OPEN REDUCTION AND FIXATION OF PROXIMAL HUMERAL FRACTURES AND FRACTURE-DISLOCATIONS


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Open reduction and internal fixation was employed in the treatment of 25 severely displaced fractures and fracture-dislocations of the proximal humerus. Our aims were accurate reduction and stable fixation to allow early mobilisation and to achieve full functional recovery. In 15 fractures an AO T-plate was used and in 10 a bent semitubular plate was employed as a blade plate. Excellent or satisfactory results were obtained in all six patients with two-part fractures involving the surgical neck; in four of the five patients with three-part fractures involving the surgical neck and tuberosities; in nine of the 11 patients with fracture-dislocation; and in two of the three patients with split fractures of the humeral head. Overall results were good or satisfactory in 21 of the 25 cases. Unsatisfactory results were associated with rotator cuff damage.

There is no consensus on the best way to treat complicated fractures of the proximal humerus. Various methods of internal fixation using wires and screws (Neer 1970), plates (Kristiansen and Christensen 1986), blade plates (Bosworth 1949), external fixators (Kristiansen and Kofoed 1987) and T-plates (Paavolainen et al 1983) have been reported but none of these methods has been consistently successful. For full functional recovery anatomical reduction, stable fixation and early mobilisation are required. With these requirements in mind, we treated such fractures with AO T-plates or blade plates.

MATERIAL AND METHODS

There were 25 patients with displaced fractures of the proximal humerus or fracture-dislocations treated by open reduction and internal fixation. Two-part fractures and fracture-dislocations involving only the greater tuberosity were not included in this study since they were managed differently by a tension band technique.

An anteromedial approach was used as described by Crenshaw (1987). In fracture-dislocations and intra-articular fractures the rotator cuff was fully exposed by Cubbin's approach to allow its repair (Cubbin, Callahan and Scuderi 1934).

Two-part fractures and fracture-dislocations involving the surgical neck (Fig. 1a) were fixed with a six-hole, AO semitubular plate, bent and contoured to form a blade plate (Fig. 1b). In three-part fractures or fracture-dislocations (Fig. 2a) a four-hole AO T-plate was used (Fig. 2b). In all cases, the plate was applied lateral to the tendon of the long head of biceps (Müller et al 1979) and special care was taken to ensure that the upper end of the plate did not impinge on the acromion when the arm was abducted. AO 6.5 mm cancellous screws were used in the cancellous bone proximally and 4.5 mm cortical screws for fixation of more distal fragments. An interfragmentary lag-screw was inserted through the plate, where possible, to improve fixation (Fig. 1b). In cases of associated rotator cuff damage, a meticulous repair was performed.

The wound was closed over a suction drain and postoperatively the arm was wrapped in a velpeau bandage. Passive mobilisation of the shoulder was started 24 to 48 hours later, and active exercises were gradually introduced.

OBSERVATIONS AND RESULTS

Most of the patients were in the younger age group (20 to 40 years). Twenty-two were male and three were female. The commonest cause of injury was a road traffic accident. Left and right arms were almost equally involved. The AO T-plate was used in 15 patients and the blade plate in 10.

Results were evaluated objectively using the scoring
Fig 1a - Radiograph of a left shoulder with fracture of the surgical neck of the humerus and subluxation, six weeks after injury. Figure 1b - Three months after fixation with a bent semitubular plate, reinforced with an oblique cancellous interfragmentary screw. There is solid bony union and the result was excellent.

Table 1. Results based on fracture type

<table>
<thead>
<tr>
<th>Fracture type</th>
<th>Number of cases</th>
<th>Excellent</th>
<th>Satisfactory</th>
<th>Unsatisfactory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Two-part fractures surgical neck</td>
<td>6</td>
<td>5</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>Three-part fractures</td>
<td>5</td>
<td>-</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Fracture-dislocations</td>
<td>11</td>
<td>4</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>Split fractures of the head</td>
<td>3</td>
<td>-</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

Fig. 2a - Radiograph of a right shoulder with an intra-articular three-part fracture, two weeks after injury. Figure 2b - Six months after fixation with a four-hole AO T-plate and cancellous screws. There is solid bony union and the result was good.
system of Neer (1970) which employs a maximum of 100 units, distributed as follows: pain, 35; function, 30; range of motion, 25; anatomy, 10. An excellent score is 90 or more; satisfactory, 80 to 89; unsatisfactory, 70 to 79; and a failure scores less than 70 units. An analysis of our results is shown in Table I. Overall results were excellent or satisfactory in 21 out of 25 cases (84%).

Unsatisfactory results were in cases of intra-articular fracture or fracture-dislocation where either meticulous reconstruction of the rotator cuff could not be done or early motion could not be instituted.

We had no major complication such as osteomyelitis, avascular necrosis or nonunion. Technical problems like high positioning of the plate, unstable fixation, or screws penetrating the joint cavity were avoided. Two patients in the older age group, one with an intra-articular fracture and one with a fracture-dislocation, developed severe periarthritis with limitation of range of motion. The lower fragment was fixed in 10° to 15° internal rotation in two cases and this led to some limitation of external rotation. Bicipital tendinitis was encountered in one case.

DISCUSSION

The shoulder is especially susceptible to stiffness following injury because of the formation of adhesions. Early mobilisation prior to maturation of adhesions around the joint’s gliding surfaces is, therefore, an essential step in the management of proximal humeral fractures. The AO T-plate or blade plate, properly applied, achieves fixation stable enough to allow immediate mobilisation.

In this group of 25 patients we achieved excellent or satisfactory results in 21 (84%), an improvement over some previously reported series. Paavolainen et al (1983) reviewed 41 cases of which 74.2% were excellent or satisfactory; Kristiansen and Christensen (1986) obtained 49% good results.

We attribute the successful results in part to the avoidance of technical errors, like high positioning of the plate, an unstable osteosynthesis, and penetration of the joint by screws. We think it important to use 6.5 mm cancellous screws for fixation in the epiphysial and metaphysial areas. Meticulous repair of the rotator cuff is mandatory when it is damaged and personally supervised postoperative exercises must be started early.

Our results were better if the rotator cuff was either not damaged or was meticulously repaired.

The 4% infection rate in our series is comparable to the 2.5% of Paavolainen et al (1983). In our series no patient had nonunion or avascular necrosis nor have these complications been reported by others (Bosworth 1949; Paavolainen et al 1983; Kristiansen and Christensen 1986). Variations in the range of motion recovered depended upon the type of injury, age, delay between injury and operation and the rigour of the exercise programme, but in no case was the postoperative score less than 70 despite the cases of periarthritis.

We conclude that two-part, displaced fractures of the surgical neck treated by early open reduction and fixation with a blade plate heal with full functional recovery except for a variable degree of restriction of external rotation. Intra-articular fractures and fracture-dislocations, treated by anatomical reduction, stable fixation with a T-plate, careful repair or reconstruction of the rotator cuff and an early start to physiotherapy, also have satisfactory results but with some degree of limitation of range of motion.

No benefits in any form have been received or will be received from a commercial party related directly or indirectly to the subject of this article.

REFERENCES


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