ACUTE HAND INJURIES FOR THE PRIMARY CARE PHYSICIAN

Disclosures

• No Financial Disclosures
Objectives

• Become familiar with the clinical anatomy of the hand and wrist
• Become familiar with several common fractures and injuries
• Become familiar with the proper radiographic studies associated with several hand/wrist injuries
• Understand the initial stabilization and treatment of acute hand/wrist injuries

Clinical Anatomy

• Eight carpal bones
• Five metacarpals
• Fourteen non-sesamoid bones (make up the phalanges)
Clinical Anatomy

- Eight carpal bones
- Five metacarpals
- Fourteen nonsesamoid bones (make up the phalanges)

Clinical Anatomy

- 12 Extensor tendons of wrist
  - Arranged in six compartments on the dorsum of the wrist
Clinical Anatomy

Twelve flexor tendons of the wrist
- Originate in the medial part of the forearm and insert on the palmar aspect of the wrist

Contents of the carpal tunnel
- Median nerve
  - Motor innervation
    - 1st and 2nd lumbricals
    - Thenar muscles
  - Sensory innervation
    - 1st – 3rd and lateral half of 4th
  - Tendons
    - Flexor digitorum superficialis
    - Flexor digitorum profundus
    - Flexor pollicis longus
Clinical Anatomy

Ulnar nerve
- Motor
  - 3rd and 4th lumbricales
  - Palmar and dorsal interossei
  - Hypothenar muscles
  - Deep portion FPB
  - Adductor pollicis
- Sensory
  - 5th digit
  - Medial half 4th digit

Radial Nerve
- Sensory only via superficial radial nerve
- Susceptible to injury
  - Wartenberg syndrome
  - 1st dorsal compartment injections
Acute Hand Injuries for the PCP

• History
  – Mechanism of injury?
  – Character and location of the pain?
  – Abnormal sounds or sensations with movement?
  – Swelling or stiffness?
  – Burning, tingling, numbness or weakness?
  – Previous injuries or medical problems?

Acute Hand Injuries for the PCP

• Physical Examination
  – Key Aspects
    • Inspection
    • Range of Motion
    • Strength Testing
    • Motor Examination
    • Circulation
    • Sensation
    • Palpation
    • Ligament Testing
    • Special Tests
Exam Essentials

• Inspection of both hands and wrists
  – Observe for redness, swelling, warmth, or atrophy

Exam Essentials

• Palpate
  – Search for areas of tenderness
  – Specific areas include
    • Snuff box – looking for scaphoid fracture
    • Radial styloid – looking for deQuervain’s tendinitis
    • CMC joint of the thumb – looking for osteoarthritis
    • Carpal tunnel – looking for median nerve involvement
    • Canal of Guyon -- looking for ulnar nerve involvement
    • Triangular fibrocartilage complex (TFCC) -- looking for a tear of the ligament at the distal ulna
    • Dorsum of the wrist and hand --- looking for extensor tendon damage
    • Palmar aponeurosis – looking for involvement of the palmar flexor tendons
    • All MCP, PIP, and DIP joints of the fingers
Exam Essentials

- **Range of Motion**
  - Wrist Flexion
    - 80°
  - Wrist Extension
    - 70°
  - Wrist Ulnar deviation
    - 30°
  - Wrist Radial deviation
    - 20°
  - Finger flexion and extension

- **Strength Testing**
  - Grip strength
  - Opponens strength

Exam Essentials

- **Sensory Testing**
  - **Radial Nerve**
    - Dorsum of hand from 3rd digit to the thumb
  - **Median Nerve**
    - Palmar aspect of hand from 3rd digit to thumb
  - **Ulnar Nerve**
    - Palmar and dorsal aspects of 4th and 5th digits
Exam Essentials

- Special Tests
  - CMC stress test and grind test
  - Finkelstein’s test
    - deQuervain’s
  - Tinel’s and Phalen’s
    - CTS
  - Ligament and Tendon Testing
    - Ulnar Collateral Ligament
      - Skier’s thumb
    - Collateral ligaments of IP joints
    - DIP Extensors
      - Mallet Finger
    - Flexor Tendons
      - Jersey Finger

Case 1

An 18-year-old man presents with dorsal right wrist pain after falling onto his outstretched hand while inline skating. He noted immediate swelling and painful wrist extension. Physical examination reveals soft tissue swelling with limited motion, mostly in extension, secondary to pain. There is bony tenderness along the distal radius. His sensory and vascular examination results are unremarkable.
Distal Radius Fracture

- **Mechanism of Injury**
  - FOOSH with hyperextension of the wrist

- **Exam**
  - Pain, swelling, ecchymosis, silver fork deformity
  - Check median nerve function
  - DRUJ stability
    - Ballottement sign

- **Imaging**
  - AP/Lateral/Oblique views

- **Extra-articular**

- **Intra-articular**
  - Radiocarpal Joint
  - Radioulnar Joint
Distal Radius Fracture

• Treatment
  – Nonsurgical (Stable & extrarticular)
    • Nondisplaced extraarticular fractures are treated with a long arm cast for 4-6 weeks

• Indications for Ortho
  – Displaced
  – Comminuted
  – Intra-articular extension
  – Loss of radial inclination
  – Dorsal tilt >20 degrees
  – Articular step off > 2mm
  – Median nerve injury

Case 2

• 17 y/o HS football athlete was tackled during a game. He states that he "twisted his wrist" while being tackled. He complained of mild pain, but was able to finish the game. The next morning he had swelling and bruising. He was evaluated by the ATC and sent to the ED for x-ray. He was placed in a thumb spica and told to follow up in 1 week
Scaphoid Fracture

• Most commonly injured carpal bone

• Mechanism of injury
  – FOOSH with wrist extension
  – Axial load to wrist

• Exam
  – Decreased motion,
  – Swelling, tenderness in anatomic snuffbox,
  – + scaphoid compression

Scaphoid Fracture

• Imaging
  – PA, lateral, scaphoid view
  – Consider motion views (ulnar deviation) and clenched fist
  – Often negative acutely
    • Thumb spica splint,
    • Reimage at 2 weeks
Scaphoid Fracture

- Vascular anatomy
  - Blood supply retrograde
  - Risk of AVN at proximal pole
  - Proximal = worse prognosis
  - Consider referral even if non-displaced

Non-Operative Treatment
- Non-displaced
- Short arm thumb spica cast
  - Extension, slight radial deviation, palmar flexion
  - 6-20 weeks
  - Proximal > Middle > Distal
Scaphoid Fracture

• Indications for Ortho
  – Displaced (> 1mm)
  – Angulated
  – Non-union
  – AVN
  – Scapholunate dissociation

• Surgical referral for stable fx
  – Accelerated RTP
  – Play with cast/splint
  – Depends on sport/position

Case 3

A 40 year old golfer participating in a scramble hits his tee shot off into the tree line. When he tries to strike the ball for the second shot, he strikes a tree root hidden beneath the leaves. He notes immediate pain at the volar ulnar aspect of the palm.
Hook of the Hamate Fracture

- 2-4 % of all carpal fractures
- Golf, baseball, and hockey
- Mechanism of Injury
  - Blunt trauma
  - End of swing
  - Fall on extended wrist

Hook of Hamate Fracture

- Presentation
  - Pain at the volar ulnar aspect of the hand
  - Worsened with a tight grip
- Examination
  - Point tenderness
  - Pain with grip
  - ROM full
  - Check Ulnar nerve
  - Hamate pull test
    - Provocative test
Hook of Hamate Fracture

- **Imaging**
  - PA, lateral, oblique; consider carpal tunnel view (may not visualize the fracture)
  - CT if negative with high clinical suspicion (Gold Standard)

- **Treatment**
  - Surgical excision is treatment of choice
  - Non-operative tx often leads to chronic/recurrent pain

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Metacarpal Fractures

- Approximately 30% of all hand fractures
  - Transverse fractures of the shaft are the most common type

- **Mechanism of Injury**
  - Fall onto clenched fist
  - Direct blow (helmet)

**Metacarpal Shaft Fx (transverse)**

- No rotation is acceptable
  - Clench fist, plane of nails aligned, fingers point toward distal radius
Metacarpal Shaft Fractures

Transverse

- Unstable fractures
  - Tend to angulate with the apex dorsal; due to volar pull of interossei
- Imaging
  - AP, lateral and oblique of hand
- Treatment
  - Reduction if:
    - Any angulation of 2nd and 3rd
    - > 20 degrees of 4th
    - > 30 degrees of 5th
  - Stable non-displaced
    - Buddy taping
    - Casting
    - Splinting
  - Unstable displaced
    - ORIF
    - Percutaneous pinning

Oblique and Spiral

- High Risk Fracture
  - Due to rotation and potential for shortening
- Mechanism of Injury
  - Fall onto open hand or direct twisting motion (such as wrestling)
Metacarpal Shaft Fracture

**Oblique and Spiral**
- Treatment
  - Ortho referral
    - Malrotation
    - Shortening > 5mm
    - Unable to reduce dorsal angulation
    - Displaced
    - Comminuted
    - > 1 Metacarpal fracture
- Stable, non-displaced
  - Gutter splint or cast x 4-6 weeks
  - Close f/u to assess for displacement/rotation

Metacarpal Neck Fractures

- Mechanism of Injury
  - Direct impact force
  - Punching with a clinched fist
- Imaging
  - AP, Lateral, Oblique
- Boxer’s Fracture
  - 5th Metacarpal Fracture
  - Most common fracture
- Apex dorsal angulation is common
Metacarpal Neck Fracture

• Treatment
  – Stable fx
    • Gutter splint x 2 weeks
    • Buddy tape
    • RTP 4-6 weeks
  – Ortho Referral
    • Angulation or displaced 2nd and 3rd
    • Rotational malalignment

First (thumb) Metacarpal Fracture

• Most occur at or near base
• Classification
  – Extra-articular
    • Most common
  – Intra-articular
  – Epiphyseal
• Mechanism of Injury
  – Axial load
  – Hyper-abduction / flexion during fall
First Metacarpal Fracture

- **Imaging**
  - True AP
    - Hand in max pronation
    - Delineates CMC joint well
  - Lateral
  - Oblique
- **Treatment**
  - Intra-articular involvement = Surgical referral
  - **Type I: Bennett Fx**
    - Intra-articular, noncomminuted base of thumb
    - ORIF – due to high risk of posttraumatic arthritis
  - **Type II: Rolando Fx**
    - Intra-articular, comminuted base of the thumb
    - Worse prognosis
    - Internal or external fixation
  - **Type III: Extra-articular Fx**
    - Closed reduction > 30 degrees angulation
    - Thumb spica splint x 4-6 wks

Middle and Proximal Phalanx Fractures

- **Mechanism of Injury**
  - Direct blow
  - Axial load
- **Classification**
  - Intra or Extra-articular
- **Indications for referral**
  - Uncorrected angulation
  - Malrotation
  - Oblique or spiral
    - Inherent instability
  - Intra-articular
- **Non-displaced, stable**
  - Buddy tape x 3-4wks
  - Close f/u
- **Displaced/angulated**
  - Closed Reduction and gutter splint x4 wks
**Middle and Proximal Phalangeal Fracture Angulation**

- MOI
  - Crushing injuries
  - Axial load

- Exam
  - Assess nail injury
  - Flexion / extension of DIP

- Non-op Tx
  - Aluminum splint x 3-4 wks
  - Leave PIP and MCP free
  - May be several mo until pain free

**Distal Phalangeal Fracture**

- MOI
  - Crushing injuries
  - Axial load

- Exam
  - Assess nail injury
  - Flexion / extension of DIP

- Non-op Tx
  - Aluminum splint x 3-4 wks
  - Leave PIP and MCP free
  - May be several mo until pain free

- Indications for Ortho
  - Angulated or displaced transverse fx
  - Failed closed reduction
  - Non-union
Finger Dislocations

- Dislocations
  - Can occur at the DIP, PIP, or MCP
  - PIP most common
  - MCP injuries most common in the thumb
  - DIP dislocations
    - Traumatic
    - Complicated by fracture and soft tissue injury
PIP Dorsal Dislocation

- **Mechanism of Injury**
  - Jamming finger
  - Catching ball, blocking, fall
  - Hyperextension and angular injury to PIP

- **Dorsal most common**
  - Easily reducible (often by athlete)
  - Volar plate disruption
  - May obstruct reduction
  - Collateral ligament injury common
  - X-ray to assess for fx
  - **Stable**
    - Buddy tape 3-6 wks
  - **Unstable**
    - Ortho referral

PIP Volar Dislocation

- **Volar dislocations uncommon**
- **Surgical reduction typical**
- **Associated with central slip injury**
  - Treat like boutonniere deformity
DIP Dislocation

- Mechanism of Injury
  - Hyperextension
  - Ball handling and contact sports
- Dorsal more common
- Mallet finger with volar dislocation
- Assess flexor tendon function
- X-rays to evaluate for fracture
- Treatment
  - Closed reduction
    - Traction/flexion
  - Splint in 10 degrees flexion x 3 weeks vs buddy tape

Instability / Ligament Injury

1st MCP ulnar collateral ligament
- AKA
  - Skier’s thumb
  - Gamekeeper’s thumb
- Mechanism of Injury
  - Hyperabduction and radial deviation
- Exam
  - Tenderness at insertion of UCL
  - Instability
Instability/Ligament Injury
1st MCP ulnar collateral ligament

- **Stener Lesion**
  - UCL avulsed from proximal phalanx
  - Visible and/or palpable mass +/- gross instability
  - 50-70% of suspected cases
  - Treatment is acute open anatomic repair

- **Imaging**
  - AP and Lateral – r/o fx
  - Stress views if no fx
    - Radial deviation in ext and 30 flexion

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Instability/Ligament Injury
1st MCP ulnar collateral ligament

- **Surgical Indications**
  - Complete tear
    - >30 degrees opening in flex
    - (<15 degrees side to side)
  - Asymmetric opening in ext
  - Stener lesion
  - Large bony avulsion

- **Non-operative Tx**
  - Partial tears
  - SA thumb spica x 4 wks
  - Splint x 2-4 mo
Jersey Finger

- Flexor Digitoum Profundus avulsion at distal phalanx
  - Ring finger most common (75%)
- Mechanism of Injury
  - Grabbing opponents jersey
  - Finger forced into extension while DIP actively flexed
- Physical exam
  - Inability to flex DIP actively
  - Pain distal or proximal (if tendon retraction)

Jersey Finger

- X-rays
  - Evaluate for fracture
- Surgical management recommended
Mallet Finger

- Disruption of terminal extensor tendon at distal phalanx
- Mechanism of Injury
  - Forced flexion of DIP
  - Ball sports most common
- Inability to extend DIP actively
- Treatment
  - Splint DIP in extension x 6 wks (continuous)
  - Additional 4 wks at night
  - Surgery for large avulsion fx

Boutonniere Deformity

- Rupture of central slip of extensor mechanism at base of middle phalanx
  - Extended PIP forced into flexion
  - Lateral bands pull into flexion
- Physical Exam
  - Acute
    - Swelling/Pain at PIP
    - Inability to actively extend PIP
    - Full passive ROM
  - Delayed (4-6 wks)
    - Hyperextension at DIP
    - Flexion at PIP
Boutonniere Deformity

- Treatment
  - Splint PIP in extension (DIP free) x 6 weeks, then night splint x 3-4 more weeks
  - If chronic (flexion contracture) may need longer period of splint vs serial casting
- Large displaced dorsal avulsion fracture
  - Surgical referral

Nail bed injuries

- Subungual hematoma
  - Crush injury
  - < 50% matrix
    - Decompress with 18g, paperclip or cautery
  - > 50% matrix
    - Assume open fx
    - X-ray
    - Removal, I&D, matrix repair
    - **classic teaching
  - If nail partially adherent and not displaced out of nail fold, trephination likely adequate
- Simple nail bed laceration
  - Remove nail plate to suture, then replace nail plate
- Complex nail bed laceration
  - Often with distal phalanx fracture, must address both
- Nail avulsion
  - Surgical repair
• Unless otherwise noted, all anatomic images obtained from various public websites and domains.

References

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