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Trauma Patterns in Patients Attending the Emergency Department in Saudi Arabia Following the Impact of Alcohol Consumption on the Trauma Patterns and Its Outcomes in Patients

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ABSTRACT

Background: Alcohol consumption is a common risk factor for traumatic injuries, and its effect on the clinical outcomes of trauma patients remains controversial. **Objective:** This study aimed to investigate the impact of alcohol on the outcomes of Saudi Arabian trauma patients. **Methods:** This is a prospective descriptive study conducted over a period of three years, from January 2020 to February 2023. Any adult aged 16 years or above who required emergency care due to any type of trauma was included. Patients were divided into two groups based on alcohol use. We compared demographic characteristics, injury mechanisms, clinical variables, interventions, and outcomes between the two groups. **Results:** There were 560 patients who reported alcohol consumption and 2590 patients who did not consume alcohol. The alcohol group had higher SBP ($p<0.001$), lower RR ($p<0.001$), lower HR ($p<0.001$), and higher lactate levels ($p=0.032$). They also had a longer hospital length of stay (10 vs. 7 days, $p<0.001$), more ventilator days (7 vs. 4 days, $p<0.001$), higher rates of surgical treatment (44% vs 18%, $p<0.001$), and higher mortality rates (8% vs. 3%, $p<0.001$) compared to the non-alcohol group. **Conclusion:** Our study suggests that alcohol use in patients with trauma is associated with worse clinical outcomes, including longer hospital stays, higher rates of surgical treatment, and increased mortality. These findings have significant implications for clinical practice in Saudi Arabia, emphasizing the importance of efforts to limit alcohol intake among Saudi Arabians.

Keywords: Alcohol consumption, traumatic injuries, clinical outcomes of trauma patients.

1. BACKGROUND

Trauma is a leading cause of morbidity and mortality around the globe (1–3), and it substantially impacts the health and well-being of individuals, families, and communities (1, 3–5). Trauma can result from a variety of causes, including accidents, violence, natural disasters, and fighting (6, 7), and it can have both physical and mental ramifications (8,9). In Saudi Arabia, trauma is a significant public health concern due to the high incidence of injuries caused by motor vehicle accidents, falls, and other causes (10, 11).

The emergency department plays a vital part in the administration and treatment of trauma patients, as it is the first initial point of contact for many patients with injuries (12). The emergency department is equipped with specialized staff and facilities to stabilize patients with traumatic injuries and provide immediate care (12, 13). Over the years, the number of trauma patients presenting to the emergency department in Saudi Arabia has increased significantly (14), straining the healthcare system. The high incidence of trauma has increased the demand for resources and specialized training among healthcare professionals in order to manage trauma patients effectively (14,15). Trauma patterns can be influenced by a variety of factors, including age, gender, financial level, environmental conditions, and cultural traditions (16, 17). Identifying these factors can aid in the development of

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targeted interventions and preventative measures to reduce the burden of trauma in Saudi Arabia.

In Saudi Arabia, alcohol consumption is a significant public health concern. The World Health Organization (WHO) estimates that the prevalence of alcohol consumption in Saudi Arabia is approximately 1.5%, which is significantly lower than the global average of 6.2% (18). Despite this, alcohol-related trauma continues to be a significant issue in the nation (19, 20). Alcohol consumption has been linked with an increased risk of trauma, including motor vehicle collisions, falls, and violent acts (21).

Understanding the patterns of trauma among individuals presenting to the emergency department is crucial for healthcare providers to identify high-risk groups, devise appropriate interventions and preventative measures, and allocate resources efficiently.

2. OBJECTIVE

The purpose of this study is to investigate the patterns of trauma in Saudi Arabian patients attend to the emergency department and to compare the patterns and the outcomes between patients who consume alcohol and who do not.

3. MATERIAL AND METHODS

Study design and setting

This is a prospective descriptive study conducted over a period of three years from January 2020 to February 2023, after obtaining approval from the ethics committee. All patients with different kinds of trauma were enrolled in the study, except for those with poisoning, burns, or electrocution.

Eligibility criteria

Any adult aged 16 years or above who required emergency care due to any type of trauma was included. This criterion ensured that we only enrolled patients who were presented with trauma and required emergency care, irrespective of the type of trauma they had sustained. However, we excluded certain patient groups from our study, including pediatric patients, pregnant patients, and those with burn injuries. Pediatric patients were excluded due to differences in their anatomy and physiology compared to adults, while pregnant patients were excluded due to the potential impact of their condition on the outcomes of the study. Patients with burn injuries were excluded because the management of burn injuries is distinct from other types of traumas and may confound the study results.

Data collection

Clinical data were collected from a pre-organized data sheet for each patient. The following data were recorded: socio-demographic data, trauma data, clinical evaluation, investigations, and treatment strategies. The socio-demographic data included age, sex, and residence. Trauma data included the pattern and mechanism of trauma.

All patients were subjected to clinical evaluation on arrival to the emergency department, including measurement of vital signs (systolic (SBP) and diastolic

blood pressure (DBP), heart rate (HR), and respiratory rate (RR)), general examination (including the Glasco coma scale (GCS)), examination of the injured part, and whole-body examination to detect any unrecognized injuries. All investigations performed on each patient, whether laboratory or radiological, were recorded. Treatment strategies, including first aid measures and definitive management, were also recorded.

Outcome measures

The outcomes included surgical and non-surgical treatments, in-hospital length of stay (LOS), ventilator days, in-hospital mortality, and emergency department (ED) LOS. We categorized the included trauma patients into two groups based on their history, clinical examination, and blood or urine screen test results related to alcohol consumption into Alcoholic and Non-Alcoholic groups in a non-randomized manner, based solely on the aforementioned criteria. This approach allowed us to compare the outcomes and other variables between the two groups.

Statistical analysis

All the collected data were coded, entered, and analyzed using the Statistical Package for Social Scientists (SPSS) version 26. Shapiro-Wilks test and histograms were used to estimate the normality of the distribution of data. Quantitative parametric variables were presented as mean and standard deviation (SD) and compared between the two groups utilizing unpaired Student's t-test. Non-parametric quantitative data were displayed as the median and interquartile range (IQR) and were tested by Mann Whitney-test. Qualitative variables were displayed as frequency and percentage (%) and were analyzed utilizing the Chi-square test or Fisher's exact test when applicable. $P < 0.05$ was considered statistically significant.

4. RESULTS

Demographics and baseline characteristics

From January 2020 to February 2023, 3783 patients were admitted to the ED because of trauma. Of them, 633 were excluded from the study due to missing data or did not meet the inclusion criteria, and 3150 patients were included (Figure 1). We divided the patients according to alcohol consumption into two groups as there were 560 patients who reported alcohol consumption, and 2590 patients who did not consume alcohol. The results showed that there was a significant difference between the two groups regarding sex, with more males in the alcohol group compared to the non-alcohol group ($p < 0.001$). The age distribution was also significantly different between the two groups ($p < 0.001$), with more patients in the 18-29 and less than 18 age groups in the alcohol group compared to the non-alcohol group. The alcohol group had a higher proportion of patients from urban areas ($p < 0.001$) and a higher incidence of fall-down trauma ($p < 0.001$). The baseline demographic characteristics of the participants are presented in Table 1.

Mechanism of trauma

Parameter	Alcohol n = 560	No alcohol n = 2590	p value	
Sex	Male	387 (69.11%)	2254 (87.03%)	<0.001
	Female	173 (30.89%)	336 (12.97%)	
Age	Less than 18	70 (12.5%)	109 (4.21%)	<0.001
	18-29	223 (39.82%)	966 (37.3%)	
	30-49	134 (23.93%)	734 (28.34%)	
	50-69	122 (21.79%)	569 (21.97%)	
	More than 70	11 (1.96%)	212 (8.19%)	
Residence	Rural	138 (24.64%)	882 (34.05%)	<0.001
	Urban	422 (75.36%)	1372 (52.97%)	
Trauma pattern	Penetrating	98 (17.5%)	654 (25.25%)	<0.001
	Blunt	275 (49.11%)	1825 (70.46%)	
	Fall down	187 (33.39%)	111 (4.29%)	

Table 1. Baseline demographic characteristics of the participants. Data is presented as number and percentage. The Chi square test was used to compare the two groups.

Parameter	Alcohol n = 560	No alcohol n = 2590	p-value
MVC, n (%)	263 (47%)	1424 (55%)	0.045
Pedestrian struck, n (%)	101 (18%)	207 (8%)	
High fall (> 3 m), n (%)	28 (5%)	104 (4%)	
Low fall (< 3 m), n (%)	123 (22%)	803 (31%)	
Penetrating trauma, n (%)	45 (8%)	52 (2%)	

Table 2. Mechanism of the trauma. Data is presented as numbers and percentages. The Chi square test was used to compare the two groups. MVC: motor vehicle crash; n: number; %: percentage.

There was a significant difference between the two groups regarding the mechanism of the trauma as the non-alcohol group had a higher proportion of motor vehicle crashes-related trauma compared to the alcohol group (47% and 55%, respectively). However, Pedestrian struck was higher in the alcohol group compared to the non-alcohol group (18% vs 8%, respectively). The comparison between the two groups in terms of the mechanism of trauma is presented in Table 2.

Clinical outcomes

All vital signs were significantly different between the two groups at the time of admission, with a higher SBP and a lower DBP in the alcoholic group, however, the difference was clinically insignificant. The HR and RR were significantly higher in the non-alcoholic group with an HR mean difference of 22 and a RR mean difference of 2. However, the GCS was not significantly different between the two groups. 27% in the alcoholic group had a lactate level of more than 2%, which was statistically significantly higher than the non-alcoholic group (17%), (p=0.032)-. Table 3.shows the comparison between the alcohol and non-alcohol groups regarding the clinical variables.

Comparing the two groups regarding the interventions needed and the related outcomes

Regarding the intervention and outcomes, the results showed that there was a significant difference in the proportion of participants receiving surgical treatment, with a higher proportion in the alcohol group (44%) compared to the non-alcohol group (18%), about 2.5 times more in the alcoholic patients. The ED LOS, hospital LOS, and ventilation days were also significantly longer for the alcoholic group than the non-alcoholic group (all p<0.001). The in-hospital mortality was significantly higher in the alcohol group (8%) compared to the non-alcohol group (3%), (p<0.001). Table 4 shows the comparison between the alcohol and non-alcohol groups regarding the intervention and outcomes.

5. DISCUSSION

Significance of the study

To the best of our knowledge, no study has been done in Saudi Arabia on this sensitive topic, and this is the first study to look at the effect of alcohol use on the clinical presentation, treatment, and outcomes of trauma patients. The study’s results have importance in view of alcohol consumption and its link to trauma-related injuries because alcohol consumption has increased in the last few years in Saudi Arabia despite being illegal.

Parameter	Alcohol n = 560	No alcohol n = 2590	p-value	
Vital signs	SBP mean ±SD	140 ± 10.5	133 ± 10.1	<0.001
	DBP	76 ± 10.3	77 ± 8.3	0.013
	RR	12 ± 2.2	14 ± 1.9	<0.001
	HR	66 ± 10.2	88 ± 14.5	<0.001
GCS, %	13-15	77	81	0.486
	13-9	21	18	
	less than 9	2	1	
Lactate more than 2 %	151 (27%)	440 (17%)	0.032	

Table 3. Comparison between the alcohol and non-alcohol groups regarding the clinical variables: Data is presented as mean ± SD or number and percentage.

Parameter	Alcohol n = 560	No alcohol n = 2590	p-value
Surgical treatment, n (%)	246 (44%)	466 (18%)	<0.001
Non -Surgical treatments n (%)	314 (56%)	2124 (82%)	<0.001
In-hospital LOS (days, mean ± SD)	10 ± 3.5	7 ± 2.2	<0.001
Ventilator days (mean ± SD)	7 ± 2	4 ± 1	<0.001
In-hospital mortality, n (%)	45 (8%)	78 (3%)	<0.001
ED LOS (minute, mean ± SD)	223 ± 44.8	174 ± 36.5	<0.001

Table 4. Comparison between the alcohol and non-alcohol groups regarding the intervention and outcomes. Data is presented as mean ± SD or number and percentage. N (%): number and percentage; LOS: length of stay; ED: emergency department.

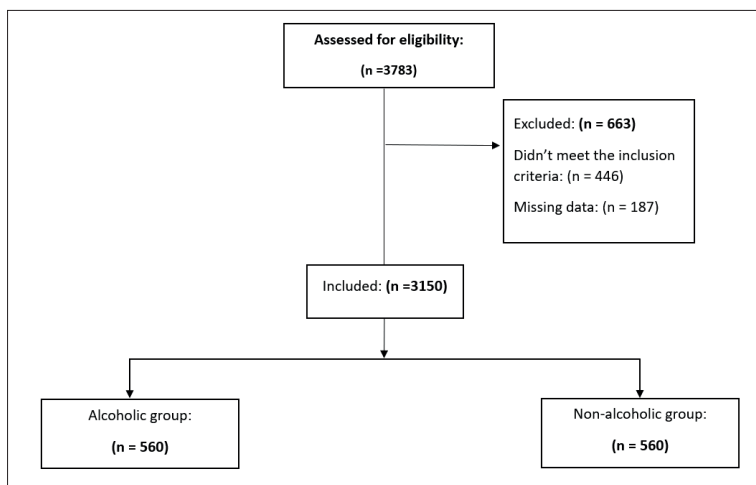


Figure 1. The flow diagram of the included patients.

Summary of findings

According to the findings of our study, trauma patients with a history of consuming alcohol had substantially different demographic and clinical features than those who did not consume alcohol. Alcohol intake was linked to an increase in penetrating injuries and falls. The alcohol group had higher SBP, lower RR, lower HR, and higher lactate levels. They also had a longer hospital length of stay, more ventilator days, higher rates of surgical treatment, and higher mortality rates compared to the non-alcohol group. According to these findings, drinking alcohol may significantly contribute to trauma incidents' negative outcomes.

Explanation of findings

Consumption of alcohol can have several kinds of negative effects on a person's health and well-being (22–29). The higher probability of injury and trauma is one of the most significant dangers associated with alcohol consumption (21). Alcohol consumers are more likely to engage in hazardous behavior, such as driving under the influence of alcohol (30,31), which can result in accidents and injuries (21). In addition to impairing coordination, judgment, and reaction time, alcohol consumption (32,33) can increase the likelihood of falls, burns, and other incidents. Additionally, alcohol consumption can negatively affect the liver and other vital organs, leading to chronic medical conditions such as cirrhosis, liver failure, and multiple kinds of cancer (22–28). Chronic alcohol consumption can also lead to cognitive impairment, memory loss, and an increased risk of mental health disorders like depression and anxiety (25, 30, 32, 34).

It has been shown that alcohol consumption increases the severity of trauma-related injuries (35). Alcohol consumption can impede a person's ability to respond appropriately to a potentially hazardous situation, resulting in more severe injuries (30,32,33,35,36). In addition, alcohol consumption can aggravate preexisting medical conditions, such as liver disease and diabetes, making it more difficult for the body to recuperate from injuries (37–39). In addition, alcohol consumption is associated with delayed hospital presentation (40, 41),

which may have contributed to the worse outcomes observed in this study.

HR and RR were significantly different between the alcohol and non-alcohol groups in our study. Alcohol's depressant effect on the central nervous system (42), which can cause a decrease in HR and RR, is one possible explanation for this observation. Consuming alcohol can impair the body's ability to regulate vital signs and other physiological processes, resulting in this decrease in HR and RR (43).

Alcohol-consuming trauma patients in this study had substantially higher lactate levels than those who had not consumed alcohol. This is consistent with previous studies that discovered a correlation between alcohol

consumption and elevated lactate levels in trauma patients (44, 45). Elevated lactate levels may indicate tissue hypoxia, a condition in which the body's tissues do not receive sufficient oxygen (46). This can be caused by a variety of factors, such as insufficient blood flow or impaired oxygen utilization (46–48). Tissue hypoxia can indicate significant injury or damage and contribute to the development of organ dysfunction and even death in the context of trauma (47).

The current study discovered that patients who consumed alcohol had significantly lengthier hospital stays and more days on a ventilator than those who did not. Similar associations between alcohol consumption and worse clinical results in trauma patients have been reported in previous studies (49,50), as supported by this finding. Alcohol consumption may impair the body's ability to heal and recover from traumatic injuries, resulting in a prolonged hospital stay and a greater need for mechanical ventilation (22, 35, 51, 52).

In our study, the alcohol group had a substantially higher hospital mortality rate than the non-alcohol group. This result is consistent with previous research that has demonstrated a correlation between trauma patient alcohol consumption and increased mortality (28, 29, 49, 50).

There is evidence that alcohol consumption increases the risk of severe injuries (35), such as traumatic brain injury and internal organ damage, which can result in complications and mortality. In addition, alcohol impairs cognitive and physical function, which can delay and exacerbate medical treatment (30, 32, 41, 42). However, some of the published articles showed that alcohol consumption did not increase in-hospital mortality, in disagreement with our findings (53).

Implications of these results in practice

The findings of this investigation have significant implications for clinical practice, particularly in Saudi Arabia. This study emphasizes the significance of identifying and treating alcohol use among trauma patients. Saudi Arabia is a conservative nation with stringent alcohol laws, but alcohol consumption is prevalent among certain segments of the population. The findings of the study indicate that alcohol consumption may exacerbate

the outcomes of trauma patients, and healthcare providers ought to monitor patients for alcohol consumption and offer appropriate interventions, such as counseling and referral to substance abuse treatment programs.

In addition, the findings of the study suggest that medical professionals should be aware of the possibility of respiratory depression and bradycardia in trauma patients who have ingested alcohol. These patients may necessitate more frequent monitoring, and providers should be prepared to act swiftly if necessary. In addition, the results of the study indicate that trauma patients who have consumed alcohol may need extended hospital stays and more intensive care, including mechanical ventilation. This has significant implications for the utilization of healthcare resources in Saudi Arabia, where healthcare costs are a major concern. Providers should consider the potential impact of alcohol use on patient outcomes when allocating resources and planning for discharge.

Strengths and limitations

Our investigation is one of the few in Saudi Arabia to investigate the relationship between alcohol consumption and the severity of trauma. Our findings are more generalizable because we used a large sample size and included both male and female patients. We collected exhaustive data on patients' demographics, severity of injury, and clinical outcomes, which allowed for a thorough analysis of the relationship between alcohol consumption and trauma outcomes. However, this study has some limitations. We were unable to account for certain confounding variables, such as the duration and frequency of alcohol consumption. Our research was conducted at a single center, which may limit the applicability of our findings to other trauma centers in Saudi Arabia or abroad. We were unable to evaluate the impact of alcohol consumption on long-term outcomes such as disability or life quality.

Recommendations for clinical practice and future research

For clinical practice, it is essential that healthcare providers assess trauma patients for alcohol consumption. Detection and intervention at an early stage can prevent further damage and enhance outcomes. In addition, medical professionals should educate patients and their families about the potential dangers of alcohol consumption and the increased risk of complications following trauma.

To confirm the link between alcohol consumption and poor outcomes in trauma patients, it would be advantageous to conduct larger studies with more diverse populations in future research. Exploring the potential impact of interventions such as alcohol cessation programs, targeted education, and brief interventions in reducing alcohol-related consequences in trauma patients would also be beneficial.

6. CONCLUSION

Our findings show that alcohol intake in trauma patients is linked to a higher risk of negative outcomes such as higher lactate levels, longer hospital stays, more

ventilator days, and higher mortality. These findings emphasize the significance of addressing alcohol intake in trauma patients as a normal clinical care component. Furthermore, our findings highlight the importance of future research into the mechanisms underlying the link between alcohol consumption and adverse outcomes in trauma patients, as well as the potential efficacy of interventions aimed at reducing alcohol consumption in this population. Finally, addressing alcohol intake in trauma patients has the potential to improve outcomes and lower healthcare costs.

- **Consent for publication:** Not applicable.
- **Availability of data and materials:** The datasets used and/or analyzed during the current study are available as MS Excel files (.xlsx) from the corresponding author upon reasonable request.
- **Author's contribution:** The author was involved in all steps of preparation for this article including final proofreading.
- **Competing interests:** All authors have no conflict of interest.
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