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The impact of preoperative opioid use on outcomes after arthroscopic rotator cuff repair

Vani J. Sabesan, MD [a,*], Graysen R. Petersen-Fitts, MD [b], Matthew C. Sweet, BS [c], Danielle L. Katz, MPH [a], Diego J.L. Lima, MD [a], James D. Whaley, MD [c]

[a] Department of Orthopaedic Surgery, Cleveland Clinic Florida, Weston, FL, USA
[b] Department of Orthopaedic Surgery, Beaumont Health, Taylor, MI, USA
[c] Department of Orthopaedic Surgery, Wayne State University School of Medicine, Taylor, MI, USA

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Background: Preoperative opioid use has been correlated to suboptimal outcomes in orthopedic surgery. This study evaluated the effect of preoperative opioid use on outcomes after arthroscopic rotator cuff repair (RCR).
Methods: A retrospective review was performed of 79 patients who underwent arthroscopic RCR; of these, 31 with a history of preoperative opioid use were compared with a control group of 48 patients without a history of preoperative opioid use. Preoperative and postoperative patient-reported outcomes and functional scores were compared.
Results: Both cohorts significantly improved on all patient-reported shoulder scores; however, the nonopioid group demonstrated significantly better postoperative patient-reported outcome scores ($P = .015$) and external rotation measurement ($P = .008$). Functional outcomes also significantly improved from preoperatively to postoperatively for forward flexion, but no differences were seen between groups.
Conclusions: Patients with a history of preoperative opioid use can still achieve significant improvements in outcomes after arthroscopic RCR, although not to the same extent as opioid-naïve patients. Therefore, orthopedic surgeons must consider a patient's preoperative opioid use and temper expectations with regard to outcomes so that they are able to set realistic postoperative goals for patients undergoing RCR.

The opioid epidemic in the United States presents a challenge for all medical specialties, especially orthopedic surgery patients, who often require significant pain management after treatment of orthopedic injuries and surgical procedures. Not surprisingly, orthopedic surgeons are the third highest prescribers of opioid pain relievers (OPRs) in the United States.[10,14] Between 1999 and 2010, pharmaceutical sales of OPRs nearly quadrupled.[1] In 2014 alone, nearly 61% of all drug overdose deaths involved an opioid, most of which involved OPR prescriptions; notably, this statistic excludes death resulting from heroin overdose.[13]

This rise in opioid use presents several challenges in the postoperative management of orthopedic patients such that pain is successfully controlled while at the same time avoiding opioid tolerance and potential dependence.[3,6,7,10,15] Current literature suggests that preoperative opioid abuse in the orthopedic trauma population significantly increases the rate of inappropriate narcotic-seeking behavior by patients from multiple providers postoperatively ("doctor-shopping").[12] Ultimately, surgeons have the responsibility to manage pain while also avoiding opioid dependence in their patients. Thus, it is important for surgeons to understand the effect of opioid use on orthopedic patients to optimize surgical outcomes.

To date, opioid use has been correlated with suboptimal patient outcomes after total knee arthroplasty, reverse shoulder arthroplasty, and spine surgery.[8,9,11,15] Morris and colleagues[9-11] evaluated the effect of preoperative opioid use on patient outcomes after reverse shoulder arthroplasty and found that patients with a history of preoperative opioid use had lower preoperative baseline scores and did not achieve the same peak outcome scores as those without a history of preoperative opioid use.

To the best of our knowledge, no studies have investigated outcomes for patients undergoing arthroscopic repair of rotator cuff tears with a history of preoperative opioid use. The purpose of our study was to evaluate the effect of preoperative opioid use on outcomes after arthroscopic rotator cuff repair (RCR). We hypothesized that patients with a history of preoperative opioid use would

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* Corresponding author: Vani J. Sabesan, MD, Department of Orthopaedic Surgery, 2950 Cleveland Clinic Blvd, Weston, FL 33331, USA.
E-mail address: sabes001@gmail.com (V.J. Sabesan).

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demonstrate lower preoperative and postoperative patient-reported and functional outcome scores compared with opioid-naïve patients after RCR.

Materials and methods

Patient inclusion criteria and demographics

In this retrospective study, we identified and reviewed all arthroscopic RCR procedures performed from 2014 to 2016. All operations were performed by the same shoulder fellowship-trained orthopedic surgeon (V.J.S.). To eliminate potential confounding factors, we only included patients with a full-thickness tear repaired using an arthroscopic technique. Patients were excluded if they had a revision RCR, a massive irreparable rotator cuff tear, concomitant labral repair, or open procedure.

History of opioid use for any reason, except those that were previously excluded, was determined using a preoperative patient questionnaire completed by all patients at their first clinic appointment. Type of narcotic medication and dosages were recorded for 2 weeks before the date of surgery. The dosage of each drug was standardized to morphine milligram equivalents,[4] and every patient received a minimum of 1 prescription of 230 mg total morphine equivalents (for example, oxycodone/acetaminophen, 5/325 mg, every 6-8 hours per day) for a duration of no more than 10 days. Baseline patient characteristics assessed included age, body mass index, sex, follow-up duration, and comorbidities, including diabetes, smoking status, morbid obesity, hypertension, and depression. Shoulder function was evaluated preoperatively and at the final follow-up visit. All patients included in this study were stratified into 2 cohorts: those with preoperative opioid use (OU) and those who had no opioid use (NOU) preoperatively.

Surgical technique and postoperative rehabilitation

All patients received standard of care general endotracheal anesthesia and multimodal pain management. Patients received a RCR with a preferred repair technique consisting of a single-row or double-row transosseous-equivalent type repair (Arthrex, Inc., Naples, FL, USA) based on the indicated tear size and characteristics.

Patients were placed in a shoulder immobilizer for the first few days after surgery and performed pendulum exercises and passive/active assist exercises for the first 6 weeks, limiting external rotation. After this point, they progressed to full active range of motion and a graduated strengthening program.

Assessment of outcomes

Patient-reported outcome data evaluated preoperatively and at the most recent patient follow-up included the visual analog scale for pain, Penn Shoulder Score, American Shoulder and Elbow Surgeons (ASES) Standardized Shoulder Assessment Form, and Subjective Shoulder Value.[5] Functional outcome data included range of motion, forward flexion, abduction, and external rotation. Patients were examined preoperatively and postoperatively at 6 weeks, 3, 6, and 12 months, and then annually.

Statistical analysis

A power analysis was calculated for NOU and OU, using cohorts based on a 7-point difference in postoperative ASES scores, and to have a power of 80% and an α of 0.05, at least 31 patients were needed in each group.

Independent sample *t* tests were used to compare demographic and outcomes scores between the 2 groups. Paired sample *t* tests were used to compare the improvement in outcomes within the NOU and OU groups, and χ^2 tests were performed to determine whether significant differences existed between subgroups for comorbidities and other demographic differences. All statistical analyses were performed using SPSS Statistics for Macintosh 24.0 (IBM, Armonk, NY, USA). A *P* value of ≤.05 was considered statistically significant for all tests.

Table I
Comparison of patient demographics and clinical characteristics

Variable	Nonopioid group (n = 48)	Opioid group (n = 31)	*P* value
Sex			
Male	34 (71)	17 (55)	
Female	14 (29)	14 (45)	
Medicaid	28 (58)	19 (61)	.819
Non-Medicaid	20 (42)	12 (39)	
Age at surgery, yr	49.5 ± 9.7	54.6 ± 9.1	.033
Follow-up, mo	6.3 ± 3.6	6.6 ± 3.5	.751
BMI, kg/m^2	29.6 ± 5.5	27.2 ± 6.9	.247
Diabetes	8 (16.7)	3 (9.7)	.513
Active smoking	13 (27.1)	11 (35.5)	.461
Morbid obesity	2 (4.2)	0 (0)	.517
Hypertension	20 (41.7)	14 (45.2)	.818
Depression	3 (6.3)	4 (12.9)	.424

BMI, body mass index.
Data are presented as number of patients (%) within the group or as the mean ± standard deviation for all patients.

Results

The study included 79 patients. There were 48 patients in NOU group and 31 in the OU group, with similar average follow-up duration of 6.4 ± 3.6 months ($P = .751$). These 2 groups differed in average age (NOU: 49.5 years; OU: 54.6 years; $P = .033$). The top prescribed narcotic medications included oxycodone, hydrocodone, and hydromorphone.

A comparison of the 2 groups found no statistically significant differences in demographic data, including, body mass index, insurance type (Medicaid or non-Medicaid), diabetes, smoking status, morbid obesity, hypertension, and depression (Table I). No significant differences were found between the OU and NOU groups in baseline patient-reported outcome scores or range of motion measurements (Table II).

Both groups significantly improved on all the patient-reported outcome scores from the preoperative to postoperative assessment (Table III). The NOU cohort had significantly better final postoperative patient-reported scores for ASES ($P < .001$), visual analog scale for pain ($P < .001$), Penn Shoulder Score ($P = .001$), and Subjective Shoulder Value ($P = .015$; Table IV). Both cohorts also significantly improved in forward flexion (NOU: $P \leq .001$; NO: $P = .047$; Table III). At the final postoperative analysis for range of motion measurements, only external rotation showed a statistically significant difference between the 2 cohorts ($P = .008$; Table IV).

Table II
Comparison of baseline preoperative patient-reported and functional outcome scores

Variable	Nonopioid group	Opioid group	*P* value
ASES	38.4 ± 19.6	32.6 ± 20.2	.233
VAS for pain	5.3 ± 2.7	5.9 ± 2.8	.439
PSS	31.9 ± 17.1	28.2 ± 17.4	.393
SSV	27.4 ± 22.7	38.2 ± 25	.143
Active range of motion			
Forward flexion, °	126 ± 45	136 ± 46	.359
Abduction, °	115 ± 58	141 ± 47	.096
External rotation, °	48 ± 31	51 ± 33	.681

ASES, American Shoulder and Elbow Surgeons score; *VAS*, visual analog scale; *PSS*, Penn Shoulder Score; *SSV*, Subjective Shoulder Value.
Mean data are presented for all patients.

Table III
Comparison of patient-reported shoulder outcome scores and functional outcome measurements based on preoperative opioid usage

Variable	Nonopioid group			Opioid group		
	Preoperative	Postoperative	*P* value	Preoperative	Postoperative	*P* value
ASES	38.8 ± 20.0	73.2 ± 21.1	<.001	34.1 ± 19.8	45.2 ± 22.4	.012
PSS	31.9 ± 17.4	70.5 ± 22.1	<.001	29.9 ± 17.7	47 ± 23.6	<.001
VAS for pain	5.28 ± 2.8	1.55 ± 2.1	<.001	5.6 ± 2.8	4.2 ± 3	.031
SSV	35.2 ± 23.1	75.8 ± 20.7	<.001	35.2 ± 24.6	60.8 ± 26.5	.005
Active range of motion						
Forward flexion, °	125 ± 45	162 ± 31	<.001	136 ± 46	154 ± 39	.047
Abduction, °	117 ± 62	145 ± 41	.166	145 ± 49	140 ± 44	.803
External rotation, °	49 ± 30	54 ± 22	.446	54 ± 34	34 ± 22	.020

ASES, American Shoulder and Elbow Surgeons Score; *PSS*, Penn Shoulder Score; *VAS*, visual analog scale; *SSV*, Subjective Shoulder Value.
Data are presented as the mean ± standard deviation for all patients.

Discussion

Preoperative opioid use has been associated with suboptimal outcomes for total knee arthroplasty, reverse shoulder arthroplasty, and spine surgery.[9,11,15] Our investigation is the first to demonstrate the effect of preoperative opioid use on patient outcomes after arthroscopic RCR. Consistent with our hypothesis, preoperative opioid use was associated with significantly lower postoperative patient-reported outcomes and higher postoperative pain scores in patients undergoing arthroscopic RCR.[2]

Consistent with previous studies on reverse and total shoulder arthroplasty, both groups significantly improved from preoperative to postoperative outcome scores, but the NO group had significantly better absolute postoperative outcome scores.[9,11] In addition, no differences were seen in functional improvement between groups which was surprising but consistent with a previous study of anatomic total shoulder arthroplasty outcomes.[11] Overall, patients with a history of preoperative opioid use can expect to achieve significant improvements in patient-reported outcomes after arthroscopic RCR but should not expect to achieve the same peak outcome scores as patients who are not using opioids preoperatively.

Our study had a number of strengths, including our matched cohorts, which increased our ability to address confounding variables that may have biased the outcome scores. In addition, all operations were performed by the same surgeon using a standardized surgical technique and postoperative rehabilitation protocol. A greater understanding of the effects of preoperative opioid use on outcomes after arthroscopic RCR is important addition to the literature for an extremely common procedure and now an increasingly common challenge facing orthopedic surgeons. This information could improve physician intervention and counseling of those patients already taking chronic opioids as well as help surgeons set realistic expectations for patients regarding their postoperative prognosis.

Our study has several limitations. The first is that all of the patients included in our study were confirmed to have had opioid prescriptions filled more than 1 month before surgery; unfortunately, the exact opioid usage was not available. The correlation between opioid usage and outcomes was not the primary objective of our study, and further research is needed to understand this relationship. We did focus on preoperative use as it relates to risk factors affecting outcomes in our study.

Another limitation is that although the differences between groups for most of the demographic variables collected were not statistically significant, there was a significant difference in average age.

In addition, the sample size was small, and we did not specifically look at factors such as socioeconomic status or additional comorbidities that may have contributed to preoperative narcotic use.

Table IV
Comparison of final postoperative patient-reported and functional outcome scores

Variable	Nonopioid group	Opioid group	*P* value
ASES	71.5 ± 22.1	45.8 ± 22.4	<.001
VAS for pain	1.7 ± 2.2	4.3 ± 2.9	<.001
PSS	68.6 ± 23.4	47.2 ± 24.1	.001
SSV	76.3 ± 19.2	61.2 ± 26	.015
Active range of motion			
Forward flexion, °	162 ± 31.2	151 ± 39.3	.191
Abduction, °	153 ± 37.1	147 ± 42	.631
External rotation, °	52 ± 22.5	36 ± 23	.008

ASES, American Shoulder and Elbow Surgeons; *VAS*, visual analog scale; *PSS*, Penn Shoulder Score; *SSV*, Subjective Shoulder Value.
Mean data for all patients.

Conclusion

Patients with a history of preoperative opioid use can still achieve significant improvements in outcomes after arthroscopic RCR. However, these patients should not expect to attain the same degree of improvement as patients without a history of preoperative opioid use. Therefore, it may be useful for orthopedic surgeons to consider a patient's preoperative opioid status before any discussion regarding prognosis. This will enable them to temper expectations about outcomes and to set realistic postoperative goals for those patients who are already taking opioids and are planning to undergo RCR.

Disclaimer

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References

1. Centers for Disease Control and Prevention (CDC). Vital signs: overdoses of prescription opioid pain relievers—United States, 1999-2008. MMWR Morb Mortal Wkly Rep 2011;60:1487-92.
2. Cuff DJ, O'Brien KC, Pupello DR, Santoni BG. Evaluation of factors affecting acute postoperative pain levels after arthroscopic rotator cuff repair. Arthroscopy 2016;32:1231-6. http://dx.doi.org/10.1016/j.arthro.2015.12.021
3. Fisher DA, Dierckman B, Watts MR, Davis K. Looks good but feels bad: factors that contribute to poor results after total knee arthroplasty. J Arthroplasty 2007;22(Suppl. 2):39-42. http://dx.doi.org/10.1016/j.arth.2007.04.011
4. Gammaitoni AR, Fine P, Alvarez N, McPherson ML, Bergmark S. Clinical application of opioid equianalgesic data. Clin J Pain 2003;19:286-97.

5. Gilbart MK, Gerber C. Comparison of the subjective shoulder value and the Constant score. J Shoulder Elbow Surg 2007;16:717-21. http://dx.doi.org/10.1016/j.jse.2007.02.123
6. Kidner CL, Mayer TG, Gatchel RJ. Higher opioid doses predict poorer functional outcome in patients with chronic disabling occupational musculoskeletal disorders. J Bone Joint Surg Am 2009;91:919-27. http://dx.doi.org/10.2106/jbjs.h.00286
7. Lawrence JT, London N, Bohlman HH, Chin KR. Preoperative narcotic use as a predictor of clinical outcome: results following anterior cervical arthrodesis. Spine 2008;33:2074-8. http://dx.doi.org/10.1097/BRS.0b013e3181809f07
8. Lee D, Armaghani S, Archer KR, Bible J, Shau D, Kay H, et al. Preoperative opioid use as a predictor of adverse postoperative self-reported outcomes in patients undergoing spine surgery. J Bone Joint Surg Am 2014;96:e89. http://dx.doi.org/10.2106/jbjs.m.00865
9. Morris BJ, Laughlin MS, Elkousy HA, Gartsman GM, Edwards TB. Preoperative opioid use and outcomes after reverse shoulder arthroplasty. J Shoulder Elbow Surg 2015;24:11-6. http://dx.doi.org/10.1016/j.jse.2014.05.002
10. Morris BJ, Mir HR. The opioid epidemic: impact on orthopaedic surgery. J Am Acad Orthop Surg 2015;23:267-71. http://dx.doi.org/10.5435/jaaos-d-14-00163
11. Morris BJ, Sciascia AD, Jacobs CA, Edwards TB. Preoperative opioid use associated with worse outcomes after anatomic shoulder arthroplasty. J Shoulder Elbow Surg 2016;25:619-23. http://dx.doi.org/10.1016/j.jse.2015.09.017
12. Morris BJ, Zumsteg JW, Archer KR, Cash B, Mir HR. Narcotic use and postoperative doctor shopping in the orthopaedic trauma population. J Bone Joint Surg Am 2014;96:1257-62. http://dx.doi.org/10.2106/jbjs.m.01114
13. Rudd RA, Aleshire N, Zibbell JE, Gladden RM. Increases in drug and opioid overdose deaths—United States, 2000-2014. MMWR Morb Mortal Wkly Rep 2016;64:1378-82. http://dx.doi.org/10.15585/mmwr.mm6450a3
14. Volkow ND, McLellan TA, Cotto JH, Karithanom M, Weiss SR. Characteristics of opioid prescriptions in 2009. JAMA 2011;305:1299-301. http://dx.doi.org/10.1001/jama.2011.401
15. Zywiel MG, Stroh DA, Lee SY, Bonutti PM, Mont MA. Chronic opioid use prior to total knee arthroplasty. J Bone Joint Surg Am 2011;93:1988-93. http://dx.doi.org/10.2106/jbjs.j.01473