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# Early motion *versus* immobilization for arthroscopic repair in the treatment of large size rotator cuff tears.

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## Abstract

**Background: To compare the clinical effect between early motion and immobilization after arthroscopic rotator cuff repair.**

**Methods: From January 2013 to July 2016, a total of 132 patients underwent arthroscopic repair of a large size rotator cuff tear, the patients were randomly divided into observation group (66 cases) and control group (66 cases). Postoperatively, the observation group received early motion and the control group received immobilization, then the clinical outcomes in two groups were comparatively analysed, including the range of motion, Visual Analogue Scale (VAS) score, muscle strength, University of California-Los Angeles (UCLA) shoulder score and Constant shoulder score, and re-tear rates, and these parameters were performed and assessed at 3, 6, and 12 months after arthroscopic rotator cuff repair.**

**Results: At 12 months after arthroscopic rotator cuff repair, the two groups showed no significant difference in the range of motion (P>0.05). Six patients in the observation group and four patients in the control group appeared re-tear, the differences were not statistically significant (P>0.05). However, the incidence of stiffness in the control group was significantly higher than that in the observation group (36.36% *vs.* 15.15%, P<0.05). The two groups both obtained significantly better functional score than that before surgery (P<0.05). However, there was no significant difference between the two groups in VAS score, muscle strength, UCLA shoulder score and Constant shoulder score at the final follow-up period (P>0.05).**

**Conclusion: Compared with immobilization, early motion can obtain similar functional outcomes in the later stage and reduce incidence of stiffness, which should be recommended in large size rotator cuff tear after arthroscopy repair.**

**Keywords:** Rotator cuff tear, Arthroscopy, Repair, Early motion, Immobilization.

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## Introduction

Rotator cuff injury caused by shoulder trauma usually occurs and manifests as partial or complete tear [1]. Partial rotator cuff tear is divided into synovial-sided tear and bursal-sided rotator cuff tear, and complete rotator cuff tear is divided into transverse and longitudinal tear with retraction of supraspinatus tendon and extensive rotator cuff tear [2,3]. There may be no obvious pain for partial rotator cuff injury, but the pain may be generated when the affected position comes into contact with the subacromial space at the shoulder abduction angle of 70-120° [4]. Shoulder joint in abduction cannot withstand resistance, and mobility of shoulder is affected. Mild rotator cuff injury can be treated by non-surgical methods, but severe cases usually require surgery [5]. Arthroscopic repair has become a main treatment for severe rotator cuff injury due to the advantage of minimal invasiveness. But the rehabilitation methods after arthroscopy are still a disputed topic. Some viewpoints believed that early exercise after surgery is favorable for avoiding ankylosis and benefiting for the functional recovery of the injured shoulder joint [6]. Others believed that refraining from early exercise is effective for preventing relapse and reducing the load of the shoulder joint, thus facilitating anatomic structures repair and functional recovery. For these reasons, 132 cases with severe rotator cuff tear received different rehabilitation procedures after arthroscopy. To investigate the effective differences of different rehabilitation on prognosis in severe rotator cuff tear, the report is as follows.

## Data and Method

### *Subjects and its inclusion and exclusion criteria*

Totally 132 cases were recruited from January 2013 to July 2016, and all patients were randomly divided into observation group (66 cases) and control group (66 cases). This study was

performed in accordance with the guidelines of the ethical board in our hospital and all the patients signed the informed consent (YA13010105). Inclusion criteria [7,8]: Restricted mobility of shoulder joint was no less than in 30° at least 2 directions out of a total of 3 directions (anteflexion, abduction and external rotation); rotator cuff injury diagnosed by MRI; patients were willing to receive rehabilitation, and have good cooperation in evaluation. Exclusion criteria: Patients with acute phase of shoulder injury, and the age is older than 70 y (>70 y); patients with neurological disorders of the cervical vertebra or upper limbs; patients with dislocation of shoulder joint and previous surgical history; patients combined with severe cardiovascular, cerebrovascular diseases, nervous system diseases and infection.

### *Method*

**Postoperative treatment:** These patients took lateral position on the healthy side and received general anesthesia, the surgical method was similar as Duncan et al. [2] described, and the debridement and reconstruction were performed according to the results of the condition of injury. After surgery, the affected limbs were immobilized and suspended by using brackets in the two groups to keep the shoulder joint at 30° abduction and 0° external rotation. The patients in the observation group began exercise at 24 h postoperative and the motion range was gradually increased, active external rotation and back extensor exercise began at 72 h postoperative, strength training of the deltoid started 1 w postoperatively and muscular counterforce training started 6 w after surgery. The affected limbs were immobilized in the control group until 6 w after surgery, and the motion range of the shoulder joint was gradually increased.

**Observation indicators:** Physical examination was performed after surgery and during the follow-up, the conditions were scored according to several rating scales. The level of pain was evaluated by VAS, passive motion of the shoulder joint was evaluated including anteflexion, abduction, external and internal rotation, the motion range was measured with an angle gauge, and the effective outcomes were evaluated by using Constant shoulder score and UCLA shoulder score. Bigliani classification [9]: Acromion morphology was classified into flat (type I), curved (typeII) and hooked (type III). Type III acromion was directly related to rotator cuff injury, so when type III acromion or burred acromion inclined considerably, there would be a high risk of collision between acromion and rotator cuff. UCLA shoulder score [10]: The content evaluated including the range of abduction, internal and external rotation as well as muscle strength. The scores assigned ranged from 0 to 20 as a measure of the motion range of the shoulder joint and the level of postoperative functional recovery. Criteria for muscle strength evaluation [11]: Muscle strength was on a graded scale of 0 to 5 (0-V).

### *Statistical analysis*

Data were analysed by using SPSS 22.0 software, all measurements were expressed as mean ± standard deviation ($\bar{x}$ ± s), analysed by t-test or analysis of variance, numerical data expressed as percentage (%), analysed by $\chi^2$ test. $P<0.05$ indicated that the differences mean statistically significant.

## Result

### *Comparison of baseline information*

There were no significant differences in baseline information in two groups ($P>0.05$). Preoperative MRI indicated that 58 cases had full-thickness rotator cuff tear and 74 cases had partial rotator cuff tear (22 cases of synovial-sided tear and 52 cases of bursal-sided rotator cuff tear), (Table 1) and the Bigliani classification based on X-ray images (Table 2).

***Table 1.*** *Comparison of baseline information ($\bar{x}$ ± s).*

| Group | Cases (n) | Age (y) | Male/female | Left/right | Tear length (mm) | BMI (kg/m$^2$) |
|---|---|---|---|---|---|---|
| Observation group | 66 | 52.32 ± 12.71 | 37/29 | 31/35 | 37.28 ± 2.28 | 21.42 ± 3.23 |
| Control group | 66 | 50.43 ± 10.92 | 32/34 | 38/28 | 38.49 ± 3.38 | 22.08 ± 2.84 |
| T or $\chi^2$ value | - | 0.92 | 0.76 | 1.49 | 2.41 | 1.25 |
| P value | - | 0.36 | 0.38 | 0.22 | 0.05 | 0.22 |

***Table 2.*** *Bigliani classification based on X-ray images.*

| Group | Case | Type II | Type III |
|---|---|---|---|
| Observation group | 66 | 38 | 28 |
| Control group | 66 | 44 | 22 |
| $\chi^2$ value | - | 1.16 | |
| P value | - | 0.28 | |

### *Comparison of the motion range in two groups*

Arthroscopic surgery was successfully performed on all severe cases under general anesthesia. The motion range of the shoulder joint in different directions was evaluated at 3, 6 and 12 months after surgery. At 3 months after surgery, the motion range of the shoulder joint of the observation group significantly improved compared with that of the control group ($P<0.05$). At 6 months and 12 months after surgery, the two

groups showed no significant difference in the motion range (P>0.05, Table 3). The level of muscle strength was assessed at 3, 6 and 12 months after surgery. At 12 months after surgery, it showed no significant difference of two groups in the level of muscle strength (P>0.05), and the assessment of muscle strength was shown in Table 4.

*Table 3. Comparisons of the motion range in two groups ($\bar{x} \pm s$).*

| Items | Before surgery | 3 months after surgery | 6 months after surgery | 12 months after surgery |
|---|---|---|---|---|
| Anteflexion | | | | |
| Observation group (66) | 101.45 ± 9.63 | 127.44 ± 11.35 | 179.48 ± 8.72 | 179.46 ± 11.32 |
| Control group (66) | 102.52 ± 8.33 | 103.38 ± 10.56 | 176.32 ± 12.54 | 176.58 ± 12.49 |
| T value | 0.68 | 12.61 | 1.68 | 1.39 |
| P value | 0.50 | 0.00 | 0.14 | 0.17 |
| Abduction | | | | |
| Observation group (66) | 102.53 ± 12.77 | 158.45 ± 10.93 | 173.12 ± 7.58 | 178.92 ± 21.34 |
| Control group (66) | 104.32 ± 11.25 | 124.31 ± 11.74 | 170.23 ± 10.83 | 177.89 ± 22.41 |
| T value | 0.85 | 17.29 | 1.78 | 0.27 |
| P value | 0.39 | 0.00 | 0.12 | 0.79 |
| External rotation | | | | |
| Observation group (66) | 20.09 ± 8.13 | 32.09 ± 6.15 | 55.41 ± 12.75 | 57.37 ± 10.80 |
| Control group (66) | 21.34 ± 7.35 | 25.10 ± 5.71 | 54.33 ± 10.98 | 58.26 ± 9.32 |
| T value | 0.93 | 6.77 | 0.52 | 0.51 |
| P value | 0.36 | 0.00 | 0.60 | 0.63 |
| Internal rotation | | | | |
| Observation group (66) | 5.92 ± 3.96 | 13.44 ± 9.56 | 31.02 ± 10.23 | 29.86 ± 4.65 |
| Control group (66) | 6.01 ± 4.13 | 7.41 ± 8.45 | 32.85 ± 9.87 | 30.56 ± 3.98 |
| T value | 0.13 | 3.84 | 1.05 | 0.93 |
| P value | 0.90 | 0.00 | 0.30 | 0.36 |

*Table 4. Comparison of postoperative assessment of muscle strength (n).*

| Group | Before surgery | | | 3 months after surgery | | | 6 months after surgery | | | 12 months after surgery | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0 and I | II and III | IV and V | 0 and I | II and III | IV and V | 0 and I | II and III | IV and V | 0 and I | II and III | IV and V |
| Observation group (66) | 17 | 32 | 17 | 8 | 27 | 31 | 4 | 19 | 43 | 0 | 9 | 57 |
| Control group (66) | 12 | 30 | 24 | 6 | 29 | 31 | 3 | 20 | 43 | 0 | 8 | 58 |
| $\chi^2$ value | 2.12 | 0.36 | 0.17 | 0.07 | | | | | | | | |
| P value | 0.35 | 0.84 | 0.92 | 0.97 | | | | | | | | |

## *Comparison of the shoulder scores after surgery in two groups*

VAS score, UCLA shoulder score and constant shoulder score of the two groups were evaluated at 12 months after surgery, the above scores in the observation group were significantly higher than that of the control group (P<0.05, Table 5).

## *Comparison of the incidence of re-tear and ankylosis in two groups*

The incidence of re-tear and ankylosis was compared between the two groups, there was no significant difference in re-tear between 6 cases in the observation group and 4 cases in the control group (P>0.05). However, the higher incidence of ankylosis in the control group was significantly higher than

that of the control group after surgery (36.36% *vs.*15.15%) (P<0.05, Table 6).

*Table 5. Comparison of the shoulder score after surgery ($\bar{x} \pm s$).*

| Group | VAS score | | UCLA shoulder score | | Constant shoulder score | |
|---|---|---|---|---|---|---|
| | Before surgery | 12 months after surgery | Before surgery | 12 months after surgery | Before surgery | 12 months after surgery |
| Observation group (66) | 8.81 ± 1.17 | 3.27 ± 1.02 | 10.39 ± 1.87 | 32.88 ± 2.26 | 40.33 ± 12.72 | 91.25 ± 10.93 |
| Control group (66) | 8.27 ± 2.14 | 3.51 ± 0.92 | 9.89 ± 1.10 | 33.72 ± 2.06 | 41.22 ± 10.32 | 88.40 ± 11.37 |
| T value | 1.80 | 1.42 | 1.87 | 1.53 | 0.44 | 1.47 |
| P value | 0.12 | 0.16 | 0.10 | 0.13 | 0.66 | 0.15 |

*Table 6. Comparison of incidence of complications (n (%)).*

| Group | Case | Re-tear | Ankylosis |
|---|---|---|---|
| Observation group | 66 | 6 (9.09) | 10 (15.15) |
| Control group | 66 | 4 (6.06) | 24 (36.36) |
| $\chi^2$ value | - | 0.43 | 7.77 |
| P value | - | 0.51 | 0.01 |

## Discussion

Rotator cuff injury is a common cause of shoulder pain, and considered as a type of disability and joint degeneration [12], which is always caused by trauma. The incidence of full-thickness rotator cuff tear is about 25% among those aged over 60 y [13]. Open surgery and arthroscopic surgery are two main types of common treatments for rotator cuff tear. In recent years, the trend of minimal invasiveness is becoming popular, arthroscopic repair for rotator cuff tear was accepted by surgeons and patients. Severe cases of rotator cuff tear, especially in large size (width of tear is above 3 cm), if these patients do not receive appropriate treatment timely, the injured limbs will suffer from stiffness, reduced mobility and low muscle strength because of secretion of inflammatory mediators and connective tissue hyperplasia. This directly leads to functional impairment and reduction of life quality [14].

Some researchers believe that arthroscopic rotator cuff repair has good prognosis [15], joint stiffness is associated with various tissues, including muscles, tendons, ligaments, and joint capsules [16]. Strauss et al. [17] found that the incidence of complications after arthroscopic rotator cuff repair ranged from 2.5% to 11.9%. Furthermore, re-tear is also common after arthroscopic rotator cuff repair. Two opposing opinions now exist as to the rehabilitation after arthroscopic rotator cuff repair, one holds that early exercise of the shoulder joint is conducive to improve joint mobility and to prevent stiffness [18], the other states that refraining from exercise at early stage is important for avoiding re-tear [19].

In our study, individualized rehabilitation program was performed for patients with different conditions, intensity of rehabilitation increased gradually. The results showed that at 3 months after surgery, the motion range of the shoulder joint of the observation group showed significant differences comparing with the control group (P<0.05), early exercise in observation group may be responsible for this differences, while the patients in the control group began exercise at 6 w after surgery. Other study reported early active and passive exercise can promote blood circulation and lymph circulation, reducing contracture and adhesion [20]. As to the incidence of postoperative complications, the incidence of joint stiffness in the control group was significantly higher (36.36%) than that in the observation group (15.15%) (P<0.05). Thus early exercise does inhibit fibroblast infiltration and scar formation by promoting local blood and lymph circulation and decreasing the secretion of inflammatory factors. Therefore, early exercise has a positive impact on improving postoperative joint stiffness [21].

However, the two groups showed no significant difference in VAS score, muscle strength, UCLA shoulder score and Constant shoulder score at 12 months postoperative (P>0.05), this indicated that the two rehabilitation programs achieved similar outcome in short-term and mid-term follow-up. Early exercise only improved joint mobility which is necessary for these severe cases, early immobilization has advantage on promoting recovery and avoiding scar formation, reducing secretion of inflammatory factors and inflammatory cell infiltration [22]. Thus, early immobilization is recommended for severe cases to achieve better prognosis and to prevent ankylosis. Based on the analysis mentioned above in this study, the postoperative individualized rehabilitation programs should be chosen for severe cases. In other studies, some viewpoints considered that early exercise is preferred for the young and middle-aged adults and those who engage in heavy physical labor. But for elderly patients who engage in light physical labor, early immobilization represents a better choice to prevent re-tear, this may need further study for controversial arguments [22-25].

To conclude, either early exercise or immobilization after arthroscopic surgery for severe rotator cuff tear can achieve satisfactory and comparable outcome in the later stage. It should be noted that early exercise can effectively reduce the incidence of joint stiffness. Because of some demerits in study

design and short follow-up time, the conclusion requires further confirmation through more clinical studies.

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