Rates of Prescription Opiate Use Before and After Injury in Patients with Orthopaedic Trauma and the Risk Factors for Prolonged Opiate Use

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Background: The prudent use of prescription opiate medications is a central aspect of postoperative pain management. The mortality associated with prescription opiate overdose is reaching epidemic proportions nationally, and is the leading cause of accidental death in greater than half the states in the United States. This study sought to determine the rates of preinjury opiate use in patients with orthopaedic trauma and the risk factors for prolonged use postinjury.

Methods: The Utah Controlled Substance Database was queried to determine the use of prescription opiates by all patients admitted to the orthopaedic trauma service for a two-year period with isolated musculoskeletal injuries. Usage three months prior to injury and six months postinjury was examined.

Results: Six hundred and thirteen patients met inclusion criteria. Among patients with orthopaedic trauma, 15.5% had filled a prescription for opiates in the three months prior to injury, compared with 9.2% of the general population (p < 0.001). More than one prescription was filled by 12.2% of the patients with trauma preinjury compared with 6.4% of the general population (p < 0.001). Postoperatively, 68.4% of all patients filled opiate prescriptions for less than six weeks, 11.9% filled opiate prescriptions between six and twelve weeks, and 19.7% filled opiate prescriptions past twelve weeks. Patients with preinjury use of more than one opiate prescription in the three months preinjury were six times as likely to continue use past twelve weeks, and 3.5 times as likely to obtain opiates from a provider other than their surgeon (p < 0.001). Opiate use was briefest with upper-extremity injuries, followed by lower-extremity injuries and pelvic or acetabular injuries. Regression models demonstrate that risk factors for prolonged use of opiates include advancing age and extent of preinjury use.

Conclusions: Patients with orthopaedic trauma are significantly more likely than the general population to use prescription opiates prior to injury. Preinjury opiate use is predictive of prolonged use postinjury and predictive of patients who will seek opiates from other providers.

Level of Evidence: Prognostic <u>Level II</u>. See Instructions for Authors for a complete description of levels of evidence.

Over the last several decades, there has been a concentrated effort by the medical community to adequately assess and address patient pain[1]. Prescription opiates have played an important role in achieving this goal[2-6]. Initially intended for the treatment of acute or terminal pain, the use of opiates has become increasingly more common for the treatment of chronic non-terminal pain. Consequently, the use and potential abuse of prescription opiates have become widespread and physicians are managing more patients who already have a history of opiate use[2,6-13].

This change in pain management has affected the orthopaedic trauma surgeon's practice. The use of prescription opiates has risen sharply in the last fifteen years, with the consumption of oxycodone increasing sixfold, and methadone increasing ninefold, from 1997 to 2005[14]. It appears likely that patients with orthopaedic trauma are taking prescription opiates at the time of injury, but this has not been established.

Although not addressing prescription opiates directly, studies have shown that patients with trauma who present on addictive substances are likely to require opiates for a longer

period of time postoperatively[11] and that patients with orthopaedic trauma frequently test positive for drug and alcohol use at the time of injury[9,13]. It has also been shown that patients' expectation of postoperative pain and pain control influences pain perceptions, often leading to dissatisfaction with the care provided by their treating surgeon[15]. The orthopaedic surgeon must find a balance between adequate postoperative pain control and the risk of prescription drug abuse in a population that has a high rate of substance abuse and dissatisfaction with pain management.

This study is designed to establish the baseline prescription opiate use rate in patients with orthopaedic trauma for the three months prior to injury, and to determine the percentage using prescription opiates more than three months postinjury. Our hypothesis was that patients with orthopaedic trauma will have a higher rate of prescription opiate use than the general population and that those taking prescription opiates preoperatively will be more likely to continue them for a longer time postoperatively. Further, this study aims to identify other risk factors for prolonged use longer than twelve weeks postoperatively.

Materials and Methods

The Utah State Division of Professional Licensing maintains the Utah Controlled Substance Database that records all Schedule-II through V prescriptions filled in the state. Schedule-II through V prescriptions include a wide variety of medications including analgesics, sedatives, stimulants, and antitussives, but only opiate analgesics were recorded for this study. All pharmacies in the state are required to submit the following information: patient's name, date of birth, sex, drug dispensed, prescription number, date prescribed, date filled, quantity given, number of days' supply, and prescribing physician's name. The Utah Controlled Substance Database records all opiate prescriptions, not just those prescribed by the treating surgeon or housestaff, and does not rely on patient reporting for accuracy. Treating physicians may use the database to query the prescription use of individuals in their practice.

This study protocol was approved by the University of Utah institutional review board and the office of the Utah Division of Professional Licensing Controlled Substance Database.

The criteria for inclusion into the study were patients who were eighteen years of age or older managed operatively by the University of Utah Orthopaedic Trauma Service from June 2005 to June 2007. The following data were obtained from institutional operative logs: name, date of birth, medical record number, procedure performed, and treating surgeon. For analysis, we categorized the procedures performed as upper extremity, lower extremity, and pelvis or acetabulum. Patients were excluded if (1) they were from surrounding states and therefore were not in the Utah database; (2) there was no record of postoperative opiate use in the Utah Controlled Substance Database; (3) they sustained multisystem trauma or multiple-limb trauma; (4) they required further surgery for nonunion, malunion, or complication; (5) the initial surgery was not trauma-related; and (6) the initial surgery was performed elsewhere. These criteria limited the study population to those with isolated musculoskeletal trauma requiring surgical intervention only in the acute phase after their trauma. These were patients with fracture surgery cases, excluding those with ligament reconstruction and infection surgery.

Patient identifiers for the included population were submitted to the Utah Controlled Substance Database to obtain an opiate history for each patient. Data for a three-month preoperative interval and a six-month postoperative interval were obtained. The data included prescriptions from April 2005 through December 2007.

Preoperative opiate use was classified as patients who filled no opiate prescriptions, those who filled one opiate prescription, and those who filled two or more opiate prescriptions within the three months prior to injury. This grouping aimed to separate those who incidentally needed a single opiate prescription from those who may have chronic or repeated use. In this study, the filling of an opiate prescription is used to represent the actual use of that medication.

As a comparison, the baseline opiate rate for the general adult Utah population was determined from data at the Utah Controlled Substance Database. The number of unique adult individuals in the database filling one opiate prescription, and more than one opiate prescription, over a three-month period, was compared with the state adult population and was used to determine a rate.

Postoperatively, we categorized the patients as those who received opiates for less than six weeks, those who received opiates between six and twelve weeks, and those who obtained opiate prescriptions for more than twelve weeks after surgery. All durations of use are referenced from the date of the surgery to the date the prescription was filled.

Statistical Methods

For categorical variables, comparisons were made with use of the chi-square test or the Fisher exact test, as appropriate, for dichotomous variables. For continuous variables, an independent samples t-test was used. For the comparison of proportions to the Utah population, a one-sample binomial test was used, with the Utah population proportion treated as a constant. The Spearman rho value was used to assess the correlation when at least one variable was an ordered categorical variable (i.e., preoperative opiate use compared with postoperative duration). To test the association of an unordered categorical variable with more than two categories with an ordered categorical variable, a nonparametric Kruskal-Wallis analysis of variance was used. For multivariable analysis of outcomes, modified Poisson regression models were fitted. This choice of model was used because it assesses the risk ratio directly, an advantage over logistic regression models[16]. Logistic regression only provides odds ratios, which have a less intuitive interpretation.

Source of Funding

Results

One thousand one hundred and eight patients were managed from July 2005 to June 2007. Eight hundred and thirty-six were Utah residents, and, of these, 748 were included after exclusion for multi-trauma, non-trauma-related surgery, or complications. Of these, 613 patients had prescriptions recorded in the Utah Controlled Substance Database.

Ninety-five (15.5%) of the 613 patients analyzed had filled an opiate prescription within three months prior to injury, significantly greater than the rate (9.2%) of the overall state population receiving a prescription for opiates in a three-month period (p < 0.001). The rate of patients obtaining more than one prescription within the preinjury interval (12.2%) was also significantly different (p < 0.001) from the rate for the overall state population (6.4%). The rate of patients filling only one prescription in the three months prior to injury (3.3%) was not significantly different (p = 0.46) from that of the overall state population (2.8%).

Postoperatively, 419 (68.4%) of all patients filled opiate prescriptions for less than six weeks, seventy-three (11.9%) filled opiate prescriptions between six and twelve weeks, and

TABLE I Preinjury Opiate Use and Effect on Postinjury Use					
		Duration of Postinjury Opiate Use			No. of Patients Who Used an Outside Provider
Preinjury Opiate Use	No. of Patients	Less Than Six Weeks	Between Six and Twelve Weeks	More Than Twelve Weeks	
All patients	613 (100.0%)	419 (68.4%)	73 (11.9%)	121 (19.7%)	207 (33.8%)
No opiate within three months	518 (84.5%)	392 (75.6%)	63 (12.2%)	63 (12.2%)	134 (25.9%)
Any opiate within three months	95 (15.5%)	27 (28.4%)	10 (10.5%)	59 (62.1%)	73 (76.8%)
One opiate within three months	20 (3.3%)	15 (75.0%)	1 (5.0%)	4 (20.0%)	6 (30.0%)
More than one opiate within three months	75 (12.2%)	12 (16.0%)	9 (12.0%)	54 (72.0%)	67 (89.3%)

121 (19.7%) continued to fill opiate prescriptions for more than three months postinjury. Approximately one-third (33.8%) of all patients obtained a prescription from an outside provider (a medical professional other than the treating surgeon or his or her team).

Among patients with no history of preinjury prescription opiate use, 76% stopped using opiates by six weeks, an additional 12% stopped using opiates by twelve weeks, and 12% continued beyond the twelve-week interval (Table I). Patients who had obtained one prescription preoperatively had similar results, with 75% using opiates for less than six weeks, 5% using opiates between six and twelve weeks, and 20% using opiates beyond three months.

However, the postoperative cessation rates for patients obtaining more than one prescription preoperatively were 16% at six weeks, 12% at twelve weeks, and 72% at more than twelve weeks. Patients who obtained more than one prescription in the three months prior to injury were six times more likely (p < 0.001) to continue opiates for more than twelve weeks postoperatively (Table I). A significant correlation (Spearman rho = 0.42, p < 0.001) was demonstrated between the degree of previous opiate use and the duration of postoperative opiate use.

Of patients with no preoperative opiate use, 26% obtained opiates from a provider other than the treating surgeon or his or her staff. Thirty percent of those patients with one prescription preoperatively obtained opiates from an outside provider. Eighty-nine percent of those patients with multiple prescriptions in the three months prior to injury obtained opiates from another provider. There was a 3.5-fold increase (p < 0.001) in obtaining prescriptions from an outside provider if the patient obtained more than one prescription in the three months preoperatively. A significant correlation (Spearman rho = 0.40, p < 0.001) was demonstrated between the degree of previous opiate use and the likelihood of using an outside provider.

To control for potential confounding variables (sex, age, previous opiate use, surgery location), a multivariable model was performed for the six-week interval. The six-week results remain significant when confounders are considered, with a risk ratio of 0.79, or 21% reduction in risk, being less likely to continue opiates past the six-week interval. Other variables that show significance include increasing age and more than one

TABLE II Six-Week Multivariable Model: Modified Poisson Regression Models for the Outcomes of Continued Use of Opiate Prescription Past Six Weeks			
	Risk Ratio*	95% Confidence Interval	P Value*
Male	1.03	0.83 to 1.28	0.77
Age (per five-year increase)	1.04	1.01 to 1.08	0.005
Previous opiate use			
None	Referent		
Used once	0.99	0.47 to 2.12	0.99
Used more than one time	3.10	2.54 to 3.77	<0.001
Surgery type			
Lower extremity	Referent		
Pelvis or acetabulum	1.32	1.00 to 1.73	0.048
Upper extremity	0.86	0.56 to 1.32	0.50
*P values of <0.05 were significant.			

TABLE III Twelve-Week Multivariable Model: Modified Poisson Regression Models for the Outcomes of Continued Use of Opiate Prescription Past Twelve Weeks (N = 613)			
	Risk Ratio	95% Confidence Interval	P Value*
Male	0.94	0.70 to 1.26	0.68
Age (per five-year increase)	1.06	1.02 to 1.11	0.003
Previous opiate use			
None	Referent		
Used once	1.66	0.70 to 3.94	0.25
Used more than one time	5.14	3.84 to 6.87	<0.001
Surgery type			
Lower extremity	Referent		
Pelvic or acetabular	1.33	0.91 to 1.94	0.13
Upper extremity	0.68	0.36 to 1.27	0.22

*P values of <0.05 were significant.

TABLE IV Duration of Use by Location of Injury				
Type of Surgery	No. of Patients	Less Than Six Weeks	Between Six and Twelve Weeks	More Than Twelve Weeks
Upper-extremity surgery	68 (11.1%)	51 (75.0%)	9 (13.2%)	8 (11.8%)
Lower-extremity surgery	470 (76.7%)	325 (69.1%)	53 (11.3%)	92 (19.6%)
Pelvic or acetabular surgery	75 (12.2%)	43 (57.3%)	11 (14.7%)	21 (28.0%)

opiate taken preoperatively. For every five years that a patient ages, he or she is 4% (risk ratio, 1.04) more likely to be on opiates at six weeks. Patients who obtained more than one opiate preoperatively are three times more likely (risk ratio, 3.10) to be on opiates at six weeks as compared with those who received no preoperative opiates (Table II).

At the twelve-week mark, significant results persisted for age and more than one opiate used preoperatively. For every five years that a patient ages, he or she is 6% (risk ratio, 1.06) more likely to be taking opiates at twelve weeks postoperatively. As compared with those taking no preoperative opiates, those taking more than one opiate in a three-month interval prior to injury are five times (risk ratio, 5.14) more likely to be on opiates at the twelve-week interval (Table III).

When injury location was compared with postoperative opiate use, a significant association existed. Upper-extremity surgery required opiates for a shorter time postoperatively than lower-extremity surgery, which required opiates for a shorter time postoperatively than pelvic or acetabular surgery. The duration of opiate use had a significant correlation (as determined by the Kruskal-Wallis analysis of variance) (p = 0.041) with injury location (Table IV).

Discussion

The clinical emphasis on the adequate treatment of acute pain has recently led to greater concern over the use of narcotics. The underlying assertion is that pain has long been undertreated by physicians, and that providers insensitive to this issue are deficient in their care of the patient. This focus on pain management culminated in the decision in 2000 by The Joint Commission to require assessment of pain as "the fifth vital sign" for hospital accreditation[1].

The Centers for Disease Control and Prevention reported that the prescription and use of opiate pain medicine have markedly increased[2,7,8,17-19]. Certainly the focus on prescription opiates and the proliferation of centers treating chronic pain with opiates have helped to account for this increased usage[17-21]. However, prescription opiate use is not without risk to patients. Deaths secondary to prescription opiate overdose are rising nationally, more than 14,000 per year in 2008[3,5,7,8,12,22,23], and are the second-leading cause of accidental death in the United States overall and the leading cause in more than half the states[22,24]. Among those groups most likely to die from prescription opiate overdose, orthopaedic surgeons are the third most common prescription providers, following general practitioners and internists, despite orthopaedic surgeons being far fewer in number than these other providers nationwide[24,25].

Addiction to prescription pain medicine has received surprisingly sparse coverage in the medical literature, but is a growing problem[8]. Further, physicians have been prosecuted by the Drug Enforcement Agency for the inappropriate use and

over-prescription of opiates[26]. Therefore, postoperative pain management is a troublesome issue for practicing orthopaedic surgeons[5,6]. Some guidelines for dosing regimens exist[6,17], but duration of treatment is specifically not addressed and physicians must use their best judgment as to postoperative treatment duration.

The patient population with trauma specifically has a high prevalence of substance abuse[9-11,13]. Many of the patient demographic characteristics that have been identified as risk factors for musculoskeletal trauma overlap substantially with risk factors for substance abuse and addiction[27-30]. The socioeconomic status, level of education, and personality types of patients with orthopaedic trauma may put them at increased risk for substance addiction.

This paper attempts to answer some of the questions surrounding the use of prescription opiates before orthopaedic trauma and after fracture surgery. The rate of preinjury use is established (15.5%), and, as we had hypothesized, it is significantly higher than that of the general population (9.2%). Further, the rate for patients obtaining more than one prescription in a three-month period was significantly higher in the patients with trauma (12.2%) than in the general population (6.4%). If we eliminate the study subjects from the general population, these numbers remain unchanged. In Utah, in any given one-year period, 21% of the state adult population fills a prescription for at least one opiate pain medicine[31].

The rate of alcohol and drug use in the trauma population exceeds that of the general population[9,10,13]. Massey et al. demonstrated in 2005 that trauma patients with a positive toxicology screen on presentation had a longer duration of postinjury prescription opiate use[11], but our study is the first, to our knowledge, to describe the rate of prescription opiate use in patients with trauma preinjury and to track the duration of use postinjury.

Overall, the duration of opiate use appeared to be primarily influenced by preinjury use. Further examination revealed that the degree of opiate use was important, not simply the presence of prior use. Patients with two or more prescriptions preinjury were six times more likely to persist in opiate use past twelve weeks. A significant correlation was demonstrated between the degree of preoperative opiate use and the duration of postoperative opiate use.

Physicians also find themselves confronted with patients seeking opiate prescriptions from multiple providers surreptitiously. Our study demonstrates that 26% of the "opiate naïve" went to an outside provider for a prescription, 30% of those with one prescription went to another provider, but 89% of those with more than one preinjury prescription sought prescription opiates elsewhere successfully. Alcohol and illicit drug use has long been a part of the preoperative history-taking. In light of these data, treating surgeons should consider inquiring specifically about the use and extent of preinjury prescription opiates. Given the potential dangers of oral prescription opiate use, early preoperative discussion and establishment of postoperative limitations are important.

Regression analysis of the factors influencing duration of opiate use isolated two significant contributors, age and previous use. The authors were surprised that increasing age was a risk factor for prolonged use, expecting quite the opposite on the basis of their experience. The effect of age may be difficult to explain, but may influence our perceptions in the treatment of older patients. This may also be consistent with data demonstrating that the age group most at risk for prescription opiate overdose fatality is forty-five to fifty-four years, older than we would have suspected on the basis of clinical impressions[22].

The findings for the duration of treatment based on injury location in this study may also influence the anticipated duration of treatment. Prior anesthesia and orthopaedic literature has indicated that ankle, knee, and spinal surgeries rate the highest for the perception of pain[6].

There were several potential weaknesses to this study design. Prescription opiates obtained illegally via street resale or taken from medicines prescribed to other patients cannot be accounted for in the Utah Controlled Substance Database. Also, this study only included those patients with isolated musculoskeletal injury. Patients with multisystem trauma or multiple-limb trauma were excluded from this study to avoid the confounding effect of multiple sources of pain. This study also excluded patients who had experienced complications or had had to undergo further surgery within the first six months after injury. Overall, these limitations on the study population were necessary to obtain clean data, but may represent a portion of the trauma population skewed toward lower-injury severity. There were also a large portion of our trauma population flown in from out of state, and a number of Utah residents were not in the database. These factors reduced our number of subjects and may have introduced some bias in the data of which we are not aware. Another possible limitation of the study was that patients were seen by only two surgeons, one of whom (T.F.H.) was an author of this study. It was not possible to test for a surgeon effect in the regression models, as the surgeon variable was completely colinear with prescribing instructions. The decision to actually stop using the opiate by six weeks or twelve weeks is a patient-driven variable. The propensity for a patient to continue using the opiate past six or twelve weeks is a patient decision that is unlikely to be influenced by characteristics of the surgeon, such as personality, experience, or expertise.

Further, no attempt was made to ascertain the reasons the patients may have been taking prescription narcotics preinjury. The potential reasons that patients were prescribed prescription opiates are multiple and varied, but this study aims to simply examine preinjury use in the trauma and background population regardless of indication. The subjective nature of pain perception and the lack of any objective metrics for pain decidedly cloud this field of research. We have found it difficult to cleanly assign causes to many of our findings. The use, and the prolonged use, of opiates may be a function of pain, but may also be influenced by myriad other factors such as addiction, psychiatric overlay, cultural influences, and other

patient background cofactors[15]. This study design had one unique advantage in the analysis of opiate use. The state-controlled substance database ensures that all prescribed opiates are captured. This database does not require patient self-reporting of medication use and the inherent inaccuracies in that method[32,33].

Postoperative pain management remains a vexing problem for orthopaedic surgeons. The question remains open whether any of these data may be extrapolated to the rest of one's practice beyond trauma. Forty states now maintain controlled substance databases that are searchable by providers, with legislation passed to establish this in eight other states. Orthopaedic surgeons may want to consider routine utilization of these resources as part of their patient care regimen. Given the widespread use of opiates in the general patient population, risk factors for long-term use may be considered in perioperative counseling. ∎

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