Urine Toxicology Screening Among Polytraumatic Patients in Tanta University Hospitals

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KEYWORDS

Toxicology, polytrauma, substance abuse, emergency department

Background: Polytrauma is a prevalent occurrence in emergency departments globally, often exacerbated by substance use, a significant factor contributing to accidents. Substance use compromises judgment, coordination, and reaction time, heightening the risk of accidents and injuries. This study aims to assess the clinical significance of urine toxicology screening in managing polytrauma patients. It evaluates the prevalence of drug use, explores the impact of positive screening results on patient outcomes, and informs treatment decisions.

Methods: This study encompassed all polytrauma patients of both genders who were presented to the Emergency Department at Tanta University Hospital between June and November 2023. Patients underwent comprehensive evaluation, including trauma assessment, Focused Assessment with Sonography for Trauma patients' examination, and urine toxicology screening.

Results: The study included 100 polytrauma patients, with ages ranging from 16 to 72 years (mean ± SD: 34.65±14.75). Males constituted 79%, while females constituted 21% of the cohort. Urine toxicology screening yielded positive results in 41% of patients, with Morphine, Tramadol, Cannabinol, Benzodiazepines, and Barbiturates among the detected substances.

Conclusion: Morphine was statistically significant, being higher in the Ejection from a vehicle group compared to other injury mechanisms. Barbiturates were significantly higher in the Crush injuries group. These findings highlight the importance of urine toxicology screening in identifying substance use patterns among polytrauma patients, facilitating tailored treatment approaches and injury prevention strategies.

Background

Polytrauma, characterized by multiple injuries across various body regions, carries a significant challenge in emergency medical care. Its prevalence has surged in recent years, making it a frequent presentation in emergency departments worldwide[(1)].

The New Berlin Definition of polytrauma is a documented definition that includes at least one of five standard physiological conditions, an Injury Severity Score (ISS) of 16 or higher, and an Abbreviated Injury Scale (AIS) score of 3 or higher in at least two different body regions. [(2)]

A notable portion of patients seen in the emergency department stem from self-harm, poisoning, or toxicological emergencies. substance use is a prominent contributing factor to such accidents, profoundly affecting judgment, coordination, and reaction time. [(3)]

Effective management of polytrauma patients requires a multidisciplinary approach, including emergency physicians, surgeons, orthopedists, and other specialists, to ensure timely and comprehensive care. [(4)]

Urine toxicology screening is a crucial tool in managing polytrauma patients, aiding in the identification of substance use disorders and guiding tailored pain management strategies. Patients with opioid use disorders, for instance, might require alternative pain management approaches or may be referred to addiction specialists to mitigate adverse effects and optimize pain control. [(5)]

Moreover, substance use increases the risk of adverse events, such as respiratory depression, overdose, and falls, among polytrauma patients. Urine toxicology screening facilitates the identification of high-risk patients, guiding the implementation of appropriate safety measures, such as medication adjustments, monitoring, and appropriate referrals. [6]

Data derived from urine toxicology screening holds potential for research and policy-making purposes, offering insights into substance use trends and informing the design of public health interventions. Such initiatives have the potential to enhance patient outcomes on a broader scale. [7]

Methods

This prospective study was conducted on all polytrauma patients of both sexes presented to the Emergency Department at Tanta University Hospital. This study commenced from June 2023 and concluded by the end of November 2023.

The study included individuals aged 18 years or older, encompassing polytrauma patients as defined by the recent Berlin criteria for polytrauma. This definition necessitates the fulfillment of all the following conditions: AIS score of 3 or greater in two or more distinct body regions, ISS of 16 or above, and the presence of one or more variables from among the five physiological parameters. These parameters include a systolic blood pressure of 90 mmHg or lower, a Glasgow Coma Scale (GCS) score of 8 or less, a base excess of -6.0 or lower, an international normalized ratio (INR) of 1.4 or higher, a partial thromboplastin time (PTT) of 40 seconds or longer and being 70 years of age or older.

Ethical committee approval and informed consent were secured from all participants or their relatives, following a detailed briefing on the potential benefits and risks associated with this study. To ensure the privacy and confidentiality of participants' data, each participant was assigned a unique code number that was used throughout the study. The data derived from this research were exclusively utilized for scientific objectives. All Methods were performed in accordance with the ethical committee.

All patients included were subjected to history including sociodemographic data, medical, surgical history, allergy, medications, special habits, and recent substance use over the last 30 days.

The trauma evaluation encompasses a comprehensive analysis starting from the time of the trauma, the day of the week it occurred, and mechanism of trauma. The AIS is utilized for assessment, employing a 6-point ordinal severity scale ranging from 1 (minor) to 6 (maximum). This scale helps in evaluating the extent of injuries across different body regions, such as the head, face, neck, thorax, abdomen and pelvic contents, spine, upper and lower extremities, and external injuries, burns, and other types of traumas.

All patients were assessed using the primary survey by assessing airway, breathing, circulation, disability, and environment. A Focused Assessment with Sonography for Trauma (FAST) scan was considered a part of the primary survey. The secondary survey takes special consideration of the presence of trace marks indicative of intravenous drug abuse, a head-to-toe examination, and recording of the proven injuries.

Additionally, a urine toxicology screening is performed using a Multi Drug Rapid Test Panel for the simultaneous, qualitative detection of multiple drugs and drug metabolites in human urine, through a rapid chromatographic immunoassay.

Drugs included in urine toxicology screening were Acetaminophen, Amphetamine, Barbiturates, Benzodiazepines, Buprenorphine, Cocaine, cannabinol, Marijuana, Methadone, Methamphetamine, Methylenedioxymethamphetamine, Morphine, Methaqualone, Opiate, Phencyclidine, Propoxyphene, Tricyclic Antidepressants, Tramadol, Ketamine, Oxycodone, Cotinine, 2-ethylidene-1,5-dimethyl-3,3-diphenylpyrrolidine, and Fentanyl.

Statistical analysis

Statistical analysis was conducted by SPSS v26 (IBM Inc., Chicago, IL, USA). The normality of data distribution was assessed using the Shapiro-Wilks test and histograms. Quantitative parametric variables were expressed as mean and standard deviation (SD) and compared patients with positive and negative urine toxicology screening utilizing unpaired Student's t- test. Qualitative variables were presented as frequency and percentage (%) and analyzed utilizing the Chi-square test or Fisher's exact test where appropriate. A two tailed P value < 0.05 was considered statistically significant.

Results

In this prospective study conducted at the Emergency and Traumatology Department of Tanta University Hospitals, a total of 100 polytrauma patients of both sexes were included for analysis. The ***Age*** of the studied participants ranged from 16 to 72 years, with a mean age of 34.65 years (±14.75 SD). Regarding ***sex***, 79 patients (79%) were males and 21 (21%) females. **(Table 1)**

Table 1: Patient Characteristics of the Studied Patients

		Total studied patients (N=100)
Age (years)	Mean ± SD	34.7 ± 14.75
	Range	16 - 72
Sex N (%)	Male	79 (79%)
	Female	21 (21%)

Urine toxicology screening was positive in 41 patients and negative in 59 patients. ***(Table 2, Figure 1)***

Table 2: Urine Toxicology Screen andType of Drug of the Studied Patients

		Number of patients (%)
Urine Toxicology Screen	Positive	41 (41%)
	Negative	59 (59%)
Type of Drug	Cannabinol	18 (43.9%)
	Benzodiazepines	7 (17.07%)
	Tramadol, Cannabinol	4 (9.76%)
	Tramadol	3 (7.32%)
	Benzodiazepines, Cannabinol	2 (4.88%)
	Benzodiazepines, Cannabinol, Barbiturates	2 (4.88%)
	Barbiturates, Cannabinol	2 (4.88%)
	Barbiturates	2 (4.88%)
	Morphine	1 (2.44%)

Regarding the ***mechanism of trauma,*** the most common mechanism was Road traffic collisions representing 40% of patients followed by fall from two stories or more representing 25% of patients. ***(Table 3, Figure 1)***

Table 3: Mechanism of Trauma of the Studied Patients

		Total Studied Patients (N=100)
Mechanism of Trauma	Road traffic collisions	40 (40%)
	Fall from two stories or more	25 (25%)
	Assault with a weapon	18 (18%)
	Ejection from a vehicle	7 (7%)
	Crush injuries	5 (5%)
	Pedestrian or cyclist versus vehicle	3 (3%)
	Prolonged entrapments	2 (2%)

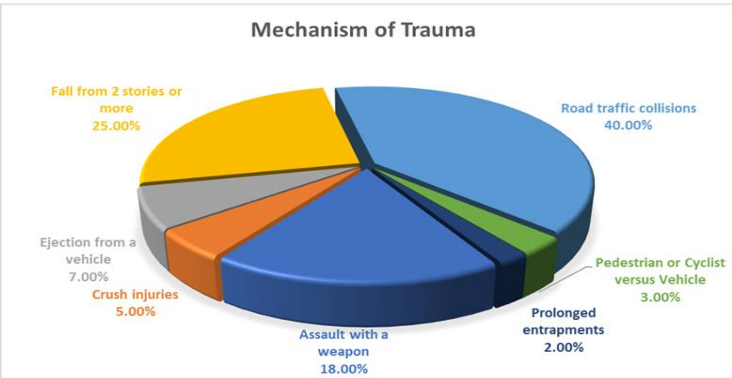

Figure 1: Mechanism of Trauma of the Studied Patients

Regarding ***Type of drug,*** Morphine was statistically significantly higher in Ejection from a vehicle group (P value=0.038). Barbiturates were statistically significant higher in Crush injuries group (P value<0.001). ***(Table 4)***

Table 4: Relation Between Mechanism of Trauma and Type of Drug of the Studied Patients

Type of drug	**Assault with a weapon (n=18) N (%)**	**Crush injuries. (n=5) N (%)**	**Ejection from a vehicle (n=7) N (%)**	**Fall from two stories or more. (n=25) N (%)**	**Road traffic collisions (n=40) N (%)**	**Pedestrian or Cyclist versus Vehicle (n=3) N (%)**	**Prolonged entrapments (n=2) N (%)**	**P value**
Morphine	0 (0%)	0 (0%)	1 (14.29 %)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	**0.038***
Barbiturates	0 (0%)	2 (40%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 0%)	**< 0.001***
Tramadol	2 (11.11%)	0 (0%)	0 (0%)	0 (0%)	1 (2.5%)	0 (0%)	0 (0%)	0.493
Cannabinol	6 (33.33%)	1 (20%)	0 (0%)	1 (4%)	10 (25%)	0 (0%)	0 (0%)	0.1180
Combined Tramadol, Cannabinol	0 (0%)	0 (0%)	0 (0%)	2 (8%)	2 (5%)	0 (0%)	0 (0%)	0.856
Benzodiazepines	2 (11.11%)	0 (0%)	0 (0%)	0 (0%)	5 (12.5%)	0 (0%)	0 (0%)	0.4830
Combined Benzodiazepines, Cannabinol	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (5%)	0 (0%)	0 (0%)	0.801
Combined Benzodiazepines, Cannabinol, Barbiturates	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (5%)	0 (0%)	0 (0%)	0.801
Combined Barbiturates, Cannabinol	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (5%)	0 (0%)	0 (0%)	0.801
Negative	8 (44.44%)	2 (40%)	6 (85.71 %)	22 (88%)	16 (40%)	3 (100%)	2 (100%)	**0.001***

This study included an ISS of 16 and more, ISS was statistically significantly higher in positive urine toxicology screen patients (P value 0.0119).
On the other hand, Revised Trauma Score ***(RTS),*** was insignificantly higher in negative urine toxicology screen patients (P value 0.068).
Trauma Score and Injury Severity Score ***(TRISS)*** or Probability of Survival (Ps) was significantly higher in negative Urine Toxicology Screens (P value 0.004). ***(Table 5)***

Table 5: Comparison of Injury Severity Score (ISS), Revised Trauma Score (RTS), and Trauma Score and Injury Severity Score (TRISS) or Probability of Survival (Ps) Between Patients with Positive and Negative Urine Toxicology Screens.

Scores		All patients	Positive (41%)	Negative (59%)	Independent Samples t-test	P wave
ISS	Range	19-75	27 – 75	19 – 75	2.56176	0.0119*
	Mean ± SD	44.98 ± 18.58	50.54 ± 18.56	41.12 ± 17.75		
RTS	Range	3.07 - 7.84	3.27 - 7.84	3.07 - 7.84	-1.84242	0.068
	Mean ± SD	6.85 ± 1.28	6.57 ± 1.20	7.04 ± 1.31		
TRISS	Range	0.25 - 92.82	0.30 – 78.71	0.25 - 92.82	-2.91515	0.004*
	Mean ± SD	48.4 ± 33.9	36.97 ± 30.63	56.35 ± 34.03		

All patients in this study were ***admitted in intensive care unit (ICU)*** for 1 to 8 days with mean duration 4.41 and 4.32 days in patients with positive and negative urine toxicology screening respectively. ***(Table 6)***

Table 6: Comparison of Hospital Length of Stay Between Patients with Positive and Negative Urine Toxicology Screens.

Length of stay Mean ± SD (days)	All patients	Positive (41%)	Negative (59%)
Range	1 - 8	1 - 8	2 - 8
Mean ± SD	4.36 ± 1.84	4.41 ± 1.92	4.32 ± 1.80
Independent Samples t-test		0.24639	
P wave		0.805	

Regarding type of drug, combined use of tramadol and cannabinol and combined use of benzodiazepines and cannabinol were statistically significant higher in Died group than Alive group (P value 0.031 and 0.005 respectively). while other drugs were insignificantly different between both groups. **(Table 7, Figure 2)**

Table 7: Relation Between Mortality and Type of Drug of the Studied Patients

		Died group (n=8)	Alive group (n=92)	P value
Type of drug	Combined Benzodiazepines and Cannabinol	2 (25%)	0 (0%)	**0.005***
	Combined Tramadol and Cannabinol	2 (25%)	2 (2.17%)	**0.031***
	Cannabinol	0 (0%)	18 (19.57%)	0.344
	Morphine	0 (0%)	1 (1.09%)	1.0
	Tramadol	0 (0%)	3 (3.26%)	1.0
	Benzodiazepines	0 (0%)	7 (7.61%)	1.00
	Combined Benzodiazepines, Cannabinol, and Barbiturates	0 (0%)	2 (2.17%)	1.00

	Barbiturates	0 (0%)	2 (2.17%)	1.00
	Combined Barbiturates and Cannabinol	0 (0%)	2 (2.17%)	1.00
	Negative	4 (50%)	55 (59.78%)	0.869

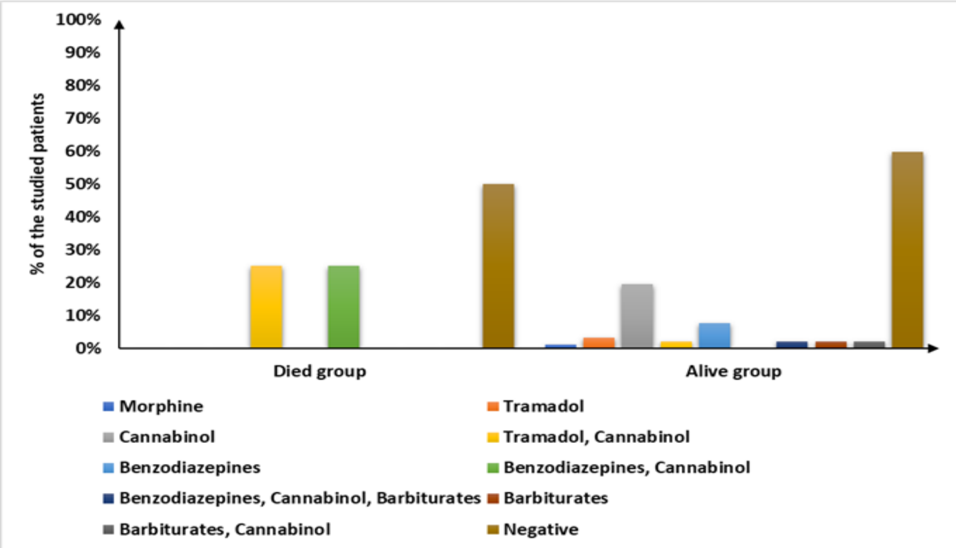

Figure 2: Relation between Mortality and Type of Drug of the Studied Patients

Discussion

Our study conducted at the Emergency Department of Tanta University Hospitalfrom June to November 2023, we investigated all polytrauma patients of both sexes. Our cohort comprised 100 patients, with 41% testing positive and 59% negative on urine toxicology screening. Firstly, differences in patient populations play a significant role.

According to **age,** range of patients was 16 to 72 years, with a mean age of 34.65 years, and males accounted for 79% of the cohort. Regarding 79 patients (79%) were males and 21 (21%) females.

In contrast, ***Figl M et al. (2010)*** reported a wider age range (14–102 years) with a higher mean age of 55 years. Additionally, they noted a higher overall incidence of drug use in the 21–30 age group and observed differences in substance use patterns between males and females, with males having a higher rate of positive screening for certain substances such as cocaine and cannabinoids. Similarly, **Tomaszewski C *et al. (2005)*** and ***Huish E et al. (2021)*** reported different demographics in terms of age and gender distribution among their study populations. [8–10]

Among those with positive results, the most prevalent substances were Cannabinol, followed by Benzodiazepines and Tramadol. Our findings highlight the significant prevalence of substance use among polytrauma patients in our setting. This trend can be attributed to the widespread use of cannabis and tramadol, which have been among the most used substances in the Egyptian market over the last decade.

For instance, **Weiss ST *et al. (2022)*** reported a higher positivity rate (70%) with a different profile of detected substances, including nicotine, caffeine, acetaminophen, and antidepressants. [11]

Figl M et al. (2010) observed a lower positivity rate (26.8%) with a predominant detection of benzodiazepines, cannabinoids, tricyclic antidepressants, and opiates. Additionally, ***Huish E et al. (2021)*** reported a higher positivity rate (59.7%) with significant differences in median Injury Severity Scores between patients with positive and negative drug screens. [8,10]

These findings suggest that while mechanisms of trauma and severity of injuries may vary among studies, there appears to be no significant association between substance use, hospital outcomes, and mortality. However, further research is warranted to explore potential relationships between substance use and trauma outcomes in larger cohorts.

In our study, the ***Mechanisms of trauma*** varied among patients. Assault with a weapon accounted for 18% of cases, Crush injuries for 5%, Ejection from a vehicle for 7%, Fall from 2 stories or more for 25%, Road traffic collisions for 40%, Pedestrian or cyclist versus vehicle for 3%, and prolonged entrapments for 2%.
In Figl M et al. (2010) study, benzodiazepine use was almost five times more common among motor vehicle crash victims than among an age- and sex-matched control. [8]
According to ***ISS***, Extremity of ISS was negative in 32 (32%) patients, serious in 45 (45%) patients, severe in 20 (20%) patients, critical in 1 (1%) patients and maximum in 2 (2%) patients. ISS score ranged from 19 to 75 with a mean value (± SD) of 44.98 (±18.58).
While in the study of ***Figl M et al. (2010)*** Most patients (n = 642) were moderately injured ISS < 16), suffering mostly from injuries to the extremities (606 patients). Only 22 patients were severely injured (ISS > 16). The mean ISS was 14.5, ranging from 9 to 50. [8]
The ***length of hospital stays*** in our study ranged from 1 to 8 days, with a mean of 4.36 (±1.84) days, and all patients were admitted to the ICU. Mortality was observed in 8% of patients.
In contrast, ***Figl M et al. (2010)*** the length stay was longer (17.4 days), with a mean ICU stay of 15.8 days and a mean ventilation time of 14.3 days among patients requiring ventilation. However, there was no significant association between hospital stay, ICU stay, ventilation days, and positive drug tests, nor was there a significant association between mortality and positive drug tests.[8]
Similarly, ***Huish E et al. (2021)*** reported a median length of stay of 3 days, with no significant difference between positive and negative groups. [10]

List of Abbreviations

AIS; Abbreviated Injury Scale, **FAST;** Focused Assessment with Sonography for Trauma, **GCS;** Glasgow Coma Scale, **ICU;** intensive care unit, **INR,** international normalized ratio, **ISS;** Injury Severity Score, **Ps;** Probability of Survival, **PTT;** partial thromboplastin time, **RTS;** Revised Trauma Score, **SD;** Standard deviation, **TRISS;** Trauma Score and Injury Severity Score

Declarations

- **Ethics approval and consent to participate:**

The Research Ethics Committee of the Faculty of Medicine at Tanta University has granted approval for this research under the approval code: 36264PR199/5/23. Informed consent was obtained from all participants and/or their legal guardians. All research was performed in accordance with the relevant guidelines and regulations.

- **Competing interests**

The authors declare that they have no competing interests

- **Funding**

This research was undertaken without any dedicated funding sources.

- **Data availability**

The datasets generated and/or analyzed during the current study are not publicly available due to the lack of consent from all patients to publish this data but are available from the corresponding author on reasonable request.

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