A Meta-Analysis of Arthroscopic versus Open Repair for Treatment of Bankart Lesions in the Shoulder

BCE Lei Wang
CD Yaosheng Liu
BE Xiuyun Su
AE Shubin Liu

Corresponding Author: Shubin Liu, e-mail: sbmmsbj@163.com
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Background: The optimal treatment for Bankart lesion remains controversial. Therefore, we performed this meta-analysis to compare the clinical outcomes of patients managed with open Bankart repair versus arthroscopic Bankart repair.

Material/Methods: After systematic review of online databases, a total of 11 trials with 1022 subjects were included. The methodological quality of randomized controlled trials (RCTs) was assessed using the PEDro critical appraisal tool, and non-RCTs were evaluated by Newcastle-Ottawa (NO) quality assessment tool. Outcomes of shoulder stability, range of motion (ROM), functional scales, and surgical times were analyzed.

Results: Data synthesis showed significant differences between the two strategies, with regards to stability of the shoulder ($P=0.008$, $RR=0.94$, 95% CI: 0.89 to 0.98), and ROM ($P<0.001$, $SMD=-0.47$, 95% CI: −0.72 to −0.22).

Conclusions: Open Bankart repair produced a more stable shoulder but had a relatively poor shoulder motion, compared with arthroscopic Bankart repair, for the treatment of Bankart lesion.

MeSH Keywords: Arthroscopy • Orthopedics • Shoulder Dislocation

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Background

Bankart lesion, initially reported in 1938 on a series of 27 patients with anterior shoulder instability by Bankart, is caused by the detachment of the anterior inferior labrum from the glenoid rim and in general affects people who are younger than 35 years of age. Traditional open Bankart repair (OBR) was previously considered as the accepted standard treatment for shoulder stabilization by many surgeons [1,2]. OBR has been shown to improve glenohumeral joint stability, with recurrence rates below 10% [3–5] and low failure rates varying between 0 and 11% [6–9]. However, restriction of external rotation and secondary osteoarthritis are the weakness of the open surgery.

Arthroscopic Bankart repair (ABR), first described in 1993 [10], was gradually advocated by some surgeons over the past two decades due to rapid development in arthroscopic instruments and implants and increased experience of surgeon [11–13]. Compared with open procedure, arthroscopic treatment has some advantages, such as smaller skin incisions, shorter surgical times, less postoperative pain and decreased rates of complications [14–16]. Nevertheless, some investigations reported that the patients with ABR had a higher recurrence rate compared with standard open procedure [17–19]. Moreover, arthroscopic technique requires experienced surgeons with a relatively long learning curve and expensive instruments. Up to now, newer techniques for ABR, such as suture anchor fixation, have been introduced with similar failure rates compared to traditional open procedure. However, these available data were obtained just at short- and mid-term follow-up, instead of long-term. Therefore, there is a lack of powerful evidence to determine the preferred method between OBR and ABR for Bankart lesion.

Although several previous studies have summarized the published studies about OBR versus ABR, most of them are systematic reviews. Some authors concluded open repair has a decreased rate of recurrence; however, the others considered there are no significant differences in failure rates between OBR and ABR. Moreover, several new high-quality studies [20–24] have been recently published. Therefore, we performed this meta-analysis to determine which procedure has better clinical outcomes in the treatment of Bankart lesion.

Material and Methods

Search strategy

The search was performed in the online databases PubMed (1966 to January 2015) and EMBASE (1966 to January 2015). Only studies published in English were included. The reference lists were also checked for possible eligible article. The keywords used for retrieval were: anterior shoulder instability, Bankart lesion, dislocation, and subluxation.

Inclusion and exclusion criteria

Inclusion criteria were set as follows: 1) English literature, 2) comparison of open versus arthroscopic shoulder stabilization for Bankart lesion, 3) all included patients aged 18 years or older, 4) a minimum of 2-year follow-up, and 5) available data for recurrence, and shoulder functional scores. Exclusion criteria were: 1) non-English language literature; 2) studies with less than 2-year follow-up; 3) original data being insufficient for a meta-analysis; 4) vitro studies or non-comparable studies; 5) included patients with younger than 18 years; and 6) sample size being less than 50. To avoid repetition, if multiple articles included the same patient population, then the results were pooled.

Data extraction and evaluation of methodological quality

Data were extracted and evaluated independently by two researchers and then verified by the third senior researcher. The extracted information included: 1) the characteristics of the included studies, including the authors, the type of study design, and publication date; 2) the demographics of included subjects, including sample size, age, gender, duration of follow-up, from injury to surgery time, and the surgical details; and 3) details of outcomes. Disagreement between the authors was resolved by discussion. In cases of missing necessary data, corresponding authors the eligible trials were contacted to obtain this data. The methodological quality of each randomized controlled trial (RCT) was assessed using the Physiotherapy Evidence Database (PEDro) scale [25]. The Newcastle-Ottawa (NO) quality assessment tool [26] was used to assess the quality of each non-randomized study. The NO scales based on standard quality ratings were as follows: 1) selection of study groups; 2) comparability of study groups; and 3) ascertain-
Statistical analysis

All statistical analyses were conducted using Review Manager 5.3. Dichotomous data were analyzed by risk ratios (RR), and continuous outcomes were determined by weighted mean difference (WMD), both with 95% confidence intervals (CIs). Chi-squared test was performed to evaluate heterogeneity, which was determined to be significant at $I^2 > 50%$. Funnel plot was used to evaluate publication bias. A fixed-effects model was initially employed when the heterogeneity was not significant, and a random-effects model was used if the significant heterogeneity was observed. Data not available for the meta-analysis were analyzed descriptively.

Results

The flow diagram of the study search process is displayed in Figure 1. After full-text reviews, a total of 11 independent studies [13,20,22,31–38] were included in this meta-analysis, with a cumulative sample size of 1022 at final follow-up (Table1). Four of all included studies [20,31–33] were RCTs and the rest [13,22,34–38] were cohort study. The pooled characteristics of the included studies are shown in Table 1. The methodological quality of RCTs is provided in Table 2. Table 3 represents the quality of the four cohort studies, as determined using the NO scale. As shown in Figure 2, publication bias was evaluated using funnel plot, which was acceptably symmetrical.

Table 1. Characteristics of studies included in this meta-analysis.

| Study     | Year | Country | Design       | Age (y) | Gender (M/F) | IDB | TFTTR (m) | Follow-up (m) |
|-----------|------|---------|--------------|---------|--------------|-----|-----------|---------------|
| Sperber   | 2001 | Sweden  | Level I RCT  | 25      | 27.5         | 21/9| 19/7      | 21 (70%)      |
|           |      |         |              |         |              | 11 (42%) | 57.6      | 42            |
|           |      |         |              |         |              |     |           | 24            |
| Fabbriciani | 2004 | Italy   | Level I RCT  | 24.5    | 26.8         | 24/6| 26/4      | 22 (73%)      |
|           |      |         |              |         |              | 17 (57%) | 25.3      | 20.2          |
|           |      |         |              |         |              |     |           | 24            |
| Bottoni   | 2006 | USA     | Level I RCT  | 25.3    | 25.2         | 30/1| 29/0      | 27 (87%)      |
|           |      |         |              |         |              | 14 (48%) | 40        | 35.1          |
|           |      |         |              |         |              |     |           | 29.1          |
|           |      |         |              |         |              |     |           | 28.5          |
| Mohtadi   | 2014 | Canada  | Level I RCT  | 27.2    | 27.8         | 80/18| 80/18     | 31 (32%)      |
|           |      |         |              |         |              | 45 (46%) | 54        | 75            |
|           |      |         |              |         |              |     |           | 24            |
| Cole      | 2000 | USA     | Prospective  | 28      | 27           | 33/4| 18/4      | 18 (49%)      |
|           |      |         |              |         |              | 8 (36%)  | 35        | 47            |
|           |      |         |              |         |              |     |           | 52            |
|           |      |         |              |         |              |     |           | 55            |
| Karlsson  | 2001 | Sweden  | Prospective  | 26      | 27           | 45/15| 38/10     | N/A           |
|           |      |         |              |         |              |      | N/A       | 31            |
|           |      |         |              |         |              |     |           | 42            |
|           |      |         |              |         |              |     |           | 28            |
|           |      |         |              |         |              |     |           | 36            |
| Kim       | 2002 | South Korea | Retrospective | 19.5 | 20.3 | 50/8 | 26/4 | N/A | 58.8 | 69.6 | 39 |
| Tjoumakaris | 2005 | USA     | Retrospective | 30.8 | 28 | 48/11 | 16/8 | 34 (58%) | 12 (50%) | >12 | >12 | 40 | 56 |
| Lützner   | 2009 | Germany | Retrospective | 25    | 27 | 35/5 | 124/35 | 109 (55%) | 32 | 21 | 32 |
| Mahiroğulları | 2010 | Turkey | Retrospective | 24.9 | 25.8 | 34M | 30M | 23 (68%) | 27 (90%) | 45.6 | 52.8 | 26.1 | 26.6 |
| Zaffagnini | 2012 | Italy   | Retrospective | 35    | 38 | N/A | N/A | 30 (61%) | 19 (58%) | N/A | N/A | 164.4 | 188.4 |

As – arthroscopic; M – male; F – female; IDB – involved dominant shoulder; TFTTR – time from trauma to repair; N/A – not applicable.
Primary outcomes

All 11 studies assessed stability of the shoulder postoperatively (Figure 3A), including 512 patients in arthroscopic group and 510 patients in open group. After meta-analysis using a fixed-effects model ($I^2=34\%$), a statistically significant difference was observed between the two treatment groups in respect to shoulder stability ($P=0.008$, RR=0.94, 95% CI: 0.89 to 0.98).

Secondary outcomes

After meta-analysis on postoperatively functional outcomes, no significant differences were shown between the two treatment strategies, in terms of Rowe ($P=0.16$), ASES ($P=0.24$),
META-ANALYSIS

In this meta-analysis, a total of 11 studies were included and analyzed. The results showed that open repair was associated with a greater risk of postoperative instability and obtained a better ROM, compared with those with open repair procedure.

For the treatment of Bankart lesion, Rowe et al. [1] first introduced OBR, which was previously regarded as the criterion standard. Recently, arthroscopic techniques have been developed in order to obtain similar outcomes to open strategy without the defects associated with OBR. Arthroscopic techniques can achieve decreased pain, shorter hospital stay, improved cosmesis, and earlier return to activity [39]. However, the optimal strategy for the treatment of Bankart lesion remains controversial, based on the comparison of postoperative outcomes, especially on instability recurrence.

Hobby et al. [40] indicated similar instability recurrence between open and arthroscopic group. They also showed that patients who underwent ABR with suture anchor repair had lower instability recurrence compared to those with other arthroscopic techniques. A case-control study published by Kim et al. [35] showed no significant difference in instability recurrence between the two treatment strategies; however, arthroscopic treatment achieved a better functional result with Rowe score. Nevertheless, Mothadi et al. [41] reported the open technique obtained better outcomes in terms of recurrence and time to return to activity. After meta-analysis in the present study, the results demonstrated that patients with OBR might have more stable shoulders postoperatively but less ROM, compared with those who underwent ABR. However, the finding should be interpreted with great caution because 7 of the included studies were non-RCTs and had a relatively lower quality in contrast to RCTs. Therefore, further trials with better design are needed.

In this meta-analysis we also observed that the patients who underwent arthroscopic technique had better external rotation and time to return to activity. After meta-analysis in the present study, the results demonstrated that patients with OBR had a better functional result with Rowe score. Nevertheless, Mothadi et al. [41] reported the open technique obtained better outcomes in terms of recurrence and time to return to activity. After meta-analysis in the present study, the results demonstrated that patients with OBR might have more stable shoulders postoperatively but less ROM, compared with those who underwent ABR. However, the finding should be interpreted with great caution because 7 of the included studies were non-RCTs and had a relatively lower quality in contrast to RCTs. Therefore, further trials with better design are needed.

Discussion

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Given the variety of functional evaluations used, it is difficult to show convincing results. Therefore, there is an urgent need to develop a standard evaluation system that is more effective to assess shoulder function postoperatively.

Several limitations of the present meta-analysis should be mentioned. Firstly, a lack of high-level evidence on the comparison of the arthroscopic-repair and the open-repair procedures limited the strength of the meta-analysis. Only four out of all included studies were RCTs. Moreover, three out of seven cohort studies included showed poor quality based on the NO scale. Secondly, sample size of each study included was mentioned. Firstly, a lack of high-level evidence on the comparison of the arthroscopic-repair and the open-repair procedures limited the strength of the meta-analysis. Only four out of all included studies were RCTs. Moreover, three out of seven cohort studies included showed poor quality based on the NO scale. Secondly, sample size of each study included was

other studies. Fabbriciani et al. [32] reported that arthroscopic procedure led to a significantly better ROM compared with the open group, but Mohtadi et al. [20] demonstrated no significant differences in ROM between the arthroscopic-repair and the open-repair groups.

Regarding functional outcomes, we found no differences between the ABR and OBR groups, but the clinical relevance of this finding is questionable. All studies included used different functional evaluations, including Rowe score, ASES, Constant score, and ULCA. Given the variety of functional evaluations
relatively small. Clinical heterogeneity might be inevitable due to the various surgical indications and the difference of experience of each surgeon. Finally, the shortage of a standard evaluation system might have a limit the strength of the evidence.

Conclusions

In summary, more stable shoulders but relatively poor shoulder motions were observed in the OBR group compared with the ABR group for the treatment of Bankart lesion. Furthermore, further trials including a larger number of patients and a better-designed method are urgently needed.

Competing interests

The authors declare that they have no competing interests.

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