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Variation in Post-Discharge Opioid Prescriptions Among Members of a Surgical Team

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Abstract

Background—Surgeons play a pivotal role in the opioid epidemic but it is unknown how different members of a surgical team vary in the way they prescribe opioids after surgical episodes.

Study Design—We conducted a retrospective cohort study of all inpatient discharges for 5 common surgeries. Total number of tablets and total milligram equivalents (MME) prescribed were calculated and differences in prescription patterns were determined for attending surgeons, surgical residents and advanced practice providers. Using a generalized ordered logistic regression, we examined factors associated with ordering a higher number of tablets or MME.

Results—The median number of tablets (range) prescribed by rank were attending surgeon 30 (6–72), surgical resident 20 (6–189) and advanced care practitioner 40 (5–1000); p<0.001. The median total MME prescribed by rank were attending surgeon 140 (30–600), surgical resident 200 (30–1600) and advanced practice provider 240(25–1000); p<0.001. There was no statistically significant difference by resident postgraduate year (PGY) for both total tablets and total MME prescribed. General surgery residents on average ordered a narrower range of total MME compared to surgical residents in other surgical specialties [20(50–600) vs 20(30–1600); p=0.03]. On regression analysis, residents were less likely to order a higher number of tablets compared to attending surgeons (OR 0.29, p=0.01). However, surgical residents and advanced care providers

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were more likely to prescribe a higher total MME compared to attending surgeons (OR 7.12, p<0.001; OR 3.39, p=0.01 for surgical resident and OR 6.46, p=0.01) for advanced practice providers)

Conclusion—There is wide variation in opioid prescription patterns by surgical providers. More studies are needed to clearly define the ideal number of tablets or MMEs to prescribe for common surgical procedures

Keywords

Opioid Epidemic; Prescription; Surgeon

INTRODUCTION

The United States is in the midst of an opioid epidemic. Death from opioid abuse is the leading cause of accidental death, surpassing motor vehicle accidents for the first time ever on record [1]. Currently, about 19 000 people die of opioid-related causes per year; a number that has grown four-fold in the last 30 years [2, 3]. 55 billion dollars is spent in health and social costs related to opioid abuse and 20 billion dollars in inpatient and emergency department -related expenses [4].

A key contributor to this epidemic may be the excess number of opioid pills prescribed following common surgical procedures and several studies suggest that surgeons often prescribe more opioid pills following a surgical procedure than are consumed by patients [5, 6, 7]. Recent studies of opioid use suggest that 70–80% of the opioid pills prescribed are not consumed by patients making them available for potential diversion, abuse or misuse [7, 8, 9]. Diversion occurs when a prescription medication is prescribed for a medically appropriate purpose but is used for a non-medical purpose or transferred to someone other than the intended user. Diversion is the single biggest source of non-medical use of prescription opioids [10]. Furthermore, surgeons were responsible for approximately 10% of all opioid prescriptions filled in 2012 or 28 million prescriptions, resulting in a staggering amount of opioid pills available for potential diversion [11]. Another study about opioid related deaths due to abuse found that surgeons were the responsible prescriber for 11.5% of cases [5]. These data suggest that surgeons are playing a pivotal role in the opioid epidemic.

About a quarter of American Hospital Association registered hospitals in the United States have surgical training programs [12]. In these hospitals, a team of individuals including interns, residents and attending surgeons, as well as, advanced practice providers (physician assistant or advanced practice nurse) prescribe post-operative pain medications. Yet, little is known about how different members of surgical teams prescribe opioids. Thus, our study sought to examine the variation in prescribing of opioids for patients being discharged after surgery by type of surgical provider, level of training, and surgical resident subspecialty type within a single, large, academic medical center. We hypothesized that while surgical residents are probably the most frequent team members to write discharge opioid prescriptions, there are significant differences in the number of opioid pills prescribed by advanced practice providers, surgical residents, and attending surgeons.

METHODS

We conducted a retrospective cohort study of all inpatient discharges for patients who underwent five common surgical procedures at a single, large academic medical center. We examined all surgical discharges between July 2015 and July 2016 by an electronic query of health records, compiled in an electronic data warehouse. The procedures included laparoscopic cholecystectomy, laparoscopic appendectomy, open umbilical hernia repair, simple mastectomy, and thyroidectomy. The primary prescriber, medication, medication dosage, number of days prescribed, and the quantity of pills to be dispensed were retrieved. For easier interpretation of the data, total number of tablets and total morphine milligram equivalents (MME) prescribed were calculated [13]. Prescribers were grouped into three categories: attending surgeon, surgical resident, and advance practice provider. For sub-group analysis, we categorized surgical residents by post-graduate year (PGY) into interns (PGY 1), junior surgical residents (PGY 2–3), and senior surgical residents (PGY 4–5). All advanced practice providers prescribed under attending physicians and all surgical residents prescribed under an institutional license.

Univariate analysis was performed by type of surgical provider (attending surgeon, surgical resident or advanced practice provider) and PGY group for surgical residents. At our institution, residents in surgical subspecialties typically rotate on general surgical services during their PGY1 and 2 years, as such we were interested in how their opioid prescribing habits, learned during their time in their respective subspecialty programs, translated when rotating for a month or two on general surgery services. As such residents were further categorized into general surgery and surgical subspecialty residents. Surgical subspecialties for residents included were vascular surgery, urologic surgery, plastic surgery, orthopedic surgery, otolaryngology and cardiac surgery. Median values are reported because of the skewed nature of the data used for the analysis. Kruskal-Wallis H tests were used to determine differences in distribution of total tablets and total MME across prescriber types.

Finally, we sought to determine the likelihood of prescribing a higher number of tablets or MMEs by provider type. Total tablets and total MMEs prescribed were grouped into tertiles in order to create ordered, categorical variables. We used generalized ordered logistic regression to evaluate the effects of provider type on the number of total tablets or total MMEs prescribed. Because surgical residents, as a distinct category, violated the assumption of proportional odds needed to perform ordered logistic regressions, separate odds ratios were estimated to reflect the effect of surgical resident on the odds of prescribing in tertiles 2–3 (higher tertiles) versus tertile 1(lowest tertile) and tertile 3(highest tertile) versus tertiles 1–2 (lower tertiles). Using this approach, the proportional odds assumption was relaxed, created a parsimonious model, and maintained information inherent in the ordering of tertiles. The model that was created adjusted for patient age, type of procedure and clustering within prescribers.

All analyses were performed with Stata, version 13.1 (Stata Corp., College Station, TX). The study was reviewed by the Northwestern Institutional Review Board and was deemed exempt.

RESULTS

The sample consisted of 615 unique surgical cases. Surgical residents prescribed 352 (57.24 %) of the opioid medications, attending surgeons prescribed 147 (23.90 %), and advanced practice providers prescribed 116 (18.86 %). Interns and junior surgical residents prescribed most, 137 (38.92%) and 146 (41.48 %), respectively, with only 69 (19.60 %) by senior surgical residents. There were 251(71.31%) orders from general surgery residents and 101 (28.69%) orders from residents in other surgical subspecialties. [Table 1]

Median number of total tablets prescribed (range) was 20 (6–189) for surgical residents; 30 (6–72) for attending surgeons; and 40 (5–100) for advance practice providers [Table 2]. There was a statistically significant difference in the total number of tablets prescribed between the three groups ($p<0.001$). The median number (range) of total tablets prescribed by surgical resident level was 20 (6–189) for interns, 20 (6–120) for junior surgical residents, and 28 (7–60) for senior surgical residents, with no statistically significant difference in the total number of tablets prescribed between the three resident groups ($p=0.28$). Finally, when surgical residents were grouped by surgical specialty, the median number (range) of total number of tablets prescribed was 24 (6–189) for general surgery and 20 (6–180) for other surgical subspecialties, with no statistically significant difference in the total number of tablets prescribed between the resident specialty groups ($p=0.07$). Similar analysis by type of procedure is shown in Appendix A.

When comparing provider type by total MMEs prescribed, the median number (range) was 200 (30–1600) for surgical residents, 140 (30–600) for attending surgeons, and 240 (25–1000) for advanced practice providers [Table 2]. There was a statistically significant difference in the total number of MMEs prescribed between the three groups ($p<0.001$). Subgroup analysis comparing surgical residents across resident levels showed that median (range) total MMEs were 200 (20–1600) for interns, 300 (30–600) for junior surgical residents and 200 (70–600) for senior surgical residents and there was no statistically significant difference between the three groups ($p=0.19$). Finally, when residents were grouped by surgical subspecialty, median (range) total MMEs for general surgery residents was 200 (50–600) versus 200 (30–1600) for residents in other surgical subspecialties. There was a statistically significant difference observed between these two groups, probably due to the skewed nature of the prescribing pattern ($p=0.03$). Similar analysis by type of procedure is shown in Appendix A.

Interestingly, we found that, when compared to attending surgeons, surgical residents were less likely to prescribe a higher number of tablets (OR 0.29, $p=0.04$), but advanced practice providers were no more likely to prescribe a higher number of tablets than attending surgeons (OR 2.142 $p=0.28$) [Table 3]. We also found that, compared to attending surgeons, surgical residents and advanced practice providers were more likely to prescribe a higher total MMEs, (OR 7.12, $p<0.001$; OR 3.39, $p=0.01$ and OR 6.46, $p=0.01$), respectively.

DISCUSSION

This study suggests that attending surgeons are more likely to prescribe a higher number of opioid tablets compared to surgical residents but less likely to prescribe more MMEs. Attending surgeons, however, are more likely to order fewer opioid tablets and less MMEs, compared to advanced practice providers.

One might expect that different prescription patterns exist by level of resident training, reflecting increasing knowledge and experience about appropriate post-operative pain management at discharge. However, this study shows no statistically significant differences. It is possible that prescribing patterns for number of tablets and total MMEs, for common surgical procedures, are similar by PGY level because they are directed by senior members of the surgical team. Further analysis is necessary to examine whether prescribing patterns of residents evolve over time, as residents advance through residency.

To date, several studies have evaluated postoperative opioid prescribing among surgical subspecialties and found excessive opioid prescribing patterns. [14, 15, 16] Rodgers et al. reported that most patients undergoing upper extremity surgery were prescribed 30 opioid tablets. [14] Surprisingly, 77% of subjects reported using less than 15 tablets and 45% took less than 5 tablets. Likewise, in a survey of 384 Oral and Maxillofacial Surgeons, Mutlu et al. found that surgeons prescribed variable strengths and numbers of opioid tablets, with 20% of surgeons prescribing more than the 20 tablets, after impacted third molar removal. [17] A study that examined opioid discharge prescriptions for adult patients who underwent various urological procedures found that only 58% of the prescribed opioids were consumed by the patients [7]. These recent studies continue to shed light on the role played by surgeons in the opioid epidemic and the need to develop strategies to help combat the problem of exposure following surgery and subsequent diversion.

Surgical providers need to assure that each patient has enough medication for post-discharge analgesic control. Many clinicians report that making a patient return to the hospital should he/she require more opioid analgesic may be inconvenient or impossible for some patients because of distance. Furthermore, legislation in some states requires written, paper prescriptions and have varying rules about which opioids can be “called in”, faxed, or sent electronically to a dispensing pharmacy. [18] While overprescribing to reduce any patient inconvenience is understandable, this practice may indirectly be helping to fuel the epidemic [11, 14, 19]. A recent study identified the number of pills to adequately treat the pain needs of 80% of patients who undergo 5 common outpatient general surgical procedures, some of which are included in this study [15]. In a follow-up study, implementation of the recommendations resulted in a 53% decrease in the number of opioid pills prescribed without need for opioid refill prescriptions. [20]. If these recommendations were followed at our medical center, the number of pills prescribed by surgeons, surgical residents, and advance practice practitioners could be dramatically reduced, suggesting a need for intensive education and outreach to all members of the surgical team.

Opioid prescribing patterns may vary widely because of inattention to the risk and benefits of opioids and lack of education on suitable alternatives to opioids. As such, it is vital to

address these knowledge deficits and prescribing habits among members of a surgical team. One approach is the concept of academic detailing that has been employed in some large health care systems and the US Department of Veterans Affairs [21]. In this program, pharmacists, nurses and physicians are specially trained in adult learning theory and behavioral modification as well as in the subject area to be addressed. These academic detailers are sent to directly interact with physicians with presentation of rigorous data and up-to-date recommendations of the proper use of a drug for the condition in question. At these sessions, discussions about non-pharmacologic and non-opioid medications as part of multi-modal pain therapy could be discussed. These measures could lead to a cultural shift in opioid prescribing habits among surgeons, advanced care providers and residents. Consequently, this could help reduce prescription of excess opioids. In addition, while there are evidence-based best practices for managing post-surgical pain, there is a lack of specific practice guidelines on how much surgeons should prescribe for certain procedures. [22, 23, 24] Additional research is needed to help guide surgical clinical practice, as most surgeons tend to order a default number of pills without specifically accounting for type of procedure and individual needs.

This study has some limitations that should be acknowledged. First, the data are from a single academic, medical center and therefore, may not be broadly applicable. However, given the known variation across multiple specialties and multiple settings, it is likely that the wide variation seen among the surgical provider types in this study also exists across different healthcare settings. Second, neither the complexity of the surgical procedure nor patient health status complexity was accounted for given the limitations of retrospective data. Therefore, some variation by procedure or patient status may be justified, however, to what extent prescriptions should vary by patient is yet unknown and an area which requires further study.

CONCLUSION

While opioids are likely to remain a necessary part of the current treatment algorithm for acute surgical pain, their widespread abuse and misuse has escalated to epidemic proportions. [1, 2, 3, 4] Our study shows that the number and strength of opioid analgesics prescribed following a surgical encounter vary widely by surgical provider type. In addition to creating better guidelines for post-operative opioid prescribing, there is a need to understand and address the underlying knowledge, attitudes, and beliefs of each provider type for future education and outreach activities.

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APPENDIX A. Variation in Opioid Prescription by Prescriber Type and Procedure

	Total Tablets		Total Morphine Equivalents	
	Median (Range)	p Value	Median (Range)	p Value
	Laparoscopic Cholecystectomy N = 208 cases			
Rank				
Surgical Resident	20 (7–120)	<0.001	200 (54–600)	<0.001
Attending Surgeon	30 (10–72)		138 (45–300)	
Advanced Practice Provider	60 (2–100)		150 (100–500)	
Resident Level				
Intern (PGY1)	20 (10–120)	0.01	200 (54–600)	0.01
Junior Resident (PGY2–3)	20 (10–120)		200 (90–600)	
Senior Resident (PGY3–6)	24 (7–60)		200 (70–600)	
Surgical Resident Subspecialty				
General Surgery	24 (7–120)	<0.001	200 (45–600)	0.80
Other	20 (20–60)		200 (100–300)	
	Laparoscopic Appendectomy N = 103 cases			
Rank				
Surgical Resident	30 (6–168)	0.03	200 (54–600)	<0.001
Attending Surgeon	30 (6–60)		135 (30–600)	
Advanced Practice Provider	30 (5–60)		150 (25–600)	
Resident Level				
Intern (PGY1)	20 (12–168)	0.06	200 (54–378)	<0.001
Junior Resident (PGY2–3)	48 (6–120)		270 (60–600)	
Senior Resident (PGY3–6)	45 (30–60)		175 (135–250)	
Surgical Resident Subspecialty				
General Surgery	30 (6–120)	0.54	135 (30–600)	0.30
Other	35 (10–168)		170 (54–600)	
	Open Umbilical Hernia Repair N = 140 cases			
Rank				
Surgical Resident	20 (7–180)	0.11	200 (50–900)	<0.001
Attending Surgeon	48 (12–72)		120 (60–300)	
Advanced Practice Provider	30 (20–60)		300 (150–300)	
Resident Level				
Intern (PGY1)	20 (10–180)	0.21	200 (50–900)	0.01
Junior Resident (PGY2–3)	20 (10–120)		200 (50–600)	
Senior Resident (PGY3–6)	30 (7–60)		200 (70–600)	

	Total Tablets		Total Morphine Equivalents	
	Median (Range)	p Value	Median (Range)	p Value
Surgical Resident Subspecialty				
General Surgery	24 (7–120)	0.32	200 (50–600)	0.06
Other	20 (10–180)		200 (50–900)	
	Simple Mastectomy N = 76 cases			
Rank				
Surgical Resident	30 (10–189)	0.34	280 (50–60)	0.65
Attending Surgeon	30 (20–60)		210 (120–400)	
Advanced Practice Provider	30 (30–60)		300 (150–400)	
Resident Level				
Intern (PGY1)	30 (20–189)	0.11	280 (100–600)	0.39
Junior Resident (PGY2–3)	20 (10–60)		200 (60–400)	
Senior Resident (PGY3–6)	30 (30–30)		300 (300–300)	
Surgical Resident Subspecialty				
General Surgery	30 (14–189)	0.15	225 (100–600)	0.60
Other	25 (10–30)		200 (50–600)	
	Thyroidectomy N = 88 cases			
Rank				
Surgical Resident	20 (6–60)	<0.001	145 (30–1600)	<0.001
Attending Surgeon	N/A		N/A	
Advanced Practice Provider	30 (20–90)		300 (120–1000)	
Resident Level				
Intern (PGY1)	20 (6–60)	<0.001	100 (30–1600)	<0.001
Junior Resident (PGY2–3)	20 (6–60)		120 (30–600)	
Senior Resident (PGY3–6)	28 (20–60)		240 (100–300)	
Surgical Resident Subspecialty				
General Surgery	24 (20–60)	<0.001	120 (100–600)	<0.001
Other	20 (6–60)		150 (30–1600)	

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1. The United States is in the midst of an opioid epidemic
2. It is unknown how much opioid prescribing patterns vary among providers on a typical surgical team
3. Creating practice-specific guidelines and education of team members may help limit the amount that they prescribe

TABLE 1

Characteristics of Opioid Prescribers on Surgical Team

TYPE OF PRESCRIBER	FREQUENCY (%)
Rank	
Surgical Resident	352 (57.24)
Attending Surgeon	147 (23.90)
Advanced Practice Provider	116(18.86)
Resident Level	
Intern	137(38.92)
Junior Resident (PGY2–3)	146 (41.48)
Senior Resident (PGY3–6)	69 (19.60)
Surgical Subspecialty	
General Surgery	251 (71.31)
Other	101(28.69)

TABLE 2

Variation in Opioid Prescription by Prescriber Type

	Total Tablets		Total Morphine Milligram Equivalents	
	Median (Range)	**p Value**	**Median (Range)**	**p Value**
Rank				
Surgical Resident	20 (6–189)	<0.001	200 (30–1600)	<0.001
Attending Surgeon	30 (6–72)		140 (30– 600)	
Advanced Practice Provider	40 (5–100)		240 (25–1000)	
Resident Level				
Intern (PGY1)	20(6–189)	0.28	200(30–1600)	0.19
Junior Resident (PGY2–3)	20 (6–120)		300 (30–600)	
Senior Resident (PGY3–6)	28 (7–60)		200 (70–600)	
Surgical Resident Subspecialty				
General Surgery	24 (6–189)	0.07	200 (50–600)	0.03
Other	20 (6–180)		200 (30–1600)	

TABLE 3

Generalized Ordered Logistic Regression Estimates of Opioids Prescribed in Different Tertiles Adjusted for Age, Procedure Type and Clustering Within Prescribers

	Tertiles 2–3 vs Tertile 1	p Value	Tertile 3 vs Tertile 1–2	P Value
Total Tablets				
Attending Surgeon (ref)	1.00		1.00	
Surgical Resident	0.29 (0.09–0.95)	0.04	0.77(0.19–3.05)	0.71
Advanced Practice Provider	2.12 (0.54–8.30)	0.28	2.12(0.54– 8.30)	0.28
Total Morphine Equivalents				
Attending Surgeon(ref)	1.00		1.00	
Surgical Resident	7.12(3.62–14.00)	<0.001	3.39(1.61–7.11)	0.01
Advanced Practice Provider	6.46(1.82–22.97)	0.01	6.46(1.82–22.97)	0.01