IATROGENIC DISPLACEMENT OF FRACTURE-DISLOCATIONS OF THE SHOULDER

A REPORT OF SEVEN CASES

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We report seven cases in which open or closed reduction of a shoulder dislocation associated with a fracture of the humeral neck led to displacement of the neck fracture. Avascular necrosis of the humeral head developed in all six patients with anatomical neck fractures. All five anterior dislocations also had a fracture of the greater tuberosity and both posterior dislocations had a fracture of the lesser tuberosity. The neck fracture had not initially been recognised in three of the seven cases.

In five cases attempted shoulder reduction led to complete displacement of the head segment, which was treated by open reduction and minimal internal fixation. In the other two cases, shoulder reduction caused only mild to moderate displacement which was accepted and the fracture was treated conservatively. We conclude that biplane radiography is essential before reduction of a shoulder dislocation. Neck fractures must always be ruled out, especially where there are tuberosity fractures.

In our series, careful closed reduction under general anaesthesia with optimal relaxation and fluoroscopic control did not prevent iatrogenic displacement. Prophylactic stabilisation of the neck fracture should be considered before reduction of such a fracture-dislocation. It may be, however, that the prevention of displacement by prophylactic stabilisation does not always prevent late avascular necrosis; we observed this in one case.

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Dislocation of the shoulder is common and may be associated with a variety of complications. These include crush fracture of the humeral head (Rowe, Patel and Southmayd 1978), fracture of the glenoid rim (Aston and Gregory 1973), neurovascular injury (Pasila et al 1978; Gugenheim and Sanders 1984), rupture of the rotator cuff (Pasila et al 1978; Tijmes, Loyd and Tullos 1979), and fracture of the tuberosities (McLaughlin 1963; Neer 1970). Associated fractures of the neck of the humerus are rare, but we have seen seven cases in which there was secondary displacement during attempted reduction of the shoulder.

PATIENTS AND METHODS

We reviewed three women and four men, with an average age of 51 years (27 to 70), in whom a primarily recognised or unrecognised humeral neck fracture displaced during reduction of a traumatic shoulder dislocation (Table I). Three of these patients were referred after attempted reduction elsewhere had led to fracture displacement, four had been treated initially at our hospital.

The fracture was at the anatomical neck in six patients and the surgical neck in one. The five patients with anterior dislocations all had additional fractures of the greater tuberosity, and the two with posterior dislocations had an additional fracture of the lesser tuberosity (Fig. 1).

Fracture displacement occurred during attempted closed reduction under sedation in three patients, during closed reduction under general anaesthesia with complete relaxation in three (Fig. 2) and during attempted open reduction under general anaesthesia in one.

In two cases, including the only surgical neck fracture, the displacement was slight and was treated by support in a sling for three weeks. The other five fractures were all severely displaced and were treated by open reduction with minimal soft-tissue dissection and minimal internal fixation, not using plates (Gerber, Mast and Ganz 1990) (Fig. 3). Open reduction was part of the primary procedure in one patient, and was performed under the general anaesthetic given for attempted closed reduction. The other three patients had open reduction and internal fixation for iatrogenic displacement soon after transfer from other hospitals.

Fig. 1a

Fig. 1b

A traumatic posterior shoulder dislocation in a 27-year-old woman with a fracture of the lesser tuberosity and a slightly displaced neck fracture. Reduction was attempted under general anaesthesia with complete relaxation and fluoroscopic control.

Fig. 2a

Fig. 2b

Despite very careful reduction the humeral head was displaced.

Fig. 3a

Fig. 3b

Fig. 4

Figure 3 – Open reduction and internal fixation was performed. Figure 4 – Complete avascular necrosis with collapse of the humeral head ensued.

Table I. Details of seven patients with iatrogenic displacement of a fracture during reduction of a shoulder dislocation

Case	Sex	Age (yr)	Original injury*	Primary treatment	Final treatment	Avascular necrosis
1	M	79	Anterior dislocation Fractures AN, GT	Closed reduction under GA†	Conservative	Yes
2	M	73	Anterior dislocation Fractures AN, GT	Closed reduction under sedation	ORIF with screws	Yes
3	M	46	Anterior dislocation Fractures AN, GT	Closed reduction under sedation	Open reduction Ender nails	Yes
4	F	57	Anterior dislocation Fractures AN, GT	Closed reduction under sedation	Open reduction K-wires	Yes
5	F	46	Anterior dislocation Fractures AN, GT, LT	Open reduction under GA	ORIF with K-wires	Yes
6	F	27	Posterior dislocation Fractures AN, LT	Closed reduction under GA	ORIF with K-wires	Yes
7	M	29	Posterior dislocation Fractures SN, LT	Closed reduction under GA	Conservative	No

* associated fractures: AN, anatomical neck; SN, surgical neck; GT, greater tuberosity; LT, lesser tuberosity

† general anaesthesia

RESULTS

Conservative management. In one patient with anterior dislocation and a mildly displaced anatomical neck fracture, displacement later increased and there was complete avascular necrosis of the head of the humerus. In another with posterior dislocation and a *surgical* neck fracture, the fracture healed with mild displacement and avascular necrosis did not develop. This patient had the only satisfactory outcome in the series.

Open reduction and minimal internal fixation. All five patients treated in this way had a poor clinical outcome, with pain and disability due to radiologically proven avascular necrosis and collapse of the humeral head (Fig. 4).

DISCUSSION

Some 80% of all fractures of the proximal humerus are undisplaced (Neer and Rockwood 1984) and do not require reduction. If such a fracture, however, is associated with shoulder dislocation, there is danger of increasing the displacement during reduction. This iatrogenic injury is rare: De Mourgues et al (1965) described four cases and Ferkel, Hedley and Eckardt (1984) another two. These six cases were all anterior fracture-dislocations with fractures of the greater tuberosity. Razemon and Baux (1969), who reviewed 1415 fractures and fracture-dislocations of the proximal humerus, concluded that iatrogenic displacement of a neck fracture occurs only very rarely in association with fracture-dislocations of the greater tuberosity.

The neck fracture was not initially diagnosed in three of our seven cases and both of the cases reported by Ferkel et al (1984). This shows that adequate radiographs and careful study of them are mandatory *before* reduction of the

shoulder is attempted. In all four cases in which the fracture was diagnosed, two films taken at right angles to each other were available before the attempt at reduction. A true anteroposterior and a true lateral view (the trauma series of Neer and Rockwood (1984)) is usually adequate, but we now routinely add an axillary lateral film taken with the patient supine and the arm held in slight abduction by the surgeon. This does not appear to cause any displacement. This third view is not always necessary, but should be added if there is any suspicion of a neck fracture. An important finding is that in all 13 reported cases there was an associated tuberosity fracture: this finding should warn the surgeon to rule out an additional fracture through the anatomical or the surgical neck of the humerus.

If an undisplaced neck fracture is not diagnosed, it seems likely that conventional reduction of the dislocation will cause displacement. We reviewed the radiographs of 114 consecutive primary shoulder dislocations, and found none with an undisplaced neck fracture. We have not seen any other such case, nor are we aware of any reported in the literature. De Mourgues et al (1965) suggested that such a fracture-dislocation should be reduced under general anaesthesia with one assistant providing longitudinal traction on the arm, one exerting lateral counter-traction at the proximal humerus, and the surgeon reducing the head by direct local pressure; but they did not report experience of the method. Ferkel et al (1984) also recommended closed reduction under general anaesthesia with full relaxation and fluoroscopic control, but reported no cases.

We have now reduced four such cases under optimal relaxation and fluoroscopic control; we caused moderate to severe displacement of the fracture in all four cases. We now believe that the best treatment may be prophylactic surgical

stabilisation of the neck fracture in situ before gentle reduction of the shoulder under optimal relaxation. We have treated only one patient in this manner, and were able to prevent displacement of the neck fracture. Three years later, however, the shoulder showed partial avascular necrosis, and therefore even this method of treatment may not guarantee a satisfactory long-term outcome. It may be that injuries to both the anterior circumflex (arcuate) artery and the intraosseous anastomoses cause avascular necrosis even in the absence of secondary displacement of the head caused by a reduction manoeuvre (Gerber, Schneeberger and Vinh 1990; Brooks, Revell and Heatley 1993). It seems possible that hemiarthroplasty should be considered as initial treatment.

In cases in which a neck fracture is displaced during closed shoulder reduction, the choice of management is difficult. We found that open reduction and internal fixation led to avascular necrosis and severe collapse of the head in all six of our cases, despite careful protection of the remaining blood supply to the head throughout the operation. These results lead us to conclude that such a fracture displacement in a dislocated shoulder may be better treated by prosthetic head replacement instead of open reduction and internal fixation.

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