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

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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.

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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. Between 1999 and 2010, pharmaceutical sales of OPRs nearly quadrupled. 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.

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. 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”). 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. Morris and colleagues 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...
demonstrate lower preoperative and postoperative patient-reported and functional outcome scores compared with opioid-naive 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, 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. 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 $\alpha$ 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 $\chi^2$ 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 $\leq 0.05$ was considered statistically significant for all tests.

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 $6.4 \pm 3.6$ 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 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 | $49.5 \pm 9.7$ | $54.6 \pm 9.1$ | .033 |
| Follow-up, mo | $6.3 \pm 3.6$ | $6.6 \pm 3.5$ | .751 |
| BMI, kg/m² | $29.6 \pm 4.5$ | $27.2 \pm 6.9$ | .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 |

| Table II | Comparison of baseline preoperative patient-reported and functional outcome scores |
|---------|---------------------------------------------------------------|
| Variable | Nonopioid group | Opioid group | $P$ value |
| ASES | $38.4 \pm 19.6$ | $32.6 \pm 20.2$ | .233 |
| VAS for pain | $5.3 \pm 2.7$ | $5.9 \pm 2.8$ | .439 |
| PSS | $31.9 \pm 17.1$ | $28.2 \pm 17.4$ | .393 |
| SSV | $274.2 \pm 22.7$ | $382.2 \pm 25$ | .143 |
| Active range of motion | | | |
| Forward flexion, ° | $126 \pm 45$ | $136 \pm 46$ | .359 |
| Abduction, ° | $115 \pm 58$ | $141 \pm 47$ | .096 |
| External rotation, ° | $48 \pm 31$ | $51 \pm 33$ | .681 |

ASES, American Shoulder and Elbow Surgeons score; VAS, visual analog scale; PSS, Penn Shoulder Score; SSV, Subjective Shoulder Value.

Mean data are presented as number of patients (%) within the group or as the mean ± standard deviation for all patients.
Comparison of patient-reported shoulder outcome scores and functional outcome measurements based on preoperative opioid usage

| Variable | Nonopioid group | Opioid group | P value |
|----------|-----------------|--------------|---------|
| ASES     | Preoperative    | Postoperative|         |
|          | 38.8 ± 20.0     | 73.2 ± 21.1  | <.001   |
| PSS      | 31.9 ± 17.4     | 70.5 ± 22.1  | <.001   |
| VAS for pain | 5.28 ± 2.8   | 1.55 ± 2.1   | <.001   |
| SSV      | 35.2 ± 23.1     | 75.8 ± 20.7  | <.001   |

Active range of motion

| Forward flexion, ° | Preoperative | Postoperative | P value |
|-------------------|--------------|---------------|---------|
| 125 ± 45          | 162 ± 31     | <.001         |
| Abduction, °      | 117 ± 62     | 145 ± 41      | .166    |
| External rotation, ° | 49 ± 30     | 54 ± 22       | .446    |

Discussion

Preoperative opioid use has been associated with suboptimal outcomes for total knee arthroplasty, reverse shoulder arthroplasty, and spine surgery. 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.

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. 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. 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.

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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