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Minimum 15-year follow-up for clinical outcomes of arthroscopic rotator cuff repair

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Background and hypothesis: Arthroscopic rotator cuff repair surgery is one of the most common shoulder procedures performed in the United States. Although several studies have shown considerable symptomatic relief in the short term following surgery, a relatively high rate of recurrent defects has led surgeons to question the long-term durability of this operation. We hypothesized that outcomes at a minimum of 15 years of follow-up in patients who underwent all-arthroscopic rotator cuff repair would be maintained and would remain significantly improved compared with the preoperative status.

Methods: All-arthroscopic rotator cuff repairs were performed in 193 patients from 2003 to 2005. Patient-reported outcomes were collected preoperatively and at 1, 2, 5, and ≥15 years postoperatively. The primary outcome was the American Shoulder and Elbow Surgeons (ASES) score. Secondary outcomes included Single Assessment Numeric Evaluation (SANE), Shoulder Activity Scale (SAS), visual analog scale, and Patient-Reported Outcomes Measurement Information System (PROMIS)–Upper Extremity (UE) scores. Patient demographic characteristics, revision surgical procedures, and complications were recorded. Generalized estimating equations were used to model scores over time, and multiple comparisons between time points were performed using Tukey adjustment.

Results: This study included 60 patients with a mean follow-up period of 16.5 years (range, 15.8-17.7 years). The mean ASES score improved from 60.2 ± 18.8 preoperatively to 93.0 ± 9.4 at ≥15 years ($P < .0001$). The mean visual analog scale pain score decreased from 4.1 ± 0.7 preoperatively to 0.7 ± 0.3 at ≥15 years ($P < .0001$). The average SANE, SAS, and PROMIS-UE scores at ≥15 years were 87.8 ± 14.8, 8.8 ± 4.3, and 49.6 ± 10.2, respectively. Of 60 patients, 7 underwent revision surgery. Older age and female sex were associated with lower SAS scores at 15 years, whereas female sex was associated with lower PROMIS-UE scores. There were no factors predictive of ASES or SANE scores.

Conclusion: At long-term follow-up (≥15 years), the patient-reported outcomes of all-arthroscopic rotator cuff repair show significant improvement from baseline preoperative function and remain durable over a period of 15 years. This information is useful in counseling patients regarding the long-term results of this procedure.

Level of evidence: Level IV; Case Series; Treatment Study

Keywords: Shoulder; rotator cuff; arthroscopic rotator cuff repair; patient-reported outcomes; long-term outcomes; rotator cuff durability

Rotator cuff tears are a common clinical problem in an aging patient population and one of the most common sources of shoulder pain.[27] Degenerative rotator cuff disease may progress over time, and full-thickness tears pose a

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greater risk of tear enlargement and pain development.[11] Considering that the natural history of rotator cuff disease is often not benign and that clinical repair outcomes are often quite good, rotator cuff repair is a reasonable treatment for many rotator cuff tears.[11,15] Over time, there has been a shift from open rotator cuff repair to arthroscopic repair, and all-arthroscopic rotator cuff repair has become the preferred technique for most surgeons.

Although short-term outcomes of all-arthroscopic repairs are very promising, little information is available on the long-term outcomes and durability of these repairs.[7,8,15,17,22,23] The long-term outcomes of open rotator cuff repair have been promising.[6,26,29] Recently, a few studies have reported 10-year outcomes after arthroscopic rotator cuff repair.[1,4,5,10,24,25] However, the majority of these studies either included mixed cohorts of patients treated with open, mini-open, and arthroscopic repairs or had small cohort sizes of patients treated with all-arthroscopic rotator cuff repair.

The Arthroscopic Rotator Cuff Registry was established at our hospital in 2003 to prospectively collect outcomes of patients undergoing rotator cuff repair. This registry has previously been used to examine the 2- and 5-year outcomes and prognostic factors for patients undergoing arthroscopic rotator cuff repair.[7,8,21-23] The purpose of this study was to report the long-term outcomes (≥15 years) of this same patient cohort to assess the durability of clinical improvement following rotator cuff repair. We hypothesized that these outcomes would be maintained and would remain significantly improved compared with the preoperative status. Furthermore, we collect additional validated patient-reported outcome measures (PROMs), not previously collected, for comparison.

Methods

Patients scheduled to undergo arthroscopic rotator cuff repair performed by 12 fellowship-trained sports medicine or shoulder surgeons from 2003 to 2005 were prospectively enrolled in our institution's Arthroscopic Rotator Cuff Registry. Patients were included if conservative management involving rehabilitation and a corticosteroid injection had failed, imaging findings (either magnetic resonance imaging [MRI] or ultrasound) consistent with a rotator cuff tear were observed, and arthroscopic rotator cuff repair was scheduled from 2003 to 2005. The exclusion criteria consisted of conversion to mini-open or open rotator cuff repair, presence of glenohumeral arthritis during the procedure, revision rotator cuff repair, or surgery cancellation. A total of 193 patients met these criteria and underwent all-arthroscopic rotator cuff repair.

Long-term outcomes were obtained for 60 patients at ≥15 years postoperatively. Telephone interviews were conducted to collect PROMs and were recorded via the Health Insurance Portability and Accountability Act–compliant REDCap system for data collection. Postoperative complications and surgical revisions since the mid-term assessment were also documented at the time of interviews, and new findings were cross-referenced with available medical records.

Patients completed a preoperative questionnaire with demographic information, history of present illness, social history, medical history, and surgical history. Patients also underwent a physical examination, and most had an MRI scan with results indicative of a rotator cuff tear.

Detailed surgical findings were recorded by the attending surgeon at the time of the procedure, including labral pathology, chondral lesions, degenerative changes or tearing of the long head of the biceps, and rotator cuff pathology in terms of tear size, tear thickness, and tendon involvement as previously described.[7] Rotator cuff integrity was classified according to the method described by Harryman et al.[9] In this classification scheme, type 0 indicates intact; type 1A, partial tear of the supraspinatus; type 1B, full-thickness tear of the supraspinatus; type 2, full-thickness tear involving the supraspinatus and infraspinatus; and type 3, full-thickness tear involving the supraspinatus, infraspinatus, and subscapularis.[9] Attending surgeons recorded details of the surgical procedure including the number and repair configuration of suture anchors, tissue quality, and amount of mobilization required for tendon repair. Additional procedures such as acromioplasty, synovectomy, labral repair, biceps procedures, or acromioclavicular joint procedures were also recorded.[7,8,22,23]

Functional outcome evaluation

Functional outcomes were assessed preoperatively and postoperatively at 1, 2, 5, and ≥15 years. Objective functional outcomes at all time points were determined by the American Shoulder and Elbow Surgeons (ASES) scores,[16] a validated, shoulder-specific outcome assessment instrument, and a visual analog scale (VAS) score was obtained for reporting of patient pain. Long-term assessment also included validated measures including the Single Assessment Numeric Evaluation (SANE) score,[28] Shoulder Activity Scale (SAS) score,[2] and Patient-Reported Outcomes Measurement Information System (PROMIS)–Upper Extremity (UE) score.

Statistical analysis

SAS software (SAS Institute, Cary, NC, USA) and Microsoft Excel (Microsoft, Redmond, WA, USA) were used to perform intergroup and intragroup analyses. Generalized estimating equations were created to model ASES and VAS scores over time; this is a robust method to control for interdependence between results. Multiple comparisons between time points were made using the Tukey adjustment. Univariable logistic regression was used to evaluate factors associated with an excellent ASES score (>90), and univariable linear regression was used to evaluate factors associated with SANE, SAS, and PROMIS-UE scores. The results are presented as the mean ± 1 standard deviation of the mean, and $P < .05$ was considered significant.

Results

Demographic and clinical data of the original cohort and each follow-up cohort are outlined in Table I. Follow-up

Table I Demographic and clinical information of patients at each time point

Variable	Baseline cohort (N = 193)		Short-term follow-up				Mid-term follow-up (5 yr) (n = 106)†		Long-term follow-up (≥15 yr) (n = 60)	
			1 yr (n = 137)		2 yr (n = 127)*					
	Mean or n	SD or %	Mean or n	SD or %	Mean or n	SD or %	Mean or n	SD or %	Mean or n	SD or %
Age, yr	59.5	10	59.8	9.6	58.6	9.8	59.1	9.4	74.5	9.2
Affected arm										
Right	114	59.1	76	55.5	72	56.7	64	60.4	35	58.3
Left	79	40.9	61	44.5	55	43.3	42	39.6	25	41.7
Sex										
Male	117	60.6	83	60.6	81	63.8	65	61.2	35	58.3
Female	76	39.4	54	39.4	46	36.2	41	38.7	25	41.7
Tendon involvement										
Single tendon	113	58.5	84	61.3	76	60.0	74	69.8	42	70.0
Multiple tendons	75	38.9	52	38.0	51	40.0	32	30.2	18	30.0
Harryman classification										
Type 1A	14	7.3	14	10.2	9	7.1	11	10.4	9	15.0
Type 1B	90	46.6	62	45.3	71	55.9	63	59.4	24	40.0
Type 2	65	33.4	46	33.6	43	33.9	27	25.5	21	35.0
Type 3	6	3.1	6	4.4	4	3.1	5	4.7	2	3.3
Unknown	18	11.9	9	6.6	0	0.0	0	0.0	4	6.7
Row configuration										
Single row	78	40.2	50	36.5	66	52.0	44	41.5	26	43.1
Double row	74	38.1	55	40.1	61	48.0	45	42.5	23	38.9
Biceps procedure										
Débridement	18	9.2	13	9.5	15	11.8	10	9.4	5	8.3
Tenotomy	9	4.6	7	5.1	11	8.7	5	4.7	2	3.3
Tenodesis	6	3.1	3	2.2	5	3.9	8	7.5	1	1.7
SLAP lesion repair	7	3.6	6	4.4	1	0.8	1	0.9	1	1.7

SD, standard deviation; *SLAP*, superior labrum anterior-posterior.
* From Nho et al (2009).[23]
† From Gulotta et al (2011).[7]

rates by time point are reported in Table II. There were 106 eligible patients who had completed 5-year follow-up and were contacted for long-term follow-up. At ≥15 years, 60 patients completed follow-up, representing 31% of the patients originally enrolled and 57% of those who returned for evaluation at 5 years. Of the 46 patients from the 5-year follow-up cohort who could not be reached, 10 were found to be deceased through public obituary records and conversations with families, 10 were not reachable, 22 had outdated contact information on record, 2 declined participation, and 2 were excluded as non–English-language speakers. According to our institution's shoulder arthroplasty registry, none of these patients underwent anatomic or reverse shoulder replacement surgery at our institution at a later date.

The average length of follow-up for the 60 patients contacted was 16.5 years (range, 15.8-17.7 years). The mean age at the time of surgery was 58.1 years (range, 37-72 years), and the mean age at most recent follow-up was 74.5 years (range, 54-88 years). There were 35 male patients (58%) and 25 female patients (42%). Seven patients underwent surgical revision of the rotator cuff repair, six of whom underwent revision rotator cuff repair and one of whom underwent revision to a reverse shoulder arthroplasty performed at another institution.

Patient-reported outcomes

Improvement in the ASES score was noted from baseline to all postoperative time points ($P < .0001$). The mean ASES score of the overall cohort improved from 60.2 ± 18.8 preoperatively to 93.0 ± 9.4 at ≥15 years ($P < .0001$). The ASES score increased from year 1 (89.0 ± 17.0) to year 2 (96.1 ± 5.6, $P = .014$) and decreased from year 2 (96.4 ± 5.3) to year 15 (91.2 ± 12.0, $P = .023$) (Fig. 1).

Improvement in the VAS score was noted from baseline to all postoperative time points ($P < .0001$). The mean VAS score decreased from 4.1 ± 0.7 preoperatively to 0.7 ± 0.3 at ≥15 years ($P < .0001$), with no significant changes between any postoperative time points (Fig. 2). The average SANE, SAS, and PROMIS-UE scores at ≥15 years were 87.8 ± 14.8, 8.8 ± 4.3, and 49.6 ± 10.2, respectively.

Table II Follow-up rates

Cohort	n	% of baseline enrollment	% of yr 1 enrollment	% of yr 2 enrollment	% of yr 5 enrollment
Baseline	193	100	—	—	—
Short-term follow-up					
1 yr	137	71	100	—	—
2 yr	127	66	93	100	—
Mid-term follow-up (5 yr)	106	55	77	83	100
Long-term follow-up (≥15 yr)	60	31	44	47	57

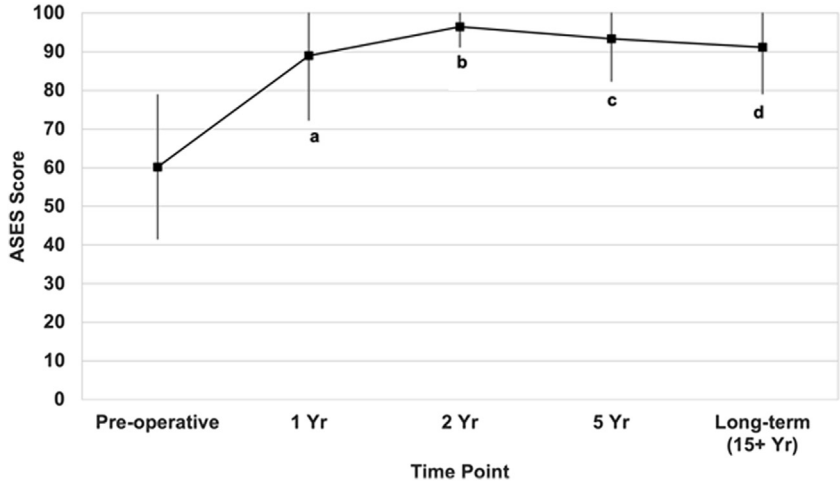

Figure 1 American Shoulder and Elbow Surgeons *(ASES)* scores of patients with ≥15 years of follow-up: preoperatively vs. 1 year postoperatively ($P < .0001$) *(a)*, preoperatively vs. 2 years postoperatively ($P < .0001$) *(b)*, preoperatively vs. 5 years postoperatively ($P < .0001$) *(c)*, and preoperatively vs. ≥15 years postoperatively ($P < .0001$) *(d)*. Data are presented as mean ± 1 standard deviation.

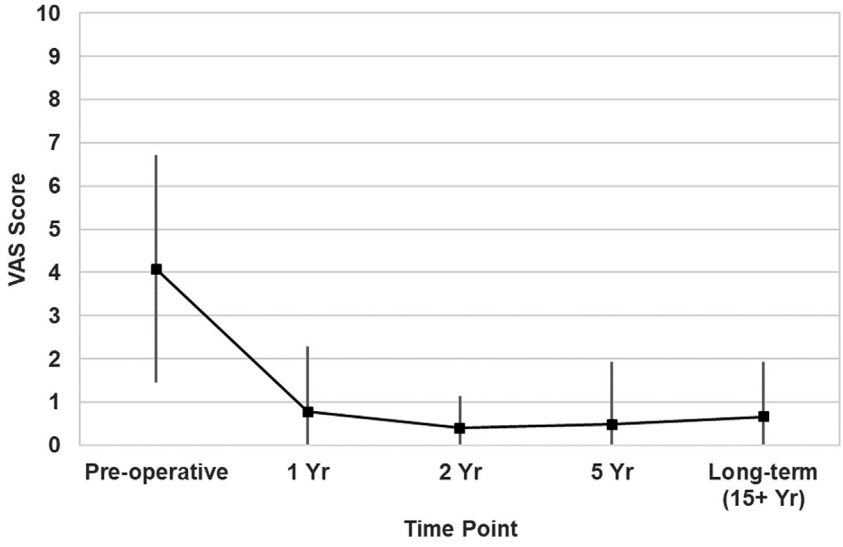

Figure 2 Visual analog scale *(VAS)* pain scores of patients with ≥15 years of follow-up: preoperatively vs. 1 year postoperatively ($P < .0001$), preoperatively vs. 2 years postoperatively ($P < .0001$), preoperatively vs. 5 years postoperatively ($P < .0001$), and preoperatively vs. ≥15 years postoperatively ($P < .0001$). Data are presented as mean ± 1 standard deviation.

Table III Prognostic factors for ASES score > 90 and SANE, SAS, and PROMIS-UE scores at 15 years of follow-up

Predictor	OR	Regression coefficient	SE	95% CI		*P* value
				Lower bound	Upper bound	
Prognostic factors for ASES score > 90 at 15 yr						
Age	0.99		0.03	0.94	1.06	.913
Sex (reference category, male sex)	0.85		0.47	0.28	2.59	.775
Arm dominance	2.43		1.13	0.26	22.44	.434
Size	1.08		0.15	0.81	1.46	.595
Multiple-tendon involvement	0.69		0.57	0.23	2.14	.525
5-yr US healing	1.25		0.77	0.27	5.71	.773
Length of follow-up	0.57		0.64	0.16	1.98	.372
Prognostic factors for SANE score at 15 yr						
Age		0.06	0.21	−0.36	0.47	.789
Sex		−0.14	3.85	−7.68	7.41	.972
Arm dominance		−2.75	6.39	−15.27	9.77	.667
Size		0.36	0.94	−1.48	2.19	.704
Multiple-tendon involvement		−4.47	3.86	−12.03	3.09	.247
5-yr US healing		6.75	5.31	−3.67	17.17	.204
Length of follow-up		−3.71	1.33	−12.22	4.64	.384
Prognostic factors for SAS score at 15 yr						
Age		0.25	0.05	−0.32	−0.11	<.001*
Sex		−3.39	1.02	−5.39	4.67	.001*
Arm dominance		2.29	1.84	1.3	5.89	.211
Size		−0.05	0.27	−0.58	0.48	.855
Multiple-tendon involvement		0.41	1.13	−1.8	2.62	.718
5-yr US healing		2.49	1.51	−0.48	5.45	.1
Length of follow-up		−0.28	0.39	−2.7	2.15	.823
Prognostic factors for PROMIS-UE score at 15 yr						
Age		−0.25	0.14	−0.53	0.03	.077
Sex		−8.69	2.39	−13.39	−3.99	<.001*
Arm dominance		−0.69	4.33	−9.19	7.79	.872
Size		−0.61	0.61	−1.81	0.59	.324
Multiple-tendon involvement		1.84	2.67	−3.41	7.08	.492
5-yr US healing		5.2	3.59	−1.85	12.24	.148
Length of follow-up		−4.04	2.89	−9.72	1.65	.164

ASES, American Shoulder and Elbow Surgeons; *SANE*, Single Assessment Numeric Evaluation; *SAS*, Shoulder Activity Scale; *PROMIS-UE*, Patient-Reported Outcomes Measurement Information System–Upper Extremity; *OR*, odds ratio; *SE*, standard error; *CI*, confidence interval; *US*, ultrasound.
* Statistically significant ($P < .05$).

Predictors of clinical outcomes

Older age (regression coefficient = 0.25, $P < .0001$) and female sex (regression coefficient = –3.39, $P = .001$) were associated with lower SAS scores at 15 years (Table III). Female sex (regression coefficient = –8.69, $P < .001$) was associated with lower PROMIS-UE scores at 15 years. There were no factors predictive of ASES or SANE scores. Surgical repair on the dominant arm, multiple-tendon involvement, tendon healing status on ultrasound at 5 years' follow-up, tendon tear size, and length of follow-up were not predictive of any PROM scores.

Discussion

The principal finding of this study is that all-arthroscopic rotator cuff repair provided durable improvements in patient outcomes at ≥15 years of follow-up. Patients with favorable outcomes at 5 years of follow-up continued to do well at ≥15 years of follow-up. Given that the majority of rotator cuff repairs are now performed with all-arthroscopic techniques, it is important to understand the long-term results of these procedures to assess durability, identify prognostic factors for worse outcomes, and set realistic expectations.

There is more extensive literature reporting good long-term outcomes of open rotator cuff repair compared with all-arthroscopic repair. Saraswat et al[26] reported that 59 patients who underwent mini-open rotator cuff repair had maintained improvements in the ASES score, Western Ontario Rotator Cuff score, and range of motion at 10 years of follow-up. At 10 years, the mean ASES score was 90.4 ± 19.4, similar to our 15-year ASES scores after all-arthroscopic repair. In a follow-up study of 30 open

repair patients who had intact rotator cuffs at 1 year of follow-up, Goutallier et al[6] reported that 29 patients had intact rotator cuffs at 9 years and only 1 patient had mild osteoarthritis on radiographs. Zumstein et al[29] reported on 23 patients examined at a mean follow-up of 9.9 years who had undergone open transosseous repair of massive rotator cuff tears. Despite a recurrent defect rate of 57%, 22 of 23 patients remained satisfied or very satisfied with the result.

Although there are more long-term data on open rotator cuff repair, there have recently been several small studies reporting long-term outcomes of arthroscopic repair. Marrero et al[15] performed a 9-year follow-up study of 24 patients who underwent all-arthroscopic rotator cuff repair, finding that 87.7% of patients had excellent or good outcomes according to the University of California, Los Angeles score and no patients had loss of motion. Similarly, at 11.4 years postoperatively, Miyazaki et al reassessed 35 patients who had undergone arthroscopic repair of massive rotator cuff tears.[18] Patients who had achieved good or excellent outcomes according to the University of California, Los Angeles criteria postoperatively at their first evaluation were found to have maintained these outcomes at 11 years. Plachel et al[24] performed a 12-year follow-up evaluation of 27 patients, comparing single-row repair vs. double-row repair, and found that both fixation techniques resulted in good to excellent long-term subjective outcomes despite recurrent defects in 45% of patients. Heuberer et al[10] conducted a 10-year follow-up study of 30 patients who underwent arthroscopic rotator cuff repair, finding that despite recurrent defects in 50% of patients on MRI at 10-year follow-up, Constant scores remained significantly higher compared with preoperative scores.

A few larger cohort studies of long-term outcomes of arthroscopic rotator cuff repair at 10 years have recently been published. Randelli et al[25] reported 10-year follow-up results of 149 arthroscopic rotator cuff repair patients, 101 of whom underwent ultrasound evaluation. They found that rotator cuff tear size at the time of surgery affected supraspinatus integrity at 10-year follow-up, with only 48.7% of supraspinatus tendons remaining intact, although larger tears were not associated with inferior subjective results. An intact tendon at final follow-up was associated with superior clinical and functional outcomes, reduction of osteoarthritis progression, and patient satisfaction. Flurin et al[5] reported 10-year outcomes of 401 patients who underwent arthroscopic or open rotator cuff repair, finding that open surgery was associated with a higher rate of osteoarthritis compared with arthroscopic surgery (26% vs. 14%) and that an unhealed or retorn rotator cuff was associated with osteoarthritis and adverse clinical outcomes. Collin et al[4] reported 10-year outcomes of 130 patients who underwent either open or arthroscopic repair of massive posterosuperior rotator cuff tears, finding that despite an overall recurrent defect rate of 34% as assessed by MRI, the postoperative Constant-Murley scores were still 25 points better than preoperative scores. Lapner et al[14] recently published a multicenter randomized trial comparing arthroscopic single-row and double-row repair in 90 patients, finding a decrease in outcome scores in both groups at 10-year follow-up. In general, the findings of these studies mirror our findings showing maintained improved outcomes from preoperative measurements, although our study has a longer follow-up period of $\geq$15 years.

There has been some debate over whether operative rotator cuff repair provides superior outcomes to physical therapy for degenerative tears. A few clinical trials with short-term outcomes have not found significant clinical benefit for operative treatment compared with conservative management.[12,13,20] Lambers Heerspink et al[13] found no significant difference in Constant-Murley scores between surgically and conservatively treated patients at 1 year, although surgical patients did have small improvements in VAS pain and disability scores. Moosmayer et al[20] published 5-year outcomes of a randomized trial comparing surgical repair vs. nonoperative treatment, finding that a substantial number of patients in the physiotherapy group eventually required secondary tendon repair. They also found better results for primary tendon repair with statistically significant intergroup differences on several outcome scales, suggesting a treatment strategy with a primary trial of physiotherapy for small- to medium-sized rotator cuff tears and surgery for patients who do not improve.

Keener et al[11] conducted a prospective longitudinal study of the risk of degenerative rotator cuff tear progression, finding that degenerative tears did progress and that shoulders with enlarged tears were associated with a greater risk of pain development. The onset of pain was associated with clinical decline in shoulder function. Moosmayer et al[19] conducted a retrospective review at 8.8 years of 49 patients with rotator cuff tears treated conservatively, finding that unrepaired small- to moderate-sized tears had increased in size, as well as degree of atrophy and degeneration, but that average functional outcomes were satisfactory. Our study found that all-arthroscopic rotator cuff repair patients maintained improved shoulder function and did not have significantly higher pain scores even at long-term follow-up.

Chalmers et al[3] recently published a systematic review of intermediate- to long-term outcomes of open and arthroscopic operative rotator cuff repair, including studies with at least 5-year results, with an average follow-up period of 9.6 years for operatively repaired rotator cuffs. The meta-analysis found that rotator cuff repair appears to protect the shoulder from the need for future operative intervention. The study also demonstrated that final tear sizes were significantly smaller after rotator cuff repair than after treatment without repair.

This study has several limitations. We present only patient-reported outcomes obtained via telephone interview owing to limitations from the COVID-19 (coronavirus

disease 2019) pandemic. The positive patient-reported outcomes in this cohort do not indicate that repair integrity is maintained. The original procedures were performed by several surgeons using similar but not identical techniques, which may make the results more generalizable. There have also been advances in suture and anchor designs and materials since the patients underwent their surgical procedures. Furthermore, the patients in this cohort did not have preoperative imaging data recorded, such as muscle fatty infiltration or tendon retraction, needed to correlate these factors with long-term outcomes.

We found no difference in PROMs between multiple-tendon tears and single-tendon tears. There are several potential explanations for this finding: Patients in the 2 groups may have exhibited similar repair results regardless of the Harryman classification[9]; the mean tear sizes between the groups may not have been substantially different (most of the observed rotator cuff tears involved either 1 tendon or 2 tendons); or the comparison in our study is underpowered. Most of the tears in this cohort were either 1- or 2-tendon tears. This may indicate a selection bias in that larger tears may have been more likely to undergo open rotator cuff repair during the study period. Furthermore, the low number of subscapularis tears may stem from under-recognition of subscapularis tears at the time this cohort was collected. Further studies with larger samples are necessary to validate this finding and identify any relationships between tendon involvement, clinical repair results, and postoperative PROMs.

Additionally, the original cohort comprised 193 patients, but we were only able to obtain the long-term patient-reported outcomes of 60 patients, representing 57% of the 5-year follow-up cohort. Many patients were unable to be contacted, and 2 refused participation. We found comparable mean ASES scores between our cohort ($n = 60$) and the original cohort ($N = 193$), as well as the 5-year cohort ($n = 106$). Comparing preoperative and 1-year ASES scores, our study reports an improvement from 59.5 ± 18.6 to 88.2 ± 17.4 whereas the original cohort study reported an improvement from 52.37 ± 24.09 to 83.88 ± 19.28. From preoperatively to 5 years postoperatively, our study reports ASES score improvement from 59.8 ± 18.8 to 93.8 ± 10.5 whereas the 5-year study reported improvement from 52.6 ± 23.2 to 93.4 ± 13.0. This comparison, along with comparable clinical data among the cohorts as shown in Table I, suggests that the group examined at 15 years is representative of the original cohort despite the loss of patients to follow-up. Despite the limitations of this study, the patient-reported outcome findings presented are useful for counseling patients on their long-term clinical course.

The strengths of this study include the 15-year follow-up period, relatively large patient cohort, and use of validated outcome assessments at several time points. Our follow-up period of 15 years represents the longest period in the literature for all-arthroscopic rotator cuff repair. Our study includes results from 12 fellowship-trained surgeons, which provides broader generalizability. Future studies will include ultrasound assessment of rotator cuff repair integrity for this long-term cohort and assessment of motion, strength, and radiographic progression of arthritic changes.

Conclusion

At 15-year follow-up, arthroscopic rotator cuff repair was associated with maintained improvement in outcomes compared with baseline function. The rate of revision surgery following rotator cuff repair was low. Patients with good outcomes at 5-year follow-up continued to do well at ≥15-year follow-up regardless of tear size.

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