Humeral shaft Fractures

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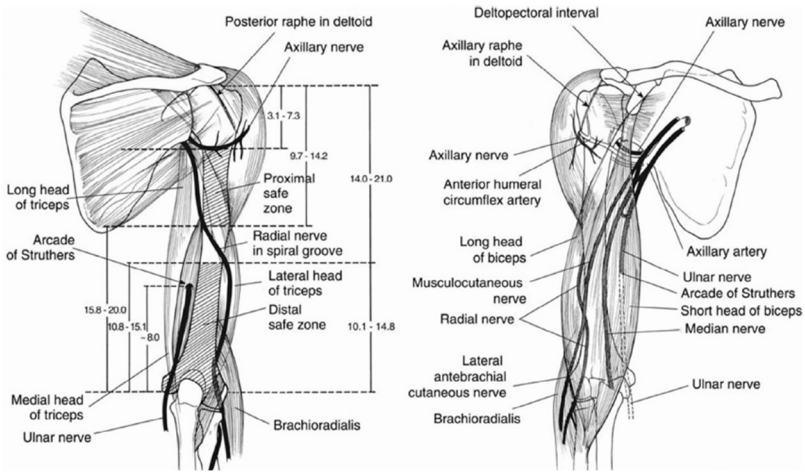
Epidemiology

Humeral shaft fractures are common injuries and account for almost 3% of all long-bone fractures. The incidence of humeral shaft fractures is approximately 13 per 100,000 persons per year. There is a bimodal age distribution wherein it occurs in young patients due to high-energy trauma and in the elderly, osteopenic patients with low-energy injuries.

Anatomy

The humeral shaft is commonly defined as the part below the surgical neck and just proximal to the epicondyles of the humerus. The shaft of the humerus is almost cylindrical in its proximal half but becomes triangular and flattened distally upon nearing the epicondyles. Proximally on the anterolateral border is the deltoid tuberosity where the deltoid muscle inserts. There is a musculospiral groove or radial groove that runs from the posterior surface and exits distally on the anterolateral aspect just distal to the lateral head of the triceps. The radial nerve and profunda artery pass within this groove. Multiple muscles insert and originate in the humeral shaft and responsible for the deforming forces of fractures. Proximally, pectoralis major, Lattisimus dorsi, and teres major muscles inserts on the intertubercular ridge of the humerus. In the middle 3rd of the medial humeral shaft, the coracobrachialis muscle inserts. Distally, the posterior, anterior, and anterolateral surfaces of the humerus serve as origins for the triceps, brachialis, and brachioradialis muscles, respectively.

Associated primary radial nerve injury rate ranges from 4% to 22% and an iatrogenic surgical injury rate of almost 3%. The radial nerve needs special attention especially during surgery. The radial nerve exits the radial groove laterally on average 12.6cm (10.1 – 14.8cm) from the lateral epicondyle and 18.1 to 20.7cm proximal to the medial epicondyle. As the radial nerve exits the spiral groove and penetrates through the lateral intermuscular septum into the anterior compartment, the nerve will be 10cm from the elbow joint. In this area, it is vulnerable to injury in the classic Holstein-Lewis humeral shaft fracture.



Mechanism of Injury

Most common mechanism is blunt/direct blow injury to the arm causing the shaft fracture and usually from trauma, such as fall and motor vehicular accidents. Spiral fracture configuration often involves an axial combined with a twisting force like a fall on an outstretched hand with the rest of the body rotating over the arm. In the elderly, fall on an outstretched arm is the most common mechanism.

Physical examination

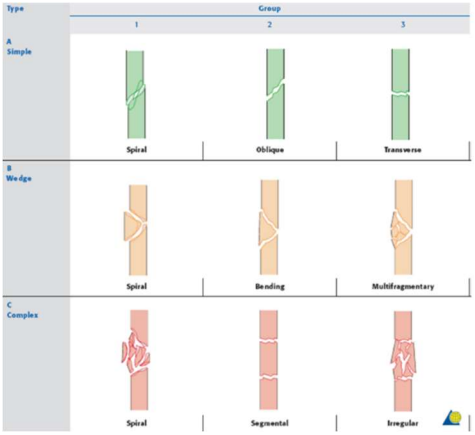
Initial examination of humeral shaft fractures follows the same principles as any other long bone fracture in the body. An adequate inspection detailing open wounds, abrasions, hematoma, and deformities should be well documented. Associated injuries in other organ systems should also be considered especially in high velocity accidents. Immediate airway access and resuscitation should be given if needed. It is critical to determine if the fracture is open or closed. Open fractures will need prompt initiation of antibiotics and urgent debridement to prevent infection.

Neurovascular examination is a must and individual peripheral nerve distributions should be evaluated, especially the radial nerve. Capillary refill time of the fingers as well as the distal pulses should also be assessed.

Gross deformities seen at initial presentation should not be mindlessly reduced without proper imaging of the fracture first. The impulsive reduction maneuver can inadvertently cause more injury in the limb. The arm should be immobilized first with a temporary splint.

Evaluation of Fracture

Routine orthogonal anteroposterior and lateral (APL) radiographic views of the whole humeral shaft should be ordered. The shoulder and elbow joints should both be visualized in the AP view. The initial radiographs should be ideally taken with doctor supervision to minimize pain for the patient and unwanted delays.



The common classification system used is the one proposed by Arbeitsgemeinschaft fur Osteosynthesefragen (AO) and Orthopaedic Trauma Association (OTA) that group the fracture depending on the fracture configuration and degree of comminution.

Management

Majority of surgeons still advocate nonsurgical treatment for closed humeral shaft fractures. The acceptable angular parameters are 20 degrees AP and 30 degrees varus/valgus angulations. A 15-degree rotational deformity and 3 cm shortening are also acceptable. Closed reduction and application of a coaptation splint is the initial mode of treatment which will be shifted to a functional brace after 2 to 4 weeks depending on the soft tissue status and if acute symptoms have subsided. The brace should be worn until fracture union at 10 to 12 weeks. Non-union rate is very low at 2%. However, recent studies comparing nonsurgical vs

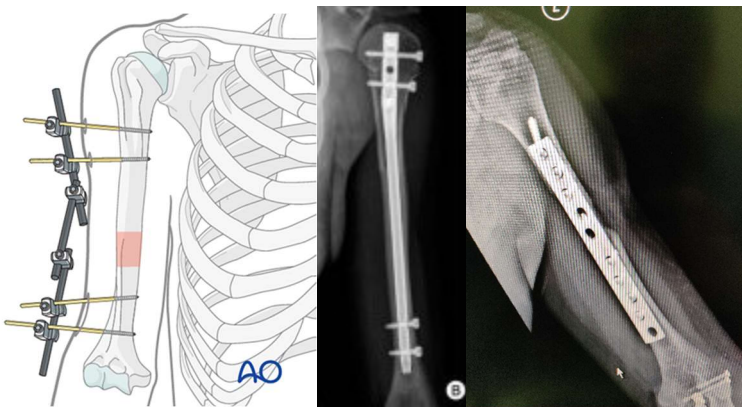
operative fixation reported that more cases of non-union were observed in the nonsurgical group.

Surgical treatment is considered in the following situations:

- Open fractures
- Unstable fracture configuration in which acceptable alignment cannot be achieved by closed means
- Documented neurovascular injuries requiring repair
- High velocity gunshot wounds
- Pathologic fractures
- Floating elbow injuries
- Intra-articular fractures
- Radial nerve injury after manipulation

The three common fixation techniques used are plates, intramedullary nail, and an external fixator for operative management of humeral shaft fractures. The external fixator is usually reserved for open fractures and as an initial temporary stabilization in polytraumatic patients (damage control orthopaedics). Intramedullary nails are gaining popularity in recent years, but comparison with plating showed more reoperations and increased shoulder pain with the use of intramedullary nails. Open reduction internal fixation (ORIF) with the use of plates is still the standard for operative management of humeral shaft fractures. Appropriate reduction and compression of the fracture site are often achieved with the use of plates. In recent years with the advent of locking plates and screws, there is now a shift to minimally invasive humeral shaft fracture ORIF surgeries.

Primary radial nerve palsies in humeral shaft fractures after traumatic injuries do not require immediate nerve exploration unless there is a high index of suspicion for a complete nerve transection. Spontaneous radial nerve recovery rate ranges from 75 to 100% but the recovery period is variable. Recovery can start as early as 2 weeks to up to 1-year post-injury.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