*OTA ANNUAL MEETING*

*OCTOBER 8, 2016*

DISTAL HUMERUS FRACTURES – TIPS AND TRICKS

Dr. Michael McKee MD FRCS(C)2

Professor, Division of Orthopaedic Surgery

Department of Surgery, Faculty of Medicine

St. Michael’s Hospital and the University of Toronto

**Introduction** Fractures of the distal humerus are increasingly common clinical problems that pose significant technical challenges to the treating surgeon. These fractures occur in adults in a bimodal fashion; elderly patients, primarily females, suffering low velocity fall-related fractures and younger patients, typically males, sustaining high velocity fractures. Both groups present treatment challenges, including open wounds, difficult exposure, significant articular involvement, and underlying osteoperotic bone. To treat these fractures effectively, it is critical to understand the underlying anatomy and anatomical concepts. While basic anatomy will not be covered in detail in this chapter, it is important to keep in mind the angular anatomy of the distal humerus for accurate reconstruction of alignment. The capitellum projects anteriorly approximately 35 to 40 degrees. The trochlea is oriented at approximately 4 to 8 degrees of valgus relative to the long axis of the humerus and internally rotated 3 to 4 degrees relative to the trans-epicondylar axis.

**Indications for Fixation** The majority of intra-articular distal humerus fractures require surgical fixation for restoration of optimal elbow function. This is due primarily to the disadvantages of non-operative treatment including elbow stiffness following prolonged immobilization, difficulty in obtaining and maintaining an adequate intra-articular closed reduction, the possibility of late displacement of fragments leading to articular incongruity and arthritis, malunion, or nonunion. A thorough pre-operative evaluation should be performed, including a detailed, documented neurovascular exam and confirmation of an intact skin barrier. The surgical technique employed is based largely on pre-operative fracture characterization. Extra-articular fractures and uni-columnar fractures are generally characterized adequately on plain films. Intra-articular fractures may benefit from computed tomography to enhance surgical planning. Three-dimensional reconstructions from CT scans are used regularly by the authors in complex C Type fractures and have been shown to increase both intra and inter-rater reliability with the AO classification system. Supplementation of plain films with pre-operative traction radiographs under general anesthesia has been advocated by some authors.

**Approach** Patient positioning, depending on associated injuries and surgeon preference, is the next consideration. The authors preference for bi-columnar fractures is the lateral decubitus position with the operative arm supported over a bolster and a non-sterile tourniquet over the proximal arm (Figure 3). This allows for a stable work surface, minimizes assistants required and allows ease of intraoperative imaging. At this point, there are a number of options for exposure of the distal humerus, which are largely based on the degree of articular involvement and the size of fracture fragments. These will be discussed. The authors preferred approach is the triceps-splitting approach.

**Reduction and Fixation** After an appropriate exposure has been performed, the fracture then requires anatomic reduction with stable internal fixation. Principles of intra-articular distal humerus fracture fixation include:

1. Anatomic articular surface reduction and fixation, creating an “articular block”
2. Stable fixation of the articular block to the humeral diaphysis
3. Plating with pre-contoured plates on each column
4. Alignment must be anatomically restored, while length may be shortened to compensate for metaphyseal communution or bone loss

Whether the plating occurs at 90 degrees (perpendicular) or 180 degrees (parallel) to each other is a current matter of controversy (Figure 6). Recent published biomechanical evidence suggests that parallel plating has a higher construct stiffness compared to perpendicular configuration in models of comminution (31, 32). Additionally, locking screw constructs performed significantly better than non-locking. We utilize a parallel plating technique with locking screws used based on underlying bone quality.

**Rehabilitation** One of the most important underlying principles of distal humerus fracture surgical fixation is stable fixation to allow early range of motion (ROM). Recent literature on complex elbow instability due to fracture demonstrates a critical period of 6 months following surgical fixation in which the majority of patients will regain functional ROM (33). Functional ROM is defined as flexion of 130 degrees, and extension of 30 degrees, making a flexion-extension arc of motion of 100 degrees. Forearm rotation is rarely affected.