Arthroscopic acromioclavicular joint excision with subacromial decompression

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Background
Shoulder impingement syndrome and acromioclavicular joint (ACJ) osteoarthritis often occur simultaneously and are easily missed. Arthroscopic resection of the distal clavicle and subacromial decompression (SAD) can avoid complications arising from the open method.

Patients and methods
In this prospective study, arthroscopic SAD as well as ACJ resection was done in 15 patients with subacromial impingement syndrome and ACJ arthritis, who were treated between March 2009 and April 2013 at Minia University Hospital after failure of a minimum of 6 months of conservative treatment. The patients were followed up for 12 months.

Results
University of California at Los Angeles score is recorded preoperatively and at final follow-up 12 months after arthroscopic SAD concomitant with arthroscopic ACJ resection. The patients' total University of California at Los Angeles score was significantly improved postoperatively ($P<0.01$) in relation to the preoperative one.

Conclusion
Arthroscopic SAD and ACJ resection gives best results in patients who failed conservative treatment and had persistent symptoms, and it helps in detection of any intra-articular pathology such as biceps tendon degeneration.

Keywords:
acromioclavicular arthritis, acromioplasty, impingement, shoulder, subacromial decompression

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Introduction

In the past two decades, subacromial impingement syndrome (SAIS) has become an increasingly common diagnosis for patients who have a painful shoulder [1–3]. However, SAIS is a specific diagnosis and is not the only cause of pain in the anterosuperior aspect of the shoulder. Impingement may be difficult to diagnose because the clinical presentation may be confusing. It is important to differentiate SAIS from other conditions that may cause symptoms in the shoulder, such as glenohumeral instability and cervical radiculitis [4]. Gartsman *et al.* [5] determined the feasibility of performing anterior acromioplasty using an arthroscopy. Historically, distal clavicle resection has been performed using an open incision over the acromioclavicular joint (ACJ) with detachment of the deltoid and trapezius muscles. Significant morbidity may follow with these open procedures. Wound infection, residual ACJ instability, cosmetically unacceptable scar, and postoperative shoulder weakness and stiffness are among the common complications reported from these open procedures [6]. Shoulder impingement syndrome and ACJ osteoarthritis often occur simultaneously and are easily missed [7]. Excellent results are obtained with combined arthroscopic subacromial decompression (SAD) and resection of the distal end of the clavicle in patients with both disorders. Arthroscopic treatment of these disorders produces more favorable results than open procedures [8]. Arthroscopic excision provides the advantage of evaluating glenohumeral joint at the time of surgery. Other shoulder joint pathology such as rotator cuff disease, loose bodies, labral tears, and biceps anchor pathology will not be missed [9]. Symptom improvement has been satisfactory in most reported series [9,10]. The failure of SAD may be attributed to persistent symptoms of ACJ arthritis, whereas inferior clavicular spurs of the ACJ may be associated with failed healing of repaired rotator cuffs [11]. In this

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series, the results of arthroscopic decompression and ACJ resection were evaluated regarding pain, function, mobility, ACJ instability, and patient satisfaction.

Patients and methods

In this prospective study, 15 patients with SAIS and ACJ arthrosis were treated in the period between March 2009 and April 2013 at Minia University Hospital, after failure of 6 months of conservative treatment and followed up for 12 months. Ethical approval for this study was granted from written informed consent was obtained from all patients. All patients were diagnosed as having SAIS and ACJ arthritis based on clinical history, physical examination, and radiological evaluation. Inclusion criteria were age group 25–65 years old, degenerative and post-traumatic patients, and failed conservative treatment for minimum of 6 months. Exclusion criteria were rotator cuff tear, significant instability as a cause of impingement syndrome, and cervical arthrosis with positive complaint. A detailed clinical history was recorded; this included the onset of symptoms with specific reference to evidence of any injury, overuse or unusual use of the affected arm, shoulder function, and hand dominance. All patients had previous treatment in the form of anti-inflammatory medication, local steroid injections, physiotherapy such as heat or ultrasound, and strengthening exercises.

Clinical diagnosis included tenderness on the surface of the cuff anterior to the edge of the acromion, pain on abduction above the shoulder with or without a painful arc, positive impingement sign, positive Hawkin sign, local tenderness at ACJ, cross-adduction test for ACJ arthritis, and speed test for biceps tendon. The glenohumeral joint was carefully assessed in an attempt to diagnose rotator-cuff impingement secondary to glenohumeral instability.

Radiographic diagnosis was done as follows: the standard radiography anteroposterior view gives an idea about the subacromial space and can see the spur and acromiohumeral distance; the anteroposterior view with abduction to see ACJ arthritis and ACJ inferior osteophyte; and the lateral scapular view is better to see shape of acromion (hooked, curved, and flat) and spur. Computed tomography arthrogram gives more detail about acromion than radiography and also gives information for rotator cuff. MRI was done in some cases with high suspicion of rotator cuff tear, clinically to prove this clinical finding or exclude it.

Based on this information, patients comprised eight men and seven women, with age range from 25 to 65 years, and the mean age was 47.15±8.62 years. The dominant side was affected in nine of 15 patients. Acromial spur was found in 12 patients and hooked acromion in three patients. History of trauma at the onset of symptoms was given by five patients and of overuse of the arm in 10 patients. Preoperative duration of symptoms was 6–15 months, with the mean of 8.05 ±3.45 months. Symptoms had been present for over a year in four patients and between 6 and 12 months in 11 patients. Clinical assessment was performed by using the rating scale of the University of California at Los Angeles (UCLA). Preoperative scores were compared with postoperative follow-up scores at last visit (12 months). In this score, pain and function are each rated, independently, on a scale of 1–10, with 1 being the worst possible score, and 10 being awarded to a symptom-free shoulder. Range of motion, muscle strength, and patient satisfaction are also included, giving a maximum value of 5 points each. The maximum score on the UCLA scale would therefore be 35 points. Results were divided into excellent (34–35 points), good (28–33), fair (21–27), and poor (20 or less points). Good or excellent scores (≥28) were considered satisfactory, and fair or poor scores (≤28) were unsatisfactory (Table 1).

Technique

Anesthesia

In this study, all patient had combined interscalene block and general anesthesia. Examination under anesthesia is a critical aspect of the procedure. The primary goals of the examination are to accurately measure the patient's range of motion and to rule out underlying glenohumeral instability.

Positioning

All patients were placed in a lateral decubitus position. The patient is supported using a bean bag. Traction on the operated arm was of ~10–15 pounds (Fig. 1). The standard posterior portal is placed in the posterior soft spot, ~3 cm inferior and 2–3 cm medial to the posterolateral corner of the acromion. Using a spinal needle, the anterior portal is established at the lateral aspect of the triangle formed by the glenoid, long head of the biceps tendon, and subscapularis tendon. Diagnostic glenohumeral examination is begun. Particular attention is paid to the undersurface of the rotator cuff and biceps tendon. For SAD, the scope is shifted from glenohumeral space to subacromial space, and a lateral working portal is then created. Proper position of this portal is essential; the portal should be positioned in an

Table 1 University of California at Los Angeles rating scale

	Number of points
Pain	
Present always and unbearable; strong medication needed frequently	1
Present always but bearable; strong medication needed occasionally	2
None or little at rest; present during light activities; salicylates needed frequently	4
Present during heavy or particular activities only; salicylates needed occasionally	6
Occasional and slight	8
None	10
Function	
Unable to use limb	1
Only light activities possible	2
Able to do light housework and most activities of daily living	4
Most housework, shopping, and driving possible; able to brush hair and to dress and undress, including fastening of brassiere	6
Slight restriction only; able to work above shoulder level	8
Normal activities	10
Active forward flexion	
>150 deg.	5
121–150 deg.	4
91–120 deg.	3
46–90 deg.	2
30–45 deg.	1
<30 deg.	0
Strength of flexion(on manual muscle testing)	
Grade 5	5
Grade 4	4
Grade 3	3
Grade 2	2
Grade 1	1
Grade 0	0
Satisfaction of patient	
Satisfied and better	5
Not satisfied and worse	0
Excellent	34–35
Good	28–33
Fair	21–27
Poor	0–20

anterior–posterior plane to allow direct access to the anterior acromion and acromioclavicular undersurface.

After the completion of bursectomy, attention is now directed toward the coracoacromial arch. The initial step in SAD is release of the coracoacromial ligament from the undersurface of the acromion. The ligament can be incised at the anterior acromial border, using arthroscopic monopolar electrocautery. The goal of acromioplasty is not shortening or flattening of the acromion but simply removal of any prominence or irregularity to the undersurface of the anterolateral corner, which is burred to the desired depth. Typically, removal of no more than 4 to 5 mm of bone is necessary. The burr should initially be used in reverse to slow the rate of bone removal and allow more precise bone removal. For ACJ resection, a 20 G 1.5-inch needle is introduced through the skin into the ACJ to determine the mid aspect of the ACJ. Once this is confirmed, a small incision is placed at the location of the needle, and different-sized trocars are introduced through this incision into the ACJ, which aid in creating and dilating a tract for the introduction of a 5-mm round bur. With visualization from the posterior, lateral, and anterior portals, the bur is moved like a windshield wiper from superior to inferior and from anterior to posterior to achieve adequate resection of ~10 mm of the distal clavicle (Fig. 2).

Aftercare

Patients were hospitalized an average of 2 days. Follow-up interview was at 1, 3, 6, and 12 months postoperatively. The UCLA shoulder scales is recorded at the latest follow-up. The patient is instructed on supine active-assisted forward elevation and external rotation range-of-motion exercises before discharge. This initial therapy session is facilitated by an interscalene block. On postoperative day 1, the patients are allowed to remove the sling and start pendulum exercises immediately after surgery and then start active-assisted range-of-motion exercises whenever the pain is tolerable. Full active motion is allowed after 4–6 weeks; after that, a rotator cuff, deltoid, and scapular strengthening program is instituted. This program, also performed at home, includes internal and external rotation resistance.

Results

Arthroscopic examination of the glenohumeral joint and subacromial space in 15 patients was done in this study (Table 2). All patients underwent bursectomy and coracoacromial ligament release. Arthroscopic ACJ excision was done in all patients through direct approach. Acromial prominence in the form of hooked (three patients) acromion or spur (12 patients) underwent smoothing by acromionizer. Three patients had biceps pathology, who underwent tenotomy, as the patients' age range was 45–65 and all were females. UCLA score is recorded preoperatively and at final follow-up of 12 months after surgery. The mean preoperative UCLA score was 14.06±2.21 (range, 11–17) and the mean postoperative UCLA score was 29.93±3.03 (range, 20–33) (Table 3). The patients' total UCLA score was significantly improved postoperatively ($P<0.01$)

Figure 1

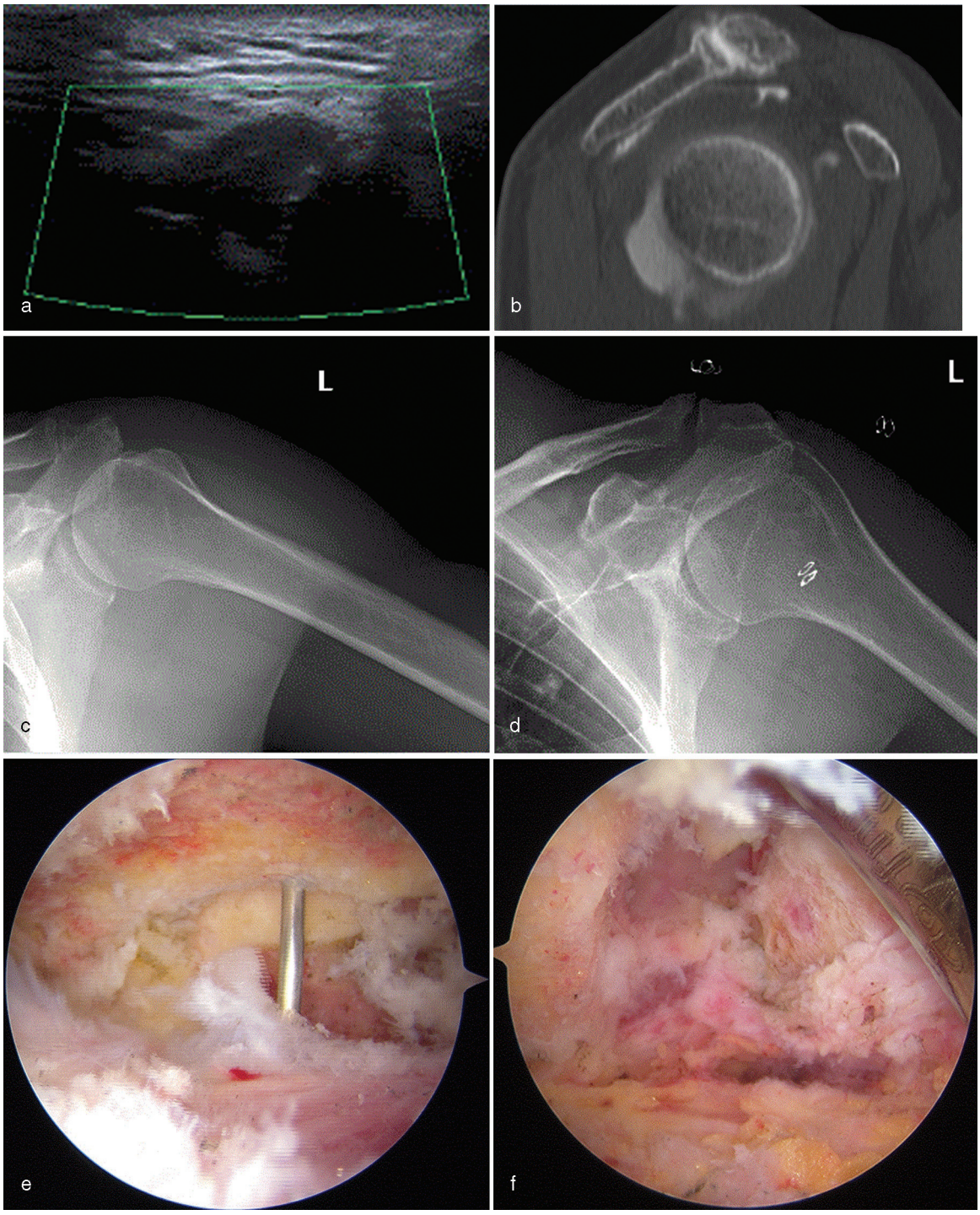
Lateral position for shoulder arthroscopy.

in relation to the preoperative one. Regarding biceps tendon tenotomy, the mean preoperative UCLA score for patients who had biceps pathology and underwent tenotomy was 14±2.82 (range, 12–18), and the mean postoperative UCLA score was 30.5±0.57 (range, 30–31), which is considered a good result. According to UCLA scoring system, 14 patients had good results (consider satisfied) and one patient had a poor result (consider unsatisfied) postoperatively. Moreover, 14 patients reported that they were markedly relived of pain. The average interval between surgery and complete resolution of pain in this was 12 weeks. In one patient, ASD and ACJ excision failed to achieve a satisfactory results. This was because this patient had ACJ instability postoperatively.

Discussion

The contribution of ACJ arthritis to subacromial impingement has been noted by many authors [12,13]. Anterosuperior shoulder pain is a complex problem, often caused not only by subacromial impingement but by ACJ arthritis as well. Thus, procedures that fail to address all potential sources of pain may result in failure to alleviate the symptoms and continued disability [13]. The failure of SAD may be attributed to persistent symptoms of ACJ arthritis [14]. With advances in arthroscopic shoulder surgery, the trend toward arthroscopic resection of the ACJ has been shown. The advantages of an arthroscopic approach have been described in comparison with open resection as better cosmesis with preservation of the acromioclavicular ligaments and capsule and deltotrapezial fascial attachments to the clavicle. This encourages accelerated rehabilitation with immediate motion and possibly a quicker return to functional and athletic activities [14]. The reported results for isolated arthroscopic ACJ excision were either the same as or even better than those reported for the open technique. ACJ pathology can occur in isolation but is often associated with other causes of shoulder pain such as subacromial impingement or rotator cuff pathology. Hemiresection of the distal clavicle will increase mobility of the ACJ because of the resultant ligament and capsular division. If the inferior ACJ is violated at all, a complete resection of the distal clavicle should be performed (the all or nothing approach). Complete resection of the distal clavicle should occur only if the ACJ itself is identified as a specific source of symptoms before surgery [15]. Buford and colleagues reviewed 56 patients with an average 4-year follow-up. All these patients had complete removal of the inferior ACJ capsule and resection of the inferior 20–25% of the clavicle; 95% of their patients were pain free at follow-up. The authors make the point that to fully address outlet impingement, any spurs under the ACJ must be removed. They advocate removal of the inferior

Figure 2



Show preoperative (a) sonar of ACJ arthritis, (b) computed tomography arthrogram, (c) abdominal anteroposterior radiography. Postoperative (d) anteroposterior radiography show ACJ resection, (e) arthroscopic view show bursectomy, smoothing of undersurface of acromion and a needle in ACJ, (f) arthroscopic view after ACJ resection. ACJ, acromioclavicular joint.

capsule and spurs and found no evidence of ACJ pain or instability with this procedure. In addition, none of these patients required repeat operation for AC problems despite the violation of the ACJ [16]. The critical amount of ACJ resection is unknown at this time. The resection should be large enough but should not jeopardize the stability of the ACJ. Most authors recommended resection of ~1 cm of the ACJ [17]. In this current study, the range of AC space after resection was approximately from 5 to 10 mm. Eskola and colleagues showed that more postoperative pain was associated with resection of greater than 10 mm of the ACJ. However, in their study, they included patients with a variety of ACJ separations and fractures, which makes it difficult to generalize this conclusion on the association between pain and the amount of ACJ

Table 2 Demographics of study

Variables	Frequency
Sex	
Male	8
Female	7
Dominant site	
Right	9
Left	6
Acromion	
Hooked	3
Spur	12
Age	25–65
Preoperative duration of symptoms	6–15

Table 3 Total University of California at Los Angeles score preoperatively and postoperatively

UCLA score	Total score
Preoperative	
Range	11–17
Mean±SD	14.06±2.21
Postoperative	
Range	20–33
Mean±SD	29.93±3.03
P_1	<0.001*

Mann–Whitney test. Wilcoxon's signed rank test. Paired sample *t* test. UCLA, University of California at Los Angeles. P_1, *P* value of comparison between preoperative and postoperative. *Significance difference at *P* value less than or equal to 0.05.

resection [18]. Failure of distal clavicle resection when less bone is removed has been reported to be owing to abutment of the distal clavicle against the acromion with arm motion [17]. This finding would suggest significant relative motion between the clavicle and acromion. However, the study by Rockwood (involving percutaneous pins into the scapulae and clavicles of 'volunteers') found that only minimal relative motion could be detected. He believed that abutment of the clavicle against the acromion results more from destabilization of the ACJ from trauma (grade II injury) or surgery (open resection of the distal clavicle) than from inadequate bone removal [19]. In this study, the mean postoperative UCLA score was 29.93±3.03 in all patients, which indicates good results. However, there was only one case that complained of pain and instability at ACJ specially during overhead activity. A direct approach to ACJ resection was used, but it has been reported much less frequently. The direct approach allows improved visualization of the entire joint, direct access to the ACJ, and decreased bony debris in the subacromial space. Levine and colleagues concluded that arthroscopic distal clavicle resection from either the bursal or direct approach yields predictable, reliable results in most patients. Care should be taken to resect an even amount of bone and preserve the supporting capsular and ligamentous structures of the ACJ to maintain stability [15]. Barber have evaluated the correlation between postoperative ACJ instability detected on physical examination and stress radiographs and pain. They were able to show that increased anteroposterior translation of the distal clavicle was associated with increased postoperative pain [20]. In this study, there was only one case with significant increased postoperative anteroposterior translation of the ACJ on clinical examination.

The function of the long head of biceps tendon in the shoulder remains controversial. Pathology of the biceps tendon such as tenosynovitis, subluxation, and prerupture is intimately associated with rotator cuff disease. Treatment therefore varies widely among surgeons and ranges from nonoperative management to biceps tenotomy or tenodesis [21].

In this series, any case with complete rotator cuff tear was excluded, and only cases with biceps pathology were included.

All these patients gained satisfactory results, as the mean postoperative UCLA score was 30.5±0.57, which is considered good results.

Gill and colleagues have also reported favorable results of biceps tenotomy. In 30 patients with biceps tenosynovitis, dislocation or partial rupture was treated with a simple arthroscopic tenotomy. They found that there was a significant improvement in functional score and reduction in pain. There was generally a high patient satisfaction rate, although one patient did require revision tenodesis owing to cosmetic deformity. The overall complication rate was 13% and included loss of overhead function secondary to impingement, persistent pain, and cosmetic deformity [22].The incidence of the Popeye sign caused by distal migration of the long head of biceps stump following biceps tenotomy is in fact far more common. In 54 patients treated with long head of biceps release carried out as an adjunctive procedure for a variety of conditions including rotator cuff tear, glenohumeral osteoarthritis, and instability, the overall incidence of Popeye sign was 70% with 38% complaining of persistent biceps fatigue discomfort after resisted elbow flexion. It is interesting to note that there was a marked difference in the incidence of Popeye deformity between men and women, at 3 and 37%, respectively [23].

Regarding Popeye sign in this current study, only one case of three have it and was complaining of persistent

biceps fatigue discomfort which improved later on after physiotherapy.

Conclusion

Arthroscopic SAD and ACJ resection gives best results to patients who failed conservative treatment and persistent symptoms. ACJ resection can be done through bursal portal or through the superior portal (direct). Regarding ACJ resection in this study, the direct approach was used, with good result without any damage to superior capsule of ACJ. A minimum 5 mm and a maximum 10 mm of ACJ is to be resected to avoid recurrence or ACJ instability. One of the best advantage of arthroscopic ACJ resection and SAD is diagnosis of any intra-articular pathology.

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Conflicts of interest

There are no conflicts of interest.

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