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Labrum repair combined with arthroscopic reduction of capsular volume in shoulder instability

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Abstract We performed arthroscopic treatment of traumatic anterior and anteroinferior shoulder instability combining three procedures—labrum repair, reduction of capsular volume and suture of the rotator cuff interval—with the aim of analysing the results with regard to stability and function. Between January 1999 and December 2003, 27 patients underwent arthroscopic treatment for labrum repair with metal anchors, reduction of capsular volume through thermal capsulorrhaphy and suture of rotator cuff interval. These patients were evaluated in the pre- and postoperative period using the UCLA and Rowe scales and in the postoperative period using the ASES scale. During a mean follow-up period of 32.4 months (range 22–74 months) all shoulders remained stable. Using the UCLA scale, there was improvement from the preoperative period, with a mean score of 24.7, to the postoperative period, with a mean of 32.81. Improvement was also shown by the Rowe scale, with a mean score of 39.81 in the preoperative period and 90.74 in the postoperative period. On the ASES scale the mean score was 92.22. All shoulders remained stable and there was marked functional improvement in the patients who were treated. These results are comparable to those obtained with open surgery, observing similar patient selection criteria.

Résumé Nous avons réalisé le traitement arthroscopique de l'instabilité de l'épaule en associant trois techniques, réparation du labrum, ligature capsulaire et suture de la coiffe. L'analyse des résultats de ces techniques a porté sur la stabilité et sur l'amélioration de la fonction articulaire. De janvier 1999 à décembre 2003, 27 patients ont été traités selon ces techniques, réparation du labrum utilisant des ancrs métalliques, la réduction capsulaire étant réalisée par une capsulorraphie et les lésions de la coiffe étant suturées. Ces patients ont été évalués en pré et post-

opératoire à l'aide des scores UCLA et Rowe et en post-opératoire avec le score ASES. Pendant toute la période de suivi 32,4 mois (22–74), les épaules sont restées stables, le score UCLA a montré une amélioration des patients (24.7 en pré-opératoire, 32.81 en post-opératoire). Ces patients ont également été améliorés comme le montre le score Rowe avec une moyenne de 39.81 en pré-opératoire à 90.74 en post-opératoire. Les scores de l'ASES ont montré une moyenne de 92.22. Conclusion : toutes les épaules sont restées stables avec une importante amélioration fonctionnelle des patients opérés. Ces résultats sont comparables aux résultats obtenus par une chirurgie à ciel ouvert si l'on compare les patients et les critères de sélection.

Introduction

Mechanical studies suggest that in traumatic anterior and anteroinferior shoulder instability, the labrum lesion is frequently associated with a deformity of the capsular ligament complex with resulting increase in articular volume [3]. Comparative studies of the arthroscopic treatment of labrum lesion show worse results than those observed with conventional arthrotomy [6, 9, 18]. The difference found by these studies may be related to the lack of attention to the deformity of the capsular ligament complex by arthroscopy.

Arthroscopic repair of the labrum lesion, when combined with decrease in articular volume, may lead to a marked improvement in the results with regard to stability [8]. Surgical articular volume reduction may be reinforced by rotator cuff interval suture [20]. We performed a study on the arthroscopic treatment of traumatic shoulder instability combining these three procedures—labrum repair, capsular volume decrease and rotator cuff interval suture—with the purpose of analysing the results with regard to stability and function.

Between January 1999 and December 2003, 27 patients with complaints of traumatic anterior or anteroinferior shoulder instability underwent arthroscopic treatment for labrum repair using metal anchors, decrease in capsular

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volume through thermal capsulorrhaphy by radio frequency (ArthroCare) and rotator cuff interval suture with nonabsorbable threads. These patients were scored in the pre- and postoperative periods using the UCLA [7] and Rowe [16] scales and the results were compared using the Wilcoxon test with $\alpha < 0.05$. In the postoperative period the ASES scale was also applied [13]. This study was performed with the consent of the patients and was approved by the Medical Ethics Committee of the “Real e Benemérita Associação Portuguesa de Beneficência”, Hospital São Joaquim, São Paulo, Brazil.

Methods

Inclusion criteria

The patients included in this study had to present at least three dislocation episodes, Hill–Sachs lesion less than a third of humeral head diameter, labrum lesion and no bone lesion of the glenoid border. Patients with transfixing lesion of the rotator cuff and voluntary dislocations were excluded.

Surgical technique

The procedures were performed under general anaesthesia, in lateral decubitus and using cutaneous traction. Once the labrum lesion was identified, débridement of its irregularities, as well as of the anterior glenoid border, was carried out with a shaver blade. The labrum was advanced to a more anterior and superior position at the glenoid and fixed with metal anchors.

Articular capsular volume reduction was performed using bipolar radio-frequency equipment (ArthroCare, Sunnyvale, CA), applied to the inferior glenohumeral ligament and the capsule. The application was discontinuous where between longitudinal application bands a non-treated band with normal tissue was inserted. The amount of reduction was assessed subjectively through observation of the change in coloring of the capsule, stria formation and the volumetric reduction itself. Rotator cuff interval suture was performed by bringing the superior subscapular tendon border close to the anterior supraspinous tendon border with a No. 5 Ethibond suture.

During the postoperative treatment all patients were immobilised in a sling for a 4-week period, followed by passive mobilisation for 2 weeks. After the 6th week, they were instructed to perform isometric exercises and self-perception training.

Results

Between January 1999 and December 2003, 27 patients underwent operation: 24 males, 12 right shoulders, 13 shoulders on the patient's dominant side. The mean duration of follow-up was 36.2 months (range 22–74). Mean age at first dislocation was 23.25 years (range 15 to 37 years). After

the first episode two patients were treated by means of immobilisation with a sling only, 18 patients were immobilised followed by physiotherapy, and two were treated exclusively with physiotherapy. Between the first episode and surgery, 17 individuals were treated with physiotherapy for a period of 3 months.

In the preoperative period, 18 patients reported pain, 26 laxity, and all complained of apprehension. The mean number of dislocations was 9.3 (range 3–40), with 40 being considered the maximum number of possible dislocations. On physical examination all 27 patients presented signs of apprehension, positive drawer test and positive repositioning test. Mean active flexion was 177.6° (range 150°–190°) and abduction 174.4° (range 110°–190°). Mean extreme rotation was 93.7° (range 45°–120°) and internal rotation D9.

On arthroscopic examination 23 patients presented a lesion of the anterior and inferior part of the labrum at the insertion of the inferior glenohumeral ligament. Two patients presented an anteroinferior lesion of the labrum associated with detachment of the superior glenoid labrum complex. Two patients presented with avulsion of the periosteum, labrum and inferior glenohumeral complex with inferior and medial reinsertion to the glenoid neck. Labrum suture with anchors was performed with a mean of 2.4 stitches (range 2–4 stitches). All patients were submitted to rotator cuff interval suture with a mean of 2.8 stitches (range 1–4 stitches). In the postoperative period, 23 patients experienced pain for a mean period of 5 days and were treated with ice and analgesics. All were submitted to physiotherapy, with a mean of 3.5 sessions (range 1–9 sessions). Recovery of maximum flexion was within a mean of 3.7 months (range 2–6 months).

The mean UCLA score in the preoperative period was 24.7 points (range 18–28 points). We considered each item of this questionnaire, obtaining the following score: pain, mean 6.88 points (range 2–10 points); function, mean 7.7 (2–10); active elevation, mean 4.96 (4–5); strength for elevation, mean 4.66 (3–5); and patient's satisfaction, 0. UCLA results in the postoperative period reached a mean of 32.81 points, being considered satisfactory. Scores were: pain, mean 8.88 points (range 6–10 points); function, mean 9.26 (4–10); active elevation, mean 4.92 (3–5); strength for elevation, mean 4.92 (3–5); and patient's satisfaction, 5 points. Fourteen patients achieved excellent results, 12, good results and one had a bad result. All gained

Table 1 Mean values before and after operation on the UCLA questionnaire

Parameter	Period	
	Preoperative	Postoperative
Pain	6.88	8.88
Function	7.7	9.26
Active function	4.96	4.92
Elevation strength	4.66	4.92
Satisfaction	0	5
Final result	24.7	32.81

Table 2 Mean values before and after operation on the Rowe questionnaire

Case number	Period	
	Preoperative	Postoperative
I	45.00	90.00
II	45.00	90.00
III	45.00	100.00
IV	15.00	100.00
V	45.00	90.00
VI	25.00	95.00
VII	30.00	90.00
VIII	45.00	90.00
IX	40.00	90.00
X	40.00	95.00
XI	40.00	90.00
XII	25.00	95.00
XIII	45.00	95.00
XIV	40.00	90.00
XV	40.00	95.00
XVI	50.00	100.00
XVII	45.00	95.00
XVIII	45.00	100.00
XIX	45.00	95.00
XX	25.00	90.00
XXI	45.00	95.00
XXII	45.00	95.00
XXIII	45.00	95.00
XXIV	45.00	40.00
XXV	45.00	65.00
XXVI	30.00	90.00
XXVII	45.00	95.00
Mean	39.81	90.74

Preoperative, Value for each individual in preoperative period; postoperative, value found for each individual in postoperative period

improvement of score compared with the preoperative period (Table 1). There was a statistically significant improvement in UCLA questionnaire results from the preoperative to the postoperative period (Wilcoxon test, $\alpha < 0.05$). Each item of the questionnaire revealed significant improvement regarding pain, function and satisfaction.

Preoperative evaluation by the Rowe score showed a mean of 39.81 points (range 15–50 points). Means were: stability 0 points, mobility 19.07 (15–20), function 21.48 (0–30). Scoring for the postoperative period by the Rowe questionnaire revealed a mean of 90.74 points (range 40–100 points). Means were: stability 50 points, mobility 16.29 (5–20), active function 4.92 (3–5), strength for elevation 27.22 (10–30) and patient's satisfaction, 5 points. Four patients obtained maximum results. All patients demonstrated improvement of scoring as compared with the preoperative period and this improvement was statistically significant (Wilcoxon test, $\alpha < 0.05$) (Table 2).

Table 3 Final postoperative result for each individual by the ASES scale

Case number	Final result (ASES)
I	100
II	100
III	98.33
IV	100
V	91.66
VI	96.66
VII	91.66
VIII	90
IX	100
X	100
XI	93.33
XII	98.33
XIII	78.33
XIV	86.66
XV	98.33
XVI	78.33
XVII	86.66
XVIII	98.33
XIX	100
XX	95
XXI	96.66
XXII	98.33
XXIII	98.33
XXIV	85
XXV	58.33
XXVI	75
XXVII	96.66

The mean score on the ASES scale in the postoperative period was 92.22 points (range 58.33–100 points). Ten patients experienced pain, with two patients eventually taking analgesics. The mean score on a visual analogue scale (VAS) for subjective pain impression was 0.78 (range 0–6), where zero represents no pain and 10, maximum pain. All shoulders were considered stable, and the mean of the median scores on a VAS for instability was 0.4 (range 0–3), where zero represents very stable and 10, very unstable. There were reports of a certain difficulty in sleeping on the operated side, in performing internal rotation, in lifting heavy objects and in putting on a coat (Table 3). On physical examination, 175° (range 110–180°) mean flexion, 173° (60–180°) abduction and 74° (9–90°) external rotation were observed.

Discussion

There was no relapse and all shoulders remained stable. The UCLA scale showed improvement from a mean score of 24.7 points in the preoperative period to a mean of 31.8 points in the postoperative period. This result can be considered satisfactory and good. There was also improvement on the Rowe scale, from a mean 39.81 points in the preoperative

period to 92.22 points in the postoperative period. A score of 100 is the maximum on this scale. With regard to mobility, there was a decrease in amplitude, mainly of external rotation. There was an unsatisfactory result in one patient who showed signs of adhesive capsulitis.

Surgical treatment of traumatic shoulder anterior instability by labrum lesion fixation may be by classical open arthrotomy or by arthroscopy. The results differ depending on the surgical route or on how labrum fixation is performed.

Conventional treatment for repair of the labrum lesion by arthrotomy is popular because there are no restrictions with regard to glenoid bone surface pathology. Repair of the labrum lesion may be performed directly without anchors. Rowe et al. described a procedure by arthrotomy considered as standard, and direct repair of labrum lesion to the glenoid. They operated on 45 patients with instability and observed a Bankart lesion in 85% of the cases, and lesion of the anterior glenoid border in 73%. In a mean 6-year follow-up, they found relapse in 3.5% of the cases and did not find signs of degenerative arthrosis [16, 17]. Rosenberg et al. evaluated 33 patients (of a total of 56) after 15 years. These patients presented in the postoperative period a mean of 84 points by the Rowe scale. The authors observed that over 50% of the patients exhibited sign of arthrosis which was related to decreased external rotation [15]. Thomas and Matsen evaluated the conventional Bankart lesion repair in 37 patients (of a total of 63), with a follow-up of 5.5 years and found a 2.7% relapse. There was decrease in external rotation following the operation [19].

Gill et al. operated on 60 patients with an average follow-up of 11.9 years and found limitation of the external rotation as sequel of the procedure and a relapse in 5% of the cases [11]. In our study, even promoting articular volume reduction and using thermal instruments, we did not observe signs of arthrosis, although there was a decrease in range of movement, particularly of external rotation.

On arthroscopic treatment by transglenoidal suture, repair of the labrum lesion is performed with several sutures passing through a tunnel in the glenoid to its posterior face and fixed at the posterior fascia or scapula. It is possible to reposition the site of suture. Anchors are not used and therefore there are no problems with intra-articular release of surgical material. Benedetto and Glotzer operated on 31 patients using this technique, with a follow-up of 2 years, and did not find any relapse [2]. Caspari et al., in a follow-up of 2–6 years, found a 4% rate of relapse [5]. In a longer follow-up, results using this technique do not seem to be so satisfactory. Walch et al. operated on 59 patients with a follow-up of 49 months and found a relapse in 49% of cases. They related the relapses to a positive sulcus sign, to anterior glenoid bone lesions and to extended ligamentous lesions [21]. Green and Christensen operated on 60 patients with a follow-up of 40 months and reported a relapse rate of 42%. There was inferior glenohumeral ligament insufficiency in the relapsing cases [10]. In these procedures capsular volume increase is not repaired, which probably is related to the unfavourable results.

Labrum repair at the glenoid with anchors is the most rigid and safe form of fixation. However, comparative studies indicate that, although suturing performed with anchors produces better results than transglenoidal suturing, the outcome remains worse than that following open surgery [12]. The results with this type of fixation may vary according to the type of anchor used, its positioning and arthroscopic knot fixation. Burkhart and De Beer performed fixation with anchors in labrum lesion in 173 patients without glenoid bone lesion, with a follow-up of 27 months, and found a relapse rate of only 4%. They concluded that the results of arthroscopic surgery are similar to those of open surgery when there is no associated bone lesion [4]. Bacilla et al. operated on 40 patients with a follow-up of 18–36 months, observing a 7.5% relapse rate. These results are also similar to those after conventional surgery [1].

Studies combining labrum suture with thermal capsulorrhaphy showed satisfactory results. Gartsman et al. operated on 53 patients, and on a 33-month follow-up they observed relapse in 7.5% of the cases. They scored the results using the UCLA questionnaire, finding a statistically significant improvement (preoperative period 17.6 points, postoperative period 32 points) [8]. Mishra and Fanton also combined labrum lesion repair with thermal capsulorrhaphy in 42 patients, with a 28-month follow-up, finding a 7% relapse rate. This author observed improvement by the Rowe score in the postoperative period [14]. These studies present an instability relapse rate between 7% and 7.5%. It is possible that the results found in our studies are related to systematic rotator cuff interval suture.

Conclusion

We observed that all shoulders remained stable and that there was marked functional improvement in the treated patients. These results are comparable to those obtained by open surgery, observing similar patient selection criteria. Arthroscopic treatment with labrum suture, rotator cuff interval suture and capsulorrhaphy should be considered a good option for treatment of shoulder instability.

References

1. Bacilla P, Field LD, Savoie FH III (1997) Arthroscopic Bankart repair in a high demand patient population. *Arthroscopy* 13:51–60
2. Benedetto KP, Glotzer W (1992) Arthroscopic Bankart procedure by suture technique: indications, technique, and results. *Arthroscopy* 8(1):111–115
3. Bigliani LU, Pollock RG, Soslowsky LJ, Flatow EL, Pawluk RJ, Mow VC (1992) Tensile properties of the inferior glenohumeral ligament. *J Orthop Res* 10(2):187–197
4. Burkhart SS, De Beer JF (2000) Traumatic glenohumeral bone defects and their relationship to failure of arthroscopic bankart repairs: Significance of the inverted-pear glenoid and the humeral engaging Hill-Sachs lesion. *Arthroscopy* 16(7):677–694
5. Caspari RB, Savoie FH III, Meyers TF et al (1989) Arthroscopic shoulder reconstruction. *OrthopTrans* 13:559

6. Cole BJ, L'Insalata J, Irrgang J, Warner JJ (2000) Comparison of arthroscopic and open anterior shoulder stabilization. A two to six-year follow-up study. *J Bone Joint Surg Am* 82-A (8):1108–1114
7. Ellman H, Kay SP (1991) Arthroscopic subacromial decompression for chronic impingement. Two-to five-year results. *J Bone Joint Surg Br* 73(3):395–398
8. Gartsman G, Roddey T, Hammerman S (2000) Arthroscopic treatment of anterior-inferior glenohumeral instability: two to five-year follow-up. *J Bone Joint Surg Am* 82-A(7):991–1003
9. Guanche CA, Quick DC, Sodergren KM, Buss DD (1996) Arthroscopic versus open reconstruction of the shoulder in patients with isolated Bankart lesions. *Am J Sports Med* 24(2): 144–148
10. Green MR, Christensen KP (1995) Arthroscopic Bankart procedure: two- to five-year follow up with clinical correlation to severity of glenoid labral lesion. *Am J Sports Med* 23(3): 276–281
11. Gill TJ, Micheli LJ, Gebhard F, Binder C (1997) Bankart repair for anterior instability of the shoulder. Long-term outcome. *J Bone Joint Surg Am* 79(6):850–857
12. Kandziora F, Jager A, Bischof F et al (2000) Arthroscopic labrum refixation for post-traumatic anterior shoulder instability: Suture anchor versus transglenoid fixation technique. *Arthroscopy* 16:359–366
13. King GJ, Richards RR, Zuckerman JD, Blasier R, Dillman C, Friedman RJ, Gartsman GM, Iannotti JP, Murnahan JP, Mow VC, Woo SL (1999) A standardized method for assessment of elbow function. Research Committee, American Shoulder and Elbow Surgeons. *J Shoulder Elbow Surg* 8(4):351–354
14. Mishra DK, Fanton GS (2001) Two-year outcome of arthroscopic bankart repair and electrothermal-assisted capsulorrhaphy for recurrent traumatic anterior shoulder instability. *Arthroscopy* 17(8):844–849
15. Rosenberg BN, Richmond JC, Levine WN (1995) Long-term followup of Bankart reconstruction. Incidence of late degenerative glenohumeral arthrosis. *Am J Sports Med* 23(5):538–544
16. Rowe CR, Patel D, Southmayd WW (1978) The Bankart procedure: a long-term end-result study. *J Bone Joint Surg Am* 60(1):1–16
17. Rowe CR, Zarins B, Ciullo JV (1984) Recurrent anterior dislocation of the shoulder after surgical repair. Apparent causes of failure and treatment. *J Bone Joint Surg Am* 66(2): 159–168
18. Steinbeck J, Jerosch J (1998) Arthroscopic transglenoid stabilization versus open anchor suturing in traumatic anterior instability of the shoulder. *Am J Sports Med* 26(3):373–378
19. Thomas SC, Matsen FA 3rd (1989) An approach to the repair of avulsion of the glenohumeral ligaments in the management of traumatic anterior glenohumeral instability. *J Bone Joint Surg Am* 71(4):506–513
20. Van der Reis W, Wolf EM (2001) Arthroscopic rotator cuff interval capsular closure. *Orthopedics* 24(7):657–661
21. Walch G, Boileau P, Levigne C, Mandrino A, Neyret P, Donell S (1995) Arthroscopic stabilization for recurrent anterior shoulder dislocation: results of 59 cases. *Arthroscopy* 11(2): 173–179