The Knee 26 (2019) 1360–1363

Contents lists available at ScienceDirect

The Knee

Early post-operative opioid consumption: A comparison between medial unicompartmental, patellofemoral, and total knee arthroplasty

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ARTICLE INFO

Article history:
Received 29 May 2019
Accepted 25 June 2019

Keywords:
Unicompartmental knee arthroplasty
Opioid
Total knee arthroplasty

ABSTRACT

Background: While there is emerging literature describing the use of narcotics for post-operative pain control following TKA, little data is available regarding narcotic use in partial knee replacements. The aim of this study is to compare the early post-operative narcotic requirements after medial compartmental arthroplasty (UKA) and patellofemoral arthroplasty (PFA) with that of TKA.

Methods: In this retrospective chart review, we identified 37 patients who underwent PFA and 71 patients who underwent UKA. We identified a cohort of TKA patients who were matched to the unicompartmental group based on sex and age ($n = 108$). The primary outcome measure was self-reported use of opioids for pain management at the first post-operative clinic visit. Opioid use between groups was compared using Chi-square analysis.

Results: The PFA group was younger ($p < 0.001$) and consisted of more females ($p < 0.001$) than the UKA group. The UKA cohort had more non-smoking patients ($p = 0.044$) compared to the PFA cohort. Self-reported opioid use at the first post-operative visit differed between the three groups of patients ($p < 0.001$). A greater proportion of both PFA (38% vs. 11%; $p < 0.001$) and TKA (41% vs. 11%; $p = 0.01$) patients reported opioid use when compared to UKA patients. No differences in opioid use existed between TKA and PFA groups ($p = 0.61$).

Conclusion: The prevalence of PFA patients who report opioid use at the first post-operative visit is similar to that for patients following TKA, suggesting that pain management protocols for this specific subset of partial knee arthroplasty patients should be structured similar to TKA patients and separate from UKA patients.

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https://doi.org/10.1016/j.knee.2019.06.016
0968-0160/

1. Introduction

Symptomatic osteoarthritis (OA) of the knee is a pervasive and functionally disabling disease that is estimated to affect over 13 million adults in the United States [1]. While total knee arthroplasty (TKA) is considered the gold standard for patients with end-stage, controversy exists regarding the optimal treatment for patients with disease isolated to a single compartment (medial, lateral, or patellofemoral). In patients with single compartment knee OA, partial joint replacement procedures may be more appropriate as these procedures are associated with higher patient satisfaction and lower cost [2,3]. Moreover, with either medial or lateral unicompartmental knee arthroplasty (UKA) or patellofemoral knee arthroplasty (PFA), only the diseased portion of the joint is replaced, which preserves bone tissue in the event that a revision procedure is required. There are many studies reporting that patients who undergo UKA procedures report better pain and experience fewer complications when compared to TKA patients [2,4]. There is little information as to whether outcomes differ between patients undergoing UKA and patients undergoing PFA.

In recent efforts to limit opioid use following orthopedic procedures, post-operative pain and opioid consumption have been fairly well characterized in patients undergoing TKA [5,6] with factors such as age, sex, and the presence of certain comorbidities, being associated with prolonged use of opioids. There are far fewer studies that have examined pain management for patients undergoing UKA [7,8] and no studies have described post-operative pain and opioid utilization for patients undergoing PFA. Moreover, the differences in this regard between these two types of partial knee arthroplasties (UKA and PFA) are unknown. Given that poor postoperative pain management is associated with increased morbidity and longer recovery times [9–11], understanding differences in postoperative narcotic requirements between patients undergoing medial UKA and PFA is essential to develop appropriate post-operative management plans.

The primary objective of this retrospective cohort study was to determine if self-reported cessation of post-operative opioid usage differed between patients who underwent medial UKA and patients who underwent PFA. A secondary objective was to compare opioid use between the two partial groups (medial UKA, PFA) and a matched cohort of TKA patients. We hypothesized that the number of patients reporting continued opioid use at the first postoperative visit following surgery would be similar between PFA and medial UKA groups.

2. Material and methods

Using our institutionally approved database of joint replacement patients, we retrospectively identified all patients who underwent either unilateral medial UKA or PFA between 2011 and 2017 from one of two surgeons. Pain management protocols did not differ between the surgeons and were not altered during the study period. There were 35 patients who underwent 37 PFA procedures (five males, 30 females) and 65 patients who underwent 71 UKA procedures (39 males, 26 females). We matched these patients to a cohort of 108 patients who had undergone unilateral TKA during the same time period (48 males, 60 females) based on age and sex. The TKA cohort ($n = 108$) did not differ from the unicompartmental cohort ($n = 108$) in terms of age (62.5 ± 11.7 years vs. 62.9 ± 11.2 years; $p = 0.82$) or sex distribution (56% vs. 56%; $p = 1.00$).

Each patient's chart was manually reviewed by a member of the research team. Demographic data, including age, sex, and body mass index (BMI), were collected for each patient. Preoperative medical comorbidity data was also collected, including obesity, diabetes status, hypertension, coronary artery disease, lung disease, depression/anxiety, and smoking status. In addition, data regarding any postoperative complications and reoperations were recorded for each patient, as well as any preoperative opioid use. The primary outcome measure was self-reported use of opioids for pain management at the first post-operative clinic visit. Patients were asked what medications they were using for pain management and, specifically, if they were still taking any prescription pain medications. Statistical comparisons were made between the UKA group and the PFA group. Separate independent t-tests were conducted for dependent variables that were normally distributed, and Mann–Whitney U tests were conducted for variables which were not normally distributed. Categorical variables were compared through the chi-square test of independence. Additionally, for the primary variables of interest, comparisons were made between the three groups (UKA, PFA, and TKA) using one-way analysis of variance (ANOVA) or chi-square analyses, as appropriate. A Bonferroni correction was applied for all post-hoc comparisons. All statistical analyses were performed using IBM SPSS v.24.0 (IBM Corporation; Armonk, NY). The level of statistical significance was set at $p < 0.05$.

3. Results

The PFA group was younger (56.4 ± 12.0 vs. 65.7 ± 10.3; $p < 0.001$) and consisted of more females (86% vs. 40%; $p < 0.001$) than the UKA group. The PFA cohort also had a greater proportion of non-smoking patients (71% vs. 45%; $p = 0.044$). No other differences in demographics or comorbidities existed between the PFA and UKA groups (Table 1). The proportion of patients who reported any preoperative opioid use was also similar between groups (seven percent vs. 12%, respectively; $p = 0.24$). The first post-operative visit occurred at a similar time from surgery for both PFA and UKA patients (28 vs. 29 days; $p = 0.61$). For five UKA patients, specific notation regarding any use of opioids at this visit was missing and they were excluded from the comparison. A greater proportion of patients who underwent PFA reported taking opioids to manage post-operative pain at the first post-operative clinic visit than patients who underwent medial UKA (38% vs. 11%; $p < 0.001$) (Figure 1). Complication ($p = 0.42$) and reoperation ($p = 1.00$) rates were similar between the two groups (PFA vs. UKA) during the post-operative period (Table 1).

When comparing postoperative days until first follow-up between the three groups (PFA, UKA, TKA), although there was a main effect of time ($p = 0.03$), post hoc analysis revealed that the time from surgery to the first follow-up visit did not differ between the TKA group (32 days) and either the UKA (29 days; $p = 0.13$) or PFA group (28 days; $p = 0.07$). In contrast, self-reported opioid use at this visit

Table 1
Demographic, comorbidity, and outcomes for PFA and medial UKA patients.

	PFA	Medial UKA	p-Value
Age	56.4 ± 12.0	65.7 ± 10.3	<**0.001***
BMI	28.2 ± 5.4	27.8 ± 3.8	0.638
Postoperative days until follow-up	28.2 ± 8.5	29.2 ± 10.0	0.606
Female sex	86% (30)	40% (26)	<**0.001***
Obesity	29% (10)	28% (18)	1.000
Hypertension	34% (12)	51% (33)	0.142
Cardiac disease	11% (4)	28% (18)	0.078
Lung disease	11% (4)	14% (9)	1.000
Diabetes	9% (3)	5% (3)	0.420
Current antidepressant use	31% (11)	14% (9)	0.064
Non-smoker	71% (25)	45% (29)	**0.044***
Postoperative complications	3% (1)	9% (6)	0.418
Reoperation rates	5% (2)	7% (5)	1.000

* significant difference at the $p < 0.05$ level

differed between the three groups of patients ($p < 0.001$) with a post-hoc analysis revealing that a greater proportion of both PFA (38% vs. 11%; $p < 0.001$) and TKA (41% vs. 11%; $p = 0.01$) patients reported using opioids for pain management when compared to UKA patients (Figure 1). Opioid use was similar between the PFA and TKA groups (35% vs. 40%; $p = 0.61$). Out of the 14 PFA patients who reported using narcotics at the first postoperative visit, 50% stated that they required occasional opioids to help sleep at night or prior to physical therapy (PT), with the other 50% stated that they required opioids regularly for pain. Similar ratios were observed for the seven UKA patients who reported opioid use, with 43% reporting occasional PT or night pain and 57% reporting regular use. For the TKA group, 64% of patients reported regular opioid use, while 36% reported only occasional use for night or activity-related pain. There was no difference in the number of patients who reported any preoperative opioid use between TKA (12%), medial UKA (four percent), and PFA (11%) groups ($p = 0.22$).

4. Discussion

Despite the increase in research examining pain management strategies for patients undergoing total joint replacement procedures [5,6], few studies have examined opioid use for patients undergoing unicompartmental knee arthroplasty [7,8], and none have compared narcotic usage between UKA and PFA procedures. In the current study, we identified that a greater proportion of patients who underwent PFA reported using opioids for pain management at the first post-operative visit compared to patients who underwent UKA. In addition, while we found no difference in the incidence of opiate use between TKA and PFA patients, fewer UKA patients reported using narcotics at their first postoperative visit compared to those who underwent TKA. Our findings suggest that patients undergoing PFA may experience pain and require opioids for pain management for a longer period of time when compared to UKA patients.

Previous studies comparing post-operative pain management between unicompartmental knee procedures and TKA have reported similar results to ours [2,4,12,13]. Overall, patients undergoing UKA report reduced pain compared to TKA [2,4]; however, those previous studies included all patients who underwent a unicompartmental procedure in the analysis, regardless of specific compartment. Previous comparisons between PFA vs TKA procedures have also yielded similar findings to ours [12,13]. No difference in post-operative pain was observed between TKA and PFA patients [12,13]. For the study by Dahm et al., the incidence of narcotic use in their cohort of PFA patients (32%) was also similar to our PFA patients (39%) [12]. Contrary to these previous studies, ours is the first to report a difference in self-reported opioid use between UKA patients and PFA patients. Our findings suggest that, while PFA patients experience similar pain to TKA, fewer UKA patients require opioids up to one month post-surgery.

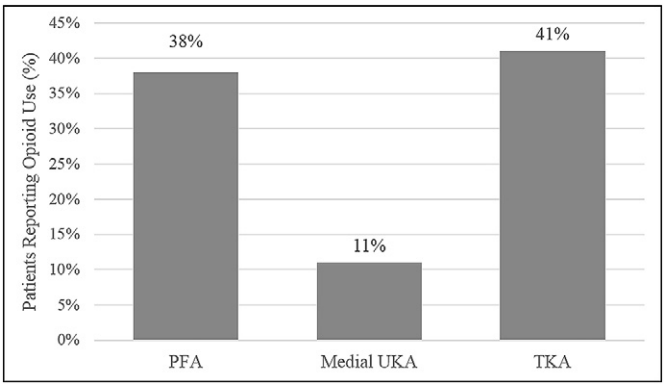

Figure 1. Proportion of patients reporting opioid use for pain management at the first postoperative clinic visit. PFA = patellofemoral arthroplasty group; Medial UKA = medial unicondylar arthroplasty group; TKA = total knee arthroplasty group.

The appropriate management of postoperative pain is critical, and significant consequences are associated with under- or overtreatment. Inadequate postoperative pain control has been shown to increase hospitalization length and impair rehabilitation. Ineffective pain control was also correlated with increased postoperative myocardial ischemia and thromboembolism [10]. Furthermore, postoperative surgical site pain has also been shown to be a significant predictor of continued opiate use in patients undergoing total hip or total knee arthroplasty [9]. However, excessive postoperative narcotic use has also been shown to have negative effects on patients. Excess use of narcotics can also lead to increased hospitalization and slower rehabilitation [11]. More importantly, relying on opioids too much following surgery can place a patient at an increased risk for long-term narcotic dependence, with as many as three percent of opioid naïve patients remaining on opiates 12 months after undergoing total knee replacement [11]. As a result, considerable attention has been paid in standardizing appropriate peri-procedural pain management which aims at improving patient satisfaction and recovery rate, decreasing hospital stays, and minimizing acute and chronic opiate dependence in recent decades. Surgery specific multimodal analgesic protocols have improved postoperative pain control while limiting narcotic use and the associated adverse events [14–16]. Our study demonstrates that the incidence of narcotic use amongst PFA patients more closely reflects that of patients undergoing TKA rather than other unicondylar arthroplasty procedures, and that appropriate surgeon and patient expectations for postoperative pain management will be critical for optimizing postoperative pain, and consequently outcomes.

Our study is not without limitations. Given that this was a retrospective analysis, our UKA and PFA cohorts were not similar in regard to age and sex distribution. This may limit the applicability of our results to patients who are similar to ours. In addition, relying on patient reported use of opioids may introduce recall bias into our data; however, we feel this risk was mitigated as patients were asked whether they were consuming opioids for pain management at the time of the visit. Finally, we were unable to quantify the exact quantity of opioids consumed by our patients during the post-operative period. We only had access to self-reported opioid status at their first post-operative visit.

5. Conclusions

Our results demonstrated that more patients undergoing PFA procedures report opioid usage at one month post-surgery when compared to UKA patients. In addition, the prevalence of PFA patients who report opioid use at the first post-operative visit is similar to that for patients following TKA, suggesting that pain management protocols for this specific subset of unicompartmental arthroplasty patients should be structured similar to TKA patients and separate from UKA patients. Future work should be done to determine the effectiveness of structured post-operative pain management on opioid consumption for UKA and PFA patients.

Declaration of Competing Interest

Dr. Freiberg reports personal fees from Zimmer Biomet, personal fees from Zimmer Biomet, other from Zimmer Biomet, other from Arthrosurface, other from Orthopedic Technology Group outside the submitted work. Dr. Bedair reports personal fees from Smith & Nephew, outside the submitted work.

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