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The perioperative effects of chronic preoperative opioid use on shoulder arthroplasty outcomes

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Hypothesis and background: Chronic opioid therapy is an increasingly used modality for the treatment of osteoarthritis-associated pain. We hypothesized that chronic opioid use would be associated with adverse outcomes in shoulder arthroplasty.

Methods: A retrospective analysis of patients undergoing elective anatomic total shoulder arthroplasty (TSA) and reverse total shoulder arthroplasty (rTSA) at a single institution from 2012-2015 was performed. Patients were stratified by preoperative opioid use (nonusers, short-acting opioid users, and long-acting opioid users), and their postoperative clinical outcomes were assessed.

Results: We identified 262 patients (170 rTSA and 92 anatomic TSA), of whom 138 were using opioids preoperatively (82% short acting and 18% long acting). When non-opioid users, short-acting opioid users, and long-acting opioid users were compared, mean total milligrams of morphine equivalents administered during postoperative hospitalization was significantly higher for those with preoperative opioid use (66.9 mg, 111.4 mg, and 208.3 mg, respectively; $P < .001$). In addition, postoperative visual analog scale pain scores were higher on postoperative day 0 (2.6, 3.2, and 3.9, respectively; $P = .007$), day 1 (4.0, 4.9, and 6.0, respectively; $P < .001$), and day 2 (3.0, 3.9, and 5.1, respectively; $P < .001$). Opioid use was not associated with a significantly increased hospital length of stay, complications, or readmission rates. For patients who completed 2-year follow-up, both the opioid user and non–opioid user groups demonstrated similarly improved postoperative American Shoulder and Elbow Surgeons shoulder scores.

Conclusion: A preoperative history of opioid use before shoulder arthroplasty was associated with significantly higher perioperative opioid consumption and visual analog scale scores. However, unlike in patients undergoing total knee or hip arthroplasty, preoperative opioid use was not associated with increased hospital length of stay, perioperative complications, or 90-day readmission rates for shoulder arthroplasty.

Level of evidence: Level III; Retrospective Cohort Design; Treatment Study

Keywords: Total shoulder arthroplasty; reverse total shoulder arthroplasty; opioid use; chronic pain; perioperative outcomes; opioid dependence; complications

Chronic opioid therapy has become an increasingly used modality for the treatment of osteoarthritic joint pain. However, concerns of opioid dependence and abuse have brought about a national spotlight on the so-called opioid epidemic.[5,17] The Centers for Disease Control and Prevention reported that 47,055 drug overdose deaths occurred in the United States in 2014, with opioid-related deaths increasing to 9 deaths per

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100,000.[20] The national concern has led the Centers for Disease Control and Prevention to issue guidelines with intentions to improve communication between clinicians and patients about the risks and benefits of opioid therapy for chronic pain; improve the safety and effectiveness of pain treatment; and reduce the risks associated with long-term opioid therapy, including opioid use disorder, overdose, and death.[8]

From a physiological standpoint, chronic pain and the use of opioids over an extended period are associated with significant changes in the patient's nervous system. These changes include increased μ-opioid receptors, increased central sensitization, and an increased incidence of anxiety and/or depression that can lead to opioid tolerance and hyperalgesia, which can negatively affect activities of daily living, coping, and rehabilitation.[7,19,22,24] Chu et al[6] used a prospective trial with oral morphine therapy to identify that only 1 month of opioid therapy can induce both opioid tolerance and opioid-induced hyperalgesia. Kidner et al[12] prospectively assessed patients with a chronic disabling occupational musculoskeletal disorder and found that chronic opioid use was a predictor for a less successful outcome, lower likelihood of weaning off opioids, lower rates of return to work, and higher rates of disability and health care utilization.

In previous studies of lower-extremity knee and hip arthroplasty, preoperative opioid use was suggestive of opioid tolerance and associated with poor analgesia, higher pain scores, and increased opioid consumption postoperatively. Furthermore, the poor level of analgesia was associated with limitations in ambulation that required a higher need for disposition to assisted care facilities rather than home. Preoperative use of opioids was also associated with an increased risk of complications within a 90-day postoperative period.[21] In a large veteran population, Ben-Ari et al[3] found that long-term opioid use in total knee arthroplasty was associated with an increased risk of revision (odds ratio, 1.76) within 1 year of implantation.

There is little existing literature evaluating the effects of preoperative opioid use on perioperative outcomes after shoulder arthroplasty. The purpose of this study was to evaluate the effects of preoperative opioid use on perioperative outcomes of total shoulder arthroplasty (TSA) and reverse total shoulder arthroplasty (rTSA) including inpatient opioid use, pain scores, length of inpatient stay, complications, and readmissions. We hypothesized that patients who used opioids preoperatively would have a level of opioid tolerance resulting in poor postoperative analgesia that could limit recovery and rehabilitation and increase the length of inpatient stay, need for disposition to assisted care facilities, and medical complications.

Methods

Patient selection and data collection

A retrospective review of a prospectively collected institutional clinical database of patients undergoing anatomic TSA or rTSA between June 2012 and June 2015 was performed. The surgical procedures were performed by 1 of 3 sports medicine and shoulder fellowship-trained surgeons.

Patients' home medications at the time of admission for shoulder arthroplasty were reported by patients and confirmed by the anesthesia, orthopedic, and nursing staff prior to surgery. Medications that were not currently in use were flagged by the staff and subsequently removed. Patients were stratified by the presence of short-acting opioids (oral hydrocodone, oxycodone, hydromorphone, or morphine) or long-acting opioids (extended release morphine, extended release oxycodone, methadone, or fentanyl patch) among their home medications at the time of surgery. Patient demographic characteristics were determined from the electronic health record system, including American Society of Anesthesiologists (ASA) physical status classification, age, gender, and smoking status. Patient body mass index (BMI) was calculated from height and weight data and stratified by World Health Organization classification.

As per institutional protocol, standard postoperative analgesia medications during hospitalization included scheduled oral hydrocodone-acetaminophen, 10 mg/325 mg every 6 hours, with as-needed use of oral oxycodone, 5 to 10 mg, and intravenous hydromorphone, 0.2 to 0.8 mg, for breakthrough pain. During the inpatient stay, oral and intravenous opioid use was titrated according to the patients' needs and overall opioid consumption. Patients who were taking a long-acting preoperative opioid continued to receive their home dose of baseline opioid medication during their inpatient stay. Perioperative regional anesthesia for both TSA and rTSA patients included a single-shot interscalene block with 15 to 25 mL of 0.5% ropivacaine prior to surgery. Intraoperative anesthesia was performed with the patient under general anesthesia with an endotracheal tube or laryngeal mask airway.

Outcomes of interest were obtained from patients' electronic health records. Average morphine equivalents administered were calculated using the medication administration record and averaged by postoperative day (POD), which was defined as the number of calendar days elapsed between the timestamp of the patient's surgical procedure finishing and the timestamp of medication administration. Opioid use was converted to morphine equivalents according to the equianalgesic dose chart created by the National Pharmaceutical Council and Joint Commission on Accreditation of Healthcare Organizations.[16] Visual analog scale (VAS) scores for pain were collected preoperatively and on POD 0 through 3 and then averaged over these time points. The distance walked by POD 1 was ascertained from physical therapy charts using the longest distance walked in a single physical therapy session. The length of the inpatient stay, disposition placement (home vs rehabilitation center or skilled nursing facility), and readmission within 90 days were tracked. Patient-reported outcomes were assessed with the American Shoulder and Elbow Surgeons (ASES) shoulder score[1,13,27] obtained preoperatively and at the 6-week, 6-month, 1-year, and 2-year postoperative periods.

Statistical analysis

All statistical analyses were performed with the R package (version 3.0.3; R Foundation for Statistical Computing, Vienna, Austria, www.r-project.org). Descriptive statistics were calculated using the Pearson χ^2 analysis and Fisher exact test. Differences in continuous outcomes were assessed using the Student t test, analysis-of-variance F test, and Kruskal-Wallis test. Significance was assessed