# Arthroscopic stabilization of anterior shoulder instability using a single anterior portal

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**Objective:** The aim of this study was to compare the effects of the use of a single anterior portal in the arthroscopic surgery treatment of traumatic anterior shoulder instability with those in the literature.

**Methods:** The study included 72 patients (60 males, 12 females; mean age: 23.9 years) who underwent surgery using a single arthroscopic anterior portal for the treatment of traumatic anterior shoulder instability between 2002 and 2011. Clinical outcomes were assessed using the Rowe and Oxford scales, forward flexion range and external rotation limitation. Redislocation was considered failure.

**Results:** Mean follow-up was 49.3 months. Bankart lesion was determined in 38 patients and Bankart and SLAP lesions in 34. An average of 3.7 (range: 2 to 5) anchors were used. Redislocation was observed in 4 (5.6%) patients in the postoperative period. Postoperative Rowe and Oxford scores were 93.4 and 42.6, respectively.

**Conclusion:** Instability surgery performed using a single arthroscopic anterior portal provided findings comparable with the literature regarding clinical outcomes, postoperative shoulder movements and low recurrence rates, emphasizing the importance of appropriate patient selection rather than the number of the portals. The use of a single portal is less invasive and reduces the surgical period.

**Key words:** Arthroscopy; Bankart; shoulder instability; single anterior portal.

Bankart lesions are defined as the tear occurring in the glenoid labrum following traumatic shoulder dislocation.[1] However, studies have shown that stand-alone labral tear does not cause instability, which is caused by capsular prolongation, with or without this tear.[2] In the past, open Bankart repair was considered the gold standard for the treatment of instability occurring after traumatic dislocation. However, arthroscopic repair methods have become popular in the last decade. Despite the negative outcomes in the early practice of arthroscopic treatment, improvements in anchors and manual tools in parallel with technological developments have reduced negative outcomes.[3,4]

Studies have reported the importance of patient selection in arthroscopic instability surgery. The most important factor to be considered for treatment selection is the presence of bone defects in the glenoid cavity and humeral head and currently open surgical methods are preferred for the treatment of patients with such defects.[5] In patients without bone defects, arthroscopic surgical

treatment using two anterior portals has been reported to provide highly successful outcomes.[6]

However, in cases with young and small patients, it may not be possible to place and effectively use two separate cannulas. In such cases, the use of a single portal may be more advantageous.

The aim of the present study was to evaluate the results of labroligamentous complex repair performed using a single anterior portal.

## Patients and methods

The study included 72 patients (60 males, 12 females; mean age: 23.9 years) who underwent surgery using a single arthroscopic anterior operating portal for the treatment of traumatic anterior shoulder instability. All patients were admitted with a diagnosis of posttraumatic anterior shoulder instability between 2002 and 2011. Inclusion criteria were posttraumatic shoulder dislocation, less than 25% glenoid bone loss and no anterior glenohumeral entrapment caused by the humeral Hill-Sachs lesion. Glenoid bone loss was determined during arthroscopy using a bare spot reference point located at the center of articular margin of the inferior glenoid.[7] Patients with non-traumatic, voluntary dislocations and multidirectional instability were excluded.

Table 1 shows the demographic characteristics of the patients. Informed consent was obtained from all patients. Detailed anamnesis on how the first dislocation occurred, how many dislocations occurred and how reduction was performed following these dislocations was obtained from the patients prior to surgery. A detailed physical examination was performed for each patient fol-

lowing anamnesis and included the amount of anterior translation of the shoulder in addition to the anterior relocation and apprehension tests. Detailed neurological examinations were performed. In addition, shoulder muscle strength was evaluated and shoulder laxity was assessed based on bilateral shoulder external rotation greater than 90 degrees with the patient in the supine position with his/her shoulder in adduction.

Shoulder X-ray, axillary X-ray and MR imaging were obtained for each patient prior to surgery. These images were evaluated regarding the Bankart lesion of the glenoid cavity and bone defects in the glenoid cavity and humerus.

All surgeries were performed by the same senior surgeon. Patients were prepared in the modified beach chair position under general anesthesia. Shoulder stability and joint motion space were reevaluated and recorded under general anesthesia. A standard 30° scope was used. The posterior portal was established 1.5 cm medial and inferior to the posterolateral corner of the acromion. The best angle and position to allow access to the glenoid labrum and anteroinferior capsule was determined by means of an epidural needle before establishing the anterosuperior portal. The anterosuperior portal was established through rotator interval ensuring a close position to the anterior corner of acromion by means of epidural needle guidance with the outside-in technique. The presence of anterior labral lesion, glenoid bone deficit, Hill-Sachs lesion and quality of capsular tissue were recorded. The size of the Hill-Sachs lesion and labrum tear were assessed by means of a 3-mm probe to measure the width, length and depth using the

**Table 1.** Demographic characteristics of the patients expressed in mean±SD. Values in parentheses show the range unless otherwise stated.

|  | Bankart | Bankart + SLAP | p | Total |
|---|---|---|---|---|
| Number of patients | 38 (52.8%) | 34 (47.2%) |  | 72 (100%) |
| Age (yrs) | 22.0±3.43 (14-30) | 26.0±3.49 (20-35) | 0.001* | 23.89±3.98 (14-35) |
| Gender |  |  |  |  |
| Male | 30 (78.9%) | 30 (88.2%) | NS† | 60 (83.3%) |
| Female | 8 (21.1%) | 4 (11.8%) |  | 12 (16.7%) |
| Affected side |  |  |  |  |
| Right | 27 (71.1%) | 28 (82.4%) | NS† | 55 (76.4%) |
| Left | 11 (28.9%) | 6 (17.6%) |  | 17 (23.6%) |
| Number of dislocations | 3.13±1.02 (2-6) | 5.65±1.84 (5-10) | 0.001‡ | 4.32±1.93 (2-10) |
| Time from injury to surgery (mos) | 30.08±14.51 (4-52) | 46.85±16.74 (12-96) | 0.001* | 38.0±17.64 (4-96) |
| Preoperative scores |  |  |  |  |
| Rowe | 27.67±5.92 (20-47) | 22.63±4.35 (18-36) | 0.001* | 25.29±5.78 (18-47) |
| Oxford | 16.33±1.82 (13-19) | 14.22±1.96 (12-19) | 0.001* | 15.34±2.16 (12-19) |

*: Student's t-test. †: Continuity correction (Yates) test. ‡: Mann-Whitney U test.
NS: Non-significant. Statistically significant p values are written in bold.

clock-face method. Capsular tissue quality and capsular tension were assessed using a grasper. The labroligamentous complex was completely separated from the glenoid and mobilized towards the superior and lateral using a rasp and radiofrequency (RF). The glenoid neck was decorticated using a burr and the bleeding bone required for tissue recovery was revealed. The glenoid rim was perforated at a 45° medial angle including the 2 mm of the glenoid anterior lip at the 5:30 o'clock position and a 2.9-mm absorbable or 3-mm metal anchor (Mitek 2.9-mm LUPINE® anchor or 3-mm FASTIN® threaded anchor; DePuy Mitek Inc., Raynham, MA, USA) was placed. Using a suture transferring system (Mitek IDEAL™ Suture Shuttle; DePuy Mitek Inc., Raynham, MA, USA), a no. 2 polydioxanone suture (PDS) was passed through the labrum and inferior glenohumeral ligament at 5 to 7 mm inferior to the anchor. Subsequently, the anchor threads were transferred and passed through the labrum and ligament using the PDS. During fixation, the shoulder was kept between the neutral position and 45° of external rotation to avoid fixation with excessive tension. Fixation was then secured using the Revo knot technique. Similarly, threads of other anchors were transferred and subsequently fixated at the 4:30 and 3:30 o'clock positions using the no. 2 PDS passed through labroligamentous tissue at an appropriate posi-

tion. Following the knot, the repair was assessed based on the presence of an arthroscopic 'drive-through sign'. Figure 1 shows the images obtained during arthroscopy and Figure 2 illustrates the schematic diagram of the procedure. In the presence of a SLAP lesion, two more anchors were placed in the anterior and posterior of the biceps anchor and their threads were transferred and fixated using the PDS passed through at an appropriate position.

All patients were kept in internal rotation with a Velpeau bandage for four weeks. Passive pendulum exercise was initiated on the first postoperative day and continued at home 5 times a day for 10 minutes. Physiotherapy was started at postoperative Week 4. External rotation was limited to 45° until the end of the 6th week. Strengthening exercises were initiated between the 8th and 12th weeks. Sportive activities were allowed after six months. Follow-up was performed at the postoperative Weeks 3 and 6 and at the 3rd, 6th and 12th month. Patients were then invited for annual visits.

Shoulder range of motion and instability tests were performed during physical examination. Pre- and postoperative assessments were performed using the Rowe and Oxford scales. A Rowe score of 100 to 90 was considered excellent, 89 to 75 good, 74 to 51 fair and 50
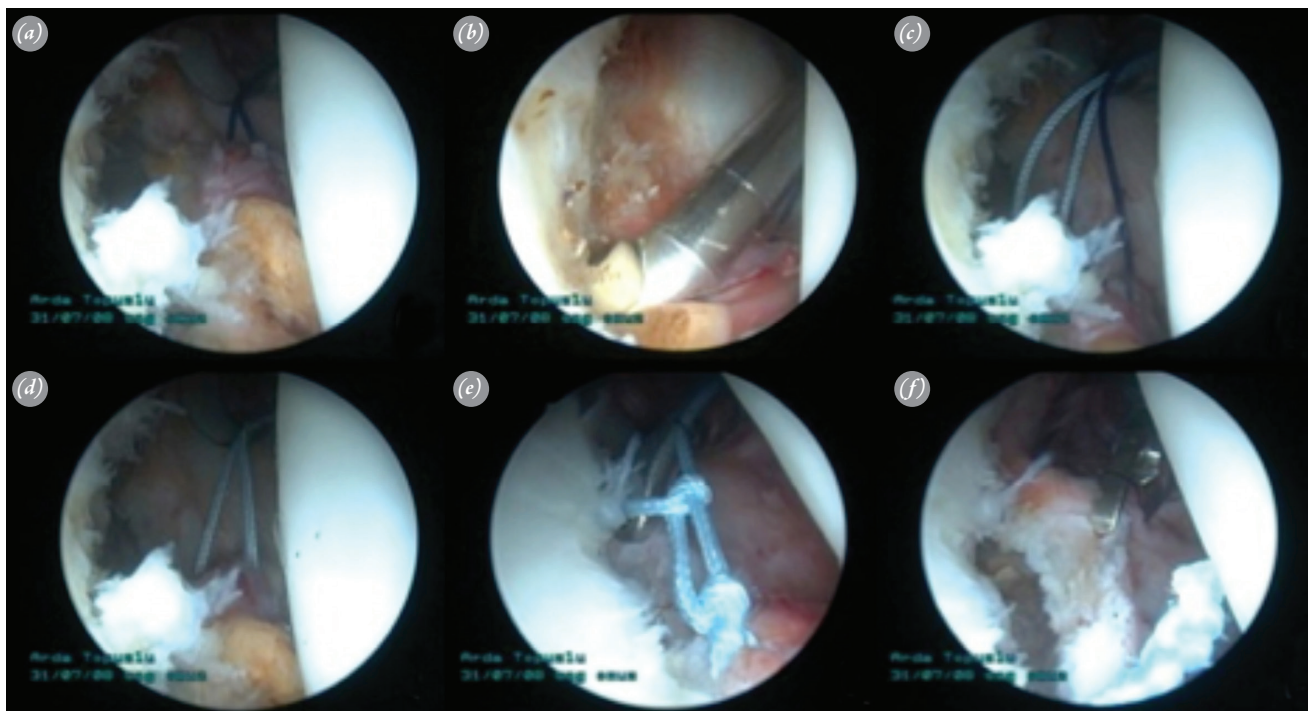


**Fig. 1.** The arthroscopic procedure. **(a)** Examination of the mobilization in the labroligamentous complex by pulling with strap stitching. **(b)** Mobilization of the labroligamentous complex by means of radiofrequency. **(c, d)** Transfer of the anchor thread placed with the PDS thread. **(e, f)** Upward and lateral fixation of the labroligamentous complex by stitches. [Color figures can be viewed in the online issue, which is available at www.aott.org.tr]
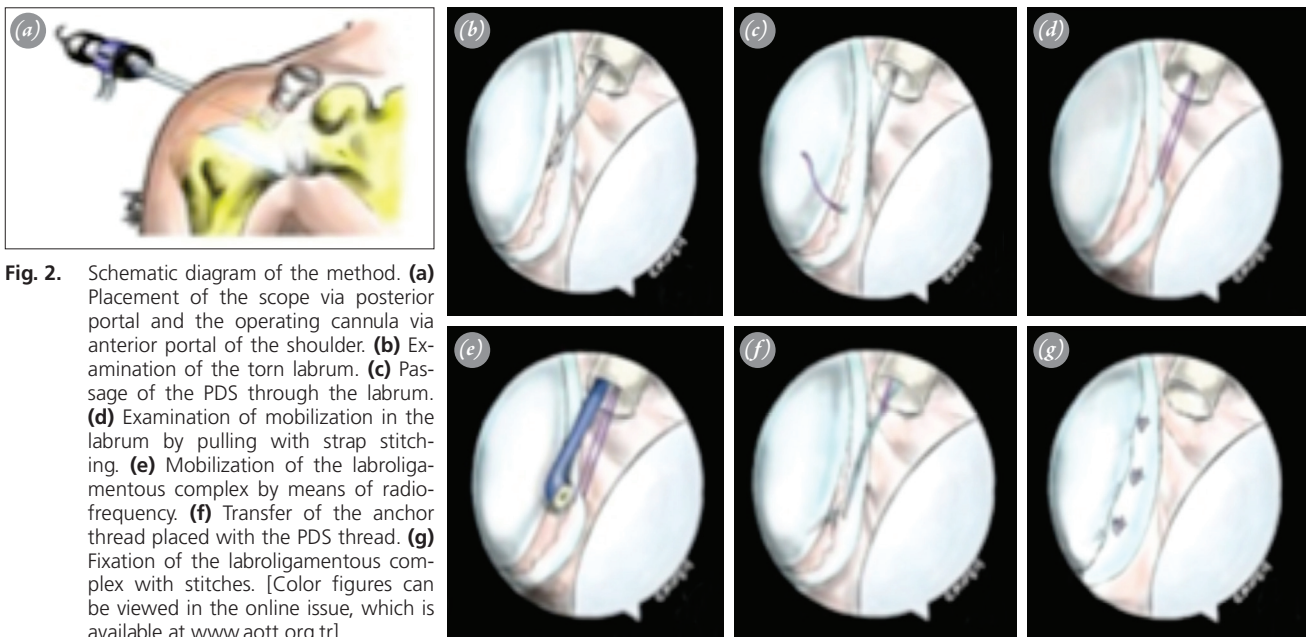
**Fig. 2.** Schematic diagram of the method. **(a)** Placement of the scope via posterior portal and the operating cannula via anterior portal of the shoulder. **(b)** Examination of the torn labrum. **(c)** Passage of the PDS through the labrum. **(d)** Examination of mobilization in the labrum by pulling with strap stitching. **(e)** Mobilization of the labroligamentous complex by means of radiofrequency. **(f)** Transfer of the anchor thread placed with the PDS thread. **(g)** Fixation of the labroligamentous complex with stitches. [Color figures can be viewed in the online issue, which is available at www.aott.org.tr]

or less poor. In the Oxford scale, scores of 48 to 40 was considered excellent, 39 to 30 good, 29 to 20 fair and 19 to 0 poor. Redislocation was accepted as failure criteria.

Statistical analysis was performed using the Student's t-test, Mann-Whitney U test, continuity correction (Yates) test, Fisher's exact test, and Pearson correlation coefficient method. The confidence level was 95% and significance was set at p<0.05. Analyses were performed using SPSS v.15 for Windows (SPSS Inc., Chicago, IL, USA) software.

## Results

Mean follow-up period was 49.31±24.72 (range: 12 to 108) months. Mean time from the first dislocation to surgical treatment was 38.0±17.64 (range: 4 to 96) months. Mean number of dislocations at presentation was 4.32±1.93 (range: 2 to 10) (Table 1). Mean number of anchors used was 3.69±0.71 (range: 2 to 5). Metal anchors were used in 38 patients and absorbable anchors

in 34. Examinations performed under general anesthesia revealed Grade 2 anterior translation in 26 (36.1%) patients and Grade 3 anterior translation in 46 (63.9%). Intraoperative examinations demonstrated Bankart lesion in 38 (52.8%) patients and Bankart and SLAP lesions in 34 (47.2%). Mean surgical duration was 68.15±7.01 (range: 55 to 94) minutes. Intraoperative findings are summarized in Table 2.

Redislocation was seen in 4 (5.6%) patients in the postoperative period. These patients received open treatment with the Latarjet method and their functional outcomes were excluded from the evaluation. Three (4.2%) patients had ongoing postoperative apprehension test and did not experience redislocation or receive any additional treatment during follow-up.

Preoperative mean Rowe and Oxford scores of patients (n=68) were 25.29±5.78 (range: 18 to 47) and 15.34±2.16 (range: 12 to 19), respectively. Mean Rowe and Oxford scores at their final follow-up were

**Table 2.** Intraoperative findings of the patients expressed in mean±SD. Values in parentheses show the range unless otherwise stated.

| | Bankart | Bankart + SLAP | p | Total |
|---|---|---|---|---|
| Number of patients | 38 | 34 | | 72 |
| Anterior translation | | | | |
| Grade 2 | 20 (52.6%) | 6 (17.6%) | 0.005* | 26 (36.1%) |
| Grade 3 | 18 (47.4%) | 28 (82.4%) | | 46 (63.9%) |
| Number of anchors used | 3.21±0.47 (2-4) | 4.24±0.49 (4-5) | 0.001† | 3.69±0.71 (2-5) |
| Surgical duration (min) | 64.63±4.36 (55-85) | 72.09±7.36 (63-94) | 0.001‡ | 68.15±7.01 (55-94) |

*: Continuity correction (Yates) test. †: Mann-Whitney U test. ‡: Student's t-test.
Statistically significant p values are written in bold.

**Table 3.** Final visit results expressed in mean±SD. Values in parentheses show the range unless otherwise stated.

| Bankart | Bankart + SLAP | p | Total |
|---|---|---|---|
| Duration of follow-up (mos) | 48.11±25.77 (12-96) | 50.65±23.81 (17-108) | NS* | 49.31±24.72 (12-108) |
| Postoperative scores | | | | |
|   Rowe | 94.86±2.21 (90-100) | 91.69±3.78 (84-100) | 0.001† | 93.37±3.42 (84-100) |
|   Oxford | 44.36±1.38 (42-48) | 40.53±2.42 (36-48) | 0.001† | 42.56±2.72 (36-48) |
| Redislocation | 2 (5.3%) | 2 (5.9%) | NS‡ | 4 (5.6%) |
| Apprehension test | 1 (2.6%) | 2 (5.9%) | NS | 3 (4.2%) |
| Time to redislocation (mos) | 23.50±0.71(23-24) | 17.5±12.02 (9-26) | NS | 20.50±7.77 (9-26) |
| Limited external rotation (deg) | 3.45±1.03 (2-6) | 5.09±1.83 (3-9) | 0.001† | 4.22±1.67 (2-9) |
| Forward flexion (range of motion) | 175.05±3.73 (166-180) | 172.12±4.64 (163-180) | 0.001† | 173.67±4.41 (163-180) |

*: Mann-Whitney U test. †: Student's t-test. ‡: Fisher's exact test.
NS: Non-significant. Statistically significant p values are written in bold.

**Table 4.** Pre- and postoperative Rowe and Oxford scores of the patients.

| | | Bankart | Bankart + SLAP | p* |
|---|---|---|---|---|
| | | Mean±SD | Mean±SD | |
| Rowe score | Preoperative | 27.67±5.92 | 22.63±4.35 | 0.001 |
| | Postoperative | 94.86±2.21 | 91.69±3.78 | 0.001 |
| | p† | 0.001 | 0.001 | |
| Oxford score | Preoperative | 16.33±1.82 | 14.22±1.96 | 0.001 |
| | Postoperative | 44.36±1.38 | 40.53±2.42 | 0.001 |
| | p† | 0.001 | 0.001 | |

*: Student's t-test. †: Paired-samples t-test.
Statistically significant p values are written in bold.

**Table 5.** Comparison of biostatistics findings of the patients who underwent arthroscopic repair.

| | | Postoperative Rowe score | Postoperative Oxford score | Limited external rotation | Forward flexion (range of motion) |
|---|---|---|---|---|---|
| Time from injury to surgery (mos) | r | 0.087 | -0.211 | -0.129 | 0.059 |
| | p | NS | NS | NS | NS |
| Dislocations | r | -0.112 | -0.156 | 0.288 | -0.045 |
| | p | NS | NS | ns | NS |
| Number of anchors used | r | -0.291 | -0.338 | -0.032 | 0.055 |
| | p | NS | NS | NS | NS |

r: Pearson's correlation coefficient. NS: Non-significant.

93.37±3.42 (range: 84 to 100) and 42.56±2.72 (range: 36 to 48), respectively. Physical examination during the final follow-up revealed a mean external rotation limitation of 4.22±1.67 (range: 2 to 9) degrees and a mean forward flexion range of 173.67±4.41 (range: 163 to 180) degrees. Mean time to redislocation was 20.50±7.77 (range: 9 to 26) months in patients with redislocation. The findings obtained during the final follow-up are summarized in Table 3. Superficial wound infection was detected and resolved with appropriate oral antibiotic therapy in one patient. No other complication was observed in our patients.

Comparison of pre- and postoperative Rowe and Oxford scores showed a statistically significant difference (p<0.05) (Table 4). There was no significant difference between the postoperative outcomes (Rowe and Oxford scores, external rotation limitation and forward flexion range) and the number of dislocations during the preoperative period, between the postoperative outcomes and time to surgical treatment, between the postoperative outcomes and grade of translations obtained during the physical examination under general anesthesia, and between the postoperative outcomes and

**Table 6.**    Biostatistics findings of the patients after arthroscopic repair.

| | Anterior translation grade | | p |
| | Grade 2 | Grade 3 | |
| | Mean±SD | Mean±SD | |
| --- | --- | --- | --- |
| Postoperative Rowe score | 95.80±2.59 | 91.95±3.04 | NS |
| Postoperative Oxford score | 44.64±2.04 | 41.35±2.32 | NS |
| Limited external rotation (deg) | 3.42±1.14 | 4.67±1.77 | NS |
| Forward flexion (range of motion) | 175.73±3.58 | 172.5±4.44 | NS |

Student's t-test. NS: Non-significant.

**Table 7.**    Number of anchors used in patients who underwent arthroscopic repair.

| | Redislocation | | p |
| | (–) | (+) | |
| | Mean±SD | Mean±SD | |
| --- | --- | --- | --- |
| Total | 3.71±0.71 | 3.50±0.58 | NS |
| Bankart | 3.22±0.48 | 3.0±0 | – |
| Bankart + SLAP | 4.25±0.51 | 4.0±0 | – |

Mann-Whitney U test. NS: Non-significant.

number of anchors used (p>0.05) (Tables 5 and 6). The number of dislocations during the preoperative period, time to surgery and grade of anterior translation during general anesthesia did not adversely affect the postoperative outcomes. There was no statistically significant difference regarding postoperative dislocation rates according to the number of anchors used in patients (p>0.05) (Table 7). A statistically significant difference was found in postoperative outcomes between patients with Bankart lesion and patients with Bankart and SLAP lesions (p<0.001). While, mean outcomes were better in patients who received treatment for Bankart lesion alone, results were excellent in both groups.

## Discussion

In the current study, the redislocation rate was 5.6% following arthroscopic repair of Bankart and Bankart and SLAP lesions. Redislocation rate was high during the first two years following surgery. Our redislocation rate was lower than those in the literature.[3,6,8] Gartsman et al. followed 53 patients for two years and reported a redislocation rate of 8%,[6] while Mahiroğulları et al. reported a redislocation rate of 5.9% in 34 patients followed for two years.[3]

According to the literature, one of the most important factors affecting outcome is the number of anchors used for treatment. The mean number of anchors used in our study was 3.7, with up to 5 anchors applied in patients with SLAP lesion. Stability requires a minimum of 3 anchors. Studies show an increased rate of redislocation with the use of 2 or fewer anchors.[8-11]

An additional risk factor is the presence of humeral bone or glenoid defects. Success rates in arthroscopic Bankart repair is particularly low in patients with an inverted pear glenoid with glenoid bone defects greater than 30% and in patients with Hill-Sachs lesion with a bone defect large enough to cause complete entrapment to the anterior glenoid at the humeral head. Redislocation rates are considerably high in these patients.[9,10,12,13] Arthroscopic Bankart repair was not used in our study in patients with a large Hill-Sachs lesion or in those with a glenoid defect greater than 25%. These patients were treated using the Latarjet method.

Another important risk factor of redislocation is joint laxity and considerably high redislocation rates have been reported in the literature. External rotation greater than 90 degrees with the shoulder in adduction during preoperative bilateral shoulder examination is a particularly important indicator. In such cases, open repair appears to produce more satisfactory outcomes than arthroscopic methods.[5,10,11,14] Arthroscopic repair methods were not used for patients with hyperlaxity in this study.

Outcomes obtained in the present study were successful compared to those in the literature.[15-17] Our study demonstrated that postoperative outcomes are not adversely affected by the number of preoperative dislocations, time to surgical treatment and grade of anterior

translation observed during preoperative examination during general anesthesia. Gartsman et al.[6] reported that increased number of preoperative dislocations, time to surgery and increased rate of anterior translation do not adversely affect postoperative outcomes. Mobilizing the anterior capsuloligamentous complex precisely from the glenoid neck, then shifting upward and towards the lateral, and fixation with an appropriate number of anchors provides successful arthroscopic outcomes.

The outcomes obtained in the current study in patients with Bankart lesion alone were better than those of patients with Bankart and SLAP lesions. As emphasized in the literature, appropriate capsule mobilization and shifting followed by SLAP repair provides comparable findings to those achieved in patients with Bankart lesion alone, even in cases in which tissue quality is disrupted.[6,18,19]

Although it has become the standard practice in arthroscopic instability surgery, the frequently used double anterior portals have certain limitations. In young patients and in those in which an appropriate preoperative plan for the administration of two portals cannot be established, the placement and efficient use of two separate cannulas may not be possible. However, there is no such limitation in single portal surgery. In single portal surgery, while it may not be possible to place the anchor at the 5:30 o'clock position through a portal established in a too superior location, a percutaneous anchor may be placed via the transsubscapular route.[20]

In conclusion, outcomes obtained using a single anterior portal for the arthroscopic surgery treatment of traumatic anterior shoulder appear to be comparable to those achieved in double portal repair. Proper patient selection contributes to the success of the procedure. This reduction in the surgical period of this less invasive procedure may be considered an advantage over double portals.

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