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Posterior Rotator Cuff Tears: Is Extracorporeal Shockwave Therapy a Risk Factor?

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Background: Negative effects of extracorporeal shock wave therapy (ESWT) on vulnerable tendon structures have been reported. Meanwhile, tears of the posterior rotator cuff tendon, which is thinner than the anterior, are not common, and the clinical features remain poorly understood. Therefore, we evaluated the relationship between ESWT and posterior rotator cuff tears (RCTs) by investigating the risk factors.

Methods: Of 294 patients who underwent rotator cuff repair between October 2020 and March 2021, a posterior RCT more than 1.5 cm from the biceps tendon or an isolated infraspinatus tear was identified in 24 (8.1%, group P). Sixty-two patients (21%) with an anterior RCT within 1.5 cm of the biceps tendon were analyzed as a control group (group A). Preoperative clinical characteristics were assessed to determine the risk factors of posterior RCTs.

Results: Calcific deposits were more frequently observed in group P (n = 7, 29.2%) than group A (n = 6, 9.7%, $p = 0.024$). Further, those in group P were more likely to undergo ESWT (n = 18, 75.0%) than those in group A (n = 15, 24.2%, $p < 0.001$). Of these, 7 patients experiencing calcific tendinitis from group P (29.2%) and 4 from group A (6.5%, $p = 0.005$) underwent ESWT for calcification removal. Furthermore, 11 patients experiencing tendinopathy from group P (45.8%), and 11 from group A (17.7%, $p = 0.007$) underwent ESWT for pain relief. The mean level of fatty infiltration of the supraspinatus was significantly higher in group A than group P (1.8 vs. 1.0, $p < 0.001$).

Conclusions: Since a high prevalence rate of posterior RCTs was related to ESWT, it should be carefully considered when treating calcific tendinitis or pain in patients experiencing tendinopathy.

Keywords: *Posterior rotator cuff tear, Extracorporeal shockwave therapy, Calcific tendinitis, Pain, Tendinopathy*

Rotator cuff disorders are the most common causes of chronic shoulder pain and disability. Chronic inflammation and degeneration are known as pathogenesis-promoting conditions, and features of the disorders are influenced by multiple factors.[1] To relieve rotator cuff-related acute shoulder pain, conservative treatments, such as anti-inflammatory medication and corticosteroid injections, have been recommended as first-line clinical treatments.[2] However, the efficacy of these therapies is still controversial.

Recently, extracorporeal shock wave therapy (ESWT) has been one of the most frequently applied treatments for shoulder tendinopathy, which includes calcific or non-calcific tendinitis. Furthermore, it has been shown that ESWT may be used to relieve pain and enhance tendon-to-bone healing.[3] Wang et al.[4,5] reported that neovascularization ingrowth may be stimulated by repeated microtrauma associated with ESWT, which has been linked to the upregulation of angiogenesis and tissue regeneration. However, some patients have experienced adverse effects of ESWT throughout the treatment process such as pain, skin erythema, local swelling, and even tendon injury.[6] Lin et al.[7] demonstrated that Achilles tendon injury might be related to ESWT in

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a case report. Rompe et al.[8] also elucidated that excessive optimal energy of EWST would be associated with tendon swelling and infiltration of inflammatory cells, especially the energy flux densities of over 0.28 mJ/mm^2. Therefore, ESWT likely has a detrimental impact on the thin and vulnerable rotator cuff tendon.

The supraspinatus tendon (SST) is the most frequently involved portion in rotator cuff tears (RCTs). The anterior SST is attached to a large bipennate muscle with an intramuscular tendon and is responsible for the bulk of the contractile force generated by the supraspinatus. In contrast, the posterior SST is not intramuscular and is unable to generate great degree of contractile force.[9] In terms of detailed anatomical characteristics, Roh et al.[9] demonstrated that anterior SST was significantly thicker than the posterior SST. In addition, previous studies have reported that SST tears usually begin at the anterior portion of the SST footprint near the biceps tendon and propagate posteriorly.[10,11] However, degenerative RCTs have commonly been observed in the posterior rotator cuff region near the confluence of the SST and infraspinatus tendon (IST).[10] Further, posterior RCTs, which involve both posterior SST and isolated IST, are uncommon, and the clinical features remain unclear.

We hypothesized that ESWT could have unfavorable consequences in posterior rotator cuff disorders. Therefore, this study was conducted to evaluate the relationship between ESWT and posterior RCTs by investigating several risk factors and explore preoperative structural variables and functional differences between patients with anterior and posterior RCTs.

METHODS

The study protocol was approved by the Institutional Review Board of Seoul National University Bundang Hospital (No. B-2108-702-110). The requirement of written informed consent was waived as only preexisting data were used for this study and the confidentiality of the patients was maintained.

Medical records of 294 patients who underwent arthroscopic rotator cuff repair between October 2020 and March 2021 were retrospectively reviewed (Fig. 1). Out of the total 294 patients, 151 patients with previous surgical history on the same shoulder, glenohumeral arthritis, large-to-massive RCTs, or RCTs involving the subscapularis tendon were excluded. Following the final inclusion criteria, 143 patients who underwent arthroscopic repair for small-to-medium partial or full-thickness RCTs were included in the current study.

The region of 15 mm posterior to the biceps tendon is approximately at the midpoint between the biceps tendon and the inferior border of the infraspinatus insertion.[10,12-14] The location of the RCT was evaluated using magnetic resonance imaging (MRI) and intraoperative arthroscopic findings. An anterior RCT was defined as an RCT that occurred within 1.5 cm of the long head of biceps brachii tendon (LHBT) (Fig. 2). In contrast, a posterior RCT was defined as either an RCT that occurred more than 1.5 cm from the LHBT or an isolated infraspinatus tear (Fig. 3). To determine whether there was a difference in risk factors related to the location of the RCT, we excluded 57 patients with concurrent anterior and posterior RCTs. Consequently, we enrolled 62 patients with an anterior RCT (group A) and 24 patients with a posterior RCT (group P) in this study.

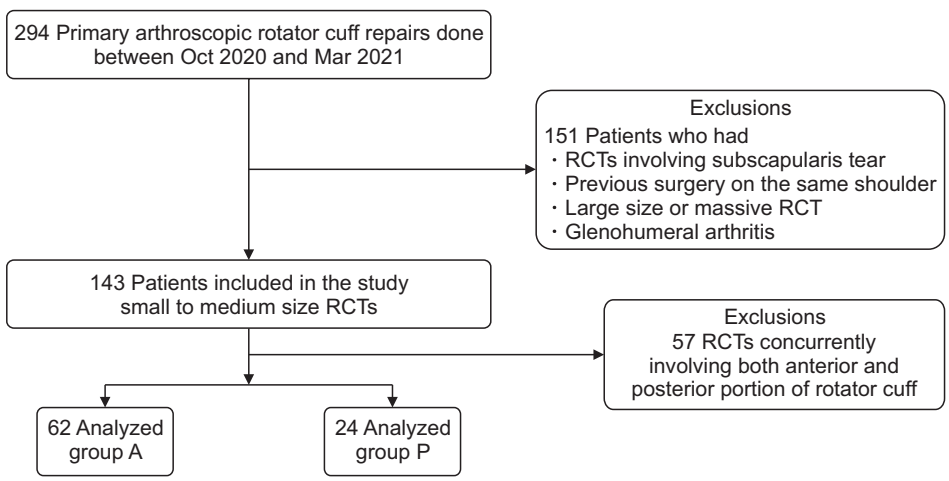

Fig. 1. Flowchart of the design of the study. Group A: patients with anterior rotator cuff tears (RCTs) confined within 1.5 cm from the biceps tendon, Group P: patients with RCTs located at more than 1.5 cm away from the biceps tendon.

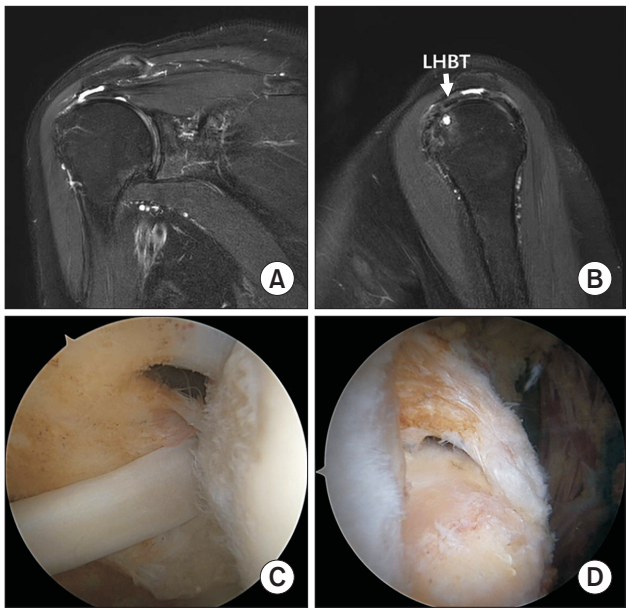

Fig. 2. Preoperative coronal (A) and sagittal (B) magnetic resonance imaging views suggested that the rotator cuff tear was located near the biceps tendon. Intra-articular (C) and subacromial (D) arthroscopic findings showed that the supraspinatus tendon tear occurred just posterior to the biceps tendon, indicating an anterior rotator cuff tear. LHBT: long head of biceps brachii tendon.

Surgical Procedure

All surgical procedures were performed by the single senior surgeon (JHO). With the patient in the lateral decubitus position, the degree and location of the RCT with regard to the LHBT were initially examined via a posterior viewing portal in the glenohumeral joint. After subacromial decompression, to confirm whether the RCT was anterior or posterior, a calibration probe was first used to palpate the LHBT groove when the shoulder was rotated externally. Next, the distance from the LHBT groove to the anterior margin of tear site was measured to confirm the location of the RCT. The appropriate repair technique was determined based on tear size, tension of the retracted tendon, and tissue quality.[15] Thereafter, rotator cuff repair was performed with a 70° scope via the posterior viewing portal. To treat an anterior RCT, external rotation (ER) of the shoulder was required to set the tear site in the center of the arthroscopic field, whereas a neutral position or slight internal rotation (IR) of the shoulder was used in the treatment of posterior RCTs.

Assessment of Clinical and Structural Variables

The following clinical variables were recorded in this study: age, sex, duration of symptom, hand dominance of the operated shoulder, smoking status, presence of diabetes mellitus, presence of dyslipidemia, history of steroid injection and EWST on the operated shoulder, bone mineral density,[16] the occurrence of a traumatic event, and the level of work- and sports-related activity. In addition to the date of ESWT, the cause of ESWT, such as pain relief in tendinopathic patients and calcification removal, was also recorded as part of a review of ESWT history. In terms of steroid injection history, patients were asked to go to the primary hospital where they received various injections and to provide the details about what kind of injection they received as well as the dosage. As no patients underwent steroid injection or EWST prior to surgery in our institution, the records were just based on the transcription of patients' dictation. The level of work- and sports-related activity was classified as high, medium, or low.[16]

The following structural variables were recorded: acromion thickness, acromiohumeral distance, fatty infiltration (FI) of both the SST and IST, evidence of tendinopathy, RCT size (including the anteroposterior [AP] and mediolateral length [retraction] of a tear), type of RCT (including bursal side partial tear, articular side partial tear, and full-thickness tear). Acromial thickness was measured using oblique sagittal T1-MRI images just lateral to the acromioclavicular joint at the widest portion of the acromion. The measurement did not include the acromial spur.[17] FI levels were evaluated based on their Goutallier classification using preoperative MRI findings.[18] Clinically detectable evidence of calcific deposits in the rotator cuff and tendinopathy were detected via preoperative plain X-ray and MRI, respectively. In particular, patients were asked to bring the previous radiological examination records from other local clinics, and we confirmed whether the diagnosis was just calcific tendinitis or an RCT. The exact tear size was measured intraoperatively using a calibrated probe after exposing the footprint and any necessary debridement. Different types of RCTs were identified in the glenohumeral joint and subacromial space by arthroscopic observation.

Functional Assessment

The degree of shoulder pain was evaluated using a 10-point visual analog scale (VAS). Active range of motion (ROM) of the shoulder in forward elevation (FE) and ER with the arm at the patient's side were measured using a goniometer, and IR was measured as the height of the spinous process of the vertebra that could be reached with the patient's thumb behind their back.[19] The following findings were considered shoulder stiffness: FE of less than 120°, ER with the arm at the side of less than 30°, or IR reaching lower than the L2 spinous process.[19]

To evaluate the muscle strength quantitatively, iso-

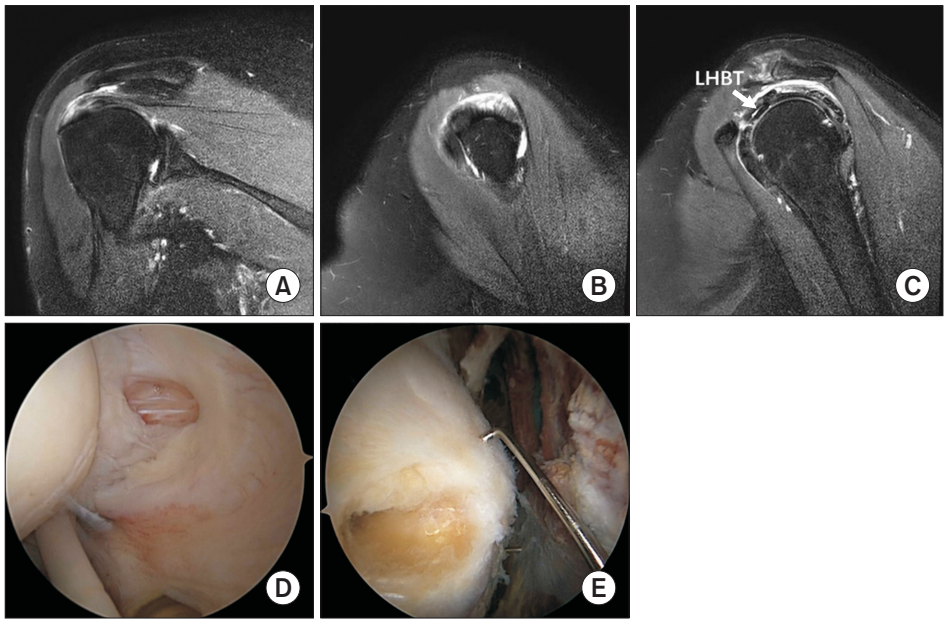

Fig. 3. Preoperative coronal (A) and sagittal (B, C) magnetic resonance imaging views suggested that the rotator cuff tear was mainly located away from the biceps tendon. Intra-articular (D) and subacromial (E) arthroscopic findings showed that the rotator cuff tear was located more than 1.5 cm from the biceps tendon, indicating a posterior rotator cuff tear. The calibration probe pointed to the long head biceps tendon groove. LHBT: long head of biceps brachii tendon.

kinetic muscle performance test (IMPT) was conducted within the 2-week period that preceded the operation in all patients using a Biodex System 3 PRO (Biodex Corp., Shirley, NY, USA).[20] The percentage of isokinetic strength peak torque deficit in abduction, ER, and IR was determined by comparing values with those of the asymptomatic contralateral shoulder. The American Shoulder and Elbow Surgeons (ASES) score and Constant score were also evaluated to assess the limitations in activities of daily living. All functional assessments were evaluated a day before surgery, except IMPT.

Statistical Analysis

All statistical analyses were performed using the IBM SPSS ver. 23.0 software (IBM Corp., Armonk, NY, USA), and differences were considered statistically significant at $p < 0.05$ for all analyses. For continuous variables, Kolmogorov-Smirnov normality test was conducted, and Student *t*-test or Mann-Whitney *U*-test was selected according to the results of normality test. Categorical variables were compared using chi-square or Fisher's exact tests according to data distribution. Mantel-Haenszel chi-square test was performed for subgroup analysis. In addition, logistic regression analysis was performed to determine the independent variable for two different located RCTs. Significant variables revealed in the univariable analysis were used for subsequent multivariable analysis.

RESULTS

Male to female ratio was not significantly different between group A (21 : 41) and group P (5 : 19, $p = 0.238$). Mean age during operation (group A vs. P, 58.9 ± 9.4 years vs. 58. 1 ± 8.2 years, $p = 0.919$) and duration of symptoms before operation (group A vs. P, 24.4 ± 28.1 months vs. 24.5 ± 30.6 months, $p = 0.996$) were also not significantly different between two groups. Hand dominance, smoking history, and medical comorbidities including diabetes, hypertension, and dyslipidemia were not significantly different between the groups (all $p > 0.05$) (Table 1). However, calcific deposits within the SST or IST were more frequently observed in group P (n = 7, 29.2%) than group A (n = 6, 9.7%) ($p = 0.024$).

The proportion of patients with preoperative steroid injection history was not statistically different between two groups (group A vs. P, 62.9% vs. 79.2%, $p = 0.149$). However, the proportion of patients who underwent ESWT was significantly greater in group P (n = 18, 75.0%) than in group A (n = 15, 24.2%) ($p < 0.001$) (Table 1), and 24 patients (11 patients in group A and 13 patients in group P) who received ESWT complained of the commonly observed complications of ESWT, such as transient pain and local swelling.

Subgroup analysis was conducted to evaluate the risk factors according to the intention for use of ESWT and the location of an RCT. The proportion of ESWT for calcification removal was significantly higher in group P (n = 7, 29.2%) than group A (n = 4, 6.5%) ($p = 0.005$) (Table 2). Likewise, the proportion of ESWT for pain relief in tendinopathy was significantly higher in group P (n = 11, 45.8%)

Table 1. Preoperative Characteristics of Patients

Variable	Group A (n = 62)	Group P (n = 24)	*p*-value
Age (yr)	58.9 ± 9.4	58.1 ± 8.2	0.919
Sex (men : women)	21 : 41	5 : 19	0.238
Symptom duration (mo)	24.4 ± 28.1	24.5 ± 30.6	0.996
Hand dominance (right : left)	62 : 0	23 : 1	0.279
Side of operated shoulder (right : left)	38 : 24	17 : 7	0.408
Smoking	11 (17.7)	3 (12.5)	0.748
Diabetes	10 (16.1)	3 (12.5)	> 0.999
Hypertension or heart disease	21 (33.9)	6 (25.0)	0.427
Dyslipidemia	14 (22.6)	9 (37.5)	0.161
Steroid injection history	39 (62.9)	19 (79.2)	0.149
ESWT history	15 (24.2)	18 (75.0)	< 0.001*
Traumatic onset	12 (19.4)	2 (8.3)	0.214
Shoulder stiffness	5 (8.0)	0 (0.0)	0.316
Calcification deposits	6 (9.7)	7 (29.2)	0.024*
Tendinopathy	26 (41.9)	15 (62.5)	0.087
Level of sports activity (high : medium : low)	10 : 25 : 27	5 : 12 : 7	0.472
Demand of shoulder activity (high : medium : low)	9 : 33 : 20	6 : 13 : 5	0.393
Bone mineral density, T-score	–1.12 ± 1.20	–1.51 ± 1.04	0.172
FI of the supraspinatus	1.8 ± 0.6	1.0 ± 0.7	< 0.001*
FI of the infraspinatus	0.3 ± 0.5	0.4 ± 0.5	0.448
Partial tear (bursal side : articular side)	27 : 19	14 : 6	0.384
Full thickness tear	16 (25.8)	4 (16.7)	0.571
Amount of retraction (cm)	1.1 ± 0.4	1.2 ± 0.5	0.794
Tear size of AP dimension (cm)	1.1 ± 0.2	1.0 ± 0.2	0.259
Acromiohumeral distance (mm)	10.2 ± 1.8	10.6 ± 2.0	0.410
Acromion thickness (mm)	8.2 ± 1.3	8.6 ± 1.5	0.258

Values are presented as mean ± standard deviation or number (%). Group A: patients with rotator cuff tears (RCTs) confined within 1.5 cm from the biceps tendon, Group P: patients with RCTs located at more than 1.5 cm away from the biceps tendon.
ESWT: extracorporeal shock wave therapy, FI: fatty infiltration, AP: anteroposterior.
*Statistically significant.

than group A (n = 11, 17.7%) ($p = 0.007$) (Table 2).

The frequency of ESWT was also analyzed according to the intention for use of ESWT and the location of RCTs. For calcification removal, group A received 2.8 ± 1.5 treatments (range, 1–5) and group P received 5.4 ± 2.3 treatments (range, 3–10). Although there was a tendency for the number to be higher in group P, it was not statistically significant ($p = 0.069$) (Table 3). The number of times of ESWT for pain relief was also not significantly different between the groups (group A vs. P, 8.4 ± 4.5 vs. 7.9 ± 6.2 treatments, $p = 0.478$) (Table 3).

The mean level of FI of the SST was significantly worse in group A (1.8 ± 0.6) than group P (1.0 ± 0.7) ($p < 0.001$). However, the mean level of FI of the IST of group

Table 2. Detailed Number of Patients for ESWT

Reason	Group A (n = 62)	Group P (n = 24)	*p*-value*
For calcification removal	4 (6.5)	7 (29.2)	0.005
For pain relief in tendinopathy	11 (17.7)	11 (45.8)	0.007
Total	15 (24.2)	18 (75.0)	< 0.001

Values are presented as number (%). Group A: patients with rotator cuff tears (RCTs) confined within 1.5 cm from the biceps tendon, Group P: patients with RCTs located at more than 1.5 cm away from the biceps tendon.
ESWT: extracorporeal shock wave therapy.
*Statistically significant.

Table 3. Detailed Frequency of ESWT Patients Underwent

Reason	Group A (n = 15)	Group P (n = 18)	*p*-value
For calcification removal, times	2.8 ± 1.5	5.4 ± 2.3	0.069
For pain relief in tendinopathy, times	8.4 ± 4.5	7.9 ± 6.2	0.478
Total, times	6.9 ± 4.8	6.9 ± 5.2	0.884

Values are presented as mean ± standard deviation. Group A: patients with rotator cuff tears (RCTs) confined within 1.5 cm from the biceps tendon, Group P: patients with RCTs located at more than 1.5 cm away from the biceps tendon.
ESWT: extracorporeal shock wave therapy.

A (0.3 ± 0.5) and group P (0.4 ± 0.5) did not differ significantly ($p = 0.448$) (Table 1).

Results of univariable and multivariable logistic regression analyses are shown in Table 4. ESWT history and FI of the SST were the only two significant risk factors associated with two different located RCTs. A high risk of anterior RCTs was found in FI of the SST (odds ratio [OR], 12.81; 95% confidence interval [CI], 3.77–43.46, $p < 0.001$). ESWT history was likely to have posterior RCTs (OR, 0.04; 95% CI, 0.01–0.21, $p < 0.001$). In terms of the preoperative functional status, pain VAS, active ROM, shoulder muscle strength, and functional scores were not significantly different between the groups (all $p > 0.05$) (Table 5).

DISCUSSION

In general, the pathogenesis of RCTs is related to degeneration of the RCT by several intrinsic and extrinsic causes. In this study, we could adequately exclude the risk factor of traumatic possibility for both anterior and posterior RCTs because there was no statistical difference between two groups. However, calcific deposits were more commonly observed in posterior RCTs than anterior RCTs, and patients with a posterior RCT received preoperative ESWT more frequently than those who were treated for anterior RCTs. Meanwhile, FI of the SST was worse in group A than group P. For the interpretation of these results, we thought more focus should be placed on ESWT-related microinjury to the relatively thin posterior rotator cuff tendon. To improve the symptoms related to the rotator cuff disorder, a number of conservative treatments were attempted. However, the effects of conservative treatments remain controversial.[21]

Recently, an increasing number of patients have been treated with ESWT, which is considered a noninvasive treatment method to relieve pain and remove calcification. Although the precise therapeutic mechanism of ESWT remains unknown, several preclinical studies have demonstrated substantial increases in the levels of neovascularization in the tendon, bone, and tendon-bone interface, which may play a key role in blood supply improvement and healing.[22-24] Therefore, ESWT has been regarded as a method for regenerating tissue.[25] Furthermore, it has been reported that ESWT is an effective conservative treatment for musculoskeletal disorders, the destruction of calcification, and various tendinopathies.[26]

However, despite numerous reports on the effectiveness of ESWT, ESWT-related complications, including transient pain, local swelling, skin erythema, and hemorrhage, also have been reported.[3] Furthermore, high-energy shock waves have the potential to damage the tendon.[27] It was reported that an SST tear starts from the anterior side near the LHBT and progresses posteriorly.[28] However, several studies have concluded that degenerative cuff tears are localized 13–17 mm posterior to the biceps tendon.[12] A previous study presented the different anatomical characteristics between the anterior SST and the posterior SST.[9] The anterior SST is shown to have a large muscle size, a fusiform structure, and an intramuscular tendinous core that is responsible for the bulk of SST-generated contractile force, and the mean thickness of the posterior SST is thinner than that of the anterior SST.[9] Furthermore, the posterior rotator cuff has a relatively weak vascular supply.[29] Therefore, the anatomical characteristics of the posterior rotator cuff would make it more susceptible to trauma.

In this study, we found that calcific deposits were more commonly observed in group P than group A ($p = 0.024$), and more patients in group P received preoperative ESWT than did those in group A ($p < 0.001$), especially for calcification removal and pain relief in patients who experienced tendinopathy ($p = 0.005$ and $p = 0.007$, respec-

Table 4. Results of Binary Logisitic Regression Analysis

Variable	Univariable		Multivariable	
	OR (95% CI)	*p*-value	OR (95% CI)	*p*-value
FI of the supraspinatus	6.69 (2.67–16.91)	< 0.001*	12.81 (3.77–43.46)	< 0.001*
Calcification deposits	0.26 (0.08–0.88)	0.03	0.32 (0.06–1.69)	0.181
ESWT history	0.11 (0.04–0.32)	< 0.001*	0.04 (0.01–0.21)	< 0.001*

OR: odds ratio, CI: confidence interval, FI: fatty infiltration, ESWT: extracorporeal shock wave therapy.
*Statistically significant.

Table 5. Preoperative Function Measurements

Variable	Group A (n = 62)	Group P (n = 24)	*p*-value
Pain VAS	5.4 ± 2.3	5.0 ± 2.3	0.496
Forward elevation (°)	150.8 ± 16.5	152.1 ± 7.1	0.485
External rotation (°)	53.5 ± 11.7	54.6 ± 11.2	0.792
Internal rotation*	T9.8 ± 2.8	T10.3 ± 2.1	0.234
Deficit of abduction peak torque deficit (%)	21.8 ± 27.9	28.6 ± 27.2	0.318
Deficit of external rotation peak torque deficit (%)	23.1 ± 23.0	24.8 ± 25.3	0.772
Deficit of internal rotation peak torque deficit (%)	10.5 ± 30.6	23.0 ± 29.5	0.093
ASES score	19.6 ± 5.6	19.8 ± 4.8	0.912
Constant score	53.5 ± 8.8	55.5 ± 4.6	0.375

Values are presented as mean ± standard deviation. Group A: patients with anterior rotator cuff tears (RCTs) confined within 1.5 cm from the biceps tendon, Group P: patients with RCTs located at more than 1.5 cm away from the biceps tendon.
VAS: visual analog scale, ASES: American Shoulder and Elbow Surgeons.
*Internal rotation was measured by the level of the highest spinous process that patient's tip of the thumb reached.

tively). Interestingly, some studies have shown that isolated IST tears are often accompanied by traumatic events or calcification.[30] Considering the data in the present study, we assumed that calcific tendinitis and ESWT might be risk factors for posterior RCTs.

Furthermore, the degree of FI in the rotator cuff also reinforced our hypothesis that posterior RCTs might be associated with the damage from ESWT, not degeneration. FI of the SST was higher in group A, however, there was no difference in FI of the IST. Fatty degeneration needs a long period to occur when accompanied by RCTs because of any given force cuff. As mentioned above, SST tears usually begin at the anterior portion of the footprint and propagate posteriorly. From here, we could theoretically suspect anterior cuff tears would be more related with chronic degeneration than posterior cuff tears. In other words, posterior cuff tears are uncommon and more related to microtrauma, calcific tendinitis, and acute injury. Even though there is no exact protocol of ESWT and much debate remains on the definite effects/role of ESWT on calcific tendinitis or rotator cuff tendinopathy, the current data would be one of the cautions for the overuse of ESWT that would be harmful to rotator cuff tendons.

We acknowledge that a major limitation of the present study is its small sample size. Although we did not perform the priori sample size calculation, we did the post-hoc power analysis with the help of a professional statistician and found that from the result of our study, the power was 0.9081487. Not performing subgroup analysis according to type, impulses, interval, and intensity used in ESWT might be another limitation. However, this study was performed in a tertiary hospital where the most of the patients were referred from other primary and secondary hospitals, and we therefore could not obtain detailed information of previous ESWT history. Furthermore, it should not be ignored that further chronic degeneration would

develop over time since patients received ESWT. However, the mean symptom duration of the two groups of patients was just around 2 years in this study, and there was no difference between the two groups. In terms of injection history, patients were not able to distinguish between steroid injection only and steroid injection with an ultrasound-guided needling procedure. We asked the patients to bring the details from the local clinics about what kind of medicine was injected and we could correctly record details about steroid injections, but the description of needling history was vague. So we had to ignore the ultrasound-guided needling history in patients with calcific tendinitis in this study. Finally, we did not analyze the postoperative clinical outcomes. To clarify the clinical outcomes according to the location of an RCT, further follow-up evaluation is needed.

Since the high prevalence rate of posterior RCTs was related to ESWT, it should be carefully considered when using for calcific tendinitis or pain in patients experiencing tendinopathy. However, to increase the power of our findings, a larger sample size should be included in future studies.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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