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Original Article

Comparison of efficacy between montgomery and Jobe technique and arthroscopic bankart repair in treating traumatic recurrent anterior shoulder dislocation

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Abstract: Objective: To compare the clinical efficacy of Montgomery and Jobe technique versus arthroscopic Bankart repair in treating traumatic recurrent anterior shoulder dislocation (ASD). Methods: A total of 113 patients with traumatic recurrent ASD admitted to our hospital from June 2016 to January 2019 were selected as study subjects, and were divided into Group A and B in accordance with surgical options. The clinical data of the subjects were collected retrospectively. Group A was treated by the Montgomery and Jobe technique, while Group B was treated with arthroscopic Bankart repair. The arthroscopic manifestations were analyzed before and after arthroscopic Bankart repair. Scores of visual analogue scale (VAS) for shoulder joint and American Shoulder and Elbow Surgeons (ASES), Constant-Murley Score (CMS), Rowe Score, and complications were compared between the two groups before and after surgery. Results: Compared with Group A, Group B had a lower score of VAS for the shoulder joint, and higher scores of the range of motion (ROM), functional activities, myodynamia, pain, CMS, vital functions, ASES, and shoulder joint function, and a higher Rowe score after surgery ($P < 0.05$). The incidence rate (1.75%) of complications in Group B was lower than that (14.29%) in Group A ($P < 0.05$). Conclusion: Arthroscopic Bankart repair is superior to the Montgomery and Jobe technique in treating traumatic recurrent ASD. Arthroscopic Bankart repair, exhibiting a high safety profile, is conducive to improving shoulder joint function and pain.

Keywords: Traumatic, recurrent, anterior shoulder dislocation, montgomery & jobe technique, arthroscopic bankart repair, comparison of efficacies

Introduction

Clinically, shoulder dislocation (SD) is one of the osteoarticular diseases with a high morbidity. SD occupies about 50% of the joint dislocation in the body in terms of morbidity, which is closely related to the physiological and anatomical characteristics of shoulder joint (e.g., a shallow and small glenoid cavity, large caput humeralis, loose articular capsule, fragile tissues in the front and lower part of shoulder joint, a large ROM of joints, and the high incidence of being subjected to external forces) [1, 2]. SD is highly prevalent in male young adults, and the clinical manifestations are pain and swelling of an injured shoulder, and restricted active and passive activities [3]. Dugas' test shows a positive result. When the affected hand is close to the chest, it is challenging to rest the palm on the opposite shoulder. The shoulder deltoid muscle is in a collapsed state and the glenoid cavity is hollow. The affected limb is elastically fixed in a mildly abducted position, and it is necessary to usually hold the affected arm with the uninjured hand [4, 5].

Traumatic recurrent ASD is usually induced by a severe traumatic force. The initial occurrence of SD leads to injuries. Although the shoulder joint can be restored after treatment, recurrent SD occurs easily with a slight external force during daily activities [6, 7]. This can be attributable to the pathological changes in the stable structure of shoulder joint that is not completely restored due to the ineffective fixation and insufficient rest. Studies suggest that Bankart injury is one of the major pathological causes of traumatic recurrent ASD. Therefore,

the key to clinical treatment of traumatic recurrent ASD is how to effectively repair Bankart injury [8, 9]. Previously, Montgomery and Jobe technique was usually used in clinical treatment. It is an open operation, which requires the operation area to be exposed intuitively. Despite of simple operation, short operation time, and clear anatomical structure, the operation trauma is large, the postoperative recovery time is long, the postoperative scars will be left, the surrounding tissues and organs and vascular nerves are easily to be damaged, the deep field of the shoulder joint is difficult to be exposed, and the incidence of postoperative complications is high. With the in-depth biological and anatomical studies on the traumatic recurrent ASD over these years, arthroscopic surgeries have been extensively implemented in treating such disease. Among them, arthroscopic Bankart repair is one of the common surgical options [10, 11].

Few studies on arthroscopic Bankart repair for treatment of traumatic recurrent ASD have been reported in China, and very few literatures exist on the comparison between arthroscopic Bankart repair and open surgery for treatment of traumatic recurrent ASD [12, 13]. In view of this, this study, demonstrating feasibility and an innovation, compared the efficacies of Montgomery and Jobe technique and arthroscopic Bankart repair in treating traumatic recurrent ASD.

Materials and methods

Clinical data

A total of 113 patients with traumatic recurrent ASD admitted to our hospital from June 2016 to January 2019 were selected as the study subjects, and were divided into Group A (n=56) and B (n=57) in accordance with surgical options. The clinical data of the subjects were collected retrospectively. Group A was treated with Montgomery and Jobe technique, while Group B was treated with arthroscopic Bankart repair. (1) Inclusion criteria: voluntary signing of informed consent form; surgical indications; traumatic recurrent ASD diagnosed by nuclear magnetic resonance (NMR), 3D CT reconstruction and X-ray examination of shoulder joint; history of ASD; Approved by the Medical Ethics Committee of Fuyang Orthopaedics and Traumatology Affiliated Hospital of Zhejiang Chinese Medical University. (2) Exclusion criteria: complicated by extensive soft tissue injury or shoulder stiffness before surgery; complicated by loosening of articular capsule; complicated by other shoulder ligament injuries; Fixed, habitual and primary shoulder dislocation; poor physical condition; unable to tolerate surgical treatment; halfway withdrawal.

Methods

Group A: the patients underwent general anesthesia or brachial plexus block anesthesia. An incision of 3-5 cm was made at 2 cm from the distal side of coracoid process downward to the plica axillaris anterior, the gap between pectoralis major muscle and deltoid muscle was separated, the conjoined tendon and coracobrachial muscle were pulled inward, and deltoid muscle was pulled outward, so that the tendon of subscapularis muscle was fully exposed. The subscapularis muscle was cut transversely, the labrum glenoidale and articular capsule were dissected and exposed, and the anterior capsule was cut along the tendon of subscapularis muscle, followed by being suspended at the upper and lower articular capsule valves at the labrum glenoidale and retracted to both sides. The glenoid cavity and articular capsules in the neck were dissected, and the smooth site of labrum glenoidale was scraped with a curette until the errhysis occurred on fresh facies ossea. The perforation was performed at 2:30, 4:30, and 6:30 of labrum glenoidale, respectively. The titanium alloy suture anchor was inserted, and pulled out from the inner side of articular capsule and the deep layer of glenoid labrum. The shoulder joint was abducted by about 60°, and externally rotated at 30-40°. The lower articular capsule was made closer to the neck of scapula in the lifting state, and the upper and lower articular capsules were sutured and fixed using the middle and upper anchors. Finally, the shoulder joint was placed in the 50° external rotation position and the 40° external abduction position, and the articular capsule was sutured with an absorbable suture using the imbricated suture technique. After washing with normal saline, the surgical incisions were sutured in sequence. After surgery, a drainage tube was placed routinely.

Group B: the patients underwent general anesthesia or brachial plexus block anesthesia. The osseous anatomic landmarks of shoulder joint

were marked, and all approaches for shoulder joint were determined. The approach was established at the soft spot to the posterolateral acromion. Using the arthroscope, the anterolateral, superolateral and anterior approaches of shoulder joint were established, and the working channels were inserted, respectively. The internal structure of glenohumeral joint was carefully examined to observe corpus liberum, injured biceps brachii tendon, superior labral anterior to posterior tear (SLAP) and defects of the osseous glenoid labrum. The types of Bankart injuries were understood. The damaged edge of the glenoid labrum was completely released to fresh sclerotin under arthroscope, and the adhesion at the site of damaged glenoid labrum of anterior and inferolateral articular capsules was with a scraper. After freshening treatment and complete release of the articular capsule edge and glenoid labrum, the sites for anchor placement were evaluated, and located and marked with the ion ablation knife. The perforation was conducted on the cartilage surface at 5:30-2:00 on the sclerotin of labrum glenoidale, the titanium alloy suture anchors (3-5 pieces) were inserted, Bankart injuries were repaired, and sutures were introduced into the damaged glenoid labrum. The suture operations were performed from the bottom to top, and then lifting and restoration were performed. After the anchor position was reached, it was pull tight, tied and fixed. After surgery, the placement of a drainage tube was not required.

After surgery, the affected limb was suspended over the chest with a triangular scarf for 4-8 weeks, and the patient was instructed to actively conduct activities in all directions 2 weeks after surgery, and avoid external rotation and abduction. The passive ROM was increased based on the patients' tolerance. At week 6 after surgery, the shoulder joint can be slightly abducted, the elbow joint was placed in the 90° flexion position, and progressive muscle strengthening exercise was performed. At week 12, the triangular scarf was removed, and the shoulder joint could be moved freely.

Observational indexes

The primary indexes, including VAS score of shoulder joint and shoulder joint function, and the secondary indexes, including manifestations before and after arthroscopic Bankart repair and complications were observed between the two groups.

(1) The manifestations were analyzed before and after arthroscopic Bankart repair.

(2) VAS score of shoulder joint [14]: Before surgery and at week 12 after surgery, the pain degrees of shoulder joint in the two groups were evaluated using VAS scores of 0 to 10 points, and 0 point indicated painless and 10 points indicated severe pain.

(3) Shoulder joint function: Before surgery and at week 12 after surgery, the shoulder joint functions in the two groups were evaluated using the scores of CMS and ASES and Rowe Score. The total score of CMS is 100 points, including 40 points for ROM of shoulder joint, 20 points for functional activities, 25 points for myodynamia and 15 points for pain. A higher score represents a better shoulder joint function [15]. The total score of ASES is 100 points, and vital functions and pain correspond to 50 points, respectively. A higher score indicated a better shoulder joint function [16]. The Rowe score consists of a total of 100 points divided into three domains: (1) stability, which corresponds to a total 50 points; (2) mobility, which corresponds to 20 points; (3) function, which corresponds to 30 points. A higher score indicted a better should joint function [17].

(4) Complications: joint re-dislocation, infection of incisional wound and hematocele in the articular cavity.

Statistical method

SPSS22.0 was adopted for statistical analysis. The measurement data were expressed by mean ± standard deviation. The data conforming to normal distribution were detected by *t* test, and those not conforming to normal distribution were detected by Mann-Whitney U test. The enumeration data were expressed by [n (%)], and the comparison of enumeration data between groups was carried out by X^2 test. $P < 0.05$ indicated a statistical significance.

Results

Comparison of general data between the two groups

There was no statistically significant difference in gender, age, course of disease, dislocation

Table 1. Comparison of general data between the two groups [n (%)]/($\bar{x}$ ± s)

Data		Group A (n=56)	Group B (n=57)	t/X^2	*P*
Gender (cases)	Male	42 (75.00)	44 (77.19)	0.075	0.785
	Female	14 (25.00)	13 (22.81)		
Age (years)		27.15±1.09	27.19±1.05	0.199	0.843
Course of disease (months)		12.58±0.19	12.61±0.17	0.885	0.378
Dislocation frequency (times)		6.58±0.15	6.61±0.13	1.510	0.134
Injured sites (cases)					
Right shoulder		31 (55.36)	33 (57.89)	0.074	0.786
Left shoulder		25 (44.64)	24 (42.11)		
Cause of initial injury (cases)					
Traffic accident injury		14 (25.00)	16 (28.07)	0.158	0.996
Strike injury		19 (33.93)	20 (35.09)		
Exercise injury		23 (41.07)	21 (36.84)		

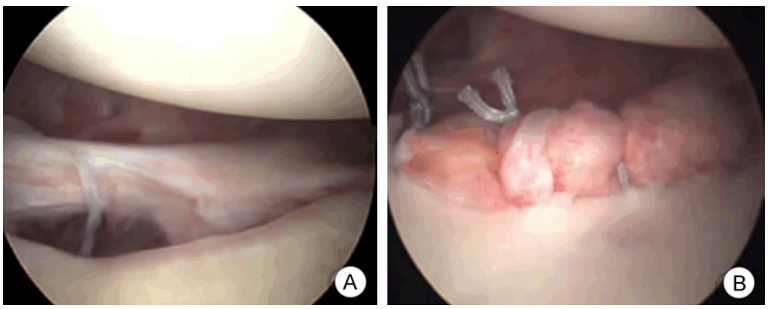

Figure 1. Analysis of manifestations before and after arthroscopic Bankart repair. A shows that before surgery, Bankart injuries are observed under the arthroscope, and the glenoid labrum-articular capsule-ligamentous complex is separated from the glenoid labrum. B shows that after arthroscopic Bankart repair, it is observed that some glenoid labrums have been sutured to their original positions.

Table 2. Comparison of VAS scores of shoulder joint between the two groups before and after surgery ($\bar{x}$ ± s, points)

Groups	Preoperative	Postoperative
Group A (n=56)	7.45±0.28	3.48±0.18
Group B (n=57)	7.49±0.25	1.02±0.08*
t	1.079	94.155
P	0.283	< 0.001

Note: *indicates the comparison with Group A, $P < 0.05$.

frequency, injured sites and cause of initial injury between the two groups ($P > 0.05$) (**Table 1**).

Analysis of manifestations before and after arthroscopic Bankart repair

Before surgery, Bankart injuries were observed under the arthroscope, and the glenoid labrum-articular capsule-ligamentous complex was separated from the glenoid labrum. After arthroscopic Bankart repair, it was observed that some glenoid labrums had been sutured to their original positions (**Figure 1**).

Arthroscopic Bankart repair reduced VAS score of shoulder joint

There was no noticeable difference in preoperative VAS scores of shoulder joints between the two groups ($P > 0.05$). Compared with those before surgery, VAS scores of shoulder joint decreased in the two groups after surgery ($P < 0.05$). The VAS score of shoulder joint in Group B was lower than that in Group A after surgery ($P < 0.05$) (**Table 2**).

Arthroscopic Bankart repair increased CMS score

There was no marked difference in the scores of ROM of shoulder joint, functional activities, myodynamia, pain and CMS between the two groups before surgery ($P > 0.05$). Compared with those before surgery, the scores of ROM, functional activities, myodynamia, pain and CMS in the two groups were elevated after surgery ($P < 0.05$). The scores of ROM, functional activities, myodynamia, pain and CMS in Group B were higher than those in Group A after surgery ($P < 0.05$) (**Figure 2**).

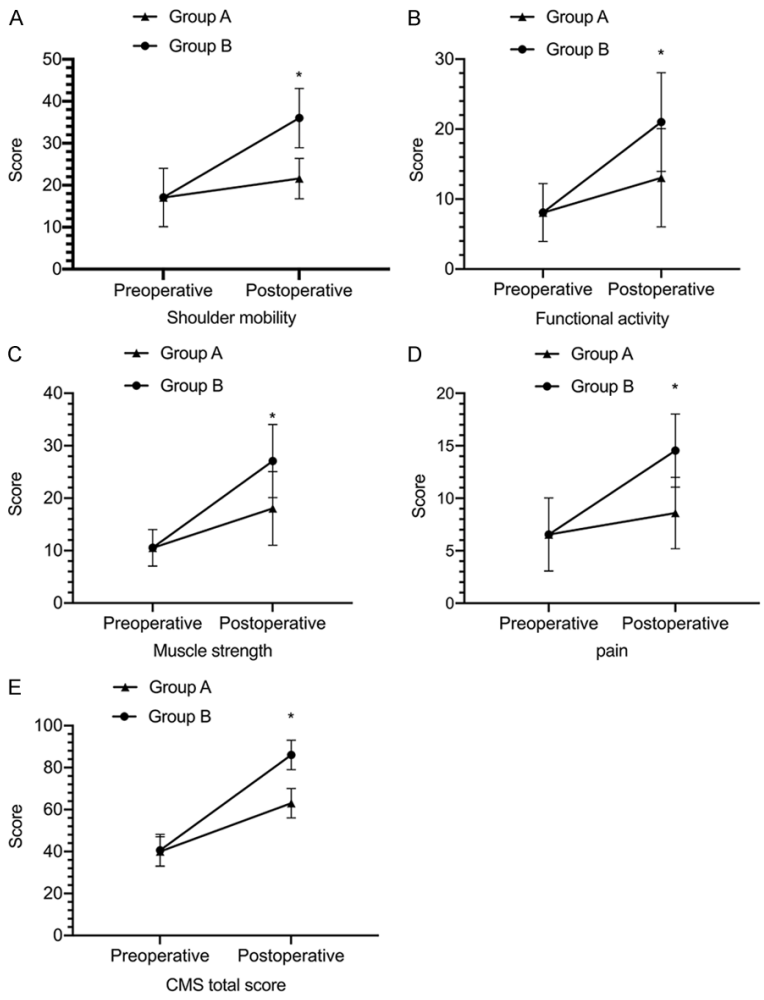

Figure 2. Comparison of CMS scores between the two groups. A shows the comparison of the scores of ROM of shoulder joint between the two groups before surgery ($P > 0.05$), and the scores of ROM of shoulder joint in Group B are higher than those in Group A after surgery ($P < 0.05$). B shows the comparison of the scores of functional activities between the two groups before surgery ($P > 0.05$), and the scores of functional activities in Group B are higher than those in Group A after surgery ($P < 0.05$). C shows the comparison of the scores of myodynamia between the two groups before surgery ($P > 0.05$), and the scores of myodynamia in Group B are higher than those in Group A after surgery ($P < 0.05$). D shows the comparison of the scores of pains between the two groups before surgery ($P > 0.05$), and the scores of pains in Group B are higher than those in Group A after surgery ($P < 0.05$). E shows the comparison of the scores of CMS between the two groups before surgery ($P > 0.05$), and the scores of CMS in Group B are higher than those in Group A after surgery ($P < 0.05$). *indicates the comparison with Group A, $P < 0.05$.

Arthroscopic Bankart repair increased ASES score

There was no remarkable difference in the scores of vital functions, pain and ASES between the two groups before surgery ($P > 0.05$). Compared with those before surgery, the scores of vital functions, pain and ASES in the two groups were improved after surgery ($P < 0.05$). The scores of vital functions, pain and ASES in Group B were higher than those in Group A after surgery ($P < 0.05$) (**Figure 3**).

Arthroscopic Bankart repair increased Rowe score

There was no obvious difference in the scores of shoulder joint function, ROM, stability and Rowe score between the two groups before surgery ($P > 0.05$). Compared with those before surgery, the scores of shoulder joint function, ROM, stability and Rowe score in the two groups were elevated after surgery ($P < 0.05$). The scores of shoulder joint function, ROM, stability and Rowe score in Group B were higher than those in Group A after surgery ($P < 0.05$) (**Figure 4**).

Arthroscopic Bankart repair reduced incidence of complications

In Group B, the infection of incisional wound and hematocele in the articular cavity were not found, and there was only one case with joint re-dislocation. In Group A, there were 2 cases with joint re-dislocation, 3 cases with infection of incisional wound, and 3 cases with hematocele in the articular cavity. The incidence rate of complications (1.75%) in Group B was markedly lower than that (14.29%) in Group A ($P < 0.05$) (**Table 3**).

Discussion

The shoulder joint is structurally classified as a synovial ball and socket joint, and it allows the

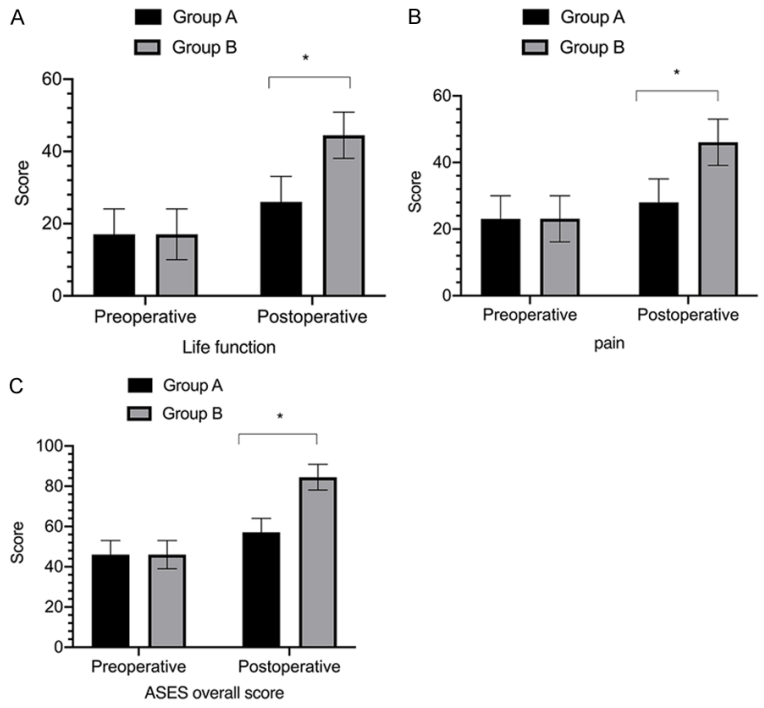

Figure 3. Comparison of ASES scores between the two groups. A shows the comparison of the scores of vital functions between the two groups before surgery ($P > 0.05$), and the scores of vital functions in Group B are higher than those in Group A after surgery ($P < 0.05$). B shows the comparison of the scores of pains between the two groups before surgery ($P > 0.05$), and the scores of pains in Group B are higher than those in Group A after surgery ($P < 0.05$). C shows the comparison of the scores of ASES between the two groups before surgery ($P > 0.05$), and the scores of ASES in Group B are higher than those in Group A after surgery ($P < 0.05$). *indicates the comparison with Group A, $P < 0.05$.

greatest ROM, as all movement types (e.g., rotation, contractions and stretching) are possible in all directions. Additionally, the shoulder joint has special biomechanical and anatomical characteristics, resulting in a high incidence rate of dislocation [18, 19]. A clinical study suggests that traumatic dislocation occupies about 96% of SD, and SD is highly prevalent in young male adults [20]. Therefore, traumatic recurrent ASD is a shoulder joint disease induced by multiple factors, and Bankart injury is the most common pathological cause of traumatic recurrent ASD [21, 22]. The Bankart injury leads to the static instability of the anterior glenohumeral joint in the abduction and rotation position, and the pathological relaxation of the shoulder joint [23].

Conservative and surgical treatments are clinically implemented for treatment of traumatic recurrent ASD. Conservative treatment is performed using drugs, and leads to a high incidence of re-dislocation. Therefore, surgery is usually implemented for repairing Bankart injury [24, 25]. Previously, the traditional open surgery was usually implemented for treatment of traumatic recurrent ASD. In this study, Montgomery and Jobe technique was implemented in Group A, requiring the exposure of surgical region. Although visual operations feature the advantages of simple operations, short surgical duration and clear anatomical structure, multiple defects are prominent, including large surgical trauma, a long postoperative recovery period, postoperative scar, damages to peripheral tissues and organs and vascular nerves, difficulty in exposing the deep visual field of shoulder joint, and a high incidence rate of postoperative complications [26]. In view of this, a surgical option that leads to less surgical trauma, a short postoperative recovery period, few damages to peripheral tissues and organs, and a low incidence rate of postoperative complications should be actively sought. With advances in clinical medical techniques over these years, arthroscopic surgery has been extensively implemented in treating traumatic recurrent ASD. Arthroscopic surgery was initially proposed in the 1980s, and has been continuously improved as medical techniques progress [27]. In this study, traumatic recurrent ASD was treated using arthroscopic Bankart repair, and the efficacies were compared between arthroscopic Bankart repair and Montgomery and Jobe technique. The results showed that compared with Group A, Group B had a lower VAS score and complication rate of shoulder joint, and higher scores of CMS and ASES and a higher Rowe Score. This exhibited that arthroscopic Bankart repair was superior to Montgomery and Jobe technique in treating traumatic recurrent ASD, and was conducive to improving shoulder joint function and

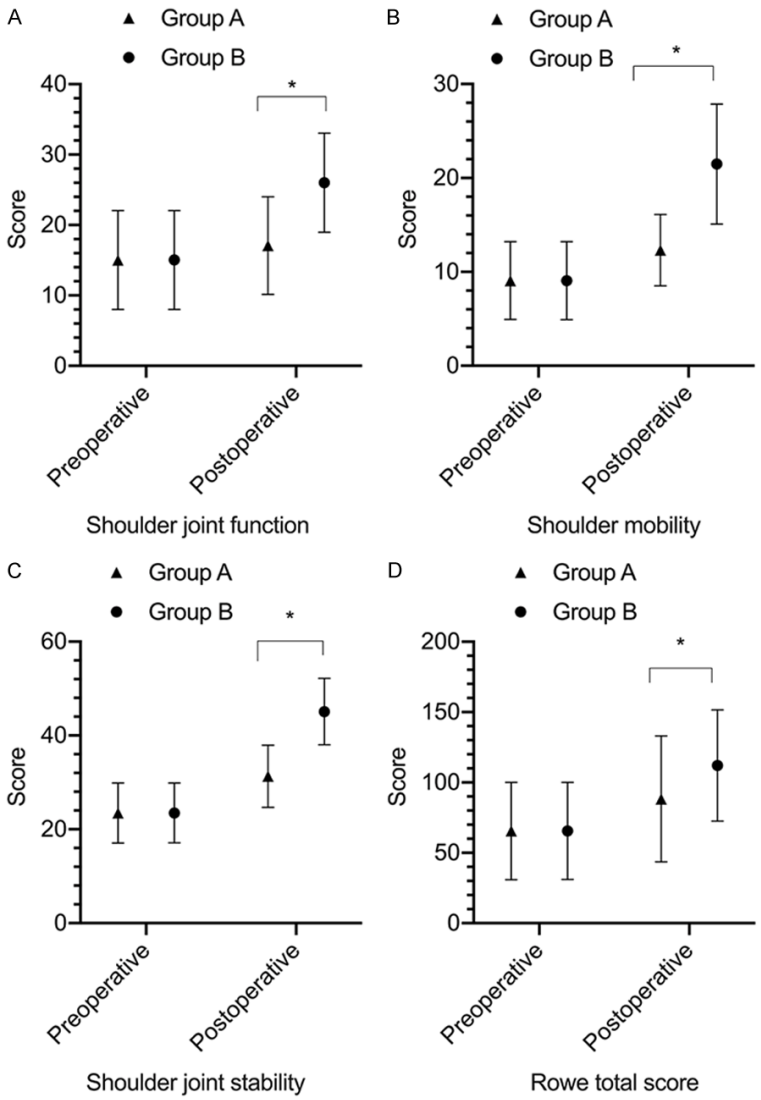

Figure 4. Comparison of CMS scores between the two groups. A shows the comparison of the scores of shoulder joint function between the two groups before surgery ($P > 0.05$), and the scores of shoulder joint function in Group B are higher than those in Group A after surgery ($P < 0.05$). B shows the comparison of the scores of ROM of shoulder joint between the two groups before surgery ($P > 0.05$), and the scores of ROM of shoulder joint in Group B are higher than those in Group A after surgery ($P < 0.05$). C shows the comparison of the scores of stability of shoulder joint between the two groups before surgery ($P > 0.05$), and the scores of stability of shoulder joint in Group B are higher than those in Group A after surgery ($P < 0.05$). D shows the comparison of Rowe Score between the two groups before surgery ($P > 0.05$), and the Rowe Score in Group B is higher than those in Group A after surgery ($P < 0.05$). *indicates the comparison with Group A, $P < 0.05$.

pain and demonstrated a high safety profile. Yan et al. [28] also found in their study that postoperative ASES and Rowe scores of patients in the arthroscopic Bankart repair group were significantly improved, which was highly consistent with the results of this study and further proved the effectiveness of arthroscopic Bankart repair. The mechanism of action has been investigated. The principle for repair of Bankart injury using arthroscopic Bankart repair is: the height of glenoid labrum of shoulder joint is reconstructed, and the integrity of glenoid labrum complex of articular capsule is promoted, so as to ensure that the anterior shoulder joint is stable after reconstruction. Previous clinical studies reveal that arthroscopic Bankart repair leads to a high recurrence rate. However, recent clinical studies demonstrate that the arthroscopic Bankart repair leads to a marked decline in the recurrence rate of traumatic recurrent ASD, and arthroscopic Bankart repair combined with suture anchors can achieve the same efficacy as open surgery, and result in a lower incidence of postoperative complications, effectively promoting the postoperative restoration of shoulder joint function [29]. In this study, suture anchors were used for treatment. The advantages of suture anchors are that the articular capsule-glenoid labrum complex can be directly fixed at the anterior edge of the glenoid using the metal suture anchors, so as to give full play to its high stability and multi-point fixation, and thus promote the effective healing of ligaments and bones. Compared with traditional open surgery, arthroscopic surgery requires a longer surgical duration and higher technical requirements for surgeons, but it leads to lesser surgical trauma, lesser amount of haemorrhage and lesser degrees of pain. Under the arthroscope, an extensive surgical field can be obtained, and pathological changes in the deep

Table 3. Comparison of incidence of complications between the two groups [n (%)]

Groups	Number of cases	Joint re-dislocation	Infection of incisional wound	Hematocele in the articular cavity	Total incidence
Group A	56	2 (3.57)	3 (5.36)	3 (5.36)	8 (14.29)
Group B	57	1 (1.75)	0 (0.00)	0 (0.00)	1 (1.75)
X^2					6.052
P					0.014

shoulder joint can be dynamically and directly explored, thus creating favorable conditions for joint reconstruction, promoting the restoration of shoulder joint function, and alleviating the pain of patients.

In summary, arthroscopic Bankart repair is superior to Montgomery and Jobe technique in treating traumatic recurrent ASD. Arthroscopic Bankart repair, exhibiting a high safety profile, is conducive to improving shoulder joint function and pain.

Limitation analysis: although arthroscopic Bankart repair is superior to Montgomery and Jobe technique in treating traumatic recurrent ASD, it exhibits some limitations when compared with Montgomery and Jobe technique. The comparisons between arthroscopic Bankart repair and other surgical options should be performed in the future studies, so as to investigate the advantages of arthroscopic Bankart repair in treating traumatic recurrent ASD.

Disclosure of conflict of interest

None.

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