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Original Research

Preoperative Opioid Use Results in Greater Postoperative Opioid Consumption After Thumb Basal Joint Arthroplasty

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Purpose: Thumb basal joint arthroplasty surgery is a common hand surgery after which patients often require opioids. To better understand safe opioid consumption patterns, this study sought to identify risk factors for filling a second prescription and/or prolonged opioid use (prescription over 6 months after the surgery). Preoperative opioid use was hypothesized to show an association with greater postoperative opioid use.
Methods: A retrospective review of consecutive patients who underwent primary thumb basal joint arthroplasty was conducted, yielding 110 patients for analysis. Demographic and clinical data were collected. Opioid prescription data were extracted from 6 months before the surgery to 9 months after the surgery using a state prescription drug monitoring program. Bivariate and multivariate analyses were performed for filling a second opioid prescription or filling an opioid prescription over 6 months after the surgery.
Results: All the patients filled their initial postoperative prescription. Of the 110 patients, 26.4% filled an opioid prescription before the surgery, 42% filled a second postoperative prescription, and 14.5% were still consuming opioids over 6 months after the surgery. Patients using preoperative opioids had 7-fold higher odds of filling a second opioid prescription and 37-fold higher odds of prolonged use. No other demographic or clinical factors, including the type of procedure or number of initial opioids prescribed, were associated with increased use of postoperative opioids. Of all the opioid prescriptions filled after the initial postoperative prescription, only 9.3% were prescribed by a surgeon's office.
Conclusions: Patients who undergo thumb basal joint arthroplasty with preoperative opioid use have much greater odds of filling a second opioid prescription and prolonged use after the surgery. Low initial surgeon-provided opioid dosages did not correlate to filling a second prescription, indicating that lower initial doses are feasible. Finally, nearly all opioid-naïve patients who filled a second opioid prescription received them from providers other than a surgeon, indicating the need for greater communication with nonsurgical providers simultaneously caring for patients in the perioperative period.
Type of study/level of evidence: Therapeutic III.

The second-most common site of hand osteoarthritis is the thumb basal joint, with moderate-to-severe trapeziometacarpal arthrosis present in over 34% of people aged between 51 and 60 years, rising to over 91% in those aged above 81 years.[1,2] As such, surgical strategies are often offered to help manage recalcitrant cases of thumb carpometacarpal osteoarthritis. A common surgical strategy, trapeziectomy with ligamentous reconstruction and tendon interposition, was chosen by 62% of the American Society for Surgery of the Hand's members when pain was intolerable for patients and conservative therapies were exhausted.[3] Postoperative pain control for this common procedure is relevant for surgeons, particularly in light of the ongoing opioid epidemic.

Although numerous multimodal analgesia strategies have emerged to guide prescribers and mitigate adverse outcomes, such as chronic opioid dependence, the United States remains the top

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prescriber and consumer of opioids globally.[4] The corollary to increased prescription and consumption is a rising opioid death toll, with an estimated 50.9% spike in opioid deaths in 2016 and an estimated economic burden of $78.5 billion in 2013.[5,6] Studies have linked preoperative opioid use to chronic opioid dependence after surgery in adult patients undergoing shoulder reconstruction and those undergoing spine surgery; however, studies are limited in the field of hand surgery.[7–9] Similarly, studies have shown that higher amounts of opioids prescribed after surgery can result in increased and prolonged opioid use; however, similar studies are lacking in the field of hand surgery.[10] Furthermore, many of the previous studies were limited with regard to data collection, relying on patient-reported retrospective surveys, with an inherent recall bias, or insurance database studies fraught with coding inaccuracies.[11]

Currently, state adoption of prescription drug monitoring programs (PDMPs) offers providers an objective insight into patient prescription history. Prescription drug monitoring programs have also helped reduce opioid prescriptions and curb the epidemic, such as that in Pennsylvania, where there has been a 36.6% reduction in opioid prescriptions since the launch of the PDMP database in 2016.[12] Data in the PDMP database have also been validated in the orthopedic literature and have shown 97.1% accuracy, with a sensitivity of 96.4% and specificity of 97.1%.[13]

At our institution, Tan et al[14] previously used the PDMP database to analyze postoperative opioid prescription patterns in patients undergoing hip arthroplasty and identify risk factors for patients who needed a second prescription and/or showed prolonged use (>6 months). They identified preoperative opioid use, sedative or sleep aids, and patient length of stay as risk factors. Similarly, our study aimed to analyze patient-filled opioid prescriptions for thumb basal joint arthroplasty (BJA) surgery, a commonly performed hand surgery after which patients often require opioid prescriptions, to identify risk factors for patients who need a second prescription and/or engage in prolonged opioid use. Our study hypotheses were that preoperative opioid use and larger amounts of initial surgeon-provided postoperative opioid prescriptions would be associated with greater postoperative use and a longer duration.

Materials and Methods

After institutional review board approval, 139 consecutive patients who underwent thumb BJA between May 2019 and June 2020 performed by 8 hand surgery fellowship-trained hand surgeons were screened for inclusion. The relevant exclusion criteria included minors, patients who underwent multiple surgical procedures (either 6 months before the surgery or 9 months after the surgery), or those who did not elect to fill their initial surgeon-provided postoperative opioid prescription. In total, 110 patients were included in the analysis, whereas 29 patients were excluded because of concomitant surgeries (n = 10), no postoperative surgeon-provided opioid prescription filled (n = 5), or no available PDMP data (n = 14).

Patient demographic data were collected using electronic medical records, including age, sex, body mass index, race, insurance type, and laterality. Clinical factors were also recorded, including procedure type, regional block use, surgeon, follow-up time with the surgeon (last outpatient visit with the operating surgeon), and postoperative complications, all of which were recorded in postoperative clinic notes (Table 1). Individual complication types were combined into a single category for statistical analysis because they were underpowered individually. From the Pennsylvania PDMP website, all prescriptions filled 6 months before and 9 months after the surgical procedure were reviewed. This timeframe was selected based on the existing literature to capture the full representative perioperative period for potential opioid use (or overuse).[14,15] The prescriptions were grouped into 4 types: stimulants (amphetamine etc), benzodiazepines (lorazepam, etc), nonbenzodiazepine sedative or hypnotics (trazodone, zolpidem, etc), and opioids (tramadol, morphine, codeine, oxycodone, etc). The Pennsylvania PDMP website also aggregates prescription data from the following states: Connecticut, Delaware, District of Columbia, Florida, Illinois, Maine, Maryland, Massachusetts, Military Health System, New York, North Carolina, Ohio, South Dakota, Texas, and Virginia.

Table 1
Patient Clinical Factors*

Procedure Type	Frequency (%) or Mean (SD)
Trapeziectomy and tightrope	55/110 (50%)
Trapeziectomy and LRTI	55/110 (50%)
Laterality	
Left	52/110 (47.3%)
Right	58/110 (52.7%)
Regional block	77/110
Postoperative complications	16/110 (14.5%)
Pain and swelling	4/110 (3.6%)
Weakness	4/110 (3.6%)
Mechanical symptoms	2/110 (1.8%)
Numbness	1/110 (0.9%)
Postoperative follow-up (wk)	22.2 ± 16.9 (1–73)
Preoperative filled prescriptions	1.58 ± 2.38 (0–9)
Opioids	0.75 ± 1.62 (0–9)
Benzodiazepines	0.40 ± 2.38 (0–6)
Stimulants	0.20 ± 1.11 (0–9)
Sedative or hypnotics	0.23 ± 0.80 (0–6)
Postoperative filled prescriptions	2.33 ± 3.53 (0–15)
Opioids	1.16 ± 2.24 (0–12)
Benzodiazepines	0.51 ± 1.64 (0–9)
Stimulants	0.35 ± 1.83 (0–15)
Sedative or hypnotics	0.30 ± 1.22 (0–8)

LRTI, ligament reconstruction tendon interposition.
* Continuous variables are presented as mean ± SD (range), whereas frequency variables are presented as fraction (percentage).

Prescription dosages, refills, dates, and numbers were recorded. Opioid dosages were converted to morphine milligram equivalents (MME) to aid in comparison. The patients were then separated based on prior exposure to a controlled medication in the 6 months prior to the surgery. This resulted in 2 groups, exposed and not exposed, for each prescription category. Our primary outcomes included the following: (1) filling of a second opioid prescription and (2) filling of an opioid prescription more than 6 months after the surgery, which was defined as prolonged opioid use. Postoperative opioid MME beyond the surgeon-provided postoperative prescription was not used as a dependent outcome because the amount of pills that the patient actually consumed could not be confirmed as part of this retrospective study and might have decreased the study's external validity. However, the patients' act of filling prescriptions was verifiable using the PDMP database. Furthermore, MME was subsequently characterized using descriptive analyses.

An initial bivariate logistic regression analysis was performed to identify preoperative and patient factors that showed an association with key binary outcomes (filling of a second opioid prescription and filling of an opioid prescription over 6 months after the surgery). The logistic regression variables included age, sex, race, Elixhauser comorbidity weighted percentage score, postoperative follow-up time, body mass index, government insurance, surgeon, procedure, regional block, laterality, postoperative complications, preoperative opioid exposure, preoperative benzodiazepine exposure, preoperative stimulant exposure, preoperative sedative or hypnotic exposure, and initial surgeon-provided postoperative opioid prescription total MME prescribed.[16] The patients

Table 2
Patient Demographic Factors*

Variable	Frequency (%) or Mean (SD)
Age	64.05 ± 8.6 (41–84)
BMI	28.5 ± 6.2 (18.5–44.9)
Sex	
Female	80/110 (72.7%)
Male	30/110 (27.3%)
Race	
White	104/110 (94.5%)
Black	3/110 (2.7%)
Native Hawaiian	1/110 (0.9%)
Other	2/100 (1.8%)
Elixhauser comorbidity scale (%)	80.37 ± 4.49 (60.2–85.2)
Government insurance	37/110 (33.6%)

BMI, body mass index.
* Continuous variables are presented as mean ± SD (range), whereas frequency variables are presented as fraction (percentage).

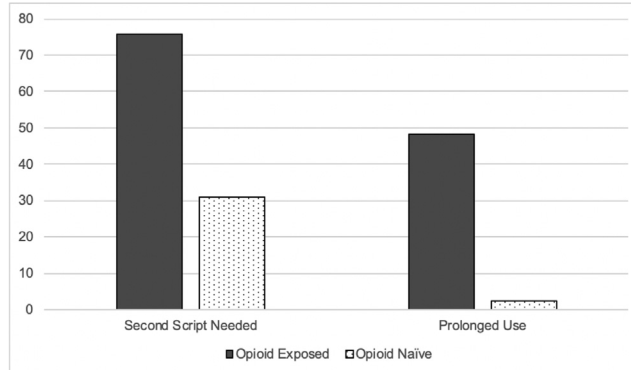

Figure. Bar graph demonstrating percentages of patients with prolonged use or those who required a second prescription based on prior opioid use.

were divided into 2 groups: opioid-exposed (OE) and opioid-naïve (ON) patients. For the surgeon-provided initial postoperative prescription MME variable, opioid prescription thresholds were tested at 10th, 25th, 50th, 75th, and 90th percentiles. The goal of this test was to identify whether the initial surgeon-provided opioid prescription MME was related to the patients filling second prescriptions or filling prescriptions over 6 months after the surgery, with the secondary objective of identifying the threshold at which the surgeon-provided prescription dosage may correlate with patient prolonged opioid use.

Variables suggesting a statistical association, as determined using the bivariate analyses ($P < .25$), were included in the final multivariate logistic regression predictive model.[17,18] For the multivariate analyses, an alpha of 0.05 was used as a threshold for statistical significance. Area under the curve was evaluated to quantify the strength of predictive models. A posthoc power analysis was performed for multivariate logistic regression, with a computed power of 0.872 to detect a standard 2-tailed effect size with a critical z of −1.96 and an alpha of 0.05. The McNemar test was used to characterize the change in "use status" from the preoperative to postoperative period, ie, when the patients did not use opioids before the surgery but used opioids after the surgery and vice versa.

Results

The mean age of our cohort was 64 ± 8.6 years, with 73% women and an overall low comorbidity burden (Tables 1, 2). In our cohort, only 26.4% (29/110) filled an opioid prescription before the surgery, 42% (47/110) filled a second opioid prescription, and 14.5% (16/110) filled opioid prescriptions over 6 months after the surgery. The mean number of initial postoperative opioid prescriptions was 36.3 ± 16.7 MME/d (range, 5–75), with a total mean MME of 119.9 ± 72.7 (range, 27–675). An average opioid prescription with 120 MME is equivalent to 16 pills of 5-mg oxycodone or 24 pills of 50-mg tramadol. Postoperative surgeon-provided opioid prescriptions were stratified into 10th, 25th, 50th, 75th, and 90th percentiles, correlating to 40, 75, 112.5, 150, and 187.5 MME, respectively. For patients who filled additional opioid prescriptions, the mean number of second opioid prescriptions filled was 30.6 ± 21.1 MME/d (range, 7.5–120), with a mean total MME of 318.0 ± 546.0 (range, 27–3,600). When combined, the total supplemental postoperative opioid prescriptions filled averaged 29.2 ± 20.1 MME/d (range, 0.2–120), with a total mean MME of 518.5 ± 366.3 (range, 45–900). Eight patients filled over 5 opioid prescriptions after the surgery (Table 1). Of all the opioid prescriptions filled after the initial postoperative surgeon-provided prescription, only 9.3% were prescribed by the surgeon's office. The PDMP only reports provider names and locations and does not report subspecialties. However, an internet search of the prescribing providers' offices showed specialties, which are as follows in decreasing: pain management (85; 21.4%), rheumatology (82; 20.7%), orthopedics (77; 19.4%), primary care (52; 13.1%), neurosurgery (36; 9.1%), internal medicine (35; 8.8%), dentistry (8; 2.0%), physical medicine and rehabilitation (6; 1.5%), podiatry (4; 1.0), general surgery (3; 0.8%), emergency medicine (2; 0.5%), plastic surgery (2; 0.5%), neurology (1; 0.3%), and urology (1; 0.3%). The degrees of the prescribing providers included Doctor of Allopathic Medicine (262; 66.0%), Physician Assistant (61; 15.4%), Doctor of Osteopathic Medicine (49; 12.3%), Nurse Practitioner (14; 3.5%), Doctor of Dental Medicine (7; 1.8%), and Doctor of Podiatric Medicine (4; 1.0%).

A second opioid prescription was filled by 75.9% (22/29) of OE patients and 30.9% (25/81) of ON patients. Opioid use in the past 6 months was found in 48.3% (14/29) of OE patients and 2.5% (2/81) of ON patients (Fig.). Patients who filled preoperative opioid prescriptions had 7-fold higher odds (odds ratio [OR] 7.04, $P < .01$) of filling a second opioid prescription and 37-fold higher odds (OR 36.87, $P < .01$) of prolonged use. In the bivariate analyses (Table 3), the associated factors for filling a second prescription included opioid exposure (OR 7.04, $P < .01$), follow-up time (OR 1.03, $P = .01$), government-provided insurance (OR 1.70, $P = .20$), and female sex (OR 0.58, $P = .23$). The bivariate predictors of prolonged opioid use included preoperative opioid exposure (OR 36.87, $P < .01$), body mass index (OR 1.08, $P = .05$), follow-up time (OR 1.03, $P = .06$), initial postoperative opioid prescription total MME above 75th percentile (150 MME) (OR 2.28, $P = .21$), and postoperative complication (OR 2.28, $P = .21$) (Table 3). There was no statistical association of the factors with the filling of over 5 opioid prescriptions after the surgery, although these analyses were likely underpowered.

In the multivariate analyses (Table 4), the factors associated with filling of a second prescription included preoperative opioid exposure (adjusted OR 5.98, $P < .01$) and follow-up time (OR 1.03, $P = .03$). In the multivariate analysis, only preoperative opioid exposure was associated with prolonged use (adjusted OR 102.32, $P < .01$). Surgeons who prescribed over 150 MME had an association with prolonged opioid use, which approached statistical significance ($P = .08$). Patients who filled second prescriptions had a mean follow-up period of 27.0 ± 20.1 weeks compared with 18.5 ± 13.0 weeks ($P < .01$), whereas patients with prolonged opioid use had a mean follow-up period of 29.9 ± 15.1 weeks compared with 20.9 ± 16.9 weeks ($P = .05$).

No other demographic and clinical factors showed significant associations. The multivariate models for second opioid

Table 3
Bivariate Predictors of Second Opioid Prescription and Prolonged Use

Predictor	OR	95% CI	*P* Value	OR	95% CI	*P* Value
Age	1.01	0.97−1.06	.695	1.02	0.96−1.08	.589
Sex	0.58	0.24−1.40	**.225**	0.80	0.25−2.52	.700
Race	1.00	0.55−1.84	.995	0.00	0.00	.998
Elixhauser comorbidity scale (%)	0.98	0.90−1.07	.682	0.95	0.86−1.06	.387
Follow-up time (wk)	1.03	1.00−1.06	**.012**	1.03	1.00−1.06	**.055**
BMI	1.03	0.97−1.10	.339	1.08	1.00−1.17	**.054**
Government insurance	1.70	0.76−3.77	**.195**	1.66	0.56−4.88	.358
Surgeon	0.95	0.80−1.12	.521	1.06	0.84−1.34	.641
Procedure	0.80	0.38−1.71	.563	1.00	0.35−2.89	1.00
Regional block	0.85	0.38−1.94	.705	1.34	0.40−4.50	.638
Laterality	0.77	0.36−1.64	.492	0.66	0.23−1.91	.439
Postoperative complication	0.78	0.26−2.31	.648	2.28	0.63−8.22	**.209**
OE	7.04	2.66−18.61	**.000**	36.87	7.59−179.18	**.000**
Benzo-exposed	1.62	0.60−4.38	.340	1.76	0.50−6.18	.381
Stimulant-exposed	0.32	0.04−2.97	.316	0.00	0.00	.999
Sedative or hypnotic-exposed	0.95	0.28−3.21	.937	0.50	0.06−4.19	.525
Postoperative opioid 10th percentile (MME > 40)	1.34	0.37−4.89	.654	0.74	0.15−3.80	.719
Postoperative opioid 25th percentile (MME > 75)	1.02	0.46−2.23	.971	0.70	0.24−2.04	.508
Postoperative opioid 50th percentile (MME > 112.5)	0.95	0.45−2.02	.891	1.23	0.42−3.58	.701
Postoperative opioid 75th percentile (MME > 150)	0.78	0.26−2.31	.648	2.28	0.63−8.2	**.209**
Postoperative opioid 90th percentile (MME > 187.5)	0.71	0.22−2.29	.571	1.74	0.43−7.09	.439

BMI, body mass index; CI, confidence interval.
Bold text signifies a *P* value less than .25 in bivariate analyses. These variables were then carried over to the multivariate analyses as detailed in the methods section.

Table 4
Multivariate Predictors of Second Opioid Prescription and Prolonged Use

Predictor	OR	95% CI	*P* Value	OR	95% CI	*P* Value
Sex	0.59	0.22−1.59	.294	–	–	–
Government insurance	1.53	0.62−3.77	.301	–	–	–
OE	5.98	2.20−16.29	**<.001**	102.32	9.56−1094.74	**<.001**
Follow-up time (wk)	1.03	1.00−1.06	**.031**	1.00	0.96−1.05	.923
Postoperative complication	–	–	–	11.3	0.87−146.81	.064
BMI	–	–	–	1.11	0.99−1.24	.066
Postoperative opioid 75th percentile (MME > 150)	–	–	–	6.90	0.81−58.67	.077

BMI, body mass index; CI, confidence interval.
Bold text in this table designates statistically significant *P*-values less than .05.

prescription and prolonged opioid use showed excellent area under the curve scores of 0.76 and 0.92, respectively. The change-in-use analysis showed that the opioid use patterns significantly changed from the preoperative period to the postoperative period ($P < .01$), with 25 of 81 ON patients (30.9%) filling at least a second postoperative opioid prescription. This suggests that thumb BJA was a primary determinant of opioid use during the patients' studied perioperative periods, and it decreases the likelihood of other confounders, which might explain the prolonged opioid use during the study period.

Discussion

Postsurgical patients might be at an increased risk of opioid dependency and abuse.[19] In a large insurance database study, Johnson et al[20] demonstrated that 13% of ON patients continued to fill opioid prescriptions 90 days after common hand surgeries. Thumb BJA is one of the most common hand surgeries. Identifying the risk factors for persistent postoperative opioid use is critical for assessing surgical candidacy, counseling patients before surgery, and individualizing multimodal analgesia strategies. Statewide PDMPs are accurate and up-to-date substance databases freely available to prescribers. This study aimed to characterize the risks of increased and persistent postoperative opioid use using such databases.

Multiple studies have sought to identify risk factors for increased opioid requirement after hand surgery. Younger age, female sex, lower income, government insurance, higher Elixhauser comorbidity index, mental health disorders, and tobacco dependency or abuse have been associated with prolonged opioid use.[20,21] Sacks et al[22] presented a psychological component of opioid consumption, showing that patients undergoing outpatient hand surgery with more catastrophizing pain and decreased mindfulness, attention, or awareness used more opioids after surgery. Wang et al[23] used the PDMP to compare the risks of prolonged opioid use in patients treated surgically versus those treated nonsurgically for common hand pathologies and found prior opioid use to be the only independent risk factor. Wong et al[24] described a preoperative opioid use rate of 23% in their patients who underwent upper extremity procedures. They found that OE patients used twice as many pills, and 41% of OE patients still sought additional pills compared with 14% of ON patients. Prescribing a different opioid for OE patients mildly reduced their opioid pill requirement.

Majority of these studies relied on insurance databases or posthoc patient surveys for analgesia information, which are subject to inaccurate coding and a recall bias, respectively. The PDMP provides data to separate patients who simply received opioid prescriptions from those who actually filled them. It also shows all prescriptions filled by the patient around the time of surgery, including those not prescribed by a surgeon. Namba et al[25] reported that primary care and internal medicine providers were the highest opioid prescribers around the time of surgery in patients undergoing hip and knee replacement. In general, multiple studies have shown the highest number of opioid prescribers to be primary care providers, followed by pain medicine providers.[26–28] Our study showed that only 9.3% of the second or supplemental postoperative opioid prescriptions were prescribed by a surgeon's office. This finding emphasizes the importance of communication with nonsurgical providers simultaneously caring for patients in the perioperative period to avoid the overprescription or duplicate prescription of opioids. Additionally, it should guide surgeons to be cognizant of other providers whom their patients may be seeing concomitantly in the perioperative period. Orthopedic providers were not the highest opioid prescribers by specialty in this study but were still one of the highest, demonstrating room for improvement in opioid use in orthopedics. Some states and electronic medical record systems have started mandating that providers examine the PDMP history for an individual patient prior to prescribing opioids, with subsequent decreases in opioid prescriptions.[29] In this study, to the best of the authors' knowledge, the surgeons included filled patient requests for a refill. If any patients were turned down for refills by their prescribing surgeon, these data were not available for collection, although these would be interesting to examine in future studies.

In our study, longer follow-up time was also associated with the filling of a second opioid prescription. Although the individualized context of these patients' visits was not recorded, it may represent opioid-seeking patients attempting to obtain additional prescriptions. "Doctor-shopping" for the prescription of opioids has been associated with greater odds of high-risk use, and these patients may schedule excessive follow-up appointments.[30] Alternatively, it might represent patients with uncontrolled postoperative pain, for whom salvage procedures for failed thumb BJA should be considered.

This finding highlights a limitation of this retrospective study and the PDMP, in that, the specific reasons for prolonged opioid use could not be ascertained and might have related to issues other than their thumb BJA surgery. However, this study presents a representative consecutive cohort at a single institution, and exclusion of patients with preoperative opioid use for the purposes of this study would have only introduced a selection bias, affecting this study's external validity. Furthermore, the inclusion of the Elixhauser comorbidity index as a representation of the patients' comorbidities, which might explain the different opioid use, and the McNemar change-in-use analysis were both used as methods to account for this limitation. Future studies may elucidate the specific reasons for chronic opioid use in this study population through prospective queries unattainable in a retrospective study.

Overall, patients with preoperative opioid use have much greater odds of filling a second opioid prescription and prolonged opioid use after thumb BJA surgery. In the multivariate analyses, other demographic and clinical factors did not show a significant association with greater opioid use, including medical comorbidities, anesthetic type, and surgical technique. These patients can be identified before surgery by reviewing their prescription history using the PDMP. If proceeding to surgery, OE patients may benefit from multimodal analgesia, alternative opioid medications, and formal preoperative opioid education.[24,31] Despite these interventions, preoperative opioid use carries an inherent risk of prolonged opioid use, and surgeons should proceed cautiously.

The mean number of surgeon-provided initial postoperative opioid prescription was 119.9 ± 72.7 (range, 27−675). In a national survey of 266 attending hand surgeons, an average postoperative prescription of 254.9 MME was reported for thumb BJA surgery.[32] Similarly, a mean consumption of 21.5 pills has been reported for patients undergoing thumb BJA.[33] Prolonged opioid use has been associated with initial postoperative prescriptions of over 675 MME, and subsequently, over half of the states have passed mandatory limits on opioid prescriptions.[34,35] Our study showed that surgeons who prescribed over 150 MME (75th percentile) for initial postoperative opioids, equivalent to 20 pills of 5-mg oxycodone, had an association with prolonged opioid use, which approached statistical significance ($P = .08$). Interestingly, lower initial doses did not show an increased association with the dependent outcomes. The observed trend toward statistical significance suggests that lower initial opioid prescriptions are reasonable. Similarly, Adalbert and Ilyas[36] found high patient satisfaction and low refill rates with low numbers of procedure- and anatomy-based postoperative opioid prescriptions.

Our study has several limitations, including those inherent to its retrospective study. Although the PDMP database captures data from most states, it is possible that patients obtained controlled substances from a state or country that does not record information in our state's database. Second, only the number of prescriptions filled was evaluated rather than the number or strength of pills that the patients actually consumed, and the individual context of prolonged opioid use could not be ascertained in every case based on the limited data in the PDMP database. Furthermore, patients obtaining drugs illegally or from nonpharmacy sources could not be accounted for. Third, it is possible that the Elixhauser comorbidity index might not have adequately represented all medical comorbidities that can lead to chronic opioid use, including chronic neurogenic pain, rheumatologic conditions, and psychiatric disorders. However, its use has been well validated in clinical research, and no validated prognostic indicator of chronic pain or opioid dependence exists to our knowledge.[37]

In summary, this study presents an analysis of a mandatory statewide database to determine the risk factors for prolonged opioid use in a large consecutive series of patients undergoing thumb BJA surgery. Multiple risk factors for patients requiring a second opioid prescription or those who filled prescriptions over 6 months after the surgery were identified. Preoperative opioid use was the greatest predictor of continued opioid use, followed by prolonged follow-up time with their surgeons. The procedure type, anesthetic type, and low initial postoperative opioid prescription amounts did not correlate with increased supplemental postoperative opioid prescriptions or prolonged use. Of all the opioid prescriptions filled supplemental to the initial postoperative surgeon-provided prescription, only 9.3% were prescribed by the surgeon's office. Surgeons should consider this information for patient selection, patient counseling, and analgesia strategy development for patients undergoing thumb BJA surgery.

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