# Relationship between os acromiale and acromioclavicular joint anatomic position

Stefano Gumina, MD, Pierfrancesco De Santis, MD, Matteo Salvatore, MD, and Franco Postacchini, MD, *Rome, Italy*

*Most of the orthopaedic literature on os acromiale is focused on the clinical implications, such as impingement and rotator cuff tears; although os acromiale is present in 8% of subjects, scarce information is reported on the causes that may predispose patients to it. Our aim is to investigate whether the origin of os acromiale is related to the position of the acromioclavicular (AC) joint. The acromions of 211 volunteers (control group) and 33 subjects without or with os acromiale were radiographically (axillary view) classified by the Edelson and Taitz method. The method distinguishes the acromion into three types on the basis of the distance between the anterior aspect of the acromion and the AC joint. Of 33 subjects with os acromiale, 11 were without pain. We have compared the frequency of the three types of acromion observed in the two investigated cohorts. Half of the acromions of the control group (52.1%) had the articular facet of the AC joint on the acromion tip, whereas in 45.4% the facet tip was located distally. On the other hand, of 33 subjects with os acromiale, 18.1% and 81.1%, respectively, had the AC joint lying on or distal to the acromion tip. Our data suggest that the greater the distance of the AC joint from the anterior edge of the acromion, the higher the likelihood of an os acromiale. (J Shoulder Elbow Surg 2003;12:6-8.)*

Around age 15 years, ossification centers of the acromion begin to appear and usually fuse by age 25 years; failure of fusion is responsible for an os acromiale. Recent literature data show that about 8% of scapulae have an os acromiale.[5,10,12] Despite its high occurrence, scarce information is available on the causes predisposing persons to os acromiale. In fact, many authors have principally investigated (1) clinical implications related to the unfused and possibly unstable (ie, subacromial impingement syndrome and rotator cuff tear)[8,9,11,14]; (2) treatment in symptomatic cases, including excision of preacromion, arthroscopic subacromial decompression,[14] and open reduction and internal fixation of the mesacromion with or without autogenous bone grafting[6,13]; and (3) the open surgical approach (ie, anterior deltoid off or transacromial approach).[6]

At present, we know that os acromiale more frequently occurs in men than in women and in blacks than in whites.[12] Furthermore, in an osteologic study performed in a life stresses–restricted community, a separate ossicle was observed in 30% of samples,[1] suggesting that os acromiale may be genetically transmitted or related to heavy manual labor started before skeletal maturity is reached.

The hypothesis that os acromiale may depend on morphologic or morphometric characteristics of the acromion has to be elucidated again. Our purpose is to investigate whether the position of the acromioclavicular (AC) joint, with respect to the anterior edge of the acromion, may affect the coalescence between the ossification centers and the remaining posterior portion of the acromion.

## MATERIALS AND METHODS

Our series is composed of 33 os acromiale; 31 were classified as mesacromion and 2 as preacromion. Twenty-two cases (sixteen male patients and six female patients) were symptomatic white patients who were examined from 1997 to April 2001; the remaining 11 cases (9 male patients and 2 female patients) were from a group of 222 white adult asymptomatic volunteers (131 male patients and 91 female patients) submitted to radiographic examinations of the dominant right shoulder. The mean age of the studied patients with os acromiale and of the 211 volunteers was 48 years (range, 37-66 years) and 54 years (range, 29-79 years), respectively. In all cases, we had radiographs, including true anteroposterior, outlet, and axillary views. The latter was obtained by positioning the arm in abduction (70°) with the beam directed superiorly toward the radiographic cassette. The focus-cassette distance was 120 cm. On the basis of the axillary view, the acromions with os acromiale and those of the remaining asymptomatic volunteers were separately classified by the three most experienced of us using the method of Edelson and Taitz.[4] This method distinguishes three types of acromion:

From II Orthopaedic Clinic, University "La Sapienza".

Reprint requests: Stefano Gumina, MD, Via Tacito 74, 00193, Rome, Italy (E-mail: *s.gumina@tiscalinet.it*).



1058-2746/2003/$35.00 + 0 **32/1/128136**

doi:10.1067/mse.2003.128136

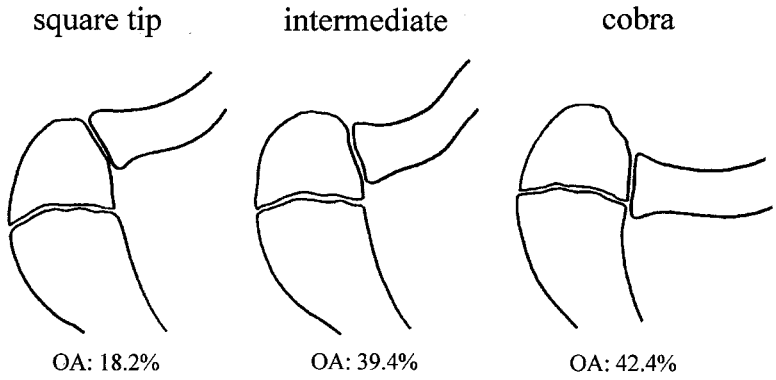


**Figure 1** The rate of os acromiale *(OA)* increases with increasing distance between the anterior aspect of the acromion and the AC joint.

**Table I** Results

| Acromion shape | Control group subjects without OA (%) | Asymptomatic subjects with OA (%) | Symptomatic patients with OA (%) |
|---|---|---|---|
| Square tip | 110 (52.13) | 2 (18.18) | 4 (18.18) |
| Intermediate | 65 (30.80) | 4 (36.36) | 9 (40.90) |
| Cobra | 31 (14.69) | 5 (45.45) | 9 (40.90) |
| Uncertain | 5 (2.36) | — | — |

*OA* = Os acromiale.

square-tip acromion, in which the articular facet for the AC joint lies at the anterior aspect of the apophysis; cobra-shaped acromion, in which the articular facet is located 5 to 10 mm posteriorly to the anterior margin; and intermediate-shaped acromion, which has characteristics between those of the other two groups. In the 6 cases in which the three investigators disagreed, acromions were classified by the opinion of the majority. Five cases were not considered because the axillary views obtained were inadequate for analysis. Radiographic magnification (9%) was established with the use of a metal marker, whose actual dimensions were known, positioned on the cassette.

We compared the frequency of the three types of acromion in asymptomatic subjects with fused acromion (control group) with that observed in the 33 cases with os acromiale. A statistical analysis was performed with the $\chi^2$ test. The level of significance was set at $P < .05$.

## RESULTS

Results are summarized in Table I. Of the 211 control group subjects, 110 (52.1%) had a square-tip, 31 (14.7%) a cobra-shaped, and 65 (30.8%) an intermediate-shaped acromion; 5 (2.4%) were not considered for the reason stated above. On the other hand, of the 33 cases with os acromiale, 6 (18.2%), 14 (42.4%), and 13 (39.4%) had a squared, cobra-shaped, and intermediate-shaped acromion, respectively (Figure 1). Differences in rates were statistically significant ($P = .0002$). A similar proportion of the three different shapes of acromion was observed, respectively, in the 11 asymptomatic and 22 symptomatic subjects with os acromiale.

## DISCUSSION

Edelson and Taitz[4] first classified the acromion on the basis of the relationship of the acromial facet to the AC joint. They observed that cobra-shaped acromions, in which articular facet lies 5 to 10 mm from the anterior aspect of the apophysis, were longer than the other two shapes and that the longer the acromion, the higher the rate of acromions with spurs at the anterior edge or with an eburneated facet (ie, a pseudoarticular surface for the humeral head). This relevance emerged from a study performed on 200 dry scapulae of persons whose ages and health conditions were partially or completely unknown. Only 3 acromions in the collection of Edelson and Taitz had an os acromiale, and out of 3, 2 had anterior spurs or the eburneated facet. Unfortunately, the shape of these acromions was not mentioned.

Our data show that the percentage of os acromiale in subjects with the AC joint located posteriorly with respect to the anterior edge of the acromion (cobra- and intermediate-shaped acromion) is 4 times higher than that observed in subjects with os acromiale and the AC joint lying on the apophyseal tip (square-tip acromion) (81.8% vs 18.1%). On the other hand, the percentage of the square-tip acromion revealed in the control group was higher than that of the other two groups considered together (52.1% vs 45.4%). Therefore, our data suggest that the longer the distance of the AC joint from the anterior aspect of the acromion, the higher the likelihood of an os acromiale. Our study is not supported by anatomic observations; however, it is plausible that ossification centers are more stable elevation in the scapular plane and forward flexion (anterior deltoid action) when close to the AC joint, whereas they undergo more mechanical

traction with a cobra- or intermediate-shaped acromion. This hypothesis explains why, in our series and other series, the frequency of the mesacromion is higher than that of the preacromion.[5,8]

Of the subjects of the control group, 11 (4.9%) had an os acromiale. These data confirm the previously reported finding that os acromiale may be occasionally observed in asymptomatic subjects when radiographs with axillary views are obtained after injuries.[2,3,7] Furthermore, as a recent article observed,[12] both in control and in symptomatic groups, the prevalence of unfused acromion is higher in male patients than in female patients.

Finally, the study of Angel et al[1] suggests that os acromiale may be related to a genetic transmission; however, it is also plausible that it is not the failure of the coalescence of the ossification centers and the remaining posterior acromion that is genetically transmitted but that AC joint position is responsible for a higher predisposition to os acromiale.

**REFERENCES**

1. Angel JL, Kelley JO, Parrington M, Pinter S. Life stresses of the free black community as represented by the first African Baptist church, Philadelphia, 1823-1841. Am J Phys Anthropol 1987;74:213-29.
2. Burkhart SS. Os acromiale in a professional tennis player. Am J Sports Med 1992;20:483-4.
3. Chung SMK, Nissenbaum MM. Congenital and developmental defects of the shoulder. Orthop Clin North Am 1975;6:381-92.
4. Edelson JG, Taitz C. Anatomy of the coraco-acromial arch. J Bone Joint Surg Br 1992;74:589-94.
5. Edelson JG, Zuckerman J, Hershkovits I. Os acromiale: anatomy and surgical implications. J Bone Joint Surg Br 1993;75:551-5.
6. Hertel R, Windinsch W, Schuster A, Ballmer FT. Transacromial approach to obtain fusion of unstable acromiale. J Shoulder Elbow Surg 1998;7:606-9.
7. Liberson F. Os acromiale—a contested anomaly. J Bone Joint Surg 1937;19:683-9.
8. Mudge MK, Wood VE, Frykman GK. Rotator cuff tear associated with os-acromiale. J Bone Joint Surg Am 1984;66:227-9.
9. Neer CS II. Impingement lesions. Clin Orthop 1983;173:70-7.
10. Nicholson GP, Goodman DA, Flatow EL, Bigliani L. The acromion: morphologic condition and age-related changes. A study of 420 scapulas. J Shoulder Elbow Surg 1996;5:1-11.
11. Ryu RK, Fan RS, Dunbar WH. The treatment of symptomatic os acromiale. Orthopaedics 1992;22:325-8.
12. Sammarco VJ. Os acromiale: frequency, anatomy and clinical implication. J Bone Joint Surg Am 2000;82:394-400.
13. Warner JJ, Bein GM, Higgins L. The treatment of symptomatic os acromiale. J Bone Joint Surg Am 1998;80:1320-6.
14. Wright RW, Heller MA, Quick DC, Buss DD. Arthroscopic decompression for impingement syndrome secondary to an unstable os acromiale. Arthroscopy 2000;16:595-9.

**CORRECTION**

The article, "Nonrecoverable strain fields of the anteroinferior glenohumeral capsule under subluxation" (J Shoulder Elbow Surg 2002;11:529-40) by Malicky et al., was the winner of the 2000 Neer Award. It was incorrectly identified as the winner of the 2001 Neer Award.