

Marijuana Screening and Trauma Outcomes

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Abstract

Objective: The objective of this study was to determine if positive marijuana toxicology screen is associated with worse outcomes following trauma. **Methods:** A 3-year retrospective study was conducted on adult trauma patients using a Level II trauma registry. Patients were included if they had marijuana toxicology results available and were excluded if they tested positive for polysubstance. Endpoints of interest were mortality, injury severity score, length of stay (LOS), Glasgow coma Scale, and blood requirements. **Results:** Three hundred and eighty-one patients met the criteria. There was no difference between the two groups with regard to mortality (1.63% vs. 3.05%, odds ratio [OR]: 0.52 [0.13–2.14]) or LOS (1 day vs. 1 day, $P = 0.125$), and $P > 0.05$ for all other metrics besides age (31.53 years vs. 50.20 years, $P = 0$). OR for suffering major trauma in patients < 55 years was 2.26 (16.88% vs. 8.26%, OR: 2.26 [1.02–5.01]), and patients 55 years and older were more likely to present with lower blood pressure (129.12 mmHg vs. 140.85 mmHg, $P = 0.002$) and higher heart rate (95.25 bpm vs. 83.47 bpm, $P = 0.026$). **Conclusions:** A positive screen for marijuana in the setting of a trauma is not associated with increased mortality or hospital LOS. These results warrant further investigation of the effects of marijuana on trauma outcomes.

Keywords: Injury, marijuana, trauma

INTRODUCTION

It is well established that marijuana use is related to risk-taking behavior.^[1] It impairs baseline mentation and predisposes users to unintentional trauma, but there are limited data on the impact of marijuana on outcomes following trauma. Our objective with this study was to discover if marijuana is associated with higher mortality, higher injury severity, and longer length of stay (LOS).

METHODS

This study was approved by the Touro University-California Institutional Review Board. Natividad Medical Center (NMC) located in Salinas, CA, has a Level II Trauma Center which was established in January 2015 and serves Monterey County and surrounding areas along California's Central Coast. It is the only trauma center in the county and receives a large variety of trauma pathologies, from high-risk motor vehicle collisions to gunshot wounds. We abstracted data and obtained our endpoints of interest from a de-identified dataset from our trauma registry, which is maintained by dedicated trauma registrars. Our study analyzed demographics and individual trauma criteria collected from all patients admitted to NMC's

trauma service from July 1, 2014, to July 1, 2017. The trauma registry includes information pertaining to patient demographics, mechanism of injury, relevant dates of arrival and discharge, International statistical classification of diseases (ICD) codes, blood alcohol content (BAC), urine drug screen findings, LOS in the hospital and intensive care unit (ICU), disposition, initial vital signs, and amount of blood products transfused. Endpoints were followed for the duration that the patient was being evaluated at our facility. Transferred patients were followed for the duration of evaluation at the transfer facility.

There were 3861 cases in the trauma registry queried in total. Patients were included if they were 18 years or older and had toxicology screening results available in the trauma registry. Nearly all of the patients who were excluded from the study did not have toxicology screening results available. Patients testing positive for polysubstance or positive toxicology screen with BAC $> 0.08\%$ were excluded from the study as well. Three

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hundred and eighty-one patients met inclusion criteria and were included in either the study group (marijuana positive) or control group (negative toxicology and BAC < 0.08%). The hospital laboratory uses an immunoassay to screen for marijuana and provides a qualitative result, either “positive” or “negative” – it is a commonly used laboratory test implemented by many hospitals across the country.

The metrics that were compared between the two groups included the following: mortality, rates of major trauma, age, hospital and ICU LOS, systolic blood pressure (SBP) on arrival, heart rate (HR) on arrival, Glasgow Coma Scale (GCS) on arrival, injury severity score (ISS), and units of packed red blood cells (PRBCs) if transfused in initial 24 h. ISS >15 was defined as “major trauma.”^[2] An odds ratio (OR) for mortality and rate of suffering major trauma was calculated. Student’s *t*-tests were performed looking at each of the variables mentioned to determine statistical significance. The cohort was stratified by age into one group containing patients <55 years and the other containing patients 55 years and greater for further analysis. The 55-year age cutoff is a commonly used cutoff age in other studies.^[3] Student’s *t*-tests were performed within each age stratification to determine if there were significant differences between marijuana positive groups and control groups.

All data were compiled and analyzed using a Microsoft Excel database. All graphs and tables were made using either Microsoft Excel (Microsoft Corp., Redmond, WA, USA) or SPSS (IBM Corp., Armonk, NY, USA). Descriptive statistics were initially calculated for all the primary variables and subsequently in their stratified groups. Means of the primary outcomes were compared between the stratified groups and ORs calculated.

RESULTS

The 381 patients included in the study were victims of various traumatic injuries, between the ages of 18 and 100 (mean 41.2 ± 2.1 years) years and consisted of 70.6% men and 29.4% women. There were 9 deaths (2.4%) in total. Positive marijuana screens were found on 184 individuals; 197 patients had negative toxicology screens. The median ISS was 5 (interquartile range [IQR] 8), and the median LOS was 1 day [IQR 2]). Figure 1 describes the cohort in further detail.

Outcome frequency tables were generated to calculate ORs for mortality and rate of suffering major trauma, defined by ISS >15. Student’s *t*-tests were performed to compare age, overall hospital LOS, ICU LOS, SBP on arrival, HR on arrival, GCS, ISS, and units of PRBCs received; 95% confidence intervals contained the null value for ORs for mortality (1.6% vs. 3.0%, OR: 0.53 [0.13–2.14]) and rate of suffering major trauma (17.93% vs. 11.68%, OR: 1.65 [0.93–2.94]), indicating no significant difference between marijuana positive and control groups. Student’s *t*-tests yielded $P > 0.05$ for all endpoints except age (31.53 years vs. 50.20 years, $P = 0$). This suggests that patients in our dataset who screen positive for marijuana

Figure 1: Descriptive table of cohort

Descriptor	Value
Total	381
Age, mean (years)	41.18
Sex, <i>n</i> (%)	
Male	269 (70.60)
Female	112 (29.40)
Mechanism of injury, <i>n</i> (%)	
MVA	234 (61.42)
Fall	46 (12.07)
Penetrating injury	53 (13.91)
Other	48 (12.60)
Primary body region injured, <i>n</i> (%)	
Head/neck	141 (37.01)
Face	15 (3.94)
Chest	56 (14.70)
Abdomen/pelvis	19 (4.99)
Extremities	71 (18.64)
External	31 (8.14)
Unspecified	48 (12.60)
Disposition, <i>n</i> (%)	
Expired	9 (2.36)
Living	371 (97.64)
LOS (days), median (IQR)	
Hospital LOS	1 (2)
ICU LOS	0 (2)
Vital signs, on arrival	
SBP, mean (mmHg)	136.74
HR, mean (bpm)	86.44
GCS, median (IQR)	15 (0)
ISS, median (IQR)	5 (8)
PRBCs received, if transfused (units), median (IQR)	5 (5) e

ISS: Injury Severity Score, IQR: Interquartile range, MVA: Motor vehicle accident, LOS: Length of stay, ICU: Intensive care unit, SBP: Systolic blood pressure, HR: Heart rate, GCS: Glasgow Coma Scale, PRBCs: Packed red blood cells

Figure 2: Age-stratified frequency tables with odds ratios and 95% confidence intervals for mortality

	Expired	Living	OR	Lower	Upper
Overall					
Marijuana (+)	3	181	0.528	0.130	2.141
Negative Tox	6	191			
<55 years					
Marijuana (+)	2	158	0.677	0.094	4.882
Negative Tox	2	107			
55+ years					
Marijuana (+)	1	23	0.913	0.097	8.571
Negative Tox	4	84			

OR: Odds ratio

are significantly younger than those who screen negative. There was no statistically significant difference in LOS, ISS, or units of PRBCs received when compared to controls.

An age-stratified analysis revealed OR for suffering major trauma in patients <55 years to be statistically significant (16.88% vs.

8.26%, OR: 2.26 [1.02–5.01]). ORs for mortality did not vary significantly within each age strata. These results suggest that younger patients are more likely to present with signs of suffering major trauma if they screen positive for marijuana. Student's *t*-tests performed with age stratification revealed a statistically significant decrease in initial SBP (129.12 mmHg vs. 140.85 mmHg, $P = 0.002$) and increase in initial HR (95.25 bpm vs. 83.47 bpm, $P = 0.026$) with positive marijuana screen for patients 55 years or older. Age-stratified analysis otherwise revealed similar outcomes between marijuana positive and control groups ($P > 0.05$ for all other endpoints). Results are outlined in Figures 2–4, including the median values and IQRs.

Figure 3: Age-stratified frequency tables with odds ratios and 95% confidence intervals for injury severity

	ISS >15	ISS ≤15	OR	Lower	Upper
Overall					
Marijuana (+)	33	151	1.653	0.930	2.939
Negative Tox	23	174			
<55 years					
Marijuana (+)	27	133	2.256	1.016	5.009
Negative Tox	9	100			
55+ years					
Marijuana (+)	6	18	1.762	0.595	5.221
Negative Tox	14	74			

ISS: Injury Severity Score, OR: Odds ratio

DISCUSSION

While it is well-documented that drug use may predispose users to unintentional injury, we hoped to further examine if marijuana is associated with worse outcomes following trauma. Singer *et al.* reported that “a positive marijuana screen is associated with decreased mortality in adult trauma patients admitted to the ICU” and may theoretically provide a neuroprotective effect in the setting of traumatic brain injury.^[4] Our study did not find a statistically significant association between positive marijuana screen and mortality. However, patients in our dataset who presented with positive marijuana screen appear to be younger than patients who screened negative, and an age-stratified analysis revealed that patients below the age of 55 years were more likely to present with signs of major trauma when they had positive urine screen for marijuana. It is possible that this statistic underscores an increased predisposition to dangerous activities and unintentional injury with marijuana use that is more prevalent in younger users, or, perhaps, older patients are more likely to screen positive for marijuana without being acutely intoxicated and undergo such injuries due to slower drug metabolism or nonrecreational use at lower dosages. Patients 55 years and older were, however, more likely to present with lower SBP and higher HRs when they screened positive for marijuana suggestive of early signs of shock. While patients may be more likely to present with signs of major trauma or

Figure 4: Table of measure endpoints with *P* values

	Marijuana (+)	Negative Tox	<i>P</i>
Overall			
Age, mean	31.533	50.198	0.000
LOS, median (IQR)	1 (2)	1 (2)	0.125
ICU LOS, median (IQR)	0 (2)	0 (2)	0.163
SBP	136.516	136.954	0.856
HR	87.643	85.335	0.245
GCS, median (IQR)	15 (0)	15 (0)	0.082
ISS, median (IQR)	5 (8)	5 (9)	0.222
PRBCs received, if transfused, median (IQR)	4 (3)	7 (3)	0.705
<55 years			
LOS, median (IQR)	1 (1)	1 (1)	0.238
ICU LOS, median (IQR)	0 (2)	0 (0)	0.214
SBP	137.639	133.807	0.223
HR	86.487	86.844	0.883
GCS, median (IQR)	15 (0)	15 (0)	0.197
ISS, median (IQR)	5 (8)	4 (8)	0.412
PRBCs received, if transfused, median (IQR)	3 (3)	12 (0)	0.336
55+ years			
LOS, median (IQR)	1 (4)	2 (4)	0.623
ICU LOS, median (IQR)	1 (2)	1 (3)	0.680
SBP	129.125	140.852	0.002
HR	95.250	83.466	0.026
GCS, median (IQR)	15 (1)	15 (0)	0.663
ISS, median (IQR)	6 (8)	6 (9)	0.404
PRBCs received, if transfused, median (IQR)	-	6 (1)	-

ISS: Injury Severity Score, IQR: Interquartile range, LOS: Length of stay, ICU: Intensive care unit, SBP: Systolic blood pressure, HR: Heart rate, GCS: Glasgow Coma Scale, PRBCs: Packed red blood cells

critical injury when under the influence of marijuana, they may also be protected to some degree as evidenced by the fact that mortality rates and LOS did not differ significantly between marijuana positive and control groups. Because our study is retrospective in nature, we are unable to comment on a causal association between positive toxicology and outcomes following trauma.

Several other limitations in our study merit discussion. Since we were only able to follow our endpoints until patient expiration or discharge and we were not able to evaluate for any changes in functional status beyond ISS, our results may be slightly skewed toward improved outcomes; our study may include patients awaiting placement in long-term care facilities, for example. The drug screen immunoassay itself has limitations, namely its relatively low specificity. Patients will screen positive for approximately 5 days (and up to 18 days) after use. Thus, patients who screen positive are not necessarily acutely intoxicated.^[5,6] Finally, because this is a single-center study, our pool of patients was not large enough to utilize matching strategies that would allow us to include patients with polysubstance.

CONCLUSIONS

Trauma patients screening positive for marijuana are more likely to present with signs of higher injury severity. Despite this, a positive screen for marijuana is not associated with

increased mortality or hospital LOS. These results warrant further investigation of the effects of marijuana on trauma outcomes.

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Conflicts of interest

There are no conflicts of interest.

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