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ORIGINAL PAPER

Management of symptomatic os acromiale: a survey of the American shoulder and elbow surgeons

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Abstract

Background The purpose of this paper was to survey members of the American Shoulder and Elbow Surgeons (ASES) to assess their opinion on management options, help highlight important clinical factors, and elucidate surgical preferences for the treatment of a symptomatic meso-os.

Methods An online questionnaire was distributed to the active members of the ASES. The survey queried surgeon demographics and perioperative management preferences, and presented multiple clinical case scenarios of patients with a presumed symptomatic, unstable os acromiale.

Results There were 116 ASES members who responded to the survey, and 26% ($n = 30$) who stated they do not operatively manage a symptomatic os. We identified two main clusters of respondents. Cluster 1 ($n = 67$) (as compared to cluster 2, $n = 19$) was comprised of surgeons with significantly more experience treating a symptomatic os acromiale ($p < 0.05$). These surgeons regarded gender, age, BMI, and hand dominance as important clinical factors when deciding when to proceed to surgery. Overall, arthroscopic management of the os was preferred, but those surgeons more experienced in treating os acromiale preferred open reduction and internal fixation (ORIF) in specific clinical cases.

Conclusion The survey findings reflect the current lack of consensus in the treatment of a unstable, symptomatic os acromiale. Overall, arthroscopic management was preferred by most surgeons, though ORIF was preferred in certain clinical scenarios by those more experienced with os acromiale. The overall preference for arthroscopy suggests a possible shift in the treatment paradigm for patients with symptomatic meso-acromions, but higher level studies are needed to substantiate these findings.

Keywords Os acromiale · Arthroscopy · Open reduction internal fixation · Survey · Shoulder · Experts

Introduction

Os acromiale is a relatively rare finding in the shoulder and represents a failure of fusion between any two of the acromial aphophyses in a skeletally mature individual (see Fig. 1) [1]. The age of appearance of acromial secondary ossification centers ranges between ten and 16 years of age [1–3], followed by apophyseal closure generally between the ages of 16 and 25 years old. Given the late closure of the more anterior ossification centers, it is important to differentiate open growth plates from an os acromiale in younger individuals [4–7].

Although most often an incidental and asymptomatic finding on imaging (see Fig. 2a–c), os acromiale is also an uncommon cause of shoulder pain secondary to an unstable meso-acromion [8]. The management of a symptomatic, unstable meso-os acromiale is controversial with no firmly established treatment guidelines [8]. Conservative management, involving a combination of nonsteroidal anti-inflammatory agents, local corticosteroid injections, and/or physical therapy, can yield satisfactory results [9]. However, in scenarios where conservative management fails, or concomitant pathology is also present, surgical management may be necessary [4, 5, 7, 10–13]. Surgical options include open reduction and internal fixation (ORIF) (see Fig. 3), with or without bone grafting, open excision, or arthroscopic

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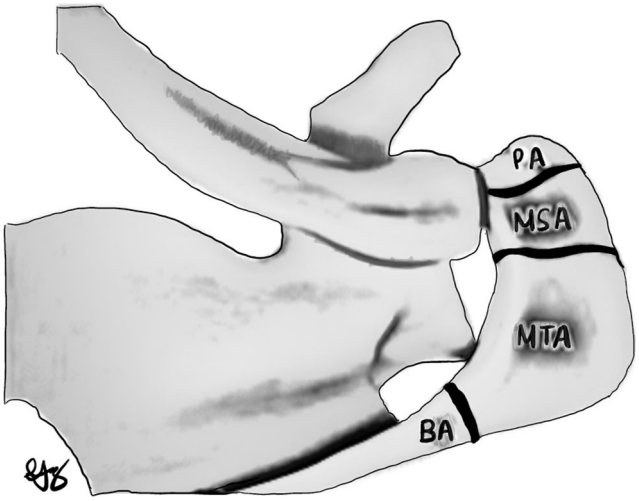

Fig. 1 BA basi-acromion, MTA meta-acromion, MSA meso-acromion, PA: pre-acromion (sketch courtesy of Sarah Lynn Yong, B.S.)

management. Various arthroscopic procedures have been described, ranging from a standard anterior acromioplasty to a partial or complete excision to an arthroscopically assisted reduction and internal fixation [4–7, 14, 15].

Operative indications and specific surgical approach and technique are among some of the variables a surgeon must consider when faced with a presumed unstable, symptomatic os. Although there have been an increased number of recent studies exploring the outcomes of various surgical techniques, there are still a relatively small number of procedures performed to address os acromiale making prospective, randomized, controlled trials difficult to perform. Thus, there is no clear consensus-driven algorithm for the treatment of a symptomatic os. In lieu of this, relying on surgical experience and expert opinion is essential to helping define the factors involved in clinical decision-making when treating a symptomatic os acromiale.

Given the breadth of potential operative interventions for an unstable os acromiale, the purpose of our study was to survey the members of the American Shoulder and Elbow Surgeons to determine the factors that drive surgeons' decisions in the treatment of an unstable, symptomatic os acromiale. By exploring surgeon demographics, perioperative factors, and surgical management options, the goal of this study was to elucidate a consensus opinion on specific treatment options among expert surgeons. We hypothesize that age, comorbidities, presence of a concomitant rotator cuff tear, and/or a concomitant indication for shoulder arthroplasty will be factors that affect the management of these lesions.

Methods

After obtaining Institutional Review Board (IRB) approval, a 21-item electronic questionnaire was sent out to all members

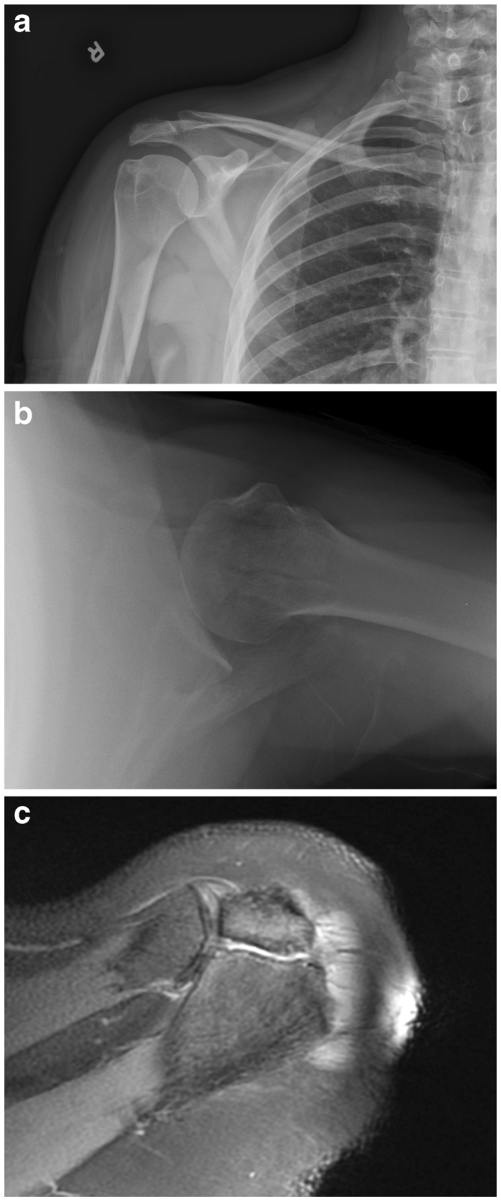

Fig. 2 **a** Anteroposterior radiograph of an os acromiale patient. The meso-os is not immediately obvious; however, the "double-density" sign can be appreciated with the meso-acromion superimposed over the base of the intact acromion. **b** Axillary lateral radiograph demonstrating a meso-os acromiale. **c** MRI of a shoulder demonstrating a meso-acromiale

of the American Shoulder and Elbow Surgeons (ASES) society practicing in various hospitals across the USA and other countries between September 2016 and October 2016. Demographic data was queried of each surgeon in order to establish a surgical-demographic profile (number of years in practice, fellowship training, annual surgical volume of shoulder cases, and the annual number of os acromiale cases managed). The main point of emphasis of the questionnaire was the surgeons' treatment preferences for a presumed symptomatic, unstable os acromiale. The participants were also queried on what factors would drive a surgical indication, such as the

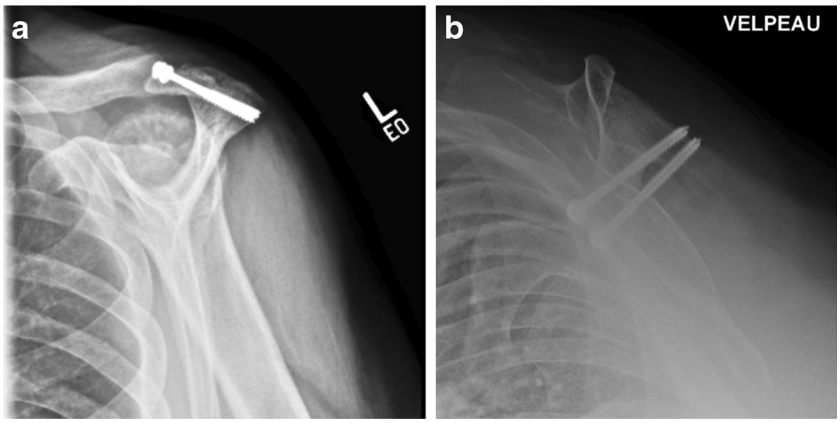

Fig. 3 **a** Lateral scapular "Y" view and **b** velpeau axillary view radiographs of a symptomatic os acromiale patient who underwent successful ORIF

presence of a full-thickness rotator cuff tear, patient age, activity level, sex, and comorbidities (including smoking and diabetes). Based on hierarchical clustering analysis, we identified two main clusters of respondents, with significant independent differences in clinical experience and the frequency of symptomatic os management (Table 1). Cluster 1 (compared to cluster 2) was defined by surgeons with > 15 years of clinical experience (76% vs. 0%, $p < 0.0001$), those who treated a symptomatic os more often (occasionally and frequently: 61% vs. 11%, $p < 0.0005$), and those who treated ≥ 2 symptomatic os annually (52% vs. 26%, $p < 0.05$). Surgical preferences between the two clusters were compared to determine if any significant differences existed perhaps due to experience with treating os acromiale.

The goal of the survey was to try and determine consensus indications for operative management, particularly in regard to arthroscopic management vs. open reduction and internal fixation (ORIF). To this end, three specific clinical scenarios were created by the senior authors (AH, RFH, MG) in order to understand the respondents' treatment algorithm for a symptomatic unstable os acromiale. These scenarios included the following: a suspected symptomatic, unstable meso-os acromiale in either a 45- or a 60-year-old patient *without* a full-thickness rotator cuff tear (case 1A and 1B, respectively); a suspected symptomatic, unstable meso-os acromiale in either a 45- or a 60-year-old patient *with* a full-thickness rotator cuff tear (case 2A and 2B, respectively); a patient with advanced glenohumeral arthritis and a suspected unstable meso-os acromiale who needs an anatomic total shoulder arthroplasty (TSA) (case 3A); and a patient with advanced rotator cuff arthropathy and a suspected unstable meso-os acromiale who needs a reverse total shoulder arthroplasty (RTSA) (case 3B).

Statistical analysis

Survey data was collected using the online software, www.surveymonkey.com (SurveyMonkey Inc., San Mateo, CA, USA, 1999–2017). All data obtained from SurveyMonkey© was anonymous. Continuous data was reported as means and standard deviations (SD), while categorical data was reported as frequencies and percentages. Multivariate hierarchical clustering was performed to group surgeons together based on similar values across a number of demographic variables. Given that we were constrained by a set number of respondents, we carried out a post hoc statistical power analysis. Power was computed by performing a two sample, two-tailed proportions analysis, with type 1 error (alpha) set at 0.05, and power = 0.80. The projected sample size needed to detect a significant difference is approximately $N = 52$. Thus, the sample size of $N = 86$ used was more than adequate for the main objectives of this study. Pearson chi-square tests for independence (or Fisher's exact test when appropriate) were used to determine whether there were significant differences between the two clusters of surgeons and surgical preferences. Multiple correspondence analyses were used to identify relationships between categorical data points. JMP Pro, Version 13 software (JMP®, Version 13. SAS Institute Inc., Cary, NC) was used for all analyses, with a p value < 0.05 indicating statistical significance.

Results

Demographics

A total of 116 ASES members responded to our email questionnaire. Thirty of the 116 respondents (26%) stated that they do not operatively manage a symptomatic meso-os acromiale, and were therefore excluded from further analysis. Of the respondents (Table 1), 41 (48%) practiced in an academic institution, 64 (74%) were fellowship trained in Shoulder and Elbow, and 61 (71%) belonged to at least two professional societies. Only two respondents stated that they "frequently" managed a symptomatic os acromiale, whereas the majority reported that they either "rarely" (43, 50%) or "occasionally" (41, 48%) treated a symptomatic os.

Table 1 Demographics of survey respondents

	Number (%)			*p* value
	Total	Cluster 1	Cluster 2	
Number of respondents	86	67 (78)	19 (22)	
Practice setting				
Academic	41 (48)	33 (49)	8 (42)	0.2502
Private	33 (38)	23 (34)	10 (53)	
Hospital employed	12 (14)	11 (16)	1 (5)	
Fellowship				
Shoulder and elbow	64 (74)	47 (70)	17 (89)	0.0884
Sports medicine	31 (36)	26 (39)	5 (26)	0.3169
Hand	8 (9)	7 (10)	1 (5)	0.4923
Other	4 (5)	4 (6)	0 (0)	0.2754
None	4 (5)	4 (6)	0 (0)	0.2754
Society membership				
ASES	85 (99)	67 (100)	18 (95)	0.0589
AOSSM	35 (41)	27 (40)	8 (42)	0.8875
AANA	32 (37)	23 (23)	9 (47)	0.2993
Other	18 (21)	15 (22)	3 (16)	0.5326
How often do you manage a symptomatic meso-os acromiale?				
Rarely	43 (50)	26 (39)	17 (89)	0.0005*
Occasionally	41 (48)	39 (58)	2 (11)	
Frequently	2 (2)	2 (3)	0 (0)	
Shoulder surgeries performed annually				
< 250	20 (23)	19 (28)	1 (5)	0.1087
250–400	47 (55)	34 (51)	13 (68)	
> 400	19 (22)	14 (21)	5 (26)	
Number of years in practice				
5–15	21 (24)	2 (2)	19 (22)	< 0.0001*
> 15	65 (76)	65 (76)	0 (0)	
Approximately how many surgical procedures do you perform to address a symptomatic meso-os acromiale each year?				
< 2	46 (53)	32 (48)	14 (74)	0.0455*
≥ 2	40 (47)	35 (52)	5 (26)	
Approximate age of the youngest patient you have treated surgically to address a symptomatic meso-os acromiale?				
12–17	4 (5)	2 (3)	2 (11)	0.3197
18–25	31 (37)	23 (36)	8 (42)	
> 25	48 (58)	39 (61)	9 (47)	

% based off of a total *N* of 86 respondents. Cluster 1: more experienced surgeons (> 15 years of clinical experience and a greater frequency of symptomatic os management (≥ 2/year)). Cluster 2: less experienced surgeons (5–15 years of clinical experience and a lower frequency of symptomatic os management (< 2/year)

Peri-operative factors and general surgical questions

Overall, the respondents attempted conservative treatment for six ± two months before moving on to surgical options (Table 2). The most preferred imaging modalities were magnetic resonance imaging (MRI) (67%) and plain radiographs (53%) (see Fig. 2a–c). The most important comorbidity was smoking (51%), followed by weight bearing shoulder, high body mass index (BMI), and diabetes. Surgeons with more experience treating os acromiale regarded the clinical factors of gender ($p = 0.0056$), age ($p = 0.0484$), higher BMI ($p = 0.0307$), and hand dominance ($p = 0.0404$) as significantly more important when deciding when surgery was indicated.

The most important factors when deciding whether to manage a symptomatic os with ORIF were as follows: the patients' activity level (22%), age (20%), the presence of a full-thickness rotator cuff tear (20%), and comorbidities (19%) (see Fig. 4). When performing ORIF, the two most preferred

Table 2 Perioperative management

	Mean (± SD)
How long (months) would you continue conservative treatment as outlined above before considering operative intervention?	6 months (2)
	N (%)
Preferred imaging modality	
MRI	58 (67)
Plain radiographs	46 (53)
SPECT-CT w/bone scintigraphy	7 (8)
CT	6 (7)
CT arthrogram	2 (2)
Dynamic ultrasound	2 (2)
MR arthrogram	1 (1)
Comorbidities (in order of importance)	
Smoker	44 (51)
Weight bearing shoulder	27 (31)
Elevated BMI	15 (17)
Diabetes	14 (16)
When performing an ORIF do you routinely use bone graft?	
Yes	41 (57)
No	31 (43)
Preferred bone graft source	
Local bone	23 (56)
Iliac crest	10 (24)
Allograft	5 (12)
Other (proximal tibia, distal clavicle, BMP)	3 (6)

% based off of a total *N* of 86 respondents

techniques of fixation were (1) the use of cannulated screws and a non-absorbable suture tension band (34%), and (2) the use of cannulated screws and a wire tension band (32%) (see Fig. 5). More than half (57%) the surgeons used bone graft when performing ORIF, and the most preferred source for the graft was local bone (56%) (Table 2). When performing ORIF, surgeons experienced with os acromiale were significantly more likely to use cannulated screws and a wire tension band (38% vs. 0%, $p < 0.0069$).

Clinical case scenarios

Case 1 (see Fig. 6) described a symptomatic, unstable meso-os acromiale in a patient *without* a full-thickness rotator cuff tear. In a 45-year-old patient (case 1A), respondents were slightly more in favour of performing open reduction and internal fixation (ORIF) (49%), followed by arthroscopic management (44%). However, in a 60-year-old patient (case 1B), respondents were more in favour of arthroscopic management vs. ORIF (45% vs. 32%). Regardless of age, the most preferred arthroscopic technique was "arthroscopic complete excision with preservation of the periosteal sleeve" (22% and 26% in the 45-year-old and 60-year-old patients, respectively). In case 1A, surgeons experienced with os acromiale (cluster 1) were significantly more likely to perform ORIF compared to surgeons less experienced with os acromiale (cluster 2) (56% vs. 26%, $p = 0.0442$).

Case 2 (see Fig. 7) described a symptomatic, unstable meso-os acromiale in a patient *with* a full-thickness rotator cuff tear. Irrespective of age, the preferred treatment option was rotator cuff repair and arthroscopic management of the symptomatic os (≥ 50%). In a 45-year-old (case 2A), the preferred arthroscopic technique was "complete excision of the os with preservation of the periosteal sleeve" (20%). In a 60-year-old (case 2B), the preferred arthroscopic technique was "arthroscopic acromioplasty" (21%). Surgeons experienced with os acromiale (cluster 1) were significantly more likely to perform rotator cuff repair and ORIF, both in case 2A (52% vs. 0%, $p < 0.0001$) and 2B (48% vs. 0%, $p = 0.0002$).

Case 3 (see Fig. 8) assesses the difference in treatment when faced with a patient with advanced glenohumeral arthritis and a suspected unstable meso-os acromiale who needs an anatomic TSA (case 3A) vs. a patient who needs a RTSA (case 3B). In either scenario, the most preferred treatment by a wide margin (≥ 45%) was to perform the shoulder arthroplasty and ignore the os. The second most preferred treatment option was to perform an ORIF of the os at the time of shoulder arthroplasty (≥ 10%).

Discussion

The results of this survey demonstrated several key findings, which partly support our hypothesis regarding the surgical management of a symptomatic os acromiale. (1) Surgeons, on average, continued conservative treatment for six months before proceeding to operative management. (2) The majority consensus among respondents when presented with the clinical cases was to choose some form of arthroscopic management, as opposed to open reduction and internal fixation. (3) However, the subset of surgeons who were more experienced in managing os acromiale (cluster 1) was significantly more likely to select ORIF for most of the presented clinical scenarios. (4) When performing an ORIF, the preferred fixation involved cannulated screws with either a non-absorbable suture tension band or a wire tension band. (5) In patients who have been indicated for either an anatomic or reverse total shoulder arthroplasty and have a concomitant unstable meso-os acromiale, surgeons prefer to proceed with the arthroplasty and ignore the os. (6) Of the queried comorbidities, a history of smoking was noted by the majority of surgeons as important to their assessment when indicating a patient with an os acromiale for surgery. Surgeons experienced with os acromiale regarded gender, age, BMI, and hand dominance as significantly important clinical factors when deciding when surgical indication was appropriate.

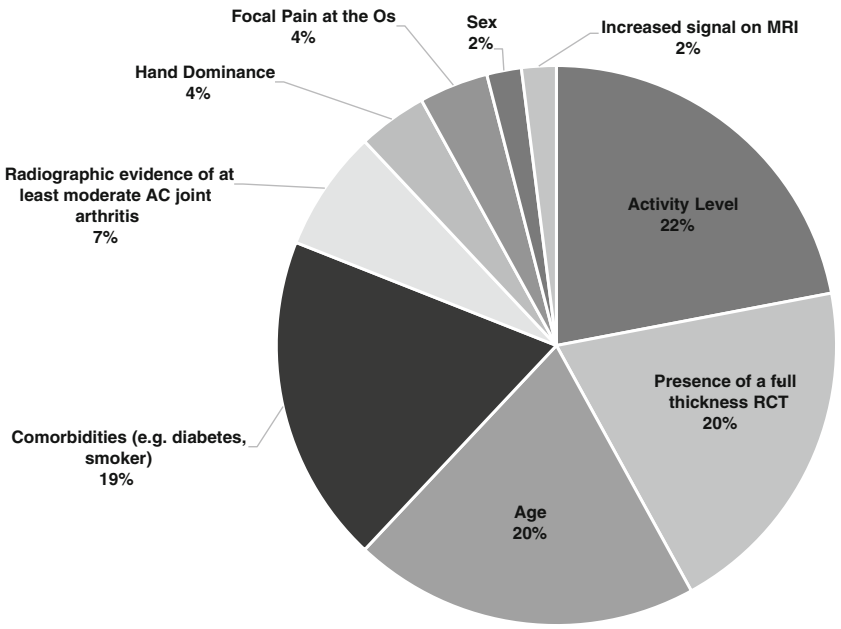

Fig. 4 What factors are important in determining when you would treat a meso-os with ORIF?

Imaging/diagnosis

The majority of surgeons preferred to use both plain radiographs and MRI in their radiographic assessment of a possible unstable os acromiale (see Fig. 2a–c). Neither ultrasound nor SPECT imaging was utilized in an appreciable fashion. The use of MRI likely reflects, in part, the difficulty of making the diagnosis on plain films. Os acromiale is easy to miss on plain radiographs if not specifically assessed for on both AP and axillary lateral views. Lee et al. [16] reported that up to 50% of os acromiale lesions was missed on AP radiographs. They described a "double-density" sign on the AP radiograph which represents the overlap between the os acromiale and the native acromion (see Fig. 2a). A good-quality axillary lateral view (see Fig. 2b) is essential [11, 15] and can reveal the size and shape of the fragment, as well as

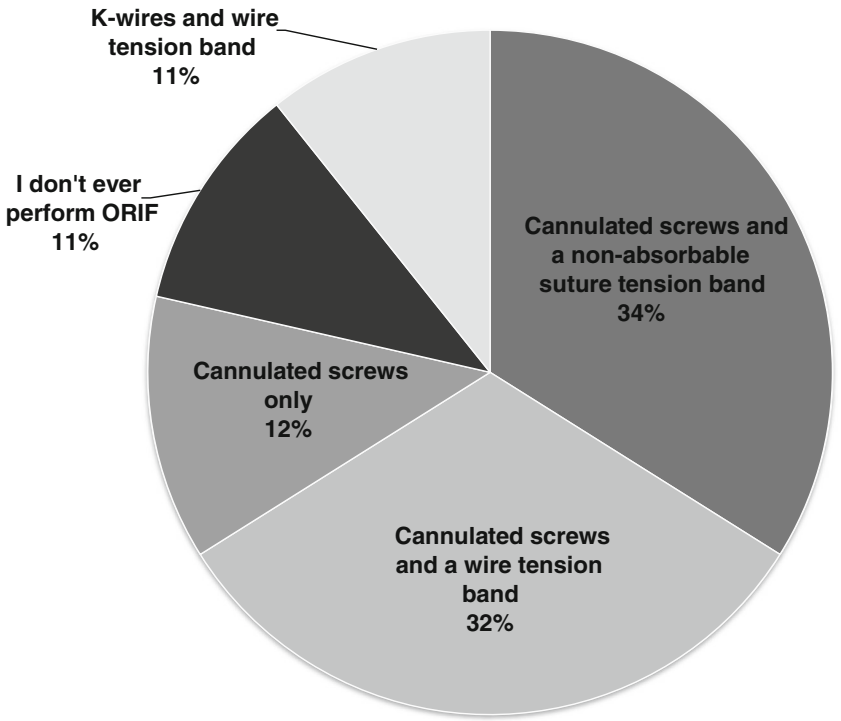

Fig. 5 When performing an ORIF, what is your preferred technique of fixation?

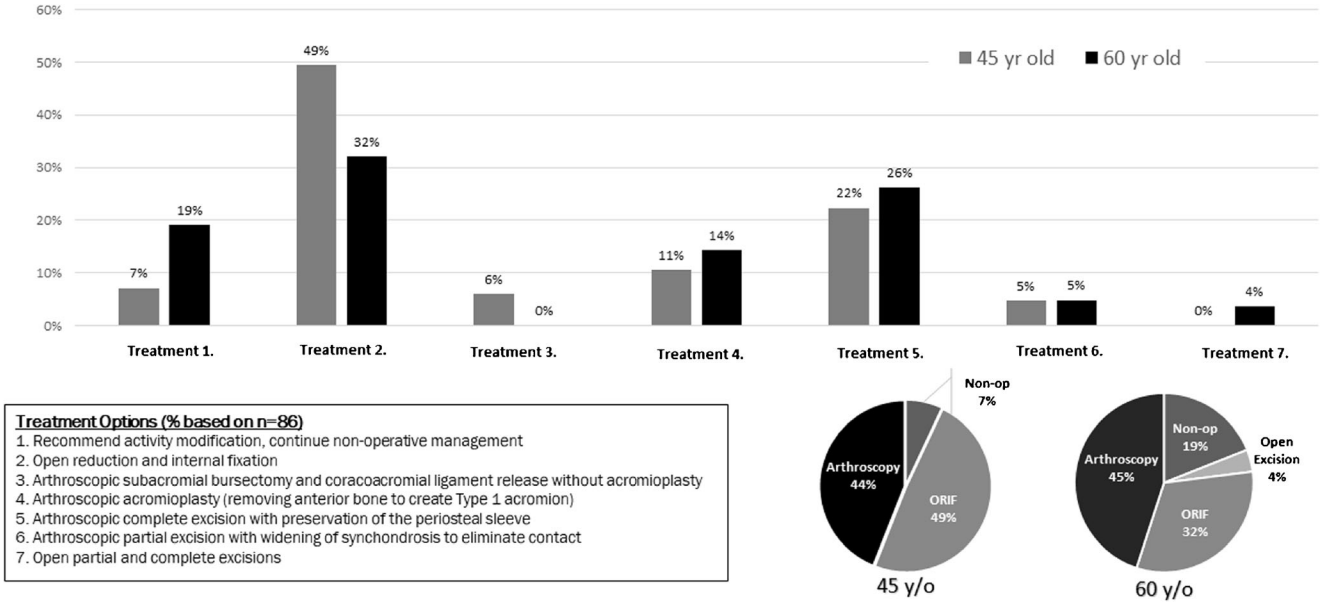

Fig. 6 Case 1: A symptomatic, unstable meso-os acromiale in a patient *without* a full-thickness rotator cuff tear in a 45-year-old (1A) vs. a 60-year-old (1B)

any degenerative changes present. Thus, relative to plain radiographs, MRI is a useful adjunctive imaging tool. Fluid-sensitive sequences can demonstrate widening of the synchondrosis as well as fluid within the synchondrosis, both of which may suggest an unstable os. MRI also allows for accurate assessment of hypertrophic osteophyte formation, and edema within both the os and intact acromion, suggesting symptomatic degenerative changes at the synchondrosis, analogous to an arthritic acromioclavicular joint [17]. Axial cuts on MRI can reliably detect an os acromiale, whereas it is often misinterpreted on sagittal and oblique cuts. Furthermore, MRI is especially important for detecting associated pathology, such as rotator cuff tears, which may alter surgical management.

Non-operative management

Our findings reaffirm the generally accepted practice of trying conservative management for at least 6 months. If symptoms persisted despite what was felt to be an appropriate trial of

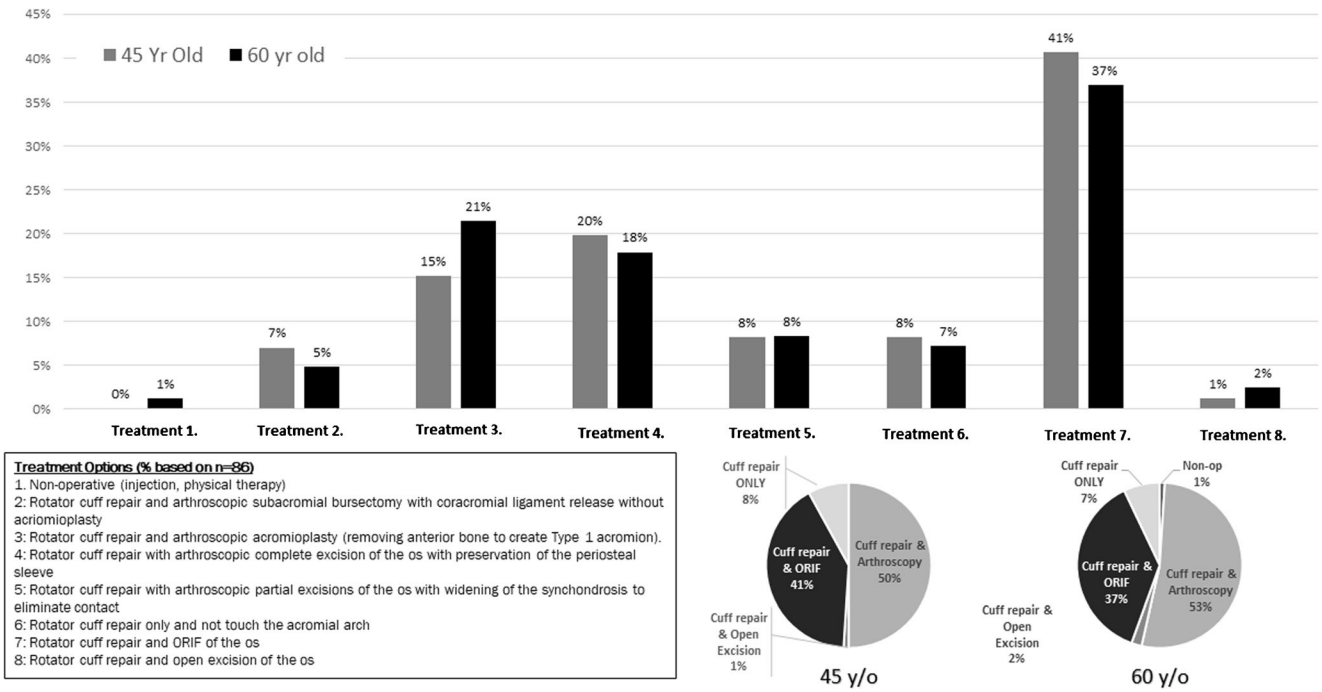

Fig. 7 Case 2: A symptomatic, unstable meso-os acromiale in a patient *with* a full-thickness rotator cuff tear in a 45-year-old (2A) vs. a 60-year-old (2B)

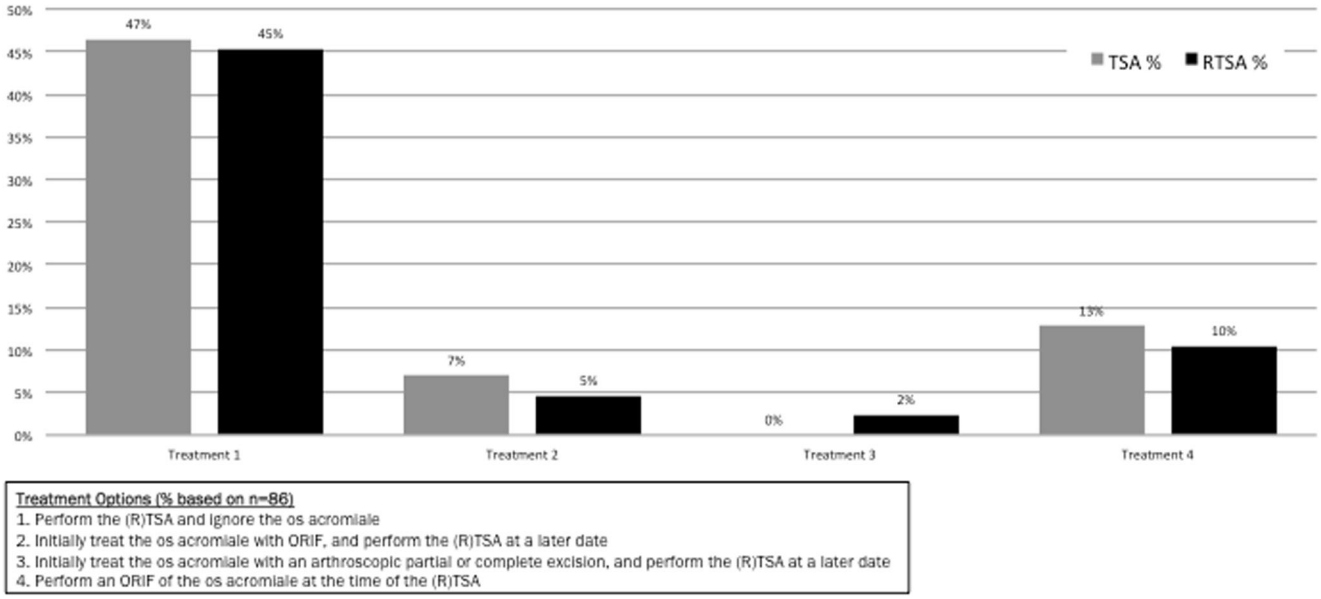

Fig. 8 Case 3: A patient with advanced glenohumeral arthritis and a suspected unstable meso-os acromiale who needs an anatomic TSA (3A) vs. a patient who needs a RTSA (3B)

non-operative treatment, surgeons elected to proceed with operative intervention in essentially all cases with associated full-thickness rotator cuff tears. However, in the absence of a full-thickness rotator cuff tear, continuation of non-operative treatment was selected at a rate of 7% and 19% for a 45-year-old and 60-year-old, respectively.

There is limited information in the literature regarding the prevalence of os acromiale in symptomatic patients. Mudge et al. reported on 145 patients with a rotator cuff tear and found nine (6.2%) cases of os acromiale [18]. Jerosch reported a 9.8% (12/122) prevalence of os acromiale in patients with symptoms of subacromial impingement without a tear of the rotator cuff [19]. These reported incidences are similar to the incidence of os acromiale in the general population. This, in part, may account for the 30 surgeons who responded that they never operate on an os acromiale, given that these surgeons may not consider os acromiale as a cause of shoulder pain. However, there is good evidence that in cases with tenderness over the os acromiale and associated rotator cuff pathology, strong consideration should be given to the os acromiale contributing to the pain [11]. A presumed unstable meso-os acromiale is thought to contribute to shoulder pain by one of the two pathways: (1) dynamic impingement of the unstable anterior acromial fragment on the rotator cuff, or (2) degenerative changes at the synchondrosis analogous to an arthritic AC joint [8].

Open excision

Only a very small minority of surgeons selected open excision as their preferred treatment for any of the clinical scenarios. Avoiding open excision is supported by the literature as uniformly poor results have been reported with open excision of large acromial fragments such as a meso-os acromiale [11, 20–22] Open excision is now typically indicated for unstable pre-acromiale ossicles or as a salvage for a failed open reduction and internal fixation [23]. However, even those two scenarios, especially the latter, are likely best treated with arthroscopic excision of the os after hardware removal for a failed ORIF [15]. Given the reported results, and availability of more favorable alternatives, open excision cannot be reliably advocated for the treatment of an unstable meso-os acromion.

ORIF vs. arthroscopic management

Overall, respondents chose some form of arthroscopic treatment more often than open reduction and internal fixation. While we expected that arthroscopic management would be the preferred choice in the older age group of patients, the high frequency of arthroscopic management in the younger age group was somewhat of a surprise as we expected that in a younger, presumably higher demand patient, ORIF would have been strongly preferred in order to maintain acromial length and best preserve the deltoid lever arm. In the case scenario of a 45-year-old *without* a rotator cuff tear (case 1A), respondents preferred ORIF over arthroscopic management by a narrow margin (49% vs. 44%). Conversely, in a 45-year-old *with* a full-thickness rotator cuff tear (case 1B), respondents preferred arthroscopic management over ORIF (50% vs. 41%). However, it is worth noting surgeons who were more experienced in managing os acromiale (cluster 1) were significantly more likely to select ORIF for all clinical scenarios presented with one exception (case 1B). The high rate of arthroscopic management being selected is likely explained in part because ORIF is often perceived to be technically difficult with a

prolonged, demanding rehabilitation and a high complication rate (particularly related to retained hardware) [11, 24–26]. These concerns are further exacerbated if the unstable anterior fragment is thin and osteopenic which can make it difficult to achieve and maintain stable internal fixation. Although arthroscopic management obviates these complications related to non-union or symptomatic retained hardware, concerns still remain regarding loss of shoulder strength and function secondary to diminution of the deltoid lever arm after excision of a large portion of the acromion. This is of particular concern in younger, more active patients [11, 24–26].

Open reduction and fixation does offer the advantage of preserving acromial length and thereby maintaining the deltoid lever arm. However, early studies in which K-wire fixation was placed through an anterior deltoid-releasing approach reported a high non-union rate, as well as a high rate of symptomatic hardware removal [11, 24–26]. More recent studies have demonstrated improved union rates (86–96%) with the use of a cannulated screw and tension band construct (either wire or suture tension band) and exposure through a trans-acromial deltoid-splitting approach which is thought to better preserve the blood supply to the anterior acromial fragment [11, 25–27].

Spiegl et al. [10] showed that using cannulated screws along with a tension band provided a significantly higher repair-strength compared to fixation with cannulated screws only. Shiu et al. [7] demonstrated a similar strength of fixation with cannulated screws and polyethylene suture. The use of cannulated screws and suture tension bands has also resulted in lower rates of hardware complications with a meta-analysis demonstrating an 83% incidence of hardware removal with a K-wire construct compared with only 38% for a cannulated screw construct. Echoing the results from these clinical studies, the majority of respondents in our study preferred the use of cannulated screws with either a suture tension band (34%) or a wire tension band (32%) when performing ORIF.

Various arthroscopic techniques have been described to treat os acromiale. In this study, of the surgeons who chose arthroscopic management, complete excision of the unstable fragment with preservation of the periosteal sleeve was the most commonly selected procedure, followed by a standard acromioplasty regardless of the associated rotator cuff pathology. While good results for the former procedure have been reported in the literature, the same cannot be said for the latter and this is discussed further below. Other arthroscopic techniques include an "extended acromioplasty" which represents a partial excision of the unstable fragment, leaving a superior cortical shell intact [28]. Resection of bone on either side of the synchondrosis to eliminate bony contact (analogous to a AC joint resection) along with resection of any prominent anterior acromial bone, leaving the rest of the os intact has also been described [5]. Such a technique was preferred by a minority of the surgeons surveyed.

A simple anterior decompression in the setting of an os acromiale has had uniformly poor results [19, 29]. However, with modification in arthroscopic techniques, better outcomes have been reported in more recent studies, especially with arthroscopic techniques characterized by complete excision of the os fragment and preservation of the periosteal sleeve [30–32]. The advantages conferred by arthroscopic management, including more rapid rehabilitation, and decreased surgical time, as well as recent studies reporting good results with arthroscopic management [28, 33–36], are likely factors underlying the shift in surgical preferences away from ORIF when treating an unstable meso-acromion.

It must be noted, however, that both the arthroscopic studies and ORIF studies are limited by small sample sizes, lack of controls, randomization, and short-term follow. Thus, further investigation is necessary to more reliably reaffirm the outcomes following either arthroscopic management or ORIF of an unstable, symptomatic os acromiale, with or without concomitant pathology. The findings in this study, instead, represent a gauge by which the treatment preferences for an unstable meso-acromion can be measured.

Limitations

One of the main limitations of the study is the nature of the data. The cross-sectional survey design effectively prohibits a causal analysis of the relationships observed. Another limitation relates to the sampling of participants. The survey itself may be subject to the element of self-selection given that participation is voluntary. Those who declined to participate may have done so for a certain, non-random reason. The results are not generalizable to orthopaedic surgeons who are not members of the American Shoulder and Elbow Surgeons society. Given that membership in ASES is heavily based in North America, our results may not represent the preferences of surgeons working in other continents.

Conclusion

The results of this study highlight the lack of consensus in the preferred treatment of an unstable os acromiale. For most of the clinical scenarios presented, the majority of surgeons favored arthroscopic treatment over open reduction and internal fixation. However, in specific clinical scenarios, surgeons more experienced with os acromiale chose ORIF. Nevertheless, the overall preference for arthroscopy suggests a possible shift in the treatment paradigm for patients with symptomatic meso-acromions. The results of this study suggest that further long-term, controlled studies would be beneficial in defining a consensus-driven treatment algorithm for managing symptomatic os acromiale.

Compliance with ethical standards

Conflict of interest The authors declare that there is no conflict of interest.

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