

Illicit drug and alcohol use and measures of musculoskeletal function and mental health in orthopaedic trauma patients

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Abstract

Objectives: The objective of this study was to describe the relationship between positive toxicology screens and measures of preinjury mental health and physical function in an orthopaedic trauma population

Design: This was a cross-sectional study.

Setting: Urban Level 1 trauma center.

Patients: A total of 125 trauma patients gave written consent for this study.

Main Outcome Measurements: Questionnaires such as, Patient Health Questionnaire-9, General Anxiety Disorder-7, PCL-5, and Short Musculoskeletal Function Assessment, were used to survey patients after surgical intervention.

Results: Patient Health Questionnaire-9 ($P = 0.05$) and PCL-5 ($P = 0.04$) were not found to have significant differences between positive and negative toxicology screens. Both General Anxiety Disorder-7 ($P = 0.004$) and Short Musculoskeletal Function Assessment function ($P = 0.006$) were significantly higher in patients with positive toxicology screens.

Conclusions: Positive toxicology seems to be associated with preinjury anxiety. Patient reported preinjury function was not adversely affected by the presence of illicit substances or alcohol, nor were levels of post-traumatic stress disorder and depression found to be higher in patients with positive toxicology screens.

Level of Evidence: Level IV Cross-Sectional Study.

Key Words: drugs, drug screen, depression, anxiety, orthopaedic, function, trauma, PTSD

1. Introduction

Depression and other psychiatric disorders occur at a high rate in the general and orthopaedic trauma population. The exact level of substance abuse as a comorbid condition with traumatic injury varies with study and how abuse is diagnosed. For instance, Australian registry data show substance use disorder in major trauma to be higher than in the general population and mental health disorder prevalence to be similar to the general population in men, but not women.¹ Using drug and alcohol screens rather than patient-reported questionnaires shows even higher levels of drug or alcohol use (although not necessarily abuse) in the trauma

population. Positive drug and alcohol screens range from 56 percent in orthopaedic trauma² to higher than 70 percent in general trauma series.^{3,4} Nearly 40% of deaths due to trauma had positive alcohol or toxicology screens.⁵ Depression is also a prevalent mental disorder seen in the traumatic population for both orthopaedics^{6,7} and general trauma. Depression has been shown to have a negative impact on long-term well-being in the general trauma⁸ and orthopaedic trauma populations.^{9,10} In addition to depression, there are high levels of anxiety and post-traumatic stress disorder (PTSD) that occur in the patient population that sustains orthopaedic trauma, and scales measuring anxiety, depression, and PTSD have shown a correlation with increased hospital stay, levels of pain, disability, and complications throughout their recovery.^{11,12} PTSD develops in nearly a quarter of civilian orthopaedic trauma,¹³ and it is correlated with less than average physical functioning¹⁴ and lower long-term outcomes.⁹

The intersection of mental health issues and illicit drug use and/or alcohol abuse has been documented in nontraumatic populations. Users of illicit drugs were found to have higher rates of major depression and suicidal ideation in adults¹⁵ older than 50 years and high school-aged adolescents.^{16,17} Patients with major depression tend to drink alcohol more and have polydrug use disorders.^{18,19} Anxiety disorder also is associated with increased disability²⁰ and an increased use of illicit drugs.²¹ To date, there has been no study in our review of the literature that investigates the association between illicit drug use and mental health measures and preinjury patient-reported function in major orthopaedic trauma patients.

The authors have no conflicts of interest to disclose.

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Given that depression and drug use have a correlation in the general population and that depression affects outcomes in the traumatic population, it would behoove us to study the correlation between mental health measures and illicit drug use or alcohol abuse in the traumatic population. Describing such a correlation will no doubt give targets for mental health intervention. In addition, in the age of patient-centered questionnaires and outcome measures, it may be useful to know of preinjury conditions that may be impactful of mental health and functional status because such measures may be affected by preinjury factors rather than the injury or treatment itself. The objective of this study was to determine whether there is a difference between trauma patients who use intoxicants and those who do not before orthopaedic trauma and their preinjury levels of major depression, PTSD, anxiety, and functional status. Our hypothesis is that a positive toxicology result for drugs or alcohol on admission will have higher levels of depression, PTSD, and anxiety and lower preinjury functional status scores.

2. Materials and Methods

The study design was an analytical cross-sectional study. The Wellstar Research Institute IRB approved the study and research was conducted in accordance with the Declaration of World Medical Association, and informed consent was obtained from all study subjects. A control group of patients with orthopaedic trauma injuries and negative toxicology screens had their data gathered at the time of admission. Initial data included a depression inventory (Patient Health Questionnaire-9 [PHQ-9]), PTSD inventory (Post-traumatic Checklist-Civilian Version [PCL-C]), anxiety inventory (General Anxiety Disorder-7 [GAD-7]), a functional status measurement (Short Musculoskeletal Function Assessment [SMFA]), a admission drug screen and admission alcohol level, and demographic information. The PHQ-9 was chosen because it is a validated²² and reliable²³ tool for the screening and evaluation of the severity of depression in both traumatic⁶ and nontraumatic populations.²⁴ Similarly, the GAD-7 is well validated and standardized as a screening test in the general population²⁵ and the PCL-C a reliable and validated measure of PTSD symptoms.²⁶ The SMFA is a reliable and valid²⁷ patient-centered instrument that is responsive to change over time.²⁸ Patients with a positive drug or alcohol screen were then compared with patients with a negative drug or alcohol screen for the difference between their mental health and functional status assessments. Urine drug and blood alcohol screens

are part of the admission laboratory tests performed on all trauma admissions at our level 1 trauma center. In the state of Georgia, there was no medically prescribed marijuana at the time of study and publication. After admission, patients were screened and consent was obtained. The following data were gathered—demographic data on patient age, sex, mechanism of injury, psychiatric history, and the open/closed status of the fracture. After any surgical intervention, but while still being an inpatient admission, patients who gave consent were interviewed using PHQ-9, PCL-C, GAD-7, and SMFA questionnaires.

Comparisons between patients screening positive and negative for drugs and alcohol were performed with a 2-sample *t* test. Because there were 5 outcome measures, our significance level was adjusted to control the family error rate. Therefore, a *P*-value of 0.01 or less was set as our significance level, rather than the customary 0.05. Using a regression framework, a 2-way analysis of variance for categorical variables and analysis of covariance for continuous variables were performed to determine whether demographic parameters had any effect on the outcome measures of mental health and function.

3. Results

From June 2017 to August 2021, 125 patients with at least one operative fracture admitted to the trauma service consented to being enrolled in the study. Table 1 summarizes the overall demographics of the patients. Of the patients who consented to being enrolled in the study, 78 tested positive for drugs and/or alcohol at the time of admission and 47 tested negative for all substances. Table 2 summarizes the distribution of positive substances that were screened for. The most common substances were tetrahydrocannabinol (*n* = 36), benzodiazepines (*n* = 27), opiates (*n* = 25), and alcohol (*n* = 25). Polypharmacy was common (*n* = 39), with at least half of all positive toxicology screens having at least 2 positive substances and the greatest number of positive substances being 5.

No difference between baseline depression was measured by PHQ-9 (*P* = 0.05) between patients with positive and negative drug screens. Similarly, symptoms of PTSD as measured by the PCL-5 about their recent trauma did not show a difference (*P* = 0.04). There was a significant difference between those with positive toxicology and negative toxicology screens for both anxiety, measured by the GAD-7 (*P* = 0.004) and function, measured by the SMFA (*P* = 0.006). The difference noted showed an increase in the GAD-7 by a mean of 2.8 points for those with a

TABLE 1
Demographic Data

		Toxicology-Positive (n = 78)	Toxicology-Negative (n = 47)	<i>P</i>
Sex	Male	53 (68%)	30 (64%)	<i>P</i> = 0.69
	Female	25 (32%)	17 (36%)	
Age		40 ± 15 y	43 ± 18 y	<i>P</i> = 0.32
Psychiatric history	Positive	13 (18%)	3 (4%)	<i>P</i> = 0.10
	Negative	64 (82%)	45 (96%)	
Open fracture	Yes	28 (36%)	12 (26%)	<i>P</i> = 0.23
	No	49 (64%)	35 (74%)	
Mechanism	GSW	6 (9%)	2 (4%)	<i>P</i> = 0.62
	Crush/Industrial	1 (1%)	3 (6%)	
	MCC	11 (14%)	9 (19%)	
	MVC	36 (46%)	22 (47%)	
	PVA	14 (18%)	5 (11%)	
	FFH	8 (10%)	5 (11%)	
	GLF	2 (2%)	1 (2%)	

TABLE 2
Toxicology Positivity (n = 78)

	n (%)
Tetrahydrocannabinol (THC)	36 (46%)
Benzodiazepine	27 (35%)
Alcohol	25 (32%)
Opiates	25 (32%)
Methamphetamine	12 (15%)
Cocaine	9 (12%)
Barbiturates	0
Methadone	0
Phencyclidine	0
Polypharmacy (at least 2 positives)	39 (50%)

positive toxicology screen. There was a decrease in the SMFA (indicating a higher level of baseline functioning) by a mean of 10.6 points for those patients who screened positive. The effect sizes for the GAD-7 and SMFA were 0.54 and 0.52, respectively, while the effect sizes for the PTSD and depression measures were 0.38 and 0.37, respectively. These data are summarized in Table 3.

There were no significant difference in any outcome measure with any of the demographic data including sex, age, psychiatric history, or mechanism of injury. These data are summarized in Table 4.

4. Discussion

Our study showed meaningful associations between positive toxicology screens and those who did not for anxiety and preinjury musculoskeletal function. Given the propensity for those suffering from anxiety disorders to self-medicate,²⁹ the finding that a measure of anxiety was found to be higher in those who find themselves in traumatic situations to which drugs and/or alcohol may have contributed was expected and in line with our hypothesis that illicit drug use is common with persons who have underlying anxiety. We observed moderate-to-large effect sizes that demonstrates strong observational associations between measures of mental health and positive toxicology screens. The fact that PTSD and depression were not found to be higher was unexpected but could be the result of a limited number of patients in the study as well as the fact that PTSD does take some time to manifest, and our data was gathered was within several days after injury. It certainly seems plausible that patients who have higher levels of anxiety or depression or are at risk of PTSD may use drugs or alcohol as coping mechanisms. The irony being that the same substances they are using to help cope for their mental health issues, diagnosed or undiagnosed, may contribute to their trauma—because inebriation predisposes humans toward accidental trauma.^{30,31}

The finding that those who had used drugs or alcohol enough to screen positive at the time of their traumatic incident had greater

TABLE 4
Regression Analysis Between Outcome Measures and Demographics

	Age	Sex	Mechanism	Psych History
PHQ-9	<i>P</i> = 0.49	<i>P</i> = 0.37	<i>P</i> = 0.12	<i>P</i> = 0.64
GAD-7	<i>P</i> = 0.78	<i>P</i> = 0.92	<i>P</i> = 0.42	<i>P</i> = 0.41
PCL-5	<i>P</i> = 0.45	<i>P</i> = 0.32	<i>P</i> = 0.61	<i>P</i> = 0.72
SMFA-F	<i>P</i> = 0.85	<i>P</i> = 0.04	<i>P</i> = 0.06	<i>P</i> = 0.21
SMFA-B	<i>P</i> = 0.76	<i>P</i> = 0.03	<i>P</i> = 0.19	<i>P</i> = 0.30

preinjury levels of musculoskeletal function was unexpected and must be interpreted with caution. It certainly seems unlikely that drug or alcohol use would improve overall musculoskeletal function, but it at least suggests that a positive drug or alcohol screen does not impede or lower self-reported baseline function before a musculoskeletal injury. This is important in an era where patient-centered metrics are increasingly used, and these data may contribute to the growing body of evidence that shows which factors can affect preinjury or postinjury musculoskeletal function from a patient-centered perspective.^{32,33}

There are several limitations to this study. First, as a single-center observational cross-sectional study, our findings should be interpreted with caution. It is not easily generalizable to all orthopaedic trauma populations. We are unable to establish causal relationships because positive toxicity screens cannot be randomly assigned. Second, this study does not longitudinally track progression of the mental health questionnaires or the SMFA. Prospective assessment of these patients could provide more insight into potential pitfalls for orthopaedic care and possible resiliency of patients from a mental health standpoint. Finally, because the admission drug screens represent a single point in time, the data do not reflect whether the positive drug screen is from a prescribed substance (in the case of opiates and benzodiazepines) or illicit use.

Taken as a whole, the screening for drug and/or alcohol use at the time of admission for traumatic injuries can be a useful tool to target behaviors that may prevent future traumatic injury. The use of screening questionnaires alone may not be sufficient to determine whether a patient has a substance use or abuse issue. However, given the increased prevalence of mental health disorders compared with the general population,^{32,34} trauma patients should be approached with a high index of suspicion and a low threshold to intervene. Admission related to orthopaedic trauma represents a unique opportunity to identify and support individuals who otherwise may have limited interaction with health care. Brief inpatient counseling sessions³⁵ or targeted intervention such as an outpatient referral to mental health professionals may prevent further injury and improve patient-reported outcomes. Our observational data show a moderately strong association of positive toxicology screens with changes in

TABLE 3
Outcome Measurement Differences

	Score and SD		Absolute Effect Size	<i>P</i>
	Toxicology-Positive	Toxicology-Negative		
PHQ-9	7.43 ± 6.35	5.34 ± 4.18	0.37	<i>P</i> = 0.046
GAD-7	6.82 ± 5.76	4.06 ± 3.78	0.54	<i>P</i> = 0.004
PCL-5	17.69 ± 14.68	12.46 ± 11.94	0.38	<i>P</i> = 0.042
SMFA-Functional	10.65 ± 15.66	21.29 ± 26.69	0.52	<i>P</i> = 0.006
SMFA-Bothersome	15.93 ± 19.34	22.97 ± 25.55	0.32	<i>P</i> = 0.084

The bold entries are *P* values that reach statistical significance (set at 0.01 for our study).

mental health scores. Further directions for research would be to follow the course of the physical function and psychological scores over time to determine whether illicit drug use at the time of injury is a factor associated longitudinally during recovery. In addition, this gives a potential starting point for mental health professionals to intervene to change patient outcomes in mental health.

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