FRACTURES OF THE CORACOID PROCESS

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We have reviewed 12 fractures of the coracoid process. In two of these patients the fracture extended into the body of the scapula and resulted in displacement of the glenoid. In some cases, there were associated acromioclavicular and glenohumeral dislocations or fractures of the clavicle and the acromion. Two patients required internal fixation to restore congruence of the glenoid; the others were treated conservatively with success.

We present a new classification of coracoid fractures which helps in their management.

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Fractures of the coracoid are uncommon, occurring in about 2% to 5% of all scapular fractures (Wilber and Evans 1977; Ada and Miller 1991). They are caused by direct trauma (Boyer 1975; Sandrock 1975; Froimson 1978) or by avulsion, either by the coraco-clavicular ligaments during an acromioclavicular dislocation (Benton and Nelson 1971; Protass, Stampfl and Osmer 1975; Smith 1975; Wolf, Shoji and Chuinard 1976; Montgomery and Loyd 1977; Lasda and Murray 1978; Ishizuki et al 1981) or by violent contraction of the attached muscles (Rounds 1949). Isolated cases have been reported of fracture of the coracoid process during dislocation of the shoulder (Bencheritri and Friedman 1979; Wong-Pack, Bobechko and Becker 1980). This may impede joint reduction (Wong-Chung and Quinlan 1989) and be associated with a fracture of the clavicle (Martín-Herrero, Rodriguez-Merchan and Munuera-Martínez 1990; Baccarani, Porcellini and Brunetti 1993).

Fractures are most common at the base of the coracoid, but injuries have been described at the distal half (Benton and Nelson 1971) and through the coracoid epiphysis (Montgomery and Loyd 1977). Avulsion injuries extending into the superior body of the scapula have also been reported (Wolf et al 1976; Ishizuki et al 1981).

The upper glenoid fossa and the upper scapular border develop from the same epiphysis, which is separate from the main body of the scapula. A force directed into the upper glenoid may therefore cause a transverse fracture which extends through the physisal scar to involve the superior border of the scapula, the type-III fractures of the glenoid fossa of Goss (1992). This displaces both the coracoid process and the superior articular surface of the glenoid, and force sufficient enough to fracture the coracoid may also cause a displaced fracture of the glenoid (Martín-Herrero et al 1990).

We describe our experience of coracoid fractures and stress the potential severity of fractures of its base which extend into the scapula and displace the glenoid. We propose a new classification of fractures involving the coracoid process.

PATIENTS AND METHODS

From 1989 to 1993, 12 patients were treated with fractures of the coracoid process. There were eight men of mean age 31 years (23 to 46) and four women of mean age 41 years (27 to 85). The injuries were caused by direct trauma to the front or side of the shoulder in two patients, a fall in seven and a road-traffic accident in three. Associated injuries included dislocation of the acromioclavicular joint in three patients, and in one patient each glenohumeral dislocation, fracture of the acromion and fracture of the clavicle. In one patient (case 5), the diagnosis was made from an isotope bone scan for unexplained pain.

Nine patients (75%) were managed with a broad arm sling, analgesia and early shoulder mobilisation; eight of them regained normal shoulder function, but the other was an elderly patient who had abduction restricted to 90°. One patient required open reduction of a dislocated shoulder because the fractured base of the coracoid impeded closed reduction and required screw fixation. The management of three patients is described below.

Case 1. A 27-year-old woman sustained repeated blows on her left shoulder during an assault and presented with anterolateral pain in a grossly swollen and bruised shoulder. A discrete tender mass was palpable anterior to the shoulder, her acromioclavicular joint was dislocated but reducible and she had hypoesthesia in the distribution of the axillary nerve. Anteroposterior and scapular radiographs showed a displaced fracture at the base of the coracoid which extended into the glenoid fossa. There was also an...
Figure 1 – An anteroposterior view shows a coracoid fracture, which was more obvious when the X-ray beam was tilted 45° in a cephalic direction (case 1). Extension into the glenoid is seen clearly. An acromioclavicular separation has been reduced, and there is an undisplaced fracture of the acromion (arrow). Figure 2 – CT confirms the intra-articular extension of the fracture.

The coracoid fracture was exposed through an anterior deltopectoral approach. The coracoacromial and coraco-clavicular ligaments were intact. A small transverse incision in subscapularis allowed inspection of a transverse fracture line across the glenoid between its upper and middle thirds. Traction on the arm displaced the fracture, but after accurate reduction of the intra-articular component had been achieved the coracoid fracture was fixed by two 35 mm AO small-fragment cancellous screws.

Gentle passive and active shoulder exercises were started after three weeks. The axillary nerve palsy recovered and there was no evidence of injury to the suprascapular nerve. Full shoulder movements were restored within six weeks.

Case 2. A 23-year-old male pedestrian was rendered unconscious by a direct blow to the head and the left shoulder after colliding with a bus. On admission he was...

Figure 3 – A fracture of the coracoid process extends into the superior body of the scapula and the glenoid. There is an associated fracture of the clavicle (case 2). Figure 4 – CT confirms involvement of the glenoid fossa.
conscious with a Glasgow coma scale of 15 and had an obvious fracture of the middle of the clavicle, but no neurovascular injury. Radiographs showed the displaced clavicular fracture and a fracture of the coracoid extending into the superior border of the scapula and the glenoid (Fig. 3). CT of the shoulder confirmed the intra-articular extension of the coracoid fracture (Fig. 4), but three-dimensional reconstruction was again unhelpful.

The fracture was exposed through a deltopectoral approach and the glenohumeral joint inspected. The intra-articular fracture was reduced and the coracoid fracture was fixed using a single large-fragment 35 mm cancellous screw placed through the base of the coracoid into the body of the scapula taking care not to penetrate the glenoid fossa. The clavicle was fixed with a six-hole plate. Active movements started after three weeks of passive exercises and a full range of shoulder movement was regained by nine weeks.

Case 3. A 17-year-old man was driving a fork-lift truck when it overturned falling on top of him and trapping his right arm. Among his other injuries was a fracture through the base of his right coracoid process, well shown on a scapular view (Fig. 5). It was treated conservatively, using a broad-arm sling, and he was allowed to mobilise the shoulder actively as comfort permitted.

**Classification and mechanisms.** Fractures of the coracoid can usefully be subdivided into the five types shown in Figure 6 with subgrouping as A or B according to the presence or absence respectively of associated injuries to the acromioclavicular joint which affect scapular stability.

On our classification, type-I, type-II and type-III fractures are probably caused by traction forces from the attached tendons or ligaments. Types IV and V are more severe. They probably result from shearing forces either when the scapula is forced inwards by a lateral blow on the humeral head or when the clavicle makes direct contact with the coracoid, as is sometimes indicated by contusions on the anterior and lateral aspects of the shoulder.

**DISCUSSION**

Most reports of coracoid fractures have been of isolated cases, and we believe that we have collected one of the largest series to be published in English. Coracoid fractures are included in various classifications of scapular fractures, such as the type-IC fractures of Ada and Miller (1991). We propose a more precise classification to help to identify patterns and assist rational management.

Only conservative treatment is needed for most cases although internal fixation is often recommended especially when there is an associated acromioclavicular separation. Pseudorupture of the rotator cuff due to haemorrhage into the muscles may produce temporary paralysis (Neviser 1956) and damage to the suprascapular nerve may also impede cuff function and affect diagnosis. Most scapular fractures make a full functional recovery, but when the

**Fig. 5**

A scapular view clearly shows a fracture through the base of the coracoid process (case 3).

**Fig. 6**

Classification of coracoid fractures: type I, tip or epiphyseal fracture; type 2, mid-process; type 3, basal fracture; type 4, superior body of scapula involved; type 5, extension into the glenoid fossa. The suffix A or B can be used to record the presence or absence of damage to the clavicle or its ligamentous connections to the scapula.
glenoid, acromion or coracoid process is involved, there may be poor results in up to 90% of patients (Wilber and Evans 1977).

We suggest that undisplaced fractures and displaced fractures of types I, II and III can be successfully treated conservatively as agreed by others (Urist 1946; Rounds 1949; Boyer 1975; Protass et al 1975; Montgomery and Loyd 1977; Froimson 1978; Lasda and Murray 1978; Carr and Broughton 1989; Martín-Herrero et al 1990; Gill and Haydar 1991). We recommend surgical stabilisation for type-IV and type-V fractures which involve the base of the coracoid, and either the body of the scapula or the glenoid fossa. Other indications for surgery are dissociation of the scapula and clavicle, caused by acromioclavicular dislocation or clavicular fracture (Barentsz and Driessen 1989) and obstruction to the shoulder reduction due to the coracoid fragment (Wong-Chung and Quinlan 1989).

Careful preoperative assessment is essential to identify any intra-articular extension of an apparently uncomplicated fracture. The coracoid view directed 45° in a cephalic direction gives clearer views than plain posteroanterior radiographs (Froimson 1978). Fractures of the coracoid must be distinguished from anatomical variations such as the persistence of the ossification centre known as the infrascapular bone (Wilber and Evans 1977). CT helped to show the extent of the intra-articular involvement in two of our cases although three-dimensional reconstruction failed, presumably because of the thickness of the slices (4 mm cuts with 3 mm table movement) and the orientation of the fracture lines to the scanner. Finer slices would have enhanced the image. An isotope bone scan identified an unsuspected coracoid fracture in one elderly patient.

The use of screws to stabilise a coracoid fracture has been described (Wong-Chung and Quinlan 1989). We found that a single large-fragment cancellous screw, inserted through the mid-part of the coracoid process, was useful in aiding reduction before fixation, and helped to avoid risk to the suprascapular neurovascular bundle. A small transverse incision in the subscapularis will allow good visualisation of the glenoid to ensure adequate reduction of the intra-articular component of the fracture.

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REFERENCES


