CHAPTER 5
The Treatment of Distal Humerus Fractures
S.W. O’DRISCOLL

Introduction

The goal of restoring normal, pain-free elbow function after a fracture of the distal humerus requires anatomic reconstruction of the articular surface, restitution of the overall geometry of the distal humerus and stable fixation of the fracture fragments to allow early and full rehabilitation [1-7]. Although these goals are now widely accepted by the orthopedic community, they may be technically difficult to achieve, especially in the presence of substantial osteoporosis or comminution [7].

Until recently, the standard technique for fixation of distal humerus fractures has been that proposed by the AO/ASIF group [5, 7]. Their recommended technique includes fixation of the articular fragments with screws and column stabilization with two plates at a 90° angle to one another [5, 8, 9]. The limiting factor of this technique unquestionably is fixation of the distal fragments to the shaft. When this method fails, it does so because of nonunion at the supracondylar level or stiffness resulting from prolonged immobilization that has been used in an attempt to avoid failure of inadequate fixation [7]. Using these fixation techniques, different authors have reported unsatisfactory results in 20%-25% of the patients [1-6].

We have found that optimal function after fixation of distal humerus fractures can be achieved by stable fixation, even in the presence of osteoporosis or comminution, using a philosophy and technique based on principles that maximize fixation in the distal fragments and compression at the supracondylar level. The stability achieved has allowed us to routinely commence an intensive rehabilitation program 36 hours post-operatively including full active motion with no external protection.

The following discussion expands on the general principles of our current approach to these fractures, the specific technical details, the post-operative program and the potential complications.

Principles

Exposure

Accurate reduction of the articular surface of the distal humerus requires good exposure, which can be achieved with either an olecranon osteotomy or the TRAP (triceps reflecting anconeus pedicle) approach [10]. Osteotomy provides the best exposure, while the TRAP approach allows adequate exposure without the need for an olecranon osteotomy. This is especially important in older patients when elbow replacement may be necessary. With the TRAP approach, the intact proximal ulna and radial head can be used as a template against which the distal humerus can be reconstructed. In addition, the potential complications associated with olecranon osteotomies are avoided [2, 11] and the innervation of the anconeus is preserved [10].
Reconstruction

Articular Surface

The articular surface of the distal humerus should be reconstructed anatomically unless bone is missing. If bone is missing, two important principles should be taken into consideration. Firstly, the anterior aspect of the distal humerus is the critical part of the articulation that needs to be fixed in order to have a functional joint; reconstruction of the posterior half is important but not as critical. Secondly, stability of the articulation requires the medial trochlea and either the lateral half of the trochlea or the capitellum. Thus, the medial trochlea is essential in order to obtain a stable and well-aligned joint.

The articular surface is fixed provisionally with small smooth Kirschner wires. In addition, or alternatively, very small (0.035 or 0.045) threaded Kirschner wires can be placed in the subchondral bone and left in place for definitive fixation after cutting them off. No screws are placed in the distal fragments before applying the plates.

Metaphyseal Region

The metaphyseal region of the distal humerus can be fixed in two different ways. An anatomic reconstruction is desirable whenever possible. However, adequate bony contact with interfragmentary compression is necessary to ensure the stability of the construct and eventually fracture union at this level. If metaphyseal comminution precludes an anatomic reconstruction with satisfactory bony contact, the humerus can be shortened at the metaphyseal fracture site, provided that the overall alignment and geometry of the distal humerus are restored. We call this alternative reconstructive technique supracondylar shortening. This technique is especially useful in cases of combined soft-tissue and bone loss. Shortening by 1 cm or less creates no apparent loss of function, and up to 2 cm of shortening can be tolerated without serious disturbance of elbow biomechanics [12]. The details of this technique of supracondylar shortening have been published [13].

Fixation

By far the majority of fixation failures after a distal humerus fracture occur at the supracondylar level, whereas the articular fragments typically unite. Based on current practice and recommendations, this should not be surprising. Many of the fractures are dependent on only two or three screws for stability at the supracondylar level. The fixation strategy should concentrate on maximizing stability between the distal fragments and the shaft of the humerus at the metaphyseal level. These “principles” are achieved by the successful execution of the following set of eight technical objectives, each of which contributes to maximizing fixation in the articular segment and the stability between it and the shaft.

Technical objectives

Concerning screws in the distal fragments (articular segment):
– Every screw should pass through a plate.
– Each screw should engage a fragment on the opposite side that is also fixed by a plate.
– Each screw should be as long as possible.
– Each screw should engage as many articular fragments as possible.
– As many screws as possible should be placed in the distal fragments.
– The screws in the distal segment should lock together by interdigitations, thereby creating a fixed-angle structure and linkage between the two columns.

Concerning the plates used for fixation:
– Plates should be applied such that compression is achieved at the supracondylar level for both columns.
– Plates used must be strong enough and stiff enough to resist breaking or bending before union occurs at the supracondylar level.

The practical application of these principles involves “parallel” (in this case is a figure-of-speech, as both plates are actually rotated slightly posteriorly) plates that permit a total of at least four long screws to be placed in the distal fragments, from one side across the other (the plates are placed with a slight offset, postero-medially and postero-laterally) (Fig. 1). The screws placed at the epiphyseal level interlock, which links the two columns together and greatly increases the stability of the construct just as the keystone provides stability to an arch (Fig. 2). The plates must be contoured or pre-contoured to the normal geometry of the distal humerus in order to allow screw placement at the appropriate places and also not to be too prominent under the skin. We use