The Knee xxx (2018) xxx–xxx

Contents lists available at ScienceDirect

The Knee

Preoperative opioid medication use negatively affect health related quality of life after total knee arthroplasty

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ARTICLE INFO

Article history:
Received 10 April 2018
Received in revised form 9 June 2018
Accepted 2 July 2018
Available online xxxx

Keywords:
Health related quality of life
Total knee arthroplasty
Patient reported outcomes
Preoperative opioid

ABSTRACT

Background: Opioids are commonly prescribed to treat patients suffering from painful knee arthritis. However, the opioid epidemic in the United States constitutes a major public health concern. This study aims to characterize the effect of preoperative opioid use on patient-reported outcome measures (PROMs) after total knee arthroplasty (TKA).
Methods: PROMs collected from patients undergoing TKA were reviewed. We identified two matched cohorts: (1) 30 patients who used opioids preoperatively and (2) 137 patients who did not use opioids preoperatively. The non-opioid cohort was carefully selected to match the opioid cohort. Statistical analyses were performed to determine the difference in demographics, PROMs, length of stay, disposition and co-morbidities between the two cohorts.
Results: The non-opioid users had significant improvement in both EuroQol5D (EQ-5D) PROMs and visual analogy scale (VAS) scores postoperatively ($p < 0.001$); however, preoperative opioid users did not show improvement in either measure. University of California Los Angles (UCLA) scores were significantly improved for both non-opioid users ($p < 0.001$) and opioid users ($p < 0.001$). Non-opioid users had higher preoperative EQ-5D scores than opioid users ($p = 0.02$). There was no difference in range of motion, length of stay, or disposition between cohorts.
Conclusion: Our results demonstrated that TKA patients with preoperative opioid use had significantly lower VAS scores and trends of lower UCLA and EQ-5D scores postoperatively compared to non-opioid patients, suggesting the use of opioid medications prior to TKA negatively affects patient reported outcomes following surgery. The current findings provide useful clinical information that can be used in counseling patients prior to undergoing TKA.

1. Introduction

Knee arthritis is a significant cause of pain and decreased mobility, which can contribute to a poor quality of life. Treatment modalities for knee arthritis include physical therapy, anti-inflammatory drugs, walking aids, knee braces, opioid pain medications, and surgical intervention. Prescription opioids have long been used for the treatment of knee arthritis and the number of patients taking opiates who present to orthopedic surgeons for knee replacement continues to increase. Prescription opioid abuse is a major public health crisis. In 2013, there were an estimated 1.9 million individuals who were dependent or abused opioid pain medication [1]. Furthermore, from 1999 to 2015, the Centers for Disease Control and Prevention (CDC) estimated that there were over 183,000 deaths in the United States related to prescription opioid use in 2014 [2, 3]. Bedard et al. reported on

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https://doi.org/10.1016/j.knee.2018.07.001
0968-0160/

patients using opioid pain medication within three months prior to total knee arthroplasty (TKA) during an eight-year period. Nearly one-third of their cohort used preoperative opioids and the percentage increased nine percent during the study period [4]. Wright et al. showed nearly 40% of patients with knee osteoarthritis received at least one opioid prescription in 2009. This percentage increased from 31% in 2003 [5].

Previous studies have shown worse outcomes in joint arthroplasty in patients who used opioids preoperatively. These studies have shown increased in-hospital complications, increased length of stay, prolonged narcotic use, and increased postoperative opioid consumption after total joint arthroplasty in patients who preoperatively used opioid pain medication [6–14]. However, there is a paucity of data regarding patient reported outcomes after total knee arthroplasty in patients who use opioid pain medication prior to surgery. Recently, Smith et al. showed preoperative opioid users had less pain relief using the Western Ontario and McMaster Universities Arthritis Index (WOMAC) pain score and the Pain Catastrophizing Scale [15]. To our knowledge, no study has compared the health-related quality of life (HRQoL) changes following TKA between opioid naïve patients and patients who use opioids preoperatively using the EuroQol5D (EQ-5D). The EQ-5D is a validated non-disease specific, preference-based, standardized instrument used to measure general health outcomes [16]. The purpose of this study was to compare the EQ-5D HRQoL measures after total knee arthroplasty in patients who used preoperative opioids vs. those who were opioid naïve.

2. Methods

2.1. Patients

Institutional review board (IRB) approval was obtained for a retrospective review of patients in our hospital medical registry who underwent TKA with completed EQ-5D index scores, visual analog scale (EQ VAS) general health scores, and University of California Los Angles (UCLA) activity scores. The charts of these patients were reviewed and cohorts were separated based on preoperative opioid use. To obtain information regarding opioid use, we reviewed the electronic medical record of each qualifying patient. The presence or absence of opioid medications documented in preoperative clinic visit notes, the primary care provider notes or medication lists was used to classify the patients. We identified two cohorts of patients: (1) 137 patients who did not use opioids preoperatively and (2) 30 patients who used opioids prior to TKA. The non-opioid cohort was carefully selected to match the opioid cohort utilizing selection criteria which were decided upon before data collection. During chart review, one of the study authors carefully selected matched control patients for each opioid patient, with age difference less than 10 years, same sex and body mass index (BMI) difference less than five kilograms per square meter. More than one matched control subject for the same opioid user was allowed. Patient outcomes were collected preoperatively at 184 [496] days (median, [interquartile range]) and 166 [531] days for users and non-users, respectively ($p = 0.67$), and postoperatively at 519 [222] days and 352 [251] days for users and non-users respectively ($p = 0.042$).

2.2. Power analysis

Prior to data collection, a statistical power analysis was performed for sample size estimation. Due to the lack of reports of the EQ-5D scores in the opioid user population, we relied on the study by Smith et al. [15], who compared another outcome variable WOMAC score at six-month follow-up between 36 preoperative opioid users and 120 non-users (mean ± standard deviation) (27.0 ± 4.3 vs. 33.6 ± 2.3, $p = 0.008$) with TKA. The effect size of this study was 1.91 (Cohen's d) and considered large according to Cohen's criteria [17]. Using their data, with an alpha = 0.05, power = 0.80 and the same sampling ratio, the projected sample size needed is approximately nine opioid users and 25 non-users. As a reference, the minimal clinically important difference is 0.16 for the EQ-5D score and 22 for the WOMAC score [18].

A statistical power analysis was performed for sample size estimation, based on published data from a similar study by Smith et al. that compared the changed WOMAC score from preoperative to six-month follow-up between 36 preoperative opioid users and 120 non-users (27.0 ± 4.3 vs. 33.6 ± 2.3, $p = 0.008$) who received TKA [15]. With an alpha = 0.05, power = 0.80 and the same sampling ratio, the projected sample size needed is approximately nine opioid users and 25 non-users. Thus, the proposed number of patients of our study was adequate for the main objective.

2.3. Statistical analysis

For statistical analysis, we compared demographic characteristics to ensure that we had selected matched cohorts. We performed unpaired two-tailed Student's t-test for continuous variables (Age, BMI, length of stay (LOS), range of motion (ROM)), and Pearson's Chi-Square test for categorical variables (Sex, Disposition, Charnley Class). We also compared clinical results to evaluate for an effect between opioid and non-opioid groups. For each patient-reported outcome measure (PROM), a generalized linear model was built to compare the main effects of changed PROM between preoperative opioid users and non-users. The model was adjusted for preoperative pain score to avoid potential confounding by the indication for opioid use and preoperative PROM and used the preoperative use of opioids as independent variables. PROMs including EQ5D index, VAS general health, and UCLA activity scores were collected. Statistical analysis was performed using the Statistical Package for the Social Sciences (SPSS) (version 19.0, SPSS Inc./IBM, Chicago, IL). Two-tailed values of $p < 0.05$ were considered statistically significant.

Please cite this article as: Manalo JPM, et al, Preoperative opioid medication use negatively affect health related quality of life after total knee arthroplasty, Knee (2018), https://doi.org/10.1016/j.knee.2018.07.001