Hand Injuries

Wesam M. Almajid - MBBS MEd
PMAH
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Outline

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  • Skin laceration/loss
  • Nerve injuries
  • Flexor tendon injuries
  • Extensor tendon injuries
  • Fingertip injuries
  • Vascular injuries
Introduction

• Common

• 5-10% of ER visits (USA)

• Wide range but similar presentations
Terminology

- Volar - dorsal
- Radial - Ulnar
- Fingers by number or name
- Motions
Anatomy

- Complex
- 27 bones
- 3 nerves
- 2 arteries
- Muscles: intrinsic and extrinsic
Bones

- 27 bones (excluding the radius and ulna)
- Carpal - metacarpal - phalanges
Bones (Cont.)

- Carpal bones are arranged into two rows:
  - Proximal: Scaphoid, Lunate, Triquetrum, +/- Pisiform (sesamoid bone)
  - Distal: Trapezium, Trapezoid, Capitate, Hamate
• Thumb: metacarpal bone and 2 phalanges
• Other digits: metacarpal bone and 3 phalanges
• Base - Shaft - neck - head
Skin

- Dorsal:
  - Thin and pliable
  - Contain veins and lymphatics
  - Attaches loosely to the underlying skeleton

- Volar/palmar:
  - Thick and glabrous
  - Strongly attached to underlying structures by fascia
Nails
Nails (Cont.)

- Specialized skin appendages
- Nail plate - nail bed - paronychium - nail fold
- Nail bed has germinal matrix, sterile matrix, and hyponychium
Palmar fascia

- Fibrous tissue
- Arranged in different directions
- Contracture of this fascia leads to Dupuytren’s disease
Nerves

- The hand is supplied by the median, ulnar, and radial nerves
- Sensory: Each finger has one radial and one ulnar digital nerves
Nerves (Cont.)

• Motor: all intrinsic muscles of the hand are supplied by the ulnar nerve except (**LOAF**) which are supplied by the median nerve:
  
  • Radial 2 **Lumbricals**
  
  • **Opponens pollicis**
  
  • **Adductor pollicis**
  
  • **Flexor pollicis brevis**
Muscles and Tendons

• Intrinsic Vs Extrinsic

• Extrinsic muscles
  • Extensors Vs Flexors

• Intrinsic muscles:
  • Thenar
  • Hypothenar
  • Lumbricals
  • Interossei
Muscles and Tendons (Cont.)

- Extensors:
  - All extrinsic except interosseous-lumbrical complex
  - Arranged into 6 compartments under the extensor retinaculum at the level of the wrist
  - Juncturae tendinum
Muscles and Tendons (Cont.)

• Extrinsic flexors:
  
  • Wrist flexors:
    
    • FCR, PL, FCU
  
  • Finger (index, middle, ring, little) flexors:
    
    • FDS, FDP
  
  • Thumb flexor:
    
    • FPL
Muscles and Tendons (Cont.)

- **Intrinsic:**
  - Thenar: APB, FPB, OP, AdP
  - Hypothenar: AbDM, FDM, ODM
  - Lumbricals: 4
  - IO: 3 volar and 4 dorsal
Joints

- Wrist: radioiocarpal, inter carpal, midcarpal
- CMC joints
- MP joint
- IP joints
Blood Supply

- Complex network
- Mainly through the radial and ulnar arteries
Blood Supply (Cont.)

- **Radial A.**:  
  - Branch of the brachial artery  
  - Runs between brachioradialis and FCR in the forearm  
  - Crosses the anatomic snuffbox  
  - Gives a superficial branch which contributes to the superficial palmar arch  
  - Forms the deep palmar arch

- **Ulnar A.**:  
  - Branch of the brachial artery  
  - Runs under the FCU in the forearm  
  - passes through Guyon’s canal then divides into two palmar branches (superficial and deep)  
  - Deep branch contributes to the deep arch  
  - superficial branch forms the superficial planar arch
Blood Supply (Cont.)

- Superficial palmar arch gives off volar common digital arteries, which bifurcate into proper digital arteries; in addition to branches to skin and muscles.

- Deep palmar arch gives the major blood supply to the thumb and radial half of the index.
Blood Supply (Cont.)

• Dorsal arteries:
  • Originate from the a dorsal carpal arch which gives off dorsal metacarpal arteries

• Veins:
  • Deep system: follows the arterial supply
  • Superficial system: cephalic and basilic and veins
Pulley System

- Critical for the flexor function of the flexor tendons

- For finger: 5 annular and 4 cruciate pulleys (most important is A2 and A4)

- For the thumb: 2 annular and 1 oblique pulley (most important is the oblique)
Hand Examination

• Always wash your hands, introduce yourself, and explain to the patient what you are about to do!

• Look

• Feel

• Move

• Special tests
Look

- Inspect both sides (dorsal and volar):
  - Posture
  - Skin colour
  - Wounds
  - Scars
- Swelling
- Deformities
- Muscle wasting
- Nails
Feel

• Both side:
  • Temperature
  • Radial and ulnar A. pulse
  • Thenar and hypothenar eminence bulk
  • Assess the sensation: touch and 2-point discrimination
  • Search for any area of tenderness
Move

- Active and passive motion
- Fingers and wrist flexor and extension
- Also check the stability of each joint by radial and ulnar stress tests for the interphalangeal joints
Special Tests

• Tinel’s test
  • Identifies nerve irritation by tapping over the nerve

• Phalen’s test
  • Positive test is suggestive of carpal tunnel syndrome

• Allen’s test
Mechanisms of Injury

- Blunt
- Laceration
- Avulsion
- Burns
History

- Hand trauma
- Pain
- Swelling
- Erythema or change of colour
- Inability to flex or extend fingers/thumb
- Decrease sensation
- Click/Snap
Physical Examination

- Look - Feel - Move - Special Tests

- Findings:
  - Laceration
  - Deformity
  - Swelling
  - Tenderness
  - Crepitus
  - Decrease sensation and increased 2-point discrimination
  - Inability to flex or extend a certain joint (active or passive)
Hand Fractures
Hand Fractures

• Most common fractures of upper extremity (40% of UE fractures)

• Mostly occur between the ages of 11 - 45 yrs

• Most managed non-operatively

• Consider fracture and patient factors in the decision making process
Presentation

- History of trauma followed by pain
- Examination: swelling/tenderness/erythema/crepitus
Investigations

- X-Ray (Gold standard)
- U/S
- CT
- ?MRI
How to describe a fracture?

- Describe the film/image
- Name and location of the involved bone
- Location of the fracture on the bone and its relationship to articular surface
- What type of fracture —> direction and comminution
- Closed/open
- Displaced or not
Management (Cont.)

- **Indications for operative management:**
  - Irreducible fracture
  - Malrotation
  - Articular surface involvement
  - Subcapital fractures of phalanges
  - Open fractures
  - Segmental bone loss
  - Polytrauma with hand fractures
  - Multiple hand/wrist fractures
  - Presence of soft tissue injury
  - Reconstructive osteotomy
Examples of casting/splinting

- Volar Wrist Splint
- Ulnar Gutter Splint
- Sugar-Tong Splint
- Thumb Spica Cast
- Thumb Spica Splint
Examples of surgical fixation
Special Fractures

- Salter-Harris fractures
- Bennet’s fracture
- Rolando’s fracture
- Boxer’s fracture
Salter-Harris Fractures

- Unique to paediatric patients
- Through the growth plates
- I - V
Soft Tissue Injuries
Soft Tissue Injuries

• Involves one or more of the following tissues:
  • Ligamanets
  • Skin
  • Tendons/muscles
  • Nerves
  • Vessels
  • Nail complex

• Therefore clinical assessment is paramount in the diagnosis
Soft Tissue Injuries (Cont.)

- Hx

- PEx:
  - Always perform a full hand examination in order not to miss any abnormality
Ligamentous Injuries
Ligamentous Injuries

- Can occur to any Collateral Ligament (CL) or Volar Plate (VP)

- Hx: of hyperextension or excessive lateral stress

  - **Partial injury:**
    - Joint is stable when involved structure is under stress
    - Tx: immobilization

  - **Complete injury:**
    - Leads to an unstable joint +/- dislocation
    - Tx: immobilization and/or surgical repair
Ligamentous Injuries (Cont.)

- **Joint Dislocations:**
  - Joints are stabilized by tendons, CL and VP
  - Disruption of 2 of 3 (the two collaterals and VP) structures
  - Dorsal > Volar DIP, PIP and MCP of fingers

- **General management:**
  - Reduce, if stable after reduction then immobilization
  - If not stable after reduction OR unable to reduce then operative reduction is indicated
Ligamentous Injuries (Cont.)

• Examples:
  
  • VP injury
  
  • UCL injury of the MPJ of the thumb:
    
    • Acute: Skier’s thumb
    
    • Chronic: Gamekeeper’s thumb
    
    • Stener lesion
Skin Lacerations/Loss
Skin Lacerations/Loss

- Tx:
  - Irrigation, debridement and approximation
  - If there is tissue loss try to primary close the wound, if unable:
    - Secondary intention
    - Skin graft
    - Flap
  - Pay attention to the orientation/landmarks
Nerve Injuries
Nerve Injuries

• Hx: decrease or altered sensation

• Examination: light touch and 2-point discrimination

• Hard to assess in kids:
  • Emersion test
  • Iodine-starch test
Nerve Injuries (Cont.)

- Nerve injuries can be classified into three types:
  - Neuropraxia
  - Axonotmesis
  - Neurotmesis
Nerve Injuries (Cont.)

• Tx:
  - Neuropraxia and Axontmesis: conservative management
  - Neurotmesis: approximation of the severed edges
  - For any sharp laceration with decrease sensation —> exploration +/- nerve repair
  - For any closed injury —> observe and reassess periodically for recovery
Flexor Tendon Injuries
Flexor Tendon Injuries

- All extrinsic flexors of the thumb and fingers pass through the carpal tunnel
- FDS tendon splits and passes on either side of FDP tendon in order to insert into the middle phalanx
- Flexor sheath starts at the A1 pulley level and continues distally
Flexor Tendon Injuries (Cont.)

- Hx: laceration or snap or click
- Examination:
  - Loss of the flexor tone (finger out of the cascade)
  - Loss of active flexion and tenodesis effect
  - Tendons should be examined individually for each digit
• Pain/tenderness on resisted flexion can signify partial tendon injury
Flexor Tendon Injuries (Cont.)

- Classification of flexor tendon injuries:
  - Zone 1: Distal to insertion of FDS
  - Zone 2: Proximal A1 pulley to FDS insertion
  - Zone 3: Distal carpal tunnel to A1 pulley
  - Zone 4: Within the carpal tunnel
  - Zone 5: From muscle-tendon junction to proximal carpal tunnel
Flexor Tendon Injuries (Cont.)

- Management:
  - Partial:
    - <50%: debride edges or repair
    - >50%: repair
  - Complete:
    - Requires surgical repair
Flexor Tendon Injuries (Cont.)

- Surgical repair:
  - Core +/- epitendinous suture
  - Many techniques
Flexor Tendon Injuries (Cont.)

- Post repair management:
  - Generally: an initial phase of complete immobilization followed by a rehabilitation phase of the repaired tendon(s)

- Specific complications:
  - Rupture
  - Tendon adhesions
Specific Flexor Tendon Injuries

- **Jersey Finger:**
  - Avulsion of the insertion of the FDP tendon off the distal phalanx
  - Patient unable to flex DIPJ
  - Treatment:
    - Surgical repair
    - Immobilization/rehabilitation
Extensor Tendon Injuries
Extensor Tendon Injuries

- Common

- The extensor tendon is superficial thus prone to injury

- Compared to flexors, they are thinner and flatter

- Most can be repaired in the ER
Extensor Tendon Injuries (Cont.)

- Classification of injury:
  - Odd = over joints
  - Even = between joints
  - 9 zones
Extensor Tendon Injuries (Cont.)

- Hx: injury to digit with a laceration followed by loss of ability to extend the digit

- Ability to extend my be still present if injury is proximal to the \textit{juncturae tendinum}
Extensor Tendon Injuries (Cont.)

• Management:

  • I&D and repair

  • Contra-indications to immediate repair:

    • Lack of surgical skill

    • Heavily contaminated wound (fight bite)

    • Presence of associated fracture or soft tissue loss

    • Zone 7 and 8
Specific Extensor Tendon Injuries

• Malet Finger Injury:

  “Characterized by discontinuation of the extensor tendon resulting in an extensor lag at the DIPJ with or without compensatory hyperextension of the PIPJ”

• Soft tissue Vs. Bony
Specific Extensor Tendon Injuries (Cont.)

• Mallet finger injury (Cont.):
  
  • Classification:
    
    • I: Closed injury +/- small avulsion
    
    • II: Open injury, laceration of the tendon with no tissue loss
    
    • III: Open injury with tissue loss
    
    • IV: Associated with a fracture
Specific Extensor Tendon Injuries (Cont.)

- Management:
  - Type I: immobilization of DIPJ in extension
  - Type II: Repair of the lacerated tenon and skin
  - Type III: Reconstruction of the tendon and skin coverage
  - Type IV:
    - Children: fixation of the fracture with a k-wire spanning the DIPJ
    - Adults: Splinting unless involves >50% of joint or presence of solar sublimation of DIPJ
Fingertip Injuries
Fingertip Injuries

- Most common type of amputation in the UE
- Fingertip: area of the distal phalanx that is distal to the insertion of the flexor and extensor tendons
- Present with:
  - laceration, tissue loss, subungual hematoma
- Nail complex
- Associated distal phalanx fracture
Fingertip Injuries (Cont.)

• Management:
  • Need to address the **wound, nail complex** and **fracture:**
    • For the wound if there is **no exposed bone:**
      • Primary closure
      • Healing by secondary intention for small wounds (1 cm or less)
      • Skin grafting
      • Composite tip graft (mainly in young children)
    • For the wound if there is **exposed bone:**
      • Needs flap coverage
Fingertip Injuries (Cont.)

• Management (Cont.):

  • For nail complex injuries:

    • If there is subungual hematoma involving >50% of nail plate —> drainage (trephination)

    • Repair nail bed if lacerated

    • Splint nail fold to avoid scarring between the ventral and dorsal surfaces of the fold
Fingertip Injuries (Cont.)

• Management (Cont.):
  
  • For fractures:
    
    • Non displaced and distal tuft fractures
      
      • Repair the surrounding soft tissue + nail acts as a splint
      
      • If nail is absent —> may need splinting or pinning
    
    • Displaced fractures:
      
      • Pinning
Vascular Injuries
Vascular Injuries

• With any injury, assessment of the vascularity is critical

• In case of insufficient vascularity exploration of the wounds is indicated and repair of the vascular injury is indicated

• Each digit has 2 digital arteries —> one is usually sufficient to maintain adequate vascularity
Vascular Injuries (Cont.)

- Attention to skeletal framework
- Revascularization vs Replantation
Replantation

- traumatic amputation followed by replantation is most common in:
  - adult males
  - 45 - 54 yrs old
  - Factory workers and carpenters
Replantations (Cont.)

• Important to keep the amputated part cool

• Consult the appropriate service (Plastic Surgery) as early as possible

• Management:
  • Stabilizing the patient
  • Surgical replantation of the amputated part if appropriate
Thank you!!
Questions...
Anatomy

• Divide into groups of 4-5 individuals and discuss the following:
  
  • Surface anatomy
  
  • Bony anatomy - carpal tunnel and Guyon’s Canal
  
  • Tendons: extrinsic/intrinsic
    
    • Intrinsic
    
    • Extrinsic:
      
      • Flexors
      
      • Extensors
    
  
  • Blood supply
  
  • Nerve supply
Exercise: X-Ray reading

• 35 year old carpenter presenting with left little finger pain following a direct blow to the digit

• on examination he has moderate tenderness over the proximal phalanx of his little finger

• what does his X-ray show?
Management

• Not displaced and stable —> non-surgical immobilization

• Displaced or has deformity —> closed reduction —> if position is satisfactory and reduction is stable —> non-surgical immobilization

• If not stable/deformity not correctable —> surgical management in the form of closed/open reduction AND percutaneous/internal fixation
Exercise

• Young male presenting with discoloration of his right index finger and severe pain following an injury that he sustained 3 hours ago.

• Diagnosis?

• Treatment? briefly describe how you will do it?
Exercise

• 27 year old lady presenting with a left middle finger deformity following a soccer injury.

• on examination she is unable to extend her DIP joint and is tender around it. There are no open wounds.

• What is the diagnosis?

• How are you going to treat it?
• 17 year old healthy lady. Presenting with a sharp laceration over her left palm with inability to flex her index finger

• How are you going to manage her?
23 year old healthy gentleman presenting with inability to move left thumb along with pain and swelling.

On examination he has tenderness at the 1st CMC joint.

What does his X-ray show?

How are you going to manage him?