Arthroscopic Excision of Os Acromiale: Effects on Deltoid Function and Strength

PETER T. CAMPBELL, FRACS; NASIR M. NIZLAN, MS(ORTH); ALLAN P. SKIRVING, FRCS

Abstract

Arthroscopic excision of os acromiale is a feasible alternative to open excision or fusion. This article describes the authors’ experience with 28 patients (31 shoulders) who underwent arthroscopic excision of os acromiale and its effect on shoulder pain and function, with specific emphasis on deltoid strength measurement.

Thirty-one os acromiale (all persistent unfused pre- and meso-acromions) in 28 patients were excised arthroscopically. Sixteen patients underwent concomitant rotator cuff repair (9 arthroscopic and 7 mini-open). At an average follow-up of 41 months, the patients were assessed using the American Shoulder and Elbow Surgeons (ASES) score, and deltoid function and strength were measured. Pain was completely alleviated postoperatively in 20 (65%) shoulders, and 9 (29%) shoulders had less pain postoperatively. Pain worsened postoperatively in 2 patients, both of whom had features of glenohumeral arthritis at arthroscopy. Average postoperative ASES score (80.33) was significantly improved compared with the average preoperative score (33.71). No significant loss of deltoid strength occurred compared with the contralateral side. No objective or subjective loss of normal deltoid appearance occurred. Rotator cuff repair did not compromise deltoid strength or significantly reduce ASES score irrespective of repair technique (arthroscopic vs mini-open).

With careful attention to surgical technique maintaining an intact periosteal sleeve to preserve the integrity of the deltoid attachment, arthroscopic excision is an effective management tool for mobile os acromiale in a painful shoulder requiring surgical intervention.

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The acromion develops from 4 separate centers of ossification: the pre-acromion, meso-acromion, meta-acromion, and basi-acromion. The basi-acromion normally fuses to the spine of the scapula by the age of 12 years. The other 3 normally fuse between the ages of 15 and 25 years. Os acromiale results from a failure of union of 1 of these ossification centers, most frequently the meso-acromion, and persists in the skeletally mature individual. Typically, only 1 unfused segment exists; however, Mudge et al reported the rare variant of both an unfused pre- and meso-acromion. By definition, a pre-acromion exists when the synchondrosis is anterior to the acromioclavicular joint, a meso-acromion exists when the synchondrosis extends into the acromioclavicular joint, a meta-acromion has the synchondrosis posterior to the acromioclavicular joint, and a basi-acromion occurs in the junction of the acromion and spine of the scapula.

The incidence of os acromiale has been reported in radiological, archeological, and cadaveric examinations of scapular bones to be in the range of 1.4% to 8.2%, and, of these, 33% to 62% are bilateral. The majority of individuals with os acromiale are symptom free, but os acromiale can become problematic. First, the mobility of the synchondrosis can cause pain, perhaps more frequently in younger patients. Second, mobility of the synchondrosis of a meso-acromion can also lead to accelerated acromioclavicular joint degeneration and pain. Third, the presence of os acromiale is statistically associated with, and therefore probably a factor in, the development of rotator cuff impingement and tears. Surgical management, in the form of open excision of the whole unstable fragment, has been criticized, particularly because of its detrimental effect on deltoid function. Because of this, some authors have advised fusion of these large os fragments, and numerous internal fixation and bone grafting techniques have been advocated. However, it is not always easy to obtain a stable fusion, and complications in the form of hardware irritation, migration, and breakage requiring a second surgical procedure are frequently reported.

Arthroscopic excision of os acromiale is a feasible alternative to open excision or fusion. This article describes the authors’ experience with 28 patients (31 shoulders) who underwent arthroscopic excision of os acromiale and its effect on shoulder pain and function, with specific emphasis on deltoid strength measurement.

**Materials and Methods**

Between January 2000 and July 2007, twenty-eight patients (17 [61%] men and 11 [39%] women; 31 shoulders) with recalcitrant shoulder pain were diagnosed with os acromiale identified on axillary radiographs and magnetic resonance imaging. Three (11%) os acromiale were bilateral. Of the 25 patients with unilateral os acromiale, 18 (72%) had it their dominant (right) shoulder. All surgery was performed by 1 surgeon (P.T.C.). Mobility of the fragment was identified arthroscopically. The bony fragment was removed using a 4.5-mm flat acromionizer burr, leaving the periosteal sleeve and deltoid attachment intact (Figure 1). The distal clavicle was coplaned.

A rotator cuff tear was identified in 16 (52%) of 31 shoulders. The tears were repaired using intraosseous suture anchors in a double-row configuration. Arthroscopic repair was performed in 9 shoulders and mini-open repair (lateral deltoid splitting) in 7. The choice of surgical technique reflected the evolution of the operating surgeon’s clinical practice and was not determined or influenced by the size of the underlying cuff tear. Lesions of the long head of the biceps in the form of tear or tendinopathy were noted in 8 (26%) shoulders. The biceps tendon was debrided and tenotomized at its origin in...
Os Acromiale Abnormalities and Procedures Performed

<table>
<thead>
<tr>
<th>Abnormality</th>
<th>No. of Shoulders</th>
<th>Procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>OS alone</td>
<td>14</td>
<td>OS excision alone</td>
</tr>
<tr>
<td>OS+cuff tear</td>
<td>9</td>
<td>OS excision and cuff repair</td>
</tr>
<tr>
<td>OS+cuff tear+LHB</td>
<td>7</td>
<td>OS excision, cuff repair, and biceps tenotomy</td>
</tr>
<tr>
<td>OS+LHB</td>
<td>1</td>
<td>OS excision and biceps tenotomy</td>
</tr>
</tbody>
</table>

Abbreviations: LHB, long head of the biceps; OS, os acromiale.

Results

All 28 patients were available for follow-up. Average patient age at surgery was 55 years (range, 21-78 years), and average duration from onset of symptoms to surgery was 9 months (range, 1-18 months).

Fourteen (45%) shoulders with a diagnosis of recalcitrant pain due to mobile os acromiale underwent arthroscopic excision. Of the 31 total shoulders, 3 (10%) had a pre-acromion os acromiale and 28 (90%) had a meso-acromion os acromiale. No meta-acromion os acromiale were noted.

One (3%) shoulder with a tear of the long head of the biceps and intact rotator cuff underwent a tenotomy, and the remaining 16 (52%) shoulders underwent rotator cuff tear repair after arthroscopic excision of the os acromiale. Of these 16 shoulders, 1 (6%) had a pre-acromion os acromiale. Arthroscopic repair of the rotator cuff was performed in 9 (29%) shoulders and a mini-open repair in 7 (23%) shoulders.

Lesions of the long head of the biceps in the form of tears or tendinopathy were noted in 8 (26%) shoulders, 7 in combination with a rotator cuff tear; they were debrided and tenotomized at their origin.

Table 1 summarizes the abnormalities found in all shoulders and the procedures performed.

Degenerative changes were noted in 5 (16%) shoulders: Outerbridge grade 3 in 3 shoulders and grade 4 in 2 shoulders.

Pain was completely alleviated postoperatively in 20 (65%) shoulders, and 9 (29%) shoulders had less pain postoperatively. Pain worsened postoperatively in 2 patients, both of whom had features of glenohumeral arthritis at arthroscopy.

Twenty-five (89%) patients were very satisfied with their outcome and would be willing to undergo the same procedure again. One patient with a worsening postoperative ASES score, thought to be due to progressive glenohumeral arthritic changes, would not choose to undergo the procedure again, and 2 other patients did not respond to the question and would presumably be reluctant to undergo the procedure again.

Mean ASES score was 33.71 (range, 6.67-86.67) preoperatively and 80.33 (range, 41.37-100) postoperatively. The difference was significant \( P<.05 \). Clinical testing of deltoid power via subjective motor power assessment revealed a mean of 4.71 on the operative side and 4.88 on the nonoperative side. The difference was not significant \( P=.103 \). Mean IsoBex reading was 8.09 N in the operative shoulder and 7.94 N in the nonoperative shoulder. The difference was not significant \( P=.769 \).

Mean postoperative ASES score for the patients with rotator cuff tears was 85.96 (range, 46.12-100.00), which
was better than the mean postoperative ASES score for the whole group (80.33). Deltoid power in the patients with rotator cuff tears averaged 4.81 on the operative side, which was not significantly different when compared with the nonoperative side ($P = .083$). Mean IsoBex reading in this group was 7.62 N on the operative side and 7.31 N on the nonoperative side, which was not significantly different ($P = .597$) (Table 2).

No subjective or objective change in the appearance or contour of the anterior deltoid was noted. No evidence of dehiscence was seen.

**DISCUSSION**

The management of mobile os acromiale remains controversial. Surgical options include open acromioplasty, fusion of the unfused segment, and arthroscopic excision of the mobile fragment.

A modified acromioplasty, reported by Armengol et al in 1994 and later by others,5,6,17 entails removal of the whole unstable fragment while leaving the superior cortical shell with its attached deltoid origin intact. This technique had promising results with no deltoid dehiscence, which often complicated open acromioplasty, or hardware problems, which sometimes followed fusion techniques.7,8,13,15 Wright et al1 performed a similar procedure where only the anterior impinging tip of the meso-acromion os acromiale was removed, thereby minimizing insult to the deltoid attachment and the acromioclavicular joint capsule. This technique resulted in satisfactory results in 11 of 13 patients in their study.4

The purpose of the current study was to evaluate the effects of arthroscopic excision of os acromiale and specifically assess any detrimental effects of the procedure on patients’ deltoid strength and function. Because the evaluation involved subjective and objective measurements of shoulder function and strength, this study significantly contributes to the evaluation of the effect of arthroscopic excision of os acromiale on deltoid strength and function. To the authors’ knowledge, this has not been reported previously.

Mean follow-up was 41 months (range, 9-85 months). Although the minimum follow-up was only 9 months, any impairment of shoulder function or deltoid strength resulting from the arthroscopic removal of the meso-acromion os acromiale would have been evident.

Shoulder pain was significantly improved in the majority of patients (29 of 31 shoulders), and postoperative ASES scores indicated that daily shoulder function was not compromised by this procedure. Objective deltoid strength measurement confirmed that deltoid muscle strength and function were not impaired by the arthroscopic removal of the unfused segment; this can be attributed to the careful preservation of the periosteal sleeve and deltoid attachment.

A difficulty with measuring forward elevation strength in the plane of the scapula is that it is a measure of both deltoid and supraspinatus strength. Because many patients in the current study with rotator cuff pathology were treated surgically, it could be argued that this represents a confounding variable. However, because the measurement of strength in patients who underwent both rotator cuff surgery and arthroscopic excision of the os acromiale was not impaired compared with the opposite side, this possible confounding variable is irrelevant. Only if the strength measurement had been reduced compared with the nonoperative side would the question of whether weakness was due to impairment of the deltoid or the supraspinatus muscle be relevant.

The rotator cuff tear rate in this study was 52%, supporting the observation that patients with os acromiale have an increased association with rotator cuff tears.5,10,11 The clinical outcomes of patients with rotator cuff tears and associated os acromiale excised arthroscopically were comparable to the others in the group without rotator cuff tears with respect to ASES scores and deltoid power and strength. This finding was true irrespective of the technique used to repair the torn rotator cuff. Patients with a torn rotator cuff for which cuff repair was performed via a mini-open technique had a mean postoperative ASES score of 80.11, which is comparable with the mean score of all patients in the study.

**CONCLUSION**

Arthroscopic excision is an effective option in the management of symptomatic mobile pre- and meso-acromion os acromiale causing impingement or associated with a rotator cuff tear. Provided that the overlying periosteal sleeve and deltoid at-

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**Table 2**  
ASES Scores and IsoBex* Readings

<table>
<thead>
<tr>
<th>Abnormality</th>
<th>No. of Shoulders</th>
<th>Mean ASES Score</th>
<th>Mean IsoBex Reading, N</th>
</tr>
</thead>
<tbody>
<tr>
<td>OS alone</td>
<td>14</td>
<td>52.6</td>
<td>12.9</td>
</tr>
<tr>
<td>OS + cuff tear</td>
<td>9</td>
<td>26.2</td>
<td>12.3</td>
</tr>
<tr>
<td>OS + cuff tear + LHB</td>
<td>7</td>
<td>41.2</td>
<td>9.1</td>
</tr>
<tr>
<td>OS + LHB</td>
<td>1</td>
<td>53.3</td>
<td>15.5</td>
</tr>
</tbody>
</table>

Abbreviations: ASES, American Shoulder and Elbow Surgeons; LHB, long head of the biceps; OS, os acromiale; Nonop, nonoperative; Op, operative; Postop, postoperative; Preop, preoperative.

*Medical Device Solutions AG, Burgdorf, Switzerland.
attachment is preserved, any detrimental effects of this procedure on deltoid strength and shoulder function tends to be insignificant, with good postoperative preservation of subjective and objective shoulder function.

REFERENCES


