Original article

Outcome of Bankart repair in contact versus non-contact athletes

N. Yamamoto a, H. Kijima b, H. Nagamoto a, D. Kurokawa a, H. Takahashi a, H. Sano a, E. Itoi a,∗

a Department of Orthopaedic Surgery, Tohoku University School of Medicine, Sendai, Japan
b Department of Orthopaedic Surgery, Akita University School of Medicine, Akita, Japan

A R T I C L E   I N F O

Article history:
Received 27 April 2014
Accepted 9 March 2015

Keywords:
Shoulder instability
Bankart repair
Contact athlete
Non-contact athlete

A B S T R A C T

Background: The clinical results of arthroscopic Bankart repair for contact athletes varies according to published reports. The purposes of this study were to analyze the clinical outcome of open or arthroscopic Bankart repair and to investigate the results in contact and non-contact athletes.

Hypothesis: Clinical outcome of arthroscopic Bankart repair is similar to that of open procedure.

Patients and methods: One hundred patients with recurrent anterior shoulder dislocation without a large bony defect were retrospectively reviewed. Fifty-one contact and forty-nine non-contact athletes were found with a mean follow-up of 17 months. Forty-nine shoulders underwent arthroscopic Bankart repairs; 51 shoulders had open Bankart repairs.

Results: In non-contact athletes, there was a 5% (1/22 cases) recurrence rate in the open group and 4% (1/27 cases) in the arthroscopic group. In contrast, in contact athletes, there was a 10% (3/29 cases) recurrence rate in the open group and 14% (3/22 cases) in the arthroscopic group. There was no significant difference in the recurrence rate between contact and non-contact athletes, although contact athletes showed two to three times a higher recurrence rate than that of non-contact athletes. The Rowe score and Constant score showed no significant difference between the two procedures and between the contact and non-contact athletes. The rate of the complete return to sports showed no significant difference between contact and non-contact athletes.

Conclusion: The recurrence rate of Bankart repair in the contact athletes was 2 times higher in the open group and 3 times higher in the arthroscopic group than in the non-contact athletes. Clinical outcome of arthroscopic Bankart repair was similar to that of open procedure.

Level of evidence: Level IV, retrospective study.

© 2015 Elsevier Masson SAS. All rights reserved.

1. Introduction

Treatment of recurrent anterior dislocation of the shoulder with arthroscopic Bankart repair is being increasingly used as the gold standard procedure. In the literature, there have been many reports describing the excellent clinical outcomes after arthroscopic Bankart repair [1–5]. Some authors have suggested that arthroscopic stabilization produces results similar to those of open stabilization. On the other hand, some pointed out that those patients who had a large glenoid or humeral defect had a high recurrence rate after arthroscopic Bankart repair [6–9]. There are some studies reporting high recurrence rates in contact or collision athletes and participation in contact athletics is a contraindication for arthroscopic shoulder stabilization [7,8,10,11]. In contrast, some described that no difference in recurrence rate after arthroscopic Bankart repair was found between contact and non-contact athletes [2,4]. Thus, the clinical results of arthroscopic Bankart repair for contact athletes varied based on reports. In order to obtain better clinical outcome after arthroscopic Bankart repair, we need to know the adequate surgical indication: which cases are indicated or contraindicated for arthroscopic Bankart repair? The purposes of this study were to analyze clinical outcomes of arthroscopic Bankart repair comparing with that of open procedure and to compare the outcome between contact and non-contact athletes.

2. Subjects and methods

One hundred and eighty-two consecutive patients with clinical evidence of recurrent anterior dislocation of the shoulder underwent Bankart repair in our institute and related hospitals between
1995 and 2010. Of these, 100 patients who met the following inclusion criteria were retrospectively reviewed:

- those with repeated anterior shoulder dislocations after an initial episode;
- the first episode was caused by a traumatic event;
- a Bankart lesion or its variants, such as Perthes lesion, anterior labroligamentous peristeal sleeve avulsion (ALPSA) lesion, or glenoid labral articular defect (GLAD) lesion was confirmed during surgery;
- they were involved in athletics;
- a minimum follow-up of 1 year.

Between January 1995 and December 2000, 41 out of 100 shoulders underwent open Bankart repairs, and between January 2001 and January 2011, 59 out of 100 shoulders had arthroscopic Bankart repairs using suture anchors. Arthroscopic Bankart repair was performed since January 2001 in our institute or related hospitals. Exclusion criteria were as follows:

- patients with a glenoid defect of greater than 21% of the glenoid length [12];
- patients with a large Hill–Sachs lesion which engages with the glenoid [13];
- revision Bankart repairs;
- patients with full-thickness rotator cuff tears;
- patients with tears on the capsule at the humeral insertion on arthroscopy.

Before surgery, X-ray, CT, and MR arthrogram were routinely taken. We evaluated the capsular lesions, such as HAGL or capsular tear before surgery and during surgery. The size of the glenoid defect was evaluated comparing the width of the glenoid of the contralateral side in the 3D-CT images. We evaluated the risk of engagement of the Hill–Sachs lesion using the glenoid track concept [13]. When a Hill–Sachs lesion was outside of the glenoid track, we judged that there was risk of engagement with the glenoid before surgery. In that case, we added bone grafting to the Hill–Sachs lesion in addition to Bankart repair.

Forty-nine contact and 51 non-contact cases were found with a 17 months (range, 12–96 months) follow-up (Table 1). The mean age at the time of surgery was 24 years (range, 14–54). There were 81 males and 19 females. Collision or contact sports included the following sports: boxing, football, wrestling, basketball, ice hockey, rugby, soccer, weight lifting, judo, and karate. The selection of collision or contact athletes was made modifying the classification system of the American Academy of Pediatrics Committee on Sports Medicine [14]. The present study was approved by the Institutional Review Board of our hospital.

2.1. Surgical techniques

All operations were performed with the patient under general anesthesia by a single surgeon (El).

2.1.1. Open Bankart repair

Open Bankart repair was performed with the patient in the semi-Fowler position. The incision was vertical from the coracoid process and was 4 to 5 cm long. The deltopectoral approach was used. The upper two-thirds of the subscapularis tendon was elevated from the underlying capsule and retracted medially to expose the anterior capsule. The capsule was incised vertically at the level approximately 5 mm lateral to the glenoid rim. The Bankart lesion was elevated from the glenoid neck with the use of an elevator. After the scapular neck was freshened, the capsulolabral structures were reattached to the glenoid rim using three to five suture anchors (2.8-mm ROC fastener, Innovative Devices, Inc., Marlborough, MA). With the arm in 30° of abduction and neutral rotation, the capsule was repaired. The rotator interval capsule was always closed with two or three interrupted sutures.

2.1.2. Arthroscopic Bankart repair

Arthroscopic Bankart repair was performed with the patient in the beach chair position. A standard posterior portal was created approximately 2 cm medial and 2 cm distal to the acromial angle. After the inspection of the glenohumeral joint, two portals (antero-superior and anteroinferior) were established. The anteroinferior portal was placed just superior to the superior edge of the subscapularis tendon. The inferior glenohumeral ligament-labrum complex was mobilized from the glenoid neck as far inferiorly as the 6 to 7 O’clock position in the right shoulder with use of an elevator. We used a bioabsorbable suture anchor (Panalok Loop anchor, DePuy Mitek, Norwood, MA) or a soft tissue penetrator (Suture Hook; Linvatec, Largo, FL) or an arthroscopic suture passer (Accu-Pass, Smith & Nephew, Andover, MA) was passed through the detached labrum. The arthroscopic technique included a minimum of 3 anchors (mean: 3.5) in all patients and a routine incorporation of capsular plication and proximal shift as previously reported [6,15]. An SMC sliding knot was tied on the soft tissue capsulolabral side of the repair. When there was anterior laxity of the glenohumeral joint under anaesthesia compared with the contralateral side (17 of 59 shoulders), the rotator interval closure was done with two interrupted sutures with #2 Ethibond (Ethicon Somerville, NJ): imbrication between the superior glenohumeral ligament and subscapularis tendon as previously reported [16,17]. We evaluated anterior laxity with arm in abduction and abduction, and when the humeral head rode over the glenoid rim, anterior laxity was thought to be positive. SLAP repair was performed in 7 of 24 shoulders. Other treatments for intra-articular lesions were done in 5 shoulders: osteosynthesis in 4 shoulders and removal of the bony fragment in 1 shoulder. We did not perform remplissage procedure for a large Hill–Sachs lesion.

### Table 1
Patient demographic.

<table>
<thead>
<tr>
<th></th>
<th>Open group</th>
<th>Arthroscopic group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of subjects</td>
<td>51</td>
<td>49</td>
</tr>
<tr>
<td>Mean age (range)</td>
<td>24.6 (15–59)</td>
<td>24.1 (14–54)</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>40</td>
<td>36</td>
</tr>
<tr>
<td>Female</td>
<td>11</td>
<td>13</td>
</tr>
<tr>
<td>Side</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dominat</td>
<td>26</td>
<td>26</td>
</tr>
<tr>
<td>Non-dominat</td>
<td>25</td>
<td>23</td>
</tr>
<tr>
<td>Sports</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contact sports</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rugby</td>
<td>12</td>
<td>7</td>
</tr>
<tr>
<td>Judo</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>Ice Hockey</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Wrestling</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Karate</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>American football</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Basketball</td>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td>Soccer</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>Non-contact sports</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseball</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Skiing</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>Volleyball</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Snowboarding</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>Tennis</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Handball</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Others</td>
<td>6</td>
<td>8</td>
</tr>
</tbody>
</table>

© 2019 Elsevier Masson SAS. Tous droits réservés. - Document téléchargé le 14/02/2019 Il est interdit et illégal de diffuser ce document.
2.2. Postoperative management

The same rehabilitation protocol was used in both arthroscopic and open groups. The arm was immobilized in adduction and internal rotation for 3 weeks, after which pendulum exercises were begun. After 6 weeks, the arm was free to move for activities of daily living, and active-assisted shoulder range of motion exercises were initiated. Isotonic deltoid muscle exercises started soon after surgery. Muscle strengthening exercises, such as cuff exercise using rubber band were started after 8 weeks. Jogging and running were authorized at 3 months. Full participation in sports was permitted after 6 months if the muscle strength returned to greater than 90% of the contralateral shoulder.

2.3. Clinical evaluation

At final follow-up, patients underwent a physical examination of the shoulder to complete the Rowe score and Constant score. Active range of motion (elevation, external rotation in adduction and abduction, and internal rotation) was recorded before and after surgery (final follow-up). Internal rotation was recorded as the level of the spinal process that the thumb could reach. A single examiner (EL) measured the range of motion of all of the patients using a hand-held goniometer.

The return to preinjury sports activities was evaluated subjectively by the patients. We divided the levels of postoperative sports activities into 4:

- complete return, a complete return to the preinjury sport activity level;
- incomplete return, an incomplete return to the preinjury sport activity level;
- inability to return, being unable to return to the sports due to any reasons related to the shoulder, such as anterior apprehension, restriction of range of motion, or pain;
- quitting the sport, because of reasons other than the shoulder.

The Chi² test was used to investigate the difference of the recurrence rate in contact and non-contact athletes. The paired t-test was performed to assess the difference in preoperative and postoperative results of each group. JMP statistical software (SAS Institute, Cary, NC) was used for all statistical analyses, with the α level set at 0.05.

3. Results

3.1. Clinical outcome

In non-contact athletes, there was a 5% (1/22 cases) recurrence rate in the open group and 4% (1/27 cases) in the arthroscopic group. In contrast, in contact athletes, the recurrence rate was 10% (3/29 cases) in the open group and 14% (3/22 cases) in the arthroscopic group. Contact athletes demonstrated 2 times higher recurrence rate in the open group and 3 times higher in the arthroscopic group compared to that of non-contact athletes, although the difference between contact and non-contact athletes did not reach a statistically significant level (P = 0.13). All of these 6 contact athletes with postoperative recurrent dislocation had a traumatic event while playing in the game, which occurred at mean 24.1 months after surgery. One shoulder in the arthroscopic group underwent the Latarjet procedure as a revision surgery.

The Rowe score significantly improved from 43.8 ± 3.5 points (mean ± SD) to 92.8 ± 8.8 points in the open group and from 44.6 ± 7.8 points to 91.1 ± 9.7 points in the arthroscopic group (P < 0.001, P < 0.001, respectively). Forty-seven shoulders were rated as excellent and 4 shoulders were rated as good in the open group (100% good-to-excellent), whereas 44 shoulders were rated as excellent and 5 shoulders were rated as good in the arthroscopic group (100% good-to-excellent). There was no significant difference in the Rowe score between the two surgical groups. The Constant score significantly improved from 66.4 ± 7.6 points to 88.2 ± 7.8 points in the open group and from 64.7 ± 9.1 points to 87.5 ± 8.3 points in the arthroscopic group (P < 0.001, P < 0.001, respectively). There was no significant difference either in the Rowe or Constant scores between the contact and non-contact athletes.

When compared with the results for the contralateral side, the patients had lost a mean of 3° in elevation, 12° in external rotation in adduction, 14° in external rotation in abduction in the arthroscopic group at the last follow-up (Table 2). In the open group, the patients had lost a mean of 6° in elevation, 12° in external rotation in adduction, 15° in external rotation in abduction. No significant difference was found in the postoperative shoulder motion between arthroscopic and open groups. Four patients (7%) in the open group and 6 patients (9%) in the arthroscopic group demonstrated positive apprehension at the final follow-up examination. There was no significant difference in the apprehension test between the two surgical groups. There were no infections, neuropathies, or implant failure as complications of surgery.

3.2. Return to sports

In contact athletes, 24 of 51 athletes (48%) returned to their previous levels of preoperative sports (Table 3). Twelve athletes (24%) incompletely returned to their previous sports because they had anterior apprehension during sport activity or restriction of range of shoulder motion (especially, external rotation) and 12 athletes (24%) quit their sports after surgery because of reasons other than shoulder problems. In non-contact athletes, 26 of 49 athletes (53%) returned 100% to their preoperative sport levels. Twelve athletes (24%) incompletely returned to their previous sports and 20% quit their sport after surgery. There was no significant difference in the return to sports between contact and non-contact athletes. Also, the rate of return to sport showed no significant difference between the open and arthroscopic groups.

4. Discussion

Regarding the recurrence rate and the clinical outcome, there was no statistically significant difference between arthroscopic and open Bankart procedures in both contact and non-contact athletes. Current evidence suggests that arthroscopic anterior stabilization techniques yield the same failure rates in athletes when compared to open techniques if patients with a large bony defect are excluded. Some authors reported similar clinical outcomes in patients without a large bony defect [3, 7]. Thus, if we narrow down the surgical indication for arthroscopic Bankart repair, we are able to expect a good outcome even in athletes being called a high-risk group.

In contact athletes, there was a 10% (3/29 cases) recurrence rate in the open group and 14% (3/22 cases) in the arthroscopic group. All of these 6 contact athletes had had a traumatic event, such as a tackle during the rugby game. Re-dislocation after surgery occurred by great external force during sport activity. Apparently, contact athletes have more chance of injury compared to non-contact athletes, which means that contact sports is one of the risk factors for re-dislocation after surgery. Our data showed that the recurrence rate of contact athletes was 2 times higher in the open group and 3 times higher in the arthroscopic group compared to that of non-contact athletes, although the differences between them did not reach a statistically significant level. Because of small sample size in the present study, we might have made a Type II error.
Table 2
Postoperative range of shoulder motion (degrees).

<table>
<thead>
<tr>
<th></th>
<th>Open group</th>
<th>Arthroscopic group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Involved</td>
<td>Uninvolved</td>
</tr>
<tr>
<td>Elevation</td>
<td>162 ± 19</td>
<td>168 ± 8</td>
</tr>
<tr>
<td>External rotation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>In adduction</td>
<td>60 ± 17</td>
<td>66 ± 17</td>
</tr>
<tr>
<td>In abduction</td>
<td>95 ± 15</td>
<td>107 ± 24</td>
</tr>
<tr>
<td>Internal rotation</td>
<td>77 ± 3</td>
<td>76 ± 2</td>
</tr>
</tbody>
</table>

$^a$ Internal rotation was recorded as the level of the vertebral spine that the thumb could reach.
$^b$ Difference of range of motion (+ uninvolved side-involved side).

Table 3
Return to sports.

<table>
<thead>
<tr>
<th>Type of sports</th>
<th>Complete (%)</th>
<th>Incomplete (%)</th>
<th>Inability (%)</th>
<th>Quit (%)</th>
<th>Others (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contact athletes</td>
<td>48</td>
<td>24</td>
<td>0</td>
<td>24</td>
<td>4</td>
</tr>
<tr>
<td>Non-contact athletes</td>
<td>53</td>
<td>24</td>
<td>0</td>
<td>20</td>
<td>2</td>
</tr>
<tr>
<td>Type of surgeries</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arthroscopic group</td>
<td>51</td>
<td>25</td>
<td>0</td>
<td>20</td>
<td>4</td>
</tr>
<tr>
<td>Open group</td>
<td>48</td>
<td>27</td>
<td>0</td>
<td>23</td>
<td>2</td>
</tr>
</tbody>
</table>

Complete: a complete return to the preinjury activity level; incomplete: an incomplete return to the preinjury activity level; inability: an inability to return to the sports due to any reasons; quit: quit from doing any sports.

5. Conclusion

The recurrence rate of Bankart repair in the contact athletes was 2 times higher in the open group and 3 times higher in the arthroscopic group than in the non-contact athletes. Clinical outcome of arthroscopic Bankart repair was similar to that of open procedure.

Disclosure of interest

The authors declare that they have no conflicts of interest concerning this article.

References


Statistical power in this study was not enough to detect the difference between the recurrence rate of contact and non-contact athletes. According to power analysis (effect size = 0.3, alpha = 0.05, power = 0.95), we need at least 145 subjects in total. This is one of the limitations in the present study.

Forty-eight percent of contact athletes and 54% of non-contact athletes could fully return to their preoperative sport levels. However, 24% of contact athletes and 24% of non-contact athletes could not completely return to their previous sports due to their apprehension during sports or restriction of range of motion. Four patients in the open group and 12 patients in the arthroscopic group demonstrated positive apprehension at the final follow-up examination. Also, the patients had lost a mean of 12° in external rotation in adduction and 14° in external rotation in abduction in the arthroscopic group with no significant difference from those in the open group. When making athletes return to their previous sport levels, we have confronted the apprehension and restriction of motion issues after surgery. In order to obtain better clinical results in athletes, we need to solve these issues.

Regarding the range of shoulder motion, it was expected that patients who underwent arthroscopic Bankart repair should have better improvement compared to open techniques as previously reported [18]. However, the patients had the same loss of shoulder motion after surgery, especially external rotation in both adduction and abduction in the arthroscopic group as in the open group. Loss of external rotation in the present study (12° in adduction and 14° in abduction) was greater than that previously reported (0° to 7° in adduction and 2° to 4° in abduction) [2,4,7,8,15,19]. In our rehabilitation protocol, the arm was immobilized with use of a shoulder brace for 6 weeks. In order to improve the range of motion after arthroscopic Bankart repair, we might want to change the rehabilitation protocol according to the previous reports [4,17], we suggest that immobilization be shortened from 6 weeks to 3 weeks, and an active-assisted shoulder range of motion exercises be initiated at 3 weeks after surgery.

There are several limitations in this study. First, as described above, the number of the subjects was small. To avoid Type II error, we need 145 subjects in total for statistical analysis. Since this is a retrospective study, it is impossible for us to obtain the subjects, which are large enough in number for statistical analysis. Second, the type of sports of the subjects was different in the open and arthroscopic groups. For example, approximately 12 cases were rugby players in the open group, whereas 7 cases in the arthroscopic group. Since 3 of 6 patients who had re-dislocation after surgery were rugby players, this may have affected the results in the present study. Also, there were many athletes who played the practiced sports in the present study. The mixture of contact and collision athletes may affect our results. Although it is ideal to collect the similar patient population whose type of sport is the same in each group, it was impossible because this was a retrospective study. Third, a minimum follow-up of 1 year is short. Recurrence after surgery may occur between 1-year and 2-year follow-up as previously reported [7]. This is one of limitations in this study.


