

Prospective Evaluation of Opioid Consumption After Distal Radius Fracture Repair Surgery

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Abstract

Pain management and opioid consumption after distal radius fracture (DRF) open reduction and internal fixation (ORIF) are highly variable and poorly understood. To optimize postoperative opioid dosage and better understand opioid consumption patterns after DRF-ORIF, we conducted a prospective study with the hypothesis that opioid consumption would increase with worsening fracture classification and various patient demographics.

All patients who underwent DRF-ORIF were consecutively enrolled over a 6-month period. Information collected included patient demographics, fracture type, anesthesia type, amount and type of opioid prescribed, number of pills taken, reason for stopping, and adverse events. Statistical analysis was performed.

Ninety-eight patients (79 female, 19 male) were eligible for the study. Mean age was 58 years. Of the 98 patients, 45 received general anesthesia, and 53 received regional anesthesia with a single-shot peripheral nerve block. Mean opioid consumption (morphine equivalence) over a mean of 4.8 postoperative days (range, 0-16 days) was 58.5 mg (range, 0-280

mg). There were no significant differences in opioid consumption between the general and regional anesthesia groups. Mean opioid consumption for the 3 fracture-type groups (AO/OTA [Arbeitsgemeinschaft für Osteosynthesefragen/Orthopaedic Trauma Association] classification) was 57.7 mg (class A), 60.3 mg (class B), and 62.0 mg (class C). Demographic analysis revealed an inverse relationship between age and opioid use. Similarly, there was a trend toward more opioid consumption among self-pay and Medicaid patients.

Opioid consumption after DRF-ORIF was equivalent for general and regional anesthesia. A significant relationship was found between increasing age and decreasing opioid consumption. Worsening fracture classification and self-payment/Medicaid payment trended toward increasing opioid consumption. Mean overall opioid consumption (morphine equivalence) was 58.5 mg, or 14.6 pills of oxycodone/acetaminophen 5/325 mg. Surgeons should take these findings into account when optimizing opioid prescribing after DRF repair.

Over the past 2 decades, prescription opioid abuse in the United States has risen steadily.^{1,2} Although use of opioid analgesics in the US far exceeds use in other countries, US patients do not report less pain or more satisfaction with pain relief.³⁻⁵ Between 1999 and 2002, oxycodone prescriptions increased by 50%, fentanyl prescriptions by 150%, and morphine prescriptions by 60%.⁶ Furthermore, the Centers for Disease

Control and Prevention (CDC) reported in 2012 that, for every 100 people in the United States, US physicians wrote a mean of 82.5 opioid prescriptions and 37.6 benzodiazepine prescriptions; in total, US clinicians wrote 259 million opioid prescriptions in 2012, enough for every adult to have a bottle.⁷ The increase in prescription opioid abuse, not surprisingly, has paralleled a 124% increase in opioid overdose-related deaths.⁸ Cicero and

Authors' Disclosure Statement: The authors report no actual or potential conflict of interest in relation to this article.

Take-Home Points

- Prescription opioid abuse and overdose-related deaths are on the rise in the United States.
- Following Open Reduction Internal Fixation (ORIF) of a distal radius fracture (DRF), patients consumed an average of 14.6 opioid pills. We recommend prescribing no more than 15-20 opioid pills after DRF ORIF.
- There was no difference in opioid consumption between patients who underwent general anesthesia vs regional anesthesia.
- There was a significant trend towards less opioid consumption with increasing age.
- There was a trend towards increased opioid consumption in patients with worsening fracture type as well as in self-pay/Medicaid patients.

colleagues^{2,9} recently found that, over the past 50 years, heroin use has dramatically shifted from being a problem mainly of urban centers and minorities toward one of older, suburban Caucasians with a previous history of prescription pain killer abuse. Deaths from prescription opioid overdoses now exceed deaths from heroin and cocaine overdoses combined.¹⁰ According to the CDC, emergency department visits related to nonmedical use of prescription opioid medications jumped 111% between 2004 and 2008.¹¹

Opioid analgesics are often prescribed for the management of musculoskeletal pain and injuries.¹²⁻¹⁶ Orthopedic surgeons, who prescribe more opioids than physicians in any other surgical field, represent the third largest group of opioid prescribers, trailing only primary care physicians and internists, who far outnumber them.¹⁷ A study focused on opioid consumption after upper extremity surgery found that upper extremity surgeons tended to overpre-

scribe opioids for postoperative analgesia.¹⁸ Many patients saved their remaining medication for later use and were never instructed on proper disposal. There is a developing consensus that opioid medication is not as safe and effective as once thought, and that a high-dose prescription or prolonged opioid therapy do not improve outcomes.¹⁹ In addition, patients may experience numerous opioid-associated adverse effects, including nausea, vomiting, constipation, lightheadedness, dizziness, blurred vision, headache, dry mouth, sweating, and itching.

In October 2012, patient satisfaction scores on the Hospital Consumer Assessment of Healthcare Providers and Systems started affecting Medicare reimbursements.²⁰ By 2017, up to 6% of Medicare reimbursement will be at risk, given the poor outcomes caused by uncontrolled pain.²¹⁻²⁴ The US healthcare culture has made it more important than ever for physicians to adequately manage postoperative pain while limiting opioid availability and the risk for abuse.

Distal radius fracture (DRF) open reduction and

internal fixation (ORIF) is commonly performed by orthopedic surgeons and hand surgeons. Pain management and opioid consumption after DRF repair may be influenced by several variables. We conducted a study to investigate the impact of several clinical variables on postoperative opioid use; to test the hypothesis that post-DRF-ORIF opioid consumption would increase with worsening fracture classification and certain patient demographics; and to seek postoperative opioid consumption insights that would facilitate optimization of future opioid prescribing.

Materials and Methods

Institutional Review Board approval was obtained before initiation of the study. All outpatients who underwent DRF-ORIF (performed by 9 hand surgery fellowship-trained orthopedic surgeons) were consecutively enrolled over a 6-month period in 2014. All procedures were performed with a standard volar plating technique through a flexor carpi radialis approach. The postoperative rehabilitation protocol was standardized for all patients. Data collected on each patient included age, sex, payer type, fracture type, opioid prescribed, amount prescribed, amount consumed, reasons for stopping, adverse events, and any postoperative adjunctive pain medications. The data were taken from questionnaires completed by patients at their first visit within 2 weeks after surgery. Anesthesia type (general or regional) was noted as well. All fractures were classified by Dr. O'Neil using the AO/OTA (Arbeitsgemeinschaft für Osteosynthesefragen/Orthopaedic Trauma Association) classification of long-bone fractures based on preoperative radiographs.

Amount of opioid analgesic consumed was converted into morphine equivalents to adjust for the different opioids prescribed after surgery: oxycodone/acetaminophen or oxycodone equivalent, hydrocodone/acetaminophen or hydrocodone equivalent, and acetaminophen/codeine.

Patients were excluded from the study if their procedure was performed on an inpatient basis, if they sustained other injuries or fractures from their trauma, or if an adjunctive procedure (including carpal tunnel release) was performed during the DRF repair.

We used the Spearman rank correlation coefficient and a count data model to examine the relationship between opioid use and age. The Kruskal-Wallis test was used to examine the relationships between opioid use and payer type, anesthesia type, and fracture type.

Table. Summary of Study Group

Mean age (range), y	58 (13-92)
Sex, n (%)	
Female	79 (80.6%)
Male	19 (19.4%)
Anesthesia type, n (%)	
Regional	53 (54.1%)
General	45 (45.9%)
Fracture type, n (%) ^a	
A	27 (27.6%)
B	8 (8.2%)
C	63 (64.3%)
Payer type, n (%)	
Private insurance	55 (56.1%)
Medicare	30 (30.6%)
Worker's compensation	10 (10.2%)
Self-pay/Medicaid	3 (3.1%)

^aAO/OTA (Arbeitsgemeinschaft für Osteosynthesefragen/Orthopaedic Trauma Association) classification.

Results

Of the 109 patients eligible for the study, 11 were excluded for incomplete postoperative questionnaires, leaving 98 patients (79 females, 19 males) for analysis. Mean age was 58 years (range, 13-92 years). Of the 98 patients, 45 received general anesthesia, and 53 received regional anesthesia with a single-shot peripheral nerve block before surgery and sedation perioperatively (Table). A single-shot supraclavicular nerve block (30 mL of 0.5% ropivacaine plus 5 mg of dexamethasone) was administered by a board-certified anesthesiologist. Mean opioid consumption (morphine equivalents) was 58.5 mg (range, 0-280 mg), roughly equivalent to 14.6 tabs of oxycodone/acetaminophen 5/325 mg. Sixty-seven patients (68.4%) consumed <75 mg of morphine equivalents, or <20 tabs of oxycodone/acetaminophen 5/325 mg. Mean duration of use was 4.8 days (range, 0-16 days) after surgery. There were no significant differences ($P = .74$) in opioid consumption between patients who received general anesthesia and patients who received regional anesthesia (Figure 1).

Of the 98 study patients, 61 reported using over-the-counter adjunctive pain medications during the postoperative period, and 37 reported no use. Mean opioid consumption was 64.7 mg of morphine equivalents for the adjunctive medication users and 48.3 mg for the nonusers ($P = .1947$).

Demographic analysis revealed an inverse relationship between age and opioid use (Figure 2). The Spearman ρ between age and opioid consumption was -0.2958 , which suggests decreased opioid use by older patients ($P = .003$). A count data model with negative binomial distribution suggested opioid consumption decreased by 1.72% per year of age (95% confidence interval, 0.35%-3.06%). Similarly, a relationship was found between opioid consumption and payer type (Figure 3), with consumption highest for self-pay and Medicaid patients ($P = .063$). However, this finding should be interpreted carefully, as it was underpowered—there were only 3 patients in the self-pay/Medicaid group.

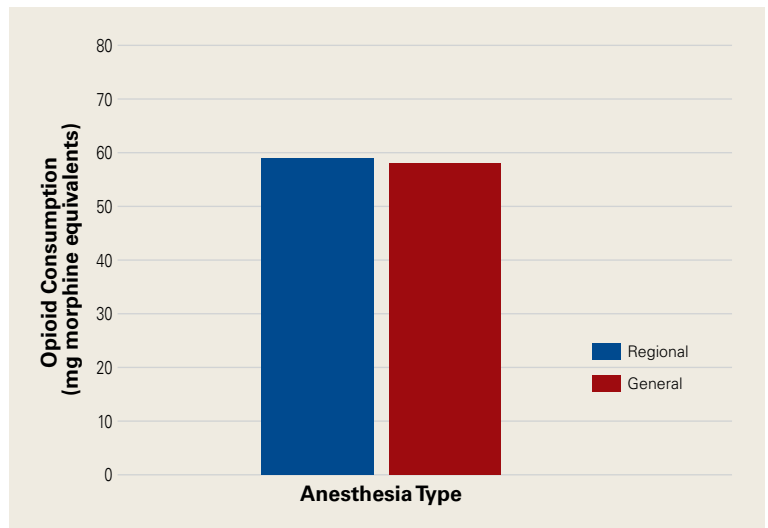


Figure 1. Opioid consumption (mg morphine equivalents) by anesthesia type (general, regional).

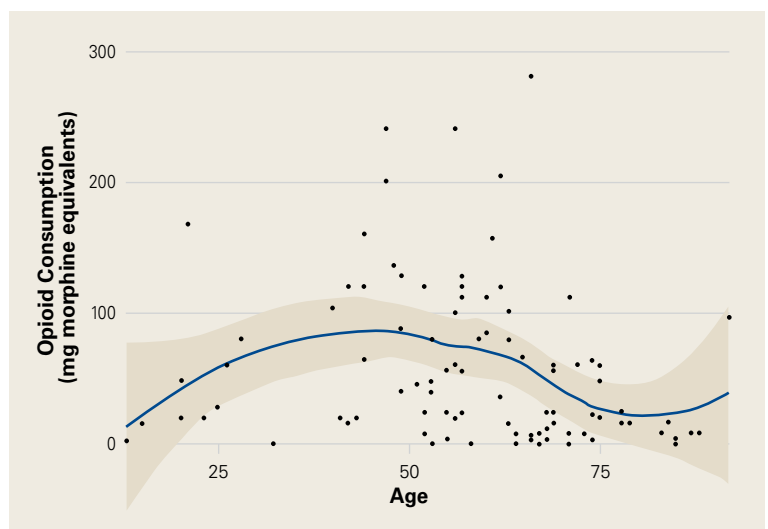


Figure 2. Opioid consumption (mg morphine equivalents) by age. There was a 1.72% decrease in opioid use per year of age ($P = .003$; 95% confidence interval, 0.35%-3.06%).

sumption was -0.2958 , which suggests decreased opioid use by older patients ($P = .003$). A count data model with negative binomial distribution suggested opioid consumption decreased by 1.72% per year of age (95% confidence interval, 0.35%-3.06%). Similarly, a relationship was found between opioid consumption and payer type (Figure 3), with consumption highest for self-pay and Medicaid patients ($P = .063$). However, this finding should be interpreted carefully, as it was underpowered—there were only 3 patients in the self-pay/Medicaid group.

All fractures were graded with the AO/OTA long-bone fracture classification system. Mean

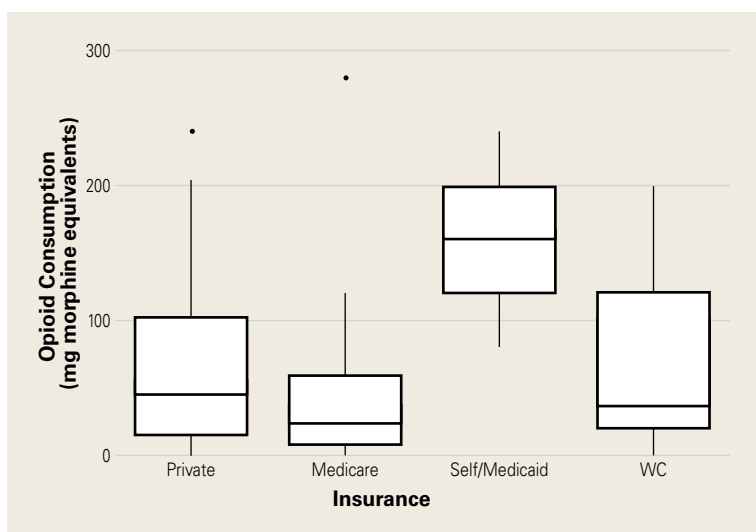


Figure 3. A box plot representing opioid consumption (mg morphine equivalents) by payer type (private insurance, Medicare, self-pay/Medicaid, worker’s compensation [WC]).

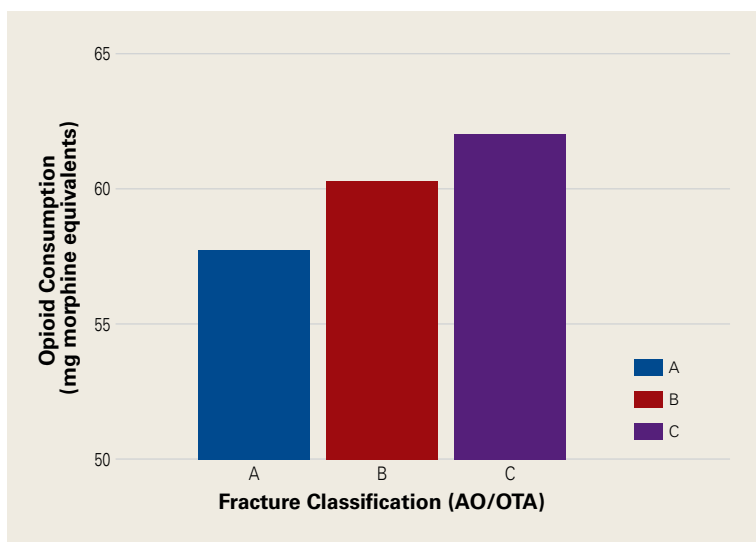


Figure 4. Opioid consumption (mg morphine equivalents) by fracture type (class A, B, C; AO/OTA [Arbeitsgemeinschaft für Osteosynthesefragen/Orthopaedic Trauma Association] classification).

opioid consumption for the 3 fracture-type groups was 57.7 mg (class A), 60.3 mg (class B), and 62.0 mg (class C) (**Figure 4**). Although the data demonstrate a trend toward increasing opioid consumption in patients who underwent fixation of complete intra-articular DRFs, as opposed to partial articular and extra-articular fractures, the difference was not significant ($P = .99$).

Discussion

The US healthcare culture has elevated physicians’ responsibility in adequately and aggressively

managing their patients’ pain experience. Moreover, reimbursement may be affected by patient satisfaction scores, which are partly predicated on pain control.²⁰⁻²⁴ However, as rates of opioid use and abuse rise, it is important that physicians prescribe such medications judiciously. This is particularly germane to orthopedic surgeons, who prescribe more opioid analgesics than surgeons in any other field.¹⁷ Rodgers and colleagues¹⁸ found upper extremity surgeons, in particular, tended to overprescribe postoperative opioid analgesics. In the present study, we sought to identify the crucial risk factors that influence post-DRF-ORIF pain management and opioid consumption.

Mean postoperative opioid consumption (morphine equivalents) was 58.5 mg, roughly equivalent to 14.6 tabs of oxycodone/acetaminophen 5/325 mg, an opioid analgesic commonly used during the acute postoperative period. In addition, almost 70% of our patients required <75 mg of morphine equivalents, or <20 tabs of oxycodone/acetaminophen 5/325 mg. For upper extremity surgeons, these numbers may be better guides in determining the most appropriate amount of opioid to prescribe after DRF repair.

As for predicting levels of postoperative opioid medication, there was a significant trend toward less consumption with increasing age. Given this finding, surgeons prescribing for elderly patients should expect less opioid use. Regarding payer type, there was a trend toward more opioid use by self-pay/Medicaid patients; however, there were only 3 patients in this group. The situation in the study by Rodgers and colleagues¹⁸ is similar: Their finding that Medicaid patients consumed more pain pills after surgery was underpowered (only 5 patients in the group).

In the orthopedic community, support for use of regional anesthesia has been widespread for several reasons, including the belief that it reduces postoperative pain and therefore should reduce postoperative opioid consumption.²⁵ However, we found no significant difference in postoperative opioid consumption between patients who received general anesthesia (with and without local anesthesia) and patients who received regional anesthesia (nerve block). Mean opioid consumption was 57.93 mg in the general anesthesia group and 58.98 mg in the regional anesthesia group. However, this finding could have been confounded by the variability in success and operator dependence inherent in regional anesthesia. In addition, the anatomical location for the peripheral nerve block and anesthet-

ic could have affected the efficacy of the block and played a role in postoperative opioid consumption.

In this study, we tested the hypothesis that there would be more postoperative opioid consumption with worsening fracture type. Although our results did not reach statistical significance, there was a trend toward increased opioid consumption in patients with a complete intra-articular fracture (AO/OTA class C) vs patients with a partial articular fracture (class B) or an extra-articular fracture (class A). In addition, patients with a partial articular fracture tended to use more postoperative opioids than patients with an extra-articular fracture. In short, postoperative opioid consumption tended to be higher with increasing articular involvement of the fracture.

This study was limited in that it relied on patient self-reporting. Given the social stigma attached to opioid use, patients may have underreported their postoperative opioid consumption, been affected by recall bias, or both. The study also did not control for preoperative opioid use or history of opioid or substance abuse. Chronic preoperative opioid consumption may have affected postoperative opioid use. Other patient-related factors, such as body mass index (BMI) and hepatorenal dysfunction, can create tremendous variability in opioid metabolism across a population. Such factors were not controlled for in this study and therefore may have affected its results. That could help explain why older patients, who are more likely to have lower BMI and less efficient organ function for opioid metabolism, had lower postoperative opioid consumption. In addition, although we excluded patients with concomitant injuries and procedures, we did not screen patients for concomitant complex regional pain syndrome, fibromyalgia, or other medical conditions that might have had a significant impact on postoperative pain management needs. Last, some findings, such as the relationship between opioid use and payer type, were underpowered: Although self-pay/Medicaid patients had higher postoperative opioid consumption, they were few in number. The same was true of the Medicaid patients in the study by Rodgers and colleagues.¹⁸

Our results demonstrated that post-DRF-ORIF opioid consumption decreased with age and was independent of type of perioperative anesthesia. There was a trend toward more opioid consumption with both self- and Medicaid payment and worsening fracture classification. It has become more important than ever for orthopedic surgeons

to adequately manage postoperative pain while limiting opioid availability and the risk for abuse. Surgeons must remain aware of the variables in their patients' postoperative pain experience in order to better optimize prescribing patterns and provide a safe and effective postoperative pain regimen.

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This paper will be judged for the Resident Writer's Award.