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Lost to follow-up: does it matter after arthroscopic rotator cuff repair (a matched cohort analysis of functional outcomes)

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Background: Loss to follow-up after surgery is problematic in that it is thought to lead to poorer outcomes. There is little research on the long-term outcomes of people who have been lost to follow-up vs. patients who attended all follow-up appointments. Rotator cuff repair is unique in that the postoperative course is lengthy, and the rehabilitation program is typically tightly supervised. Therefore, the aim of this investigation is to determine whether there is any long-term difference in functional outcomes after arthroscopic rotator cuff repair between patients who are noncompliant with follow-up appointments vs. those who are compliant with all follow-up.

Methods: A database query was carried out which identified 782 patients who underwent arthroscopic rotator cuff repair at our institution during 2016. Patients were separated into 2 cohorts based on whether they were compliant with all follow-up appointments. Demographic variables such as age and sex were compiled along with objective details from surgery such as size of tear, number of anchors, and other pathologies treated. Patients who were lost to follow-up were contacted by phone to answer survey questions. A matching control group of patients who attended all follow-up appointments was identified based on demographics and surgery details using propensity score matching. The control group was then contacted by phone to answer survey questions. Statistical results were reported as *P* values. Minimum follow-up was set at 2 years.

Results: The nonsatisfactory follow-up cohort consisted of 44 people (average follow-up: 30 months), with the satisfactory follow-up cohort consisting of 57 people (average follow-up: 42 months). There was no statistical difference between groups in sex, age, American Shoulder and Elbow Surgeons scores, Single Assessment of Numeric Evaluation scores, number of anchors, number of tears, additional surgical procedures, and patient satisfaction with the surgery and the surgeon. Of the reasons patients gave for why they did not attend follow-up appointments, 25.0% felt fine or returned to work, 22.7% did not know why, 15.9% reported travel distance, 13.6% of patients gave other explanations, 11.4% reported unrelated medical issues, and 11.4% were unaware they missed any appointments.

Conclusion: This study demonstrated that there is no difference in the outcomes of patients who attended all follow-up appointments vs. patients who prematurely discontinued follow-up after arthroscopic rotator cuff repair. Better communication with patients in the postoperative period may help to improve follow-up after arthroscopic rotator cuff repair.

Postoperative follow-up appointments allow surgeons to screen for complications, track outcomes, and promote adherence to rehabilitation guidelines.[7] Rotator cuff repair (RCR) is unique in that the postoperative course is lengthy, and the rehabilitation program is tightly supervised.[8] After RCR, patients typically return for outpatient appointments at 2 weeks, 1 month, 3 months, 6 months, and occasionally 12 months postoperatively. Unfortunately, some patients stop attending postoperative appointments before they are discharged by their surgeon. Outcome studies on patients who quit attending follow-up are sparse, with many of the studies limited in their scope and objectives.[5]

Factors that influence functionality after arthroscopic RCR remain controversial in the literature.[1-3,5,6,8] Denard et al described tear size as one of the major factors that influences functional

Thomas Jefferson University Institutional Review Board approved this study (IRB #: 18D.654).

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recovery.[4] Some authors have shown evidence for tendon healing to have an effect on clinical outcomes after arthroscopic RCR.[1,3] RCR postoperative rehabilitation is also believed to impact functional outcomes in addition to surgical factors.[8] This shows that rehabilitation compliance and surgical factors both influence the healing process. Norquist et al in 2000 found comparable scores in the Simple Shoulder Test between patients who responded to surveys vs. nonresponders, indicating no long-term differences in the functional outcome; however, this study was conducted on patients who were already enrolled in a prospective shoulder study and could represent a different population more likely to present for follow-up care.[10]

There is no clear answer to why patients discontinue their follow-up. Samade et al in 2019 explain that over half of hand and upper extremity patients discontinued follow-up in their study because they erroneously believed follow-up was completed.[11] Half of those who deliberately missed appointments stated that no intervention would have improved attendance.[11] Mean patient satisfaction with surgery was 10/10, indicating they felt satisfied with their treatment and perhaps felt no need to follow-up. However, this study only evaluated patient satisfaction with surgery and did not evaluate patient outcomes or functionality postoperatively.[11] Zelle et al in 2015 investigated risk factors leading to loss to follow-up in orthopedic trauma cases. They found male gender, uninsured or government insurance, smoking, and illicit drug abuse to be risk factors for noncompliance with follow-up.[12] Patients with trauma represent a different patient population in that they are known to have high truancy rates and are not representative of an elective patient population.[12]

The review of the literature indicates that there are not enough data exhibiting a correlation between arthroscopic RCR functional outcomes and follow-up with adequate control of surgical factors (size of tear, etc.). Therefore, the purpose of this study is to identify factors associated with premature discontinuation of postoperative follow-up of patients undergoing RCR and determine if premature discontinuation affects postoperative patient-reported outcomes in a qualitative manner that controls for both patient demographics and the complexity of the repair. We believe that there will be no difference in outcomes between patients lost to follow-up and patients who attended their follow-up appointments when controlling for the size of tear and repair.

Methods

Study population

The protocol of this retrospective study was approved by the institutional review board. Patients who underwent primary arthroscopic RCR from 01/01/2016 through 12/31/2016 at our institution were identified by database query and reviewed for inclusion in this study. Patients were separated into 2 cohorts based on when they stopped attending postoperative appointments. Postoperative follow-up cessation was defined as a gap of 15 or more weeks between appointments. The satisfactory follow-up (SFU) cohort attended follow-up appointments for at least 90 days, whereas the non-SFU (NFU) cohort stopped attending appointments during the first 90 postoperative days. The NFU cohort has also been divided by number of postop visits attended and whether they were attending physical therapy (PT). Our standard postoperative care involves follow-up appointments at 2 weeks, 6 weeks, 3 months, and 6 months at minimum. One patient was excluded because of a reported fall at 6 weeks postop which resulted in the need for a revision. We identified 101 potential patients for the NFU group and 681 patients for the SFU group.

Retrospective chart review

After a list of patients for each cohort was identified, the surgery notes for every patient were reviewed. Objective information was compiled in a spreadsheet for every patient on the following items: size of tear, specific tendon torn, grade of tear, number of anchors used, whether a biceps tenodesis or tenotomy or open subpectoral tenodesis was performed, whether a bursectomy or acromioplasty was performed, and age and gender. Patients were excluded from the study if all of the required information could not be found in operative notes. After this step, there were 79 potential patients in the NFU group and 566 patients for the SFU group.

Telephone surveys of the NFU group

Patients in the NFU group were first contacted by telephone up to 5 times at different days and times of the day. In the event that an answering machine was encountered, a message was left with a call-back number. On successful contact of a patient, they were asked to complete the American Shoulder and Elbow Surgeons (ASES) and Single Assessment of Numeric Evaluation (SANE) questionnaires, a patient satisfaction questionnaire, and questions about any subsequent shoulder surgeries. The questions were either answered over the phone with a medical researcher or patients were given the option to complete the surveys online using an email link to the RedCap database for the study. The responses given over the phone were transferred into the RedCap database. After this step, there were 44 patients in the NFU group, with 6 surgeons performing all procedures.

Identification and contact of the SFU control group

We performed propensity score matching between the NFU and SFU groups using R Studio (Version 3.6.3, Vienna, Austria) to identify a control group. The control group was identified from the 566 SFU patients based on matching with age, gender, size of tear, specific tendon torn, grade of tear, number of anchors used, whether a bursectomy or acromioplasty was performed, and whether a biceps tenodesis or tenotomy or open subpectoral tenodesis was performed. The patients identified as appropriate controls in the SFU group were then contacted to complete ASES, SANE, and satisfaction questionnaires as well as report any subsequent shoulder surgeries in the same manner as the NFU group. After this step, there were 57 patients in the SFU group, with the same 6 surgeons as the NFU group performing all procedures.

Statistics

All statistical analyses were carried out using R Studio (Version 3.6.3; Vienna, Austria). Results were rounded to two decimals of precision. Two-sample t-tests assuming equal variances were performed to compare continuous variables. Categorical values were compared using chi-squared tests. The significance level used was $\alpha = 0.05$.

Results

The following results can be found summarized in Table I.

Forty-four patients were included in the NFU group (average follow-up: 30 months, mean age: 58.86 ± 9.65 years, 61% men), and fifty-seven patients were assigned to the SFU group (average follow-up: 42 months, mean age: 58.95 ± 9.81, 63% men). Of the NFU group, 7 patients attended 1 surgeon visit (15.9%), 3 of which were involved in PT (42.9%); 26 attended 2 surgeon visits (59.1%),

Table I
Comparison between groups.

Variable	NFU (44 total sample size)	SFU (57 total sample size)	*P* value
Sex	27 men (61%) 17 women (39%)	36 men (63%) 21 women (37%)	.85
Average age	58.86 ± 9.65	58.95 ± 9.81	.96
ASES score mean	80.10 ± 22.32	82.50 ± 20.94	.58
SANE score mean	82.70% ± 23.54	83.23% ± 21.13	.91
Avg. # anchors	2.36 ± 1.28	2.44 ± 1.21	.76
Avg. # tears	1.68 ± 0.77	1.54 ± 0.63	.32
Partial tears	4 supra (9.09%) 6 subscap (13.64%) 2 infra (4.55%) 0 teres (0%)	4 supra (7.02%) 9 subscap (15.79%) 0 infra (0%) 0 teres (0%)	
High-grade tears	8 supra (18.18%) 4 subscap (9.09%) 2 infra (4.55%) 0 teres (0%)	10 supra (17.54%) 6 subscap (10.53%) 0 infra (0%) 0 teres (0%)	
Full tears	30 supra (68.18%) 8 subscap (18.18%) 10 infra (22.73%) 0 teres (0%)	39 supra (68.42%) 7 subscap (12.28%) 13 infra (22.81%) 0 teres (0%)	
Bursectomy and acromioplasty	14 acromioplasty (30.4%) 27 bursectomy (58.7%) 3 none (10.9%)	19 acromioplasty (33.3%) 34 bursectomy (59.6%) 4 none (7.1%)	.98
Tenodesis vs. tenotomy vs. open subpectoral biceps tenodesis vs. none	12 tenodesis (27.3%) 3 tenotomy (6.8%) 10 open subpectoral (22.7%) 19 none (43.2%)	17 tenodesis (29.8%) 6 tenotomy (10.5%) 11 open subpectoral (19.3%) 23 none (40.4%)	.89
Overall satisfaction w/ the surgery*	88.09 ± 22.98	92.07 ± 17.36	.32
Overall satisfaction w/ the surgeon*	95.02 ±12.33	97.48 ± 8.14	.24
Overall satisfaction w/ clinical staff*	94.70 ± 14.75	98.98 ± 3.95	.04
Likeliness of returning to the same surgeon if other shoulder needs surgery*	91.79 ± 25.63	97.86 ± 9.61	.11
Since repair, # of surgeries on the opposite shoulder*	8 out of 43 18.6%	9 out of 56 16.1%	.63

ASES, American Shoulder and Elbow Surgeons; *SANE*, Single Assessment of Numeric Evaluation; *NFU*, nonsatisfactory follow-up; *SFU*, satisfactory follow-up; *supra*, supraspinatus; *subscap*, subscapularis; *infra*, infraspinatus; *teres*, teres minor.
*Both groups had 1 nonresponder to the patient satisfaction survey.

21 of which were engaged in PT (80.8%); 11 patients attended 3 surgeon visits (25%), 9 of which were attending PT (81.8%). The primary outcome of either rehabilitation follow-up group revealed no significant difference ($P = .58$) in functionality based on the ASES shoulder score between the NFU (mean: 80.10 ± 22.32) and SFU group (mean: 82.50 ± 20.94) cohorts. There was no significant difference in the SANE ratings ($P = .91$) between the NFU group (mean: 82.70% ± 23.54) and the SFU group (mean: 83.23% ± 21.13). In addition, 30.4% (n = 14) of patients in the NFU group had an acromioplasty, whereas 58.7% (n = 27) had a subacromial bursectomy, and the remaining 10.9% (n = 3) had no additional procedures documented. In the SFU group, 33.3% (n = 19) of patients had an acromioplasty, whereas 59.6% (n = 34) had a subacromial bursectomy, and the remaining 7.1% (n = 4) had no additional procedures. There was no significant difference in the rate of arthroscopic biceps tenodesis with 27.3% (n = 12) in the NFU group vs. 29.8% (n = 17) in the SFU group or tenotomy with 6.8% (n = 3) in the NFU group vs. 10.5% (n = 6) in the SFU group or open subpectoral biceps tenodesis with 22.7% (n = 10) in the NFU group vs. 19.3% (n = 11) in the SFU group ($P = .89$). The mean number of tears was 1.68 in the NFU cohort and 1.54 in the SFU cohort and was not significantly different ($P = .32$). The number of surgeries on the opposite shoulder since repair was not significantly different between the NFU group (18.6%, n = 8) and the SFU group (16.1%, n = 9) ($P = .63$).

There was no significant difference between NFU and SFU groups in overall satisfaction with the surgery ($P = .32$) or with the surgeon ($P = .24$) that could account for a reason as to why follow-up was discontinued. There was a significant difference in satisfaction with clinical office staff between the NFU group reporting 94.70% ± 14.75 vs. the SFU group reporting 98.98% ± 3.95 satisfaction ($P = .04$). There was no significant difference in likelihood of the patient returning to the same surgeon if another surgery was necessary with the NFU group (mean satisfaction: 91.79% ± 25.63) and the SFU group (mean satisfaction: 97.86% ± 9.61) ($P = .11$). There was also no significant difference in the rate of tenodesis, tenotomy, and open subpectoral biceps tenodesis between groups ($P = .89$).

The free text response question in the patient satisfaction survey given to the NFU group asking why they stopped attending follow-up had explanations which fell into the following categories: 11 patients (25.0%) quit attending follow-up because they felt fine or returned to work; 10 patients (22.7%) reported they did not know or simply did not respond to this question, 7 patients (15.9%) because of travel distance, 6 patients (13.6%) gave other explanations, 5 patients (11.4%) due to unrelated medical issues, and 5 patients (11.4%) were unaware they missed any appointments.

Discussion

The purpose of this study was to identify factors associated with premature discontinuation of postoperative follow-up of patients undergoing RCR and determine if premature discontinuation affects postoperative patient-reported outcomes in a qualitative manner that controls for both patient demographics and the complexity of the repair. The results of our study support our hypothesis that there would be no difference in outcomes between groups.

When deciding to continue follow-up rehabilitation, a patient is motivated by their postoperative pain and stiffness. Of the limited literature on the subject, there has been little consensus on whether or not loss to follow-up after RCR is detrimental to the long-term functional outcome. A study on loss to follow-up after hip arthroplasty clearly came to the conclusion that it matters, as

pain, range of motion, radiological features, and the patient's opinion of their progress were all significantly inferior in the patients lost to follow-up over 16 years.[9] Prior studies on loss to follow-up after RCR or upper extremity surgery have come to the conclusion that methods of questioning the patients can result in different results and that patients are often satisfied with treatment or were unaware they missed follow-up.[10,11] The aforementioned and personal experiences with loss to follow-up with RCR in a clinical setting led us to believe there is possibly more to the story, and a new study was warranted given the limited literature on this subject. This study aimed to convey whether loss to follow-up after RCR led to poorer outcomes than those who continued with follow-up while matching complexity of the repair.

There can be significant variability in the degree of repair during RCR surgery, which is why we felt it imperative to extract all the major surgical details from the operative notes. Hip arthroplasties, for example, are far more invasive than simple RCR, so the results of a study on arthroplasties cannot be extrapolated to RCRs as a result. In addition, the degree of repair needed in RCR, if not properly quantified and controlled for, could easily skew the results of a study on postoperative results and follow-up.

In this analysis, we identified a large cohort of patients for inclusion in the study so we could have controls who were appropriate across the large spectrum of demographic data collected (age, sex, size of tear, number of anchors, etc.). Patient age, gender, number of anchors, size of tear, specific tendon(s) torn, degree of tears, percentage of acromioplasties vs. bursectomies, and whether an arthroscopic tenodesis, tenotomy, or open subpectoral biceps tenodesis was performed were roughly equivalent between groups (Table I).

When we examined outcomes, ASES and SANE scores showed no significant differences between groups. Patient satisfaction with the surgery and the surgeon also showed no significant differences between groups. Most patients even stated they would return to the same surgeon if the other shoulder needed surgery, with no significant difference between groups. The only significant difference between groups was in overall satisfaction with clinical office staff, which may not have been clinically meaningful. Our data indicate that there is no difference in outcomes in patients lost to follow-up after arthroscopic RCR.

When we examine the reasons patients terminated follow-up, the largest reason was because patients felt fine or went back to work which occurred 25% of the time. An additional 22.7% of patients reported they did not know why they discontinued follow-up or simply did not answer the question, indicating that they possibly did not feel the need for additional follow-up. This is in dramatic contrast to a previous study which found 65.3% of patients believed they had completed all follow-up appointments after their procedure.[10] In our study, only 11.4% were unaware they had missed any follow-up, indicating that it was more of a conscious decision due to other factors or a lack of communication between the surgical team and the patient. The dramatically different reasons for loss to follow-up between our study and previously published literature can likely be attributed to the matched cohort design of our analysis.

Our study is not without limitations. This study is a retrospective cohort study and may be subject to recall bias, and it is possible that patients willing to participate in this study represent a different group from the population as a whole; however, because of the nature of the study and the intent to evaluate patients who were truly lost to follow-up, a prospective study design may not be possible. In addition, this study relies on patient-reported outcome measures, which are the individual patient's perception of how they are doing. To get truly objective measurements, we would have had to bring the patients in for a physical examination to assess their shoulder function. Previous studies have also demonstrated differences in survey responses depending on the method the surveys are administered to patients,[3] and the inclusion of survey answers both over the phone and through an email link after talking over the phone might have skewed the results of our surveys. The time since surgery could also affect the patients' memory and answers on the satisfaction survey. The geographical location of our patient base could be another limiting factor, preventing the generalizability of our results to the country as a whole. In addition, our study included patients from multiple surgeons which may have mitigated differences between groups. Finally, the NFU group had 44 patients who could be reached who were willing to participate in the study out of the 79 eligible patients identified. This 55.7% response rate in the NFU group limits the generalizability and findings of this study.

Conclusion

This study demonstrated that there is no difference in the outcomes of patients who attended all follow-up appointments vs. patients who prematurely discontinued follow-up after arthroscopic RCR.

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