

RESEARCH ARTICLE

The Effect of Angled and Straight Anchor Guides on Clinical Outcomes in Patients Undergoing Arthroscopic Bankart Repair

Artroskopik Bankart Onarımı Yapılan Hastalarda Açılı ve Düz Ankor Kılavuzlarının Klinik Sonuçlara Etkisi

Musab SOLGUN¹, Murat GÜRGER², Ömer ESMEZ^{3,a}

¹Beyhekim Eğitim ve Araştırma Hastanesi, Ortopedi ve Travmatoloji Kliniği, Konya, Türkiye

²Fırat Üniversitesi, Ortopedi ve Travmatoloji Anabilim Dalı, Elazığ, Türkiye

³Fethi Sekin Şehir Hastanesi, Ortopedi ve Travmatoloji Kliniği, Elazığ, Türkiye

M.S. 0000-0003-2448-4751, M.G. 0000-0002-7510-7203, Ö.E. 0000-0002-4475-3501.

*Corresponding Author: Ömer ESMEZ (dresmezomer@gmail.com)

ABSTRACT

Objective: To compare the effect of angled and straight anchor guides on clinical outcomes in patients undergoing arthroscopic Bankart repair.

Material and Method: A total of 43 patients who underwent arthroscopic Bankart repair with at least one year of follow-up were included in the study between January 2013 and January 2020. In 23 patients, an angled anchor guide was used, while in 20 patients, a straight anchor guide was used. Preoperative and postoperative data were retrospectively compared using the Rowe and Constant shoulder scoring systems.

Results: No statistically significant difference was observed between the angled and straight guide groups in postoperative Constant scores (95.4 ± 4.3 vs. 93.1 ± 6.4 ; $p = 0.188$) or postoperative Rowe scores (96.4 ± 4.7 vs. 95.3 ± 7.0 ; $p = 0.551$). When all patients were evaluated together, postoperative Rowe and Constant scores increased significantly compared with preoperative values ($p < 0.001$).

Conclusion: The impact of the two guides employed in arthroscopic Bankart repair on functional outcomes was comparable. The angled guide offered two key advantages. Firstly, it permitted the deployment of an anchor in a more anteroinferior direction relative to the glenoid anteroinferior, with a superior angle of approach. Secondly, it reduced the risk of articular cartilage damage.

Keywords: Bankart Lesion, Arthroscopic Repair, Curved Guide, Straight Guide, Anchor.

ÖZET

Amaç: Artroskopik Bankart tamiri yapılan hastalarda kullandığımız açılı ve düz ankor kılavuzlarının klinik sonuçlara etkisini karşılaştırmaktır.

Gereç ve Yöntem: Ocak 2013 ile Ocak 2020 tarihleri arasında artroskopik Bankart tamiri yapılan ve en az bir yıl takibi olan 43 hasta çalışmaya dahil edildi. Çalışmaya katılan hastaların 23'ünde açılı ankor kılavuzu, 20'sinde düz ankor kılavuzu kullanıldı. Hastaların retrospektif olarak elde edilen, ameliyat öncesi ve ameliyat sonrası verileri Rowe ve Constant omuz skorlama sistemleri kullanılarak karşılaştırıldı.

Bulgular: Açılı kılavuz kullanılan hastaların postop Constant ($95,4 \pm 4,3$) ve postop Rowe ($96,4 \pm 4,7$) skorları ile düz kılavuz kullanılan hastaların postop Constant ($93,1 \pm 6,4$) ve postop Rowe skorları ($95,3 \pm 7,0$) arasında anlamlı farklılık görülmedi ($p = 0,551$). Tüm hastalar birlikte değerlendirildiğinde ameliyat sonrası Rowe ve Constant skor ortalamaları anlamlı olarak arttı ($p < 0,001$).

Sonuç: Artroskopik Bankart tamirinde kullanılan iki kılavuzun fonksiyonel sonuçlara etkisinin benzer olduğu görüldü. Glenoid anteroinferioruna daha iyi bir açı ile ankor gönderilebilmesi ve eklem kıkırdak hasarı riskini azaltması açılı kılavuzun avantajları olarak değerlendirildi.

Anahtar Sözcükler: Bankart Lezyonu, Artroskopik Onarım, Kavisli Kılavuz, Düz Kılavuz, Ankor.

The glenohumeral joint is the joint with the greatest range of motion and the most common site of instability. The incidence of traumatic shoulder instability has been reported to be 1.7%. Anterior dislocations account for 90% of traumatic shoulder dislocations. The prevalence of anterior shoulder dislocation in the general population is 15.5-21.7 times higher than that of posterior shoulder dislocation, and it is most commonly observed in young men aged 15-24 years (1).

Anterior shoulder instability represents the most prevalent form of shoulder instability. It is a clinical condition that manifests following a fall on the arm in abduction and external rotation (2). In patients presenting with a traumatic dislocation for the first time, the most common labroligamentous lesion is the Bankart lesion (3). A Bankart lesion has been identified in 97% of cases of anterior shoulder instability (4). On magnetic resonance arthrography (MRA), the deformed antero-inferior labrum is observed to be completely separated from the glenoid bone and adherent to the IGH (5). The Hill-Sachs lesion has been observed in more than 80% of traumatic instabilities; however, it has been determined that this lesion has no significant effect on instability unless it involves more than 30% of the humeral head (6).

The standard treatment for an acute anterior shoulder dislocation is reduction of the dislocated joint, followed by immobilisation and appropriate rehabilitation. Nevertheless, the efficacy of this treatment is a matter of debate. The incidence of redislocation in post-traumatic anterior shoulder dislocations has been reported to range from 14% to 100%. The treatment of recurrent anterior glenohumeral instability is surgical intervention (7, 8).

It has been demonstrated that there is no significant difference between open and arthroscopic surgical procedures with regard to the recurrence of instability in cases of anterior shoulder instability. Nevertheless, a randomised controlled trial demonstrated superior functional outcomes with arthroscopic surgery. The advent of arthroscopic techniques, coupled with the accumulation of surgical experience and the advent of earlier rehabilitation, has established arthroscopic surgery as the gold standard in the present era (1).

At present, suture anchors are employed in the arthroscopic repair of the Bankart lesion. Suture anchors are classified into two categories: metal and non-metal (biodegradable) (Figure 1).

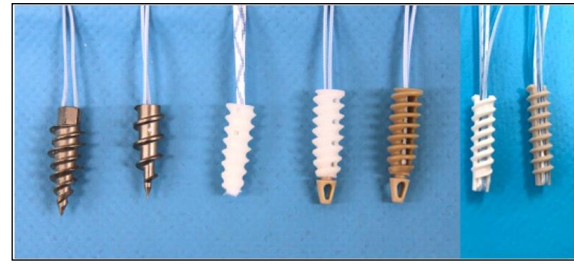


Figure 1. Metal and biodegradable anchors.

Metal anchors are composed of steel, titanium, nitinol, and their respective composites. Biodegradable suture anchors may be composed of polyglycolic acid (PGA), polylactic acid (PLA), or a combination of these two materials (9).

Anchor guides are employed to direct the placement of anchors into the glenoid fossa. These guides can be classified into two categories: traditional straight guides and curved guides. Anchor guides are positioned at the site where the freed capsulolabral structures are to be secured to the glenoid. A drill is then passed through the anchor guide to create the anchor tunnel.

The difficulty of suturing the inferior region with straight anchor guides, the necessity of sending the anchor with a wider angle, and the occurrence of cortical perforation due to the anchor itself led to the production of angled anchor guides. These are distinguished from straight anchor guides by their angulation at the ends (Figure 2).



Figure 2. Anchor guides; the angled (top) and straight anchor guides (bottom).

The objective of this study was to evaluate the impact of utilising straight and angled anchor guides during arthroscopic Bankart repair on patients' functional outcomes.

MATERIAL AND METHOD

This study was conducted in accordance with the ethical standards set forth by the Fırat University Non-Interventional Research Ethics Committee (2021/04-08). The study included 43 patients who underwent arthroscopic Bankart repair between January 2013 and January 2020. The patients were required to have a follow-up period of at least one year and their data was obtained from the hospital data system. The aforementioned information is presented for further context. Angled anchor guides were utilised in 23 patients, while straight anchor

guides were employed in 20 patients. Patients with additional shoulder pathology other than a Bankart lesion, patients who intentionally dislocated the anterior shoulder, patients with muscle disease or joint laxity, patients with Hill-Sachs lesion size exceeding 30%, and patients who did not volunteer to participate in the study were excluded from the study. The functional results of the patients were compared retrospectively using the Rowe and Constant shoulder scoring systems, both preoperatively and postoperatively.

The Rowe scoring system is assessed on a scale of 100 points. The evaluation encompasses the assessment of pain, movement, function, stability and strength. A total of 15 points are allocated for pain, 25 for movement, 10 for strength, 25 for stability and 25 for function. A score between 85 and 100 is considered excellent, 70–84 good, 50–69 fair, and below 50 poor (10).

In the Constant scoring system, pain, daily activity, internal and external rotation, forward and lateral elevation, and strength parameters are evaluated over the previous four weeks. The total score is also 100. A total of fifteen points are allocated to pain, twenty to daily activity, forty to the degree of motion, and twenty-five to strength (10).

Statistical Analysis

The analyses were evaluated using the SPSS 22.0 package program. Descriptive data were presented as absolute and relative frequencies for categorical variables and as mean $\pm$ standard deviation and median values for continuous variables. A Pearson Chi-square test was employed to ascertain any significant differences between the categorical variables observed within the various groups. The compliance of continuous variables with a normal distribution was evaluated using the Shapiro–Wilk test. The Student's t-test was employed for variables exhibiting a normal distribution, whereas the Mann-Whitney U test was utilised for variables lacking such a distribution. A dependent groups t-test was employed for the analysis of repeated measurements. The level of statistical significance was set at $p < 0.05$ for the analyses.

RESULTS

The study included 43 patients who underwent arthroscopic Bankart repair utilising 23 angled anchor guides and 20 straight anchor guides. Two patients (8.7%) who underwent surgery with angled guides were female, while all other patients were male. No significant difference was observed between the groups with regard to gender ($p=0.491$). The mean age at the initial dislocation was 22.2 ± 5.5 years (min =17, max =37) in patients with angled guides and 25.3 ± 6.6 years (min =18, max =39) in patients with straight guides. No significant difference in age was observed between the two

groups ($p=0.105$). It was observed that 21 (91.3%) of the patients with angled anchors and 19 (95%) of the patients with straight anchors exhibited a right-dominant arm ($p=0.635$). The initial dislocation occurred subsequent to a fall on the open arm in 10 patients (43.5%), as a result of sporting activity (contact sports and swimming) in 8 patients (34.8%), during a physical altercation in 3 patients (13%), as a consequence of a work-related accident in 1 patient (4.3%), and due to an epileptic seizure in 1 patient (4.3%). In patients with a straight guide, 9 (45%) had a first dislocation after a fall on an open arm, 5 (25%) during sporting activity, 2 (10%) during military activity, 2 (10%) in a traffic accident, 1 (5%) in a fight and 1 (5%) in a work accident. No significant difference was observed between the groups in terms of the type of initial dislocation ($p=0.440$).

In addition to the Bankart lesion, the Hill-Sachs lesion was observed in 12 (52.2%) and 11 (47.8%) of the patients who underwent angled guidance. Conversely, the Hill-Sachs lesion was observed in 8 (40%) of the patients who underwent straight guidance, but not in the 12 (60%) who underwent angled guidance. No significant difference was observed between the groups in terms of the prevalence of the Hill-Sachs lesion ($p=0.425$).

The median number of preoperative dislocations was 5.0 (2.0-30.0) in patients with angled guidance and 5.5 (2.0-20.0) in patients with straight guidance. No significant difference was observed between the two groups ($p=0.470$). The median time between dislocation and operation was 12.0 (1.0-120.0) months in patients with angled guidance and 10.0 (2.0-72.0) months in patients with straight guidance, with no significant difference between the two groups ($p=0.779$).

The median operative time was 36.0 (30.0-47.0) minutes for patients with angled guides and 37.0 (33.0-53.0) minutes for patients with straight anchors, with no significant difference between the two groups ($p=0.212$). The median postoperative follow-up period for patients with an angled guide was 14.0 (12.0-33.0) months, while the median postoperative follow-up period for patients with a straight anchor was 15.0 (12.0-30.0) months. No significant difference was observed between the two groups ($p=0.704$).

Postoperative redislocation was observed in one patient (4.3%) in the angled guide group and one patient (5%) in the straight guide group. No significant difference was observed in the incidence of postoperative dislocation between the two groups ($p=0.919$).

The preoperative apprehension test was positive in all patients in both groups ($p=1,000$). In the postoperative follow-up, the apprehension test yielded a positive result in one patient who had undergone surgery with the use of a straight guide. No significant difference was observed between the

two groups in terms of the postoperative follow-up apprehension test results ($p=0.463$).

The mean number of anchors utilised in the angled anchor guide group was 2.3 ± 0.4 , while the mean number of anchors employed in the straight anchor

guide group was 2.2 ± 0.4 . No statistically significant difference was observed in the number of anchors used between the two groups ($p=0.385$) (Table 1).

Table 1. Comparison of various characteristics of the groups.

		Angled anchor		Straight anchor		P
		number	%	number	%	
Postop dislocation	yes	1	4,3	1	5,0	0,919*
	no	22	95,7	19	95,0	
Preop Apprehension Test	yes	23	100,0	20	100,0	1,000*
	no	0	,0	0	,0	
Postop Apprehension Test	yes	0	,0	1	5,3	0,463*
	no	22	100,0	18	94,7	
Number of anchors(Mean±SS)		2,3±0,4		2,2±0,4		0,385**

Patients with postoperative redislocation were excluded from postoperative apprehension test analysis.

The mean preoperative Rowe score was 33.5 ± 10.3 in patients with angled guides and 34.8 ± 8.8 in those with straight guides. No significant difference was observed in the preoperative Rowe score between the two groups ($p=0.668$). The mean postoperative Rowe score was 96.4 ± 4.7 and 95.3 ± 7.0 in patients with angled and straight guides, respectively. No significant difference was observed in the postoperative Rowe score between the two groups (p

$=0.551$). The two groups exhibited similarly poor preoperative Rowe scores ($p=1.000$). In the postoperative period, one patient with angled guidance exhibited a good Rowe category, while the remaining patients demonstrated excellent outcomes. Conversely, one patient with straight guidance exhibited a fair Rowe category, while the remaining patients demonstrated excellent outcomes ($p=0.718$) (Table 2).

Table 2. Comparison of preop and postop Rowe scores of the groups.

		Angled anchor		Straight anchor		P
		number	%	number	%	
Preop ROWE score (Mean±SS)		33,5± 10,3		34,8± 8,8		0,668*
Postop ROWE score (Mean±SS)		96,4± 4,7		95,3± 7,0		0,551*
Preop ROWE category	Bad	23	100,0	20	100,0	1,000**
	Middle	0	,0	0	,0	
	Good	0	,0	0	,0	
	Perfect	0	,0	0	,0	
Postop ROWE category	Bad	0	,0	0	,0	0,718**
	Middle	0	,0	1	5,3	
	Good	1	4,5	0	,0	
	Perfect	21	95,5	18	94,7	

Postoperative Rowe category analysis was performed excluding patients with redislocation.

The mean preoperative Constant score was 61.5 ± 9.7 in patients who received angled guidance and 64.6 ± 4.7 in patients who received straight guidance. No significant difference was observed between the groups in terms of the preoperative Constant score ($p=0.187$). The mean postoperative Constant score was 95.4 ± 4.3 and 93.1 ± 6.4 in patients who had received angled and straight guidance, respectively. No significant difference was observed in the postoperative Constant score between the two groups ($p=0.188$) (Table 3).

Table 3. Comparison of preop and postop Constant scores of the groups.

	Angled anchor Mean±SS	Straight anchor Mean±SS	p*
Preop CONSTANT score	61,5±9,7	64,6±4,7	0,187
Postop CONSTANT score	95,4±4,3	93,1±6,4	0,188

A combined evaluation of all patients yielded the following results: the mean preoperative Rowe score was 34.1 ± 9.5 , and the mean Constant score was 63.0

± 7.9 . The mean postoperative Rowe score was 95.9 ± 5.8 , and the mean Constant score was 94.3 ± 5.4 . There was a statistically significant increase in both the Rowe and Constant scores following the surgical procedure ($p < 0.001$) (Table 4).

Table 4. Comparison of Rowe and Constant scores before and after operation.

	Preop Mean $\pm$ SS	Postop Mean $\pm$ SS	P*
ROWE score	34,1 $\pm$ 9,5	95,9 $\pm$ 5,8	<0,001
CONSTANT score	63,0 $\pm$ 7,9	94,3 $\pm$ 5,4	<0,001

DISCUSSION

The shoulder joint is the joint with the greatest range of motion in the human body, and consequently, the joint with the highest degree of instability. Approximately 85-90% of shoulder dislocations are anterior (1, 11).

In excess of 95% of anterior shoulder dislocations are attributable to traumatic causes (12, 13). The most prevalent pathology in traumatic shoulder dislocations is the Bankart lesion. Burkart and Debski (4) demonstrated that 97% of cases of anterior shoulder instability were associated with a Bankart lesion.

The treatment of recurrent shoulder instability is surgical intervention. In the early years, open surgery was the gold standard. However, recent developments have seen arthroscopic Bankart repair become the standard treatment. This is due to increased experience in shoulder arthroscopy, the emergence of successful surgical series, decreased recurrence rates, and facilitated early return to work and sports. Furthermore, arthroscopic Bankart repair techniques and the biomaterials used have evolved and changed over the years. The most commonly used biomaterial today is anchors (1, 7-9).

In a prospective, randomised study, Milano et al. (14) compared the efficacy of metal and bioabsorbable anchors in the treatment of traumatic anterior shoulder instability. The researchers compared the Rowe scores, Constant scores and shoulder, arm and hand disability ratios (DASH) between the two groups. The functional outcomes of arthroscopic Bankart repair were comparable between patients treated with metal and bioabsorbable anchors.

In a prospective study, Tan et al. (15) compared metal and bioabsorbable anchors in arthroscopic Bankart repair. The Oxford Shoulder Instability Score, Visual Analogue Score (VAS), and Short Form 12 (SF-12) were calculated for each patient prior to and following surgical intervention. No significant difference was identified between the two groups in terms of redislocation and shoulder functional scores.

In the present study, metal anchors were employed in patients with straight guides, whereas bioabsorbable anchors were utilised in patients with angled guides. One patient (5%) with metal anchors experienced posttraumatic dislocation at the eighth postoperative month. Despite reduction, the patient's pain persisted, and imaging studies revealed that the metal anchor had migrated into the joint. A second arthroscopic procedure was conducted, during which the metal anchors were extracted and replaced with bioabsorbable anchors, accompanied by a labral repair. In the cohort treated with bioabsorbable anchors, one patient (4.3%) experienced redislocation following an epileptic seizure in the second postoperative year. Subsequently, the patient underwent a second surgical procedure to address the recurrence of dislocation. No significant difference was observed in the incidence of redislocation between the two anchor groups ($p = 0.91$).

Frank et al. (16) examined the impact of portal location and angled guide on anchor placement during arthroscopic Bankart repair. The hypothesis was that the angled guide and trans-subscapular portal would have a favourable effect on anchor placement, prevent cortical perforation and be biomechanically stronger. Irrespective of the portal and guide employed, the 3 o'clock anchors demonstrated greater load tolerance than the 5 o'clock anchors. No significant difference was observed between the groups in terms of maximum applied load at the 5 o'clock position. In conclusion, the strength exhibited against the applied force was found to be similar across all three groups, with no statistically significant difference observed. Nevertheless, the trans-subscapular portal and 5 o'clock anchors were demonstrated to markedly diminish the likelihood of perforation of the contralateral cortex.

In a study conducted by Grieshaber and colleagues (17), the biomechanical forces and glenoid perforation rates of anteroinferior portal-guided apertures and apertures were compared. The results demonstrated that, in terms of both the maximum load applied to the anchor and the angle of glenoid perforation, the open guide did not outperform the traditional straight anchor. No statistically significant difference was observed between the two groups.

In a recent study, Liu and colleagues (18) investigated the impact of angled guidance systems on the optimal positioning of the lowest anchor in arthroscopic Bankart repair procedures. The incidence of perforation of the contralateral cortex was significantly lower in the angled guide group (11%) than in the straight guide group (56%) ($p = 0.02$). The distance between anchor placement and the guide was significantly shorter in the angled guide group (4 ± 1.6 mm) than in the straight guide group (7 ± 2.4 mm) ($p < 0.01$). The insertion angle and the angle relative to the clock quadrant in the straight anchor group were found to be significantly higher

than in the group without perforation. Among the anchors that did not perforate the cortex, the insertion angle and the angle relative to the clock quadrant were found to be significantly higher in the straight anchor group than in the angled group. In light of these findings, Liu et al. concluded that angled guides offer a distinct advantage for anchors placed anteroinferiorly, as compared to straight guides.

There are some limitations to our study. Our sample size may be limited due to the scope of our research topic and the fact that it was conducted in a single center. A larger sample size with multiple centers is required to generalize the topic. In addition, the experience of the operating physician and the amount of bone loss in the patients may affect the results.

In the present study, the functional conditions of patients who underwent arthroscopic Bankart repair were compared using a traditional straight guide and an angled guide. The Rowe and Constant scoring systems were employed to assess the functional outcomes. The findings of our study indicated that

the use of straight and angled guides in accordance with existing literature did not result in a notable alteration in the functional outcome of arthroscopic Bankart repair. In recent years, our clinic has increasingly favoured the use of angled guides and bioabsorbable anchors. In particular, the ability to send an anchor to the anteroinferior region at a superior angle with an angled guide, the reduction of the risk of joint cartilage damage with the use of a bioabsorbable anchor, and the absence of artefacts on MRI are among the most compelling reasons for our preference. A review of the literature revealed a paucity of studies that met the two established guidelines for arthroscopic Bankart repair. It is our contention that further studies and the dissemination of additional case series will facilitate the acquisition of more accurate data regarding the optimal guidelines and materials, thereby contributing to a reduction in the recurrence and complication rates associated with arthroscopic Bankart repair.

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