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Results of the surgical treatment for symptomatic mesoacromion

Semptomatik mezo-akromiyon cerrahi tedavisinin sonuçları

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Amaç: Bulgu veren mezo os akromiyale nedeniyle tedavi edilen hastaların fonksiyonel sonuçları geriye dönük olarak değerlendirildi.

Çalışma planı: Konservatif tedaviye yanıt vermeyen, semptomatik os akromiyale tanısıyla ameliyat edilen altı hasta (5 kadın, 1 erkek; ort. yaş 58.5; dağılım 51-64) değerlendirildi. Tüm hastalara internal tespit ve kemik grefti uygulaması yapıldı. Değerlendirmede fizik muayene ve radyografi bulguları ve UCLA (University of California at Los Angeles) skoru göz önüne alındı. Hastaların tümünde subakromiyal sıkışma bulguları vardı ve çeşitli derecelerde rotator manşet yırtığı bulunuyordu. Semptomatik os akromiyale tanısı görüntüleme yöntemleri ve akromiyon üzerinde palpasyonla hassasiyet saptanmasıyla kondu. Akromiyon stabilitesinden şüphe edilen olgularda akromiyon hareketi artroskopiyle incelendi. Tespit materyali olarak, kanüllü vidalar (n=4) veya K-telleri (n=2), serkilaj teli veya erimeyen dikişler kullanıldı. Kemik grefti lokal olarak sağlandı. Ameliyat sonrasında ortalama takip süresi 29 aydı (dağılım 18-35 ay).

Sonuçlar: Ameliyat öncesinde 11.8 olarak ölçülen UCLA omuz skoru, ameliyat sonrasında 28.2'ye yükseldi. Dört hastada kaynama elde edildi. Bu hastaların tümünde kanüllü vidalar kullanılmıştı. K-telleri kullanılarak tespit edilen diğer iki hastada ise kaynama elde edilemedi.

Çıkarımlar: Semptomatik os akromiyale tedavisinde daha sıkı tespit sağlayan kanüllü vidalar kullanılarak başarılı sonuç alınabilir. Os akromiyalenin semptomatik olup olmadığına karar vermede artroskopik değerlendirme yararlı olabilir.

Anahtar sözcükler: Akromiyon/anormallik/cerrahi; kemik vidası; kemik teli; internal fiksatör; eklem instabilitesi/cerrahi; omuz eklemi/anormallik/cerrahi.

Objectives: Functional results of patients who were operated on for symptomatic meso os acromiale were retrospectively evaluated.

Methods: The study included six patients (5 females, 1 male; mean age 58.5 years; range 51 to 64 years) who underwent surgical treatment for symptomatic os acromiale following unsuccessful conservative treatment. Internal fixation and bone grafting were performed in all the patients. Evaluations were based on physical assessment, radiographic examination, and the UCLA (University of California at Los Angeles) score. All the patients had symptoms of subacromial impingement accompanied by various degrees of rotator cuff tears. Symptomatic os acromiale was diagnosed by imaging studies and tenderness over the acromion during palpation. In case of suspected stability of the acromion, arthroscopy was performed. Fixation was performed with cannulated screws (n=4) or K-wires (n=2) and a cerclage wire or nonabsorbable sutures. Bone graft was harvested locally. The mean follow-up period was 29 months (range 18 to 35 months).

Results: The mean UCLA score increased from a preoperative 11.8 to postoperative 28.2. Union was achieved in four patients in whom cannulated screws were used. Two patients who were fixed with K-wires remained ununited.

Conclusion: It is possible to obtain satisfactory results with cannulated screws which probably enable a more rigid fixation in symptomatic os acromiale. Arthroscopic evaluation may be helpful in deciding whether or not os acromiale is symptomatic.

Key words: Acromion/abnormalities/surgery; bone screws; bone wires; internal fixators; joint instability/surgery; shoulder joint/abnormalities/surgery.

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The acromion has four ossification centers; they normally fuse to the scapular process until the age 12 and with each other until the age 25. These four centers are named as pre-acromion, meso-acromion, meta-acromion and basi-acromion.[1] The preacromion is the insertion point of the coraco-acromial ligament and the anterior part of the deltoid, whereas the middle and posterior parts of deltoid muscle inserts to the meso and meta acromion. When there is an insufficiency in osseos coalition between the acromial apophysis and the scapular process in the skeletally immature individuals, the ununited acromial apophysis is named as the os acromiale. [2] Incidence of the os acromiale is reported to be between 1.4-15%.[1-3] Although it is commonly asymptomatic and found incidentally in shoulder x-rays, it is reported to coexist with subacromial impingement syndrome and rotator cuff tears. [4,5] It is suggested that abnormal motion on the ununited acromial part, by the inferior pulling effect of the deltoid muscle, may cause mechanical damage of the rotator cuff and pain by narrowing the subacromial space (Figure 1a, b). [6] There is no consensus in treatment options. Different treatment methods from conservative treatment to excision acromioplasty or internal fixation and grafting has been reported. [7]

In this study, functional results of the patients whom were operated because of symptomatic os acromiale are evaluated.

Patients and methods

Six patients (five females, one male; mean age 58.5 range; 51 to 64 years) whom were operated with the diagnosis of os acromiale between 2000-2003 in our clinic, and whose last controls were performed were included to this study. There was left shoulder involvement in two patients and right in four patients. The main complaint of the patients was shoulder pain in increasing activity and three of them complained of weakness, additionally. The mean duration between the beginning of the complaints and the diagnosis of symptomatic os acromiale and repair was 26.3 months (range; 4 to120 months). While four patients had the complaints post-traumatically, two patients had no significant trauma history. In all of the patients, sensitivity with digital pressure on the acromion was obtained preoperatively.

Various types of rotator cuff tears were present additionally to os acromiale in all patients. Tear size was found by measuring the widest gap, after 1-2 mm slight debridement of rotator cuff tear (8). Accordingly, there was one big, one middle, two small full-thickness rotator cuff tears and two had partial tear smaller then one half of the tendon thickness on the bursal side.

Range of motions were measured by a goniometer while sitting and muscle strengths manually

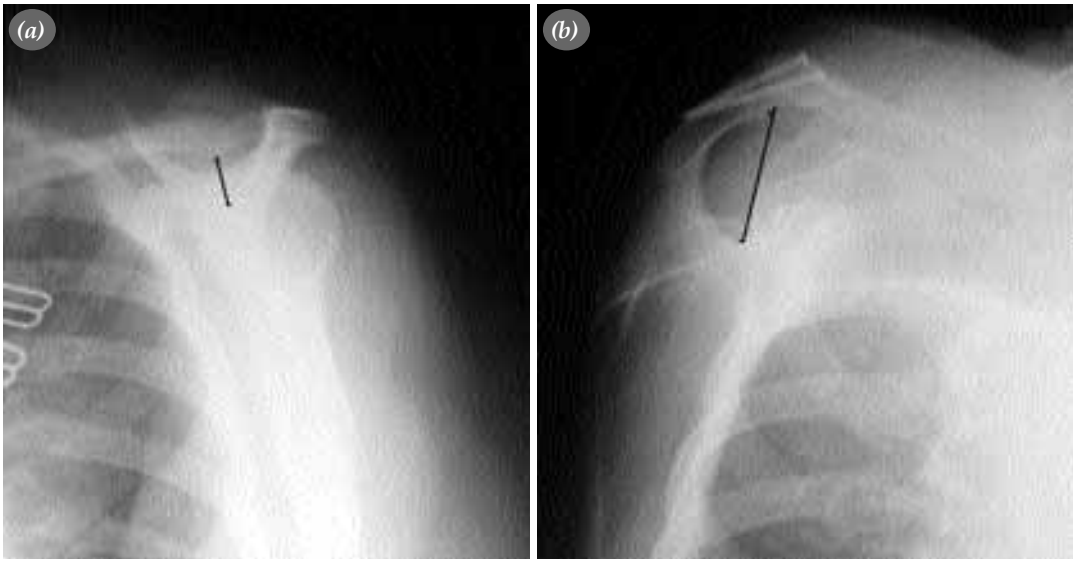

Figure 1. (a) In a case with os acromiale, the pull-down effect of the deltoid narrows the subacromi al space and **(b)** after the fixation the space is widened.

(max. 5) during the physical examinations preoperatively and during the latest follow-up. Accordingly, the mean active forward elevation was 116.6 degrees (range; 90 to140 degrees), and the adduction-external rotation was 35.8 degrees (range; 30 to 45 degrees). The adduction-internal rotation were found to be at level L_1 in three patients, at posterior inferior iliac spine in two patients, and at T_{12} in one patient, preoperatively. The mean supraspinatus muscle strength was 3.16 (range; 2 to 4).

Neer's sign and Hawkin's tests, which evaluates the subacromial impingement, were positive in all patients.[9] All of the patients were evaluated by means of anterior-posterior, axillary, and supraspinatus outlet x-rays and magnetic rezonance imaging preoperatively, and in one patient, computerized tomography study was done additionally. The imaging modalities were repeated at the latest follow-up. The mesoacromion was determined in all patients (Figure 2).

Patients were evaluated according to the UCLA shoulder evaluation form pre and postoperatively (max 35 points); which consists of pain (10 points), function (10 points), active forward elevation (5 points), manuel forward flexion strength (5 points), and patient satisfaction (5 points). Accordingly, 34-35 points were excellent, 28-33 points were good, 21-27 points were fair, and 0-20 points were poor.[10]

Figure 2. The magnetic rezonance image of the mesoacromion.

Surgical indications

Conservative treatment was priorly performed for the patients with partial rotator cuff tear and subacromial impingement symptoms. Medical treatment, with non-steroidal antiinflammatory drugs, activity modification, intermittent cold application and physical rehabilitation were applied as conservative treatment modalities. Surgical procedure was planned for the patients who had pain which persisted more then three months and effected daily living or for symptomatic rotator cuff tears, and for pain which cannot be subsided. The os acromiale was decided to be unstable in patients with significant rotator cuff tears at whom pain could be noted with digital pressure over the acromion. Motion of the acromion was evaluated by performing diagnostic arthroscopy in patients who had partial or small rotator cuff tears and suspected stability of the os acromiale. Arthroscopy was performed to evaluate the stability of the acromion in four patients. Two of them had small, and the other two had partial rotator cuff tears. In patients whom subacromial bursectomy was performed following glenohumeral arthroscopy through standart posterior and anterior-superior portals at beach chair position under general anesthesia, motion in the lower surface of the acromion was evaluated by inspecting the acromion during the stability test performed by digital pressure applied in a downward direction. Tension band fixation was performed by using k-wires and serklage wires in two, and 4 mm cannulated screws and k-wires in four, of the six patients who had unstable os acromiale and who were included in this study. There was medium size rotator cuff tear in one, and a large tear in the other one of the two patients, whom were repaired by k-wires. Open rotator cuff repair was performed in the patient who had medium size tear. Open rotator cuff repair and biceps tenodesis was performed in the patient who had large rotator cuff tear. Small rotator cuff tears were found in two, and bursal side partial rotator cuff tear which involved less than 50% of the tendon thickness was determined in the other two of the four patients who underwent fixation with 4mm cannulated screws. Open repair for the two patients who had full thickness tears and arthroscopic debridement for the other who had two partial tears were performed.

Surgical technique

Tension band fixation with k-wires and serklage wires: This procedure was performed in the patients

Figure 3. The postoperative x-ray of a patient treated with k-wires and No:5 nonabsorbable sutures.

Figure 4. Placement of the cannulated screw after tem porary fixation with a k-wire.

to whom 4 mm cannulated screws could not provided. Patients were operated on beach chair position and under general anesthesia. The acromion and the insertio of the deltoid was visualised by the insicion starting from the posterior corner of the acromion to one cm lateral of the coracoid process. The os acromiale was found. Its motion was inspected by applying digital pressure to its anterior part. The fibers of the deltoid were detached subperiostally from the anterior and lateral corner of the acromion by an electrokotery and being perpendicular to the os acromiale. While performing this, we tried to preserve the acromioclavicular ligament which had an additional aid for the stability of the free acromial piece at the frontal side. The cartilage and the fibrous tissues of the nonunion sites were debrided by a small currette and motorized shavers. The anterior part of the acromion was reducted by leveling it with the posterior part digitally. In this way the intervale between the humeral head and the acromion was widened. Two k-wires were placed from anterior to posterior of the acromion, in a way that paralel to the ununited part. The bone graft provided from the humeral head was placed perpendicular to the unfused part of the acromion after preparing that side by a curette and motorized shavers. It was fixed in a figure- of-eight fashion serklage wires or No:5 nonabsorbable sutures tightened arround the k-wires (Figure 3). Open rotator cuff repair without acromioplasty was performed in patients with rotator cuff tears.

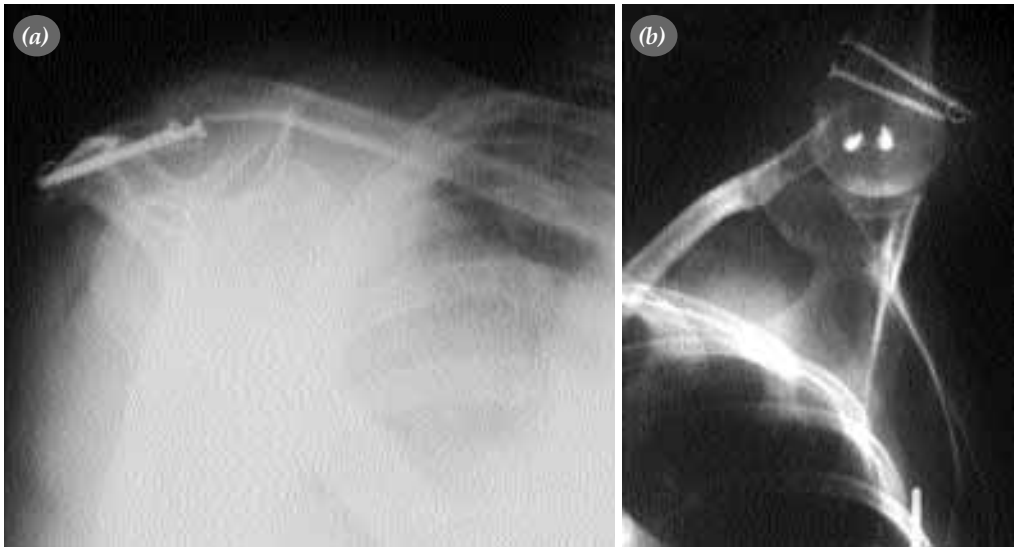

Figure 5. (a, b) The postoperative x-rays of a patient treated with cannulated screws and serklage wires.

Table 1. Pre and postoperative range of motion and supraspinatus muscle strenght of the patients.

	Active forward elevation (°)		Add-external rotation (°)		Supraspinatus strenght	
	Mean	Range	Mean	Range	Mean	Range
Preop	116.6	90-140	35.8	30-45	3.2	2-4
Postop	159.1	145-170	45	30-50	4.3	3-5

Tension band fixation with cannulated screws and serklage wires: In this procedure cannulated screws were used instead of k-wires using the same surgical technique. Following the reduction of the acromion, the os acromiale was fixed temporarily with two parallel k-wires placed through the scapular process from anterior to posterior of the acromion. After drilling with a 2.7 mm cannulated drill over the k-wires, fixation was performed by 4.0 mm partially threaded cortical screws (Figure 4). It was verified that the the screw heads were burried into the bone providing the appropriate reduction and compression. After placing the graft, No:18 serklage wire passing through the canals of the screws was tight strongly over the acromion. Soft tissues over the acromion were sutured in a routine manner (Figure 5a, b).

Postoperative care

Abduction brace was applied to the patients. Passive motion were started at the first week postoperatively, active motions were permitted for restricted simple daily activities and over head activities after the sixth weeks. Full active motion was permitted after the twelfth week.

The mean follow-up was 29 months (range; 18 to 35 months).

Results

There was no complication during the surgery. UCLA shoulder score which was measured 11.8 preopertavively, increased to 28.2 postoperatively. Pre and post operative range of motions and supraspinatus muscle strenghts are shown in Table 1.

Adduction internal rotation, which was at the level of T_{12} in one patient, L_1 in three patients and posterior-superior iliac spine in two patients preoperatively, was found to be at level T_4 in three patients, T_7 in two patients, and T_{12} in one patient postoperatively. X-rays obtained at the latest follow-up showed that, union had formed in four patients at whom 4mm cannulated screws were used for fixation. No union was observed in two patients at whom k-wires were used. The fixation materials were removed from the two patients who were fixed by k-wires because of pain and skin problems.

Discussion

Incidence of os acromiale in skeletal and cadaveric studies was reported between 1,4-15 %.[1-3] Os acromiale accompanying subacromial impingement and rotator cuff tears have been reported, but, in most of the cases, os acromiale is asymptomatic and determined incidentally with imaging methods.[4,5] Burkhart reported a high level tennis player who had os acromiale, joining competitions without having any functional disorder and pain for 15 years before being evaluated for a simple reason.[11] Evaluating the stability of os acromiale before planning the surgery is important. De Palma reported that he had performed open acromioplasty and rotator cuff repairs and by this way he was able to control the stability of the bone. In case of any stability he only performed standard acromioplasty and if instability had been observed the procedure was changed to fixation.[12] Warner et al. pointed out the importance of presence of pain with palpation over acromion in the os acromiale cases, and determined the importance of demonstrating increased uptake in unstable nonunion zone by bone scintigraphy, under the circumstances of suspect os acromiale stability.[2] There are various treatment options for os acromiale and there is no consensus on them.[6] Neer, reported that small unfused acromial parts could be excised, but bigger pieces should be fixed for protecting the deltoid functions.[13] He has suggested to lift-up the unfused acromial part in order to prevent subacromial impingement, applying curettage and local grafting, and performing tension band fixation with non metalic suture materials and k-wires or compression screws. But, he also reported that achieving the union had been difficult.

Armengol et al. suggested modified acromioplasty, because of the failure of the results obtained from internal fixation and open reduction or excision and reported 86% succesful results in patients whom they treated with this metho.[14] Hutchinson and Veenstra reported the recurrence of pain and impingement signs at their patients, at whom they performed arthroscopic acromioplasty.[4] Different results related with the size of the excised part of the os acromiale have been reported. Mudge et al. treated six patients with excision and reattachment of the deltoid to the remaining acromion and reported very good results in four cases, and fair in two after a 1-6 years of follow-up.[5] Osaki and Kondo reported achieving good results with rotator cuff repair and excision of meso acromion in four patients who had symptomatic meso acromion and rotator cuff tears.[15] Wright et al. obtained 85% good results by excision in unstable meso acromion cases.[16] The size of the excised piece was reported to play role on weakness and functional disorder of the deltoid .[7]

Many authors have suggested many different methods of fixation of the apophysis in order to prevent subacromial impingement. Hertel et al. reported that preserving the distal branches of the thoracoacromial artery was important in obtaining succesful results in cases treated with k-wires and serklage wires.[17] Peckett et al.suggested achieving union in 25 of 26 patients fixed with non absorbable sutures or k-wires and serklage or cannulated screws.[3] Satterlee obtained excellent results after 3-6 years of follow-up in six patients, by bone grafting, figure-of-eight sutures combined with 4,5 mm cannulated herbert screws and abduction splint postoperatively.[18] Ryu et al. reported good results in all patients with bone grafting obtained from greater tuberosity and 3,5 mm partially threated cannulated screws.[19] In many studies, fixation with tension band and cannulated screws was found to be successful than other methods in obtaining union of symptomatic os acromiale.[2,20,21]

In case of significant rotator cuff tears, in all our patients, we performed open cuff repair in the presence of pain by pressure applied on the acromion. We also performed internal fixation when acromial motion was observed. We concluded that, performing diagnostic arthroscopy priorly is useful to determine the stability of the acromion, when subacromial impingement accompanies partial or small rotator cuff tears and the acromial stability is suspicious.

In the study of Warner et al. treatment results of 12 shoulders of 11 patients who had symptomatic os acromiale was reported; union was noted in only one of five patients who were operated with k-wires and tension band tecnique, and no union could be observed at the other cases.[2] In contrast, union was achieved in six of seven patients treated with tension band tecnique with cannulated screws. In our cases, union and good results were obtained in four of the six patients. While evaluating the clinical results of patients, effects of rotator cuff tears to the results should be kept in mind. Radiologic and clinical solid fusion obtained in all of the patients at whom 4.0 mm cannulated screws were used, mentiones the importance of rigid fixation. It is possible to obtain succesful results by using cannulated screws in the treatment of symptomatic os acromiale. We do not recommend using k-wires because they don't provide secure fixation and may cause complications.

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