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RESEARCH ARTICLE

Opioid Use Among Orthopaedic Patients and Comparison of Opioid Prescribing Patterns Among Spine Surgeons and Other Orthopaedic Subspecialists in the United States

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ABSTRACT

Background/Introduction: The US opioid epidemic has received particular attention with 33091 reported deaths from narcotic overdose in 2015. A recent survey comparing US and Japanese opioid prescribing patterns from the AOA-JOA traveling fellows included 76 US orthopedic surgeons representing 8 subspecialties. We used this data to compare opioid prescribing patterns among US spine surgeons to other orthopaedic subspecialties.

Materials/Methods: The survey included data based on surgeon demographics (gender, age, years in practice), patient baseline opioid use (pre/post-operative opioid use, types of opioid agents, duration of opioid use), perioperative pain management (procedure/institution factors, multimodal analgesic therapy), and responses to questions regarding opioid use attitudes. Survey responses were recorded as either categorical or semi-continuous variables. Statistical analysis was performed using chi-squared analysis for categorical responses and Kolmogorov-Smirnov testing to a statistical significance level of $p < 0.05$. Parameters that trended toward significance to $p < 0.10$ were also recorded. Statistical analysis was performed using Stata statistical analysis software [StataCorp, College Station, Texas].

Results: Spine patients were more likely using opioid medications prior to evaluation by spine surgeons compared to non-spine patients($p=0.029$). Patients with spine pathologies treated non-operatively were also more likely to be prescribed opioids($p=0.006$). Post-operatively, spine patients were less likely to stop opioid prescriptions on the intended time ($p=0.046$). Peri-operatively, spine patients were more likely to be given muscle relaxant medications, and less likely to receive local/regional anesthesia($p=0.0025$). Additionally, spine patients showed a trend toward association for requesting additional opioids beyond their initial prescription($p=0.057$). Spine surgeons showed a trend toward association for choice of opioid agent prescribed–spine patients were less likely to receive codeine/tramadol analogs($p=0.062$). When surveyed on opinions regarding opioid use, US spine surgeons did not show significantly different opinions regarding opioid use compared to surgeons in other subspecialties.

Discussion/Conclusion: Spine patients did demonstrate statistically significant patterns of opioid use, particularly regarding opioid use prior to evaluation by orthopedic surgeon and use of opioids for nonoperative pathologies. They were also less likely to stop opioid prescriptions on time. Surgeon prescription patterns and perceptions of opioid use were not significantly different for spine surgeons compared to other subspecialties.

1. Introduction:

Recently, the opioid epidemic in the US has received particular attention with 33,091 reported deaths from narcotic overdose in 2015, with over half related to prescription pain medications.[1] Perioperative narcotic prescriptions for orthopaedic procedures have been identified as an inciting factor for opioid abuse, particularly related to wide variability in quantities and patterns of prescription.[2-27] Orthopaedic practices account for an estimated 7.7% of all opioid prescriptions in the US, making them the third-highest prescribers among physicians.

Spinal pathologies and spine surgery have been associated with high rates of perioperative opioid prescription and increased risk of opioid abuse. Although multiple studies have reported on opioid prescription patterns among individual subspecialties, comparisons between different orthopaedic subspecialties, including spine surgery, have not been well quantified. Often recognized as one of the most challenging issues in pain management, chronic back pain is estimated to incur a 50-100 billion dollar cost in the United States annually.[5] Attitudes regarding opioid use in chronic back pain patients have continued to evolve, and a review of opioid use among Veteran Affairs (VA) spine patients in 1997 demonstrated the effectiveness of opioids in reducing the severity of pain, even with prolonged use beyond 3 months.[6] Similarly, Schoenfeld and associates demonstrated that opioid naïve patients were able to predictably discontinue opioid use by 6 months postoperatively.[7] However, other studies have drawn correlations between the prevalence of overdose with chronic pain and prolonged opioid use in post-operative spine patients, particularly with concomitant mental health disorders and other social factors involved.[8,9] As a result, it is crucial to better characterize the role of appropriate opioid pain medication prescriptions and gain a clearer understanding of current prescribing patterns and opinions about opioid medications.

The 2018 American Orthopedic Association (AOA) – Japanese Orthopedic Association (JOA) traveling fellows had recently developed an electronic survey comparing opioid prescription patterns among surgeons in the United States and Japan. The US cohort included 76 orthopedic surgeons representing 8 subspecialties. By analyzing the results of this survey among United States orthopaedic surgeons, we aim to elucidate differences in spine patients' use of opioid medications, as well as differences in opioid prescription patterns among spine surgeons compared to those of other orthopaedic subspecialties.

2. Materials and Methods

The survey was designed to identify differences in opioid prescription patterns among orthopaedic surgeons and opioid usage patterns among orthopaedic patients. In addition to Japanese surgeons abroad, the 2018 AOA Traveling Fellows conducted a survey among US orthopaedic surgeons. The survey included the following questions: Physician age, gender, subspecialty (total joint arthroplasty, foot and ankle, hand, shoulder/elbow, sports, trauma, pediatrics, and spine), number of years in practice, opioid prescribing patterns for non-surgical patients, and opioid prescribing patterns for patients undergoing surgical treatment. Perioperative use of opioids for surgical treatment was also sub-stratified to account for multiple scenarios (i.e. modifying opioid use per institutional policy, case complexity, and revision vs. primary surgeries). The survey also investigated the types of prescribed opioid agents, the number of opioid pills prescribed, the intended duration of the prescription, and potential indications (patient and procedural factors) that may affect opioid prescriptions. The use of non-opioid pain medication prescriptions and the use of multimodal analgesia therapy were also investigated. Finally, the survey investigated surgeons' perceptions of opioid use and prescription patterns.

Secure anonymous survey software was used (SurveyMonkey – the survey may be viewed at https://www.surveymonkey.com/r/JOA2018).

Survey data were then compared after stratification based on subspecialty for spine versus non-spine surgeons. Survey responses were recorded as either categorical or semi-continuous variables among a spectrum of response values. Statistical analysis was performed using chi-square analysis for categorical responses. Kolmogorov-Smirnov testing was utilized for semi-continuous variables to identify distribution differences between the cohorts. Statistical testing was conducted to a statistical significance level of $p < 0.05$; parameters that trended toward significance to $p < 0.10$ were also recorded. Statistical analysis was performed using Stata statistical analysis software [StataCorp, College Station, Texas].

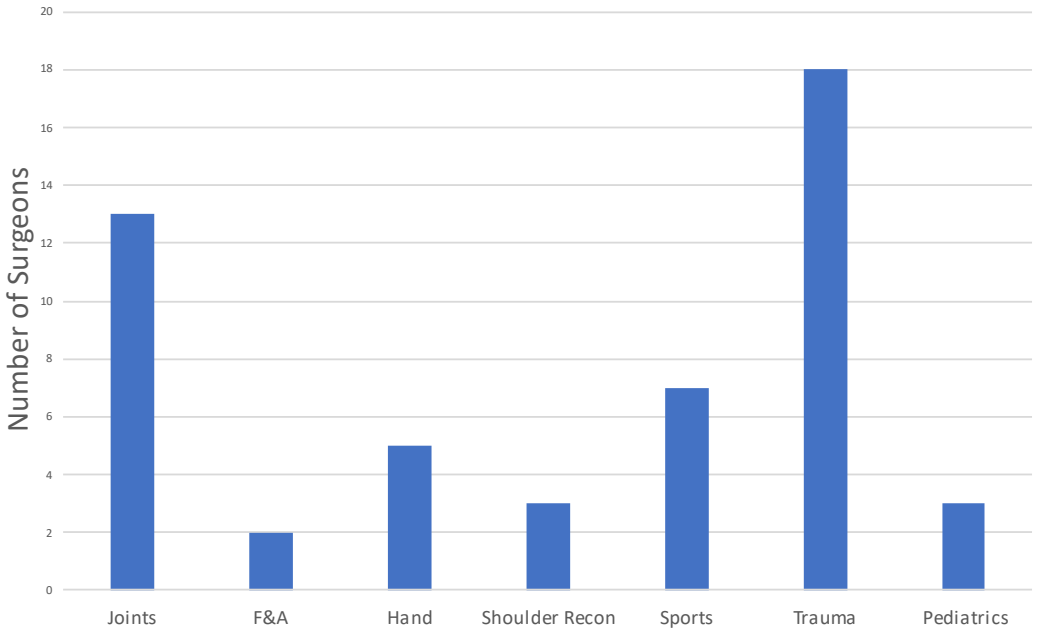
3. Results

Study Sample and Demographics

The survey respondents included 76 orthopaedic surgeons from the United States representing 8 surgical subspecialties (total joint arthroplasty, foot and ankle, hand, shoulder/elbow, sports, trauma, pediatrics, and spine). The survey respondents included 37 spine surgeons and 39 surgeons from other orthopaedic subspecialties.

Gender and age distributions varied and were both statistically significant among US survey participants. There were no female spine surgeons surveyed ($p = 0.013$) and spine surgeons were older on average than their non-spine counterparts. Most spine surgeons were between 41-50 years of age while most non-spine surgeons were between 31-40 ($p = 0.023$). The surveyed spine surgeons were also more experienced on average compared to non-spine surgeons; most surveyed spine surgeons were "late-career" (greater than 10 years in practice) compared to non-spine surgeons been "early and mid-career" ($p = 0.03$). The distribution of surgeons from non-spine specialties can be seen in Figure 1.

Figure 1: Distribution of Non-Spine Orthopedic Subspecialty Surgeons



Beliefs Regarding Pre-Operative Pain Medications and Opioid Use

Spine patients were more likely to be using opioids prior to their initial evaluation by a spine surgeon, a significant finding when compared to non-spine patients ($p = 0.029$). For patients who were taking opioids prior to their first visit with an orthopaedic surgeon, there were no significant differences between the spine and non-spine cohorts' prescribed analgesic(s) ($p = 0.66$), with oxycodone and hydrocodone analogs being the most reported medications. Additionally, both cohorts were comparable regarding non-opioid medication use, and the duration of opioid use (more than 3 months in the majority of patients) prior to the initial evaluation by an orthopaedic surgeon ($p = 0.186$ and 0.926 respectively).

On the other hand, spine patients were significantly more likely to be prescribed opioids for conditions managed non-operatively, despite most spine surgeons reporting fewer than 20% of their non-operative patients being prescribed opioids ($p = 0.01$).

Self-Reported Prescribing Patterns and Beliefs Regarding Patients' Habits

The survey queried the surgeons' patterns of post-surgical opioid prescription accounting for patient factors (medical and social history), procedure factors and complexity (classified as primary simple, primary complex, and revision surgeries), and hospital policy. Spine surgeons, compared to non-spine orthopaedists, did not demonstrate statistically different opioid prescription patterns for any of these factors ($p = 0.895$). Most surveyed

US orthopaedic surgeons (78% of spine surgeons and 64% of non-spine surgeons) reported routine prescription of opioids to patients undergoing orthopaedic surgery ($p = 0.277$).

However, spine surgeons did demonstrate a trend toward significance for a preferred post-operative opioid agent(s), showing similar rates of prescription for hydrocodone and oxycodone analogs, but were less likely to prescribe tramadol and codeine analogs than non-spine surgeons ($p = 0.06$). There were no statistically significant differences in the quantity of initial post-operative opioid prescription (number of tablets prescribed) or the intended duration of post-operative opioid prescription between spine and non-spine surgeons ($p = 0.11$ and 0.13 respectively). Both groups reported a comparable post-operative prescription amount ranging between 30-60 tablets (of their preferred agent), and for an intended duration of 1 month or less.

On the other hand, spine patients did demonstrate distinctly different patterns of post-operative behavior regarding their opioid usage compared to non-spine patients. According to the survey results, only 50% of spine patients stopped their initial opioid prescription on time (intended period determined by the orthopaedic surgeon), compared to >80% of non-spine patients ($p = 0.05$). Additionally, spine patients showed a trend toward requesting additional opioids beyond their original prescription; up to 60% of the spine patients requested additional opioids, compared to 40% of non-spine orthopaedic patients ($p = 0.057$).

Despite these differences, spine surgeons did not demonstrate significantly different prescribing patterns compared to non-spine surgeons when addressing post-operative opioid requests from their respective patients. Both spine and non-spine surgeons were unlikely to prescribe additional opioid medications to their patients – in fact, 66% of spine surgeons reported that they never prescribed additional opioids, compared to just 13% of non-spine surgeons.

Self-Reported Use of Opioid Taper Program and Multimodal Analgesia

The distributions of spine and non-spine surgeons who reported using opioid tapers and multimodal therapy post-operatively also did not show statistically significant differences ($p = 0.19$ and 0.28 respectively). Spine surgeons did demonstrate a statistically significant difference in preference for multimodal analgesic agents, as they were more likely to administer muscle relaxant medications and were less likely to utilize local or regional anesthesia perioperatively.

Beliefs Regarding General Opioid Indications and National Use

Both orthopaedic surgeon cohorts (spine and non-spine) exhibited similar opinions regarding general opioid indications and national opioid use.

Most US participants (77% of spine surgeons, and 66% of non-spine surgeons) agreed that opioids are necessary for adequate post-surgical analgesia and to improve patient satisfaction ($p = 0.99$). Similarly, most of the respondents (93% of spine surgeons, and 88% of non-spine surgeons) agreed that opioids are indicated when non-opioid modalities are ineffective ($p = 0.99$). Finally, when asked about their perceptions regarding the national opioid use in the USA, the majority of US orthopaedic surgeons (87% of spine surgeons, and 83% of non-spine surgeons) concurred that opioids "are used too often" ($p = 1.00$).

The above results are summarized in Table 1.

Table 1. Overview of US Spine and non-Spine Opioid Prescription Patterns

Parameter (Spine vs. Non-Spine)	**p value**	**Description**
Surgeon Characteristics		
Gender	0.013	No female spine surgeons
Age	0.023	Spine surgeons older on average
Years in practice	0.034	Spine surgeons more experienced
Patient Characteristics		
Opioid use before surgeon evaluation	0.029	Spine patients more likely
Type of opioid used before surgeon evaluation	0.661	
Non-opioid use before surgeon evaluation	0.186	
Duration of pre-op opioid use	0.926	
Patients stopping post-op opioids on time	0.046	Spine patients less likely to stop on time
Patients requesting additional opioids	0.057	Spine patients more likely
Surgeon Patterns		
Opioid prescription for non-op patients	0.006	Spine patients more likely
Opioid prescription for operative patients	0.277	
Preference for post-op opioid prescription	0.062	Spine surgeons less likely to use codeine analogs
Duration of post-op opioid prescription	0.129	
Quantity of post-op opioid prescription	0.106	
Patients given post-op opioid taper	0.185	
Patients given multi-modal analgesia	0.275	
Type of multimodal analgesia	0.003	See text
Attitudes		
Are opioids for post-surgical pain necessary and contribute to better patient satisfaction?	0.990	
Do you believe opioids are indicated when non-opioid modalities are ineffective?	0.994	
Perceptions of opioid prescription (Too often, just right, too seldom)	1.000	

4. Discussion

Despite accounting for a relatively small proportion of medical specialties, orthopaedic surgeons are the third-highest prescribers of opioid medications in the United States.[10] Although recent studies have evaluated the particular patterns of opioid prescription among orthopaedic surgery in general, and certain orthopaedic sub-specialties in particular, data comparing opioid prescribing patterns between orthopaedic subspecialties is limited.[11–17] This survey provided a unique opportunity to compare opioid prescribing patterns between spine surgeons and other orthopaedic subspecialists and to identify key differences in perioperative behavior for patients undergoing spine surgery.

We found that the surveyed US spine surgeons displayed similar opioid prescribing patterns to those of other orthopaedic subspecialties. On the other hand, spine patients with chronic back pain behaved significantly different than non-spine orthopaedic patients, with notable increased perioperative opioid usage and request, and decreased compliance with post-operative prescription amount and duration. Patients with back pain undergoing initial evaluation by a spine surgeon were significantly more likely to be taking opioids prior to their evaluation and were more likely to receive opioid pain medication for spine conditions being treated without operative intervention. ($p = 0.03$ and 0.01 respectively).

These findings could be corroborated by recent reports implicating initial provider specialty with early opiate prescription and chronic opioid use among opiate-naïve patients. The authors found that emergency medicine providers and pain management/anesthesiologists were the most commonly identified early and long-term opioid prescribers, respectively.[18] Additionally, orthopaedic surgeons tend to be more conservative than their primary care colleagues with regard to opioid prescribing patterns.[10] Other investigations highlighted preoperative opioid use and opioid dependence as risk factors for increased complication rates, postoperative opioid usage, prolonged length of stay, adverse self-reported outcomes, and increased healthcare costs in patients treated with spinal fusion.[19–21] As our study found no statistically significant difference in opioid prescribing patterns among spine surgeons compared to non-spine orthopaedic surgeons, future studies may be warranted to confirm that spine surgeons show more conservative opioid prescribing patterns compared to nonsurgical primary care practitioners.

Developing a better understanding of these patterns among orthopaedic subspecialties can allow for informed patient-specific decision-making, as differences in perioperative patient expectations and pre-operative opioid use have been associated with worse adverse outcomes across multiple orthopaedic subspecialties.[21–24] Additionally patients undergoing surgical treatment for spine pathologies were also significantly less likely to stop their opioid prescription on time and showed a trend toward association for requesting additional opioids beyond their initial opioid prescription ($p = 0.05$ and 0.06 respectively). Spine patients should therefore be particularly monitored for development of postoperative opioid dependence, as Helmerhorst and colleagues determined that regardless of surgery type, extended opioid use one-to-two months post-operatively is associated with increased psychological distress, and less effective coping strategies, greater pain symptoms, and disability.[25]

Our survey also highlighted a collective awareness of the US orthopaedic community of the ongoing epidemic crisis in the United States. This perhaps reflects a nationwide realization of this burden and a collective effort to reduce the opioid epidemic. Recent progress was reported by the American Medical Association, noting a 22% reduction in opioid prescriptions in the US between 2013 and 2017.[26]

Nonetheless, comparing opioid prescribing and consumption trends in the US with those of other countries, highlight the greater reliance on opioid prescribing and utilization in the US following common procedures. The US consumes 27,400,000 grams of hydrocodone annually compared with 3,237 grams for Great Britain, France, Germany, and Italy combined.[28] Ladha et al. compared opioid prescribing patterns after surgery in the US, Canada and Sweden. The authors found a significantly lower proportion of patients, who filled an opioid prescription within the first week after any procedure, in Sweden (11.1%) compared to the US (76.2%) and Canada (78.6%) ($p < 0.001$).[29] The authors also highlighted that the post-surgical opioid consumption, measured by morphine milligram equivalent (MME), was highest in the US (mean 247) compared to Canada (169) and Sweden (197). Similar findings were reported by Young et al.[30] underlining greater opioid prescribing habits per procedure among orthopaedic trauma specialists in the US (mean MME 338) compared to Haiti (mean MME 101) and the Netherlands (mean MME 229) ($p<0.0001$).[30] Another cross-cultural survey based comparative study of orthopaedic surgeons, underscored the pronounced opioid prescribing practices and consumptions in the US compared to Japan.[31]

While these international trends highlight contrasting patterns in opioid prescribing and consumption in the US vs other countries, they may not be truly reflective of the cross-cultural differences among spine surgeons and spine patients of various countries.

Finally, there are several limitations to our study. The small sample size and use of physician-reported survey data may not be an accurate reflection of reality. Participation in the survey was optional for orthopaedic surgeons at the home institutions for the 2018 AOA Traveling Fellows and presented a very narrow subset of the United States orthopaedic surgery population. The sub-stratification of the survey's data was also limited by a relatively high proportion of spine surgeon participation, which may have introduced sample bias, while also precluding an effective similar comparison of other orthopaedic sub-specialties that were less well-represented in the survey.

5. Conclusion

In conclusion, United States spine surgeons did not demonstrate significantly different patterns of perioperative opioid analgesic medication prescription compared to their non-spine US orthopaedic colleagues. However, US orthopaedic

spine patients, when compared to US orthopaedic non-spine patients, did demonstrate a significant pattern of greater opioid pain medication utilization during conservative management as well as for post-surgical analgesia at all phases throughout the perioperative period. This indicates that the currently reported differences in opioid utilization and prescription among orthopaedic surgeons may benefit from the additional subgroup analysis. Such analysis could better characterize the underlying specific factors that drive the high rates of opioid use in orthopaedics. In the future, similar studies conducted on a larger scale could allow for specific, directed quality improvement systems to be developed to combat the opioid crisis most effectively in the United States.

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