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Rotator cuff tear with early osteoarthritis: how does it affect clinical outcome after large to massive rotator cuff repair?

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Background: Rotator cuff tear and glenohumeral osteoarthritis are 2 common diseases, but there are few studies about their clinical correlation. The purpose of this study was to evaluate the influence of mild glenohumeral osteoarthritis on the clinical outcome after large to massive rotator cuff repair.

Methods: This study included 146 patients who underwent rotator cuff repair for large to massive tears and were available for follow-up at a minimum of 2 years. Of the patients, 74 had mild glenohumeral osteoarthritis (group A) and 72 did not have glenohumeral osteoarthritis (group B).

Results: The mean visual analog scale score during motion, mean University of California at Los Angeles score, and mean Constant score were 1.8, 30.2, and 87.4, respectively, in group A and 2.0, 30.8, and 89.2, respectively, in group B at final follow-up. The retear rates were 31.1% (23 of 74 patients) in group A and 25.0% (18 of 72 patients) in group B. The osteoarthritis progression rates were 12.1% (9 of 74) in group A and 13.8% (10 of 72) in group B. However, in group A, the osteoarthritis progression rates were 26.1% (6 of 23) for retear cases and 5.9% (3 of 51) for healed cases. There was a significant difference in the progression rates between retear and healed cases in group A (odds ratio, 5.65; $P = .022$).

Conclusions: There were no significant differences in clinical outcomes between patients with and without glenohumeral osteoarthritis before surgery and during final follow-up. The progression of osteoarthritis in large to massive rotator cuff tears is relatively low. However, it is significantly higher in patients with retears in whom osteoarthritis is present.

Level of evidence: Level III; Retrospective Cohort Design; Treatment Study

Keywords: Shoulder; rotator cuff tear; osteoarthritis; glenohumeral joint; large to massive; retear

Rotator cuff tear and glenohumeral osteoarthritis are 2 common pathologies of the shoulder.[22,24] However, there are few reports of their relationship. Both rotator cuff tear and glenohumeral osteoarthritis are identified as age-related diseases[15,20]; therefore, the number of affected patients is expected to increase as the average life expectancy increases. The reported rate of rotator cuff tear accompanying glenohumeral osteoarthritis varies from 23% to 76%.[8,13,18,21] However, studies to date have not clearly identified whether rotator cuff tear and glenohumeral osteoarthritis occur independently or whether a correlation exists.[13,15,23] Previous studies have reported that glenohumeral osteoarthritic changes progress slowly in degenerative cuff disease and that glenohumeral osteoarthritis progression is not correlated with tear size or severity.[1,13,23] For cases involving rotator cuff tears accompanied

This study is retrospective in nature, and final approval of exemption by the Institutional Review Board of Kyung Hee University Medical Center was obtained (approval No. KHUH 2017-05-088).

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by severe osteoarthritis, arthroplasty such as total shoulder arthroplasty with rotator cuff repair or reverse total shoulder arthroplasty is known to be a valuable treatment.[3,19,28,29] However, despite the fact that most cases of osteoarthritis accompanying rotator cuff tears are known to be not severe,[17] only a few studies have examined the effects of mild glenohumeral osteoarthritis on rotator cuff treatment. Previous studies have reported that glenohumeral osteoarthritis has negative effects on rotator cuff treatment, but they included not only mild but also severe osteoarthritis.[17,19] Therefore, more studies are needed to determine the effects of mild osteoarthritis on rotator cuff tear treatment.

Our study had 2 goals: (1) to evaluate the influence of mild glenohumeral osteoarthritis on preoperative status and clinical outcomes after rotator cuff tear treatment and (2) to determine the rate of glenohumeral osteoarthritis progression with rotator cuff tear. We hypothesized that there would be no significant differences in clinical outcomes between rotator cuff tear groups with and without glenohumeral osteoarthritis. We also hypothesized that glenohumeral osteoarthritic changes in rotator cuff tears would progress slowly during midterm follow-up.

Materials and methods

This was a retrospective case-control study. The informed consent requirement was waived.

Patient selection

From January 2001 to January 2015, we reviewed 370 patients who had diagnoses of large to massive rotator cuff tears and underwent rotator cuff repair surgery. Patients who underwent surgery for small- to medium-sized rotator cuff tears during the same period were excluded because they were considered unlikely to have osteoarthritis compared with those with large to massive rotator cuff tears. In addition, we excluded patients with severe glenohumeral osteoarthritis (n = 33) or a trauma history (n = 8), as well as those who underwent arthroplasty surgery (n = 40) or staged bilateral rotator cuff repair (n = 12).

After exclusion of patients based on the aforementioned criteria, 277 patients remained; of these remaining patients, 146 who could be followed up for at least 2 years via clinical and radiologic follow-up examinations were included in this study. Among them, 74 patients had mild glenohumeral osteoarthritis (group A) and 72 patients did not have glenohumeral osteoarthritis (group B).

In group A, the mean patient age at the time of surgery was 60.8 years (range, 45-79 years) and the mean follow-up period was 58.4 months (range, 24-166 months). In group B, the mean patient age at the time of surgery was 60.1 years (range, 41-74 years) and the mean follow-up period was 65.9 months (range, 24-190 months). There were 29 men (39.1%) and 45 women (60.9%) in group A and 34 men (47.2%) and 38 women (52.8%) in group B. In group A, 50 patients (67.6%) had undergone arthroscopic repair and 24 (32.4%) had undergone open repair. In group B, 48 patients (66.7%) had undergone arthroscopic repair and 24 (33.3%) had undergone open repair. The tears were classified based on size and according to the system proposed by DeOrio and Cofield.[4] In group A, there were 45 large and 29 massive tears; in group B, there were 47 large and 25 massive tears. The demographic data of the 2 groups were not statistically different in terms of sex, affected side, age, follow-up period, tear size, or repair technique. The demographic data of the patients in the 2 groups are described in Table I.

Operative techniques

Surgical treatment was considered if patients had persistent shoulder pain that was unresponsive to at least 6 months of adequate conservative treatment such as anti-inflammatory medication, physical therapy, subacromial corticosteroid injections, and activity modification. All surgical procedures were performed by the senior author with patients in the beach-chair position. Arthroscopic repair was performed when the tear could be repaired without undue tension based on arthroscopic findings. Double-row repair using a suture bridge technique was used for large tears, whereas single-row repair was used for massive tears that could be repaired with full coverage of the footprint.

Open repair was indicated when a tear was arthroscopically less mobile because of severe retraction of the tendon, when tendon tissue quality was poor, or when the configuration of the tear was unclear with arthroscopy. In the case of open repair, a retracted cuff was mobilized after full release of the proximal region and a suture anchor or transosseous suture was used for the repair.

Postoperative rehabilitation

All patients participated in a standard postoperative rehabilitation program. On the day of surgery, patients started passive range-of-motion (ROM) exercises, including pendulum exercises, passive forward flexion, and external rotation in a tolerable range; they were instructed to perform 10 repetitions 3 times per day. Active exercises were not allowed until 6 weeks postoperatively or until full passive ROM was regained. Active-assisted exercises were started at 6 weeks postoperatively, and muscle-strengthening exercises were introduced gradually thereafter.

Preoperative and postoperative evaluation

The radiographic analysis consisted of assessment of glenohumeral osteoarthritis on true anteroposterior radiographs. We used the modified Samilson and Prieto classification according to Gerber[9] for glenohumeral osteoarthritis grading. According to this classification, glenohumeral osteoarthritis is mild (grade 1) if an inferior osteophyte at the humerus or glenoid smaller than 3 mm is present, moderate (grade 2) if such an osteophyte measures between 3 and 5 mm and is associated with mild joint line irregularity and subchondral sclerosis, and severe (grade 3) if the degenerative changes in the joint are more severe than grade 2. This classification has shown reliability comparable with that of the commonly used glenohumeral osteoarthritis grading systems according to Samilson and Prieto.[6] Preoperative fatty infiltration of the supraspinatus, infraspinatus, and subscapularis was evaluated using the Goutallier classification as modified by Fuchs et al.[7,11] Preoperative muscle atrophy was evaluated on the oblique sagittal plane image medial to the level of the coracoid process with the 4-stage grading system (normal, mild, moderate, or severe) developed by Warner et al.[30]

Table I Patient demographic characteristics

Variable	Group A: with mild OA (n = 74)	Group B: without OA (n = 72)	*P* value
Sex, male/female, n	29/45	34/38	.327
Age, mean age (range), yr	60.8 (45-79)	60.1 (47-74)	.624
Follow-up, mean (range), mo	58.4 (24-166)	65.9 (24-190)	.198
Right/left side, n	60/14	53/19	.281
Dominant/nondominant, n	58/16	50/22	.219
Size of RCT, No. of shoulders			.576
Large	45	47	
Massive	29	25	
Operative technique, n			.908
Arthroscopic RC repair	50	48	
Open RC repair	24	24	
Global fatty infiltration index*	1.9 ± 0.4	1.8 ± 0.3	.575
Muscle atrophy,† n			.750
Normal	0	0	
Mild	29	24	
Moderate	33	36	
Severe	12	12	

OA, glenohumeral osteoarthritis; *RCT*, rotator cuff tear; *RC*, rotator cuff.

* Preoperative fatty infiltration of the supraspinatus, infraspinatus, and subscapularis was evaluated using the Goutallier classification as modified by Fuchs et al.[7,11] The global fatty infiltration index was calculated as the mean value of the grades for the supraspinatus, infraspinatus, and subscapularis.

† Muscle atrophy was defined according to the classification of Warner et al.[30]

To assess rotator cuff healing, anatomic evaluation of the rotator cuff repair was performed using magnetic resonance imaging. All 146 patients underwent routine magnetic resonance imaging at least 9 months after surgery to assess tendon integrity. All studies used a 3.0-T system (Achieva; Philips, Best, The Netherlands) and routine pulse sequences. Two fellowship-trained surgeons who were blinded to the patients' details evaluated the radiographs. All patients underwent physical examination 1 day before surgery. Postoperative evaluations were performed at 3, 6, 9, and 12 months and then yearly on an outpatient basis, and the results of the last follow-up were analyzed. Preoperative and postoperative subjective pain at rest and during active shoulder motion was assessed using a visual analog scale (VAS). Quantitative muscle strength of the rotator cuff was assessed using a portable handheld Nottingham Mecmesin myometer (Mecmesin, Nottingham, UK). Elevation strength was tested with the patient in the seated position with the arm flexed to 90° in the scapular plane. External rotation and internal rotation were tested with the shoulder in a neutral position and the elbow in 90° of flexion. For shoulder ROM, active forward flexion (aFF), external rotation at the side (ERs), internal rotation to the posterior (IRp), and abduction were assessed before and after surgery. IRp was measured by the vertebral level of the hand. The Constant score[2] and the shoulder rating scale of the University of California at Los Angeles (UCLA)[5] were used for clinical assessment.

Statistical analysis

The paired *t* test was performed to evaluate the differences between preoperative and postoperative pain, ROM, muscle strength, and clinical scores in groups A and B. The Pearson χ^2 test and Fisher exact test were performed to compare demographic data, retear rates, and glenohumeral arthritis progression rates between the 2 groups. All statistical analyses were performed using SPSS software (version 21.0; IBM, Armonk, NY, USA). Significance was set at an α level of .05 with 95% confidence intervals.

Results

Pain

In the group with mild glenohumeral osteoarthritis (group A), the mean VAS scores at rest and during motion were 2.4 ± 1.1 (range, 0-7) and 5.1 ± 1.8 (range, 2-8), respectively, preoperatively and 0.3 ± 0.7 (range, 0-3) and 1.8 ± 1.7 (range, 0-7), respectively, at final follow-up. For the group without glenohumeral arthritis (group B), the mean VAS scores at rest and during motion were 2.4 ± 1.3 (range, 0-6) and 5.2 ± 1.9 (range, 2-10), respectively, preoperatively and 0.3 ± 0.8 (range, 0-5) and 2.0 ± 2.0 (range, 0-7), respectively, at final follow-up. There were no significant differences in VAS pain scores between groups A and B preoperatively or at final follow-up ($P = .962$, $P = .674$, $P = .621$, and $P = .560$) (Tables II and III).

Range of motion

In group A, the mean preoperative ROM for aFF, ERs, IRp, and abduction were 141° ± 33° (range, 45°-175°), 53° ± 24° (range, 20°-90°), T11 ± 3.7 (range, T4 to sacrum), and 141° ± 24° (range, 80°-180°), respectively. These values at the last follow-up were 153° ± 18.4° (range, 80°-170°), 50° ± 17° (range, 10°-80°), T10 ± 3.4 (range, T4 to sacrum), and 143 ± 31° (range, 80°-180°), respectively. In group B, the

Table II Preoperative clinical evaluation

	Group A	Group B	*P* value
VAS score			
At rest	2.4	2.4	.962
With ROM	5.1	5.2	.674
ROM, °			
aFF	141	139	.661
ERs	53	55	.497
IRp	T13	T13	.783
Abduction	141	142	.795
Muscle strength, kg			
FF	3.9	3.9	.487
ER	4.3	4.3	.647
IR	5.1	5.2	.834
Abduction	4.1	3.9	.225
UCLA score, mean ± SD	21.1 ± 3.2	20.9 ± 4.1	.803
Constant score, mean ± SD	57.5 ± 9.6	57.9 ± 10.9	.801

VAS, visual analog scale; *ROM*, range of motion; *aFF*, active forward flexion; *ERs*, external rotation at side; *IRp*, internal rotation to the posterior; *FF*, forward flexion; *ER*, external rotation; *IR*, internal rotation; *UCLA*, University of California at Los Angeles; *SD*, standard deviation.

Table III Clinical evaluation at final follow-up

	Group A	Group B	*P* value
VAS score			
At rest	0.3	0.3	.621
With ROM	1.8	2.0	.560
ROM, °			
aFF	153	154	.751
ERs	50	52	.396
IRp	T10	T10	.914
Abduction	143	143	.985
Muscle strength, kg			
FF	5.4	5.1	.378
ER	5.8	5.8	.949
IR	6.7	6.3	.160
Abduction	5.5	5.1	.226
UCLA score, mean ± SD	30.2 ± 4.9	30.8 ± 3.6	.385
Constant score, mean ± SD	87.4 ± 8.2	89.2 ± 7.8	.099

VAS, visual analog scale; *ROM*, range of motion; *aFF*, active forward flexion; *ERs*, external rotation at side; *IRp*, internal rotation to the posterior; *FF*, forward flexion; *ER*, external rotation; *IR*, internal rotation; *UCLA*, University of California at Los Angeles; *SD*, standard deviation.

mean preoperative ROM for aFF, ERs, IRp, and abduction were 139° ± 38° (range, 45°-175°), 55° ± 19° (range, 20°-90°), T11 ± 3.6 (range, T4 to sacrum), and 142° ± 30° (range, 80°-180°), respectively. These values at the last follow-up were 154° ± 20° (range, 80°-180°), 52° ± 17° (range, 15°-90°), T10 ± 3.5 (range, T4 to L5), and 143° ± 38° (range, 90°-180°), respectively. There were no significant differences in aFF, ERs, IRp, and abduction between groups A and B preoperatively ($P = .661$, $P = .497$, $P = .783$, and $P = .795$, respectively) or at final follow-up. ($P = .751$, $P = .396$, $P = .914$, and $P = .985$, respectively) (Tables II and III).

Muscle strength

The mean muscle strength values for forward flexion, external rotation, internal rotation, and abduction for group A were 3.9 kg, 4.3 kg, 5.1 kg, and 4.1 kg, respectively, preoperatively and 5.4 kg, 5.8 kg, 6.7 kg, and 5.5 kg, respectively, at the last follow-up. For group B, the mean preoperative muscle strength values were 3.9 kg for forward flexion, 4.3 kg for external rotation, 5.2 kg for internal rotation, and 3.9 kg for abduction; at the last follow-up, the mean muscle strength values changed to 5.1 kg, 5.8 kg, 6.3 kg, and 5.1 kg, respectively. There were no significant differences in muscle strength between groups A and B preoperatively ($P = .487$, $P = .647$, $P = .834$, and $P = .225$, respectively) or at final follow-up ($P = .378$, $P = .949$, $P = .160$, and $P = .226$, respectively) (Tables II and III).

Clinical assessment

In group A, the mean UCLA score significantly improved from 21.1 ± 3.2 (range, 16-29) preoperatively to 30.2 ± 4.9 (range, 21-35) at the last follow-up ($P < .001$). Similarly, it improved from 20.9 ± 4.1 (range, 14-29) preoperatively to 30.8 ± 3.6 (range, 23-35) at the last follow-up in group B ($P < .001$). Furthermore, the mean Constant score significantly improved from 57.5 ± 9.6 (range, 26-76) preoperatively to 87.4 ± 8.2 (range, 61-98) at the last follow-up in group A ($P < .001$) and from 57.9 ± 10.9 (range, 26-76) preoperatively to 89.2 ± 7.8 (range, 53-98) at the last follow-up in group B ($P < .001$). However, there were no significant differences in UCLA and Constant scores between groups A and B preoperatively ($P = .803$ and $P = .801$, respectively) and at final follow-up ($P = .385$ and $P = .099$, respectively) (Tables II and III).

Progression of glenohumeral osteoarthritis

Among 74 patients in group A, 9 had progression of glenohumeral osteoarthritis. All these cases progressed by 1 stage. Seven patients progressed from stage 1 to stage 2, and two patients progressed from stage 2 to stage 3. In group B, 10 patients had an aggravated glenohumeral osteoarthritis grade. Of these cases, 8 progressed by 1 stage, 1 progressed by 2 stages, and 1 progressed by 3 stages at final follow-up. However, there was no significant difference in progression rates between group A (12.1%) and group B (13.8%) at final follow-up ($P = .759$) (Table IV). In group A, the number of progression cases was 5 in the arthroscopic repair subgroup and 4 in the open repair subgroup. In group B, there were 6 cases in the arthroscopic subgroup and 4 in the open subgroup. There were no significant differences in progression rates between the arthroscopic and open subgroups in groups A and B ($P = .460$ and $P = .722$, respectively). Total progression of osteoarthritis occurred in 19 of 146 patients (13.0%). The mean age of these patients at the time of surgery was

Table IV Progression of glenohumeral osteoarthritis

	Modified Samilson and Prieto classification*	Preoperative, n	At final follow-up, n				Progression rate
			Grade 0	Grade 1	Grade 2	Grade 3	
Group B	Grade 0	72	62	8	1	1	13.8% (10 of 72)
Group A	Grade 1	67	0	60	7	0	12.1% (9 of 74)
	Grade 2	7	0	0	5	2	
P value	NA	NA	NA	NA	NA	NA	.759

NA, not applicable.
* Modified Samilson and Prieto classification according to Gerber[9] for glenohumeral osteoarthritis.

Table V Correlation between glenohumeral osteoarthritis and retear

	Group A (n = 74)	Group B (n = 72)	*P* value
Retear cases, n	23 (31.1%)	18 (25.0%)	.414
OA progression (progression No./total No.)			
Healed	5.9% (3/51)	13.0% (7/54)	
Retear	26.1% (6/23)	16.7% (3/18)	
Odds ratio	5.65	1.34	
P value	.022*	.703	

OA, glenohumeral osteoarthritis.
* Statistically significant.

60.5 years (range, 46-70 years), and the mean follow-up period was 85.4 months (range, 38-174 months). The shortest progression interval was 38.1 months.

Retear rate and glenohumeral osteoarthritis relationship

The retear rates were 31.1% (23 of 74 patients) in group A and 25.0% (18 of 72 patients) in group B. There was no significant difference between the 2 groups ($P = .414$). In group A, the retear rates were 30.0% (15 of 50) in the arthroscopic repair subgroup and 37.5% (9 of 24) in the open repair subgroup. In group B, the retear rates were 22.9% (11 of 48) and 29.2% (7 of 24), respectively. The retear rate in the open repair subgroup tended to be higher than that in the arthroscopic repair subgroup but was not statistically significant in both group A and group B ($P = .519$ and $P = .564$, respectively). However, there was a difference between groups A and B regarding the correlation between progression of osteoarthritis and retear. Specifically, in group A, osteoarthritic progression was noted in 6 cases (26.1%) among 23 retear cases and in 3 cases (5.9%) among 51 healed cases. There was a significantly different progression rate between retear cases and healed cases in group A. The odds ratio for progression of osteoarthritis and retear was high (5.65) in group A ($P = .022$). However, in group B, among 18 retear cases and 54 healed cases, progression occurred in 3 cases (16.7%) and 7 cases (13.0%), respectively. Unlike group A, there was no significant correlation between progression and retear in group B ($P = .703$) (Table V).

Discussion

Glenohumeral osteoarthritis is a common age-related disease that induces shoulder disability.[15,27] It has been reported that osteoarthritis is identified in up to 32.8% of persons older than 60 years. Because the average life expectancy is increasing worldwide, the prevalence of glenohumeral osteoarthritis will inevitably increase as well.[15,27] Degenerative rotator cuff tear is also a common disease that is age dependent[20]; therefore, the probability of glenohumeral osteoarthritis and a rotator cuff tear occurring together is likely to be higher in elderly patients. Petersson[27] reported in an anatomic study that 76% of 34 shoulders with cartilage degeneration had rotator cuff disease. Recently, Le et al[18] conducted a study involving 1000 patients with rotator cuff repair and radiologically identified that 23.2% had osteoarthritis. Although the ratio differs depending on the study method, many patients have both diseases.

For patients with severe osteoarthritis with rotator cuff tear or cuff tear arthropathy occurring during the late phase of rotator cuff tear, total shoulder arthroplasty with rotator cuff repair or reverse total shoulder arthroplasty is known as the most effective treatment option.[12,25,26] However, few studies have been conducted to identify the influence of mild-grade glenohumeral osteoarthritis on rotator cuff tear treatment. Klinger et al[16] studied prognostic factors in 31 patients with massive rotator cuff tears and claimed glenohumeral arthritis as a negative prognostic factor. However, this result was merely a deduction based on the fact that 2 of the 6 patients who had poor outcomes had glenohumeral arthritis. Liem et al[19] reported that radiologic analysis showed progression of osteoarthritis in 9 cases (29.0%) after arthroscopic débridement of massive tears and found that this had no influence on the American Shoulder and Elbow Surgeons score. Kukkonen et al[17] indicated that even mild radiologically diagnosed osteoarthritis is likely to be predictive of a worse postoperative outcome. In our study, the Constant score in the group with glenohumeral osteoarthritis was 49.9 preoperatively and 73.9 at final follow-up; in the group without glenohumeral osteoarthritis, the Constant score was 60.1 preoperatively and 82.8 at final follow-up. No significance between severity of preoperative osteoarthritis and Constant score was found. The midterm follow-up of the group with mild glenohumeral osteoarthritis and the group without glenohumeral osteoarthritis revealed no statistically significant differences regarding clinical outcomes and VAS, UCLA, and Constant scores preoperatively and at final follow-up. This absence of significant clinical disability of mild osteoarthritis is probably due to the glenohumeral joint not being a weight-bearing joint like the knee and hip.[13]

Among previous studies of the correlation between retear rate and osteoarthritis, the study by Le et al[18] was conducted to identify factors that can predict retear. They reported that glenohumeral osteoarthritis and retear were positively correlated (absolute correlation [r] = 0.18). However, in our study, comparison of the group with mild glenohumeral osteoarthritis and the group without glenohumeral osteoarthritis did not show a statistically significant influence on the retear rate ($P = .356$). Such differences in results are likely due to the fact that the study by Le et al did not classify the severity of glenohumeral osteoarthritis and included mild to severe glenohumeral osteoarthritis. Our study only included mild glenohumeral osteoarthritis. Of the 23 cases of retear in patients with mild glenohumeral osteoarthritis preoperatively, 26.1% (6 cases) showed progression of glenohumeral osteoarthritis; however, among the 51 cases in the healed group, only 5.9% (3 cases) showed progression. The odds ratio was 5.65, thus indicating statistical significance ($P = .022$). The group without preoperative osteoarthritis did not show significant retears or progression ($P = .703$). It can be assumed from these results that for patients who have various factors that cause glenohumeral arthritis, the probability of glenohumeral osteoarthritis progression may be high if retear occurs after repair. Furthermore, it is implied that even if osteoarthritis is present, successful healing after rotator cuff repair can prevent progression of osteoarthritis. Therefore, these findings have clinical significance indicating that retears should be considered when performing surgery in patients with preoperative osteoarthritis.

Studies of the effect of a rotator cuff tear on glenohumeral osteoarthritis progression have reported variable results. Gerber et al[10] conducted a study involving 46 shoulders that underwent latissimus dorsi transfer for massive rotator cuff tears with a minimum follow-up period of 10 years. Among these shoulders, 48% showed osteoarthritis progression with a Samilson and Prieto classification grade of at least 1; the average grades ranged from 0.4 to 1.0, indicating statistically significant increases. Zumstein et al[31] followed up 23 cases of open repair of massive rotator cuff tears for an average of 9.9 years, which resulted in a Samilson and Prieto classification grade ranging from 1.3 to 2.0, indicating a statistically significant increase; 61% showed changes to grade 2 or higher. However, Jost et al[14] conducted an analysis of the Samilson and Prieto classification in 20 patients who experienced retears after rotator cuff repair and underwent follow-up for an average of 7.6 years. They reported that only 3 patients (15%) showed osteoarthritis progression and that a statistically significant increase in degeneration grade was not observed. In the most recently reported prospective cohort study, Chalmers et al[1] indicated that progression of glenohumeral arthritic changes remains minimal within an 8-year period for degenerative cuff disease and that progression is not influenced by tear severity or enlargement at midterm time points. In their study, of the 118 patients who attended the final follow-up after a median of 8 years, 4 showed progression to Samilson and Prieto classification grade 2 and only 1 progressed to grade 3. In our study, only 19 of 146 cases (13.0%) showed glenohumeral osteoarthritis progression. These results are similar to those of the most recent study by Chalmers et al, which was based on patients with small to medium rotator cuff tears but without glenohumeral osteoarthritic changes. However, our study included patients with large to massive tears, which are clinically observed more often with glenohumeral osteoarthritic changes. Furthermore, the mean age of the patients was 60.6 years, which is the age group in which glenohumeral osteoarthritic changes are often observed.

This study had some limitations. First, there was a relatively short follow-up period (mean, 5 years) during which osteoarthritic progression was evaluated; however, progression of glenohumeral osteoarthritis is likely to occur slowly. Therefore, further longer-term follow-up studies are needed. Second, this was a retrospective study; therefore, it had all the limitations of a retrospective study. In particular, 277 patients met the study criteria but 131 patients in this study population were followed up for less than 2 years and were not included in the study. Thus, there may be selection bias in this study. In addition, the study involved patients with mild or no glenohumeral osteoarthritis, thereby presenting possible selection bias because patients were at relatively lower risk of progression. Third, this study lacked analyses of intraobserver and interobserver reliability during the radiographic study. However, 2 experienced shoulder surgeons defined the Samilson and Prieto osteoarthritis grade by conducting radiographic evaluations without any patient information and were in agreement. Despite these limitations, to our knowledge, this is the first retrospective comparative study of the influence of mild glenohumeral osteoarthritis on clinical outcomes after treatment of rotator cuff tears.

Conclusion

Rotator cuff repair for large to massive tears showed satisfactory clinical outcomes for patients with and without osteoarthritis. The presence of mild glenohumeral osteoarthritis accompanying rotator cuff tears did not have a statistically significant influence on clinical outcomes after rotator cuff repair. During the midterm follow-up, the progression of glenohumeral osteoarthritis was also relatively slow. In the group without preoperative osteoarthritis, tendon healing did not have a statistically significant influence on the progression of arthritis; however, in the group with preoperative osteoarthritis, osteoarthritis progression showed a statistically significant increase in retear cases. Although preoperative mild glenohumeral osteoarthritis has a minimal influence on the clinical outcomes of rotator cuff repair, there is a high probability that retear patients with osteoarthritis will experience progression of osteoarthritis. This should be recognized before surgery, and in such cases, the proper precautions should be taken to prevent retears.

Disclaimer

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