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ORIGINAL ARTICLE

Factors affecting rotator cuff integrity after arthroscopic repair for medium-sized or larger cuff tears: a retrospective cohort study

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Background: We wished to identify the preoperative prognostic factors associated with structural integrity after repair of medium-sized and larger rotator cuff tears and to determine the cutoff values using receiver operating characteristic curve analysis.

Methods: The study included 180 patients with medium-sized and larger rotator cuff tears. Each had a minimum 2-year postoperative follow-up by magnetic resonance imaging. We assessed several patient-related and disease-related preoperative factors using univariate and multivariate logistic regression analysis. To determine the cutoff value for the significant variables, receiver operating characteristic curve analysis was performed.

Results: Retears occurred in 28 of the 180 patients (15.6%). Univariate analysis found that retear was significantly affected by the type of work and pattern of tear. The rate of retear was significantly increased in diabetes and with increasing tear size, extent of retraction, delamination, and fatty infiltration. Furthermore, reduced remnant tendon length, distance from the musculotendinous junction to the face of the glenoid, occupation ratio, and acromiohumeral interval were also significant risk factors. In the multivariate analysis, body mass index, diabetes, dyslipidemia, extent of retraction, delamination, distance from musculotendinous junction to face of glenoid, occupation ratio, fatty infiltration of infraspinatus, and acromiohumeral interval remained significant risk factors. The extent of retraction (22.2 mm) and the occupation ratio (53.5%) showed highly accurate cutoff values for predicting retear.

Conclusion: Multiple factors influenced the healing process after rotator cuff repair. The best predictors were the extent of retraction and occupation ratio, which could help assist in determining the prognosis after rotator cuff repairs.

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

Keywords: Rotator cuff tear; risk factors for retear; factors affecting cuff integrity; cutoff value for retear; extent of retraction; occupation ratio

This study was approved by the Institutional Review Board at the Gil Medical Center, Gachon University: GCIRB2017-175.

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Several perioperative factors in a rotator cuff repair can increase the chances of retear after the operation. Le et al reported that anteroposterior tear length, size of the tear area, mediolateral tear length, tear thickness, age, and operative time were the best independent predictors of retears.[32] A systematic review by Saccomanno et al showed that the retear risk was mainly affected by older age and larger tear size.[45] Retears were associated with greater fatty infiltration, larger tear size, older age, and double-row repairs according to the systematic review and meta-analysis by Matsen et al.[36] These results were obtained by analyzing a wide spectrum of rotator cuff tear (RCT) sizes. However, the perioperative risk factors for retear after repair of medium-sized or larger RCTs were found to be different from those for the full spectrum of RCT sizes. Furthermore, there are only a few studies assessing medium-sized and larger RCTs. Many studies state that preoperative factors have the most impact on prognosis after rotator cuff repair.[2,6-8,15,32,38,42] Our goal was therefore to identify the preoperative prognostic factors that were significantly associated with the structural integrity of medium-sized or larger RCTs. In addition, we evaluated the cutoff value using the receiver operating characteristic (ROC) curve for each of the prognostic factors. The value could suggest a reference point of the size of cuff tear for determining retear or not.

Materials and methods

Patient selection

Institutional review board approval was obtained for this study protocol. In this retrospective cohort study, we evaluated 180 consecutive patients with medium-sized or larger RCTs who underwent arthroscopic rotator cuff repair by a single senior surgeon from February 2007 to August 2014 and had a minimum 2-year postoperative follow-up with magnetic resonance imaging (MRI) performed at the final follow-up. The medium-sized or larger cuff tears were defined as over 1 cm, according to Cofield.[10]

All patients underwent arthroscopic rotator cuff repair of full-thickness tears with either the double-row suture-bridge technique (61 cases) or single-row repair (119 cases). Cases of partial-thickness RCTs, isolated tears of subscapularis tendon, incompletely repaired tendons, irreparable RCTs, and isolated subscapularis tear were excluded.

Patient-related preoperative factors

Many patient-related factors were studied, such as sex, age, dominant hand, duration of symptoms, type of work, smoking status, bodymass index (BMI), diabetes mellitus (DM), and dyslipidemia (Table I), most of which have been reported to affect rotator cuff tendon healing.[32,39,42,45,51] The type of work was classified as high, medium, or low; a high demand of shoulder activity during work was defined as heavy manual labor, medium demand as manual labor with less activity, and low demand as sedentary work.[8] BMI was calculated as weight in kilograms divided by height in meters squared. As a measure of relative weight, BMI is an acceptable proxy.[3] We assumed that BMI of each patient was not changed during the period of study. Patients were assigned to the diabetic cohort if they were diagnosed with diabetes by their physician on the basis of the American Diabetes Association criteria: fasting blood glucose level >25 mg/dL or a random glucose level > 200 mg/dL and currently using oral or injectable antihyperglycemic medications. Patients were assigned to the nondiabetic cohort if they did not present with a diagnosis of diabetes.[12] The National Cholesterol Education Program defines hypercholesterolemia (also known as dyslipidemia) as a blood

Table I Preoperative demographic data of patients (N = 180)

	Patients
Male sex	84 (46.7)
Age (yr)	60.4 ± 7.4
Dominant hand	177 (98.3)
Duration of symptom (mo)	16.4 (0.5-240)
Type of work*	
High	94 (52.2)
Medium	29 (16.1)
Low	57 (31.7)
Smoking	29 (16.1)
BMI (kg/m^2)	24.5 ± 3.1
DM	25 (13.9)
Dyslipidemia	36 (20)
MRI follow-up period (mo)	26.8 (24-103)
Type of torn tendon	
SS	180 (100)
IS	36 (20)
TM	0 (0)
SSc	119 (66.1)
Pattern of tear	
C shaped	108 (60)
L shaped	25 (13.9)
Reverse L shaped	7 (3.9)
U shaped	40 (22.2)
Size of tear (mm)	32.6 ± 6.7
Extent of retraction (mm)	17.1 ± 8.7
Delamination	57 (31.7)
Length of remnant tendon (mm)	11.6 ± 5.3
Distance from MTJ to face of glenoid (mm)	16.4 ± 7.9
Occupation ratio (%)	63.6 ± 18.8
Fatty infiltration†	
SS	2.2 ± 0.8
IS	1.3 ± 0.6
SSc	1.5 ± 0.6
GFDI	1.7 ± 0.5
Symptomatic arthritis of ACJ	33 (18.3)
AHI (mm)	7.6 ± 2.5

BMI, body mass index; *DM*, diabetes mellitus; *MRI*, magnetic resonance imaging; *SS*, supraspinatus; *IS*, infraspinatus; *TM*, teres minor; *SSc*, subscapularis; *MTJ*, musculotendinous junction; *GFDI*, global fatty degeneration index; *ACJ*, acromioclavicular joint; *AHI*, acromiohumeral interval.

Categorical variables are presented as number (%). Continuous variables are presented as mean ± standard deviation.

* Type of work was classified as high, medium, or low. High demand of shoulder activity during work was defined as heavy manual labor; medium demand, as manual labor with less activity; and low demand, as sedentary work.[9]

† Graded according to the criteria by Goutallier et al.[23]