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Majority of patients find sleep patterns return to normal 6 months following rotator cuff repair

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Background and hypothesis: Rotator cuff tears have a wide variability in presentation, with some causing pain and reduced function but others remaining completely asymptomatic. Sleep disturbances are a primary driver for patients with rotator cuff tears to see a physician, and one of the main goals of rotator cuff repair (RCR) surgery is to restore normal sleep patterns in these patients. The primary purpose of this study aimed to determine the percentage of patients undergoing RCR who report preoperative sleep disturbances. Second, this study sought to identify at what postoperative follow-up intervals patients stopped reporting sleep disturbances and how the percentages change over time. It was hypothesized that the majority of patients undergoing arthroscopic RCR would report preoperative and initial postoperative sleep disturbances and that 75% of patients would report resolution of sleep disturbances by 1 year postoperatively.

Methods: A total of 326 patients undergoing primary arthroscopic RCR were prospectively enrolled in this study. Validated patient-reported outcome measures were obtained preoperatively and postoperatively, including the visual analog pain scale score, American Shoulder and Elbow Surgeons score, Single Assessment Numeric Evaluation score, Simple Shoulder Test (SST) score, and Veterans RAND 12-Item Health Survey physical and mental component scores.

Results: According to question 2 of the SST, 291 patients (89%) reported preoperative sleep disturbances. Within the cohort of patients who reported resolution of sleep disturbances, 46% reported resolution by 3 months postoperatively; an additional 31%, by 6 months; a further 14%, by 12 months; and the final 8%, by 24 months. Age $\geq$ 65 years was significantly associated with increased reporting of resolution compared with age $<$ 65 years. All patient-reported outcome measures, including the visual analog pain scale score, American Shoulder and Elbow Surgeons score, Single Assessment Numeric Evaluation score, SST score, and Veterans RAND 12-Item Health Survey (physical component) score, showed statistically significant improvements after surgery.

Conclusions: Eighty-nine percent of patients reported preoperative sleep disturbances. Seventy-seven percent of patients reported resolution of sleep disturbances by 6 months postoperatively, and 81% of patients reported resolution of sleep disturbances by 2 years postoperatively.

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

Keywords: Arthroscopic rotator cuff repair; sleep disturbance; shoulder arthroscopy; shoulder; rotator cuff; shoulder pain; sleep patterns

Rotator cuff tears have a wide variability in presentation, with some causing pain and reduced function but others remaining completely asymptomatic. Several studies have shown that 20% of the population may have asymptomatic rotator cuff tears and that these tears become more prevalent with increased age, dominant-arm involvement, and

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increased use of the arm.[20,22] When tears do become symptomatic, many patients report pain and trouble sleeping.[13,19] This discomfort may become severe enough to influence patients to seek medical evaluation and undergo subsequent surgical repair of the rotator cuff. Because sleep disturbances from pain are a primary driver for patients with rotator cuff tears to see a physician, one of the main goals of rotator cuff repair (RCR) surgery is to eliminate night-time pain and restore normal sleep patterns in these patients.

The restoration of productive sleep becomes even more important when looking at the growing incidence of surgical repair of rotator cuff tears.[2,4] Notably, studies have found that the majority of patients currently undergoing surgery are aged < 65 years[10] and are still a part of working society.[11] Because these patients are most likely still contributing to the workforce in a meaningful way, it is even more vital to understand when these patients can expect to have improved night-time pain and, therefore, better sleep.

Although several previous studies have analyzed sleep disturbances before and after surgery in individuals undergoing RCR, the sample sizes have consisted of <75 patients, with even fewer of these patients completing follow-up as long as 24 months.[1,5] These small cohorts have made it difficult to draw strong conclusions on what percentage of patients undergoing RCR have preoperative sleep disturbances, how long those disturbances last postoperatively, and what percentage have complete resolution of sleep disturbances. Additionally, it is widely accepted that many patients with rotator cuff tears experience trouble sleeping; however, there is continued debate about what demographic or clinical factors may contribute to these sleep disturbances. For example, existing studies analyzing rotator cuff tears have shown conflicting results regarding the impact of tear size on sleep disturbances and pain level, with one study concluding that there was no correlation[17] but another study finding that patients with smaller tears report worse sleep than those with massive or large tears.[5]

This study uses a larger sample size to shed more light on the pattern of these sleep disturbances both before and after arthroscopic RCR surgery. The primary aim of this study was to determine the percentage of patients undergoing RCR who report preoperative sleep disturbances and what demographic and clinical factors may influence the presence of these disturbances. Second, this study sought to identify at what postoperative follow-up intervals patients stopped reporting sleep disturbances and how the percentages change over time. It was hypothesized that the majority of patients undergoing arthroscopic RCR would report preoperative and postoperative sleep disturbances and that 75% of patients would report resolution of sleep disturbances by 1 year postoperatively.

Materials and methods

Study design

A consecutive cohort of patients undergoing RCR was prospectively enrolled in this retrospective review of prospectively collected data. Between August 1, 2012, and March 1, 2019, 326 patients scheduled to undergo arthroscopic RCR performed by a single surgeon at a single institution were enrolled in the Surgical Outcome System (SOS) database (Arthrex, Naples, FL, USA), which is a Health Insurance Portability and Accountability Act (HIPAA)–compliant global registry database, and provided complete preoperative baseline data. All patients provided informed consent. Patients were indicated for shoulder arthroscopy and RCR if they had rotator cuff tears per the clinical history, physical examination findings, and/or magnetic resonance imaging findings. The presence of rotator cuff tears was confirmed by the surgeon intraoperatively. Prior to consent for surgery, nonoperative treatments had been exhausted in all patients, including nonsteroidal anti-inflammatory medications, activity modification with or without physical therapy, and/or injections.

Demographic information was recorded within the database. Patient characteristics were recorded and included age, body mass index (BMI), sex, ethnicity, race, history of diabetes mellitus, preoperative narcotic use, smoking status, workers' compensation status, and concomitant biceps tendon procedure. Validated clinical outcome instruments were obtained preoperatively and postoperatively and included the visual analog scale (VAS) for pain,[15,16] American Shoulder and Elbow Surgeons score,[12] Single Assessment Numeric Evaluation score,[21] Simple Shoulder Test (SST) score,[8] and Veterans RAND 12-Item Health Survey (VR-12) physical and mental component scores.[18] Rotator cuff tear characteristics were recorded by the surgeon at the time of the procedure and included tear acuity (acute [$\leq$3 months] or chronic [>3 months]) and the Cofield classification of tear size (small, medium, large, or massive).[3]

All patients aged $\geq$ 18 years who underwent primary RCR during the study period and provided complete preoperative baseline data in the Surgical Outcome System (SOS) database were included in the initial cohort of this study. Given that the primary purpose of this study was to determine the percentage of patients who reported preoperative sleep disturbances, a response to question 2 of the SST (''Does your shoulder allow you to sleep comfortably?'') was required preoperatively and was used to identify this cohort. Patients were classified based on the presence of preoperative sleep disturbances. To evaluate the resolution of sleep disturbances postoperatively, we included those patients who reported preoperative sleep disturbances and additionally required that patients complete SST question 2 at the 3-month follow-up assessment. The primary endpoint of this study was an answer to SST question 2 that indicated resolution of sleep disturbances.

Statistical analysis

Means, standard deviations, and medians are presented for continuous variables. Numbers and percentages are presented for categorical variables. Changes in patient-reported outcome measures (PROMs) from preoperative baseline to postoperative follow-up intervals were assessed using a linear mixed-effects

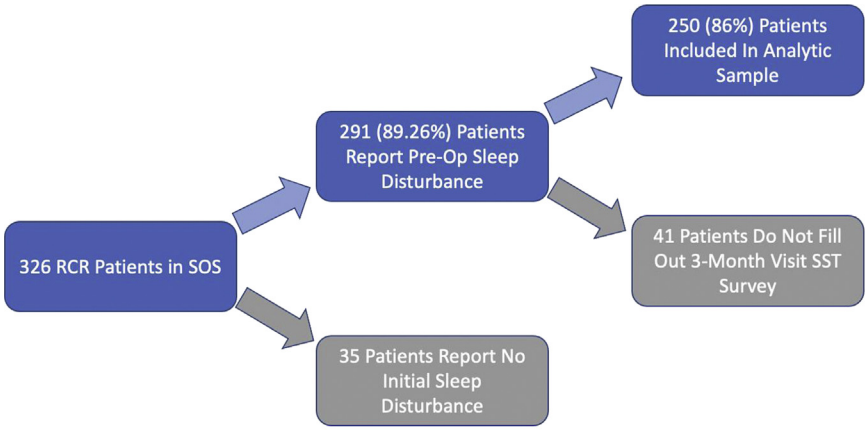

Figure 1 The analytic cohort was selected by including patients who reported preoperative sleep disturbances (291 patients) and, at a minimum, completed survey data at 3 months postoperatively (250 patients). *RCR*, rotator cuff repair; *SOS*, Surgical Outcome System; *Pre-Op*, preoperative.

model. $P < .05$ was considered statistically significant. A Cox proportional hazards analysis was performed to assess the association between baseline characteristics and resolution of sleep disturbances. This approach incorporates both whether patients had the outcome of interest (resolution of sleep disturbances) and the follow-up time, and it allows for the inclusion of participants with incomplete follow-up data; participants who did not report resolution of sleep disturbances were censored at their last survey. We included variables with $P < .15$ in a multivariable model. All statistical analyses were performed using SAS software (version 9.4; SAS Institute, Cary, NC, USA).

Results

Demographic and clinical characteristics

After exclusion of revision cases, 387 patients were originally enrolled in the database; however, 61 of these patients did not answer the baseline question (ie, SST question 2) preoperatively and were excluded from the study. As such, 326 patients remained, of whom 35 (11%) reported no preoperative sleep disturbances according to SST question 2. Of the 291 patients (89%) who reported preoperative sleep disturbances, 250 answered SST question 2 at the 3-month postoperative visit and were included in the final analytic cohort (Fig. 1).

The demographic and clinical data of the analytic cohort are shown in Table I. The study population had a mean age of 55.6 ± 9.5 years and a mean BMI of 28.6 ± 5.6 kg/m^2. Of the patients, 38% were classified as overweight and 35% were classified as obese. Fifty-two percent of patients were women, 93% were nonsmokers, 11% had workers' compensation cases, and 6% had diabetes mellitus. The mean duration of symptoms preoperatively was 13.6 ± 28.2 months. According to the Cofield classification of tear size intraoperatively, 78% of patients had small or medium rotator cuff tears and 22% had large or massive rotator cuff tears.

Table II shows the demographic and clinical data of all patients separated into 2 groups based on whether they reported preoperative sleep disturbances. Patients with workers' compensation cases were significantly more likely to report sleep disturbances; all 34 patients who had workers' compensation cases reported preoperative sleep disturbances compared with 88% of patients without workers' compensation cases. Additionally, the pretreatment mean VAS pain score was significantly higher in the group that reported sleep disturbances. No other significant differences were detected between groups. Of note, 91% of patients with tears classified as small or medium tears reported preoperative sleep disturbances compared with 88% of those with tears classified as large or massive tears.

Resolution of sleep disturbances

In the analytic cohort, 81% of patients (202 of 250) reported that their sleep disturbances resolved by 2 years postoperatively (Table III). Of the 48 patients who did not report sleep disturbance resolution, 15 (31%) filled out all postoperative surveys at 3, 6, 12, and 24 months. The remaining 33 patients were lost to follow-up at various time intervals: 15 (31%) only completed surveys at 3 months, 10 (21%) completed surveys at 3 and 6 months, and 8 (17%) completed all surveys except those at 24 months. Within the cohort of patients who reported resolution of sleep disturbances, 46% reported resolution by 3 months postoperatively; an additional 31%, by 6 months; a further 14%, by 12 months; and the final 8%, by 24 months (Fig. 2).

Postoperative follow-up data were available for 32 of the 35 patients who reported no preoperative sleep disturbances. Of these patients, 12 (37%) reported postoperative sleep disturbances, with 10 reporting resolution by 6 months and 1 reporting resolution by 24 months (Table IV).

Within the analytic cohort, age was the only variable significantly associated with resolution of sleep

Table I Patient demographic and clinical characteristics

	n (%) or mean ± SD	Median (range)
Sex		
Female	130 (52)	
Male	120 (48)	
Race		
Asian	1 (0)	
Black or African American	6 (2)	
White	238 (95)	
Other	5 (2)	
Ethnicity		
Not Hispanic or Latino	238 (95)	
Hispanic or Latino	12 (5)	
BMI group		
Underweight <18.5	1 (0)	
Normal weight 18.5–24.9	66 (26)	
Overweight 25.0–29.9	96 (38)	
Obese >=30.0	87 (35)	
Smoking status		
No	233 (93)	
Yes	17 (7)	
Workers' compensation case		
No	222 (89)	
Yes	28 (11)	
Diabetes mellitus		
No	235 (94)	
Yes	15 (6)	
Cofield classification of tear size		
Small or medium	194 (78)	
Large or massive	54 (22)	
Missing	2	
Age at treatment, yr	55.6 ± 9.5	55.5 (20.0-77.0)
BMI, kg/m^2	28.6 ± 5.6	27.5 (17.7-53.1)
Duration of symptoms, mo*	13.6 ± 28.2	7.0 (0.2-276.0)
Pretreatment VR-12 mental health score†	53.7 ± 10.0	55.9 (12.4-71.2)

SD, standard deviation; *BMI*, body mass index; *VR-12*, Veterans RAND 12-Item Health Survey.
There were 250 patients included in the analytic cohort.
* Data on the duration of symptoms were missing for 37 patients.
† The pretreatment VR-12 mental health score was not available for 1 patient.

disturbances (Table V). Patients aged ≥ 65 years had a 1.5 times increased likelihood of reporting resolution of sleep disturbances compared with those aged < 65 years. An increased likelihood of reporting resolution of sleep disturbances was also found for male patients (hazard ratio [HR], 1.17; 95% confidence interval [CI], 0.88-1.56) and patients with large or massive tears (HR, 1.27; 95% CI, 0.91-1.77); however, these results were not statistically significant ($P = .2714$ and $P = .1633$, respectively) (Table V). A 9.2% increase in baseline VR-12 mental health score (50.0 vs. 54.6) was associated with an increased likelihood of sleep disturbance resolution (HR, 1.01; 95% CI, 0.99-1.02), although this finding was not statistically significant ($P = .2567$). Additionally, a 17.7% decrease in baseline VAS pain score (6.2 vs. 5.1) was associated with a decreased likelihood of sleep disturbance resolution (HR, 0.95; 95% CI, 0.89-1.01) but was not statistically significant overall ($P = .0978$) (Table V). The multivariable Cox proportional hazards model included sex, age, and baseline VAS pain score. After adjustment for sex and baseline VAS pain score, age remained significantly associated with the resolution of sleep disturbances. The magnitude of the association between each predictor and the resolution of sleep problems was similar in the adjusted model for all included variables (Table V).

The results of a linear mixed-effects model were assessed to evaluate PROMs over time and change from baseline. All PROMs, including the VAS pain score, American Shoulder and Elbow Surgeons score (index and function), Single Assessment Numeric Evaluation score,

Table II Patient demographic and clinical characteristics for all 326 patients separated into 2 groups based on preoperative sleep disturbances

	Answer to pretreatment SST question 2 ("Does your shoulder allow you to sleep comfortably?")		*P* value
	No (n = 291)	Yes (n = 35)	
Sex			.8596
Female	146 (90)	17 (10)	
Male	143 (89)	18 (11)	
Missing	2	0	
Age			.1269
<65 yr	233 (91)	24 (9)	
≥65 yr	58 (84)	11 (16)	
Cofield classification of tear size			.3697
Small or medium	225 (91)	22 (9)	
Large or massive	63 (88)	9 (13)	
Missing	3	4	
BMI group			.8329
Normal weight (<25 kg/m^2)	73 (89)	9 (11)	
Overweight (25-30 kg/m^2)	109 (92)	10 (8)	
Obese (>30 kg/m^2)	105 (91)	11 (9)	
Missing	4	5	
Race			.2633
Asian	1 (50)	1 (50)	
Black or African American	8 (100)	0 (0)	
White	272 (89)	32 (11)	
Other	7 (100)	0 (0)	
Missing	3	2	
Ethnicity			.3747
Not Hispanic or Latino	277 (89)	35 (11)	
Hispanic or Latino	13 (100)	0 (0)	
Missing	1	0	
Smoking status			.0912
No	265 (89)	34 (11)	
Yes	24 (100)	0 (0)	
Missing	2	1	
Workers' compensation case			.0344
No	255 (88)	34 (12)	
Yes	34 (100)	0 (0)	
Missing	2	1	
Diabetes mellitus			>.99
No	271 (89)	32 (11)	
Yes	18 (90)	2 (10)	
Missing	2	1	
Duration of symptoms, mo	14.2 ± 31.6	15.3 ± 30.0	.8513
Pretreatment VR-12 mental health score	53.2 ± 10.5	55.7 ± 7.3	.0719
Pretreatment VAS pain score	5.4 ± 2.3	3.4 ± 2.4	<.0001

SST, Simple Shoulder Test; *BMI*, body mass index; *VR-12*, Veterans RAND 12-Item Health Survey; *VAS*, visual analog scale.
Data are presented as number (percentage) or mean ± standard deviation.

SST score, and VR-12 (physical component) score, showed statistically significant improvements after surgery (Table VI).

Discussion

Many patients with rotator cuff tears report preoperative sleep disturbances. However, little is known about whether the sleep disturbances eventually resolve and when patients can expect to experience resolution after arthroscopic RCR. In this study, the percentage of patients with preoperative sleep disturbances was 89%, similar to rates seen in other studies that looked at patients with rotator cuff tears, as well as similar shoulder pathologies such as tendinitis and impingement.[1,6,7,14] Among patients who reported resolution of sleep disturbances by 24 months (202 patients), a

Table III Preoperative survey answers and postoperative reported outcomes

Answer to SST question 2 ("Does your shoulder allow you to sleep comfortably?")	n (%)
Preoperative sleep disturbance	326
No	35 (11)
Yes	291 (89)
Sleep disturbances resolved by 24 mo	250
No	48 (19)
Yes	202 (81)
Month by which sleep disturbances resolved	202
3	93 (46)
6	63 (31)
12	29 (14)
24	17 (8)

SST, Simple Shoulder Test.
There were 326 patients who responded to the preoperative questionnaire. Of the 291 patients who indicated preoperative sleep disturbances, 250 were included in the cohort (ie, those who indicated preoperative sleep disturbances and completed at least 1 postoperative survey at 3 months).

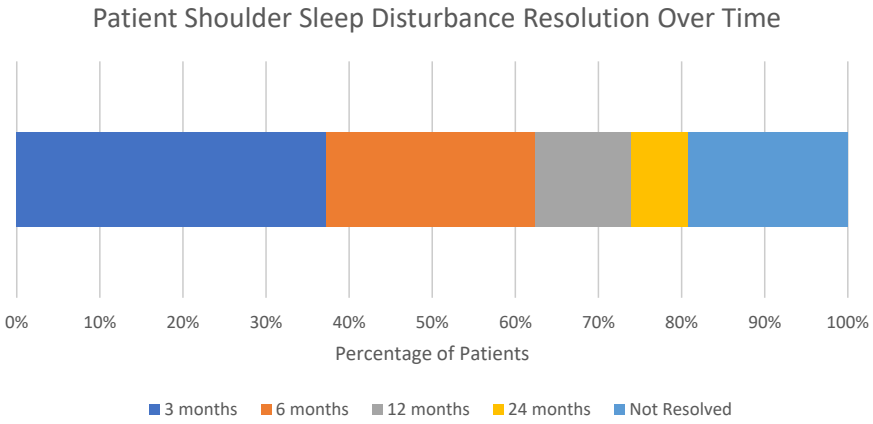

Figure 2 Percentage of patients who reported shoulder-related sleep disturbance resolution at specific survey time intervals.

Table IV Postoperative reported outcomes for patients with no preoperative sleep disturbances

Answer to SST question 2 ("Does your shoulder allow you to sleep comfortably?")	n (%)
Postoperative sleep disturbances at 3 mo	32
No	20 (63)
Yes	12 (37)
Sleep disturbances resolved by 24 mo	12
No	1 (8)
Yes	11 (92)
Month by which sleep disturbances resolved	11
6 mo	10 (91)
12 mo	0 (0)
24 mo	1 (9)

SST, Simple Shoulder Test.
Postoperative follow-up data were available for 32 of the 35 patients who reported no preoperative sleep disturbances.

majority (156 of 202, 77%) achieved resolution by 6 months postoperatively. When including all patients who reported preoperative sleep disturbances (250 patients), our study showed that the percentage that reported resolution of sleep disturbances by 6 months postoperatively was 77% (156 of 250 patients). This finding is very similar to the

Table V Cox proportional hazards analysis for predictors of symptom resolution (ie, resolution of sleep disturbances)

	Sleep disturbances resolved		Unadjusted HR (95% CI)	*P* value for unadjusted HR	Adjusted HR (95% CI)	*P* value for adjusted HR
	No	Yes				
Sex, n (%)				.1438		.2714
Female	28 (22)	102 (78)	Reference category			
Male	20 (17)	100 (83)	1.23 (0.93-1.62)		1.17 (0.88-1.56)	
Age, n (%)				.0173		.0202
<65 yr	43 (21)	159 (79)	Reference category			
≥65 yr	5 (10)	43 (90)	1.51 (1.08-2.12)		1.50 (1.07-2.10)	
Cofield classification of tear size, n (%)*				.1633		
Small or medium	38 (20)	156 (80)	Reference category			
Large or massive	9 (17)	45 (83)	1.27 (0.91-1.77)			
BMI group, n (%)				.3842		
Normal weight (<25 kg/m^2)	16 (24)	51 (76)	Reference category			
Overweight (25-30 kg/m^2)	16 (17)	80 (83)	1.28 (0.90-1.82)			
Obese (>30 kg/m^2)	16 (18)	71 (82)	1.14 (0.80-1.64)			
Baseline VR-12 mental health score, mean ± SD†	50.0 ± 10.6	54.6 ± 9.7	1.01 (0.99-1.02)	.2567		
Baseline VAS pain score, mean ± SD‡	6.2 ± 2.1	5.1 ± 2.2	0.95 (0.89-1.01)	.0978	0.96 (0.9-1.02)	.1866

HR, hazard ratio; *CI*, confidence interval; *VR-12*, Veterans RAND 12-Item Health Survey; *SD*, standard deviation; *BMI*, body mass index; *VAS*, visual analog scale.

* The tear size (according to the Cofield classification) was missing for 1 patient.

† The VR-12 depression score was measured per 1 unit.

‡ The VAS score was measured per 1 unit.

results of several other studies showing that among patients who originally reported sleep disturbances, the percentage of patients with unresolved shoulder pain at 6 months was around 35%-38%.[1,9] However, rather than showing a leveling off at this point, our results indicated a further improvement in sleep on surveys obtained at both 12 months and 24 months, with resolution in about 74% (185 of 250 patients) and 81% (202 of 250 patients), respectively. This result is slightly different from that obtained by Horneff et al[5] when surveying patients after 24 months, which showed that 41% of patients still had sleep disturbances. This difference may possibly be accounted for by either the smaller sample size in the aforementioned study or the different surveys used to define the cohort of patients who had sleep disturbances (Pittsburgh Sleep Quality Index [PSQI] value < 5 vs. answer of no to SST question 2). It is important to note that within our study, there was potential for an even higher percentage of patients to have achieved resolution of sleep disturbances because 33 patients were lost to follow-up before completing the final survey at 24 months. Most likely, some of these patients experienced resolution by 24 months postoperatively, which would further increase the percentage of patients who achieved resolution of sleep disturbances.

Notably, our study results showed no statistically significant relationship between rotator cuff tear size and preoperative sleep disturbances, which is similar to the findings of a growing number of studies showing no relationship between the clinical aspects of a tear as observed by preoperative imaging or intraoperative classification and a patient's sleep problems.[17] For example, a cross-sectional study including 209 patients with full-thickness rotator cuff tears found no correlation between rotator cuff tear characteristics and sleep quality as determined by the PSQI.[17] In contrast to our study results that showed no correlation between patient demographic factors and sleep disturbances, one study found female sex, diabetes, and elevated BMI to be associated with worse sleep quality.[7] The findings of the same study did agree with our results that showed that patients with preoperative sleep disturbances reported a higher mean VAS pain score.[7] Our only other statistically significant finding in this area can most likely be assumed based on circumstance: Patients with workers' compensation cases were significantly more likely to report preoperative sleep disturbances. It is vital to note that the statistical significance of these results should be regarded with a degree of hesitation given the small sample size of patients who did not report preoperative sleep disturbances (n = 35).

In addition, this study showed that postoperatively, there was no statistically significant relationship between rotator cuff tear size and the resolution of sleep disturbances,

Table VI Descriptive statistics for PROMs at baseline and 1 and 2 years postoperatively and linear mixed-effects model assessing PROMs over time and change from baseline to 2 years postoperatively

PROM	Baseline, mean ± SD	1 yr, mean ± SD	2 yr, mean ± SD	Change from baseline to 2 yr	
				Estimate (95% CI)	*P* value
VAS pain score	5.32 ± 2.20 (n = 250)	1.41 ± 1.96 (n = 214)	1.06 ± 1.68 (n = 173)	4.13 (3.80 to 4.45)	<.0001
ASES index score	46.36 ± 16.19 (n = 250)	85.22 ± 15.94 (n = 214)	89.07 ± 14.28 (n = 172)	−41.62 (−44.09 to −39.14)	<.0001
ASES function score	13.78 ± 5.14 (n = 250)	25.36 ± 4.80 (n = 214)	26.62 ± 4.44 (n = 172)	−12.55 (−13.32 to −11.78)	<.0001
SANE score	38.57 ± 18.88 (n = 243)	80.34 ± 20.35 (n = 214)	9.80 ± 26.00 (n = 172)	−41.25 (−45.66 to −36.85)	<.0001
SST score	34.67 ± 21.73 (n = 250)	80.37 ± 21.37 (n = 214)	83.67 ± 21.45 (n = 172)	−47.50 (−50.90 to −44.10)	<.0001
VR-12 physical component score	35.75 ± 7.62 (n = 249)	47.91 ± 7.86 (n = 214)	48.96 ± 8.05 (n = 172)	−12.92 (−14.13 to −11.71)	<.0001
VR-12 mental component score	53.75 ± 10.03 (n = 249)	56.03 ± 8.55 (n = 214)	55.51 ± 9.27 (n = 172)	−0.932 (−2.23 to 0.363)	.1575

PROM, patient-reported outcome measure; *SD*, standard deviation; *CI*, confidence interval; *VAS*, visual analog scale; *ASES*, American Shoulder and Elbow Surgeons; *SANE*, Single Assessment Numeric Evaluation; *SST*, Simple Shoulder Test; *VR-12*, Veterans RAND 12-Item Health Survey.

which is consistent with the study results of Serbest et al,[19] who found a statistically significant improvement in PSQI scores at 6 months postoperatively but observed no correlation between the size of the tear and sleep quality. Our study, however, did show that age was the only variable significantly associated with sleep disturbance resolution, with older patients having an increased likelihood of reporting resolution of symptoms postoperatively. Although all PROMs collected showed statistically significant improvements from baseline to 2 years postoperatively, our study results showed no significant correlation between different demographic factors (eg, sex or BMI group) and sleep disturbance resolution.

There are noteworthy limitations to this study, similar to those encountered by other database studies. These limitations, however, were somewhat mitigated by using a surgeon-specific database so that recording of data was more consistent and reliable. A limitation specific to this study was the use of SST question 2 as the sole indicator of sleep disturbances. Future studies should aim to determine whether this survey question is correlated with a PSQI value < 5, which is more commonly referenced in the literature to indicate patients with shoulder-related sleep disturbances. A loss to follow-up occurred when patients did not complete postoperative surveys after certain time points; although the Cox proportional hazards model can include such patients, this limitation results in unknown data regarding whether sleep disturbances resolved postoperatively in these patients and at what time point. Additionally, patients in whom recurrent sleep disturbances may have developed at 2 years postoperatively but who had no reported sleep disturbances at 1 year postoperatively would not have been captured by these data. This limitation applies to any time point when sleep disturbances may have recurred following resolution; however, there is no evidence that would show this new sleep disturbance to have any correlation with a rotator cuff tear or RCR. Finally, this study analyzed a homogeneous patient population; future studies should try to understand whether different populations show changes in recovery times and the percentage of patients achieving sleep disturbance resolution. The strengths of this study include the prospective collection of data, the 2-year follow-up period, the use of validated PROMs, and the large study population (n = 250).

The results we obtained are an important contribution toward understanding that a majority of patients (81%) have resolution of sleep disturbances within 2 years after undergoing RCR and that 77% of these patients have resolution of symptoms by 6 months postoperatively. It is important for surgeons to be able to relay this recovery information to patients who are considering surgery so that the timeline for healing can be known and appropriate expectations can be set. There is still much uncertainty regarding the greatest contributors to sleep disturbances in patients with rotator cuff tears, and future studies should

continue in the effort to understand what factors affect sleep disturbances and how these factors can be minimized postoperatively.

Conclusion

Eighty-nine percent of patients reported preoperative sleep disturbances. Seventy-seven percent of patients reported resolution of sleep disturbances by 6 months postoperatively, and 81% of patients reported resolution of sleep disturbances by 2 years postoperatively.

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