Elbow, Forearm, Wrist, & Hand

Chapter 19

Objectives

- Identify and discuss the functional anatomy of the elbow and forearm
- Discuss the common injuries associated with these anatomical structures

Bony Anatomy

Bones

- **Anterior View – full extension**
  - Medial epicondyle
  - Lateral epicondyle
  - Radial head

- **Posterior View – full extension**
  - Olecranon
  - Groove for ulnar nerve
  - Radial head
  - Medial epicondyle
  - Lateral epicondyle

- **Lateral View – full extension**
  - Lateral epicondyle
  - Olecranon
  - Radial head
Bones
- Lateral View – 90 deg. flexion

Bones of the Wrist
- Radius
- Ulna
- Carpals (8)

Bones of the Wrist
- Radius
- Ulna
- Carpals (8)

Bones of the Hand
- Metacarpals (5)
- Phalanges (14)
  - Proximal (5)
  - Middle (4)
  - Distal (5)

Joints of the Hand & Fingers
- Metacarpophalangeal (MCP)
- Interphalangeal
  - Proximal (PIP)
  - Distal (DIP)

Ligaments
Ligaments of the Elbow

- **Lateral View**
  - Capsule
  - Radial (Lateral) Collateral Ligament

- **Anterior View**
  - Anterior Capsule
  - Radial (Lateral) Collateral Ligament
  - Anular Ligament

- **Medial View**
  - Ulnar (Medial) Collateral Ligament
  - Anular Ligament

Ligaments of the Wrist

- **Palmar View**
  - Joint capsule
  - Collateral ligaments
  - Volar (Palmar) ligaments

- **Dorsal View**
  - Joint capsule
  - Collateral ligaments
  - Transverse ligaments of MCP

Ligaments of the Fingers

- Joint capsule
- Collateral ligaments
- Palmar ligaments
- Transverse ligaments of MCP
Muscles of the Forearm
- Elbow flexors/extensors
- Forearm pronators/supinators
- Wrist flexors/extensors
- Finger flexors/extensors

Muscles
- Elbow extensors
  - Anconeus

Muscles
- Wrist Extensors
- Finger Extensors
  - Ext. carpi radialis longus
  - Ext. carpi radialis brevis
  - Ext. digitorum
  - Ext. digitii minimi
  - Ext. carpi ulnaris

Muscles
- Thumb Extensors
  - Abductor pollicis longus
  - Ext. pollicis brevis
  - Ext. pollicis longus
Muscles

- Wrist Flexors
  - Flexor carpi ulnaris
  - Palmaris longus
  - Flexor carpi radialis

Muscles

- Pronators
  - Pronator teres
  - Pronator quadratus

Muscles

- Supinators
  - Supinator

Elbow Injuries

Acute Soft Tissue Injuries

Contusions

- Contusion to olecranon bursa
  - Significant swelling
  - Mild to moderate pain
  - Limited elbow flexion

Acute Soft Tissue Injuries

Sprains

- Excessive joint loading
- Ulnar collateral sprains caused by valgus force
**Acute Soft Tissue Injuries**

**Sprains**
- Radial collateral sprains caused by hyperextension w/forearm supinate

**Sprains**
- Anterior capsular sprain caused by forced hyperextension of the elbow

**Sprains**
- Signs & Symptoms
  - Sensation of “pop”
  - Point tenderness
  - Swelling
  - Decreased ROM
  - Pain and/or laxity with stress test(s)

**Strains**
- One-time episode of excessive overload or stretch
- Excessive eccentric loads

**Strains**
- Wrist flexor/pronator group
- Wrist extensor/supinator group
- Distal biceps tendon (rare)
- Distal triceps tendon (rare)

**Chronic Soft Tissue Injuries**
- Bursitis
- Tendinitis
- Epicondylitis (lateral: tennis elbow; medial: golfer’s elbow)
- Periostitis
- Valgus overload instabilities
**Bursitis**
- Fluid accumulation in olecranon bursa
- Caused by repetitive friction or direct trauma

**Signs & Symptoms**
- Large localized accumulation of fluid in the bursa
- Limited ROM
- Warm to the touch

**Tendinitis**
- Overuse injury
- Inflammatory response at tendon insertion site

**Lateral Epicondylitis “Tennis Elbow”**
- Causes
  - Repeated tension and stress on the wrist extensor & supinator groups
  - Backhand in tennis
  - Faulty mechanics
  - Inadequate muscle strength & endurance
  - Poor racket fit (improper string tension, grip size, racket weight or size)

**Epicondylitis**
- Degenerative changes
  - Lateral (tennis elbow)
  - Medial (golfer’s elbow)
    - Less common

**Lateral Epicondylitis “Tennis Elbow”**
- Signs & Symptoms
  - Gradual onset of pain along lateral epicondyle
  - Pain with gripping and wrist extensor activities
  - Pain with passive stretching
Medial Epicondylitis
“Golfer’s Elbow”

- **Causes**
  - Repeated tension or stress on the wrist flexor & pronator groups
  - Baseball pitching
  - Golf swing
  - Overhead tennis serve
  - Forehand racket motion
  - Faulty mechanics

- **Signs & Symptoms**
  - Gradual onset of pain along medial epicondyle
  - Point tenderness just distal and lateral to the medial epicondyle (common flexor tendon)
  - Pain with resisted wrist flexion & forearm pronation
  - Pain with passive stretching
  - Ulnar nerve symptoms

Traumatic Fractures

**Distal Humerus**

- Potential for neurovascular injury (peripheral nerves)

Dislocations & Subluxations

**Humeroulnar Joint**

- Posterior most common
  - Hyperextension during forced axial loading
  - Ulna & radius usually displace together
  - Potential for neurovascular injury
    - Brachial artery
    - Entrapment of medial and/or ulnar nerve

Dislocations & Subluxations

**Radioulnar Joint**

- Signs & Symptoms
  - Pain
  - Limited ROM
  - Elbow effusion
  - Inability to supinate
  - Tenderness over antecubital area
Traction Apophyseal and Epiphyseal Injuries

- “Little league elbow”
  - Repetitive valgus forces
  - Starts out as apophysitis

Osteochondral Defects

- Osteochondritis dissecans
  - Most often seen in young throwers
  - Compressive forces damage blood supply to the capitellum & radial head
  - Aseptic necrosis
  - Loose body

Bony Lesions 2° to Repetitive Stress

General Evaluation Principles

- History

General Assessment

Observation

- How athlete holds elbow
- Location and degree of swelling and discoloration
- Carrying angle
- Relationship between olecranon and epicondyles 0° to 90°
Observation

- Carrying angle
  - Cubital varus
    - “gunstock deformity”

General Assessment

Observation

- Carrying angle
  - Cubital valgus

General Evaluation Principles

Observation

- Relationship between olecranon and epicondyles 0° to 90°

General Evaluation Principles

Observation

- Swelling, deformity, discoloration
- Alignment of fingers/joint

General Evaluation Principles

Observation

- Hand/finger creases
- Size & shape of fingernails
  - Spoon shaped - fungal infections
  - Club shaped - respiratory & heart conditions
- Motion of fingers

General Evaluation Principles

Palpation

- Bony & soft tissue structures
  - Deformity
  - Crepitus
  - Warmth
  - Compare bilaterally
Wrist & Hand Injuries
- Sprains
- Strains, tendon avulsions
- Fractures
- Chronic inflammatory conditions

Wrist Sprains
- Distal radial ulnar joint
- Radiocarpal joints
- Intercarpal joints

Wrist Sprains
- Mechanism of Injury
  - Falling on outstretched hand
  - Hyperflexion
  - Hyperextension
  - “Jamming”, compressive forces

Wrist Sprains
- Signs & Symptoms
  - Pain
  - Swelling
  - Point tenderness over involved joint
  - Pain w/active and passive ROM

Finger Sprains
- “jammed” finger
- MCP, PIP, DIP

Finger Sprains
- Collateral ligaments
  - Mechanism of Injury
    - Axial force that produces valgus/varus stress
  - Volar ligaments
    - Mechanism of Injury
      - Hyperextension force
Finger Sprains

Signs & Symptoms
- Pain
- Swelling
- Point tenderness over involved joint/ligament
- Collateral sprains: pain/laxity with valgus & varus stress tests
- Volar sprains: laxity with PIP hyperextension

Evaluation
- Valgus stress test
- Varus stress test

Ulnar (medial) collateral
Radial (lateral) collateral

Management
- Collateral sprains
  - Splint until pain subsides
    - PIP: 30-40° flexion
    - DIP: full extension
    - Buddy tape for activity
- Volar sprains
  - Splint 20-30° flexion x 3 wks
  - Buddy taping

Complications
- Collateral sprains
  - Deformity
  - Loss of function
- Volar sprains
  - Swan-neck deformity
    - DIP hyperextension, PIP hyperextension
  - Pseudoboutonniere deformity
    - DIP hyperextension, PIP hyperextension

Thumb Sprains

Gamekeeper’s (Skier’s) Thumb
- Sprain of UCL of MCP

Mechanism of Injury
- Forced ABD/hyperextension of thumb

Signs & Symptoms
- Pain
- Swelling
- Point tenderness over UCL
- Pain and/or weakness with pinching (2nd or 3rd degree)
Thumb Sprains

- Management
  - Refer for x-rays
  - Partial tears
    - Splint or cast for 4-6 wks w/MCP in slight flexion
  - Complete tears
    - Surgical repair required

Muscle/Tendon Injuries

- Mallet finger
  - Rupture/avulsion of extensor tendon at DIP insertion

- Mallet finger
  - Mechanism of injury
    - Forced flexion of DIP

- Mallet finger
  - Signs & Symptoms
    - Pain
    - Point tenderness over the distal attachment
    - Flexion deformity of distal phalanx
    - Inability to actively extend DIP

- Mallet finger
  - Evaluation
    - Mallet finger test (extensor tendon avulsion test)

- Mallet finger
  - Management
    - Refer for x-rays
    - Splint DIP in extension or hyperextension x 4-6 wks
    - Splint for activity another 4 wks
Muscle Tendon Injuries

- Mallet finger
  - Complications
    - Permanent flexion deformity

Musculotendinous Injuries

- Boutonniere deformity
  - Mechanism of Injury
    - Forced flexion of PIP
  - Signs & Symptoms
    - Pain at PIP joint
    - Point tenderness near tendon’s insertion
    - Weakness or inability to extend PIP

Musculotendinous Injuries

- Boutonniere deformity
  - Rupture/avulsion of central slip of extensor tendon

Musculotendinous Injuries

- Jersey Finger
  - Rupture/avulsion of the flexor digitorum profundus
Jersey Finger
- Mechanism of Injury
  - Forced extension of flexed DIP

Signs & Symptoms
- Pain
- Swelling
- Point tenderness at insertion site of flexor digitorum profundus
- Inability to actively extend DIP

Evaluation
- Flexor digitorum profundus test

Management
- Surgical repair
- Splint/buddy tape prior to referral
  -PIP in flexion

Complications
- Loss of motion/function
- Scarring

Navicular (scaphoid) Fx
- Typical mechanism: falling on an outstretched hand
Fractures

- Navicular (scaphoid) Fx
  - Signs & symptoms
  - Evaluation

Fractures

- Distal radius fx (Colles’s fx)
  - “silver fork” deformity

Fractures

- Distal radius fx (Colles’s fx)
  - Signs & Symptoms
    - Immediate pain
    - Swelling
    - Tenderness
    - Deformity
    - Sensation changes if the median nerve is injured
  - Management

Fractures

- Navicular (scaphoid) Fx
  - Management

Fractures

- Distal radius fx (Colles’s fx)
  - Mechanism
    - Falling on outstretched hand

Fractures

- Distal radius fx (Colles’s fx)
  - Management
    - Splint
    - Refer to physician
Fractures
- Distal radius fx (Smith fx)
  - Opposite of Colles’s fx
  - Volar displacement of distal fragments

Fractures
- Distal radius fx (Smith fx)
  - Mechanism
    - Falling on back of hand
    - Hyperflexion

Fractures
- Distal radius fx (Smith fx)
  - Signs & Symptoms
    - Same as Colles’s fx
  - Management
    - Same as Colles’s fx

Fractures
- Bennett’s fx

Fractures
- Phalangeal fx

Chronic Inflammatory Injuries
- Tendinitis/Tenosynovitis
- De Quervain’s Disease
- Trigger Finger
- Dupuytren’s Contracture
- Wrist Ganglion
Soft Tissue

- Subungual hematoma

- Ganglion cyst

- Trigger finger

Questions?