OS ACROMIALE: ANATOMY AND SURGICAL IMPLICATIONS

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We examined 270 scapular bones and found an incidence of os acromiale of 8.2%. In most cases, the free fragment was approximately one-third of the overall length of the acromion, and included the acromioclavicular facet and the principal areas of attachment of the coracoacromial ligament. Two-thirds of the specimens showed a distinctive pattern of osteophytic lipping.

Based on this study, we devised operative procedures for symptomatic patients, and operated upon seven, with good results in six.

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The presence of an os acromiale is usually an incidental finding on an axillary radiograph (Fig. 1a), and has been reported to occur in 1% to 15% of shoulders (Liberson 1937b). The incidence of symptoms caused by an os acromiale is unknown, but there is a well-documented association with localised degenerative changes and impingement syndromes (Norris et al 1983), and with rotator-cuff tears (Mudge, Wood and Frykman 1984). When symptomatic, the surgical management is controversial (Neer 1990).

MATERIALS AND METHODS

It has been our privilege to examine 350 scapular specimens from three separate archaeological sites in Israel. Of these, 190 were well preserved and were from mature individuals aged between 30 and 60 years (Içcan and Loth 1986). We also studied 80 specimens from dissecting-room cadavers, making a total of 270 scapulae. Our clinical experience is based on seven patients with symptomatic os acromiale, who had been operated upon over the past 3.5 years.

Specimens. An os acromiale was present in 22 of the 270 mature bony specimens (8.2%) (Fig. 2). This figure is similar to those quoted for dissection specimens (Liberson 1937b), but higher than those from radiographic studies. Most radiographic studies, however, have been based on standard anteroposterior films which often fail to show the lesion (Fig. 1b) (McClure and Raney 1975). We found bilaterality in five paired specimens (ten of the 22 shoulders), but we cannot give an accurate incidence since both scapulae of an individual were not always preserved or available in our dry specimens.

Degenerative changes were present at the site of the nonunion in 12 of our 22 specimens. These were usually on the proximal acromial fragment which showed

Fig. 1a

Fig. 1b

Figure 1a – Axillary radiograph showing an os acromiale. Figure 1b – Anteroposterior view of the same shoulder. The defect cannot be seen.
downward 'lipping' or a degenerative ridge of bone more prominent medially (Fig. 3). Similar, but less marked degenerative lipping was present on the adjacent areas of the distal free fragment in four specimens.

The undersurface of the distal fragment was scored with longitudinal ridges and indentations indicating that it served as the main area of insertion for the coracoacromial ligament (Ogata and Uhthoff 1990). The undersurface of the proximal acromion showed few such ridges. The cap-shaped form of the os acromiale was very similar in nearly all the specimens (Fig. 4) as were the shapes of the acromial bases. The one exception is shown in Figure 5. The maximum length of the other acromial fragments varied from 1.4 to 2.6 cm, and all but one were approximately one-third of the length of their respective acromions (Fig. 6).

The facet of the acromioclavicular joint was located...
The os acromiale fragment, whether large or small, measures approximately one-third of the overall length of the acromion of which it is part.

Cadaver specimen showing nonunion through the acromioclavicular joint. One-third of the joint is on the proximal fragment.

on the os acromiale in 20 of our 22 specimens, again with the exceptions of the small fragment in Figure 5 and the dissected specimen in Figure 7 in which the line of nonunion crossed the proximal third of the facet.

DISCUSSION

The anatomy and development of unfused apophyses of the acromion were discussed in the French and German literature in the early part of this century (Folliasson 1933; Schär and Zweifel 1936) and expanded upon in English by the radiologist Liberson (1937b). It was suggested that there were two or sometimes three distinct and separated centres called the meta-acromion, meso-acromion, and pre-acromion, arranged as shown in Figure 8. The size and shape of the acromial fragment were thought to depend on which of these three segments failed to unite to its proximal base. These ideas, derived principally from radiographic studies, have persisted into the current orthopaedic literature (Post 1988; Neer 1990; Rockwood and Matsen 1990). No evidence, however, has been presented from bony specimens or anatomical dissections to confirm this and we have found no supporting evidence.

The acromial apophysis is in fact one continuous cartilaginous cap which covers the scapular spine. It develops an ossification centre or centres which spread out and replace the cartilage anlage (Fig. 9). Once understood, this can be appreciated on radiographs, especially on axillary or modified oblique views (Liberson 1937a) of children in their early teens (Fig. 10). There appears to be a separate apophyseal centre for the acromial facet of the acromioclavicular joint (see Figs 9 and 10).

The shape and relative size of the os acromiale were
relative constant, but radiographs, unless they are positioned to compensate for the slope of the acromion (Edelson and Taitz 1992), tend to exaggerate the size of the fragment.

Clinical relevance. There is lack of guidance in the surgical literature on how to treat patients with symptomatic os acromiale. These patients usually have associated rotator cuff or impingement problems. It is generally recommended that 'small' acromial fragments should be excised, and that 'large' ones should be fused (Post 1988).

Fusion is sometimes difficult to accomplish (Neer 1990) and also precludes the acromioplasty and subacromial decompression which these patients usually require.

Twenty-one of the 22 acromial fragments in our dry bone and cadaver specimens formed about one-third of the length of the acromions from which they came, thus very large or very small fragments are extremely rare. Nearly all acromial fragments therefore should be amenable to excision, especially when decompression is also needed.

We have performed excision in five patients by a modification of the technique recommended by Bosley (1991) for total excision of the acromion (Fig. 11). Coincident rotator-cuff tears in all five cases were readily exposed and repaired through the deltoid-splitting element of the incision, which is more laterally placed than in the standard approaches (Neer 1972). To complete the decompression the osteophyte on the proximal acromial fragment was excised. The superior aspect of the distal clavicle was preserved to leave soft-tissue attachments for secure deltoid reconstruction, but its undersurface may be bevelled to improve the decompression. Post-operatively, patients were immobilised for six weeks in a cast or abduction brace.

We have also treated two patients with os acromiale who did not require subacromial decompression. They complained of local tenderness; no rotator-cuff pathology was demonstrable on arthrography or arthroscopy. Fusion was chosen in order to retain optimal deltoid function (Fig. 12). The first patient was a 26-year-old woman who had previously undergone biopsy of the cystic lesions seen on the CT scan (Fig. 13). The second patient was a 35-year-old woman who had suffered a displaced fracture of her os acromiale in a fall that had also caused an anterior dislocation of her shoulder. She had an undisplaced, asymptomatic os acromiale on the opposite side (Dennis, Ferlic and Clayton 1986). No prominent lipping of the proximal fragment was palpated at the time of surgery in either of these patients.

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CT scan of a 26-year-old woman who had a locally painful os acromiale. The cystic lesions on either side of the growth plate were biopsied and then fusion was performed by the technique illustrated in Figure 12.

The malleolar screw fusion in both of these cases was supplemented by locally harvested bone-graft shingles (Fig. 12) placed across the defect. Insertion of the screw and washer was facilitated by blunting the tip of the acromial fragment with a rongeur. In both patients, the screws were removed; one at nine months and one at one year after surgery when union had occurred.

At a follow-up of 18 to 40 months, six of our seven patients were satisfied with their results. The shoulders treated by fusion had normal ranges of motion. Those treated by decompression and rotator-cuff repair had an average 150° of forward flexion in the scapular plane, internal rotation to the belt line, and external rotation which averaged 45°.

The single failure in our series was in a well-muscled, 70-year-old man with an irreparable rotator-cuff tear and an intra-articular rupture of the long head of the biceps. We excised the os acromiale and a 2 cm portion of the distal clavicle; this was early in our series before we appreciated the need to retain this. After operation, his severe pain was completely relieved but he was unable to forward-flex his arm. This shows that extensive de-roofing should be avoided, especially when the rotator cuff cannot be reconstructed. Preservation of an arch allows secure deltoid reattachment, and also ensures that the humeral head cannot ride up into a large iatrogenic defect. When there is a coexistent irreparable rotator-cuff tear, we would now prefer os acromiale fusion, with judicious burring of the undersurface. Where indicated, this may be combined with humeral head hemiarthroplasty (Pollock et al 1992) or a debridement procedure (Rockwood and Matsen 1990).

We cannot advocate these operative procedures on the basis of a large series or a long follow-up. We present them for consideration in the light of the paucity of information in the literature and on the basis of our anatomical studies. The treatment of symptomatic os acromiale by arthroscopic subacromial decompression with or without accompanying rotator-cuff repair has recently been reported (Armengol-Barrallet et al 1993), but we have no experience with this method.

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