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Characterization of Post-Operative Opioid Use Following Total Joint Arthroplasty

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ABSTRACT

Background: The purpose of our study is to examine post-operative opioid use in total hip arthroplasty (THA) and total knee arthroplasty (TKA) patients and describe factors associated with the need for refill prescriptions.
Methods: Using online prescription information, we calculated the number of filled prescriptions, total morphine equivalent dose (MED) and quantity of pills, and date of last opioid prescription (days) for 197 TKA and 186 THA patients. Patients were classified based on refill status. Opioid data were compared between TKA and THA patients. Relationships between comorbidities and refill status were examined.
Results: Number of prescriptions ($P < .001$), total quantity ($P < .001$) and MED ($P < .001$), and days on opioids ($P < .001$) were greater for TKA patients. TKA patients required more refills ($P < .001$) for a greater quantity of pills ($P = .007$). The presence of a comorbidity ($P = .003$) or anxiety/depression ($P = .004$) were correlated with refills for TKA patients only. A comorbidity increased the risk of refills by 3.1 times, while anxiety/depression had a 2.5 times greater risk of refills.
Conclusion: Compared to THA patients, TKA patients were twice as likely to require refill opioid prescriptions and were prescribed a greater total MED for a longer period of time post-operatively. Patients undergoing TKA who present with a comorbidity or are currently being treated for anxiety or depression are more likely to require a refill.

The use of opioids for the treatment of musculoskeletal pain has increased by 50% over the last 15 years [1], and, with this, concerns regarding both their efficacy [2,3] and the potential for developing chronic opioid use [4–6] have emerged. Prescription opioids are an integral part of acute post-operative pain management following joint replacement operations. Managing opioid use in arthroplasty patients can be challenging, as patients may be taking opioids prior to surgery to address related or unrelated painful conditions [7]. As such, determining post-operative opioid use in total joint replacement patients is imperative to establishing appropriate prescribing guidelines to address post-operative pain while preventing chronic use.

Identifying risk factors for chronic opioid use in arthroplasty patients has become a crucial area of research [8–10]. Prescription opioid use prior to surgery was shown to be a strong indicator of long-term use after total hip and knee replacement [8,9]. Additional risk factors included younger age, female gender, and the presence of comorbidities such as low back pain, diabetes, and depression [8,10]. Chronic use of opioids prior to arthroplasty was also associated with an increased risk of post-operative complications [11] and early revision operations [12]. While many patients who are taking opioids prior to surgery continue long-term use following surgery [9], the development of new chronic opioid use in opioid-naive joint replacement patients is not common [8,9]. Understanding opioid use in opioid-naive patients is critical to reducing excessive opioid use post-operatively.

Despite the widespread use of opioids for pain control in post-operative arthroplasty patients, data regarding specific prescribing patterns and use in opioid-naive patients during the recovery

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period are limited. Therefore, we sought to answer the following questions: (1) What is the postoperative opioid use rate for opioid-naïve patients undergoing total joint replacement?; (2) Does opioid use differ between total knee replacement and total hip replacement patients?; and (3) Are there factors which are associated with the need for refill opioid prescriptions following joint replacement?

Materials and Methods

Using our institutionally approved prospective database of joint replacement patients, we identified 547 patients who underwent primary joint replacement in our clinic between January 1, 2016 and March 1, 2017. Patients were excluded if they had another hip or knee arthroplasty within 6 months of the index procedure or if they underwent an additional operation for any reason during the first 90 days post-operatively. Bilateral arthroplasty procedures were identified for 34 patients and repeat procedures were identified for 31 patients in the early post-operative period. Electronic medical records were reviewed for the remaining 482 patients to determine their prescribing history. A preliminary review of prescribing information was undertaken to identify those patients considered "opioid-naïve," defined as no history of long-term opioid use, no opioid prescriptions within 1 year prior to surgery, and no history of narcotic dependence. This review revealed 55 patients with chronic opioid use, which we defined as greater than 6 continuous months of opioid use prior to surgery; 5 patients with a history of narcotic dependence; and 3 patients who refused narcotics following surgery. The remaining cohort included 419 opioid-naïve patients, 214 who had THA operations and 205 who had TKA operations.

Demographic data including age, gender, body mass index (BMI), and comorbidities were extracted from our database for each patient. The comorbidities included in the analysis were diabetes, hypertension, congestive heart failure, chronic lung conditions, current prescription to treat diagnosed depression/anxiety, and history of chronic pain conditions. These were chosen as they are the most commonly reported in our patient population. To better understand the role of comorbidities in opioid use, we further categorized patients based on presence or absence of any comorbidity, presence or absence of a pain-related comorbidity, and presence or absence of depression/anxiety, as defined by the current use of anti-anxiety or anti-depressant medications. Complete opioid data were obtained from each patient's prescription history in their medical record, including the drug name, date, dosage, and duration of each prescription. We utilized our state's (Massachusetts) online prescription monitoring program to confirm that the prescriptions identified for each patient were actually filled by the patient and that no patient obtained opioids from any other prescriber during the post-operative period. The system collects data on all opioid prescriptions filled by a patient, regardless of prescriber, for not only our state, but 20 additional states, allowing for a comprehensive assessment of opioid use in our patients.

The daily morphine equivalent dose (MED) for each prescription, along with the total MED for each patient for all prescriptions during the post-operative period, was calculated using an online conversion tool [13]. The number of filled prescriptions, number of unique opioids, time between each prescription, and the number of days from surgery of the last opioid prescription were determined for each patient. In addition, we calculated the total quantity of pills prescribed post-operatively, the average quantity and duration of all prescriptions, and the average daily quantity and MED for each patient. Patients were further categorized based on whether or not they obtained an opioid refill. For patients with more than one prescription, we also determined whether the quantity of pills at refill was increased compared to index prescription and whether the type of opioid at refill differed from index prescription.

Demographic and opioid data were summarized and presented separately for total hip arthroplasty (THA) and total knee arthroplasty (TKA) groups. Each dependent variable was averaged for both THA and TKA groups as a whole and separately within each group for patients with and without a refill prescription. Quantitative variables were expressed with a sample mean and standard deviation and examined for deviation from normality using the Shapiro-Wilk test. Independent t-tests were conducted for dependent variables that were normally distributed, and Mann-Whitney U-tests were conducted for those variables which were not normally distributed. Categorical variables were presented as percentages and examined using the chi-squared test of independence. To determine differences in opioid use between TKA and THA patients following surgery, comparisons were made between the 2 groups for both the overall group means and independently for the refill and no refill subgroups. Relationships between relevant comorbidities and the need for opioid refills were assessed using Spearman Rho correlation coefficients. To determine predictors for refill prescriptions of opioids, a stepwise multivariable logistic regression analysis was conducted separately for THA and TKA groups. Odds ratios and 95% confidence intervals (95% CIs) were calculated for all significant independent predictors. All statistical analyses were performed using IBM SPSS v.23.0 (IBM Corporation, Armonk, NY). The level of statistical significance was set at $P < .05$.

Results

The study cohort included 419 opioid-naive patients (199 men, 220 women) with an average age of 65.2 ± 10.7 years and average BMI of 30.1 ± 5.4. There were 205 TKA patients (95 men, 110 women) and 214 THA patients (104 men, 110 women). Descriptive data for each group are presented in Table 1. The TKA group was older ($P = .003$) and had a higher BMI ($P = .014$) compared to the THA group. Overall, more TKA patients presented with at least one comorbidity compared to THA patients (83.9% vs 74.3%, $P = .017$). Specifically, the surgical groups contained a similar percentage of patients presenting with obesity ($P = .23$), chronic lung disease ($P = .73$), pain comorbidity ($P = .17$), and anxiety/depression ($P = .19$); however, a greater number of TKA patients presented with hypertension ($P = .047$), diabetes ($P = .045$), and cardiac issues ($P = .013$). A check of the online prescription monitoring program revealed that 36 patients (8.6%; 28 THAs, 8 TKAs) did not fill a single opioid prescription during the post-operative period, a finding we confirmed with each patient. Pain control was achieved in these

Table 1
Demographic and Comorbidity Data.

Variable	Total Cohort (n = 419)	TKA (n = 205)	THA (n = 214)	*P*-Value
Age (y)	65.2 ± 10.7	67.0 ± 9.3	62.9 ± 11.5	**.003**[a]
Female gender	52.5% (220)	53.7% (110)	51.4% (110)	.696
BMI	30.1 ± 5.4	30.7 ± 5.6	29.5 ± 5.1	**.014**[a]
Obesity	40.8% (171)	43.9% (90)	37.9% (81)	.233
Hypertension	58.9% (247)	63.9% (131)	54.2% (116)	**.047**[a]
Cardiac	14.6% (61)	19.0% (39)	10.3% (22)	**.013**
Chronic lung disease	9.1% (38)	9.8% (20)	8.4% (18)	.734
Diabetes	9.5% (40)	12.7% (26)	6.5% (14)	**.045**[a]
Anxiety/depression	27.2% (114)	30.2% (62)	24.3% (52)	.188
Presence of any comorbidity	79.0% (331)	83.9% (172)	74.3% (159)	**.017**[a]
Presence of a pain comorbidity	9.1% (38)	11.2% (23)	7.0% (15)	.173

[a] Statistically significant difference between TKA and THA groups.