mary Lloyd Ireland, MD, nor any family member(s), have any relevant financial relationships to be discussed, directly or indirectly, referred to or illustrated with or without recognition within the presentation.
Menu

DDX
Plain Radiographs
SL Dissociation
Imaging
Scaphoid FX
Hamate FX
Hand
Introduction

Most Important and Key to Correct Diagnosis

- HISTORY
- PHYSICAL EXAM
- GOOD PLAIN RADIOGRAPHS
IS IT A WRIST SPRAIN OR NOT?

Make the Diagnosis!
Wrist Sprains Do Exist, but . . .

• You must make a diagnosis

• Don’t miss:
  • Scaphoid fractures
  • Carpal instability
  • Hook of hamate fracture
  • Tendinopathies

• If missed, athlete will develop chronic wrist problems and disability
Physical Exam by Zones

• Anatomic: 5 zones of the wrist
  • Radial dorsal
  • Central dorsal
  • Ulnar dorsal
  • Radial volar
  • Ulnar volar
Radial Dorsal Zone

- Ganglion cyst
- Sensory branch radial nerve irritation
- Intersection syndrome
  - Friction between extensor pollicis brevis and abductor pollicis longus
Radial Dorsal Zone

- Fracture
  - Scaphoid
  - Radial styloid
- Arthritis
  - 1st CMC
  - Basilar joint
- Tenosynovitis
  - De Quervain’s
De Quervain’s Tenosynovitis

Abductor pollicis longus

Extensor pollicis brevis
DeQuervain’s tenosynovitis
Central Dorsal Zone

- Kienbock’s Disease
- Ganglion cyst
- Scapholunate ligamentous injury
- Capitate pain

Radial Volar Zone

- Scaphoid tuberosity pain palpation
- Flexor carpi radialis tendinitis
- Median nerve – carpal tunnel syndrome
- Vascular
  - Allen’s test
Ulnar Dorsal Zone

- DRUJ
  - Instability
- TFCC Tear
- Ulnar impaction
- Fracture
  - Hook of hamate
  - Pisiform

Ulnar Dorsal Zone

- Lunotriquetral instability
- Extensor carpi ulnaris
  - Instability
  - Strain
  - Tendinitis
Ulnar Volar Zone

- Arthrosis
  - Pisotriquetral
- Fracture
- Ulnar nerve compression
Volar Wrist Ganglion

• Diagnosis
  • Location over STT joint (adjacent to FCR tendon) or over radiocarpal joint

• DDx
  • Radiocarpal arthritis
  • FCR tendinitis
  • CMC/STT arthritis
Cysts / Masses
- Dorsal Wrist Ganglion
- Volar Wrist Ganglion
- Volar Retinacular Ganglion Cyst
- Giant Cell Tumour of the tendon sheath
- Mucous cyst of DIP joint
Dorsal Wrist Ganglion

• **Diagnosis**
  - Mass over dorsal radial carpus
  - Fluctuates in size
  - Pain often associated with increases in size, but may also be present if mass disappears
  - Sometimes a history of indirect injury
• Compression: Nerve or tendon
  • Carpal tunnel syndrome
  • Cubital tunnel syndrome
  • Radial tunnel syndrome
  • DeQuervaine’s
  • Trigger finger
Carpal tunnel syndrome
Cubital tunnel syndrome
Radial tunnel syndrome
Physical Exam:
Know the surface anatomy and location of structures

Radial styloid process

Anatomical Snuff Box
Cubital tunnel syndrome
Hematoma, no fracture

Infection, MRSA
Plain Radiographs

- Three views: AP, Lateral, Oblique
- Marked cone views
- Bilateral views
  - Navicular
  - Stress
- Carpal tunnel views
GENERAL PRINCIPLES

Two plain orthogonal x-ray views that incorporate ‘the joint above and the joint below’ may be (and often are) insufficient to diagnose fractures and dislocations of the hand and wrist.
A physical examination precedes every plain radiograph so that appropriate orthogonal views to the expected plane of the pathology/fracture can be requested.
GENERAL PRINCIPLES

Remember to request ‘stress’ views for the evaluation of suspected ligamentous disruption of the hand and wrist (such as SLIOL tears, LTIOL tears, collateral ligament tears of the MCP and IP joints)
ANGLED RADIOGRAPHS

- Carpometacarpal joints

- Trapeziometacarpal
- Trapezoidometacarpal
- Scaphotrapezial
PLAIN RADIOGRAPHS

- Carpus
  - Scaphoid

Pisiform uncovered on pronated view

25 degree pronated
PLAIN RADIOGRAPHS

- Carpus
  - Lunate
PLAIN RADIOGRAPHS

- Carpus
  - LT ligament, triquetrum
PLAIN RADIOGRAPHS

- Carpus
  - Trapezoid: Hyperpronated view
PLAIN RADIOGRAPHS

- Carpus
  - Capitate

25 degree caudad
Scapholunate Dissociation

- Wrist injuries very common in sports
- Some injuries difficult to diagnose
- Scapholunate ligament injuries typically occur from a fall on an outstretched hand or forced extension and radial deviation
Physical examination

- Tender to palpation directly over the lunate and the scapholunate interval
- "Snuffbox" non-tender
- Pain with wrist extension
- Watson’s test negative
Scapholunate Dissociation

- Typical findings
  - Positive Watson’s test
  - Increased scapholunate angle on lateral view - DISI deformity
  - Widened scapholunate interval on ulnar deviation and clinched fist views
Watson’s Test

Scaphoid
Forceful resistance against pronation and radial deviation
Patient able to voluntarily reproduce “popping” maneuver in wrist
Physical examination

- Tender to palpation directly over the lunate and the scapholunate interval
- “Snuffbox” non-tender
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Scapholunate Dissociation

- Typical findings
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Clenched Fist  PA View
Scapholunate Ligament Disruption

The Capitate migrates proximally in the distal row forcing the proximal row scaphoid and lunate to move apart
Ulnar deviation views

Normal

Scapholunate dissociation
Terry Thomas sign
Wrist arthritis

- Sequel of untreated SL dissociation or scaphoid waist fracture
Plain Xrays

- Soft tissue swelling / fat pad

MRI Scan

- Soft tissue masses
- Fixed / Mobile

CT Scan

- Bone fracture healing

Ultrasound

- Solid vs. cystic lesions
Acute scapholunate ligament tear

Chronic triquetrum fracture

Chronic triquetrum fracture
UNCLEAR MEDICINE

- Limited usefulness
  - Gilula says:
    It’s only hot if it’s REALLY hot
CT SCAN

- **Principle:**
  The plane of the imaging should be determined before the scan is done, so that 2-D (transverse, sagittal or frontal) or 3-D recons are not counted upon to make up for information that was unobtained at the time of scan.
CT SCAN

- Coronal, sagittal, frontal
CT SCAN

- Scaphoid
CT SCAN

- Scaphoid: A fracture is not healed until it is healed radiographically (usually by CT scan)
• T1, T2, fat suppression T2
MRI

- Radiolunate OA vs. ulnocarpal impaction vs. Kienbock’s
• Ganglion

MRI

- Guyon’s canal
- SLIOL
- Occult DCG
MRI

- TFCC

Ligamentum subcruratum
MRI

- AVN

T2 fs

T1
s/p CTR: Palmar subluxation of median nerve
MRI

- ECU disease
MRI

- Occult fracture - scaphoid
MRI

- Arthrography: Added value c/w plain MRI
  - SLIOL
  - TFCC
Difficult Wrist Injuries in Athletes

- Radial Sided Wrist Injury
- Fall on Hyperextended wrist in Radial deviation
- Easy to Diagnose
- Difficult management decisions
- Potential long term severe disability
- Non union common

= Scaphoid

Dr. Steve Carter • Consultant Hand Surgeon
Sports Science Institute • Capetown, South Africa
Symptoms

- Weakness of grip
- Tenderness (specifically anatomic snuff box)
- Limited ROM
- NOT specific to scaphoid fractures
Vascularity

- Increased incidence of delayed healing/ nonunion with isolation of proximal pole by the fracture
- No interosseus anastomosis
- 1. Dorsal branch of radial artery
- 2. Volar scaphoid branch
Fracture type comparison

Intraarticular
Tubercle Fracture

DISTAL POLE

Vertical oblique
Transverse
Horizontal oblique

WAIST

Proximal third

PROXIMAL POLE
Proximal Pole Scaphoid Fracture
Ulnar Styloid Fracture

Initial View

Immobilized 4 Months
Osteopenia except proximal pole
Scaphoid Fracture

ORIF
Ulnar deviation views

Normal

Scapholunate dissociation
Scaphoid fracture, left wrist
Basketball Injury, 10 YO, Left Wrist: Initial
Basketball Injury, Left Wrist: 2 weeks

Scaphoid Fracture Can you see it?
Basketball Injury, Left Wrist: 5 weeks
Now you can..
Basketball Injury, Left Wrist: 8 weeks
Casted SATS 6 weeks then brace-wore at all times! HEALED!
Making the diagnosis with a negative x-ray

- MRI
  - Accurate
    - (Fowler, Sullivan Skeletal Radiol 1998 Dec;27(12))
  - Cost effective
    - (Brooks, Br J. Sports Med 2005 Feb;39(2))
    - Gooding N Z Med J. 2004 Sept 10;117
    - Dorsay, Am J Roentgenol 2001 Dec 177(6)
• Occult fracture - scaphoid
Scaphoid Fracture Nonunion
Difficult Wrist Injuries in Athletes

- Ulna sided wrist injury
- Fall on hyperextended wrist in Ulna deviation
- Difficult to diagnose
- Difficult to Image Controversy as to Imaging techniques
- Easy management decision
- Very few long term problems
- Non union common

= Hook of Hamate
Keys to Diagnosis...
Targeted clinical examination:
- Volar tenderness over hamate hook
- Resisted Flexion of ring and little fingers with wrist in ulnar deviation
Radially deviated wrist

- Almost linear flexor tendon excursion
- Small resultant ulnar vector
- Minimal pain with resisted flexion of ring and little fingers
Ulnar deviated wrist

- Hook acts as pulley for RF and LF excursion
- Large resultant ulnar vector
- Shearing force against hook causes pain
ANGLED RADIOGRAPHS

- Carpus
Hamate Fracture
PLAIN RADIOGRAPHS

- Carpus
  - Hamate

PA

15 degree supinated
Wrist

- Triangular fibrocartilage disorders
  - Assessment
  - Repair vs. debridement
- Intra-articular fractures
- Acute instability

\textit{WRIST PAIN = LOW BACK PAIN}
History

- Single Episode or Chronic Overuse
- Grip Style
  - ‘loose grip’
- Swing Style
  - Spin
  - Double or single handed
- Dominant Hand?
Physical Examination

- **Swelling**
- **Point of Maximal Tenderness**
- **Provocative testing**

ECU tendinitis (primary)
ECU subluxation
Physical Examination

**ECU tendinitis (primary)**
**ECU subluxation**
**Ulno-carpal impaction**
**TFCC injury**
**FCU tendinitis**
**Lunotriquetral ligament tear**
**Triquetral hamate impaction**
**Hook of the hamate fracture**
Triangular fibrocartilage complex
MRI

- TFCC

Ligamentum subcruatum
• ECU disease
Ulnar sided wrist pain

- “DRUJ-ery” – Richard A Berger, MD, Mayo Clinic
- “I have spent over 25 years studying an area of the wrist that measures one square centimeter” – William B. Kleinman, MD, Indiana Hand Center
Hamate Fracture
CT SCAN TO DIAGNOSE Hook of Hamate fracture
Summary

• A hook of hamate fracture should not be missed!

• Have a high index of suspicion based on suggestive history.

• Include resisted finger flexion in the ulnar deviated wrist and palpation over the hamate hook as part of your examination

• Request a CT scan rather than MRI or XR to confirm clinical diagnosis
Distal radial growth arrest

Little Leaguer’s Shoulder
Wrist

• Distal radius epiphyseal fractures
  • Gymnast’s wrist
    • Symptoms: wrist pain
    • Xrays widened distal radius
    • Trend toward negative ulnar variance
    • Then higher than normal 80% load on radial epiphyseal plate

Wrist

- More \( \oplus \) ulnar variance
- Ulnar variance not associated with wrist pain
- 59 Gymnasts (28 girls / 31 boys)
  - Average age 9.3 years
    - 10-14 years of age: 83% had wrist pain
    - Outside that age range: 44% had wrist pain

Wrist

- Radiographic survey
  - 60 gymnasts (39 females / 21 males)
  - Delay in maturation for females
  - 5 abnormal wrist x-rays (4 females / 1 male)
  - Look for widening and irregularity, distal radius
  - Look for arrested growth
  - Positive ulnar variance in Salter I or II fractures
  - Need larger scale studies

Congenital laxity party trick
PIPJ dorsal dislocation deformity at joint

Proximal phalanx fracture deformity proximal to joint with rotation
MCP, Volar dislocation, reducible

Some are not
PLAIN RADIOGRAPHS

Digits
PLAIN RADIOGRAPHS

Digits
Gamekeepers Thumb
Stener’s lesion complete UCL tear adductor aponeurosis attached to fragment
PLAIN RADIOGRAPHS

• MCPs
PLAIN RADIOGRAPHS

- PIPs
PLAIN RADIOGRAPHS

• XR evaluation of ‘jersey finger’
Trigger finger

- **Diagnosis**
  - **THE GREAT PRETENDER**
    - Clicking, locking
    - Pain over A1 pulley
    - Mass at MCP flexion crease
    - Flexion deformity of PIP joint
    - “Weakness” of power grip
  - **Associated diagnoses**
    - Diabetes mellitus
    - Hypothyroidism
Trigger finger

- Diagnosis
  - Tenderness over A1 pulley is the SINE QUA NON of diagnosis
PIP & DIP joint arthritis

- Diagnosis
  - PIP nodes: Bouchard
  - DIP nodes: Heberden
  - AM pain, stiffness
  - Systemic diathesis
PIP & DIP joint arthritis

- Diagnosis
  - Radiographic findings
PLAIN RADIOGRAPHS

• Metacarpals
Thumb CMC Arthritis

- **Diagnosis**
  - Pain at thumb base or thenar eminence upon attempted key pinch, attempted ‘wide grip’ (opening tight jar), attempted ‘narrow grip’ (turning doorknob)
  - Perceived decrease in function due to poor thumb anteposition
    - Thumb MC adducted into web space
Thumb CMC Arthritis
Conclusions

- Do history and physical before imaging studies
- Imaging studies may overdiagnose hand disorders
- Must correlate your exam with imaging studies
- History and physical overrides imaging
Splints – Many Companies Many Braces

- Wrist and Hand Supports
- One company 29 different braces for forearm, wrist, hand, and thumb
- Waterproof reformable removable braces
- heat, fit, mold, fit to patient

- Wrist sprains require compression and splinting until painless range of motion is possible, then functional exercise and sport specific activities.

- Kinesiotaping: For axial load or bat/racquet sports
Treatment of Wrist Sprains

- Cold -- not directly on skin
- Putty and other materials for padding and restoration of active motion and intrinsic muscle activation
- Immerse the Hand in Warm Sand or Wax
- Local Modalities
  - Ultrasound, Iontophoresis, many others . . .
- Creams
- Early On Get OT, ATC and Patient on an Intense Reduction of Swelling & Restoration of Function Program. Splint appropriately
Conclusions

• Make sure your diagnosis is correct
• Many wrist sprain diagnoses are not!
• Don’t miss:
  • Scaphoid Fracture
  • Carpal Instability
  • TFCC Injuries
  • Hamate Fractures in Athletes . . .