

The Management of Proximal Humerus Fracture

Department of Orthopaedic Surgery Chang Gung Memorial Hospital at
Kaohsiung Taiwan, ROC

Jih-Yang Ko

There has been a greater controversy about the management of fractures of the proximal humerus (5% of all fractures). In 1934, Codman suggested classification of this disease for 4 main anatomic segments: the head, the greater and lesser tuberosities, and the shaft. This was the precursor of later classifications. In 1970, Neer published his classification based on 4 main fracture fragments and the type of dislocation. He also noted the significance of greater than 10 mm separation between fracture fragments or greater than 45° fragment angulation. The AO/Association for the Study of Internal Fixation classification scheme placed greater emphasis on the humeral head blood supply.

Many articles dealing with management of the displaced fracture of the proximal humerus present varied opinions based on Neer's classification. The significant factors are poor interobserver reliability and intraobserver reproducibility. However, we think that the 4-part concept is useful in pre- and intraoperative judgment and management of the fracture if strict criteria are followed. The first such criterion is that a significant displacement of greater than 1 cm or angulation of greater than 45° must be present to be considered as a 1-part fracture. Any vague or uncertain displacement or angulation is considered insignificant. This strict criterion provides more accurate comparison of the functional result among different series and avoids unnecessary prosthesis insertion. Second, when routine AP and scapular Y or axial radiographic views provide inadequate information, a CT scan is used. It can better demonstrate the displacement and rotation and the integrity of the articular surface. MRI is sometimes used to aid in the diagnosis of occult fractures of the greater tuberosity or to assess for the presence of associated rotator cuff injuries. Arthroscopy has also been suggested as a useful tool in fully evaluating the extent of shoulder injury. Third, as mentioned by Neer, both tuberosities usually are displaced in 4-part fracture dislocations; however, in some cases the tuberosities remain together, and the head is dislocated out from under them. There is high incidence of avascular necrosis of the humeral head in these conditions that should be considered 4-part fracture dislocations.

There are some principles and management techniques that are unique to the proximal humeral fractures: (1) the rotator cuff provides a better anchor than the bony fragments for sutures or wire in osteoporotic bone, where the fracture usually occurs. Failure to repair the damaged rotator cuff may contribute to unsatisfactory results; (2) the humeral head is perfused mainly by the anterolateral ascending branch of the anterior circumflex humeral artery. Any trauma that disrupts this arterial system may lead to osteonecrosis of the humeral head; (3) the shoulder is a relatively nonweight bearing joint. The occurrence of avascular necrosis of the

humeral head does not necessarily lead to a poor result; and (4) early passive rehabilitation is necessary for a good functional result.

The choice of treatment for a proximal humeral fracture should be based on age and activity level of the patient, the presence and nature of comorbid medical conditions, the general quality of the bone, the presence of other concurrent injuries, and the type of fracture. Nonsurgical management with early supervised range of motion is the treatment of choice for nondisplaced or minimally displaced fractures. Two-part fractures of the surgical neck are the most common type of displaced proximal humeral fracture. If a closed reduction of the fracture can be obtained, stabilization with terminally threaded percutaneous pins is often advocated. However, percutaneous pin stabilization should be used with caution; maintenance of reduction with this technique is much less reliable in patients with poor bone quality. Open reduction commonly involves use of Ender nails with figure-of-8 tension banding, intraosseous sutures, or plate and screw fixation.

Two-part fractures of the greater tuberosity often occur in conjunction with a glenohumeral dislocation. After closed reduction of the glenohumeral dislocation, the tuberosity may return to its anatomic position. If superior or posterior displacement greater than 5 mm persists, open reduction and fixation of the tuberosity fragment with repair of the rotator cuff tear should be considered. Although rare, displaced lesser tuberosity fractures can be associated with posterior shoulder dislocations and may be treated by closed reduction if the articular involvement is less than 20% and the injury occurred within 2 to 3 weeks. The arm should be immobilized in neutral or slight external rotation. For defects involving 20 to 45% of the anterior head that are associated with a posterior dislocation, we prefer to use a modification of the McLaughlin procedure. The lesser tuberosity, with the attached tendon of the subscapularis, is transferred into the defect in the head and fixed with a screw or heavy nonabsorbable sutures through an anterior approach. For head defects greater than 45%, or when the dislocation is 6 months or more old and the head has softened or degenerated, we prefer to use a prosthesis.

The treatment of three- and four-part fractures of the proximal humerus is controversial. Functional results in anatomically reduced fractures were significantly better than in fractures with residual displacement. Although the techniques for reduction and stabilization of these fractures are similar to those for two-part surgical neck fractures, improved results may be achieved with minimal osteosynthesis. It is suggested that all 3-part fractures or fracture dislocations and 4-part fractures without dislocation be treated with operative reconstruction as soon as the patient can tolerate the procedure, assuming there is adequate bone quality that can withstand pin fixation. Primary prosthetic replacement for 4-part fractures generally has been reported to result in good pain relief but poor range of shoulder motion. Thus, it is worthwhile to attempt osteosynthesis in young patients with 4-part fracture dislocations of the proximal humerus. Primary prosthetic replacement should be reserved for: (1) a complex fracture in a patient with osteoporotic bone that cannot hold pins or external fixation; (2) a 4-part fracture dislocation in an older patient in whom avascular necrosis of the humeral head occurs frequently and in whom a subsequent endoprosthesis insertion is inappropriate if osteosynthesis fails; (3) a

compression fracture of the articular surface; (4) a comminuted fracture of the humeral head fragment; and (5) delayed primary operation in which the humeral head is severely absorbed.

In summary, the optimal principles of management for complex proximal humeral fractures are (1) minimal soft tissue dissection to enhance healing and to avoid the occurrence of avascular necrosis of the humeral head, (2) functional reduction and adequate fixation to provide good stability for early rehabilitation, and (3) rotator cuff repair to give the best functional results. Further advances may include the usage of growth factors or shock wave to enhance early bony union.