



ELSEVIER

Contents lists available at ScienceDirect

The Journal of Arthroplasty

journal homepage: www.arthroplastyjournal.org

Health Policy and Economics

Preoperative and Postoperative Opiate Use by the Arthroplasty Patient

Bradley J. Zarling, MD^a, Sanar S. Yokhana, MD^b, Darren T. Herzog, MD^a,
David C. Markel, MD^{a, b, *}^a Detroit Medical Center/Wayne State University Orthopaedic Surgery Residency Program, Detroit, Michigan^b Department of Orthopaedic Research, Providence-Providence Park Hospital and The CORE Institute, Southfield, Michigan

ARTICLE INFO

Article history:

Received 29 December 2015

Received in revised form

22 March 2016

Accepted 28 March 2016

Available online 12 April 2016

Keywords:

opiate use

arthroplasty

postoperative narcotics

narcotic prescriptions

Michigan Automated Prescription System

ABSTRACT

Background: As opioid use increases nationally, the arthroplasty surgeon is likely to see more patients taking opioid analgesics on initial presentation. The purpose of this study was to investigate the use of opiate medication in the preoperative and postoperative patient undergoing primary total joint arthroplasty.

Methods: From October 2010 to November 2011, data on 367 consecutive patients who underwent primary total joint arthroplasty were reviewed. Using the Michigan Automated Prescription System database, data were collected on opiate use from 3 months preop to 12 months postop. Patients were grouped by preoperative opiate use. Patients with ≥ 2 opiate prescriptions filled per 6-week period before surgery were considered chronic opiate users.

Results: Three hundred fifteen patients fit our inclusion/exclusion criteria. There were 158 primary total knee and 157 primary total hip arthroplasty patients. At 1 year after operation, 64% of chronic opiate users were still being prescribed opiates compared with 22% of the control group ($P < .001$). Thirty-one percent of the chronic opiate users were discharged to an extended care facility compared to 21% of the control group ($P = .123$). Of all the opiate prescriptions, 77% were written by a practitioner other than the surgeon.

Conclusions: Opiates are frequently prescribed by providers other than the surgeon preoperatively and postoperatively. The use of opiates that were presumably prescribed to treat joint pain was continued for more than 1 year postoperatively in 64% of cases. Patients taking multiple opiates or more potent opiates preoperatively filled more prescriptions postoperatively. Chronic use of opiates negatively influenced the discharge disposition.

© 2016 Elsevier Inc. All rights reserved.

Osteoarthritis (OA) is a degenerative joint disease that is characterized by articular cartilage degeneration, subchondral bone sclerosis, and osteophyte formation. Clinical symptoms include chronic pain, joint instability, stiffness, and radiographic joint space narrowing [1–4]. OA is the most common cause of disability in adults and affects over 27 million Americans. Seventy percent of people aged older than 65 years demonstrate radiographic evidence of disease [3,5]. The World Health Organization places OA as the disease with the fourth highest impact on years of life lost due to disability [6]. Given the significance of disability and the cost of

treatment, we expect the management of OA to be an increasingly larger challenge for the aging patient and the United States health care system [7].

Early management of OA includes physical therapy, weight loss, and nonsteroidal anti-inflammatory drugs [8]. As OA progresses, pain management becomes more of a challenge and alternative medications such as opioid analgesics are commonly used. Opioids are one of the oldest classes of analgesics, and their use in the noncancerous setting has not been without controversy [9–11]. Nonetheless, we continue to see an increase in the overall use of opioids to manage chronic pain caused by OA.

According to the Centers for Disease Control, prescription drug abuse is the fastest growing drug problem in the United States [12]. In 2013, approximately 16,000 deaths occurred in the United States from pain killer overdose (Fig. 1). This number has quadrupled since 1999 [12]. As opioid use increases, the arthroplasty surgeon is likely to see more patients who are taking opioid analgesics on initial presentation. Data on the perioperative use of these medications

One or more of the authors of this paper have disclosed potential or pertinent conflicts of interest, which may include receipt of payment, either direct or indirect, institutional support, or association with an entity in the biomedical field which may be perceived to have potential conflict of interest with this work. For full disclosure statements refer to <http://dx.doi.org/10.1016/j.arth.2016.03.061>.

* Reprint requests: David C. Markel, MD, Market President, The CORE Institute, Chief, Orthopaedic Surgery, Providence-Providence Park Hospital, 22250 Providence Drive, Suite #401, Southfield, MI, 48075.

<http://dx.doi.org/10.1016/j.arth.2016.03.061>

0883-5403/© 2016 Elsevier Inc. All rights reserved.

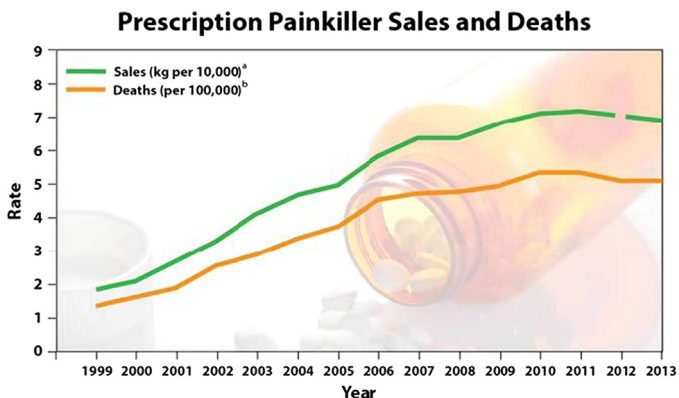


Fig. 1. Rate of prescription pain killer sales and deaths—United States, 1999–2013. ^aAutomation of Reports and Consolidated Orders System (ARCOS) of the Drug Enforcement Administration (DEA), 2012 data not available; ^bCenters for Disease Control and Prevention. National Vital Statistics System mortality data. (2015) Available from URL: <http://www.cdc.gov/nchs/deaths.htm>.

are lacking [13]. The purpose of this study was to investigate the use of opiate pain medication in the preoperative and postoperative period for patients undergoing primary total knee arthroplasty (TKA) or total hip arthroplasty (THA).

Methods

The Michigan Automated Prescription System (MAPS) requires all pharmacies, dispensing practitioners, and veterinarians to report the dispensation of schedule II-V drugs on a weekly basis. Data reported include patient name, date of birth, gender, drug dispensed, prescription number, date prescribed, date filled, quantity dispensed, days' supply, and the name of the prescribing physician. After institutional review board approval, 367 consecutive patients who underwent primary TKA or THA by 3 surgeons were retrospectively reviewed using the MAPS database, hospital charts, and office-based charts. Data were collected on patients with procedures that occurred between October 2010 and November 2011. Patients undergoing revision surgery or patients lacking adequate MAPS or patient chart data were excluded. Patient records were reviewed for opiate-containing medications during the 3-month period before surgery and for the first 12 months after surgery. Date, time, quantity, and name of each prescription were recorded. Prescriber specialty, patient age, and city of residence were also recorded. The medical record was reviewed to determine patient gender, type of procedure, date of surgery, length of stay, cost of care, and discharge disposition. The number of prescriptions filled per 6-week period was recorded for each of the following time intervals: 0–3 months before surgery, 0–6 weeks after surgery, 7–12 weeks after surgery, 3–6 months after surgery, and 6–12 months after surgery. These periods were selected according to a previous publication [14]. Patients were grouped by preoperative opiate use. Patients with ≥ 2 opiate prescriptions filled per 6-week period in the 3 months before surgery were defined as chronic opiate users, whereas those that did not meet this requirement were defined as the control group.

Statistical Analysis

Results were analyzed using 2-tailed Student's *t* test for univariate results and chi-square analysis for categorical results. A logistic regression was used to identify predictors of chronic opiate use. A *P* value of .05 or less was considered statistically significant.

Table 1
Patient Demographics.

Demographic	Total Knee Arthroplasty	Total Hip Arthroplasty	All Patients
Age (Mean \pm SD)	69.07 \pm 10.85	68.26 \pm 10.18	68.66 \pm 10.5
Female (N)	107	101	208 (66%)
Male (N)	51	56	107 (34%)
Chronic Opiate Users (N)	54	52	106 (34%)
Control Group (N)	104	105	209 (66%)
Urban Zip Code (N)	49	44	93 (30%)
Suburban Zip Code (N)	109	113	222 (70%)
Length of Stay (Mean \pm SD)	2.71 \pm 1.09	2.75 \pm 1.17	2.73 \pm 1.13
Total	158	157	315

SD, standard deviation.

Results

Demographics

Of the 367 patients initially identified, 52 did not have adequate data and were excluded. This left 315 patients for analysis. Of these 315 patients, 158 had undergone primary TKA, and 157 had primary THA. Of the 158 patients undergoing TKA, the average age was 69 years. There were 107 females (68%) and 51 males (32%). Of the 158 patients undergoing THA, 102 patients were females (64%), 56 were males (36%), and the average age was 68 years (Table 1). Over the study period encompassing 3 months preoperatively and 12 months postoperatively, the total number of prescriptions filled for TKA patients was 1382 and 1030 for THA patients. The average number of prescriptions per TKA patient was 8.7 and 6.3 per THA. We observed a significant difference in prescriptions written by medical specialty. Of all arthroplasty patients, only 23% of the opiate prescriptions were written by the orthopedic surgeon, whereas 49% of prescriptions were written by a primary care physician and the remainder were written by other specialists (*P* < .001; Fig. 2). Thirty-three percent of patients had 3 or more prescribers. Analyzing patient zip codes showed 70% lived in the suburbs and 30% lived in the city. Twenty-seven percent of patients from the city and 24% of patients living in the suburbs were considered chronic opiate users.

Preoperative Opiate Use

The average number of prescriptions filled per 6-week period during the preoperative period was 0.72 \pm 1.29 for TKA and

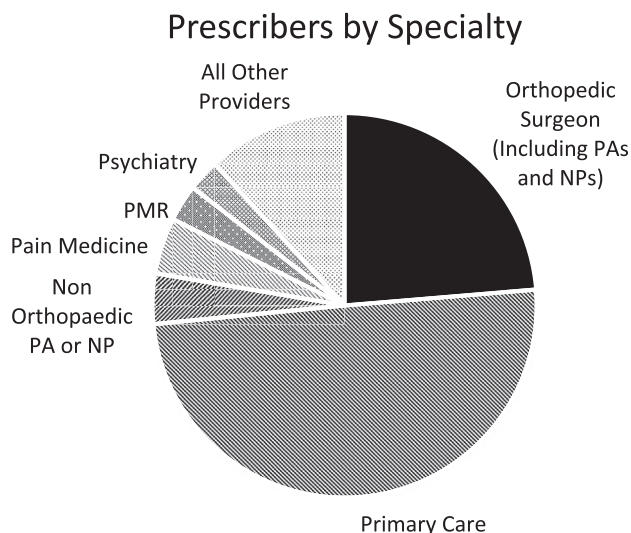


Fig. 2. Percentage of all opiate prescriptions written by each medical specialty. NP, nurse practitioner; PA, physician assistant; PMR, physical medicine and rehabilitation.

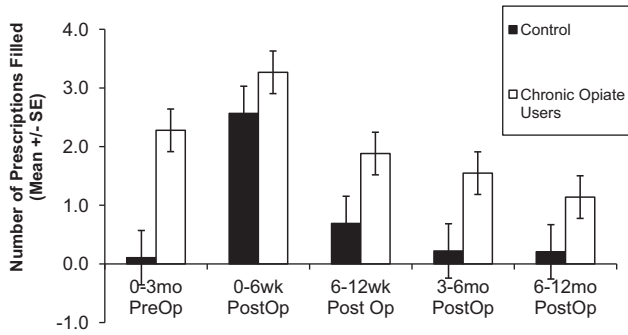


Fig. 3. Average number of prescriptions filled per 6 weeks for all patients undergoing TKA by this period ($P < .001$ between series for all periods). SE, standard error; TKA, total knee arthroplasty.

0.63 ± 1.23 for THA. When patients were defined as either chronic opiate users or control, the average number of prescriptions filled per 6-week period preoperatively was 2.28 ± 1.53 for TKA in chronic users compared to 0.11 ± 0.21 in the control patients. The number of preop prescriptions filled by chronic users before undergoing THA was 2.35 ± 1.61 compared to 0.12 ± 0.21 per period in the control patients. Being female and having a TKA were identified as risk factors for chronic opiate use ($P = .0024$ and $.001$).

Figures 3 and 4 demonstrate the average number of prescriptions filled per 6-week period for TKA and THA. As expected, there was a significant increase in the average prescriptions filled in the 6 weeks immediately after surgery for all groups ($P < .001$). Of note, all groups did decrease over time; however, chronic opiate users decreased at a slower rate in both TKA and THA. Of the chronic opiate users, 64% were still filling opiate prescriptions at 1 year postop. This was statistically higher than the control group in which 22% were filling prescriptions at 1 year postop ($P < .001$). The most common prescription was for acetaminophen/hydrocodone (47%) followed by acetaminophen/oxycodone (12%) and acetaminophen/codeine (6%). Patients who were using oxycodone, morphine, or transdermal fentanyl preoperatively all filled significantly more opiate prescriptions 1 year postoperatively (Table 2). Twenty percent of patients were taking more than one opiate preoperatively. These patients filled on average 3 times more prescriptions 1 year after their arthroplasty (2.57 vs 0.8 $P < .001$). No significant differences were found in the number of chronic opiate users between surgeons.

Discharge Disposition, Length of Stay, and Cost

We compared the discharge disposition for chronic opiate users and control for all arthroplasty patients. Chronic users showed a trend of being discharged at a higher frequency to extended care

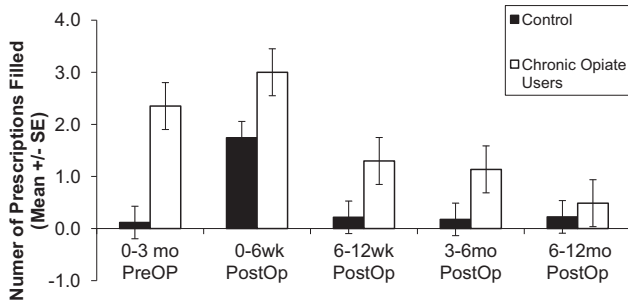


Fig. 4. Average number of prescriptions filled per 6 weeks for all patients undergoing THA by this period ($P < .001$ between series for all periods). SE, standard error; THA, total hip arthroplasty.

Table 2
Most Common Prescriptions.

Medication	Number of Prescriptions	Total Opiate Prescriptions Filled per Patient (Mean)		P Value
		0-3 mo Preop	6-12 mo Postop	
Acetaminophen/hydrocodone	1123	1.21	0.47	<.001
Acetaminophen/oxycodone	283	1.40	0.24	<.001
Acetaminophen/codeine	139	1.02	0.42	<.001
Oxycodone	92	5.72	1.39	<.001
Morphine	59	2.3	1.17	<.001
Transdermal fentanyl	41	5.73	1.45	<.001

Postop, postoperative; Preop, preoperative.

facilities ($P = .123$; Fig. 5). No significant differences were found in length of stay or hospital cost of care between chronic opiate users and control for TKA or THA.

Discussion

OA is a leading cause of disability in the United States. Research has shown that total joint arthroplasty (TJA) is expected to increase by 174% for primary THA and 673% for TKA by the year 2030 [15]. An increasing life expectancy will increase the prevalence and incidence of OA [15]. Pain management is an important part of treating OA especially in the perioperative arthroplasty patient. The American Academy of Orthopaedic Surgeons recently released the second edition of its evidence-based clinical practice guidelines for treatment of OA of the knee. They recommend neither for nor against the use of opioid-containing medications [10]. The Appropriate Use Criteria for nonarthroplasty treatment of knee OA state that opiate-containing medications may be appropriate for refractory pain when used in conjunction with other therapies [11]. The total amount of opioid medication prescribed and distributed through the pharmaceutical system in the United States has increased markedly with time. In 1997, the equivalent of 96 mg of morphine per person was distributed. This number had risen to 700 mg per person in 2007. This is an increase of over 600%. Ten percent of opiate-using patients are prescribed high doses from multiple providers and account for 40% of opioid overdose cases [12,16]. The patient who is undergoing arthroplasty surgery often requires a great deal of pain management, and we were interested in how opiates are used at our health system.

Discharge Disposition by Pre-Op Opiate Use

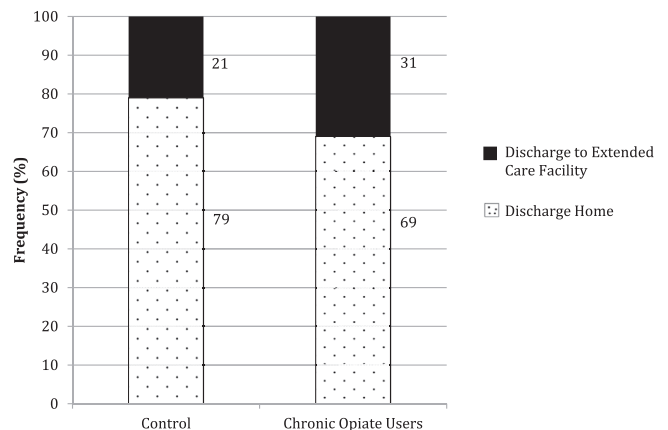


Fig. 5. Discharge disposition based on preop opiate use ($P = .123$).

We conducted a retrospective case series examining the use of opiates in patients who have undergone primary TJA at our facility. Our series included patients from both urban and suburban backgrounds. Although the literature has shown that men were 2–3 times more likely to have TJA [17], our study population depicts female patients outnumbering male patients by almost a 2:1 ratio. Our results also indicate that there is a gender preference to becoming a chronic opiate user. Women had a significantly higher chance of being chronic users compared to men. These findings led us to speculate that women in our study may have delayed surgery longer and chose to treat their OA with pain medication. In addition, patients who had a TKA were 2.6 times more likely to be a chronic opiate user compared with the THA patients. When looking at prescription trends across specialties, we found that 77% of the prescriptions included in our study were written by nonorthopedic physicians. Furthermore, in chronic opiate users, 85% of the prescriptions were written by nonorthopedic physicians (Fig. 2). Finally, it was concerning that a third of patients had 3 or more prescribers. These findings illustrate the importance of interdisciplinary collaboration that is needed to adequately treat and manage the pain of patients undergoing TJA.

There was a trend observed for discharge disposition between chronic opiate users and our control (Fig. 5). Chronic opiate users were discharged to an extended care facility (ECF) more frequently than the control group ($P = .123$). Although our data did not show differences in length of stay or hospital cost between chronic and control groups, discharge to an ECF ultimately leads to higher costs to the patient and the health care system. Ramos et al [18] found that patients discharged to inpatient facilities after TJA were more likely to be readmitted within 30 days postop when compared to patients discharged home. Readmission rates were not included in our study, but this is an interest for future projects. Pivec et al [19] showed that patients with prior opiate use undergoing THA had lower outcome scores. Similarly, our data showed that chronic opiate users remained on opiates postoperatively more often than the control group. Patients filling multiple opiate prescriptions or more potent opiates preoperatively filled opiate prescriptions more frequently 1 year postoperatively. These results may begin to impact an orthopedic surgeon's practice as reimbursement becomes more dependent on performance and outcome.

Our study has several limitations. First, the overall sample size was small which is why we could only show a trend for discharge disposition. Another limitation was that our data only represent one community hospital in a suburban setting. Our results may not accurately reflect prescribing habits in other areas of the country. In addition, our database did not specify comorbidities nor did it link diagnosis to prescription. We realize that many patients may be taking opiate medication for other problems or even psychiatric illnesses. Furthermore, we did not identify patient insurance types. Finally, our data only represent information from the MAPS database. Patients who are taking nonprescribed opiates are not represented in our data. Further research should be conducted regarding differences in prescribing habits based on geographic region, mental illness, and insurance carrier. It would also be interesting to investigate how the recent rescheduling of certain opiate-containing medications by the Food and Drug Administration and Drug Enforcement Agency affect prescribing habits.

Conclusions

Our study showed that 64% of chronic opiate users continued to have opiate prescriptions filled at 1 year postoperatively. Patients taking multiple opiates or more potent opiates preoperatively filled more prescriptions postoperatively. Chronic opiate users were discharged to an ECF after TJA more frequently than our control group. Finally, it was concerning that the overwhelming majority of all opiate prescriptions pre- and post-TJA were written by a practitioner other than the orthopedic surgeon.

Acknowledgments

The authors would like to acknowledge the following people for their help with data analysis and manuscript editing: Jon Carlson, MD, Jeffrey Flynn, PhD, Nancy Jackson, PhD, and Chris Bergum, BS.

References

- Buttgereit F, Burmester G-R, Bijlsma JWJ. Non-surgical management of knee osteoarthritis: where are we now and where do we need to go? *RMD Open* 2015;1(1):e000027.
- Hawker G. Update on the epidemiology of the rheumatic diseases. *Curr Opin Rheumatol* 1997;9(2):90.
- Lawrence RC, Felson DT, Helmick CG, et al. National Arthritis Data Workgroup. Estimates of the prevalence of arthritis and other rheumatic conditions in the United States. Part II. *Arthritis Rheum* 2008;58(1):26.
- Wang M, Shen J, Jin H, et al. Recent progress in understanding molecular mechanisms of cartilage degeneration during osteoarthritis. *Ann New York Acad Sci* 2011;1240:61.
- Lane NE, Thompson JM. Management of osteoarthritis in the primary-care setting: an evidence-based approach to treatment. *Am J Med* 1997;103(6A):25S.
- Reginster JY, Khaltav NG. Introduction and WHO perspective on the global burden of musculoskeletal conditions. *Rheumatology (Oxford, England)* 2002;41(Suppl 1):1.
- Kotlarz H, Gunnarsson CL, Fang H, et al. Insurer and out-of-pocket costs of osteoarthritis in the US: evidence from national survey data. *Arthritis Rheum* 2009;60(12):3546.
- Jones BQ, Covey CJ, Sineath MH. Nonsurgical management of knee pain in adults. *Am Fam Physician* 2015;92(10):875.
- Goodwin JLR, Kraemer JJ, Bajwa ZH. The use of opioids in the treatment of osteoarthritis: when, why, and how? *Curr Rheumatol Rep* 2009;11(1):5.
- Jevsevar DS, Brown GA, Jones DL, et al. American Academy of Orthopaedic Surgeons. The American Academy of Orthopaedic Surgeons evidence-based guideline on: treatment of osteoarthritis of the knee, 2nd edition. *J Bone Joint Surg Am* 2013;95(20):1885.
- Sanders JO, Heggeness MH, Murray J, et al. The American Academy of Orthopaedic Surgeons Appropriate Use Criteria on the non-arthroplasty treatment of osteoarthritis of the knee. *J Bone Joint Surg Am* 2014;96(14):1220.
- Centers for Disease Control and Prevention (CDC). CDC grand rounds: prescription drug overdoses—a U.S. epidemic. *MMWR Morbidity Mortality Weekly Rep* 2012;61(1):10.
- Petre BM, Roxbury CR, McCallum JR, et al. Pain reporting, opiate dosing, and the adverse effects of opiates after hip or knee replacement in patients 60 years old or older. *Geriatr Orthopaedic Surg Rehabil* 2012;3(1):3.
- Holman JE, Stoddard GJ, Higgins TF. Rates of prescription opiate use before and after injury in patients with orthopaedic trauma and the risk factors for prolonged opiate use. *J Bone Joint Surg Am* 2013;95(12):1075.
- Kurtz S, Ong K, Lau E, et al. Projections of primary and revision hip and knee arthroplasty in the United States from 2005 to 2030. *J Bone Joint Surg Am* 2007;89(4):780.
- Agarin T, Trescot AM, Agarin A, et al. Reducing opioid analgesic deaths in America: what health providers can do. *Pain Physician* 2015;18(3):E307.
- O'Connor MI. Sex differences in osteoarthritis of the hip and knee. *J Am Acad Orthopaedic Surgeons* 2007;15(Suppl 1):S22.
- Ramos NL, Karia RJ, Hutzler LH, et al. The effect of discharge disposition on 30-day readmission rates after total joint arthroplasty. *J Arthroplasty* 2014;29(4):674.
- Pivec R, Issa K, Naziri Q, et al. Opioid use prior to total hip arthroplasty leads to worse clinical outcomes. *Int Orthopaedics* 2014;38(6):1159.