Patient-reported opioid analgesic requirements after elective inguinal hernia repair: A call for procedure-specific opioid-administration strategies

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Background. A better understanding of the analgesia needs of patients who undergo common operative procedures is necessary as we address the growing opioid public health crisis in the United States. The aim of this study was to evaluate patient experience with our opioid prescribing practice after elective inguinal hernia repairs.

Methods. A prospective, observational study was conducted between October 1, 2015, and September 30, 2016, in a single-surgeon, high-volume, practice of inguinal hernia operation. Adult patients undergoing elective inguinal herniorrhaphy under local anesthesia with intravenous sedation were invited to participate. All patients were prescribed 10 opioid analgesic tablets postoperatively and were counseled to reserve opioids for pain not controlled by nonopioid analgesics. Their experience was captured by completing a questionnaire 2 to 3 weeks postoperatively during their postoperative visit.

Results. A total of 185 patients were surveyed. The majority of the participants were males (177, 95.7%) and $\geq$ 60 years old (96, 51.9%). Of the 185 patients, 159 (85.9%) reported using $\leq$ 4 opioid tablets; 110 patients (59.5%) reported that they used no opioid analgesics postoperatively. None of the patients was taking opioids within 7 days of their postoperative appointment. Of the 147 patients who were employed, 111 (75.5%) reported missing $\leq$ 3 work days, 57 of whom (51.4%) missed no work at all. Patients who were employed were more likely to take opioid analgesics postoperatively (P = .049). Patients who took no opioid analgesics experienced less maximum (P < .001) and persistent groin pain (P = .037). Pain interfered less with daily activities (P = .012) and leisure activities (P = .018) for patients who did not use opioids.

Conclusion. The majority of our patients reported that they did not require any opioid analgesics, and nearly all of those who thought that they did need opioids used < 5 tablets. Our data suggest that for elective inguinal hernia repair under a local anesthetic with intravenous sedation, a policy of low opioid analgesic prescribing is achievable; these findings call for further investigation of how to best prescribe opioid medications to patients after an inguinal herniorrhaphy. (Surgery 2017;■:■-■.)

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EVEN THOUGH we are often reminded of the impact that the opioid epidemic is having on our society, our efforts to control this trend have not been successful.[1,2] Deaths secondary to overdose of prescription opioid analgesics have quadrupled during the past decade and now seem to have surpassed fatalities from motor vehicle crashes and firearms.[2-5] Recent data suggest that the risk of long-term (>90 days) opioid dependence after an operation is as great as 6%,[6] and patients treated by "high-intensity" prescribers seem to be 30% more likely to become long-term opioid users.[7] Therefore, overuse of opioid analgesics can be attributed at least in part to the prescribing patterns of proscribers.[1,7,8]

Many studies trace the origin of opioid over-prescribing to internists and primary care providers,

0039-6060/$ - see front matter

http://dx.doi.org/10.1016/j.surg.2017.06.017

but surgeons also are inadvertently overprescribing opioid analgesic medication to their patients.[8-11] Despite the fact that tension-free hernia repairs are thought to have led to decreased postoperative pain, the opioid-prescribing habits of surgeons may not have been impacted by this observation.[12,13] Efforts have been made to better understand surgeon prescribing habits after different operative procedures.[8,9] Of note, Hill et al reported recently that a median of 30 opioid tablets are prescribed routinely to patients undergoing laparoscopic and open herniorrhaphies.[8,9] These authors also attempted to provide guidelines for prescribers and suggested that 15 opioid tablets would provide the ideal amount of analgesia after repair of an inguinal hernia.[8,9] Their recommendations, however, were based primarily on physician experience and may not reflect true patient needs. Our findings suggest that data-driven, low opioid prescribing may be achievable in elective inguinal herniorrhaphy and call for the evaluation of strategies of procedure-specific opioid administration.

METHODS

Patient selection. This prospective, observational study was conducted between October 1, 2015, and September 30, 2016, in a single-surgeon (M.R.), high-volume practice of elective inguinal hernia operation. Adult patients undergoing elective Kugel repair for primary or recurrent inguinal hernia were invited to participate in the study. Patients with a history of radical prostatectomy were excluded because scarring from prior procedures can make intraoperative dissection in the preperitoneal space more challenging, thus increasing potentially their risk for postoperative pain and need for opioid use. In addition, patients undergoing non-Kugel inguinal hernia repair and patients <18 years old also were ineligible for participation. All patients provided consent for this study. The study protocol was approved by the Institutional Review Board of Newton-Wellesley Hospital prior to beginning data collection with postoperative surveys.

Operative repair. The Kugel repair is a well-described, open, preperitoneal procedure based on the technique first described by Stoppa as the only mesh repair to cover the entire myopectineal orifice of Frouchaud.[14,15] In our series, the hernia repair was performed via a 4-cm, transverse incision just below McBurney's point. For each patient, local anesthesia mixture (35 mL of 0.25% Marcaine [NOVAPLUS, Lake Forest, IL] mixed in equal parts with 1.0% Lidocaine [Hospira, Lake Forest, IL] with epinephrine) was administered as an ilioinguinal nerve block prior to incision and subsequently prior to any tissue manipulation. This technique allowed for the repair to be completed under local anesthesia and intravenous (IV) sedation in every patient.

Postoperative pain management. Based on our personal perceptions of the needs for postoperative analgesia, all patients were given a prescription for 10 Vicodin (hydrocodone 5 mg/acetaminophen 325 mg) tablets. Prior to operation and in the postanesthesia care unit, the patients were advised that their postoperative pain level may not require an opioid and were encouraged to manage their pain using nonopioid analgesics, such as acetaminophen and/or ibuprofen.

Assessment tool. We designed and implemented a survey (Supplementary Fig 1) based on current literature supporting the utility of the Visual Analogue Scale (VAS) pain scores and the Patient-Reported Outcomes Measurement Information System (PROMIS) questionnaire evaluating quality of life questions.[16-19] The PROMIS 10 questionnaire was modified by adding "hernia surgery" to each question. The survey was utilized to quantify postoperative consumption of opioid analgesics after inguinal herniorrhaphy. Patient-centered outcomes also were evaluated to contextualize the profiles of postoperative pain with patient function after the inguinal herniorrhaphy. All patients were asked to participate in our study by completing a survey in their 2- to 3-week postoperative appointment. At that time, patients still experiencing pain with a VAS score of ≥4 were determined as having persistent groin pain.[19] Postoperative complications and recurrence rates were obtained by chart review at the end of our study. Data were collected by and stored in a Health Insurance Portability and Accountability Act-compliant Research Electronic Data Capture server approved by Partners Healthcare; analysis was performed only after deidentification had been completed.

Procedure-specific opioid-administration strategies. The data acquired through this systematic, patient-centered approach were utilized to guide subsequently the prescribing of postoperative opioid analgesia in our own practice after elective inguinal herniorrhaphy.

Statistical analysis. Categorical variables were summarized using frequencies and percentages and continuous variables as means and standard deviations or, if the data were skewed, as medians with 25th and 75th percentiles. Descriptive statistics were computed using the 2-sided Pearson χ^2 test for dichotomous variables. Cross-tabulation was performed to create contingency tables for

Table I. Patient demographic characteristics (*n* = 185)

Patient characteristics	Frequency (relative rate)
Age, y	
<21	3 (1.6%)
21–29	6 (3.2%)
30–39	8 (4.3%)
40–49	29 (15.7%)
50–59	39 (21.1%)
≥60	96 (51.9%)
No. of patients who did not respond to this question	4 (2.2%)
Sex	
Male	177 (95.7%)
Female	8 (4.3%)
Laterality	
Unilateral	151 (81.6%)
Bilateral	34 (18.4%)
Recurrent	
Yes	18 (9.7%)
No	164 (88.7%)
No. of patients who did not respond to this question	3 (1.6%)
Work involve lifting >25 lbs	
Yes	40 (21.6%)
No	123 (66.5%)
No. of patients who did not respond to this question	22 (11.9%)
Somatometric measurements, mean ± standard deviation	
Height, cm	177.8 ± 8.4
Weight, kg	81.8 ± 11.9

comparisons across respondent characteristics. Linear-by-linear association was performed to test the association between ordinal variables and non-ordered categorical variables. Simple and multivariable linear regression models were used to investigate associations between the use of opioid analgesics and other relevant patient-centered outcomes. Data analyses were performed in R 3.3.2 (R Core Team, Vienna, Austria) Statistical Software and in IBM SPSS Statistics 23.0 (IBM Corp., Armonk, NY).

RESULTS

After informed consent was obtained, 185 adult patients were surveyed. The majority of the study participants were males (177, 95.7%) and were ≥60 years of age (96, 51.9%). Most of the inguinal hernias in our cohort were primary (164, 88.7%), unilateral (151, 81.6%) hernias. Patient demographics can be seen in Table I. One patient developed a hernia recurrence during the follow-up. In addition, 3 patients (1.6%) had urinary retention postoperatively and were catheterized in the postanesthesia care unit before being sent home. One patient (0.5%) had nerve entrapment of a branch of the ilioinguinal nerve during closure of the external oblique muscle. This patient called the office on postoperative day 1 to report no pain relief with the standard prescription and was provided a prescription for hydromorphone. On postoperative day 2, he recalled reporting no relief with the hydromorphone and was taken to the operating room where the entrapped nerve was released under local anesthesia. One patient developed operative site infection and was treated with a course of oral antibiotics. Lastly, one patient required a refill of their Vicodin prescription.

The primary objective of this study was to better define the profiles of postoperative pain and to determine the use of opioid analgesics in patients undergoing inguinal herniorrhaphy as an outpatient with local anesthesia with IV sedation. Interestingly, 85.9% (*N* = 159/185) of our patients reported using ≤4 Vicodin tablets. Furthermore, 110 of those 185 patients (59.5%) used no opioid analgesics. Only 13 patients (7%) in our entire cohort needed ≥9 tablets to alleviate their pain, and none of our patients reported taking opioids within the 7 days before their 2- to 3-week postoperative appointment. Of note, 2 patients reported taking opioid analgesics preoperatively for other medical conditions (chronic low back and postoperative pain due to recent neck operation). After the inguinal herniorrhaphy, one of these patients reported that he did not use opioid analgesics for postoperative hernia-related pain, whereas the other patient took only one Vicodin tablet. Although 9 of 185 of our patients (4.8%) utilized alternative techniques of nontraditional pain management, no statistical difference was found between patients who used opioid analgesics and those who did not (*P* = .706). Persistent groin pain defined as pain with a VAS score of ≥4 in the 2- to 3-week postoperative appointment was encountered in 5 patients (2.7%), but none was taking opioids to treat discomfort.[19] Detailed information regarding postoperative pain and use of opioid analgesics is provided in Table II.

Another important end point of this study was to determine when patients returned to activities of daily living (ADL) and work. By the time of their 2- to 3-week postoperative appointment, 123 patients (66.5%) reported that pain did not interfere with their ADL, and 42 (22.7%) thought that their activities were restricted only a little bit. Five patients (2.7%) reported that pain affected their ADL quite a

Table II. Postoperative pain and use of opioid analgesics

Patient-reported outcomes	Relative rate
Use of opioid analgesics for pain control postoperatively, %	
Yes	40
No	59.5
% of patients who did not respond to this question	0.5
No. of opioid tablets that patients used, %	
1	6.5
2–4	20
5–8	6.5
9–12	6.5
>12	0.5
Use of opioid analgesics within the 7 days before the 2- to 3-week postoperative appointment, %	
Yes	0
No	98.9
% of patients who did not respond to this question	2.7
Use of alternative pain management techniques, %	
None	94.7
Meditation	2.8
Acupuncture	0.5
Physical therapy	0.5
Injection therapy	0
Other/Unspecified	1
% of patients who did not respond to this question	0.5
Average pain on a scale from 0–10, %	
0	39.5
2	40.5
4	17.8
6	1.6
8	0.5
10	0
Worst pain on a scale from 0–10, %	
0	10.8
2	22.7
4	23.2
6	26.5
8	13
10	3.8
Pain at the time of the 2- to 3-week postoperative appointment on a scale from 0–10, %	
0	79.5
2	17.8
4	2.7
6	0
8	0
10	0

Table III. Patient-centered outcomes as determined at the 2- to 3-week postoperative appointment

Patient-reported outcomes	Relative rate
Pain interference with activities of daily living, %	
Not at all	66.5
A little bit	22.7
Somewhat	7.6
Quite a lot	2.7
I cannot do anything	0
Not applicable	0.5
Pain interference with leisure activities, %	
Not at all	55.7
A little bit	18.4
Somewhat	10.3
Quite a lot	3.2
I cannot do anything	0.5
Not applicable	11.4
% of patients who did not respond to this question	0.5
Pain interference with vigorous activities (such as running, heavy lifting, or participating in strenuous sports), %	
Not at all	28.7
A little bit	18.9
Somewhat	9.8
Quite a lot	7
I cannot do anything	3.2
Not applicable	31.9
% of patients who did not respond to this question	0.5
Job limitations due to pain, %	
Not at all	58.4
A little bit	9.3
Somewhat	3.2
Quite a lot	2.2
I cannot do anything	3.2
Not applicable	23.2
% of patients who did not respond to this question	0.5

lot; however, no patient was unable to engage in their daily activities, and none was using opioids at this time point. Data on patient-centered outcomes are summarized in Table III. Furthermore, 111 of 147 patients (75.5%) who were employed reported missing ≤3 work days, and 57 (51.4%) missed no work at all. Only 24.5% ($N = 36/147$) of our patients took ≥4 off of work; however, the majority of these patients (67%, $N = 24/36$) reported that their occupation required lifting >25 pounds and were advised to wait 14 days postoperatively prior to resuming their normal work activities. Supplementary Fig 2 represents the distribution of days missed from work for our entire patient cohort. Patients who were employed at the time of their operation were more likely to take opioid analgesics postoperatively ($P = .049$).

Patients who took no opioid analgesics experienced less maximum pain ($P < .001$) and persistent groin pain by the time of their postoperative visit ($P = .037$). Pain interfered less in ADL ($P = .012$)

and activities done for fun in patients who did not use opioids (P = .018). Furthermore, patients were asked to estimate their pain on average throughout the 2- to 3-week postoperative period. No difference was observed in average pain levels between patients who did or did not use opioid analgesics (P = .081). In linear regression analysis, patients who experienced more maximum pain took more opioid tablets ($\beta1$: 0.088, 95 confidence interval [CI] 0.006–0.170, P = .034). After adjusting for patient sex, patients who took opioids had greater maximum pain levels ($\beta1$: 0.047, 95 CI 0.021–0.074, $P < .001$), as did study participants who took more opioids compared to those who took less ($\beta1$: 0.087, 95 CI 0.0061–0.16, P = .035). Even after adjusting for recurrent hernias, patients who required opioid analgesics had greater maximum pain levels ($\beta1$: 0.048, 95 CI 0.021–0.074, $P < .001$), and again so did study participants who reported taking more opioid analgesic tablets compared to those who reported taking less ($\beta1$: 0.084, 95 CI 0.0024–0.16, P = .043). Detailed results of cross-tabulation analyses are presented in Supplementary Tables I and II.

DISCUSSION

In the context of a growing opioid epidemic, a fine balance must be struck between achieving adequate analgesia and treating pain as the "fifth vital sign" by overprescribing opioid medication.[1,2,20] Although attempts have been made to affect prescribing habits of surgeons, to our knowledge, our study focuses on quantifying the number of opioid tablets that patients reported using after an elective inguinal herniorrhaphy under local anesthesia with IV sedation.[8,9] Our findings could provide a useful benchmark for establishing data-driven prescribing for elective herniorrhaphies.

We found that prescribing 4 opioid tablets would be enough to fulfill the postoperative analgesia requirements of $\approx 86\%$ of our patients who underwent an elective inguinal herniorrhaphy under local anesthesia with IV sedation. Even though our intentions were to limit opioid prescribing by dispensing only 10 tablets, we still provided our patients with 150% more opioid tablets than the majority of patients actually needed. Several studies in a variety of other surgical disciplines also have indicated that well-intentioned surgeons may be overprescribing opioid analgesics.[21-24]

Recent attempts to modify the opioid prescribing habits of surgeons by recommending an ideal number of 15 tablets for inguinal hernia repairs are well meaning but also might cause clinicians to overprescribe opioids by $\approx 300\%$.[8,9] Patient surveys conducted in these studies had very low response rates ($<30\%$) and may not provide reliable estimates of opioid analgesia requirements after an elective inguinal herniorrhaphy.[8,9] We think that utilizing accurate patient data to define postoperative analgesic needs is important as we attempt to improve our practices.

With $\approx 750,000$ inguinal hernias repaired in the United States each year, prescribing 4 instead of 30 opioid tablets would decrease the number of opioid analgesics dispensed annually for hernia operation from 22.5 million to 3 million.[25] As a result, ≈ 20 million fewer tablets per year would be available for potential diversion and abuse or as a stimulus for the start of opioid dependency.[26,27] Our findings also demonstrate that patients would not experience greater postoperative pain due to this change in prescribing habits after such an elective inguinal hernia repair.

In Massachusetts, efforts have been made to control the impact of the opioid epidemic by introducing electronic prescribing of substances with addictive potential and by having patients return excess opioid tablets when they no longer need them.[28] Despite following these government initiatives, we found that we still overprescribed opioid analgesics to our patients. The results of our study have allowed us to modify our opioid-prescribing practice by administering even fewer tablets. Therefore, we encourage others to validate these findings for elective hernia operation in their own practice and to similarly evaluate patient opioid use for other operative procedures as well.

Our study has several limitations. First, our data reflect the experience of a single surgeon (M.R.) in a high-volume hernia practice. Therefore, additional study is needed to assess whether our results are reproducible in less-specialized surgical centers and other surgical disciplines. Second, although we performed the analysis using deidentified data, patients were not blinded when they completed the survey during their postoperative visit. Indeed, certain patients might consider needing opioid analgesics less socially acceptable or might be reluctant to report honestly their consumption to their physicians. Therefore, the risk of social desirability bias cannot be dismissed.[29] Third, as with any survey study, we also have to consider the risk of recall bias, albeit small given that the patients completed the questionnaire just 2 to 3 weeks after their operation. Fourth, we evaluated elective inguinal herniorrhaphies with only one operative technique performed with local anesthesia with IV sedation. Lastly, Massachusetts likely does not represent the socioeconomic diversity of other states in the United States, and therefore, further study in other regions is needed

to ensure that our outcomes are generalizable throughout the rest of the country.

Despite our intent to limit opioid prescribing by dispensing 10 tablets, we found that the majority of our patients needed fewer opioid analgesics than the 10 tablets we prescribed after elective inguinal hernia operation, and most of those who used opioids for pain relief used ≤4 tablets. These findings suggest that recommendations made based on a single surgeon's personal perceptions or the prescribing practices across a heterogeneous group of providers may be inaccurate.[8] Although our study is limited to a single procedure, performed by a single surgeon in a high-volume center, implementing patient-centered, procedure-specific opioid administration strategies may be conceivable across a variety of surgical disciplines. This approach merits further evaluation and validation as it might best identify the actual opioid requirements after specific procedures to further decrease the number of opioid analgesics prescribed. Such an approach could further decrease the number of patients who become long-term opioid users and limit the amount of excess opioid tablets available for diversion and abuse by others.

SUPPLEMENTARY DATA

Supplementary data related to this article can be found online at http://dx.doi.org/10.1016/j.surg.2017.06.017.

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