Modified Bankart procedure for recurrent anterior dislocation and subluxation of the shoulder in athletes

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Summary. *Thirty-four athletes (34 shoulders) with recurrent anterior glenohumeral instability were treated with a modified Bankart procedure, using a T-shaped capsular incision in the anterior capsule. The inferior flap was advanced medially and/or superiorly and rigidly fixed at the point of the Bankart lesion by a small cancellous screw and a spike-washer. The superior flap was advanced inferiorly and sutured over the inferior flap. Twenty-five athletes (median age: 22) were evaluated over a mean period of follow-up of 65 months. The clinical results were graded, according to Rowe, as 22 (88%) excellent, 3 (12%) good, and none as fair or poor. The mean post-operative range of movement was 92° of external rotation in 90° of abduction. Elevation and internal rotation was symmetrical with the opposite side. Twenty-four patients returned to active sport, 22 at their previous level. This modified Bankart procedure is an effective treatment for athletes with recurrent anterior glenohumeral instability.*

Résumé. *Trente quatre athlètes (34 épaules) avec une instabilité gléno-humérale antérieure récidivante ont été traités selon une procédure Bankard modifiée avec incision capsulaire en forme de T de la capsule antérieure. Cette procédure consiste à déplacer le lambeau inférieur de manière médiale et/ou vers le haut et de le fixer en place au point de la lésion de Bankart à l'aide d'une petite vis spongieuse et d'une rondelle à crampon. Le lambeau supérieur est ensuite déplacé vers le bas et suturé sur le lambeau inférieur. Vingt cinq athlètes (de 22 ans d'âge moyen) ont été suivis sur une période moyenne de 65 mois. Les*

résultats cliniques classés conformément à Rowe (1981) sont les suivants: 22 (88%) excellents, 3 (12%) bons et aucun passable et faible. La mobilité moyenne post-opératoire était de 92° en rotation externe et de 90° en abduction. L'élévation et la rotation interne étaient symétriques au côté controlatéral dans tous les cas. Vingt quatre patients ont repris leurs activités sportives et vingt deux d'entre eux ont retrouvé leur niveau préalable. Cette procédure de Bankart modifiée s'avère un traitement efficace pour les athlètes présentant une instabilité gléno-humérale antérieure récidivante puisqu'elle leur permet de reprendre leurs activités sportives.

Introduction

Since Bankart et al. [3, 4] described reattachment of an avulsion of the anterior glenohumeral ligament from the glenoid for the surgical treatment of recurrent anterior dislocation of the shoulder, many authors have reported good results [5, 7, 11, 17–21, 23, 24]. However, in athletes, numerous problems may occur due to recurrence of the dislocation or subluxation, persistent pain or apprehension, and limitation in the range of movement, especially external rotation. Recent clinical and experimental studies have suggested that the causes of failure after Bankart repair are due to capsular redundancy, laxity, elongation or stretching, capsular ligamentous attenuation, a rotator interval lesion, a defect in the glenoid rim or a degree of tension in the capsular repair [2, 6, 8, 9, 13–15, 19–22, 24, 25].

The purpose of this study is to describe a T-shaped capsular shift procedure for recurrent anterior dislocation and subluxation in the shoulder, and to present our results from treating these injuries in athletes.

Patients and methods

Between 1986 and 1994, 34 shoulders in 34 athletes with traumatic anterior recurrent dislocation and subluxation were treated using a modified Bankart procedure. All patients had their first episodes of dislocation or subluxation due to trauma. Patients who had atraumatic anterior instability were excluded from this study. Pre-operatively, all except 2 had undergone a programme of rehabilitation of the shoulder which included rest, modification of activity and a specific exercise pro-

gramme for strengthening the rotator cuff muscles, the deltoid and the muscles of the scapula lasting for three to six months. Seven patients who underwent the modified Bankart procedure combined with a Bristow operation were excluded, and two were lost during follow up, leaving 25 patients (21 males and 4 females) for evaluation. There were 11 injuries to the right shoulder and 14 to the left. All patients were right handed. Their median age at the time of operation was 22 years (range 15–34 years). A median of seven episodes of anterior dislocation and/or subluxation had occurred prior to the operation,

Table 1. Classification of sports

Contact/collision	No.	Limited contact	No.	Non-contact	No.
Boxing	5	Baseball	1	Aerobic dancing	1
Football		Basketball	4	Swimming	
American	3	Skiing	2	Surfing	1
Rugby	1	Volleyball	1	Wind surfing	1
Martial arts				Tennis	1
Judo	2				
Karate	1				
Soccer	1				
Total	13		8		4

Adapted from American Academy of Pediatrics Committee on Sports Medicine: Recommendation for participation in competitive sports [1]

Fig. 1. Anterior view of the left shoulder: T-shape capsular incision, medial retraction of the subscapularis

Fig. 2. Anterior decortication at the scapular neck

Fig. 3. The inferior capsular flap is shifted superiorly and medially; the Bankart lesion is fixed by a small cancellous screw with spike-washer

Fig. 4. The capsule is sutured over the superior and the inferior flap

with the number of episodes ranging from 2 to more than 100. The follow up period averaged 6 months (range 26–129).

The diagnosis was recurrent dislocation in 14 cases and a recurrent subluxation in 11, including 11 with mild inferior and/or posterior laxity. Patients with a grade-III inferior instability [2] and symptomatic posterior instability were excluded from this series. These patients were generally treated using the capsular shift procedure of Neer [14].

Thirteen patients played contact sports, 12 at competition level; 8 played limited contact sports, including 6 at competition level; 4 played non contact sport. Overall, 18 patients (72%) played at competitive level, and all played recreational sport (Table 1).

Operative technique

Both shoulders were examined under anaesthetic to diagnose the direction and degree of instability. An arthroscopic examination was performed in all cases. The patient was placed in the beach-chair position. A straight skin incision was made lateral from the line from the coracoid process to the axilla. Exposure of the anterior glenohumeral capsule was carried out as advised by Rowe et al. [19]. Usually, we did not carry out an osteotomy of the coracoid process. When a patient had a rotator interval lesion, this was repaired with interrupted sutures. A T-shaped capsular incision was used: the first incision was made transversely at the mid-portion of the capsule and the joint inspected. When a Bankart lesion was present a second incision was made vertically at 1.5 cm medial to the glenoid margin, with the arm in full external rotation (Fig. 1). The anterior aspect of the neck of the glenoid was decorticated using an osteotome and a curette (Fig. 2). If a Bankart lesion was not present the procedure was changed from a modified to Neer's anterior capsular shift [14]. The inferior flap was advanced medially and/or superiorly and rigidly fixed at the point of the Bankart lesion with a small cancellous screw and a spike-washer (Fig. 3), with the arm held in 30–45° of abduction and 30–45° of external rotation. The superior flap was advanced inferiorly and fixed with a small cancellous screw or sutured over the inferior flap and the remaining medial capsule using non-absorbable thread (Fig. 4).

Post-operatively, the arm was placed in a Velpeau sling for three weeks, followed by another three weeks in a simple sling. In the fourth week the patient began supportive passive exercises without external rotation, in the fifth week movement with external rotation and in the seventh week resisted active exercises. The full range of movement was usually restored within three months of operation. We did not allow any sport activity until normal muscle strength had been regained. Non-contact sports without overhead movement were allowed after four months. At six months the patient usually returned to previous contact or competition sports practice.

All patients in this series had a Bankart lesion. A Hill-Sacks lesion was found in 22 (88%) of the patients, a rotator interval lesion was noted in 14 (56%) of the patients, capsular redundancy in 12 (48%) and attenuation of the capsule in 10 (40%).

Results

All patients were examined at follow-up and the results graded according to the system established by Rowe et al. (Table 2) [20]. No patient had a positive apprehension test and none showed recurrent anterior instability. Clinical results were graded as 22 (88%) excellent, 3 (12%) good and none were fair or poor. The average functional score was 48 points, with pain 10, stability 30 and movement 8 points. The accumulated average score was 96 points.

The mean range of movement at follow-up was 169° (150–185°) of elevation, 56° (40–80°) of external rotation in the neutral position, 92° (78–105°) of external rotation in 90° of abduction, and internal rotation so that the hand touched the spinous process of the 6th thoracic vertebra (range 4th–7th thoracic vertebra). Elevation and internal rotation were symmetrical with the opposite unaffected side in all the patients.

Table 2. Grading system established by Rowe et al. [20]

Criterion	No. of points
Function	
No limitation in sports or work; able to play baseball and football; can swim crawl stroke	50
No limitation in work; slight limitation in throwing baseball, serving forcibly in tennis, or swimming crawl; can throw football normally	35
Moderate limitation in overhead work, throwing baseball and football, swimming crawl, or serving in tennis	20
Marked limitation in throwing and in all sports; unable to work overhead	0
Pain	
None	10
Moderate	5
Severe	0
Stability	
Negative apprehension test; no subluxation	30
Negative apprehension test, but discomfort with arm in abducted and externally rotated position	15
Positive apprehension test and sense of subluxation	0
Motion	
Full range of motion	10
As much as 25% loss of motion in any plan	5
More than 25% loss of motion in any motion	0

Excellent=90 to 100 points; Good=70 to 89 points; fair=40 to 69 points; and poor=39 points or less

All but one of the athletes returned to active sport for more than two years following the operation, 22 (88%) to their previous level. At the most recent follow-up, 21 (84%) were playing active sport. In contact sports 10 (77%) of 13 athletes returned to their previous level, in limited contact sports 7 (88%) of 8, and in non-contact sports all 4 athletes achieved their preoperative level. All but one of the athletes returned to sport by 9 months after operation, with an average of 6.5 months.

Overall, only 3 (12%) athletes could not regain their previous level of sport.

There were no operative complications, no infections, no neurovascular problems and no loosening of the internal fixation.

Discussion

Since Bankart first described his repair [3, 4] various modifications of the procedure have been described, with good results [5, 7, 12, 17–21, 23, 24].

However, recent experimental studies have demonstrated that the Bankart lesion is not the sole defect. Bigliani et al. and Speer et al. studied the role of the inferior glenohumeral movement in cadaver's shoulders and emphasised the importance of capsular stretching, as well as the detachment of the inferior glenohumeral ligament complex, in recurrent instability, [6, 22]. They suggested that capsular stretching should be considered in the surgical repair of recurrent instability. Harryman et al. showed, in cadaver studies, that section of the rotator interval capsule allowed a significant increase in anterior, posterior and inferior translation of the head of the humerus and that the imbrication of the rotator interval lesion decreased both inferior and posterior instability [10].

Clinical studies have also demonstrated various lesions other than the Bankart lesion, such as capsular redundancy [26–71%], including elongation, stretching or laxity, capsular attenuation (42–47%), a rotator interval lesion, and a defect in the glenoid rim, which may influence recurrent anterior glenohumeral instability [2, 8, 9, 13, 14, 19–21, 24, 25]. In our series, 12 (48%) of 25 athletes had capsular redundancy, 10 (40%) demonstrated capsular attenuation and 14 (56%) a rotator interval lesion.

In Rockwood's view, the incidence of recurrence following a Bankart or modified Bankart procedure was 3.3% [18]. However, Loomer et al. and Ungersbock et al., reported high recurrence rates, with 4 (13%) of 30 patients and 4 (9.5%) of 42 patients, respectively, who continued competitive or contact sport after a modified Bankart repair [12, 24]. Arthroscopic Bankart repair is unsuitable for athletes in competitive sport since it does not allow treatment of the capsular redundancy or attenuation [28] and some surgeons have reported high recurrence rates of between 19 and 44% [13, 16, 25, 28].

However, Altcheck et al., Jobe et al., Wirth et al. and ourselves have performed capsular shift and im-

brication, combined with the Bankart repair and reported low rates of recurrence [2, 11, 27].

These clinical and experimental studies have indicated that it is important to repair the Bankart lesion and also to reconstruct any redundant capsule or ligament to the proper tension by a capsular shift, to reinforce any attenuated capsule by overlapping it in a double fix procedure and to repair a rotator interval lesion.

It is important to restore the range of motion and muscle strength in the shoulder to the level of that before the injury. Recovering the appropriate range of motion depends on restoring correct tension to the capsule and on the programme of rehabilitation carried out after operation.

Warner et al. stated that the position of the shoulder at the time of repair of the capsule should be between 60 and 80° of abduction, 45 and 60° of external rotation and 10° of forward flexion. In their series, 11 (61%) of 18 patients recovered a symmetrical range of movement and 13 (72%) returned to overhead sports [26]. Jobe et al. described an anterior capsulolabral reconstruction in the shoulder of athletes playing overhand sports with a special programme of rehabilitation, including throwing exercises, for one year; 17 (72%) of 25 athletes were able to return to their previous level of competitive sport for at least one year [11]. In our series, 21 (84%) athletes returned to their previous level. However, two became dissatisfied with their throwing ability. For athletes in overhand sports, we believe that when the capsular repair is undertaken there should be an increased degree of abduction and external rotation.

The operation we have described uses three modifications of the Bankart procedure. A screw and spike-washer make it easier to obtain rigid repair of the lesion and allow early and safer rehabilitation. The capsular shift and the repair of the rotator interval lesion allow correction of redundant and attenuated capsule. Repair with the arm held at 45° of abduction and in 45° of external rotation enables proper tension of the ligaments of the capsule.

References

1. American Academy of Pediatrics Committee on Sports Medicine (1988) Recommendation for participation in competitive sports. *Pediatrics* 81:737–739
2. Altchek DW, Warren RF, Skyhar MJ, Ortiz G (1991) T-plasty modification of the Bankart procedure for multidirectional instability of the anterior and inferior types. *J Bone Joint Surg [Am]* 73:105–112
3. Bankart ASB (1923) Recurrent or habitual dislocation of the shoulder-joint. *Br Med J* 2:1132–1133
4. Bankart ASB (1938) The pathology and treatment of recurrent dislocation of the shoulder-joint. *Br J Surg* 26:23–29
5. Berg EE, Ellison AE (1990) The inside-out Bankart procedure. *Am J Sports Med* 18:129–133
6. Bigliani LU, Pollock RG, Soslowsky LJ, Flatow EL, Pawluk RJ, Mow VC (1992) Tensile properties of the inferior glenohumeral ligament. *J Orthop Res* 10:187–197

7. du Toit GT, Roux D (1956) Recurrent dislocation of the shoulder: a twenty-four-year study of the Johannesburg stapling operation. *J Bone Joint Surg [Am]* 38:1–12
8. Field L, Warren RF, O'Brien SJ, Altchek DW, Wickiewicz TL (1995) Isolated closure of rotator interval defects for shoulder instability. *Am J Sports Med* 23:557–563
9. Goldberg BJ, Nirschl RP, McConnell JP, Pettrone FA (1993) Arthroscopic transglenoid suture capsulolabral repair: preliminary results. *Am J Sports Med* 21:656–665
10. Harryman DT, Sidles JA, Harris SL, Matsen FA (1992) The role of the rotator interval capsule in passive motion and stability of the shoulder. *J Bone Joint Surg [Am]* 74:53–66
11. Jobe FW, Giangarra CE, Kvitne RS, Glousman RE (1991) Anterior capsulolabral reconstruction of the shoulder in athletes in overhand sports. *Am J Sports Med* 19:428–434
12. Loomer F, Fraser J (1989) A modified Bankart procedure for recurrent anterior/inferior shoulder instability: a preliminary report. *Am J Sports Med* 17:374–379
13. Mologne TS, Lapoint JM, Morin WD, Zilberfarb J, O'Brien TJ (1996) Arthroscopic anterior labral reconstruction using a transglenoid suture technique: results in active-duty military patients. *Am J Sports Med* 24:268–274
14. Neer CS II, Foster CR (1980) Inferior capsular shift of involuntary and multidirectional instability of the shoulder. *J Bone Joint Surg [Am]* 62:897–908
15. O'Connell PW, Nuber GW, Mileski RA, Lautenschlager E (1990) The contribution of the glenohumeral ligaments to anterior stability of the shoulder joint. *Am J Sports Med* 18:579–584
16. Pagnani MJ, Warren RF, Altchek DW, Wickiewicz TL, Anderson AF (1996) Arthroscopic shoulder stabilization using transglenoid sutures: a four-year minimum followup. *Am J Sports Med* 24:459–467
17. Rao JP, Francis AM, Hurley J, Dackewycz R (1986) Treatment of recurrent anterior dislocation of the shoulder by du Toit staple capsulorrhaphy: results of long-term follow-up study. *Clin Orthop* 204:169–176
18. Rockwood CA Jr (1984) Part 2: Subluxations and dislocations about the shoulder. In: Rockwood CA Jr, Green DP (eds) *Fractures*, 2nd edn, vol 1. Lippincott, Philadelphia
19. Rowe CR, Patel D, Southmayd WW (1978) The Bankart procedure: a long-term end-result study. *J Bone Joint Surg [Am]* 60:1–16
20. Rowe CR, Zarins B (1981) Recurrent transient subluxation of the shoulder. *J Bone Joint Surg [Am]* 63:863–872
21. Rowe CR, Zarins B, Ciullo JV (1984) Recurrent anterior dislocation of the shoulder after surgical repair. *J Bone Joint Surg [Am]* 66:159–168
22. Speer KP, Deng X, Borrero S, Torzilli PA, Altchek DA, Warren FR (1994) Biomechanical evaluation of a simulated Bankart lesion. *J Bone Joint Surg [Am]* 76:1819–1826
23. Thomas SC, Matsen FA III (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]* 71:506–513
24. Ungersböck A, Michel M, Hertel R (1995) Factors influencing the results of a modified Bankart procedure. *J Shoulder Elbow Surg* 4:365–369
25. 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* 11:173–179
26. Warner JJP, Johnson D, Miller M, Caborn DNM (1995) Technique for selecting capsular tightness in repair of anterior-inferior shoulder instability. *J Shoulder Elbow Surg* 4:352–364
27. Wirth MA, Blatter G, Rockwood CA Jr (1996) The capsular imbrication procedure for recurrent anterior instability of the shoulder. *J Bone Joint Surg [Am]* 78:246–259
28. Youssef JA, Carr CF, Walther CE, Murphy JM (1995) Arthroscopic Bankart repair for recurrent traumatic unidirectional anterior shoulder dislocation. *Arthroscopy* 11:561–563