Elbow Joint Anatomy

– Joint articulations
  • Humeroulnar
  • Radiohumeral
  • Radioulnar (proximal and distal)
Bone Anatomy

- **Mid-Distal Humerus**
  - Trochlea
  - Medial epicondyle
  - Coronoid fossa
  - Capitulum
  - Radial Fossa
  - Lateral epicondyle
  - Olecranon Fossa

- **Proximal Radius**
  - Head
  - Fovea
  - Radial tuberosity

- **Proximal Ulna**
  - Olecranon process
  - Coronoid process
  - Trochlear notch
  - Radial notch
Elbow ROM

Flexion & Extension Humero-Ulnar/Humero-Radial joints
- Normal (maximal): +5°-145°
- Functional: 30°-130°

Pronation/Supination Radioulnar joints
- Normal Pronation 75°
- Normal Supination 85°
- Functional: 50° for both

Elbow Resting Position (open packed)

- UH: 70° flexion, slight supination
- RH: full extension, supination
- Proximal RU: 70° flexion, 35° supination
- Distal RU: 10° supination
Elbow Closed Packed Position

• UH: full extension
• RH 90 flexion, 5° supination
• Proximal RU: 5° supination, full elbow extension
• Distal RU: 5° supination

Arthrokinematics: Humero-ulnarJt

• Humero-ulnar Joint:
  Concave trochlear notch rolls and glides on the convex trochlea

• Humero-radial Joint:
  Concave radial fovea rolls and glides on the convex capitulum
  -flexion: proximal radial glide
  -extension: posterior and distal radial glide
Arthrokinematics: Radio-ulnar Joint

**Pronation**
- Ulna and radius cross
- Ulna moves posterior/lateral
- Limited by bone on bone

**Supination**
- Radius and ulna are parallel
- Ulna moves medial and anterior
- Limited by tightening of interosseus membrane, quadrate ligament and anterior ligament of distal RU joint

Carrying Angle

Carrying angle: average 13°

--conjunct rotation of the ulna producing slight pronation in ext, slight supination in flexion
Joints of the Forearm

Radio-ulnar Joint
- Proximal radio-ulnar jt
  – lateral surface: radial head
  – medial surface: radial notch and annular ligament
- Distal radio-ulnar jt
  – Btw concave ulnar notch of radius and convex lower end of ulna
  – Joint surface enclosed by articular capsule and disc (TFCC)
- Radio-ulnar syndesmosis

Ligament Stabilizing Structures
- Anterior/Medial—UCL, Anterior Capsule, Annular Ligament
- Lateral—RCL
Joint Stabilizing Structures

Interosseous Membrane
- Stabilize the radius & ulna
- Transmit forces proximally through the ulna (20%) and radius (80%)
- Site of muscle attachments

Joint Stabilizing Structures

- Distal Radio-ulnar Joint
  Triangular Fibrocartilage Complex (TFCC)
- Articular Disc Functions:
  - Connection of Radius and Ulna
  - Separation of RU joint from RC joint
  - Provides a dual articular surface to ulna during pronation and to triquetrum during wrist ROM
Function Elbow-Forearm Muscles

**Elbow Flexors**—strength max 90-110 deg
- Biceps brachii—fast resisted
- Brachialis—primary
- Brachioradialis

- Elbow Extensors
  - Triceps brachii
  - Anconeus
Function Elbow-Forearm Muscles

• Forearm Supinators
  – Supinator—slow
  – Biceps—fast/resisted, strongest at 90 deg

• Forearm Pronators
  – Pronator teres
  – Pronator quadratus
Medical Orthopedics-Elbow

• Arterial Injury
  – Pain out of proportion to injury and associated with stretch of muscle
  – Decreased or absent pulses, changes in skin color and decreased skin temperature
• Compartment Syndrome (Volkmann’s Ischemia)
  – Pain out of proportion to injury and not relieved by immobilization
  – Swelling, numbness, weakness, tense tissues, but intact pulses and no changes in skin color
• Olecranon Bursitis
  – Inflammation of bursal sac
  – Acute onset of unexplained swelling
  – Septic (aspiration) vs. aseptic (quick resolution)

Elbow Instability

• Subluxation/Dislocation
  – M01-fall on outstretched hand or traumatic event
  – Presentation-deformity/asymmetry
  – Need to rule out vascular and neural involvement
  • Ulnar and median common w/simple dislocations, radial with complex ones involving radial head
Elbow Instability

- Fractures
  - Olecranon
    - Common in elderly
    - Need to know fracture site and/or surgical procedure for PT decision making
  - Radial head
    - Fracture MOI: axial load on pronated forearm, direct blow to elbow or hyperflexion
    - Excision: used when UCL intact
    - Replacement: may be performed if surrounding stabilizing structures are compromised

- Capitulum
  - Uncommon
  - Young makes with high force trauma or elderly females, low trauma

- Coronoid
  - Typically part of terrible triad: posterior dislocation of elbow w/fracture of radial head, olecranon or medial epicondyle

Elbow Instability

- Little Leager’s Elbow
  - Children/adolescent overhead throwers
  - Apophysitis/fragmentation due to insufficient ossification centers
  - Risk factors: # of pitches
    - < 25 pitches increased risk of elbow injury to 21%
    - 75-99 pitches = 35% risk
  - Treatment: REST, gradual return to sport, limit # pitches

- Distal Biceps Rupture
  - Males 40-60 yrs or younger athletes (weight lifters)
  - MOI: rapid, eccentric contraction of biceps with “pop”
  - Eccymosis at antecubital fossa, deformity of biceps insertion when acute
  - Surgery within 10 days
Complications of Elbow Trauma, Instability and Injury

• Elbow stiffness
  – Presentation—loss of extension, mild/mod pain, possible ulnar neuritis
  – Non-operative management
    • NSAIDs
    • Gentle mobilization
  – Operative management—failure of non-operative management, contracture for 12 months, lack of functional AROM
    • Dictated by structures involved

• Complex Regional Pain Syndrome
  – Pain disproportionate to injury
  – Intractable pain in a nonperipheral nerve distribution
  – Edema, sensory, motor changes
  – Hyperalgesia, hyperpathia, allodynia, skin changes, integumentary changes