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Orthopedic Surgery Opioid Stewardship

Abstract

Opioid prescribing has become a national focus for healthcare providers with an increased emphasis on adequately managing pain while limiting overprescribing and prescription opioid abuse. To address these concerns, a pharmacy driven orthopedic surgery opioid stewardship initiative (OSI) was implemented for all patients undergoing elective joint replacement surgery at our hospital. The OSI included development of standardized opioid recommendations, preoperative pain management assessment and development of a patient centric postoperative pain management plan, postoperative assessment with the interdisciplinary team, evaluation of discharge opioid needs, perioperative pain management education, and post-discharge phone follow-up. Data were collected for a three-month period prior to and after implementation of the orthopedic surgery OSI. Compared to baseline data, implementation of the OSI significantly decreased average hospitalization oral morphine equivalents (OME) from 94.20 mg to 51.09 mg ($p < 0.01$) and average discharge OME from 547.82 mg to 289.20 mg ($p < 0.01$). Mean peak visual analog scale (VAS) scores were not significantly different. Average hospital length of stay significantly decreased from 2.00 days to 1.67 days ($p < 0.01$) and same-day discharge significantly increased from 4.90% to 19.69% ($p < 0.01$). There was no significant difference in 30-day readmission. The results show that implementation of a pharmacist driven orthopedic surgery OSI can curb opioid overprescribing without adversely affecting patients' perception of pain management. In addition to improving medication safety, the OSI also led to improvements in quality and financial measures including same day discharge and length of stay.

Medication-Use System Initiative Scope

Long term opioid use often begins with treatment of acute pain¹ and data suggest that patients undergoing orthopedic surgery are at highest risk of becoming chronic opioid users.² Based on inpatient and discharge opioid prescribing, pharmacists identified the need for adjustment of pain management practices by orthopedic practitioners. The pharmacist assigned to the surgical floor noticed that patients undergoing elective joint replacement surgery were standardly prescribed oxycodone for postoperative pain, unless they had a documented allergy. No further consideration was given to past opioid use, tolerance, and effectiveness, or other baseline patient characteristics. The regimented prescribing of opioids sometimes posed issues with disposition as it took time to adjust the postoperative pain regimen when the initial choice was not tolerated or was ineffective. If a patient's pain was not well managed, IV opioids for frontline treatment of pain, a long acting opioid, or escalating doses of opioids were sometimes prescribed without consideration for non-opioid adjunctive treatments. Upon discharge, the majority of

¹ Dowell D, Haegerich TM, Chou R. CDC Guideline for Prescribing Opioids for Chronic Pain — United States, 2016. *MMWR Recomm Rep* 2016;65(No. RR-1):1–49. doi: <http://dx.doi.org/10.15585/mmwr.rr6501e1>

² Sun EC, Darnall BD, Baker LC, et al. Incidence of and Risk Factors for Chronic Opioid Use Among Opioid-Naïve Patients in the Postoperative Period. *JAMA Intern Med* .1293 1286:(9)176;2016 . doi:10.1001/jamainternmed.2016.3298

patients were prescribed at least 60 tablets of oxycodone 5mg, irrespective of hospital usage. Additionally, pain management expectations were not explicitly reviewed with patients and opioid education was limited. These practices were not aligned with current guidelines by the American Pain Society, Centers for Disease Control, and Society of Hospital Medicine who recommend review of the prescription drug monitoring program (PDMP) database, preoperative evaluation to guide the perioperative pain management plan, multimodal pain management with appropriate use of non-opioid and non-pharmacological therapies, use of oral pain medications whenever possible, avoidance of long-acting opioids in the immediate postoperative period, and patient-centered and individually tailored education on the pain treatment plan including tapering of analgesics after hospital discharge and appropriate storage and disposal of prescription opioids.^{1,3,4,5} The baseline prescribing practices had the potential to increase the risk of chronic opioid use, dependency, and adverse events including death. To address these concerns, we implemented a medication safety improvement initiative by utilizing the perioperative surgical home (PSH) pharmacist to focus on opioid stewardship in all patients undergoing elective joint replacement surgery. The approach to mitigating opioid misprescribing was to address all phases of the surgical period as well as to provide consistent care and education from all members of the interdisciplinary team.

Pharmacist Leadership

In early 2017, pharmacy staff identified opportunities to improve medication safety in the orthopedic surgery patient population and recommended incorporation of a pharmacist into the hospital's established PSH model. The pharmacist evaluated patients undergoing elective joint replacement surgery by a single, high-volume orthopedic surgeon and focused on medication reconciliation, perioperative management of anticoagulation and other high risk medications, and basic pain management assessment. Following successful integration into the PSH, additional opportunities to improve opioid prescribing practices were identified by the PSH pharmacist. Pharmacy staff gathered baseline opioid use data and, utilizing the PSH pharmacist, proposed the development and implementation of the orthopedic surgery OSI. The OSI expanded PSH services to all patients undergoing elective joint replacement surgery and included more extensive pain management assessment throughout the perioperative period, development of guidelines to increase consistency amongst providers, and substantial patient and staff education.

³ Chou R, Gordon DB, de Leon-Casasola, et al. Management of Postoperative Pain: A Clinical Practice Guideline From the American Pain Society, the American Society of Regional Anesthesia and Pain Medicine, and the American Society of Anesthesiologists' Committee on Regional Anesthesia, Executive Committee, and Administrative Council. *J Pain*. 2016 Feb; 17 (2): 131-57. doi: 10.1016/j.jpain.2015.12.008.

⁴ Herzig SJ, Hilary J, Mosher, MD, Calcaterra SL, Jena AB, Teryl K, Nuckols, MD, Improving the Safety of Opioid Use for Acute Noncancer Pain in Hospitalized Adults: A Consensus Statement From the Society of Hospital Medicine. *J. Hosp. Med* 2018;4;263-271. doi:10.12788/jhm.2980

⁵ Anderson WG, Solomon L. Improving Pain Management for Hospitalized Medical Patients: A Society of Hospital Medicine Implementation Guide.

Preoperatively, the pharmacy technician and PSH pharmacist completed medication reconciliation, PDMP review, and patient interviews to assess opioid needs and develop a patient centric postoperative pain management plan. The plan was documented in the medical record and the patient was provided verbal and printed education about postsurgical expectations, pain management practices, potential side effects of opioids, and information about safely using opioids during the perioperative period. Postoperatively, the pharmacist addressed pain management with the interdisciplinary team on daily rounds, assessed and tailored pain management needs based on inpatient opioid use, and provided medication education with instructions on safely weaning off of opioids and appropriate storage and disposal. The PSH pharmacist also facilitated discharge assisting in pre and post operative evaluation of discharge medication and supporting the Bed-Med discharge program to encourage patients to have medications delivered at bedside prior to discharge. Approximately two weeks after hospital discharge, the PSH pharmacist completed a post discharge phone call to discuss pain management and review discharge opioid use and quantity remaining.

In addition to direct patient care efforts, the pharmacist also coordinated focused presentations and discussions with the orthopedic interdisciplinary team, created written patient education information, developed a standardized approach to opioid prescribing during hospitalization and discharge, collected and analyzed outcome data, and conducted routine meetings to update the interdisciplinary team on the OSI process improvement.

Planning and Implementation

Medication safety is addressed at multiple levels within our site and health system. Patient safety and quality is a daily focus for all departments and improving medication safety is consistently a top priority within the organization. Managerial staff participate in daily safety huddles where events from the previous day are presented and discussed openly with follow up and resolution. Several site and health-system committees assess and review medication based patient safety initiatives including, but not limited to, the Pharmacy Nursing Committee, site and health-system Pharmacy and Therapeutics (P&T) Committee, and Patient Safety and Quality Services Committee. Participation and feedback of medication management safety initiatives is interdisciplinary, including physicians, nurses, pharmacists, quality improvement, risk management, and information technology. Historically, medication safety performance improvement projects are often triggered either by a safety event, regulatory requirement, or generated by front line staff. The results of previous medication management performance improvement projects have led to site and health system practice change to improve patient safety and quality.

The initial incorporation of a pharmacist into the PSH provided a basis on which to expand opioid stewardship. The impact of the PSH pharmacist was notable, increasing home medication reconciliation accuracy from 60% to 99.2% and improving complex medication management and transitions of care with 668

interventions documented in 77% (394/507) of patients assessed in the PSH over the course of a year. Although a baseline pain management assessment was done preoperatively, significant efforts to address opioid prescribing was not an initial focus.

In order to address opioid prescribing practices, a proactive OSI was proposed to include more extensive perioperative patient assessment along with a broader focus on patient and staff education and increased practitioner engagement in opioid stewardship efforts. The overall purpose of the OSI was to increase adherence to national opioid prescribing recommendations and forthcoming state and national outpatient prescribing restrictions. With implementation of the OSI, the goal was to impact opioid use during hospitalization and upon discharge without adversely affecting patient's pain management. Outcome measures were selected to include hospital opioid usage (measured as standardized oral morphine equivalents, OME), peak VAS scores (on a scale of 0 to 10), discharge opioid OME, long-acting opioid prescriptions upon discharge, and opioid refills within 30 days. Peak VAS score was selected over average VAS score because it has been shown to impact patients' perception of pain control the most.⁵ The 30 day timeframe for opioid refills was recommended by the orthopedic surgeons and hospitalists as this was felt to be an appropriate time frame to assess management of postoperative pain. Refills beyond this period may reflect other indications or baseline conditions. With the individualized assessment in the preoperative period and increased education, another goal was to appropriately manage pain more efficiently by decreasing delays due to medication adjustment without affecting the quality of care provided. In order to assess this, outcomes such as length of stay, same-day discharge, and 30-day readmission were selected as secondary measures.

Once the outcome measures were established, the orthopedic surgery OSI was presented for feedback and approval. The OSI was presented at meetings with the orthopedic surgery and PSH teams, the Pharmacy and Nursing workgroup, the Health-System Quality and Safety Board, and the P&T committee. The pharmacy incorporated input and feedback from hospital executives, nursing supervisors, anesthesiologists, hospitalists, orthopedic surgeons and physician's assistants, direct patient care nurses, physical therapists and nurse case managers.

Following discussions with the PSH and orthopedic interdisciplinary team and guideline approval from the P&T Committee and hospital leadership, a start date and a timeline for education and implementation was created. The pharmacy developed standardized pain management recommendations and patient education handouts; standardization was implemented to decrease inter-provider variability and improve consistency of care. The pain management recommendations consisted of an opioid decision tree for initial pain management selection and guidelines for selecting appropriate discharge opioid quantities based on inpatient use. The patient education handouts contained information on indication, side effects, and how to safely use opioids including messaging on potential risks of prolonged use, safe handling and storage, proper disposal, and weaning of opioids. The opioid

decision tree and patient education handouts were utilized preoperatively by the PSH pharmacist to assist with the development and discussion of an individualized pain plan. Postoperatively, the PSH pharmacist or pharmacist on the surgical floor utilized the discharge guidelines to review appropriate discharge opioid amounts with the prescriber. Prior to discharge, a second patient education handout was provided to patients to reinforce pain management principles, encourage non-opioid therapies, and review information on appropriate opioid weaning, safe handling, storage, and disposal.

In addition to patient education, staff education was provided to orthopedic surgeons, physician's assistants, hospitalists, nurses, and physical therapists; education included background information on the opioid epidemic, current recommendations and opioid prescribing guidelines, and proposals for standardized pain management recommendations and patient education. To target direct patient care nurses on the surgical floor, pharmacists attended daily morning huddles for a week to review the orthopedic surgery initiative and discuss postoperative pain management.

In November 2017, the orthopedic surgery OSI was implemented for all patients undergoing elective joint replacement surgery. Data were retrospectively collected at monthly intervals and updates were provided to the orthopedic team during brief meetings following patient care rounds. The concurrent feedback provided pertinent and timely information to the prescribers and patient care team and allowed for meaningful discussions on pain management. This also provided the opportunity to revise the initiative if detrimental changes in patients' pain control were noticed and to ensure that prescribers were successfully adopting the new prescribing practices.

During implementation of the OSI, we encountered some hesitance from a prescriber who felt that the orthopedic surgery patient population was not at high risk for opioid abuse and that reducing opioid prescribing in post-surgical patients would lead to poor pain control and decreased patient satisfaction. Pharmacy provided additional re-education at a hospitalist meeting with emphasis on the opioid epidemic and the risk associated with overprescribing not just for patients, but also for those who may have access to their medications. Literature was presented showing that 77% of patients who underwent orthopedic surgery reported unused opioids with greater than 15 tablets remaining.⁶ Recommendations and guidelines were emphasized, new opioid state legislation was outlined, and preliminary baseline and OSI data were shared. The hospitalists were reassured that patients' pain would be addressed appropriately and that pain management would remain a primary focus. Following re-education, the specific physician agreed to trial the prescribing guidelines and frequent updates were provided. The physician eventually embraced the OSI and their prescribing practices changed accordingly.

⁶ Bicket MC, Long JJ, Pronovost PJ, et al. Prescription Opioid Analgesics Commonly Unused After Surgery. *JAMA Surg*. Published online August 02, 2017. doi: 10.1001/jamasurg.2017.0831

During assessment of interim outcome data, pharmacy leadership recommended to include information on intravenous opioid use during hospitalization as well as financial outcomes. In addition to complying with recommended prescribing practices of preferential use of the oral route, reserving intravenous opioids for specific instances in comparison to upfront use was beneficial due to ongoing injectable opioid drug shortages. The suggestion to gather financial data was recommended in order to show a greater magnitude of impact and translate outcomes to decreases in healthcare cost. Changes in length of stay and same-day discharge were correlated to estimated costs of hospital services and overall hospital charges. Hospital services were estimated based on average cost reported by the clinical service line director. Hospital charges were individually assessed for all patients based on review of patient hospital accounts. Average differences between hospital charges of patients admitted and those discharged on the same-day were calculated for each surgery type and were noted in the outcomes.

Measured Outcome and Impact

Data were collected for a three-month period prior to and after implementation of the orthopedic surgery OSI; the baseline group includes all patients undergoing elective joint replacement surgery between November 2016 and January 2017 (N=143) and the OSI group includes patients undergoing elective joint replacement surgery between November 2017 and January 2018 (N=127). Exclusion criteria included revision total joint arthroplasty and patients that did not receive a preoperative peripheral nerve block. The slight difference in number of patients evaluated is attributed to surgeon vacation. From November 2016 through January 2018, there were no other significant changes in patient care outside of the OSI; the surgeon and hospitalist patient care teams, multi-modal pain management regimen, and anesthesia practice (general anesthesia coupled with a peripheral nerve block) were similar.

Discharge opioid prescribing data were collected for all patients who were discharged home (Table 7); patients who discharged to a care facility after hospitalization were excluded as prescribing practices at the care facility were not likely to be influenced by the OSI. The baseline group included 107 patients and the OSI group included 98 patients.

Table 1. Patient demographics

	Baseline N=143	OSI N=127	P-Value
Age, Mean (SD) [years]	66.42 (12.21)	68.40 (9.57)	0.14
Male, n (%)	51 (35.66%)	59 (46.46%)	0.07
Body Mass Index, Mean (SD) [kg/m ²]	30.31 (11.84)	30.36 (18.85)	0.54

Table 2. Patient Baseline Characteristics

	Baseline N=143	OSI N=127	P-Value
Opioid use prior to admission, n (%)	39 (27.27%)	29 (22.83%)	0.40
Chronic Opioid Use, n (%)	9 (6.29%)	6 (4.72%)	0.59
Chronic Pain, n (%)	14 (9.79%)	11 (11.02%)	0.74
Mental Health History, n (%)	20 (13.99%)	19 (14.96%)	0.82
Benzodiazepine Use, n (%)	7 (4.90%)	12 (9.45%)	0.14
Illicit Drug Use, n (%)	4 (2.80%)	3 (2.36%)	0.82

Table 3. Surgery Type

	Baseline N=143	OSI N=127	P-Value
Unilateral UKA, n (%)	22 (15.38%)	18 (14.17%)	0.78
Unilateral TKA, n (%)	39 (27.27%)	21 (16.54%)	0.03
Unilateral THA, n (%)	54 (37.76%)	52 (40.94%)	0.59
Bilateral UKA, n (%)	3 (2.10%)	16 (12.60%)	< 0.01
Bilateral TKA, n (%)	11 (7.69%)	9 (7.09%)	0.85
Bilateral THA, n (%)	14 (9.79%)	11 (8.66%)	0.59
UKA = unicompartmental knee arthroplasty, TKA = total knee arthroplasty, THA = total hip arthroplasty			

Table 4. Hospital Opioid Prescribing

	Baseline N=143	OSI N=127	P-Value
Total Hospital OME, Mean (SD) [mg]	94.20 (144.1)	51.09 (64.33)	< 0.01
Number of intravenous opioid doses used, n	42	19	0.04

Table 5. Peak VAS pain scores

	Baseline N=143	OSI N=127	P-Value
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PACU, Mean (SD)	3.69 (3.64)	4.55 (3.54)	0.05
POD 0, Mean (SD)	3.86 (3.17)	4.22 (3.16)	0.37
POD 1, Mean (SD)	6.03 (2.85)	6.13 (2.33)	0.78
POD 2, Mean (SD)	6.87 (2.33)	6.26 (2.31)	0.26
POD 3, Mean (SD)	6.47 (2.48)	5.60 (3.36)	0.52
PACU = post anesthesia care unit, POD = postoperative day			

Table 6. Other outcome measures

	Baseline N=143	OSI N=127	P-Value
Length of Stay, Mean (SD) [days]	2.00 (0.88)	1.67 (0.86)	< 0.01
Same-Day Discharge, n (%)	7 (4.90%)	25 (19.69%)	< 0.01
30-day hospital readmissions, n (%)	2 (1.40%)	2 (1.57%)	0.91

Table 7. Discharge Opioid Prescribing

	Baseline N=107	OSI N=98	P-Value
Total Discharge OME, Mean (SD) [mg]	547.82 (459.90)	289.20 (181.60)	< 0.01
Discharge Quantity, Mean (SD)	60.22 (19.38)	39.95 (14.71)	< 0.01
Discharge Day Supply, Mean (SD) [days]	6.70 (2.69)	5.19 (2.04)	< 0.01
Patients prescribed long-acting opioid, n (%)	9 (8.41%)	0 (0%)	< 0.01
Patients with at least 1 opioid refill within 30 days, n (%)	45 (42.06%)	35 (35.71%)	0.35
* when adding long acting opioids prescribed upon transfer from the hospital to a care facility, % of patients prescribed long-acting opioid is 9.8% in the baseline group (remains 0% in OSI group)			

Patient baseline characteristics and demographics were not significantly different between the two groups. There were some changes in surgery type with more patients in the OSI group undergoing bilateral UKA (12.60% vs 2.10%, $p < 0.01$) and less undergoing unilateral TKA (16.54% vs 27.27%, $p = 0.03$). This difference could potentially increase opioid use as bilateral knee replacements tend to be more painful than unilateral.

The primary outcome results demonstrate that implementation of the OSI significantly decreased average opioid usage during hospitalization (51.09 mg vs 94.20 mg, $p < 0.01$), intravenous opioid use (19 vs 42, $p = 0.04$), long-acting opioid prescribing (0 vs 8.41%, $p < 0.01$), and average discharge opioid amounts (39.95 vs 60.22, $p < 0.01$; 289.20 mg vs 547.82 mg, $p < 0.01$). Average peak VAS scores were unchanged (except in the PACU) and the percent of patients requiring an opioid refill was slightly lower (35.71% vs 42.06%, $p = 0.35$), suggesting that changes in opioid prescribing did not adversely affect pain management. Although average peak VAS scores in the PACU were slightly higher (4.55 vs 3.69, $p = 0.05$), the interventions of the OSI did not specifically target care provided in the PACU. Post-discharge phone calls revealed that on average, patients had approximately 50% of their discharge supply remaining around 2 weeks after discharge. Average length of stay significantly decreased (1.67 vs 2.00, $p < 0.01$) and same-day discharge significantly increased (19.69% vs 4.90%, $p < 0.01$) without any significant change in 30-day readmissions, suggesting that there was greater efficiency without compromising quality.

Potential financial benefit was evaluated based on decrease in length of stay and same-day discharge. It was estimated that cost of hospitalization was approximately \$1500 per patient per day. The decrease of 0.33 days translates to an average cost savings of \$495 per patient, extrapolated to an estimated annual length of stay cost savings of \$251,460. There was also a decrease in hospital charges noted with the same-day surgeries. On average, there was a decrease of \$22,420 per same-day discharge, with an estimated annual decrease in hospital charges by \$484,592 and a total estimated annual savings of \$736,052 following OSI implementation.

Interim and finalized OSI outcome data were presented to the PSH and orthopedic interdisciplinary teams, the site P&T committee, and the entire hospitalist group. Information will also be shared with the Patient Safety Quality Committee and the Health-System P&T Committee.

Innovation and Generalizability

An orthopedic surgery OSI led by a PSH pharmacist is an innovative way to improve medication safety. A single published report in literature described pharmacist involvement in opioid management in the postoperative setting, however outcomes were not provided.⁷ This patient safety initiative details the planning and implementation of a well-designed interdisciplinary perioperative opioid stewardship program and demonstrates measurable improvements in patient safety and financial outcomes.

The OSI is easily transferrable to other institutions and can be implemented in varying patient populations and care settings. Opioid use is prevalent in all settings

⁷ Genord C, Frost T, Eid D. (2017). Opioid exit plan: A pharmacist's role in managing acute postoperative pain. *Journal of the American Pharmacists Association*. 57. S92-S98. 10.1016/j.japh.2017.01.016.

of health care and the ability to minimize overprescribing without compromising pain management is highly desirable. The initiative involved limited additional resources and focused on creating standardized tools, improving communication, and increasing education. The PSH pharmacist utilized the standardized tools and helped to provide reinforcement of pain management principles. Patient and staff education was an important component of this initiative and helped increase engagement of all members of the patient care team to produce a consistent message throughout the patients' perioperative experience. The importance and impact of opioid stewardship and proposed interventions were clearly communicated with the care team and preliminary and final outcomes of the OSI were routinely shared at interdisciplinary and medical staff meetings, allowing for simultaneous feedback and continuous process improvement.

This initiative incorporates pharmacist involvement in the PSH two to three days a week and is sustainable utilizing per diem and pharmacy resident staff. Based on the return on investment with significant improvements in patient safety outcomes and financial impact, there is a renewed effort to obtain approval for designated pharmacy resources to the PSH with intent to expand services to other surgical specialties.

The results of this initiative will be shared at a state pharmacy association meeting in April 2018 and at national annual meetings later in 2018. The OSI initiative continues to be shared with leadership teams and committees at the site and health-system level. Pharmacy will continue to present and discuss outcomes from the OSI with members of hospital leadership to request further resources to support further expansion. Information will also be shared with the quality improvement team in an effort to globalize opioid stewardship efforts and further education will be provided to nurses in the PACU area.

Plans for Sustaining and Advancing the Initiative

This medication safety initiative validates the benefit of perioperative opioid management and the value of the pharmacist integrated in the PSH as a member of the interdisciplinary team with improvements in medication safety while demonstrating financial impact and cost containment of resources. If further funding becomes available, pharmacy resources in the PSH will be increased to expand the OSI to additional surgical specialties and, in cases of complex patient care, to be available for consultation and coordination of care including after-visit follow-up. In addition to expansion of PSH services, additional funds would be utilized to improve opioid prescribing not only in the surgical patient population, but hospital and institution-wide. Resources could be utilized to allow for expanded education to all hospital and clinic staff.

The impact of a pharmacy driven, interdisciplinary orthopedic surgery opioid stewardship initiative was clinically and statistically significant, achieving primary medication safety outcomes of establishing opioid best practices with realization of financial cost savings as a secondary outcome.