



# The Functional Results of Arthroscopic Bankart Repair with Knotless Anchors for Anterior Glenohumeral Instability

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## ABSTRACT

**Aim:** The purpose of this study was to evaluate the functional results of arthroscopic Bankart repair in patients with posttraumatic recurrent anterior glenohumeral instability

**Method:** Forty one patients (6 female, 35 male; mean age 24.4; range 19 to 39 years) underwent arthroscopic Bankart repair with knotless anchors for posttraumatic recurrent anterior glenohumeral instability. The mean age that first dislocation occurred was 22.3 (range 16 to 36 years old). Involvement was on the right side in 27 patients, on the left in 14 patients, and on the dominant side in 32 patients. Pre and postoperative evaluations included detailed physical examination, assesment with the Rowe and Constant scale for shoulder functions, anteroposterior and axillary radiographs, routinely arthro-CT and arthro-MRI. Postoperatively the mean follow up was 29.8 months (range to 6 to 62 months).

**Result:** According to Rowe score, the results were excellent in 31 patients (75.7%), good in 6 patients (14.6%), fair in 3 patients (7.3%) and poor in 1 (2.4%) patients. The mean preoperative Rowe score was 20.1, which increased postoperatively 89.1. Preoperative mean Constant scale was 64.2 and 87.6 postoperatively. The mean preoperative active external rotation was 45°, which decreased postoperatively to 40° respectively ( $p<0.05$ ). Thirty seven (90.2%) patients were satisfied with the operation. The patient with the poor result developed redislocation postoperatively seventh month due to epileptic seizure.

**Conclusion:** This study shows arthroscopic Bankart repair with knotless anchors for recurrent anterior glenohumeral instability is a useful and succesful procedure.

**Key words:** Anterior shoulder instability, arthroscopic surgery, Bankart repair, shoulder dislocation, suture anchors

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## Anterior glenohumeral instabilite tedavisinde artroskopik Bankart tamirinin sonuçları

**Amaç:** Travmatik tekrarlayan anterior glenohumeral instabilitesi bulunan hastalarda artroskopik Bankart tamir ameliyatı sonuçları değerlendirildi.

**Metod:** Çalışmaya travmatik rekürren anterior glenohumeral instabilite nedeniyle düğünsüz ankorlar ile artroskopik Bankart tamiri yapılan 41 hasta (6 kadın, 35 erkek; ort.yaş 24.4; dağılım 19-39) dahil edildi. İlk çıkığın olduğu en küçük yaş 16, en büyük 36, ort. ilk çıkık yaşı 22.3 idi. Yirmi yedi hastada sağ, on dört hastada sol omuz tutulumu mevcuttu. Otuz iki hastada tutulum dominant taraftaydı. Hastaların ameliyat öncesi ve sonrası ayrıntılı muayeneleri yapıldı, omuz değerlendirme formları tutuldu. Ön-arka ve aksiller grafler, arthro-BT ve arthro-MR ile değerlendirildi. Ameliyat sonrası ortalama takip süresi 29.8 ay (dağılım 6-62 ay) idi.

**Bulgular:** Sonuçlar Rowe ve Constant omuz skorlarına göre değerlendirildi. Ameliyat öncesi ortalama 20.1 (dağılım 15-25) olan Rowe skoru ameliyat sonrası ortalama 89.1 (25-100) olarak değerlendirildi. Otuz bir hastada (%75.7) sonuçlar çok iyi, altı hastada (%14.6) iyi, üç hastada (%7.3) orta (yetersiz) ve bir hastada (%2.4) kötü olarak tespit edildi. Ortalama Constant skoru ameliyat öncesi 64.2 (46-78) iken ameliyat sonrası ortalama 85.6 (48-100) olarak tespit edildi. Ameliyat öncesi ortalama aktif dış rotasyon 45° iken ameliyat sonrası ortalama 40° olarak ölçüldü ( $p < 0.05$ ). Otuz yedi (%90.2) hasta yapılan ameliyattan memnun olduğunu bildirdi. Sonucu kötü olan bir hastada ameliyat sonrası yedinci ayda epileptik atak sırasında redislokasyon gelişti.

**Sonuç:** Çalışma travma sonrası gelişen rekürren anterior glenohumeral instabilite tedavisinde düğünsüz ankorlar ile yapılan artroskopik Bankart tamirinin kullanışlı ve başarılı bir tedavi yöntemi olduğunu göstermiştir. Beraberinde kapsül laksitesi bulunanlarda kapsülün daraltılmasına yönelik girişimlerin yapılabilmesi avantajdır. Bu konudaki tecrübeler ve büyük hasta serileri arttıkça açık cerrahi teknikler eski önemlerini kaybedecek gibi görünmektedir.

**Anahtar kelimeler:** Glenohumeral instabilite, artroskopi, omuz çıkığı, sütür ankor

## INTRODUCTION

Comparing with the others the shoulder joint has the most widely range of motion, but also increased predisposition to dislocation (approximately 50 percent of all dislocations) due to its biomechanics and less bony stability. It usually occurs anteriorly (85-95%). Also its recurrence is more likely than the other joints. Recurrence is relevant with the patient age that first dislocation occurred, closed reduction methods, immobilization time, severity of trauma, accompanied fracture and soft tissue damage. Traumatic anterior instability is the most common form of the glenohumeral instability. Nearly all traumatic anterior instabilities consists Bankart lesion. An avulsion of the labrum from the glenoid rim is known as Bankart lesion (1). Sometimes Hill-Sachs lesion, capsular laxity, SLAP lesion and rotator interval dilatation (enlargement) also accompany to anterior instability.

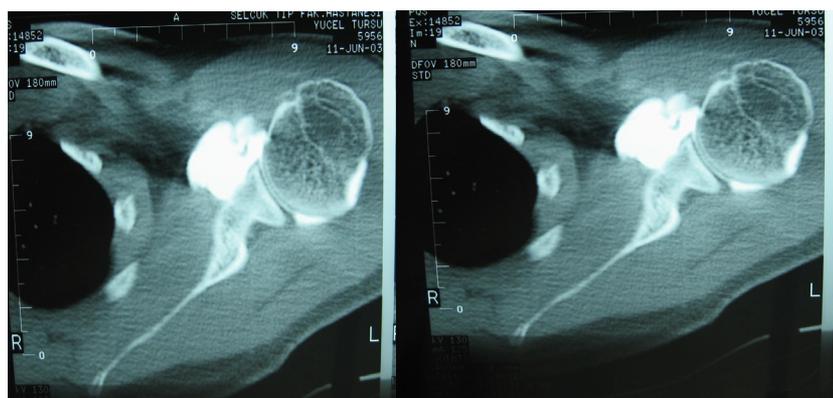
We know that treatment of recurrent anterior glenohumeral instability is surgery. Until recently more than 300 surgical techniques have been reported (2-5) When treating shoulder instability, one should consider the ideal surgical technique. Satisfactory stabilization has been accomplished with open anterior capsulolabral reconstructions such as the Bankart procedure (4,6,7). However, difficulty in achieving strength and in returning to daily activities as well as a decreased range of motion following open Bankart procedures has led to the development of arthroscopic stabilization techniques.

So shoulder arthroscopic stabilization techniques are gradually getting much more used. Arthroscopic methods offers some advantages such as recognising all pathologies causing instability and repairing lesions with less soft tissue damage. In the other hand stability of the shoulder has varied widely after arthroscopic procedures, and technical complications and anatomical limitations have narrowed the indications for arthroscopic stabilization.

The purpose of this prospective study was to assess the results of arthroscopic Bankart repair for anterior glenohumeral instability with the use of knotless anchors.

## MATERIALS AND METHODS

From 2000 to 2005, 41 (6 female, 35 male; mean age 24.4; range 19 to 39 years) patients underwent arthroscopic Bankart repair for recurrent anterior glenohumeral instability at our institution. Involvement was on the right side in 27 patients, on the left in 14 patients, and on the dominant side in 32 (78%) patients. The inclusion criteria included recurrent anterior subluxation or dislocation after the initial episode of traumatic anterior shoulder dislocation and a Bankart lesion confirmed by arthroscopic examination. Patients with acute shoulder dislocation, accompanied glenoid or tuberculum fracture, rotator cuff tear, capsular laxity, posterior instability and multidirectional instability were excluded from the study.



**Figure 1.** Arthro-CT and arthro-MRI view of Bankart lesion

Detailed medical histories and physical examination were obtained preoperatively. Symptoms, complaints, cause and type of instability, type of initial trauma, immobilization after initial dislocation, duration of time to surgery, number of dislocation at this time and expectations from surgery were recorded. Range of motions were measured with a goniometer. Muscle strength were measured manually. To assess the type of laxity sulcus sign, load and shift, apprehension, Jobe's apprehension-relocation, and posterior apprehension tests were used. All patients were evaluated with anteroposterior and axillary radiographs. Arthro-CT and arthro-MRI with 15-20 cc gadolinium were routinely performed (Figure 1). Pre and postoperatively all data were recorded to our shoulder form which included Rowe score and Constant scale.

All operations were performed with a standardised technique by the same surgeon. After induction of general anaesthesia, the patient was placed in a beach chair position and a physical examination was performed to assess the magnitude and direction of instability. Shoulders were evaluated for anteroposterior and inferior sliding preoperatively (8). The shoulder was prepared and draped in a sterile manner, and the bony landmarks were marked carefully. A standard posterior viewing portal and two anterior portals were established using outside-in technique with a spinal needle to establish the most appropriate placement of the cannulas. Priorly diagnostic arthroscopy was performed and inner side of shoulder evaluated systematically. Diagnostic arthroscopy included glenoid labrum, capsule, rotator cuff, both articular surfaces, biceps tendon, and glenohumeral ligaments. Inferior glenohumeral ligament,

middle glenohumeral ligament and their attachments to glenoid and humeral head were evaluated for Bankart lesion. Also humeral head was evaluated for Hill-Sachs lesion. Biceps tendon and rotator cuff were evaluated for additional pathologies. Capsular laxity was examined with probe. Drive through sign was searched (9).

After confirming anteroinferior instability caused by Bankart lesion, capsulolabral tissue was mobilised from the glenoid rim by using periosteal elevators. The goal was to mobilise the labrum such that it could be shifted superiorly and laterally. The glenoid edge between 1 and 5 o'clock position in right shoulder (7 and 11 o'clock position in left) was abraded using a rasp or an arthroscopic burr. Anterior part of the glenoid labrum and the associated inferior glenohumeral ligament is advanced superiorly and the first knotless anchor (no:2 nonabsorbable polyester (ethibond) loaded) was placed at the 5.00-5.30 o'clock position of glenoid edge. The second anchor is placed at the 3.00-3.30 o'clock, and the third one is at 1.30-2.00 o'clock position in the same manner. (Figure 2) Additional suture was used if necessary according to examination and arthroscopic findings. During this procedure, arm was positioned in 10° external rotation and abduction in order to avoid external rotation restriction. After repairing labrum arthroscopic thermal capsular shrinkage applied, and rotator interval was closed if capsular laxity was still going on. For this purpose, soft tissues over subscapularis tendon and anterior border of supraspinatus were stitched together.

Postoperatively, the patients were placed in a gunsling (abduction arm sling) for the first three weeks and they were only allowed hand, wrist and elbow motions. (Figure 3) In the second three weeks they used



Figure 2. Arthroscopic view of Bankart repair with knotless anchor and postoperative radiography

gungling only in the night and pendular and passive assistive exercises were begun. From the sixth to the ninth weeks range of motion increasing exercises were begun with physical therapist surveillance. After ninth weeks active external rotation exercises were started. They were allowed all activities except contact and upper extremity sports at the 16. weeks. Upper extremity sports allowed after eighth months.

Postoperative assesment included Rowe score and Constant scale for shoulder functions. Data analysis comparing the scores before and after surgery was performed using the t-test. A p-value of <0.05 was taken as statistically significant. All the patients were followed up at intervals of three weeks, six weeks, three months and, every six months thereafter postoperatively. The criteria used to define the treatment as a failure was recurrent dislocation, symptomatic subluxation or instability preventing return to full active duties or necessitating an additional surgical stabilisation procedure.

## RESULTS

There were 41 patients (6 female (14.6%), 35 male (85.4%)) underwent arthroscopic Bankart repair. The mean age at the time of surgery was 24.4; range 19 to 39 years. Involvement was on the right side in 27 (65.9%) patients, on the left in 14 (34.1%). 32 (78%) patients had instability at the dominant side, and 9 (22%) had at the nondomi-

nant side. The mean age that first dislocation occurred was 22.3 (range 16 to 36 years old). After first dislocation, immobilization time in 6 (14%) patients was shorter than a week, 1 to 3 weeks in 12 (29.2%) patients, more than 3 weeks in 15 (36.6%) patients.

The etiology of traumatic dislocation was sports in 29 (70.7%), falling down in 9 (22%), swimming in 1 (2.4%), fighting in 1 (2.4%) and epileptic seizure in 1 (2.4%) cases. The mean interval from the initial dislocation and surgery was 40.2 months; range 5 to 192 months. The mean number of dislocation before surgery was 6.1 times; range 2 to 20 times. No neurological deficiency was detected preoperatively. Apprehension test was positive in all patients and anterior translation in 15. 8 patient was existing stage 1 sulcus sign. Diagnostic and operative findings are summarised in Table 1. The mean duration of surgery was 82 minutes. In one patient during surgery an anchor insufficiency developed and it removed. There were no postoperative complications related to the arthroscopic procedure like infection, compartment syndrome, or nevre injury.

The mean duration of follow up was 29,8 months; range 6 to 62 months. The mean postoperative shoulder scores were significantly improved at the time of the final follow-up. The mean preoperative Rowe score was 20.1 (15-25), which improved 89.1 (25-100) postoperatively ( $p < 0.05$ ). According to Rowe score, the results were excellent (perfect) in 31 patients (75.7%), good



**Figure 3.** Shoulder position in abduction arm sling postoperatively

in 6 patients (14.6%), moderate(mean) in 3 patients (7.3%) and poor in 1 (2.4%) patients. Preoperative mean Constant scale was 64.2(46-72) and improved 87.6(48-100) postoperatively ( $p < 0.05$ ). 37(90.2%) patients were satisfied to the surgery. All patients demonstrated a good range of motion.

Preoperatively active external rotation was  $45^\circ$  ( $25^\circ - 70^\circ$ ), which decreased to  $40^\circ$  ( $25^\circ - 60^\circ$ ) postoperatively. Related to the surgery mean external rotation limitation was  $5^\circ$ . One patient with poor Rowe score had recurrent dislocation at the 7. month postoperatively due to an epileptic seizure. He was followed up with conservative treatment. One of three moderate results had positive apprehension test in certain arm positions. The other patient had discomfort and weakness during daily activities. The third one had  $25^\circ$  external rotation limitation and pain postoperatively.

## DISCUSSION

Anterior instability is the most common form of the glenohumeral instability (10,11) Most of the recurrent anterior glenohumeral instability originate due to traumatic conditions. Rowe and Zarins reported a rate of 95.6% traumatic origin to anterior dislocation in their study that included 500 patient (12). Similarly, all patients in our study had recurrent anterior glenohumeral instability because of initially traumatic anterior dislocation.

Anterior dislocations of the shoulder usually develops in the abduction and external rotation position due to decreasing joint stability (10,13). In a cadaveric study

Turkel et al. found that IGHL (inferior glenohumeral ligament) is the primer barrier to avoid dislocation of the shoulder in the  $90^\circ$  abduction and external rotation position (14)

Bankart lesion is traditionally the main reason responsible for anteroinferior shoulder instability, hence requires surgical treatment. Bankart lesion has been found in 90% of patients with traumatic anterior shoulder dislocations.15 Rowe et al. reported as a rate of 85% and Gartsman et al reported 83% Bankart lesion in their series. We found a rate of 97% (in 40 patients) Bankart lesion and 3% ALPSA (anterior labroligamentous periosteal sleeve avulsion) lesion(1 patient) in our patients.

The socket-deepening effect of the glenoid labrum has been proven to be important in maintaining shoulder stability (16,17). Studies have shown that the labrum contributes to 50% of the total depth of the glenoid socket (18). An avulsed or detached labrum known as Bankart lesion therefore causes significant instability because the bumper effect of the labrum is lost and the humeral head has the tendency to roll off the edge of the glenoid socket, resulting in subluxation or dislocation of the humeral head (19). Re-attaching the labrum onto the articular surface restores its socket-deepening bumper effect. This is accomplished using sutures and suture anchors, which can be done either open or arthroscopically (17,20).

Capsular laxity is the other reason for glenohumeral instability. Lack of diagnosing and treating variable capsular laxity accompanying Bankart lesions may cause failure of repair (21,22). For a perfect shoulder instability repair result, all the facts causing instability must be understood and treated appropriately. The decrease of arthroscopic capsular volume can be possible by performing thermal capsuloraphy.

Recently, arthroscopic repair of capsulolabral tissues with appropriate tension using suture anchors is becoming the standart treatment in suitable anteroinferior shoulder instabilities. Arthroscopic Bankart repair has many advantages compared to the open technique. It offers a minimally invasive approach with less surgical trauma and blood loss. Postoperative recovery and rehabilitation is faster than open surgical techniques. Postoperative range of motion is also not sacrificed for the sake of stability. It also prevents cosmesis of the shoulder. Patients are able to have a good range of motion functionally, especially external rotation which al-

lows them to return to their sports or high-demand jobs (23-26).

The high recurrence dislocation statistics in the early times of arthroscopic repairs, have become comparatively as good as open techniques by newer surgical techniques and patient selection. According to Cole et al in a retrospective study comparing arthroscopic and open methods relaxation rate was 24% in arthroscopic group and 18% in open group (27). Gartsman et. al. performed arthroscopic Bankart repair, capsular plication, and if necessary thermal capsuloraphy in 53 patients with anteroinferior shoulder instability. After two years follow-up good and excellent results were 92% and 7,5% of them had recurrence (25). Mishra and Fanton reported a failure rate of 7% with arthroscopic Bankart repair combined with thermal treatment (28). Similarly, Ide et al reported a 7% failure rate after performing arthroscopic Bankart repair in a young, athletic group of patients (29). After two years follow up Westerheide et al., stated 85 mean Rowe score and 7% redislocation rate in 71 shoulders of 67 patients, who underwent arthroscopic Bankart repair (26). Sedeek et al. reached at a 92,5% succesful rate after arthroscopic treatment of 40 shoulders (30). On the other hand in a retrospective study comparing open versus arthroscopic treatment Lützner et al found a tendency towards more frequently and earlier recurrence of instability (31). In our study all patients with anteroinferior shoulder instability underwent arthroscopic bankart repair priorly, if necessary rotator interval closure and thermal capsuloraphy then. At a mean follow-up for 29.8 months, 1 of fortyone patients had recurrence (luxation). The failure rate in our study was 2.5% which was better than the other published studies. This higher success rate of our study may be due to short follow up period, prolonged postoperative immobilization or our nonaggressive rehabilitation programme.

Arthroscopic shoulder instability repair has lots of difficulties. Suture anchors must be put in appropriate angles and places. Also must be put in adequate number. Capsulolabral stabilization was performed at least three anchor insertion by Karlsson (32), Kim (33), Fabriciani (34) and Ide (35). During surgery we usually inserted three anchors, but sometimes two or four depending on the size of the Bankart lesion. Implant failure including migration, loosening and insufficiency (breaking) is not rare perop and postoperatively (34). Likewise an anchor insufficiency developed in one patient and it removed

instantly. On postop radiographs no patients anchors were in wrong position.

All our patients are young, physically active persons who engage in high-demand jobs. The first episode of acute shoulder dislocation is invariably painful and traumatic. Subsequently, it is found that they sustain recurrent shoulder dislocation with increasing ease, even during performing tasks of daily activities, i.e. reaching for overhead objects, stretching, sleeping. The recurrence sustained varies from multiple sublaxations to complete dislocations. Our patients expressed a high degree of satisfaction with arthroscopic Bankart repair. Functional Rowe scores were good-perfect in 37 cases (90,2%), mean in 3 (7,3%), poor in 1 (2,4%). In mean group various complaints like positive apprehension test, weakness, discomfort, and external rotation limitation were going on postoperatively. Relaxation were continuing in one patient of poor group.

Satisfactory range of motion, especially external rotation that allows proper functioning during activities of daily living, is considered more important than just stability alone. So range of motion must be protected while treating shoulder instability. Studies have shown a good range of motion achieved after arthroscopic repair than those achieved after open repair. In a prospective study by Karlsson et. al. comparing arthroscopic and open methods, after a mean duration of 28 months, external rotation was 80° in open group and 90° in arthroscopic group postoperatively (32). Archiero et al. (36) reported a decreasing external rotation rate of 3°, Gartsman et al. (25) reported 5°, Synder et al. (37) reported 5°, and Kim et al. (33) reported 4° in their series. Similarly mean external rotation limitation was 5° in our patients postoperatively.

In conclusion, this study shows arthroscopic Bankart repair with knotless anchors for recurrent anterior glenohumeral instability is a useful and succesful procedure. Identification of patients with evident capsular laxity and addition of thermal capsuloraphy to the procedure to eliminate this laxity may contribute to higher success rates. Widening arthroscopic studies with larger patients, it seems open surgery techniques will lose their significancy completely in the future.

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