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The results of arthroscopic repair in partial rotator cuff tears

Rotator manşetin kısmi yırtıklarında artroskopik tedavi sonuçları

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Amaç: Rotator manşette tendon kalınlığının %50'sinden daha az kısmi yırtık bulunan hastalarda uygulanan artroskopik tedavi sonrasında yırtığın seyri ve bunun hastalara etkisi değerlendirildi.

Çalışma planı: Çalışmaya, kısmi rotator manşet yırtığı nedeniyle uygulanan konservatif tedaviye yanıt vermeyen ve artroskopik tamir veya birlikte subakromiyal dekompresyon uygulanan 19 hasta (10 kadın, 9 erkek; ort. yaş 49; dağılım 40-70) alındı. On iki hastada yakınmalar belirgin bir travma sonrası başlamıştı. Yakınmaların süresi ortalama 12 ay (dağılım 7-24 ay) idi. Kısmi yırtık 12 hastada artiküler, yedi hastada ise bursal yüzdeydi. Hastalar ameliyat öncesi ve sonrasında fizik muayene, manyetik rezonans görüntüleme (MRG) ve UCLA skoru ile değerlendirildi. Ameliyattan sonra ortalama takip süresi 29 ay (dağılım 12-63 ay) idi.

Sonuçlar: Ameliyat öncesinde 16.8 (dağılım 10-20) olan UCLA skoru ortalaması ameliyat sonrasında 29.0 (dağılım 9-35) bulundu ($p<0.05$). On dört hastada iyi-çok iyi, (%73.7), iki hastada orta (%10.5), üç hastada ise kötü (%15.8) sonuç alındı. Ameliyat sonrası dönemde bir hastada gelişen omuz sertliği rehabilitasyonla düzeldi. Ameliyat sonrası MRG incelemelerinde, 13 hastada kısmi yırtığın devam ettiği, beşinde ilerlediği, birinde ise tam kat yırtık geliştiği görüldü. Kısmi yırtığın ilerlediği hastalarda ağrı yakınmalarının artarak sürdüğü görüldü. Tam kat yırtık gelişen hastada altıncı ayda mini açık rotator manşet tamiri yapıldı.

Çıkarımlar: Kısmi rotator manşet yırtığının artroskopik onarımı sonrasında olguların çoğunda klinik semptomlarda gerileme görülse de, yırtığın çoğunlukla iyileşmediği ve bazı olgularda ilerleyerek tam kat yırtığa dönüştüğü göz önünde bulundurulmalıdır.

Anahtar sözcükler: Akromiyon/cerrahi; artroskopi; debridman; manyetik rezonans görüntüleme; rotator manşet/patoloji/yaralanma; yırtılma; tendon yaralanması; tedavi sonucu; yara iyileşmesi.

Objectives: We evaluated patients who underwent arthroscopic repair for partial rotator cuff tears less than 50% of tendon thickness with respect to the course of tears and functional results.

Methods: Nineteen patients (10 women, 9 men; mean age 49 years; range 40 to 70 years) who did not benefit from conservative treatment for partial rotator cuff tears were treated with arthroscopic debridement with or without subacromial decompression. Twelve patients had a history of trauma before the appearance of complaints which had a mean duration of 12 months (range 7 to 24 months) before arthroscopic repair. Partial tears were on the articular side in 12 patients, and on the bursal side in seven patients. The patients were assessed with preoperative and postoperative physical examination, magnetic resonance imaging (MRI), and UCLA scores.

Results: The mean preoperative and postoperative UCLA scores were 16.8 (range 10 to 20) and 29.0 (range 9 to 35), respectively ($p<0.05$). The results were excellent or good in 14 patients (73.7%), fair in two patients (10.5%), and poor in three patients (15.8). One patient developed shoulder stiffness which improved following rehabilitation. Postoperative MRI showed persistence of partial tears in 13 patients, progression in five patients, and development of total rupture in one patient. Complaints of pain increased in severity in patients in whom partial tears manifested a progressive course. One patient with total rupture underwent mini-open rotator cuff repair in the postoperative sixth month.

Conclusion: Although clinical symptoms show improvement in most of the patients following arthroscopic treatment, partial rotator cuff tears do not heal completely in a considerable number of cases, and may progress to full-thickness tears in some.

Key words: Acromion/surgery; arthroscopy; debridement/methods; magnetic resonance imaging; rotator cuff/pathology/injuries; rupture; tendon injuries; treatment outcome; wound healing.

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Accumulating information concerning rotator cuff diseases have led to better understanding of this particular spectrum of pathology. Cuff pathology commenced by tendon stress and edema may lead to partial tear and finally to complete rupture of the rotator cuff.[1, 2] Partial tears of the rotator cuff might be defined as tears not any relation to glenohumeral joint and subacromial bursa.[3] These might be in the form of bursal side tears, articular side tears or intrasubstance tears. Diagnosis of these tears through open surgical operations and traditional imaging techniques is rather difficult. The developments in ultrasonic and magnetic resonance imaging (MRI) methods rendered rotator cuff to be evaluated through non-interventional methods.[4,5] The developments in the shoulder arthroscopy furthermore are presenting opportunities regarding accurate diagnosis of rotator cuff pathologies and treatment by less invasive methods.

Conservative treatment should be the first method to be chosen for partial tears. In cases where conservative treatment fails; either open or arthroscopic debridement, subacromial decompression or cuff repair methods or any combinations of the above might be performed. However, a basic and practical-for-all treatment scheme concerning which method is to be applied in which conditions is not currently present. Furthermore, how the treatment performed on patients with partial rotator cuff tears affects the natural course of the tear is not precisely determined to date. [6]

In this study, a retrospective evaluation have been carried out regarding the natural course of the tear following surgical treatment performed on patients with rotator cuff tears less than 50% of the tendon thickness and concerning the functional results thereof.

Patients and the method

KNineteen patients (10 female, 9 male; mean age: 49; range 40-74) without any instability who did not benefit from conservative treatment of rotator cuff tears and who were diagnosed with partial rotator cuff tears less than 50% tendon thickness were treated in our clinic between years 1997 and 2003 by arthroscopic tear debridement alone or along with subacromial decompression. The duration of the complaints of the patients before the operation have been approximately 12 months (range: 7-24 months) long. None of them have undergone any surgical intervention previously. All the patients were subjected to physical therapy program before the surgery. To this end, in order to control the inflammation in subacromial bursa, limited physical activity, intermittent cold application and non-steroid anti-inflammatory (NSAI) drug treatment were applied. Single dose of intra-articular corticosteroid injection was used for patients who did not respond to the above treatment. Exercise aimed at enhancing the range of motion was prescribed following the diminution of inflammation and pain. Exercise directed at strengthening of the rotator cuff and muscles around the scapula was utilized. Surgical treatment was planned for patients who did not respond to physical therapy held for at least 3 months. Patients with more than 50% partial rotator cuff tear were subjected to cuff repair and were excluded from the study.

Partial tear diagnosis was verified by the observation of partial tear in tendon fibrils which were examined by probe during the arthroscopy.

Tear debridement alone was applied for patients with tears less than the half of the tendon thickness and who were diagnosed with type 1 acromion whereas other patients diagnosed with acromion type 2 or 3 were also subjected to subacromial decompression along with debridement.

The condition of the tear and its functional effects on patients were intended to be ascertained through physical examination, x-ray and MRG held before the operation and during the final control.

Range of motion was measured by an inclinometer with the patient in sitting position. Muscle strengths were assessed manually. Frontal and posterior shoulder, supraspinatus outlet radiographies were taken.

Preoperative and postoperative MR images were evaluated by the same radiologist without the knowledge of clinical results of the patients. Partial rotator cuff tear was diagnosed by recognition of increased signal intensity in a part of the tendon on T1-weighted images; with the fact that this did not comprise the whole tendon and by observing increased signal in T2- weighted cross sections.

Preoperative and postoperative functional states of the patients were evaluated by means of UCLA (University of Los Angeles California) score.[7] Patients were evaluated in terms of pain relief,[8] functional ability,[8] active forward elevation, [5] strength of forward flexion[5] and patient satisfaction according to UCLA scale (highest score being 35). Relatively; a score of 34-35 points was defined as excellent, 28-33 as good and 0-20 as poor results.

Chi-square test was used for statistical evaluations.

Method of surgery

The patients were operated under general anesthesia and in semi-sitting position (beach-chair). Initially the patients underwent an examination under general anesthesia and were evaluated with regards to stability. Arthroscopic standard posterior and anterior portals were opened. Any partial tears on the articular side and other pathologies within the joint were recorded through standard glenohumeral examination (Table 1). In the case of partial tears; the tear was debridated by motor bone shaver following the examination and its size and depth were recorded (Figure 1a,b). As Synder et al. [9] has described, a spinal needle percutaneously inserted over the deltoid muscle was used to pass a polydioxanon (PDS) suture and the partial tear was marked. Using the same portals subacromial bursoscopy was performed then and the bursal side of

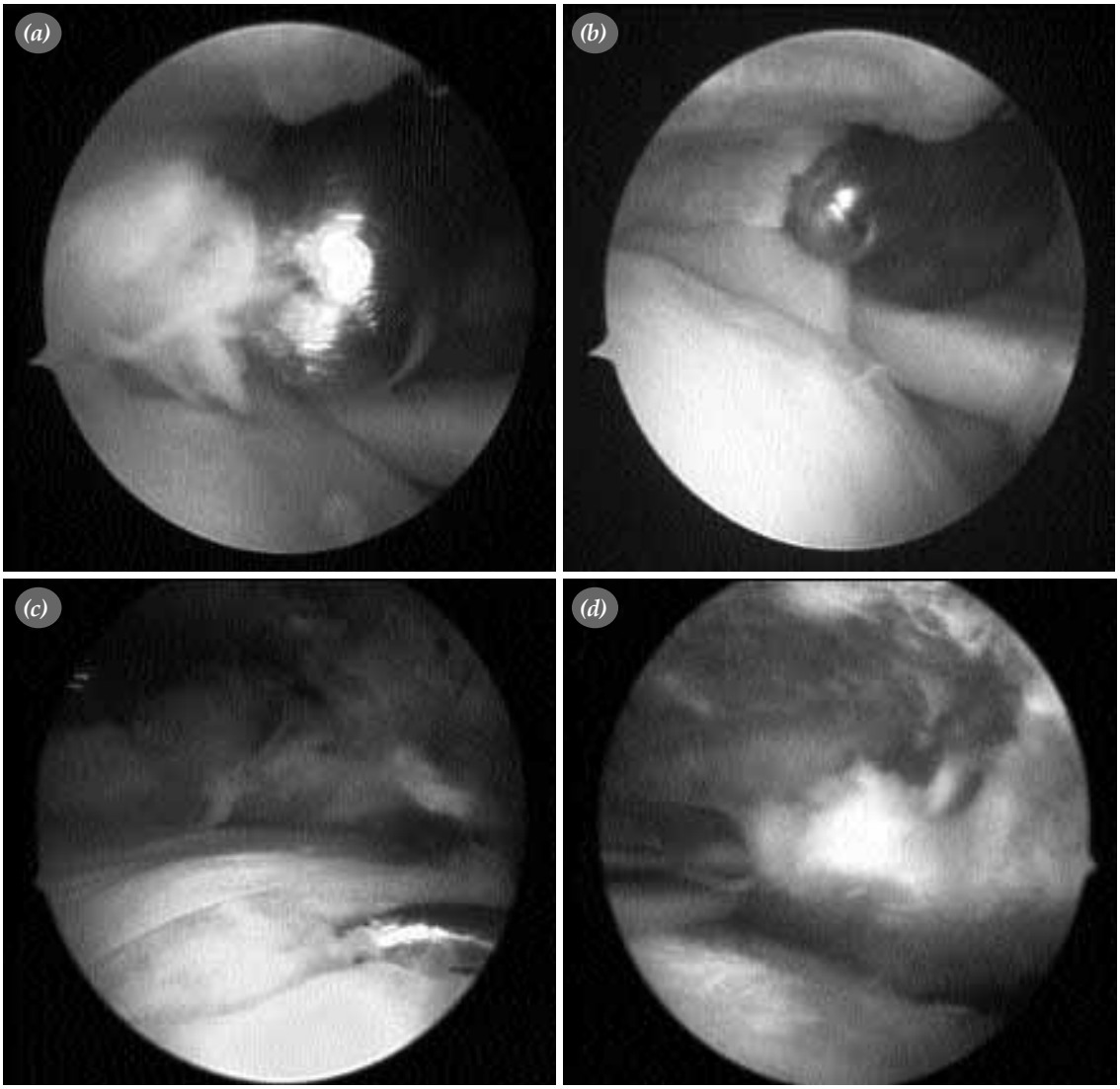

Figure1. Partial tear **(a)** and debridement **(b)** on the articular side. View of partial tear **(c)** on the bursal side following debridement and subacromial decompression **(d)**.

Table 1. Accompanying pathologies in patients and treatments used

Accompanying pathology	Treatment used
• Supraspintus outlet constricted by acromioclavicular joint lower side (n=3)	• Distal end of the clavicula was leveled with acromion
• Chondromalasia in glenohumeral joint (n=2)	• Debridement
• More than 50% tear in biceps tendon (n=1)	• Biceps tenotomy
• Restricted internal rotation due to posterior capsule contracture (n=2)	• Posterior capsular release
• Vertical partial tear (n=1)	• Partial tear was sewn side to side by applying polidioxanon suture no.1

the rotator cuff was evaluated. In cases wherein arthroscopic decompression was to be performed; lateral portal was also opened; the coracoacromial ligament was excised by way of a radiofrequency probe and partial bursa excision was performed by a motor bone shaver. Any isolated partial tears detected in the bursal side were debrided (Figure 1c, d). In cases with acromion type 2 and 3, subacromial decompression was performed as described by Elmann and as modified by Altchek et al. [10]

An arm sling was used for the first week postoperatively and exercises for range of motion, stretching and strengthening the muscles around the shoulder together with rehabilitation and physical therapy were prescribed starting from the first day.

Results

The main complaint in all patients prior to the operation had been pain starting from the shoulder and moving into the arm causing loss of function. The complaints have started following a particular trauma in twelve patients. Trauma was caused by heavy lifting in two patients, falling on the arm in five, hanging by the arm in four and falling with the arm extended forward in one. There were no trauma histories regarding the other seven patients.

Preoperative and postoperative physical examination symptoms are summarized in Table 2.

Pre-op Neer impingement test applied by local anesthesia injection (Marcaine 10mg.) gave positive results in all patients. Hawkins sign gave positive results in eleven patients.

In antero-posterior and supraspinatus outlet x-rays, non-displaced and stable fracture in tuberculum majus in one patient and cystic changes in two patients were observed.

Acromion was evaluated as type 3 in three of the patients, as type 2 in eleven and as type 1 in five of the patients.

Surgical findings

No instability symptoms were seen in any of the patients during the examination held under general anesthesia.

Partial tear was on the articular side in twelve patients and on the bursal side in seven patients.

In five patients with acromion type 1, partial tear was on articular side. These patients were subjected to tear debridement. Fourteen patients with

Table 2. Preoperative and postoperative physical examination findings concerning the patients

	Pre-Op	Post-Op
Active forward elevation (°)	136.3 (90-170)	162.1 (110-170)
Adduction/external rotation (°)	46.3 (30-85)	69.4 (40-90)
Adduction/internal rotation (°)	4 patients T_7	17 patients T_7
	7 patients T_{12}	1 patients L_1
	3 patients L_1	1 patients L_5
	2 patients L_5	
	3 patients PSIS	
Supraspinatus muscle strength	4 (3-5)	4.78 (3-5)

PSIS: Posterior iliac crest

acromion type 2 and three on the other hand were subjected to subacromial decompression along with debridement. Among these patients partial tear was on articular side in seven and on bursal side in seven.

Pre-op UCLA score average of 16.8 (range: 10-20) was found to be 29.0 (range: 9-35) following the operations ($p<0.05$).

The results were found to be good to excellent in fourteen patients (73.7%), moderate in two patients (10.5%) and poor in three patients (15.8%).

No complications were encountered during the operations. One patient developed shoulder stiffness in the postoperative period. A successful result concerning this patient was obtained through rehabilitation.

By examining the postoperative MR images of the patients it was observed that the partial tear had persisted in thirteen patients and had deteriorated in five while complete tear had developed in one patient.

Full rupture developed in one of the patients with poor results and in the sixth month mini open rotator cuff repair was accomplished. In the case of the other four patients, it was observed by means of the MR images that the partial tear deteriorated and the complaints of the patients persisted increasingly.

Discussion

Difficulties in the past regarding the precise diagnosis of partial rotator cuff tears and in definition of contributing factors have complicated the way to

Figure 2. Partial rotator cuff tear in magnetic resonance imaging. Views before the operation **(a)** following debridement and subacromial decompression **(b)** one year after the operation and three years after the operation.

understanding the natural course of these tears. Today, more accurate information might be obtained through MRG and arthroscopic examinations. However, appropriate clinical approach for this situation is still not totally defined. [3, 5]

Factors related to partial rotator cuff tear development are classified as extrinsic, intrinsic and traumatic. Extrinsic impingement due to supraspinatus outlet constriction caused by coracoacromial arch anomalies might lead to cuff damage. This mechanism is considered to be playing an essential role in the development of many partial tears. Excessive strain due to wounding and repetitive stress might also initiate partial tears. Concerning fourteen of our patients in whom acromion type 2 and type 3 were encountered it was concluded that the partial tear has developed due to constriction of the supraspinatus outlet whereas for five patients with acromion type 1 it was assumed that the tear resulted from trauma and repetitive stress.

Partial tears might be located on the articular side, bursal side or in the tendon. [8] It has been reported that tears on the articular side are 2-3 times more commonly encountered than the bursal side tears. [3] In our studies, partial tears were on the articular side in twelve patients (63.2%) and on the bursal side in seven patients ((36.9%).

To date, natural course of the partial tears in the rotator cuff has not been precisely defined. [3,5] While it has been reported that partial tears might heal spontaneously,[3] no proof has been found regarding active tissue healing in rotator cuff sections with partial tears. [5] Hamada et al.[11] have reported in a histochemical study that while a tear in the rotator cuff tendon has a healing potential just as any other tendon in the body; nevertheless complete closure of the defect is doubtful.

Patients with partial tear in the rotator cuff should initially receive conservative treatment. Monitoring 40 patients with partial tear in the articular side who received conservative treatment in a two-year follow-up study with artrography; Yamanaka and Matsumoto [12] concluded that complete tear in the rotator cuff has developed in 28% of the patients whereas 10% of the patients have healed. The authors have reported that whilst minor rotator cuff tears developed in younger patients following a trauma has a potential of healing; majority of the tears have deteriorated in time.

Concerning our cases, surgical treatment was planned when no relief was observed in the symptoms after three months. One of the following three approaches was applied to the patients for the surgical treatment of tears: Tear debridement, acromioplasty along with debridement or tear repair along with acromioplasty. These operations were applied through arthroscopic methods. The evaluation of the articular side of the rotator cuff and diagnosis and treatment of other pathologies in the glenohumeral joint was allowed through arthroscopic examination.

The treatment to be applied was designed in accordance with the reasons of the tear and the accompanying pathologies. Only tear debridement was applied to patients with acromion type 1 and partial tears on the articular side. It has been demonstrated that partial tears might occur on the bursal side, articular side or in the tendon due to pressure rooting from subacromial impingement.[13] Therefore, regardless of whether the partial tear was located on the bursal or articular side or not; acromioplasty was applied along with debridement in patients with acromion type 2 or 3 and who presented subacromial impingement symptoms. Lesions which lead to complaints in the patients were also treated along with the partial tear.

The effect of surgical treatment on the course of partial rotator cuff tear is not yet known absolutely. There is no proof of debridement of the partial tear triggering a healing response.[3,5] In our study, when the postoperative MR images were examined in order to evaluate the condition of the partial tear, it was seen that the tear has remained the same in thirteen patients, has deteriorated in five patients and has transformed to full tear in one patient.

When the results in the literature are examined the role of debridement alone in the treatment of partial tears is vague. Successful results in tear debridement have been reported also without the use of acromioplasty. [9, 14]

Andrews et al.[14] have reported good and excellent results with a rate of 85% concerning arthroscopic examination and debridement they have applied on patients with partial tear in supraspinatus tendon. [9, 14] Carrying on a retrospective examination

over thirty-one patients with partial tear Synder et al. [9] have indicated that subacromial decompression in bursal side tears and debridement in bursal side tears would be sufficient. Successful results between 75-83% with tear debridement and acromioplasty have been reported.[3] On the other hand, there are also studies reporting successful results on only 50% of the patients with debridement of partial tears. [15] In our study, good and excellent results (73.7%) on fourteen patients, moderate results on two patients (10.5%) and poor results on three patients (15.8%) were obtained. Preoperative rate of 16.8 (range 10-20) in UCLA score increased up to 29.0 (range 9-35) following the operation ($p<0.05$). In patients with poor results the complaints were considered to be rooting from the deterioration of the partial tear.

A weak point of our study has been the applications of processes on some of the patients due to accompanying pathologies which in turn have violated the standardization of our study. However, the addition of further pathologies to partial tears is common. Andrews et al. [14] have reported partial tear on the long head of the biceps tendon in three of the patients and tendinitis of the long head of the biceps tendon in two of the patients among thirty-six patients who were subjected to arthroscopy due to partial tear in the rotator cuff. Wright and Cofield [16] have reported that they have come across degenerative arthritis in the acromioclavicular joint in fourteen among thirty-nine patients and that they have applied biceps tenodesis on two of the patients. Furthermore, Gartsman and Milne[17] have detected biceps tendon pathology in twenty-three patients during the arthroscopic treatment of partial rotator cuff tears on the articular side and have reported that partial tears might be the junction point for various pathologic conditions.

Consequently, when the MR images of patients we have subjected to surgical treatment and have followed up for 29 months are evaluated; in none of the cases complete healing of the partial tear was observed. However, in the clinical evaluations during the final controls it was observed that good or excellent results have been obtained in 73.7% of these patients. It might be declared that in short term, the surgical treatment applied has been successful in reducing the clinical symptoms in most of the cases. Subacromial decompression might delay deterioration in partial tears developing due to constriction in the subacromial outlet. However, it should be considered that in patients with rotator cuff tear who would be subjected to surgical treatment the tear does not heal and develop into full tear in some cases.

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