Toxicology Screening Testing in Patients Undergoing Spine Surgery: A Prospective Observational Pilot Study

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Background: Chronic opioid use and polypharmacy are commonly seen in chronic pain patients presenting for spine procedures. Substance abuse and misuse have also been reported in this patient population. Negative perioperative effects have been found in patients exposed to chronic opioid, alcohol, and recreational substances. Toxicology screening testing (TST) in the perioperative period provides useful information for adequate preoperative optimization and perioperative planning.

Methods: We designed a pilot study to understand this population's preoperative habits including accuracy of self-report and TST-detected prescribed and unprescribed medications and recreational substances. We compared the results of the TST to the self-reported medications using Spearman correlations.

Results: Inconsistencies between TST and self-report were found in 88% of patients. Spearman correlation was 0.509 between polypharmacy and intraoperative propofol use, suggesting that propofol requirement increased as the number of substances used increased.

Conclusions: TST in patients presenting for spine surgery is a useful tool to detect substances taken by patients because self-report is often inaccurate. Discrepancies decrease the opportunity for preoperative optimization and adequate perioperative preparation.

Key Words: toxicology screening testing, spine surgery, propofol requirements, preoperative optimization

INTRODUCTION

Patients who present for elective spine surgery commonly experience chronic pain, which is a major social and economic problem globally. Frequently, patients with chronic pain are treated with opioids; this has increased opioid dependence and mental health diseases, such as anxiety, somatoform and affective disorders, and substance abuse.[1] The negative effects of chronic opioid use in surgical patients include more severe postoperative pain, prolonged pain resolution despite increased dosage of medications, higher risk of complications, and worse outcomes.[2,3] Moreover, marijuana and alcohol use also exacerbate the difficulty of managing these patients. The requirement for higher anesthetic doses has been reported in patients who are chronic marijuana users.[4] Thus, it is important that patients presenting for spine surgery undergo a complete preoperative evaluation comprising assessments of opioid use, polypharmacy, and the use of other recreational substances, because this may negatively affect the perioperative course.

Our study was an exploratory pilot study that aimed to assess whether toxicology screening testing (TST) was feasible in patients undergoing spine surgery and if it would provide more reliable information than the current standard of self-reporting. Our observational pilot study showed that in most patients, self-reporting was inaccurate and that preoperative TST provided valuable quantitative information about substances being taken by patients at the time of surgery. Therefore, this information may be used by clinicians to develop comprehensive and multidisciplinary strategies to improve perioperative patient care.

METHODS

After the institutional review board approved the study, 30 patients with a history of chronic back pain, defined as pain experienced for longer than 12 weeks, and

who were scheduled for moderate-to-major spine surgery within the next 6 months, were enrolled in a single-center observational study. Written informed consent was obtained before sample collection. A 5-mL urine sample was collected on the day of the preoperative clinic visit; and a second sample was collected on the day of surgery, when the patient had been admitted to the preoperative area, but before the patient had received any preoperative medications. Samples 1 and 2 were analyzed using an on-site liquid chromatography-tandem mass spectrometry (LC-MS/MS) assay capable of quantifying 136 substances and confirming the structure of positive results in a single run 5 (a detailed description of the assay, assay performance, and validation parameters are presented in reference 5). A positive result in either sample indicated use of the substance. TST results were compared with the patient's self-reported medications. Discrepancies between the TST and self-reporting were presented as count (%) for each substance and analyzed using Spearman correlations to examine the monotonic relationship between polypharmacy and select intraoperative and postoperative outcome parameters. The R statistical computing software (version 3.5.1, The R Foundation, Vienna, Austria) was used for all analyses.

RESULTS

Twenty-seven patients (10 men; 17 women) completed the study and were included in the analysis. One patient withdrew consent and 2 patients did not undergo the scheduled surgery owing to illness. The median age of patients was 59 years (range, 33–76 years). Patient demographics and outcome parameters are shown in **Supplemental Digital Content 1** (see **Table S1**, http://links.lww.com/TDM/A455). We found inconsistencies between self-reporting and TST in 24 of the 27 study participants (88%): some patients reported no use of a substance that was subsequently detected in the TST, whereas others endorsed the use of a compound that was not detected (Table 1). Such discrepancies occurred for at least one of the following categories: acetaminophen, opioids, benzodiazepines, muscle relaxants, antidepressants, nonsteroidal anti-inflammatory drugs (NSAIDs), antiepileptics, antihistamines, lidocaine, and hypnotics. The most notable discrepancies were for NSAIDs (44%), benzodiazepines (33%), and opioids (25.9%). In contrast, marijuana had 100% accuracy between self-reporting and TST, whereas alcohol had 87.5% accuracy. The Spearman correlation between polypharmacy (number of drugs detected in the TST) and the induction dose of propofol was 0.509, suggesting that as the number of substances detected increased, propofol use tended to increase (see **Table S2**, **Supplemental Digital Content 1**, http://links.lww.com/TDM/A455). Using the same test, a mild positive monotonic response was found between polypharmacy and the pain score on days 1 and 2 (Spearman correlations of 0.252 and 0.340, respectively).

The Kruskal–Wallis test was used to compare positive and negative groups for marijuana and alcohol, as found in the LC-MS/MS TST, with selected outcomes. Although probably related to the small sample size, a statistically significant difference was not found, the results suggest an increased requirement for propofol and fentanyl during induction and higher pain scores in patients who tested positive for alcohol. Similarly, higher propofol requirements during induction were found in marijuana

TABLE 1. Agreement/Disagreement Between Self-Report Usage and TST Results of Individual Drugs

Substance	Negative History/Negative TST	Negative History/Positive TST	Positive History/Negative TST	Positive History/Positive TST	Disagreement
	n	n	n	n	%
Acetaminophen	10	4	5	8	33.3
Narcotics	9	2	7	9	33.3
Benzodiazepines	17	0	9	1	33.3
Muscle relaxants	21	0	5	1	18.5
Antidepressants	13	0	2	12	7.4
NSAIDs	13	1	12	1	48.1
Gabapentin/Lyrica	13	5	1	8	22.2
Marijuana	22	0	0	5	0
Alcohol	19	1	0	7	3.7
Cotinine	18	5	1	3	22.2
Antihistamines	20	3	2	2	18.5
Lidocaine	20	4	3	0	25.9
Zopiclone	24	0	1	2	3.7
Total	**219**	**21**	**48**	**59**	24.8

History: self-reported drug history, TST: toxicology urine screen test using LC-MS/MS. For each substance, a participant could fall into one of 4 categories: 2 categories indicated agreement (negative history/negative TST and positive history/positive TST), whereas 2 categories indicated inconsistency between self-reporting and the TST; namely, either the study participants reported no use of a substance that appeared in the TST (negative history/positive TST) or they reported use of a substance that did not appear in the LC-MS/MS screen (positive history/negative TST).

users, and higher pain scores were reported on postoperative day 2 (see **Table S3**, **Supplemental Digital Content 2**, http://links.lww.com/TDM/A455).

DISCUSSION

Importantly, the present pilot study showed discrepancies between self-reporting and TST in 88% of patients. Moreover, the results suggested that polypharmacy had a negative effect on patient management during surgery. There was a positive correlation between the number of medications taken and the requirements for propofol during the induction period. Pain scores were also higher on postoperative days 1 and 2 in patients consuming a higher number of medications, which was in agreement with previous reports.[2–4,6,7] The results of the present pilot study have provided the first evidence that the use of TST, to detect compliance and drugs of abuse, is superior to the clinical standard of relying on self-reporting and is feasible in a preoperative setting on the day of surgery. Our results suggested that reliable quantitative information about substances currently taken by patients at the time of surgery may permit the development of comprehensive and multidisciplinary strategies to improve perioperative patient care and safety. In addition, this information can be used to prevent and manage withdrawal syndrome in individuals at risk. The applicability of the TST can be expanded to other types of surgeries and to ensure compliance with therapies before surgery.

Marijuana use has become widespread after its legalization for medical and recreational use in some states. The effects of marijuana on anesthetic requirements have previously been reported.[4] In Colorado, the state where the study was performed, marijuana is legal for medical and recreational use. In our study sample, positive results were found for 5 of 27 (18%) patients for marijuana and 8 of 27 (29%) for alcohol. Interestingly, the accuracy between self-reporting and TST for marijuana was 100%. The legalization of marijuana may have contributed to patients being less hesitant to admit marijuana use.

Four patients who tested positive for marijuana also tested positive for alcohol and narcotics. The combination of substances is of great concern as it increases the risk of complications, including death.[6] Early identification of those patients is important for the implementation of appropriate perioperative and anesthetic care plans.

The present study was designed as an exploratory pilot and feasibility study. Therefore, the sample size was an inherent limitation. In addition, because this was a prospective study, consent was required. This may have led to self-selection bias against enrollment in some patients who may have been concerned about drug testing. It is possible that, if these patients were included, the percentage of

inconsistencies may have been even higher. The first of the 2 samples collected for each patient was on the day of the preoperative clinic visit, which was a few days before surgery. This is beneficial because it allows sufficient time to receive the TST results before surgery, especially if the toxicology laboratory cannot return results within a few hours, as with our laboratory. There is no guarantee that the drugs detected in this sample remain present at the time of surgery. The clinical value of such a sample requires further assessment. The present results provide the rationale and justification for conducting a larger prospective, randomized study to further corroborate these findings, to establish the clinical rationale for routine preoperative TST, and to establish corresponding guidelines in this patient population.

CONCLUSIONS

TST in patients presenting for spine surgery is a useful tool to detect substances taken by patients because self-report is often inaccurate. Discrepancies decrease the opportunity for preoperative optimization and adequate perioperative preparation.

The development of perioperative strategies targeted to better pain control may reduce postoperative complications such as the withdrawal syndrome, improve patient satisfaction, and decrease length of stay. The challenges faced by physicians who are providing care for patients exposed to polypharmacy and marijuana also represent opportunities to study the clinical interaction of these substances with routine and complex patient care. The development of randomized clinical trials may provide the necessary understanding for the establishment of guidelines in this patient population.

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