Fractures of the Metacarpals and Phalanges

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ANATOMY

DESCRIBE LOCATION
- DORSAL
- VOLAR
- RADIAL
- ULNAR

FINGER NOMENCLATURE
- INDEX FINGER
- LONG / MIDDLE FINGER
- RING FINGER
- SMALL FINGER
- THUMB

AVOID CONFUSION OF NUMBERED DIGITS

SURFACE ANATOMY- CREASES

BONES AND JOINTS
**EVALUATION**

- **History**
  - Age, handedness, occupation
  - Past medical history
  - History/Mechanism of Injury
  - History of Previous injuries/treatment
  - Tetanus vaccination status

**EVALUATION**

- **Physical exam**
  - Skin/Nail bed integrity
  - Deformity/Swelling
  - Neurologic evaluation
    - Light touch, 2-point discrimination
    - Capillary refill, pulse
    - Flexor, extensor tendon function
    - Ligaments

**EVALUATION**

- **Digital Rotation**
  - All digits should point towards scaphoid
  - Look for abnormal digital overlap/scissoring
  - Compare with other hand

**HAND RADIOGRAPHIC ANATOMY**

- **MUST HAVE GOOD X-RAYS**

**THE PERFECT X-RAY**

- Perfect Lateral Essential
  - Should see the MP and IP joints in profile
  - Often need dedicated finger films
  - There should be a smooth arc over the dorsum of the phalanges and concentric reduction of the IP joints

**METACARPAL FRACTURES**

- 5 Metacarpals (RAYS) grouped by type
  - Central Rays: LONG & RING
    - Inherent stability due to transverse MC lig.
  - Border Rays
    - Less stable, more likely to shorten or rotate
  - Thumb Ray
    - Essentially a separate category
      - Lacks stability of lesser digits
      - Larger requirement for motion
METACARPAL FRACTURES

- **Classification**
  - Location
    - Base
    - Shaft
    - Neck
  - Pattern
    - Transverse
    - Short Oblique
    - Spiral
  - Quality
    - Comminuted
    - Articular involvement

- **Key Questions**
  - Articular involvement
  - Displacement
  - Stability

THUMB METACARPAL

- Approx 25% of all metacarpal fractures occur in the thumb metacarpal, with 80% of those occurring at the base. The Bennett fracture is the most common.
- Because of the compensatory movement of the adjacent joints, the thumb is more forgiving of residual deformity than the fingers.
- Malrotation is rarely a problem.
- Angulations in the frontal plane of <15-20 degrees and in the lateral plane usually cause no functional deficits.

BENNETS FRACTURE

- Intra-articular fracture of 1st MC Base
  - Most common Thumb MC Fx
  - Predictable pattern of deformity
    - Adduction Supination & Shortening
  - Generally requires operative fixation to prevent subluxation of CMC joint and post-traumatic OA.

BOXER FRACTURES

- Treatment based on location & displacement
  - Location
    - Better tolerated in Small > Ring > Long > Index
  - Angulation – Almost always apex dorsal
  - Acceptable Angulation controversial
    - Small finger <30-50 degrees
    - Index finger <10-15 degrees
  - Recent survey of ASSH members showed wide variation in surgical indications
  - Rotational Deformity Poorly Tolerated
    - Check for scissoring or overlap, if present then CRPP indicated
  - Multiple Fractures – Inherently less stable
    - Often requires operative fixation

Green's Operative Hand Surgery
METACARPAL SHAFT FRACTURES

- Treatment Based Of Location & Displacement
  - Central Ray better tolerated than Border Ray
  - Almost all minimally displaced metacarpal fractures can be managed non-operatively

- SURGICAL TREATMENT FOR
  - Any Rotational Deformity
  - Multiple adjacent fractures
  - Excessive Angulation
    - >10°to radial and long
    - >20-30° for ring and small
  - Shortening >-5 mm --- will result in extensor lag
  - Displaced transverse fractures
  - Open Fractures

Surgical Treatment

- Three Basic Options
  - CRPP with K-wires or Metacarpal Nail
    - Good for transverse or very short oblique
  - ORIF with Lag Screws
    - Good for long oblique fractures
    - Technically demanding
    - Always some anxiety with early motion
  - ORIF with Plate and Screws
    - Will work for most fracture patterns
    - Rigid fixation allows early motion
    - New generation of dedicated low profile hand plates result in fewer tendon problems

METACARPAL ORIF

- Can be Intra or Extra-Articular
  - Near anatomic alignment is a prerequisite for treatment
    - Intra-articular fractures
      - Joint MUST be concentrically reduced
    - Extra-articular fractures
      - Malalignment or shortening will invariably lead to poor outcomes due to extensor mechanism imbalance

MIDDLE/PROXIMAL PHALANX FRACTURES

- Close Treatment
  - Short-arm cast or orthosis for 4 weeks
    - SAC with MPJs in flexion
    - Dorsal blocking splint with metacarpal bar
      - I have not had much success in maintaining reduction of displaced fractures
      - Best results in fractures that are minimally displaced

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PHALANGEAL SHAFT FRACTURES

- Fracture Displacement dictated by location in relation to tendon insertions
- Proximal Phalanx Shaft: Apex volar due to pull of intrinsics and Central slip
- Middle Phalanx Shaft:
  - Proximal to FDS insertion >> Apex Volar
  - Distal to FDS insertion >> Apex Dorsal

Closed treatment:
- Only if anatomic reduction possible
- Generally reserved for stable transverse fractures
- Must watch closely with serial x-rays

Surgical treatment:
- Oblique or unstable fractures
- Open fractures
- Displaced fractures

PHALANGEAL SHAFT FRACTURES

ORIF
- Comminuted fractures or treatment delay
- Extensor tendon issues inevitable
- Proximal Phalanx:
  - I approach through the central tendon for prox fractures and through the transverse retinacular ligament for distal fractures
- Middle Phalanx:
  - Mid-Lateral approach
- Fixation with multiple screws or wires vs. a low profile modular hand plate
  - Technically demanding, limited real-estate, tiny screws that love to fall off of screwdriver

Surgical Options
- CRPP:
  - Best for transverse or oblique fractures without severe comminution
  - Needs to be done early (callous forms quickly)
  - Preferred technique when feasible do to minimal scarring of extensor mechanism
  - Use multiple small wires and try to avoid tethering the central slip

THE JAMMED FINGER

INTRA-ARTICULAR PHALANX FRACTURES

- Often missed initially
- Delayed Rx >>> Poor result
- Jammed fingers need quality dedicated films that show concentric reduction on the true lateral

INTRA-ARTICULAR PHALANX FRACTURES

Dorsal Fracture Dislocation of PIP
INTRA-ARTICULAR PHALANX FRACTURES

3 GOALS OF TREATMENT
• Concentric reduction of joint
• Restoration of articular surface (if possible)
• Allow early controlled motion
  ○ PIP joint gets stiff quickly

Multiple Treatment options available
• Highly challenging injury without single ideal treatment
• Closed Reduction and splinting
  ○ Dorsal blocking splint that allows flexion
  ○ Must confirm reduction and follow closely w/ serial x-rays
• ORIF
  ○ Technically difficult
  ○ Surgical trauma can lead to profound stiffness
• Dynamic External Fixation
  ○ Allows for early motion
  ○ Minimal surgical trauma
• Extension Block Pinning
  ○ Problems with tethering of extensor mechanism

CONDYLER FRACTURES

Intra-Articular fractures of the Phalangeal Head
• Highly Unstable
  ○ Almost all require surgery
  ○ If caught early can generally reduce closed and fix with percutaneous wires or screws

FRACTURE DISLOCATIONS OF THE PIP JOINT

Challenging Injuries
• Often neglected or misdiagnosed as a “Jammed Finger”
• PIP Joint is sensitive to injury and prone to stiffness
• Delay in Rx → Poor Result
• The key to Diagnosis is a good lateral x-ray that is reviewed by a discerning eye

PIP FRACTURE DISLOCATIONS

Dorsal fracture dislocations (most common)
• Middle phalanx displaces dorsally
  ○ Volar Base of Middle phalanx fractures
    ○ Combo of avulsion from volar plate and impaction from proximal phalangeal head
  ○ Treatment dictated by post-reduction stability
    ○ Stable reduction → Splinting
    ○ Unstable → Surgery

Operative Orthopaedics

This will never stay reduced
PIP FRACTURE DISLOCATIONS

- Closed Management
  - Possible with smaller avulsion fractures
  - Usually <40% of articular surface
  - After closed reduction must assess position of stability
  - Fractures tend to be less stable in extension
  - Dorsal block splint to block extension
  - I use fluoroscopy to determine “safe zone”
  - Ideally you should not splint in more than 30 degrees to prevent flexion contracture

- Operative treatment for unstable fractures
  - ORIF
  - Reduction and dorsal-block pinning
    - Technically simple and avoids surgical trauma
    - Drawback is tethering of central slip → tendon adhesions
  - Dynamic External Fixation
    - Technically demanding (fussy operation)
    - Must have a compliant patient and good therapist
  - Hemi-Hamate Arthroplasty
    - Very difficult but very cool
    - Big-time surgical trauma → lots of rehab
    - Donor site morbidity

DORSAL BLOCK PINNING

Operative Orthopaedics

PIP ORIF

Operative Orthopaedics

DYNAMIC EXTERNAL FIXATION

Operative Orthopaedics

HEMI-HAMATE

Operative Orthopaedics
**FINGERTIP INJURIES AND DISTAL PHALANX FRACTURES**

**SUBUNGUAL HEMATOMA**
- Traditionally > 50% Hematoma Assoc. w/ Underlying Nail-bed Laceration
- Need For Repair Based On Status Of Nail Plate
  - IF INTACT
    - Simple drainage for pain relief
    - Stone at needle or heated paper clip
  - IF FRAGMENTED
    - Need to remove nail and repair nail-bed lac
- 50% of Nail Bed Injuries associated w/ distal phalanx fracture.
  - Should be referred for x-ray evaluation

**SEYMORE FRACTURE**
- Distal Phalanx fracture assoc. w/ a nail-bed lac
- Open fracture
  - Needs ER referral for debridement and ABX
  - Nail-bed often interposed in fracture site

**NEVER, EVER, PUT NYLON SUTURES IN SMALL CHILDREN**

**TUFT FRACTURES**
- Extra-Articular Fractures
  - Usually crush injuries
    - Soft Tissue component often dictates Rx
      - Nail bed injury – Chin requires repair
      - Soft tissue loss – May need coverage
  - Crush type fractures of the tuft are generally stable and do not require stabilization
    - Even non-unions are often painless
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DISTAL PHALANX FRACTURES

- Articular Fractures
  - Generally involve the insertions of the flexor or extensor tendons
  - Dorsal Lip Fractures “Boney Mallet”
    - Avulsion of the terminal extensor
  - If >40% of articular surface then may see volar subluxation of distal phalanx
    - Treat with CRPP or ORIF (I prefer pinning)
  - Volar Lip Fractures “Boney Jersey Finger”
    - These are typically treated surgically
    - Must Restore the FDP insertion

FDP AVULSION FRACTURE

SUMMERY

- Wide variety of hand fractures
- Early diagnosis and timely orthopaedic follow-up is key to successful outcome
- Need a high index of suspicion for articular fractures
  - BEWARE THE “JAMMED FINGER”
- Treatment aimed at creating stability to allow early motion.
- Good therapy is the key to success

THANK YOU