Humeral Shaft Fractures - Approaches & Techniques

Incidence

- 3-5% of all fractures
- bimodal age distribution
  - young patients with high-energy trauma
  - elderly, osteopenic patients with low-energy injuries

Non-operative Rx

- Most humeral fractures are amenable to closed, nonsurgical treatment
  - rigid immobilization is not necessary for healing
  - perfect alignment is not essential for an acceptable result

Relevant Anatomy

- Muscles
  - insertion for
    - pectoralis major
    - deltoid
    - coracobrachialis
  - origin for
    - brachialis
    - triceps
    - brachioradialis
- Nerve - radial nerve
  - courses along spiral groove
  - 14cm proximal to the lateral epicondyle
  - 20cm proximal to the medial epicondyle
  - Radial nerve injury common for distal third fractures

Mechanism of Injury

- Direct
  - Direct blow most common cause
- Indirect forces
  - Violent muscle contraction
  - Torsion => spiral fx

Fracture Descriptors

- Location
- Pattern
- Low-energy vs. high-energy
- Open / Closed Injury

Imaging

- Standard radiographic examination
  - AP view
  - lateral view

  Include both joints

Nonsurgical Treatment

- Most humeral fractures are amenable to initial closed, nonsurgical treatment
  - rigid immobilization not necessary for healing
  - perfect alignment not essential for an acceptable result

- Closed Treatment
  - Coaptation splint for 7-10 days followed by functional brace
  - gold standard and indicated in vast majority of humeral shaft fractures
  - criteria for acceptable alignment include:
    - < 20° anterior angulation
    - < 30° varus/valgus angulation
    - < 3 cm shortening
  - Functional bracing
    - Rigid, light weight prefabricated plastic brace
    - Anterior and posterior shell, Velcro straps
    - Early application may be associated with higher percentage of healing
- Nonsurgical Treatment – Requirements
  - A cooperative, preferably upright and mobile patient
  - A dedication to close patient supervision & follow-up
  - An acceptable reduction

ORIF

- Absolute indications
  - open fractures
  - vascular injury requiring repair
  - brachial plexus injury
- Relative indications
  - ipsilateral forearm fracture (floating elbow)
  - bilateral humerus fracture
  - polytrauma or associated lower extremity fracture
    - allows early weight bearing through humerus
  - pathologic fractures
  - burns or soft tissue injury that precludes bracing
  - fracture distraction

Approaches

- Surgical approach is dependent on the fracture level and the need to visualize the radial nerve
- Anterolateral, posterior incisions most common
- Lateral and medial approaches are described but not commonly used
- Anterolateral approach is preferred for proximal third fractures
- Anterolateral and posterior approach are both adequate for midshaft and distal third fractures
- Posterior approach is preferred for distal third fractures

Anterolateral approach

- used for proximal third and midshaft fractures
- distal extension of the deltopectoral approach
- radial nerve identified between the brachialis and brachioradialis distally
- Benefits
  - Supine positioning
  - Proximal extension possible via deltopectoral interval
- Drawbacks
  - Allows for less direct exposure of radial nerve since it lies posterior to intermuscular septum

Posterior approach

- used for distal to middle third shaft fractures
- triceps may either be split or elevated off the posterior humeral shaft
- radial nerve is found medial to the long and lateral heads and 2 cm proximal to the deep head of the triceps
- radial nerve exits the posterior compartment through lateral intramuscular septum 10 cm proximal to radiocapitellar joint
- posterior antebrachial cutaneous nerve serves as an anatomic landmark leading to the radial nerve during a paratricipital approach
- Benefits of posterior approach
    - Allows more direct exposure of the radial nerve
    - Allows application of a broad plate to flat surface of distal humerus for distal third fractures
- Drawbacks to posterior approach
    - Requires lateral or prone positioning which may be problematic for polytrauma patient
    - Requires nerve mobilization for plate application, theoretically increasing risk of iatrogenic palsy

Postoperative Management

- Sling or splint for postoperative comfort
- Begin early (within 1 week) ROM
- WBAT for shaft fractures
- NWB for fractures that extend into the proximal and distal thirds

Outcomes

- High union rates (90-98%)
- Iatrogenic radial nerve palsy 2-5%
    - Often resolves in 3-6 months
    - EMG evaluation with prolonged palsy
    - Exploration and consideration tendon transfers when no fcn returns by 6 months
- Limited prolonged stiffness unless proximal and distal third