

# Arthroscopic Fixation of *Os Acromiale* with Cannulated Screws

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## Abstract

**Introduction:** *Os acromiale* is a developmental fusion failure of an acromion accessory ossification nucleus. It is associated to higher rates of Impingement Syndrome and rotator cuff tears due to narrowing of subacromial space. Surgical treatment of symptomatic *os acromiale* is classically done by open incision osteosynthesis or removal of the loose bone fragment. This study presents a modern minimally invasive arthroscopic technique and its preliminary result.

**Methods:** 13 arthroscopic surgeries were performed on patients with symptomatic *os acromiale* between 2007 and 2013. Outcomes were evaluated by UCLA scores before and 2 years post-operatively.

**Results:** Average follow up was 65.23 months (32-105). Pre-operative UCLA averaged  $21.46 \pm 0.87$  rising to  $28.92 \pm 1.57$  at 2 years post-operatively ( $p=0.001$ ).

Adverse results occurred in two patients: one patient had osteolysis of the anterior acromion fragment requiring a switch to open osteosynthesis; and another patient had fragmentation of the acromion during procedure and had to be excised.

**Conclusion:** Arthroscopic *os acromiale* osteosynthesis is still a difficult and challenging surgery. Evolution of technique and devices has been encouraging surgeons to make it doable and reproducible. Although there is not significant evidence of long-term benefits of arthroscopic over open technique, it is a minimally invasive procedure with better cosmetic results, reduced postoperative pain and magnified optic access to several shoulder structures.

**Key words:** *Os Acromiale*, Shoulder arthroscopy, rotator cuff

## Introduction:

*Os acromiale* is an uncommon shoulder disorder derived from nonunion of acromion accessory ossification centers. It is estimated to occur in 2.7% of shoulders (8). Acromion ossification nuclei rise between 15 to 18 year-old and usually get completely fused by 25 year-old (9). Failure of fusion might ensue at any ossification centers: preacromion, mesoacromion, metacromion or basiacromion. The most common type of *os acromiale* is the mesoacromiale, followed by preacromiale and metacromiale (12,14). Basiacromiale type is extremely rare. Excessive movement at fusion sites is thought as a possible reason for *os acromiale* formation (6) since impingement occurs over the anterior part of acromion.

Most *os acromiales* are silent, only being diagnosed after imaging in patients suspected of Impingement Syndrome. Main symptoms are chronic sore shoulder, pain on elevation, night pain and movement restraint. There may be tenderness to palpation over the site of the nonunion. High rates of Impingement Syndrome are associated to *os acromiale* (11), whose prevalence in patients with massive rotator cuff tears rises up to 12% and it can be as high as 32% among those presenting cuff arthropathy (1). When bilateral involvement is present, prevalence reaches its utmost 62% (7,12,14).

Treatment of *os acromiale* has not been well established yet. Some suggest removal of the acromion loose fragment in symptomatic

patients (9), whereas others prefer stable fixation if fragment is big enough (4,16). Osteosynthesis of mesoacromiale and metacromiale seems to have better results than excision by preserving anterior deltoid muscle attachment intact (16). Open osteosynthesis and bone grafts (2) have also been described to fix *os acromiale*. The development of shoulder arthroscopy allowed surgeons to access many different structures of shoulder, including the acromion. Recently a cadaveric study presented an arthroscopic technique to fix the *os acromiale* using 2 cannulated screws (5).

This study presents results of an all-arthroscopic technique for treating symptomatic *os acromiale*.

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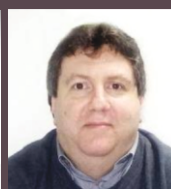
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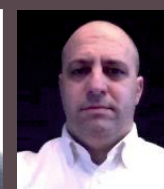
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## Material and Methods

From 2007 to 2013, 13 patients underwent arthroscopic osteosynthesis for *os acromiale*. All patients were assessed

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**Figure 1 & 2:** PA:Posterior Acromium, AA: Anterior Acromium

prospectively according to the IDEAL-Collaboration (10) surgical research methodology. Inclusion criteria are: over 18 years-old; shoulder pain resilient to conservative treatment for longer than 6 months; diagnosis of mesoacromiale or metacromiale, Liberson classification type 1 (8) on MRI or CT scan; and having more than 2 years of follow-up. Patients without pre-operative assessment and previous shoulder surgeries were excluded. Assessment of patients with UCLA score (13) was done before surgery (baseline) by the senior author and 2 years post-operatively by others than the senior author who performed the surgical procedures. Roentgenograms of acromion were obtained at 2 and 5 weeks and 2 years after surgery to confirm union of the acromion. Statistical analyses were performed using Prism6® for Mac (GraphPad Software Inc.). All data were tested for normality using statistical tests of D'Agostino and Person, Shapiro-Wilk and Kolmogorov-Smirnov (KS). The Intention-To-Treat (ITT)(15) principle was used whenever possible. Interim sample size was calculated to determine whether this study achieve significance and statistical power as an adaptive design. A two-tailed test of significance was used for all possible assessments considering  $p < 0.05$  statistically significant. Adverse events, complications and causes of withdrawal were reported for all the patients enrolled in the study. Surgical procedures were all performed by the senior author following the standardized technique that follows(Video 1): patient under general anesthesia in 'beach-chair' position, a standard posterior portal was settled to glenohumeral joint and subacromial space inspection using a 30° angled arthroscope and 60mmHg pump

pressure; through lateral and anterior portals, bursectomy, coracoacromial ligament release, os acromiale site exposure and fibrotic tissues excision were performed using a 4mm shaver and electrocautery until exposure of cancellous bone of both acromion fragments.

An osseous shaver is used to expose the marrow bone(Figs 1 and 2) in order to achieve the best osteosynthesis. The scope is inserted in the lateral portal just under the region of the os acromiale is. A spinal needle was inserted in antero-posterior direction just under acromion as reference for screw insert; two 1mm Kirshner wires are inserted through both acromion fragments(Fig3); finally, two 2.7mm cannulated screws are introduced fixing both parts of the acromion under fluoroscopy. A final Roentgenogram is done in order to confirm the osteosynthesis(Fig. 4)

### Results

Thirteen arthroscopic osteosynthesis of os acromiale were performed: 11 right shoulders and 2 lefts, 8 men and 5 women. Average follow-up was 65.23 months (32-105). Baseline UCLA scores average of  $21.46 \pm 0.87$  (SD = 3.15; CI 19.56 to 23.37) risen to  $28.92 \pm 1.57$  (SD = 5.65; CI 25.51 to 32.34) post-operatively confirming statistical difference on nonparametric Wilcoxon matched-pairs test ( $p=0.001$ ). There was none withdrawal on this study since intention-to-treat (ITT) statistical model was used and sample size necessary to achieve the minimal of 4 points difference between baseline and 2-year follow-up UCLA mean scores was achieved on phase one of this trial. One patient that had a pre-operative 50%

partial rotator cuff tear evolved to a complete tear and underwent surgical repair with satisfactory functional outcome at a 2-year period after surgery.

Adverse results occurred in two patients (15.38%). One patient had osteolysis of the anterior acromion fragment, evolving with poor UCLA post-operative score (15 points) and requiring an open procedure to remove screws. Another patient had a fracture of the anterior part of acromion during screw fixation and the fragment had to be excised. Despite this patient had a good result, he was graded the same for baseline and post-operative UCLA scores in order to use ITT analysis.

### Discussion

A gold standard for surgical treatment of os acromiale has not been established yet. Several osteosynthesis techniques were described with good and satisfactory outcomes. Until now, there are no trials comparing arthroscopic acromion osteosynthesis in human beings. Our review of scientific literature found only one cadaveric study demonstrating feasibility of performing an arthroscopic acromion fixation(5).

Acromion fixation using cannulated screws has shown greater healing rates when compared to K-wires and the rate of radiographic healing has been positively correlated to better clinical outcomes(4). In this study we had 92.31% of union (healing) of os acromiale using 2.7mm screws, which confirms the superiority of cannulated screws.

The diameter of screws seems to be very important since some case reports had shown anterior acromion fragment fractures due to screw sizes over 2.7mm. This is of most importance in women whose acromion tends to be smaller and thinner. Concerning the significant prevalence of right (84.61%) os acromiales over left-sided ones (15.39%) founded on our study, we identified that from the 2 left-sided cases, one patient was left handed, suggesting that the 'dynamic subacromial space narrowing caused by os acromiale' theory might be right.

Arthroscopic approach to os acromiale allows better fibrotic tissues excision, which seems to favor the biological aspect of bone healing. It also makes possible accessing and



Figure 3: K-wires through the acromion parts, lateral view



Figure 4: Final Roentgenogram

repairing the rotator cuff and other shoulder structures through a minimal wound. While, an open technique would require a much larger incision or more than one wound, to access these same structures altogether. Some authors have presented good results when preacromiale is treated with excision of the bone fragment, but this technique seems not to have acceptable outcomes for mesoacromiales (16). All patients enrolled in this trial had mesoacromiale or metacromiale, classified by Liberson as type I (8), confirming the trend of good outcomes with meso-metacromiale

osteosynthesis.

#### Limitations:

Due to rarity of os acromiale it was difficult to find symptomatic patients to enroll in this study. It took us 4 years to get 13 patients that needed surgical treatment for os acromiale. Multicentric trials would be a solution to improve statistical power of similar studies.

This is an IDEAL type 2A trial, phase 1, which means it just enable us to conclude about effective of the surgical procedure, not allowing us to assume its superiority

over other techniques.

A long-term trial comparing arthroscopic versus open fixation of os acromiale with cannulated screws will be necessary to establish a definite conclusion.

### Conclusions

Arthroscopic os acromiale osteosynthesis with cannulated screws is still a difficult and challenging technique. Outcomes of this study prove this technique is effective and reproducible for treatment of os acromiale, with benefits of being minimally invasive and allowing concomitant access to rotator cuff and other shoulder structures.

Surgical devices advances may be necessary to facilitate this procedure in order to rise its acceptance among shoulder surgeons.

Until now there is not significant evidence of long-term difference between open versus arthroscopic os acromiale fixation with cannulated screws. Further data and randomized controlled trials will be necessary to this purpose.

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Video of the technique is found on the webpage of the article. Please scan the QR Code to see the video or go to the link <http://asesjournal.com/>

