

Original Article

Arthroscopic versus open bankart repair in patients with recurrent anterior dislocation of the shoulder-a ten year follow-up study

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Abstract: Purpose: The goal of this study was to compare the safety and effectiveness of open and arthroscopic approaches in the treatment of recurrent anterior dislocation of the shoulder secondary to traumatic injury. Methods: Patients who were treated in our center for recurrent anterior dislocation of the shoulder secondary to traumatic injury from January 2003 to January 2008 were included in the current study. They were divided into two groups according to the surgical treatment (arthroscopic surgery and open surgery) they have received. Intraoperative time and hemorrhage, surgery related complications, total time of stay in hospital, incidence of recurrence dislocation of the shoulder joint, VAS pain scores, and Rowe scores before surgery and during follow-up visits were compared between the two groups. Results: Three hundred and forty six patients (130 female, 216 male, age: 18-47, average 28.5 ± 10.2) were included in the final analysis. Of those, 158 patients received arthroscopic surgery and 188 underwent open surgery. There were no significant differences between the two groups concerning age, gender, and duration of the disease. Arthroscopic surgery was superior to open surgery concerning intraoperative hemorrhage, total stay in hospital, and VAS pain scores one month after the surgery ($P < 0.01$), but was inferior concerning the time of surgery ($P < 0.01$), incidence of recurrence dislocation of the shoulder joint ($P = 0.01$), and Rowe score at last follow-up ($P < 0.01$). Surgical complications and VAS pain scores at the last follow-up were not significantly different between the two groups ($P > 0.05$). Conclusions: Although open Bankart repair is more invasive than the arthroscopic Bankart surgery, it should still be considered for some patients due to the superior outcomes of open surgery concerning long term stability of the shoulder joint.

Keywords: Shoulder, anterior dislocation, Bankart repairmen, open surgery, arthroscopic surgery

Introduction

The shoulder joint has complicated functions and relatively fragile anatomic construction, which makes it liable to dislocation. Dislocation of the shoulder joint consists half of all joint dislocations, and anterior dislocation contributes to 85% of all shoulder dislocations. Most shoulder joint dislocations are caused by traumatic injury and a few from other reasons, and the most common etiology is the avulsion of glenoid labrum and the capsuloligamentous complex from the lower lip of glenoid cavity: the Bankart injury [1-3]. Recurrence of traumatic anterior dislocation of shoulder joint is caused by severe injury, and it is accompanied by rupture of joint capsule, ligaments, glenoid labrum

and even rotator cuff injury or the fracture of glenoid cavity. If the injury is not healed when the severe traumatic injury first caused the shoulder joint dislocation, it could easily become recurrent. Because conservative treatment options such as Hippocrates and Rowe methods cannot achieve repair of the shoulder joint, most authors recommend surgical treatment for Bankart injury [4, 5]. Currently both open and arthroscopic approaches are performable for shoulder joint diseases in many orthopedic centers. However, there is no consensus on the better approach of those two methods [6-8]. The current study was designed to find which method is more effective and safe for the treatment of Bankart injury during a long follow-up period.

Materials and methods

The study was approved by the Ethics Committee of the authors' institution, and signed consents were provided by patients before the enrollment. Patients with confirmed diagnosis of recurrent anterior dislocation of shoulder secondary to traumatic injury and were treated with either open or arthroscopic Bankart repairs in our department between January 2003 and January 2008 were included in the current study. X-ray films and three dimensional computed tomography scans were applied to find if there were any bone defects. Inclusion of patients was decided by the type of injury, complications, patients' overall health status and willingness to participate in the surgery (Table 1).

Treatment

Preoperative preparation: Patients chose which surgical procedure they wanted to receive after their surgeon provided comprehensive information on those methods. Both surgeries were carried out under general anesthesia. After anesthesia, the anatomic landmarks of clavicle, processus, and acromion were marked for the guidance of further procedure.

Surgical treatment

Open surgery: patients were placed in supine position after anesthesia. Montgomery & Jobe method was used for the open surgery [9]. An incision was made 2 cm from the coracoid process to the anterior axillary fold along the Langer line. The gap between deltoid and pectoralis major muscle was separated and subscapularis muscle tendon was exposed. A transverse incision was made along the direction of muscle fiber at the junction of upper 2/3 and lower 1/3 of subscapularis muscle tendon. After the joint capsule was exposed, the anterior capsule was horizontally cut along the subscapularis muscle tendon. A suspension was made on upper and lower capsule of labrum glenoidale to retract it to two sides. A narrow retractor was applied to tract the head of humerus laterally, and the anterior joint capsule was stripped subperiosteally. Holes were drilled on glenoid rim at 2, 4, 6 o'clock positions. Anchors with nonabsorbable suture (Smith & Nephew, Memphis, USA) were placed

in each hole. Sutures were tensioned to set the anchors. The inferior flap was fixed on the neck of scapula, shifting the capsule superiorly. The superior flap was shifted inferiorly, overlapping and reinforcing the inferior flap. The arm was placed in a position that abducted 45 degrees and outboard-rotating 45 degrees, and the capsule was loosely closed with non-absorbable sutures, then the cut was sutured by layers.

Arthroscopic Bankart repair: patients were placed on a lateral decubitus position. The arthroscope was inserted via posterolateral acromion. Integrity of the glenoid labrum, biceps brachii tendon, existence of free bodies in the joint was examined through the portal. An arthroscope through the anterior shoulder joint was applied to clean the edges of glenoid labrum, and the anterior scapular neck was cleaned using a motorized burr. Then 3 to 5 titanium anchors (Smith & Nephew, Memphis, USA) with 2-0 sutures were placed on the glenoid labrum. The inferior glenohumeral ligament was then reinserted using anchors. The capsule was shifted from inferior to superior position, and for far inferior detachments, the most inferior stitch was performed through the posterior portal to gain more access [10].

Postoperative treatment

After surgery, all patients were fixed with shoulder-elbow bracelet in outreach-neutral position for four weeks. Passive forward and extension activities were started 2 days after surgery, and the active exercises started 4 weeks after the surgery. Patients were allowed to engage in daily activities 8 weeks after the surgery, non-competitive sports activities 3 months after the surgery, and competitive sports 6 months after the surgery.

Statistics

All data was analyzed by SPSS22.0 software (IBM, IL, USA). Duration of the disease, intraoperative time, hemorrhage, total stay in hospital, time of recurrence dislocation, VAS pain scores, and Rowe stability scores before and after the surgery, and the last follow-up were recorded and compared between the two groups using one way ANOVA and χ^2 analysis. Differences were considered significant when $P < 0.05$.

Arthroscopic versus open surgeries for shoulder dislocation

Table 1. Inclusion and exclusion criteria of patients

Inclusion criteria	Exclusion criteria
Known history of traumatic injury of shoulder joint	Instability of the shoulder joint toward multiple directions
Confirmed anterior dislocation of shoulder joint	Anterior to posterior injury of superior labrum
Manual reduction of the joint was carried out by Hippocrates or Rowe technique at least 3 times	The thickness of the injured bony structure exceeded 5 mm
Bankart injury was confirmed by MRI analysis	Patients with large (> 25% of width in axial view) glenoid fractures
Patient has adequate overall health status to receive surgical treatment	Instability of multiple joint capsules
The patient agreed to receive surgical treatment and participate in the study	Refused to participate in the study and pay regular visits to the clinic after the surgery

Table 2. No significant differences were observed when comparing the demographic characteristics of the included patients in two groups

		Arthroscopic	Open	P
Gender	Male	102	114	0.64
	Female	56	74	
Age		31.6 ± 8.6	32.2 ± 12.2	0.52
Duration (days)		12.2 ± 6.8	16.0 ± 8.3	0.35
Times of dislocation		5.8 ± 3.3	6.2 ± 3.6	
Origin of injury	Falls	27	31	
	Sports	72	95	
	Bicycle accident	9	11	
	Car accident	18	22	
	Other	32	29	

Table 3. Total operation time was significantly longer in the arthroscopic surgery group than the open surgery group, while intraoperative hemorrhage and total hospital stay were shorter in the arthroscopic surgery group than the open surgery group

Approach	Time (minutes)	Hemorrhage (ml)	Total hospital Stay (days)	Complications	
				Nerve Injury	Infection
Arthroscopic	94 ± 8.6	15 ± 6.9	4.3 ± 1.5	1	0
Open	65 ± 10.6	137 ± 22.6	7.2 ± 2.6	1	4
P value	< 0.01	< 0.01	< 0.01	1.0	0.13

There were no significant differences between the two groups concerning the intraoperative complications such as neural injuries and surgical site infection.

Results

During the time of the study, 346 patients (130 female, 216 male, age: 18-47, average 28.5 ± 10.2) received surgical treatment for recurrent anterior dislocation of shoulder secondary to traumatic injury in 352 shoulders in our center. Among those patients, 158 patients received arthroscopic surgery and 188 underwent open surgery. There were no significant differences between the two groups concerning age, gender, and the duration of disease (**Table 2**).

All patients were hospitalized before surgery and all surgeries were carried out according to the original surgical plan, and none of the arthroscopic surgeries needed to be converted to open surgery. Time of surgery was significantly longer in the arthroscopic surgery group than the open surgery group ($P < 0.01$). Intraoperative blood loss was significantly larger in the open surgery group than the arthroscopic surgery group ($P < 0.01$) and total time of hospital stay was significantly more in the open surgery than the arthroscopic surgery

group ($P < 0.01$). There were no differences concerning the surgery related complications such as neural injury and wound infection ($P > 0.05$) (**Table 3**).

After surgery, decline of VAS pain scores and increase in Rowe score after the surgery was significantly higher in the open surgery group than the arthroscopic surgery group ($P > 0.05$). Recurrent dislocation was found in 8 patients with eight shoulders in the arthroscopic surgery group but only in one patient in the open surgery group. The difference was significant ($P < 0.05$) (**Table 4**).

Discussion

More than a century ago, surgeons proposed different hypotheses for the etiology of unstable shoulder. The Bankart lesion was defined as the detachment of

anteroinferior labrum from inferior glenohumeral ligament complex [11]. Bankart used labrum reattachment for patients with shoulder instability and achieved satisfactory results. This procedure was called the Bankart procedure [12].

The open Bankart procedure has been recognized as the best approach in the treatment of shoulder instability [13-15]. However, when Bankart lesion accompanies other injuries of the shoulder joint such as Hill-Sachs injury, rotator cuff injury, SLAP injury, and bony Bankart lesion, surgical procedures that only reattach the labrum to the glenoid while ignoring rebuilding the inferior glenohumeral ligament complex may still fail to achieve satisfactory results [16, 17].

Arthroscopic techniques have been applied to restore shoulder stability since From the 80s of the 20th century [18, 19]. They were developed in order to avoid large incisions that may result in more intraoperative hemorrhage, tissue damage and postoperative scarring. U

Table 4. VAS and Rowe scores were not significantly different between the two groups

Approach	VAS pain score			Rowe score		Recurrent dislocation
	Before	After	Last	Before	Last	
Arthroscopic	6.2 ± 1.3	1.5 ± 0.3	1.8 ± 0.7	35.7 ± 7.6	54.3 ± 11.8	8
Open	7.1 ± 1.5	3.5 ± 0.5	2.3 ± 1.0	38.6 ± 8.7	70.5 ± 12.4	1
<i>P</i> value	0.32	0.03	0.65	0.26	< 0.01	0.01

There were significant differences between the two groups comparing the ratio of recurrent dislocation of shoulder during the follow-up.

shaped anchors, transglenoid sutures, bioabsorbable tacks, and suture anchors have been used in the surgery with different results [20, 21]. Now arthroscopic Bankart repair has become popular in the treatment of anterior shoulder instability in many orthopedic centers, mostly due to its minimal invasive nature. It is also apparent from the current study that arthroscopic Bankart repair can alleviate intra and post-operative pain. However, there has been reported a ratio of recurrent shoulder dislocation after arthroscopic Bankart repair in the current literature ranging from 2 to 10 percent [22-24]. In the current study, there were 8 patients (2.5%) in the arthroscopy group with recurrent shoulder dislocation or subluxation, while only one patient in the open surgery group experienced recurrent shoulder dislocation after the surgery. This is similar to previous studies. However, with the development of arthroscopic surgical technique, stability of the shoulder can be further enhanced in the future studies.

Safety of a surgical procedure is often measured by the incidence of surgery related complications. In the current study, there were significant differences between two groups concerning the incidence of postoperative wound infection ($P = 0.16$) and neural injury ($P = 1.0$). One patient in each group experienced dysesthesia after the surgery, which was healed within six months during postoperative follow-up. There were 4 patients in the open surgery group with superficial surgical site infection, all of which were healed with the application of antibiotics and changing of dressing. Those results indicate that with rigorous training of the practitioner, both open and arthroscopic Bankart repair are equally safe surgical techniques. Damage of vascular or neural structures could also be avoided by sufficient preoperative planning and meticulous surgical manipulation.

The main novelty and strength in the study is that this is one of the longest follow-up studies with the largest patient size so far. Additionally, the results of this study can be directly used for future clinical procedures. However, as a non-randomized prospective study, data based on this study may be biased by the patient inclusion. Since the arthroscopic Bankart repair is not covered by the medical insurance, patients who are willing to receive this surgery are more likely to be the patients without insurance and their economic status are not as strong as those who received open Bankart repair. Moreover, since some patients experienced several dislocations before they could receive surgical treatment, small glenoid fractures or erosions as well as Hill-Sachs lesions could be present, and this could affect the stability of shoulder joint after arthroscopic surgery.

It can be concluded from those results that although open Bankart repair is more invasive than the arthroscopic Bankart surgery, it should still be considered for some patients due to its effect on long term stability of the shoulder joint. However, arthroscopic surgery can still be prioritized to open surgery in many patients since it leads to less hemorrhage, shorter stay in hospital, smaller scarring and less pain after the surgery. Since arthroscopic Bankart repair technique is still evolving, it is likely that functional recovery and stability after arthroscopic surgeries will be further improved in the foreseeable future.

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