Opioid Prescribing Habits of Orthopedic Surgeons Following Total Hip Arthroplasty and Total Knee Arthroplasty: A Pilot Study

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ABSTRACT

Background: Adequate pain management is important in patients' recovery from total hip arthroplasty (THA) and total knee arthroplasty (TKA).

Objective: To determine whether risk factors for prolonged opioid use are considered when discharge prescriptions for postoperative pain are written following THA and TKA.

Methods: Opioid prescriptions written between June 14 and July 9, 2021, for patients who underwent THA or TKA were analyzed. Data were also collected on the patients' age, sex, type of surgery, type of anesthesia (regional or general), preoperative use of opioids, and preoperative use of antidepressants.

Results: Among the 59 patients included in the study, the most common prescriptions were for hydromorphone 2 mg (n = 15, 25%) and hydromorphone 1 mg (n = 15, 25%). At discharge, patients received a median of 400 morphine milligram equivalents (MMEs). There was no significant difference in the quantity of opioids (MMEs) prescribed at discharge in relation to surgery type (p = 0.63), sex (p = 0.44), preoperative antidepressant use (p = 0.22), or preoperative opioid use (p = 0.97). There also appeared to be no correlation between a patient's age and MMEs at discharge (p = 0.21; r^2 = 0.028). None of these variables could be used to predict which patients would receive more than 400 MMEs.

Conclusions: Patient-specific factors appeared not to be taken into consideration when opioids were prescribed for postoperative pain among patients who underwent THA or TKA.

Keywords: opioids, prescribing patterns, orthopedics, analgesia

RÉSUMÉ

Contexte : Une gestion adéquate de la douleur est importante pour le rétablissement des patients après une arthroplastie totale de la hanche (ATH) et une arthroplastie totale du genou (ATG).

Objectif : Déterminer si les facteurs de risque relatifs à l'utilisation prolongée d'opioïdes sont pris en compte lors de la rédaction d'ordonnances de congé pour douleurs postopératoires après une ATH et une ATG.

Méthodes : Les prescriptions d'opioïdes rédigées entre le 14 juin et le 9 juillet 2021 pour les patients ayant subi une ATH ou une ATG ont été analysées. Des données ont également été recueillies sur l'âge, le sexe, le type de chirurgie, le type d'anesthésie (locale ou générale), l'utilisation préopératoire d'opioïdes et l'utilisation préopératoire d'antidépresseurs.

Résultats : Parmi les 59 patients compris dans l'étude, les prescriptions les plus fréquentes étaient l'hydromorphone 2 mg (n = 15; 25 %) et l'hydromorphone 1 mg (n = 15; 25 %). Les patients recevaient une médiane de 400 équivalents milligrammes de morphine (MME) au moment du congé. Aucune différence significative quant à la quantité d'opioïdes (mesurée en MME) prescrits au moment du congé en fonction du type de chirurgie (p = 0,63), du sexe (p = 0,44), de l'utilisation préopératoire d'antidépresseurs (p = 0,22) ou de l'utilisation préopératoire d'opioïdes (p = 0,97) n'a été observée. Il ne semblait pas non plus y avoir de corrélation entre l'âge d'un patient et les MME au moment du congé (p = 0,21; r^2 = 0,028). Aucune de ces variables ne pouvait être utilisée pour prédire quels patients recevraient plus de 400 MME.

Conclusions : Les facteurs spécifiques au patient ne semblaient pas être pris en compte lors de la prescription d'opioïdes pour la douleur postopératoire chez les patients ayant subi une ATH ou une ATG.

Mots-clés : opioïdes, tendances en prescription, orthopédie, analgésie

INTRODUCTION

The 2 most frequently performed orthopedic surgeries in Canada are total hip arthroplasty (THA) and total knee arthroplasty (TKA). For both procedures, adequate pain management is important for patients' recovery and management of postoperative complications.[1-3] In the United States, it is estimated that hydrocodone–acetaminophen and oxycodone–acetaminophen make up 47.1% and 17.5%, respectively, of all opioid prescriptions written by orthopedic surgeons.[4] These proportions have been steadily decreasing in recent years as physicians switch to other forms of pain control; however given the ongoing opioid epidemic, understanding prescribing patterns remains informative.[5] Currently, the maximum recommended amount of opioids prescribed at discharge after TKA or THA is 400 morphine milligram equivalents (MMEs).[6] In Canada, data on opioid prescribing are very limited, and not much is known about the amounts of opioids that patients are receiving.

In Canada, the opioid-related death rate is roughly 7.8 per 100 000; however, the rate varies greatly across jurisdictions, from 2.2 per 100 000 in the Northwest Territories to 20.0 per 100 000 in British Columbia.[7] Among people who experience an opioid overdose, aggregate data from across Canada show that approximately 25% received their opioids solely from pharmaceutical sources (e.g., prescriptions), with extremes of approximately 0% in British Columbia and 93% in Nova Scotia.[7] This situation emphasizes the need for health care professionals to examine their prescribing habits and ideally tailor them to each individual patient.

Several risk factors should be considered with regard to opioid prescribing. Previous studies have shown that upward of 10% of opioid-naive patients who receive opioids in association with surgery will develop a dependence postoperatively, regardless of the type of surgery.[8-10] There are numerous factors that may predict opioid dependence in opioid-naive patients, including anxiety or depression, preoperative or perioperative opioid use, alcohol misuse, and a larger amount of opioids prescribed at discharg.[11,12] Further information on these risk factors, including potential mechanisms of dependence, can be found in a previously published article.[13]

The purposes of this study were to explore orthopedic surgeons' opioid-prescribing habits at the time of patient discharge after elective TKA or THA and to provide the groundwork for further studies into this topic.

METHODS

This study was approved, on May 11, 2021, by the Nova Scotia Health Research Ethics Board as a quality improvement project and as such was exempt from ethics review. Because there was no direct patient involvement in the study, patient consent was not required; prescribers were aware of the study and consented to involvement.

This prospective study included patients of all ages who underwent elective primary TKA or THA, with same-day admission, at the Halifax Infirmary between June 14, 2021, and July 9, 2021. Patients who underwent revision surgeries or surgery for treatment of fracture were excluded. Chart reviews were performed during the patients' admission for the surgery, and information was stored in a password-protected Excel spreadsheet file (Microsoft Corporation). Patient identifiers were removed to provide anonymity. Medication reconciliation orders at admission and discharge were examined to determine preoperative use of opioids and antidepressants, defined as any current opioid or antidepressant use, regardless of dosage and duration. Antidepressants were grouped by indication, as opposed to class, because these drugs can have various uses, including treatment of chronic pain. Anesthesia charts were used to determine perioperative anesthesia medications (either general or local, including nerve blocks and spinal anesthesia). Discharge prescriptions were obtained from either a physical version given to the patient or the Nova Scotia drug information system (for e-prescriptions). In this study, prescriptions were written primarily by orthopedic surgeons, but also by clinical associates or their residents. Barring complications, patients were discharged home within 24 hours of their surgery. All opioid doses were converted to standardized MMEs using conversions set by the National Pain Centre.[14]

Because this was a pilot project, and one of the first of its kind in Canada, there were insufficient data available to perform a sample size calculation; therefore, a convenience sample was used. Based on the presence of outliers and non-normal distribution, Prism software (GraphPad Software) was used to perform Mann-Whitney *U* tests, Spearman correlation, and relative risk (RR) calculations. Because of the small sample size, statistical significance for RR calculations was determined using Fisher exact tests. The WRS2 package in RStudio (v1.4.1106) was used to perform 2-way analysis of variance (ANOVA) for medians.[15]

RESULTS

A total of 59 patients (36 women and 23 men), with average age of 65.1 years (range 15.0–86.0 years), were included in the study. Overall, 31 patients underwent THA, 28 underwent TKA, and the median prescribed opioid dose was 400 MMEs (interquartile range 200–400 MMEs) (Figure 1A).

Of the 59 patients included in this study, 53 received a hydromorphone prescription, 4 received a morphine prescription, and 2 did not receive any opioid prescription at discharge. Of these medications, the 2 most common prescriptions were for hydromorphone 2 mg 1–2 tablets PO q4–6h PRN and hydromorphone 1 mg 1–4 tablets PO q3–6h PRN (Figure 1B). The number of tablets prescribed for each patient was highly variable, ranging from 0 to 120 tablets total (including refills), with 24 (41%) of the patients having a prescription for 40 tablets (Figure 1C). The amount of opioid prescribed at discharge was also highly variable, ranging from 0 to 1200 MMEs, with 23 (39%) of the patients receiving 400 MMEs (Figure 1D).

Once we had analyzed the baseline prescriptions, we next sought to determine whether there were differences within the individual parameters that had been measured. Initially, we were interested in whether there were any differences in MMEs prescribed for patients who underwent TKA relative to those who underwent THA; both groups of patients received a median of 400 MMEs at discharge ($p = 0.63$; Figure 2A). Men and women received the same median amount of opioids at discharge (400 MMEs for each sex, $p = 0.44$; Figure 2B). With stratification by age, using 65 years as the cutoff, patients received the same amount of opioids regardless of age group, with a median of 400 MMEs given to both groups ($p = 0.24$; Figure 2C). Furthermore, when linear regression was performed comparing patients' age with the size of their discharge opioid prescriptions, we

found no significant correlation between these variables ($r^2 = 0.028$, $p = 0.21$; Figure 2D). Patients who were taking opioids preoperatively received a median of 350 MMEs, whereas those who were opioid-naive received a median of 400 MMEs ($p = 0.97$; Figure 2E). Finally, for patients using antidepressant medications at the time of admission, a median of 400 MMEs was prescribed; the median prescription was also 400 MMEs for those who were not taking antidepressants ($p = 0.22$; Figure 2F).

To eliminate potential confounding associated with pooling surgery types, we stratified the parameters by surgery type and performed 2-way ANOVA with multiple comparisons, to determine sources of variation. This analysis revealed no statistically significant differences for any of the parameters measured, although there was a nearly statistically significant interaction between preoperative opioid use and surgery type ($p = 0.07$; data not shown).

Finally, we investigated whether any of the measured parameters could be used to predict which patients would receive prescriptions for more than the recommended limit of 400 MMEs. To that end, we calculated RRs for the various parameters and found that none were able to predict which patients would receive larger discharge prescriptions, although preoperative use of opioids and antidepressants were associated with statistically nonsignificant RRs of 1.42 and 1.24, respectively (Figure 2G).

DISCUSSION

In this small pilot study, we found no statistically or clinically significant differences in the amount of opioids prescribed to patients after THA and TKA, regardless of patients' risk factors for prolonged opioid use or uncontrolled pain. Parameters examined included age, sex, surgery type, anesthesia

A

Parameter	THA	TKA	Total
Patients, Total No.	31	28	59
Mean age, yrs (range)	63.7 (28.0-86.0)	66.7 (15.0-83.0)	65.1 (15.0-86.0)
Female, n (%)	19 (61.3)	17 (60.7)	36 (61.0)
Preoperative opioid use, n (%)	8 (25.8)	4 (14.3)	12 (20.3)
Anti-depressant use, n (%)	9 (29.0)	9 (32.1)	18 (30.5)
MMEs at discharge, median (IQR)	400 (200, 400)	400 (225, 415)	400 (200, 400)

B

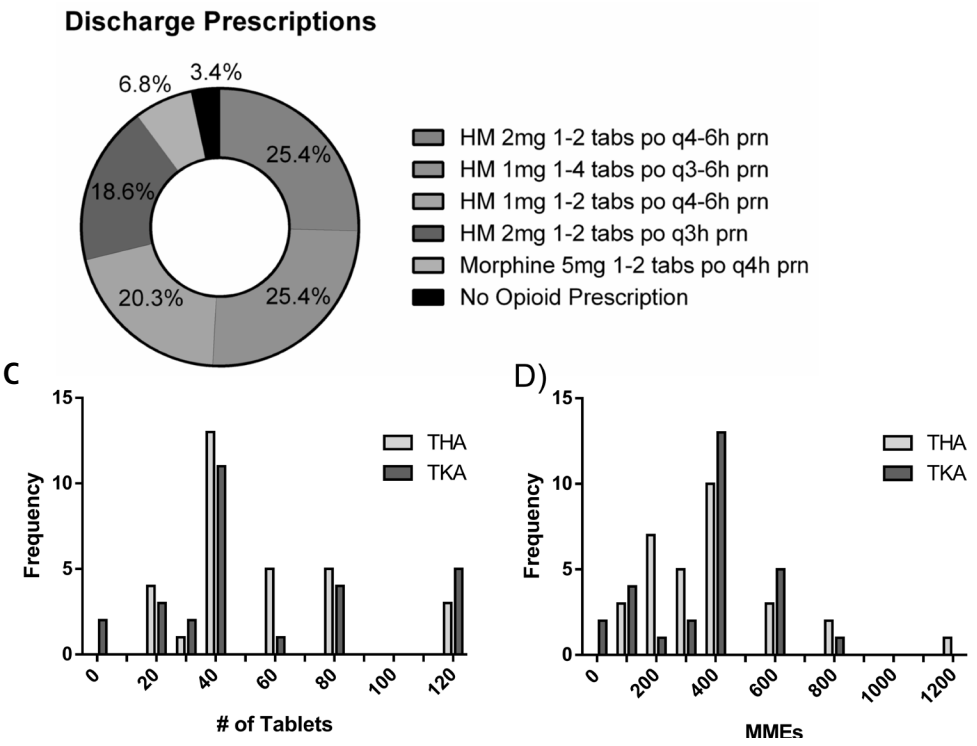
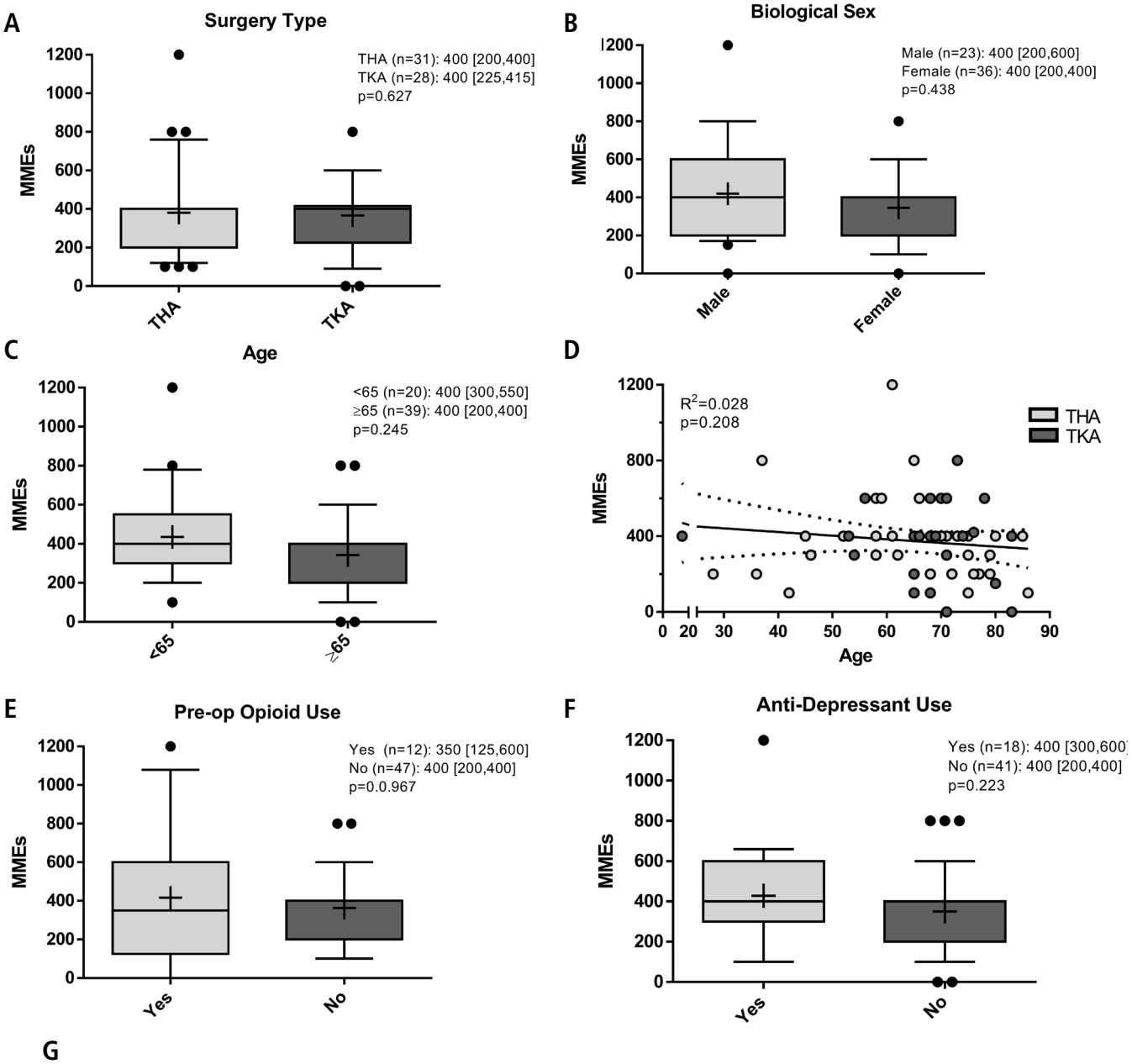


FIGURE 1. Discharge prescription characteristics. **A:** Demographic characteristics of study participants. **B:** The most common prescriptions and directions for administration (listed in descending order by percentage). **C:** Number of opioid tablets prescribed for patients at discharge. **D:** Distribution of opioid dosage (in terms of morphine milligram equivalents [MMEs]) prescribed at discharge. HM = hydromorphone, IQR = interquartile range, THA = total hip arthroplasty, TKA = total knee arthroplasty.

type, preoperative opioid use, and preoperative antidepressant use. When the data were further stratified by surgery type, we found that preoperative opioid use posed a potential source of variability within the data set, which suggests a possible correlation between this risk factor for prolonged use and uncontrolled pain, which might ultimately influence



G

Parameter	THA	TKA	Total
TKA Surgery			1.08 [0.82, 1.42]
Female Gender	1.06 [0.75, 1.49]	0.77 [0.47, 1.27]	0.92 [0.69, 1.23]
Pre-op Opioid Use	1.83 [0.90, 3.69]	1.00 [0.54, 1.84]	1.42 [0.87, 2.34]
Anti-Depressant Use	1.36 [0.84, 2.21]	1.78 [0.82, 3.82]	1.24 [0.87, 1.77]
General Anesthesia	1.12 [0.77, 1.64]	0.80 [0.56, 1.14]	0.92 [0.71, 1.21]

FIGURE 2. A–F: Univariate analyses (based on Mann-Whitney *U* tests) comparing opioid dosage (in terms of morphine milligram equivalents [MMEs]) at discharge in relation to the parameters measured in this study. In each box-and-whisker plot, the box represents the second and third quartiles, the whiskers represent the first and fourth quartiles, the plus sign represents the mean, and solid circles represent outliers. **G:** Risk ratios for receiving more than 400 MMEs of opioid therapy at discharge. Note: Throughout Figure 2, numeric values represent medians with interquartile ranges; THA = total hip arthroplasty, TKA = total knee arthroplasty.

prescribing habits. Furthermore, we found that none of these parameters could be used to determine which patients were at risk of receiving more than the recommended limit of 400 MMEs.

Numerous studies are in progress to determine the feasibility of opioid-sparing pain management systems. These interventions have been shown to reduce the MMEs per patient by about 50%–60% while maintaining patient satisfaction, and they have been associated with several other benefits, including promotion of the use of alternative methods of pain control, reduction in complication rates, and reduction in the amount of unused medication.[16-18] There may be some concerns that limiting the amount of opioids at discharge will lead patients to have their medication refilled more frequently to compensate. However, this does *not* seem to be the case, at least in the context of THA.[19] There is also evidence that preoperative opioid education can reduce, by as much as 50%, the amount of opioids used by patients who have undergone orthopedic surgery.[20]

Although this was a relatively small study, it represents one of the first Canadian reports of opioid prescribing habits following THA and TKA surgery and the first such study in Nova Scotia. Notably, of the 2 patients with no prescription of opioids at discharge, both had used opioids preoperatively and both underwent TKA surgery, leading to a larger amount of variability within the TKA group.

CONCLUSION

In this study population, patient-specific factors for prolonged opioid use or uncontrolled postoperative pain do not appear to have been taken into consideration when opioids were prescribed after THA or TKA surgery. The next step toward understanding the prescribing habits of orthopedic surgeons in Canada would be to repeat this study with a larger study sample.

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