Original Article

Comparison of epidemiology and outcomes of arthroscopic rotator cuff repair for anterosuperior and posterosuperior rotator cuff tears

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ARTICLE INFO

Article history:

Received 30 June 2017

Accepted 21 July 2017

Available online 21 July 2017

Keywords:

Anterosuperior rotator cuff tear

Posterosuperior rotator cuff tear

Prevalence

Epidemiology

Facet

Long head of biceps

ABSTRACT

Background: The purpose of this study was to investigate the prevalence, epidemiology, and outcomes of anterosuperior (A group) rotator cuff tears (RCTs) and posterosuperior (P group) RCTs treated by arthroscopic rotator cuff repair (ARCR).

Methods: A total of 67 A group patients and 14 P group patients were included in the study.

Results: The prevalence of the A group (82.3%) was significantly higher than that of the P group (17.7%).

Conclusion: The outcomes in both groups were good, even though the A group had a higher rate of injury to the LHB than the P group.

Level of evidence: Level III, case-control Study, treatment study.

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1. Introduction

There are few reports on the relationships between rotator cuff tear (RCT) patterns, shoulder joint pain, and shoulder joint dysfunction. In recent years, it has been suggested that restoration of subscapularis tendon (SSC) tears is important for arthroscopic rotator cuff repair (ARCR).^{1,9}

It has been reported that most degenerative RCTs begin with an anterior supraspinatus tendon (SSP) tear,^{2,4,5} with subsequent enlargement in the anterior and posterior directions. However, as the tear pattern varies according to the direction of tear enlargement, the associated shoulder pain and decline in muscle strength pattern may also differ.

The purpose of this study was to investigate the prevalences, epidemiological factors, and clinical outcomes, including range of motion (ROM), retear rate, and pathological features of the long head of biceps (LHB) between anterosuperior and posterosuperior RCTs. The main hypothesis was that the prevalence of anterosuperior RCT is higher than that of posterosuperior RCT. A second hypothesis was that ARCR for anterosuperior RCT has better clinical outcomes than that for posterosuperior RCT.

2. Materials and methods

This retrospective study was approved by our Institutional Review Board. The inclusion criteria were patients who had: (1) undergone preoperative magnetic resonance imaging (MRI) documenting an RCT; (2) undergone ARCR; and (3) availability for a minimum 2-year clinical follow-up. Exclusion criteria

included RCTs of more than three tendons, cuff tear arthropathy, and previous surgery on the affected shoulder. In total, 82 shoulders (78 patients) underwent ARCR during the study period. The indications for surgical treatment of RCTs at our institute were typical symptoms of shoulder pain and detected dysfunction of the shoulder joint. All patients underwent nonsurgical treatments including a corticosteroid injection to the subacromial space and physical therapy before surgery. One patient was excluded after the record review because of a history of shoulder surgery on the affected side. The remaining 81 patients were included in the study. The patients were divided into two groups: anterosuperior RCT group (A group), comprising tears of the SSC, SSP, and infraspinatus tendon (ISP) from the superior facet to the anterior half of the middle facet; and posterosuperior RCT group (P group), comprising intact SSC and tears of the SSP and ISP from the superior facet to the posterior half of the middle facet. Evaluation of SSC tears was performed during surgery, and any case requiring repair was regarded as tearing.

2.1. Study variables

2.1.1. Outcome instruments

Preoperative and postoperative instruments for shoulder function included the American Shoulder and Elbow Surgery (ASES) score and Constant score. All patients underwent a standardized physical examination performed by the first author (T.T.) both preoperatively and postoperatively. Active ROM was measured with a goniometer and included evaluation of the scapular plane elevation of the shoulder and external rotation with

the arm at the side. Pseudoparalytic shoulder was defined as 90° or less for active anterior elevation.

2.1.2. Demographics

The demographic variables evaluated in both groups were: age; sex; dominant side; comorbidities (heart and vascular disease, diabetes mellitus); smoking status; and occupation (light work including housework, heavy work).

2.1.3. Radiographic and operative variables

Postoperative rotator cuff integrity was categorized according to the Sugaya classification⁷ at 6 months and 1 year after surgery using MRI, and Types 4 and 5 were defined as a retear. The pathology of the LHB was evaluated intraoperatively.

2.2. Surgical procedure

All operations were performed by the first author (T.T.) with the patient under general anesthesia and in the beach chair position. Depending on the size of the RCT, single-row repair was performed for partial tears of the SSP, ISP, and SSC, while conventional suture bridge repair was performed for complete tears of the SSP, ISP, and SSC. Subacromial decompression and anterior acromioplasty were performed in all patients. LHB tendon tenotomy or tenodesis was performed in patients with a positive hourglass test result and in patients with dislocation or subluxation of the LHB as detected from the bicipital groove. Pathological conditions of the LHB were divided into four groups according to the condition of the LHB⁸: absent group (absence of the LHB within the joint); hourglass group (positive hourglass test result); dislocation group (dislocation or subluxation from the bicipital groove); and fraying group (fraying of the LHB).

A sling was used for 5 weeks postoperatively. At 3 weeks postoperatively, passive ROM exercises with physical therapy were permitted in all patients. At 6 weeks postoperatively, active ROM exercises were permitted.

2.3. Statistical analysis

The Mann–Whitney test was used to compare differences in outcomes between the two groups. A paired *t*-test was used to compare differences in preoperative and postoperative outcomes within each group. Multivariate analyses were carried out with the chi-square test. SPSS Statistics for Windows version 20.0 (IBM Corp., Armonk, NY) was used for all statistical analyses. The level of statistical significance was set at $P < 0.05$. Results are given as mean values.

3. Results

3.1. Patient demographics

The patient demographics are listed in Table 1. The prevalence of the A group (82.3%) was significantly higher than that of the P group (17.7%). There were no significant differences in mean age and sex between the two groups. There were also no significant differences in the proportions of dominant shoulder affected, proportions of patients with heart and vascular disease, or diabetes mellitus, numbers of smokers, and proportions of patients engaged in light work or heavy work between the two groups.

3.2. Clinical outcomes

The preoperative and postoperative clinical scores and ROMs in the two groups are listed in Table 2. All clinical scores and ROMs showed significant postoperative improvements within the two groups, but there were no significant differences between the two groups. The proportions of preoperative pseudoparalytic shoulder did not differ significantly between the two groups.

3.3. Radiographic and operative variables

The radiographic and operative variables are listed in Table 3. The retear rates were similar between the two groups. The proportion of injury to the LHB in the A group (47.8%) was significantly higher than that in the P group (28.6%). The proportion of patients with dislocation was significantly higher in the A group (19.4%) compared with the P group (0%).

4. Discussion

In the present study, an epidemiological investigation was performed on RCT patterns divided into anterosuperior and posterosuperior groups, but no significant differences were observed in all categories. These findings suggest that RCT patterns cannot be predicted based on patient background characteristics.

As physical findings, there were no significant differences between the preoperative ROMs and preoperative pseudoparalytic shoulder cases among the two groups, and also no significant difference in the tear patterns.

Regarding the image findings, the retear rates at 6 months and 1 year postoperatively did not show any significant differences between the two groups, and an effect of the tear patterns was not observed.

Table 1
Patient Demographics.

	Anterosuperior group	Posterosuperior group	P value
Number (%)	67 (82.3)*	14 (17.7)	<0.05
Age at surgery, year (range)	65.0 (46–81)	63.6 (46–85)	0.65
Males: females, number (%)	37 (55.2): 30 (44.8)	6 (42.9): 8 (57.1)	0.89
Dominant shoulder affected, number (%)	49 (73.1)	11 (78.6)	0.67
Co-morbidities, number (%)			
Heart and vascular disease	25 (37.3)	8 (57.1)	0.2
Diabetes mellitus	14 (20.9)	0 (0)	0.06
Smoker, number (%)	10 (14.9)	2 (14.3)	0.98
Occupation, number (%)			
Light work (included housework)	28 (41.8)	5 (35.7)	0.74
Heavy work	38 (56.7)	7 (50.0)	0.74

* Significant P value ($P < 0.05$).

Table 2

Comparisons of Preoperative and Postoperative Clinical Scores and Ranges of Motion Between the Groups.

	Pre-op	Post-op 6 months	Post-op 1 year	Post-op 2 years
ASES (range)				
Anterosuperior group	34.5 (10.3–71.7)	89.9 (41.7–100) [*]	92.6 (66.7–100)	93.3 (71.7–100)
Posterosuperior group	34.6 (16.7–73.3)	89.9 (73.0–100) [*]	91.3 (73.3–100)	91.0 (68.3–100)
Constant (range)				
Anterosuperior group	62.5 (15.0–96.0)	91.5 (74.0–98.0) [*]	94.0 (80.0–100)	95.4 (92.0–100)
Posterosuperior group	67.8 (18.0–83.0)	91.9 (82.0–98.0) [*]	93.9 (83.0–100)	94.1 (75.0–100)
Forward elevation, degree (range)				
Anterosuperior group	141.1 (30–175)	156.4 (95–175)	165.1 (140–175)	164.8 (140–175)
Posterosuperior group	148.6 (30–175)	163.3 (140–175) [*]	163.3 (150–175)	167.9 (160–175)
External rotation, degree (range)				
Anterosuperior group	57.7 (5–85)	53.8 (25–70)	57.1 (30–60)	57.3 (30–60)
Posterosuperior group	58.6 (30–70)	54.6 (40–60)	52.2 (20–60)	52.8 (30–60)
Pseudoparalytic shoulder [†] , number (%)				
Anterosuperior group	11 (16.4)	0 (0)	0 (0)	0 (0)
Posterosuperior group	2 (14.3)	0 (0)	0 (0)	0 (0)

Values are expressed as mean.

ASES, American Shoulder and Elbow Surgeons.

^{*} Statistically significant difference between preoperative and postoperative 6 months values ($P < 0.05$).[†] Pseudoparalytic shoulder was defined as 90° or less for active anterior elevation.**Table 3**

Comparisons of Rotator Cuff Retear Rates and Long Head of Biceps Statuses Between the Groups.

	Anterosuperior group (n = 67)	Posterosuperior group (n = 14)	P value
Retear rate of rotator cuff tear, number (%)			
Postoperative 6 months	4 (6.0)	1 (7.1)	0.88
Postoperative 1 year	5 (7.5)	1 (7.1)	0.96
Type of injury of long head of biceps, number (%)	32 (47.8) [*]	4 (28.6)	<0.05
Absent group ^a	3 (4.5)	1 (7.1)	0.06
Hourglass group ^a	12 (17.9)	2 (14.3)	0.34
Dislocation group ^a	13 (19.4) [*]	0 (0)	<0.05
Fraying group ^a	3 (4.5)	1 (7.1)	0.06

^a Absent group, absence of long head of biceps within the joint, Hourglass group, positive hourglass test, Dislocation group, dislocation or subluxation from the bicipital group, Fraying group, fraying of long head of biceps.^{*} Significant P value ($P < 0.05$).

Namdari et al.⁶ described that 77.0% of patients had pathological changes to the biceps tendon, although one of their inclusion criteria was SSC tears of >50.0%. Gerber et al.³ also defined SSC tears as an inclusion criterion, and reported that 63% of patients had pathological changes to the biceps tendon. In the present study, there were no cases of LHB dislocation in the P group without SSC tears, but a relationship between LHB dislocation and SSC tears was strongly suggested in the A group including SSC tears.

Regarding the relationship between RCT size and shoulder pain, it was previously reported that tear size was significantly larger in symptomatic RCTs than in asymptomatic RCTs.¹⁰ In the present study, 82.3% of the cases were in the A group, being significantly greater than the 17.7% of cases in the P group. These findings probably arise because an RCT is likely to occur in the anterior direction including the SSC, and if the tear enlarges in the anterior direction, it can become symptomatic and the number of cases requiring surgery may increase. In the present study, no significant differences were found in the clinical outcomes of RCTs that underwent ARCR, and no characteristic tear patterns were found.

As limitations of this study, we only examined cases in which ARCR was performed at our hospital and we did not consider cases undergoing conservative therapy. It remains unknown whether

RCTs themselves tend to cause large numbers of anterosuperior RCT patterns including SSC tears.

5. Conclusion

The first hypothesis that the prevalence of anterosuperior RCT is higher than that of posterosuperior RCT was correct, but the second hypothesis that ARCR for anterosuperior RCT has better clinical outcomes than that for posterosuperior RCT was denied.

In the present study, the prevalence of cases that underwent ARCR for RCT was significantly higher in the A group than in the P group. There were no significant differences in the epidemiological factors, clinical outcomes, and re-tear rates between the two groups, although the rate of injury to the LHB was significantly higher in the A group. Compared with the P group, LHB dislocation was observed significantly more often in the A group.

Disclaimer

The authors, their immediate family, and any research foundation with which they are affiliated did not receive any financial payments or other benefits from any commercial entity related to the subject of this article.

Nakatsushima Hospital Institutional Review Board (IRB) approved this study on April 1, 2012 (IRB No.: 2012-04-002).

Conflict of interest

"The author has none to declare.

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