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A Controlled Study on Shoulder Joint Function Recovery in Patients with Arthroscopic Rotator Cuff Repair for Rotator Cuff Injuries

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Abstract: *Objective:* To investigate the effect of arthroscopic rotator cuff repair on shoulder joint function recovery in patients with rotator cuff injuries. Methods: From June 2023 to June 2025, 80 patients with rotator cuff injuries who underwent surgery at our hospital were included in the study. Patients were divided into two groups based on the surgical procedure. The control group (arthroscopic single-row anchor fixation, n = 40) was compared with the observation group (arthroscopic double-row suture bridge technique, n = 40) in terms of perioperative indicators, shoulder joint function [UCLA Shoulder Function Scale; American Society for Shoulder and Elbow Surgery (ASES)], and postoperative pain intensity [Visual Analog Scale (VAS)]. Results: The observation group had longer operation time, less intraoperative blood loss, and shorter hospital stay, all with statistically significant differences ($p < 0.05$). The observation group had relatively higher UCLA and ASES scores at 1 and 3 months postoperatively ($p < 0.05$), and lower VAS scores at 1 and 3 months postoperatively ($p < 0.05$). Conclusion: Arthroscopic double-row suture bridge technique for treating rotator cuff injuries takes longer, results in less bleeding, leads to faster postoperative recovery, and causes significantly less pain compared to arthroscopic single-row anchor fixation, with more ideal functional recovery.

Keywords: Arthroscopic rotator cuff repair; Small incision rotator cuff repair; Rotator cuff injury; Shoulder joint function

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1. Introduction

Rotator cuff injury is a type of high-risk shoulder joint disease. Most of the patients suffering from this disease are middle-aged and elderly people. They generally report shoulder joint pain and varying degrees of limitation in active activities. If timely intervention is not performed, there is a risk of muscle atrophy around the shoulder joint [1]. Clinical intervention: Patients with rotator cuff injuries often rely on surgical

repair, especially those with larger tears and those with poor results from conservative treatments. With the continuous development of minimally invasive technology and the optimization of rotator cuff repair procedures, arthroscopic rotator cuff repair has high hopes. The difference in efficacy between this minimally invasive surgery and traditional small incision repair still needs more clinical data to verify. Based on this, the researchers selected a sufficient number (n = 80) of rotator cuff injury case samples within a specific time (2023.06–2025.06) to conduct a retrospective comparative study.

2. Materials and methods

2.1. General information

Cases were screened from 2023.06, and a total of 80 patients with rotator cuff injuries were included by 2025.06. Their surgical procedures were reviewed and grouped according to differences. Simple descriptive statistics: There are 40 cases in the control group, 22 males (55.00%) and 18 females (45.00%). The age range is [45, 72] years old and the mean is (58.36 ± 6.52) years old. The body mass index is [20.12, 28.34] kg/m² and the mean value is (24.15 ± 2.36) kg/m²; there were 40 cases in the observation group, 25 cases (62.50%) and 15 cases (37.50%) women, [43,74] (59.02 ± 6.78) years old, [19.85, 28.62] (24.32 ± 2.48) kg/m². Difference test between groups: The two groups were similar in gender composition ($\chi^2 = 0.464$, $p = 0.496$), age ($t = 0.444$, $p = 0.658$), and body mass index ($t = 0.314$, $p = 0.754$). They could be compared in the follow-up, and both gave informed consent.

2.1.1. Inclusion criteria

(1) Clear diagnosis of full-thickness/partial rotator cuff tear through shoulder joint MRI examination, and both can be repaired;
(2) Poor joint mobility, and conservative treatment for ≥ 6 weeks has not been effective;
(3) Good tolerance to surgery.

2.1.2. Exclusion criteria

(1) Combined with shoulder joint osteoarthritis;
(2) Significant upward movement of the humeral head;
(3) Previous history of ipsilateral shoulder joint surgery.

2.2. Method

Before surgery, the same group of surgeons completed shoulder joint MRI reading and tear degree assessment in both groups. The patients were fasted for 8 hours and drank for 4 hours. After entering the room, the patients were given venous access, connected to the monitor, and placed in a general anesthesia + lying position on the unaffected side.

2.2.1. Control group: Single-row anchor fixation under arthroscopic surgery

(1) Instruct the patient to lie on his side with the healthy side down and the affected shoulder upward;
(2) Make small surgical holes on the back and outside of the shoulder to establish an approach for the arthroscope and related instruments;
(3) Check the status of the glenohumeral joint, rotator cuff articular surface, and subacromial space under

the microscope, carefully clean up the subacromial bursal tissue and inflammatory tissue, release the coracoacromial ligament, and expand the shoulder.

(4) Use a drill to polish the footprint area of the greater tubercle of the humerus until it is fresh, rough, and slightly bleeding;

(5) Insert an appropriate number of anchors with threads in the footprint area based on the size of the crack, and fix the broken end of the rotator cuff with a single row of sutures;

(6) Check the tendon tension and fixation under arthroscopy to confirm that the footprint area is well covered and there is no gap left; flush the joint cavity, and suture the incisions of each approach.

2.2.2. Observation group: Arthroscopic double-row suture bridge technique

(1) Position preparation

Take the healthy side lying down, keep the affected limb flexed 30–40° forward, abducted 10–15° + suspension traction;

(2) Approach establishment

Mark the key positions such as the front and lateral sides of the acromion clearly, and establish a standard posterior approach. Position the puncture about 1cm inside the lateral inferior corner of the acromion;

(3) Arthroscopic exploration

Inject normal saline to fully expand the joint cavity, insert the arthroscope, and explore the glenohumeral joint, articular cartilage, long head tendon of the biceps brachii, and rotator cuff articular surface injuries in sequence;

(4) Treatment of the subacromial space

Use the arthroscope to the glenohumeral joint is inserted into the subacromial space through the rotator cuff space. The same steps are followed as in the control group to evaluate the mobility and reducibility of the rotator cuff;

(5) Preparation of the footprint area and anchor placement

The preparation of the footprint area is also the same as that of the control group, and then the double-row suture bridge technique is used to screw in 1- on the inside of the footprint area. Two anchors with threads are used as the inner row, while the sutures are left on the outer side. Use these sutures to pass through the torn rotator cuff tendon and then tighten and knot them. Screw in another anchor on the outside of the footprint area as the outer row. Pass the sutures of the inner row of anchors into the outer row of anchors and lock them;

(6) Inspection and closure are performed as in the control group.

2.3. Observation indicators

(1) General indicators during the perioperative period: record the time of the operation (from the time of skin incision to the end of skin suturing); intraoperative blood loss (calculated by gauze weighing + suction device measurement); length of hospitalization (based on the information in the medical record system);

(2) Shoulder joint function indicators

Evaluated before and 1 and 3 months after surgery, respectively. Assessment tools: UCLA Shoulder

Function Scale, which contains five dimensions including pain, with a full score of 35 points; American Shoulder and Elbow Surgery Association Rating Scale, which covers two dimensions: pain and daily life function, with a full score of 100 points. For both scales, the higher the score, the better the function.

(3) Pain degree index

The evaluation time point is the same as above, and the evaluation method is the Visual Analog Scale (VAS). A score of 0 means "no pain", a higher score means more pain, and a score of 10 means "unbearable".

2.4. Statistical methods

Various measurement data (operation and hospitalization time, blood loss; UCLA and ASES scores; VAS scores; average age and body mass index) are represented by ($\bar{x} \pm s$). After being confirmed by the Shapiro-Wilk test to be in compliance with the normal distribution, an *independent t* test was performed between groups; gender composition was counted data, represented by (n, %), and the χ^2 test was used. The above statistical process was completed by SPSS 28.0. If the output *p*-value is < 0.05, the difference is statistically significant.

3. Results

3.1. Analysis of general conditions during the perioperative period

Comparing between groups, the observation group had longer operation time, less intraoperative bleeding, and fewer days of hospitalization. The differences are significant as shown in **Table 1**.

Table 1. Comparison table of general indicators in the perioperative period ($\bar{x} \pm s$)

Group	Operation time (min)	Intraoperative blood loss (mL)	Length of stay (d)
Observation group (n = 40)	72.35 ± 10.24	48.26 ± 12.53	5.14 ± 1.32
Control group (n = 40)	63.18 ± 9.67	86.43 ± 18.72	7.36 ± 1.85
t	4.118	10.717	6.178
p	< 0.001	< 0.001	< 0.001

3.2. Analysis of shoulder joint function

The preoperative UCLA and ASES of the two groups were similar, and the observation group was significantly higher at each postoperative time point, as shown in **Table 2**.

Table 2. Comparison table of shoulder joint function scores ($\bar{x} \pm s$)

Group	UCLA rating (points)			ASES score (points)		
	Preoperative	1 month after surgery	3 months after surgery	Preoperative	1 month after surgery	3 months after surgery
Observation group (n = 40)	12.43 ± 2.86	24.15 ± 3.52	31.26 ± 2.74	38.52 ± 6.74	72.34 ± 7.86	86.48 ± 6.23
Control group (n = 40)	12.08 ± 2.54	20.36 ± 3.18	27.53 ± 3.12	39.16 ± 7.12	64.53 ± 8.42	78.35 ± 7.14
t	0.579	5.053	5.681	0.413	4.288	5.426
p	0.565	< 0.001	< 0.001	0.681	< 0.001	< 0.001

3.3. Analysis of pain level

The preoperative VAS scores of the two groups were similar, and there were significant differences at each postoperative time point, with the observation group being lower, see **Table 3**.

Table 3. Pain VAS score comparison table ($\bar{x} \pm s$)

Group	Preoperative (minutes)	1 month after surgery (minutes)	3 months after surgery(minutes)
Observation group (n = 40)	6.52 ± 1.24	2.86 ± 0.83	1.24 ± 0.56
Control group (n = 40)	6.38 ± 1.18	3.74 ± 0.96	2.08 ± 0.72
t	0.517	4.386	5.824
p	0.606	< 0.001	< 0.001

4. Discussion

Rotator cuff repair surgery has gradually evolved from the earliest open surgery to arthroscopic surgery, and then a variety of fixation methods have emerged, such as single-row anchor fixation and double-row suture bridges [2]. The safety and overall effect of the surgery are more assured. The advantages of arthroscopic double-row suture bridge technology in postoperative functional recovery need to be further explored. The results and their causes are analyzed as follows: ① From the perspective of general perioperative indicators, the observation group took longer to operate, had less intraoperative bleeding, and had shorter hospitalization days. The *p*-values between groups were all <0.05, which better illustrates the advantages of arthroscopic double-row suture bridge technology in terms of surgical safety and postoperative recovery speed. This is because the arthroscopic double-row suture bridge operation is more delicate and requires the establishment of multiple approaches. It is also necessary to complete the insertion of internal and external row anchors and the locking of the suture bridge. The operation time is usually longer, but this operation does not require incision of the deltoid muscle and causes almost no additional damage. Therefore, there is less bleeding, which is of great significance in shortening the postoperative drainage time and hospitalization days. ② In terms of shoulder joint function recovery, the UCLA and ASES scores of the observation group 1 month after surgery and 3 months after surgery were both higher, and the differences between the groups were all $p < 0.05$. This shows that the double-row suture bridge technology under arthroscopy has obvious advantages in promoting the recovery of shoulder joint function in patients with rotator cuff injuries. It should be noted that both surgeries are completed under arthroscopy. The difference is that the double-row suture bridge technology can repair the patient's rotator cuff. The tendon is more completely fixed in the original attachment area, ensuring that the tendon is in contact with the bone as much as possible, allowing the doctor to complete key operations such as thorough cleaning of the subacromial bursa directly under the microscope, which greatly reduces the risk of postoperative adhesion. In addition, the magnified field of view under the arthroscope helps to accurately judge the tear shape and tendon quality, which provides a basis for the selection of anchors and the layout of the suture bridge, and the repair effect is more ideal [3]. ③ From the perspective of pain degree, the pain VAS scores of the observation group 1 month after surgery and 3 months after surgery were relatively lower, with $p < 0.05$ between groups, suggesting that the double-row suture bridge has a sustained advantage in reducing postoperative pain. On the one hand, compared with single-row anchors, under the microscope, the soft tissue damage under the double-row suture bridge is less severe, and there is less postoperative inflammatory exudation [4]. On the other hand, the tissue where inflammatory mediators accumulate under

the acromion can be more thoroughly cleaned, which greatly reduces the source of postoperative chemical stimulation. A virtuous circle is formed between pain relief and functional recovery [5].

5. Conclusion

In summary, when arthroscopic double-row suture bridge technology is used to treat patients with rotator cuff injury, although the operation takes longer, the intraoperative bleeding is less, the postoperative recovery is faster, the postoperative pain is less, and the shoulder joint function recovery effect is more ideal. It should be noted that in subsequent in-depth studies, extended follow-up time can be considered, or indicators such as rotator cuff re-tear rate can be included to clarify further the best applicable scenarios for each of the two surgical techniques.

Disclosure statement

The authors declare no conflict of interest.

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