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# Comparison of Open Bankart Repair versus Modified Bristow Operation for the Treatment of Traumatic Recurrent Anterior Dislocation and Capsular Laxity of the Shoulder

## *Tekrarlayan Travmatik Anterior Omuz Çıkıklı ve Kapsüler Laksisiteli Omuzlarda Açık Bankart Tamiri ve Modifiye Bristow Ameliyatlarının Karşılaştırılması*

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## Abstract

**Objective:** The purpose of this study was to compare the results of open Bankart repair versus those of modified Bristow operation in patients with recurrent anterior dislocations of the shoulder, the last of which was caused by a minor trauma.

**Materials and Methods:** This study included 38 patients (34 (89.5%) male and 4 (10.5%) female) who presented recurrent dislocation of the shoulders with capsular laxity and who underwent an open Bankart repair or a modified Bristow operation. The mean age of the patients was 29.6 years (range, 17-60 years). The mean follow-up period was 5.5 years (range, 35 months to 9 years). A total of 25 patients (65.8%) underwent an open Bankart repair, whereas 13 (34.2%) underwent a modified Bristow operation. The treatment results were assessed using the Rowe score for instability.

**Results:** Of the 38 shoulders assessed, 24 (63.1%) were right shoulders and 14 (36.9%) were left shoulders. Furthermore, 26 (68.4%) were the dominant shoulders of the patients, and 12 (31.6%) were the non-dominant shoulders. The mean time from the first dislocation was 3.8 years (range, 10 months to 11 years). The age at which the first shoulder dislocation occurred was 20 years or younger in 7 cases (18.4%), 21-30 years in 22 cases (57.9%), 31-40 years in 6 cases (15.8%) and 41 or older in 3 cases (7.9%). The patients had experienced 4-10 recurrent dislocations in 15 cases (39.5%), 10-20 recurrent dislocations in 10 cases (26.3%) and 20 or more recurrent dislocations in 13 cases (34.2%). The mean Rowe score was 85.6 following open Bankart repair and 81.9 following modified Bristow. No significant difference was observed between these good and excellent Rowe scores following the open Bankart repair and the modified Bristow operation ($p>0.05$).

**Conclusion:** Proper patient selection for the open Bankart repair and the modified Bristow operation is crucial. When the proper patients have been selected for these procedures, both produce satisfactory results for the treatment of patients with capsular laxities.

**Key Words:** Capsular laxity, Modified Bristow operation, Open Bankart repair, Recurrent dislocation of shoulder

## Özet

**Amaç:** En son omuz çıkığı düşük kuvvetli bir travmayla oluşmuş, tekrarlayan travmatik anterior omuz çıkıklı hastalarda açık Bankart ve modifiye Bristow ameliyatlarının sonuçlarını çok yönlü değerlendirmesini amaçladık.

**Gereç ve Yöntem:** Tekrarlayan travmatik anterior omuz çıkıklı ve kapsüler laksisitesi olan, açık Bankart veya modifiye Bristow ameliyatları ile tedavi edilen 38 (dağılım, 34 (%89.5) erkek, 4 (%10.5) kadın) hasta çalışmaya alındı. Ortalama yaşları 29.6 yıl (dağılım, 17-60 yıl). Ortalama takip süresi 5.5 yıldı (dağılım, 35 ay-9 yıl). Hastaların 25'ine (%65.8) açık Bankart tamiri, 13'üne (%34.2) modifiye Bristow ameliyatı yapıldı. Tedavi sonuçları Rowe'un skorlama sistemine göre yapıldı.

**Bulgular:** Toplam 38 omuzun 24'ü (%63.1) sağ, 14'ü (%36.9) sol) omuzdu. Omuzlardan 26'sı (%68.4) dominant, 12'si (%31.6) non-dominant omuzdu. İlk çıkıktan sonra geçen süre ortalama 3.8 yıldı (dağılım, 10 ay-11 yıl). İlk çıkığın oluştuğu yaş 7 olguda (%18.4) 20 yaş ve altında, 22 olguda (%57.9) 21-30 yaşları arasında, 6 olguda (%15.8) 31-40 yaşları arasında ve 3 olguda (%7.9) 41 yaş ve üzerindeydi. Tekrarlayan çıkık sayısı, 15 omuzda (%39.5) 4-10 arasında, 10 omuzda (%26.3) 10-20 arasında, 13 omuzda (%34.2) 20 ve üzerindeydi. Açık Bankart tamiri yapılan hastalarda Rowe puanı 85.6, modifiye Bristow ameliyatında 81.9 bulundu. Rowe değerlendirme kriterlerine göre açık Bankart ve modifiye Bristow ameliyatlarının çok iyi ve iyi toplamları arasında istatistiksel olarak anlamlı bir fark bulunmadı ($p>0.05$).

**Sonuç:** Açık Bankart tamiri ve modifiye Bristow ameliyatları için uygun hasta seçilmesi çok önemlidir. Uygun hasta seçimi yapıldığı takdirde bu iki ameliyat tekniği kapsüler laksisiteli hastaların tedavisinde başarılı bir tedavi yöntemidir.

**Anahtar Kelimeler:** Kapsüler laksite, Modifiye Bristow, Açık Bankart tamiri, Tekrarlayan omuz çıkığı

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## Introduction

Recurrent anterior instability of shoulder is the most common joint instability, accounting for 50% of all dislocations [1, 2].

The main cause of shoulder instability is trauma, which accounts for 95% of all shoulder dislocations. Most patients (98%) with shoulder dislocations suffer from anterior dislocations; the remaining 2% suffer from posterior dislocations [3]. The incidence of traumatic anterior shoulder dislocation in the general population is 1.7%. The recurrence rate after conservative management is high among patients who are under 20 years old and lower among patients who are over 40 years old [4]. The location and magnitude of the first trauma is correlated with the recurrence rate [5].

In patients with anterior recurrent dislocations of the shoulder, especially those whose last dislocation resulted from a minor trauma, capsular pathologies concomitant with Bankart lesions are common, and the treatment of choice is an open capsular ligament repair [1, 6]. Open procedures include the open Bankart repair and the modified Bristow operation.

In this retrospective study, we aimed to compare the results of the open Bankart repair versus the modified Bristow operation in patients with recurrent anterior dislocations of the shoulder, the last of which was caused by a minor trauma.

## Patients and Methods

This study included 38 patients who had underwent operations for traumatic anterior recurrent dislocation of the shoulder by open Bankart repair or by modified Bristow operation and who could be contacted and followed up properly. The patients with bony Bankart lesions were excluded. The first dislocations were caused by traumas, and the patients suffered from recurrent dislocations afterwards. All of the last dislocations of the subjects were caused by minor traumas. The last follow-up visits were performed by the same physician, and the results were evaluated using the Rowe Score for instability.

The first trauma that caused the instability was assessed through patient interview during the preoperative anamnesis. The presence of voluntary dislocation due to a psychological ailment was thoroughly questioned. The number of dislocations and the time between the operation and the first dislocation was assessed. A physical examination of the shoulder was performed bilaterally, comparing both of the shoulders. The presence of ligamentous laxity was investigated. Tests that allowed multidirectional evaluation of the shoulder were performed to determine the existence and direction of the instability of the shoulder joint (these tests included the apprehension test, drawer test, sulcus test and relaxation test). Shoulder X-ray images in the true AP position (taken in the plane of the scapula), axillary X-ray images and shoulder MRI were taken. In the cases in which these X-ray images were unsatisfactory, further views were collected: the stryker notch view and the west point view. A hematologic and biochemical laboratory blood work up was performed prior to the operation. Informed consent was obtained from all of the patients. For each patient, 1 unit of blood was prepared, and 8 hours of preoperative starvation was ensured. The patients underwent the operations under general anesthesia or interscalene block anesthesia in the supine position. The arm was abducted 45 degrees, and the upper part of the operating table had been flexed to 30 degrees. A pillow was positioned under the back to raise the chest. The open Bankart repair or modified Bristow operation was carried out through an anterior deltopectoral approach by the same senior surgeon.

The patients were kept in velpeau bandages until the postoperative 3$^{rd}$ day and then slings were used. Pendulum exercises for the shoulder were suggested during the first two days after the operation. After that point, exercises that provided an increase in ROM were suggested. During the 3$^{rd}$ and 4$^{th}$ weeks after the surgery, pendulum exercises followed by active flexion of the shoulder joint up to 90 degrees and abduction of the shoulder were suggested. Nocturnal use of the sling was suggested after the 5$^{th}$ and 6$^{th}$ weeks, as well as active internal and external rotation, abduction, flexion and extension. During the 7$^{th}$ and 8$^{th}$ weeks, internal and external rotation using 2 to 3 kg dumbbells was suggested. From the postoperative 9$^{th}$ to 12$^{th}$ weeks, assisted active exercises that involved external rotation of the humerus in the shoulder joint were included. All of these exercises involved the patients performing the movements of the shoulder joint to the extent of their ability and a physiotherapist aiding them to maintain a full range of motion. In addition, isotonic flexion, extension, abduction and internal rotation exercises against increasing resistance were suggested. From the postoperative 12$^{th}$ to 16$^{th}$ weeks, all physical activities except throwing were permitted. After the 4$^{th}$ month, contact-free sports were permitted, and after the 6$^{th}$ month, contact sports were permitted.

The postoperative follow-ups were carried out by the same physician and the ROMs were evaluated using a goniometer.

### Statistical evaluation

The data were analyzed using the Statistical Package for Social Sciences (SPSS Inc., Chicago, IL, USA) version 18.0. The definitive statistics were presented as the standard deviation of the mean and the median for the measurable variants; the nominal variants were presented as the number of cases or % values. The significance of the statistical differ-

ence between the independent groups was evaluated using Student's t-test. The importance of the continuous measurement of distortion, for the differences in terms of the normal variables, was evaluated using the Mann-Whitney U test. For categorical comparisons, Pearson's chi square test was used. The Wilcoxon test was also used. The acceptable level of significance was chosen to be $p<0.05$.

## Results

In this study, 38 shoulders (24 (63%) right and 14 (35%) left) of 38 patients (34 (90%) male and 4 (10%) female) were included. Out of the 38 shoulders, 26 (69%) shoulders were dominant, and 12 (32%) were non-dominant. Out of the 38 patients, 25 (66%) of the patients underwent open Bankart repair, and 13 (34%) underwent modified Bristow operation. The mean age of the patients was 29.6 years (range, 17-60 years). The mean time interval between the first dislocation and the operation was 3.8 years (range, 10 months to 11 years). The mean follow-up period was 5.5 years (range, 35 months to 9 years).

The first age of dislocation was 20 years or younger in 7 patients (18%); 21-30 in 22 patients (58%), 31-40 in 6 patients (16%) and 41 or older in 3 patients (8%).

The trauma responsible for the first dislocation was most commonly a fall onto the shoulder, with an abducted shoulder joint and a pronated hand (Table 1).

The number of recurrences of shoulder dislocations until the operation was 4-10 in 15 shoulders (39.5%), 10-20 in 10 shoulders (26.3%) and over 20 in 13 shoulders (34.2%). No recurrences were noted postoperatively. In one patient, an axillary nerve lesion was observed, which healed by the end of second month after the operation.

No significant postoperative or intraoperative complications were observed.

**Table 1. Causes of the first dislocation**

| | The number of shoulders | % n=38 |
|---|---|---|
| Falling directly on the shoulder, or pronation of the hand with the shoulder in abduction | 14 | 37 |
| Epileptic seizures | 7 | 18 |
| Sports injuries | 7 | 18 |
| Sudden motions without major traumas | 6 | 16 |
| Lifting heavy objects | 4 | 11 |
| Total | 38 | 100 |

No statistically significant difference was observed between the open Bankart repair and modified Bristow operations, according to the Rowe evaluation criteria ($p>0.05$) (Table 2).

In the patients who underwent open Bankart repair (Figure 1 and 2), the mean elevation loss was 8.6 degrees, the mean internal rotation loss was 12.5 degrees and the mean external rotation loss was 11.6 degrees. These changes in the ranges of motion were significant according to the Wilcoxon test ($p<0.05$).

In the patient who underwent modified Bristow repair (Figure 3 and 4), the mean elevation loss was 10 degrees, the mean internal rotation loss was 12.5 degrees and the mean external rotation loss was 14.3 degrees. These changes in the ranges of motion were significant according to the Wilcoxon test ($p<0.05$) (Table 3).

The number of operations was significantly correlated with the results of the operations ($p<0.05$). The outcomes of the dislocations caused by sports traumas were better than those due to other causes (epilepsy, lifting a heavy object, making a sudden motion, falling), but these results were not statistically significant ($p>0.05$). Better joint functional outcomes were observed in the younger patients, but these results were not statistically significant ($p>0.05$).

**Table 2. The results of treatment, according to the Rowe evaluation criteria**

| | Very good | Good | Insufficient | Poor | *Rowe Score |
|---|---|---|---|---|---|
| Bankart | 16 (64%) | 6 (24%) | 3 (12%) | -(-) | 85.6 |
| Bristow | 6 (46%) | 5 (39%) | 2 (15%) | -(-) | 81.9 |
| Total | 22 (58%) | 11 (29%) | 5 (13%) | -(-) | |

*Mann-Whitney U test ($p>0.05$)

***Figure 1.*** *Postoperative 5th year after open Bankart repair.*

***Figure 2.*** *Postoperative 6th year after open Bankart repair.*

***Figure 3.*** *Postoperative 5th year after modified Bristow procedure.*

***Figure 4.*** *Postoperative 6th year after modified Bristow procedure.*

## Discussion

This study was designed to compare and evaluate the outcomes of the open Bankart repair and the modified Bristow operation for the treatment of recurrent anterior dislocation of the shoulder joint. Our results and the rate of complications, including ROM losses, were in agreement with the current literature [7-12]. Our study revealed that both of these operations produce satisfactory results.

The younger the age of first dislocation, the higher the risk of recurrence. In addition, males have a six-fold greater risk of recurrence than do females [4, 13]. Rowe and Sakellarides [14] reported that 94% of all dislocations involved patients who were younger than 20 years of age. Another study revealed that the risk of recurrence in patients who are under 30 years of age is 30%, whereas in patients who are between 30-40 years of age, the risk of recurrence is 10% [8]. In our study, 2 patients were younger than 20 years of age, 14 were between 21-30 years of age and 5 were 41 or older.

Recurrent anterior shoulder dislocations are frequently caused by traumas. Rowe [3] reported that shoulder dislocations are caused by traumas in 96% of all cases. Within our sample, 16% of the patients suffered from dislocations caused by sudden movements without major traumas. Dominant shoulders are usually dislocated [15, 16]. We observed 24 (63%) right shoulder dislocations and 14 (37%) left shoulder dislocations; 26 (68%) of the dislocated shoulders were dominant, and 12 (32%) of the dislocated shoulders were non-dominant.

Capsular pathologies are usually concomitant with Bankart lesions, particularly in cases of recurrent traumatic anterior shoulder dislocations when the last dislocation was caused by a minor trauma [1]. The presence of capsular laxity is an indication for open surgical intervention. Preoperative assessments may not reveal the presence of capsular or labral pathologies, so in patient with chronic instability, the surgical technique must be chosen during the operation upon examining the signs [17]. The current aims of open surgical procedures include fixing the ruptured part of the bone and eliminating the capsular laxity. In cases of recurrent dislocations, open procedures are extensively performed. In addition, open surgical procedures are recommended for athletes. Anatomic reconstruction, which was defined by

**Table 3. The results of the functional assessments**

| | Mean elevation loss | Mean internal rotation loss | Mean external rotation loss |
|---|---|---|---|
| Bankart | 8.6° | 12.5° | 11.6° |
| Bristow | 10° | 12.5° | 14.3° |
| *Wilcoxon test ($p<0.05$) | | | |

Bankart, is the most commonly performed operation for the treatment of chronic anterior shoulder instability [2, 18].

The Bankart procedure, as performed by Rowe et al. [19], is considered to be the best procedure to stabilize a recurrent anterior shoulder dislocation [20]. The placement of suture anchors to the most inferior part of the anterior glenoid (which marks the anteroinferior glenoid ligament) for the treatment of Bankart lesion provides the best anatomic repair and the lowest rate of recurrence [21]. When capsular laxity is the major pathology, with or without Bankart lesions, open capsular sliding must be performed. So in cases of concomitant Bankart lesions and capsular laxities, performing an open Bankart repair with capsular sliding ensures a minimal level of recurrence. Arthroscopic capsulolabral repair should be performed when advanced capsular laxity is not observed [22-24].

The aim of the modified Bristow operation is to provide dynamic support to the short heads of the biceps brachii and coracobrachialis during abduction and external rotation and to the anterior and inferior parts of the joint. In addition, the transferred bone tissue provides support to the anteroinferior part of the joint, which is the weak point [25]. A satisfactory outcome of the modified Bristow procedure is correlated with a sufficient fixation of the transferred bone [26].

When relieving the shoulder instability, the ranges of motion of the joints must be preserved. Limitations of the range of motion usually results from improper capsular tension. During open surgical procedures, a too tight repair of the capsule and the subscapularis muscle, along with fibrosis during the recovery, results in a limitation of external rotation [27].

There are many variables that can affect the outcome of the operation: gender, age, whether the involved region is dominant, the number of dislocations, the side and severity of the pathologic laxity, the pattern of lesions, surgical technique, rehabilitation course and follow-up period.

The effect of the number of previous dislocations on the functional results was evaluated in our study. The number of prior dislocations before the operation did not have a significant effect on the functional outcome; but clinical observations revealed worse outcomes with an increasing number of dislocations. The presence of a bone defect determines the surgical technique. In cases in which the bone defect is too much, iliac bone grafting or coracoid transfer for glenoid reconstruction is necessary.

An increasing number of preoperative dislocations and increases in age result in worse outcomes. There was no statistically significant difference in the outcomes between the two procedures in cases of recurrent shoulder dislocation. In terms of the range of motion in the joint, the open Bankart repair is superior to the Bristow operation. The recurrence rate is low following both of these procedures. Proper patient choice is crucial for both procedures. If the patients are properly chosen, both of these procedures are successful treatments for patients with capsular laxities.

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