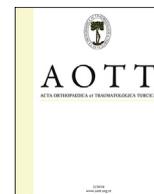


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Single anterior portal: A better option for arthroscopic treatment of traumatic anterior shoulder instability?



Hakan Çiçek*, Ümit Tuhanioglu, Hasan Ulaş Oğur, Firat Seyfettinoğlu, Osman Çiloğlu, Tahsin Beyzadeoğlu

Adana Numune Training and Research Hospital, Adana, Turkey

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ABSTRACT

Objective: The aim of this study was to compare single and double anterior portal techniques in the arthroscopic treatment of traumatic anterior shoulder instability.**Methods:** A total of 91 cases who underwent arthroscopic Bankart repair for anterior shoulder instability were reviewed. The patients were divided into 2 groups as Group 1 (47 male and 2 female; mean age: 25.8 ± 6.8) for arthroscopic single anterior portal approach and Group 2 (41 male and 1 female; mean age: 25.4 ± 6.6) for the classical anterior double portal approach. The groups were compared for clinical scores, range of motion, analgesia requirement, complications, duration of surgery, cost and learning curve according to a short questionnaire completed by the relevant healthcare professionals.**Results:** No statistically significant difference was found between the 2 groups in terms of pre-operative and post-operative Constant and Rowe Shoulder Scores, range of motion and complications ($p > 0.05$). In Group 2 patients, the requirement for post-operative analgesics was significantly higher ($p < 0.001$), whereas the duration of surgery was statistically significantly shorter in Group 1 ($p < 0.001$). In the assessment of the questionnaire, it was seen that a single portal anterior approach was preferred at a higher ratio ($p = 0.035$). The cost analysis revealed that the cost was 5.7% less for patients with a single portal.**Conclusion:** In the arthroscopic treatment of traumatic anterior shoulder instability accompanied by a Bankart lesion, the anterior single portal technique is as successful in terms of clinical results as the conventional double portal approach. The single portal technique has advantages such as less post-operative pain, a shorter surgical learning curve and lower costs.**Level of Evidence:** Level III, Therapeutic study.© 2017 Turkish Association of Orthopaedics and Traumatology. Publishing services by Elsevier B.V. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

The glenohumeral joint is a synovial joint, and is the most commonly dislocated joint in the human body.¹ Glenohumeral luxation is seen in approximately 2% of the population.² Bankart lesion, which is defined as anteroinferior detachment of the glenoid labrum, has been demonstrated in 87%–100% of first-time dislocations.^{3,4} Since risk of recurrent dislocation is high, particularly in younger patients, it persists as a problem, lowering quality of life at later age.⁵ Currently, the most popular method of treatment is arthroscopic repair. Successful results observed in studies of

anterior instability treatment using single anterior portal without the need for an additional portal have been published in literature.^{6,7}

The aim of the present study was to compare clinical scores, length of hospital stay, analgesia requirement, and total cost of treatment of single portal and double portal techniques for Bankart lesion repair performed due to traumatic anterior shoulder instability. Hypothesis was that single portal technique could be reliable treatment alternative for Bankart lesion.

Patients and methods

A retrospective evaluation of patients who underwent arthroscopic Bankart repair for anterior shoulder instability between 2009 and 2012 at Adana Numune Training and Research Hospital

* Corresponding author.

E-mail address: drcekeh@hotmail.com (H. Çiçek).

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and who were followed-up for at least 2 years was conducted. Exclusion criteria were multi-directional instability, accompanying superior labral tear from anterior to posterior and/or rotator cuff tear, anterior labrum atrophy, diagnosis of posterior bony Bankart, or exitus during follow-up. Study included total of 91 patients who met the criteria. Patients were separated into 2 groups. Group 1 comprised 49 patients (47 males, 2 females) on whom single portal technique was used, and Group 2 comprised 42 patients (41 males, 1 female) who were operated on using double portal technique. Data were obtained from patient records, including preoperative Constant Shoulder Score (CSS) and Rowe Score for Instability (RWS) test results and external rotation and abduction angles (measured with goniometer) of the pathological shoulder. Groups had similar demographic characteristics in terms of age and gender (Table 1).

All surgical procedures were performed by the same orthopedist with different accompanying assistant doctors and specialist surgeons. All patients were operated on in beach-chair position under hypotensive general anesthesia with the aid of arthropump (Arthrex AR – 6480 DualWave Arthroscopy Pump, Inc., Naples, FL, USA) with adjustable pressure and flow speed. Classic posterior portal was used for imaging.

In Group 1, single anterior portal was opened 1 cm lateral and 1 cm superior to the corocoid notch for 7.5-mm cannula and in Group 2, 2 anterior portals, anterior-inferior and anterior-superior, were opened with the same characteristics. In all patients, following preparation of the glenoid and release of the labrum, and after passing non-degradable sutures (FiberWire; Arthrex, Inc., Naples, FL, USA) through in lasso-loop fashion, labrum fixation was achieved with at least 3 knotless anchors (PushLock; Arthrex, Inc., Naples, FL, USA) of 2.9-mm or 3.5-mm diameter (Fig. 1).

Duration of surgery, requirement for postoperative analgesia (Tramadol İ.V, Contramal; Abdi İbrahim İlaç Sanayi ve Ticaret A.S., Istanbul, Turkey) and length of hospital stay were retrieved from records of each patient. Patient request for analgesia for pain was defining criterion in determining analgesic dose.

Cost was calculated separately for each patient. Since same rehabilitation protocol was applied, rehabilitation expenses were not included in cost calculation. Codman's pendulum exercises were initiated on first day after surgery. Shoulder-arm sling with abduction pillow was used by the patients for 3 weeks, followed by smooth shoulder-arm sling with abduction pillow for additional 3 weeks. Rehabilitation program with the Department of Physical Treatment and Rehabilitation was initiated at the end of the first week; forced external rotation was not allowed for 6 weeks. All patients had follow-up examinations two times at month. Evaluation of external rotation and abduction angles of the operated



Fig. 1. View of lasso lock inserted intra-operatively to labrum before glenoid anchoring.

shoulder was recorded using CSS and RWS tests at final assessment. Any perioperative or postoperative complications were also noted.

Statistical analysis

Analysis of data was performed using SPSS for Windows statistical software package (version 11.5; IBM Corp., Armonk, NY, USA). Conformity to normal distribution of continuous and discrete numerical variables was analyzed using Kolmogorov–Smirnov test. Descriptive statistics were expressed as mean \pm SD, or as median (minimum–maximum) for continuous and discrete numerical variables, and as number and percentage for nominal variables.

Significance of the difference between groups in terms of mean values was evaluated with Student's t-test, and in terms of median values with Mann–Whitney U test. Significance of the difference in median values of follow-up time between groups was evaluated with Wilcoxon signed-rank test. Spearman's correlation test was applied to determine any statistically significant relationship between continuous and discrete numerical variables. Nominal variables were assessed with Pearson's chi-square or Fisher's exact test. Unless otherwise stated, results were considered statistically significant at value of $p < 0.05$. Bonferroni correction was applied to prevent Type I error in all likely multiple comparisons.

Results

In comparisons between Group 1 and Group 2, no significant difference was found in terms of mean age, gender distribution, affected side, mean follow-up time, total number of dislocations, or time between first dislocation and surgical treatment (Table 1).

Table 1
Demographic and clinical characteristics of the patients by group.

Variables	Group 1 (n = 49)	Group 2 (n = 42)	p value
Age (years)	25.8 \pm 6.8	25.4 \pm 6.6	0.793 ^a
Gender			1.000 ^b
Male	47 (95.9%)	41 (97.6%)	
Female	2 (4.1%)	1 (2.4%)	
Affected side			0.897 ^c
Right	24 (49.0%)	20 (47.6%)	
Left	25 (51.0%)	22 (52.4%)	
Follow-up time (months)	30 (25–38)	31 (25–37)	0.403 ^d
Number of dislocations	5 (3–12)	6 (3–11)	0.654 ^d
Time between dislocation and treatment (months)	31 (6–124)	25.5 (6–144)	0.370 ^d

^a Student's t test.

^b Fisher's exact test.

^c Pearson's chi-square test.

^d Mann–Whitney U test.

When clinical scores of the 2 groups were compared, median CSS values increased from preoperative value of 36 (range: 17–56) to postoperative 90 (range: 56–100) in Group 1, and from preoperative 35.5 (range: 22–56) to postoperative 86.5 (range: 58–100) in Group 2. RWS values increased from preoperative 25 (range: 0–45) to postoperative 85 (range: 65–95). Although significant increase in median clinical scores of both groups was seen at final follow-up ($p < 0.001$), there was no statistically significant difference ($p > 0.05$) (Table 2).

Active preoperative range of motion (ROM) was compared to postoperative level. While there was no statistically significant difference in median preoperative external rotational angles ($p = 0.501$), statistically significant reduction in postoperative external rotational angle compared to preoperative values was determined in both groups ($p < 0.001$). There was no statistically significant difference between groups in median postoperative external rotation angles.

While there was no statistically significant difference in median preoperative abduction angle [Group 1: 145° (range: 130° – 150°), Group 2: 145° (range: 130° – 150°); $p = 0.092$], a statistically significant reduction was determined in postoperative abduction angle in Group 1: 145° (range: 100° – 150° ; $p = 0.007$). Statistically significant reduction in median postoperative abduction angle was seen in Group 2 compared with Group 1 ($p < 0.001$). Median postoperative abduction angle of Group 2 was statistically significantly lower ($p < 0.001$). Decrease in postoperative abduction angle in Group 2 was statistically significantly higher ($p < 0.001$) (Table 2). In both patient groups, negative correlation was determined between CSS value at first dislocation and time of surgical

Table 2
Preoperative and postoperative clinical and active range of motion measurements by group.

Variables	Preop	Postop	p value†	Change
Constant Shoulder Score				
Group 1	36 (17–56)	90 (56–100)	<0.001	52 (32–71)
Group 2	35.5 (22–56)	86.5 (58–100)	<0.001	52 (26–74)
p value‡	0.832	0.377		0.716
Rowe Score for Instability				
Group 1	25 (0–45)	90 (55–100)	<0.001	65 (10–95)
Group 2	20 (10–45)	85 (65–95)	<0.001	65 (40–80)
p value‡	0.404	0.057		0.673
External rotation				
Group 1	85 (80–90)	80 (70–90)	<0.001	-5 (-15 to 0)
Group 2	85 (80–95)	80 (70–90)	<0.001	-5 (-15 to 5)
p value‡	0.501	0.373		0.028
Abduction				
Group 1	145 (130–150)	145 (100–150)	0.007	0 (-45 to 0)
Group 2	145 (130–150)	140 (130–145)	<0.001	-5 (-10 to 0)
p value‡	0.092	<0.001		<0.001

Bold value signifies when clinical scores of the 2 groups were compared, median CSS and RWS values increased preoperatively and statistically significant reduction in median postoperative abduction angle was seen in Group 2 compared with Group 1 ($p < 0.001$).

The mean postoperative CSS and RWS scores of both groups were statistically higher than preoperative values, and no statistically significant difference was found for clinical scores when postoperative values between groups were compared. There is a statistically significant decrease in postoperative external rotation and abduction rates for both groups. When the postoperative abduction rates of the groups are compared, statistically more decrease was observed in Group 2 than Group 1.

† Comparisons made within the groups in terms of pre- and post-operative measurements, Wilcoxon Sign Rank test, Results were accepted as statistically significant for $p < 0.025$ according to Bonferroni Correction.

‡ Comparisons made between the groups in terms of clinical measurements, Mann Whitney U test, while pre- and post-operative measurements are compared, results were accepted as statistically significant for $p < 0.025$ according to Bonferroni Correction, while comparing the changes in post-operative period with regard to pre-operative period results were accepted as statistically significant for $p < 0.05$ according to Bonferroni Correction.

Table 3
Correlation between first dislocation, surgical treatment, and Constant Shoulder Score.

Variables	N	Correlation coefficient	p value ^a
Constant Shoulder Score			
Group 1	49	-0.120	0.413
Group 2	42	-0.408	0.007
General	91	-0.262	0.012

Bold value signifies when clinical scores of the 2 groups were compared, median CSS and RWS values increased preoperatively and statistically significant reduction in median postoperative abduction angle was seen in Group 2 compared with Group 1 ($p < 0.001$).

^a In both patient groups, negative correlation was determined between CSS value at first dislocation and time of surgical treatment.

treatment (Group 1 $r = -0.120$, Group 2 $r = -0.408$) (Table 3). Median surgery time of Group 2 was 53.5 min (range: 35–75 min), and was statistically significantly longer than that of Group 1: 35 min (range: 25–60 min). Quantity of analgesia required in Group 2 was found to be higher than that of Group 1 [Group 1: 200 mg (range: 200–300 mg), Group 2: 300 mg (range: 200–400 mg); $p < 0.001$]. Complication rates were similar between groups. Redislocation was detected in 2 patients (4.1%) in Group 1, and in 1 patient (2.4%) in Group 2 ($p = 1.000$). Mean length of hospital stay for patients in Group 2 was statistically significantly longer [Group 1: 1 day (range: 1–2 days), Group 2: 1.5 days (range: 1–3 days); $p < 0.001$] (Table 4). Cost analysis conducted for each patient included implant used, medical treatment, and length of hospital stay. It was calculated that costs were approximately 5.7% higher for Group 2. Assessment of 8 of 10 assistant doctors and 4 of 5 fellows who participated in the surgical procedures indicated preference for technique used in Group 1. In other words, single portal technique was preferred by 80% of attending physicians and double portal technique by 20%. The difference was statistically significant ($p = 0.035$).

Discussion

Less invasive techniques are increasingly preferred among current treatment options. Advantages reported for arthroscopic shoulder instability surgery include shorter hospital stay, less postoperative pain and loss of motion, shorter duration of surgery, less morbidity, better cosmetic appearance and fewer complications.^{8,9,10,11,12} Disadvantages of arthroscopic surgery are longer learning curve and need for special equipment and instruments. Moreover, in some studies, much higher rates of post-operative recurrent shoulder dislocation have been reported.⁷ In other studies, similar clinical results to those of open procedures have been reported.^{13,14} Single anterior portal application that we perform at our clinic provides several advantages in this sense

Table 4
Other clinical data by group.

Variables	Group 1 (n = 49)	Group 2 (n = 42)	p value
Surgery time (min)	35 (25–60)	53.5 (35–75)	<0.001 ^a
Quantity of analgesics (mg)	200 (200–400)	300 (200–400)	<0.001 ^a
Complication	2 (4.1%)	1 (2.4%)	1.000 ^b

Bold value signifies when clinical scores of the 2 groups were compared, median CSS and RWS values increased preoperatively and statistically significant reduction in median postoperative abduction angle was seen in Group 2 compared with Group 1 ($p < 0.001$).

^a Mann–Whitney U test.

^b Fisher's exact test.

compared with double anterior portal, which has been the classic technique for surgical treatment of the shoulder for many years. At the stage of suturing the glenoid labrum, single portal application removes the possibility of threads becoming entangled, as sutures are applied singly, and because there is no need to continue sutures to a second portal, it is a technique that is easy and can be performed in less time. Fact that sutures used in single portal technique are always done separately also avoids excessive suture material associated with different anchors inside the joint. At this point, a clearer screen image enables easier application. Results of the questionnaire used in the current study indicated that since it can be learned and applied easily, single portal application was preferred by majority of the specialist fellows and assistants who participated in the surgical procedures. Procedure also provides the advantage of less postoperative pain because second trauma to the deltoid and skin of the rotator interval is not required. Rotator interval contributes to humeral head stability, and rotator interval laxity is associated with shoulder instability and systemic joint hyperlaxity.^{15,16} Rotator interval closure increases humeral head stability and reduces shoulder range of motion.^{17,18} Opening the rotator interval can negatively affect stability of the glenohumeral joint, thereby increasing inferior and posterior translation of the humerus head.¹⁹ Rotator interval laxity, reported at 9% in the normal population, has been reported at rate of 54% in cases of recurrent shoulder dislocation.²⁰ Even in cases of shoulder instability, successful results have been reported from closure of only the rotator interval.²¹ Single anterior portal technique is less invasive and therefore has less negative effect; double portal technique involves rotator interval during classic technique of arthroscopic treatment of anterior shoulder instability. Decreased need for postoperative analgesia, given less invasive procedure, also ensures higher consistency at the rehabilitation stage. Some publications have reported that excessive imbrications and deviation of the insertion position in the repair of Bankart lesion lead to loss of motion and stability.²² Therefore, aggressiveness of the treatment may affect the results unfavorably. Innovations in design and developments in the properties of the implants currently used have allowed surgeons to work more easily during surgical procedures. Clinical and experimental studies have shown that newly designed anchors ensure same success rate obtained with conventional anchors.^{23–25} Furthermore, they are easier to apply from a technical perspective than tying knots.¹⁷ Knotless anchors used in these procedures with lasso suture technique are advantageous implants due to both technique of separate application and shorter surgery time (Figs. 2–3). Recently, different portals have been



Fig. 2. Demonstration of the lasso technique.



Fig. 3. View of single anterior portal.

defined for repair of Bankart lesions apart from conventional insertion points, and successful results have been reported.^{26,27} Satisfactory results have been obtained by adding supplementary portals to classic portals, although this renders the procedure more invasive. In the current study, it was observed that single anterior portal was sufficient to fulfill surgical requirements as an alternative to the generally accepted classic double anterior portal application. Limitations of this study are that it is a retrospective study, and that cost analysis did not include postoperative rehabilitation expenses.

Single anterior portal application has advantages of reduced general cost, easier learning curve, greater adaptation to rehabilitation due to lower requirement for analgesia, and lower requirement for implant compared with classic double portal application. As there was no significant difference between the 2 techniques with respect to clinical results or complication ratios, single portal technique was determined to be reliable treatment option.

Conclusion

In conclusion, single portal technique for patients undergoing surgery for arthroscopic repair of Bankart lesion was demonstrated to be more cost-effective technique by virtue of lower requirement for postoperative analgesia. Additional economic advantages include less instrument usage, as this less invasive technique does not require second portal.

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