RESEARCH PAPER

Prevalence of Alcohol Intoxication in Trauma Patients Presenting to the Emergency Department: A Pilot Study

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ABSTRACT

Background: One of the leading causes of death and disability, especially among young adults, is trauma, which is a major global health concern. Road accidents, falls, violence, and industrial injuries are the main sources of trauma-associated morbidity and mortality. In addition to being a major contributing factor to traffic accidents, alcohol has also been implicated in assault cases, falls, domestic abuse, and industrial mishaps. For appropriate treatment, investigations, and legal evidence in trauma situations, early detection of alcohol intoxication is crucial. This study was necessary to determine the prevalence of alcohol intoxication among trauma patients who visited the emergency room and to look into the connection between blood alcohol content, trauma severity, and death.

Materials and Methods: The study was conducted in the Department of Emergency Medicine at a tertiary care centre in Puducherry after clearance from the Scientific Research and Institutional Human Ethics Committees. Trauma patients reporting to the Emergency Department and meeting inclusion criteria were enrolled using convenience sampling, with a sample size of 60 based on previous records. Data were collected using a validated semi-structured proforma covering demographics (age, gender, residence, occupation, education, marital and socio-economic status), mechanism and time of injury, mode of hospital conveyance, and medical history. Clinical evaluation included assessment of alcohol intoxication via breathalyzer or, when not feasible, hospital-based BAC estimation, categorizing patients as alcohol positive or negative. Additional data on GCS, vital signs, injury type, Injury Severity Score, hospital stay, and outcomes were collected. Excel 2019 and SPSS v23.0 were used to analyze the data; quantitative variables were expressed as mean ± SD or median (IQR), qualitative variables as frequency/percentage, associations were tested using Chi-square/Fisher's exact test, and group comparisons were done using independent t-test/Mann-Whitney U test, with significance at $p<0.05$. The results were displayed in tables and bar/pie charts.

Results: The majority of the 67 trauma patients were male (95.6%) and young adults (19–29 years old, 55.2%). They were all BAC >0.1 g/L: 13.5% high, 28.4% moderate, and 58.2% low. The neurological state revealed GCS impairment of 82.2% mild, 14.9% moderate, and 2.9% severe. 46.4% of injuries were light, 35.8% were moderate, 11.9% were serious, and 5.9% were severe. Outcomes were 76.1% healed/discharged and 23.9% referred; hospital stays were ≤3 days in 74.6% and >3 days in 25.4%. Lower limb fractures accounted for 38.8% of all injuries, followed by upper limb fractures and soft tissue injuries (23.9% each), head injuries (14.9%), facial fractures (13.4%), vertebral fractures (6%), and rib fractures (3%). X-ray and eFAST were most frequently coupled in investigations (43.3%).

Higher BAC was substantially linked to deteriorating GCS, higher ISS, and longer hospital stays, according to statistical analysis ($p=0.001$). According to logistic regression, worsening GCS was a significant predictor (AOR=1.915, $p=0.025$), ISS exhibited a non-significant trend (AOR=1.321, $p=0.063$), and BAC was not independently predictive of bad outcome (AOR=0.509, $p=0.562$). Spearman's correlation revealed that BAC had a negative association with GCS ($\rho=-0.485$, $p<0.001$) and a positive correlation with ISS ($\rho=0.896$, $p<0.001$) and hospital stay ($\rho=0.360$, $p=0.003$). Hospital stays were favorably connected with ISS ($\rho=0.440$, $p<0.001$) and negatively correlated with GCS ($\rho=-0.576$, $p<0.001$), but there was no significant correlation between GCS and hospital stays.

Conclusion: Higher blood alcohol concentration (BAC) was found to be substantially linked to more serious injuries, worse neurological status, and longer hospital stays. Alcohol's effect on trauma severity was highlighted by the strong connections found: BAC was negatively correlated with the Glasgow Coma Scale (GCS) and positively correlated with the injury severity score (ISS) and hospital stay. However, once injury severity variables were taken into account, BAC was no longer an independent predictor of poor outcome. Worsening GCS, on the other hand, was found to be a substantial independent predictor of a bad prognosis, highlighting the vital need of neurologic examination in trauma patients.

Keywords: Trauma, alcohol intoxication, road accidents, blood alcohol concentration

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INTRODUCTION

Trauma is a significant global health concern that has been identified as one of the main causes of death and disability, particularly among young adults. According to the World Health Organization (WHO), injuries cause around 4.4 million fatalities annually, or nearly 8% of all deaths worldwide. The primary causes of trauma-associated morbidity and mortality include road accidents, falls, violence, and workplace injuries.[1]

The intake of alcohol is known to be a significant modifiable risk factor associated with traumatic injuries. In the case of alcohol intoxication, individuals become poor judges of situations and their decisions are affected due to reduced reaction times. This results in an increased risk of getting involved in road traffic injuries, assault injuries, and other kinds of injuries. Alcohol-related harm contributes to 2.8 million deaths per year and 5.3% of the world's total deaths.[2] There has been a marked rise in alcohol intake in the last two decades in India due to various reasons such as urbanization, lifestyle changes, and socio-economic changes. Alcohol-impaired driving is an important factor leading to road traffic accidents; alcohol has also played an important part in falling accidents, assault cases, domestic violence, and accidents at the workplace. Early detection of alcohol intoxication in trauma cases is important for proper treatment and investigations and legal evidence.[3]

Trauma centers provide an appropriate setting for assessing alcohol injuries since they serve as the site of care for trauma sufferers. Quick detection of alcohol consumption is made easier by objective procedures such as blood alcohol content estimation and breath alcohol testing. Determining the burden of alcohol-related injuries and creating injury prevention plans will be made easier with the estimation of the prevalence of alcohol intoxication among trauma patients.[4]

Studies in the past have stated that around 20 to 50 percent of trauma cases who come to emergency have alcohol in their blood and the severity of injury is much higher in alcohol-positive trauma cases when compared to non-alcoholic cases. However, there are insufficient studies for alcohol intoxication in trauma cases in Indian tertiary hospitals.[5] Thus, it became imperative to conduct this study in order to ascertain the prevalence of alcohol intoxication among trauma patients visiting the Emergency Department and investigate the relationship between blood alcohol concentration, severity of trauma, and mortality.

MATERIALS AND METHODS

After receiving clearance from the Scientific Research Committee and Institutional Human Ethics Committee, the research study was carried out in the Department of Emergency Medicine in a tertiary care centre at Puducherry. Patients suffering from trauma, reporting to the Emergency Department and fulfilling the inclusion criteria, will be enrolled for the study through the convenience sampling method. The sample size of the study will be 60 patients (based on previous records).

Data related to the study will be gathered with the help of a validated and pre-tested semi-structured proforma. The proforma will have two sections. In the first section, demographic details like age, gender, place of stay, occupation, education, marital status and socio-economic status of the participants will be included. Information about the mechanism of injury (road traffic accident, fall, assault, occupational injury or other reasons), time of injury, mode of conveyance to the hospital and medical history will also be obtained.

The second phase would consist of clinical evaluation and identification of alcohol intoxication. Alcohol intoxication would be determined by breath alcohol testing (breathalyzer) on the spot when patients arrive at the Emergency Department or as soon as possible thereafter. For those patients where alcohol breath testing is not possible for clinical reasons, BAC would be estimated as per hospital protocols. Patients will be considered either alcohol positive or alcohol negative according to their alcohol status. Information about clinical findings, GCS, vital signs, nature of injury, Injury Severity Score, hospital stay duration and outcome will be recorded.

The collected data will be imported into Microsoft Excel 2019 and subjected to statistical analysis through SPSS software version 23.0. Quantitative parameters will be represented as mean ± SD or median (IQR), whereas qualitative parameters will be represented as frequency and percentage. Association between categorical parameters will be tested through Chi-square test/Fisher's exact test, whereas independent samples t-test/Mann-Whitney U test will be applied to compare quantitative parameters between two groups. Statistical significance will be assumed at p value <0.05. The findings will be presented by means of tabulation and bar diagram/pie chart representation.

RESULTS

Distribution of patients by age groups is presented in Figure 1 (N = 67). Most patients were found in the 19-29 years age group (37; 55.22%), while the second highest group comprised those in the age group 30-39 years (17; 25.37%). Patients belonging to the age group 40-49 years were five (7.46%), while those belonging to ≥60 years age group were seven (10.46%). There was only one patient (1.49%) in 50-59 years age group.

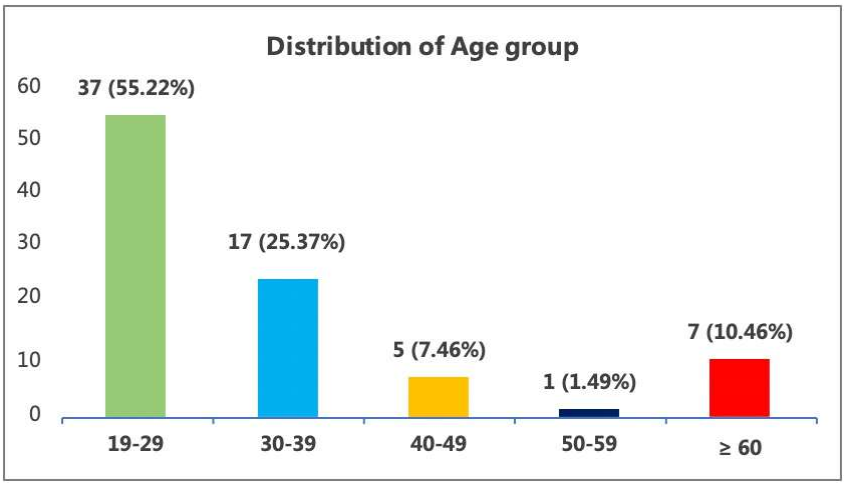

Figure 1: Frequency Distribution of Age group among the Patients (N = 67)

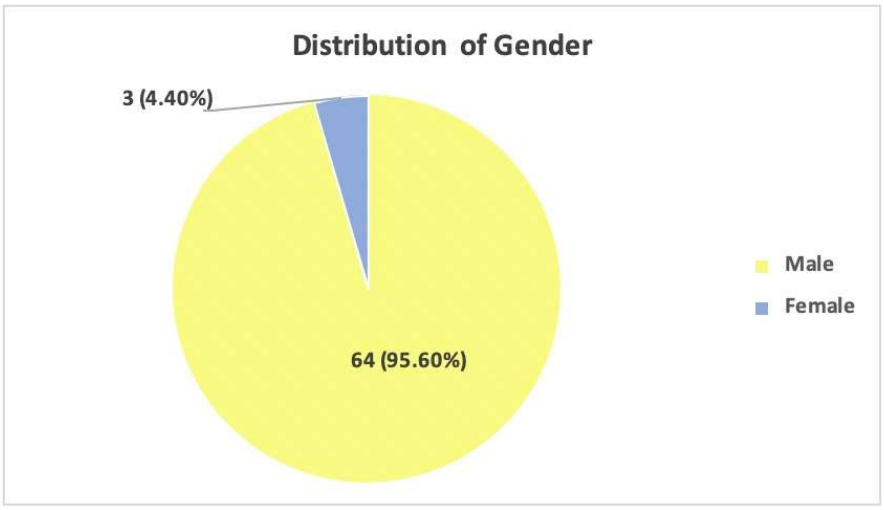

Figure 2: Frequency Distribution of Gender among the Patients (N = 67)

Figure 2 presents the gender distribution of the Patients (N=67). Most of them were males (64; 95.60%) while only 3 (4.40%) of them were females. This clearly shows that there was an overwhelming majority of males among trauma patients.

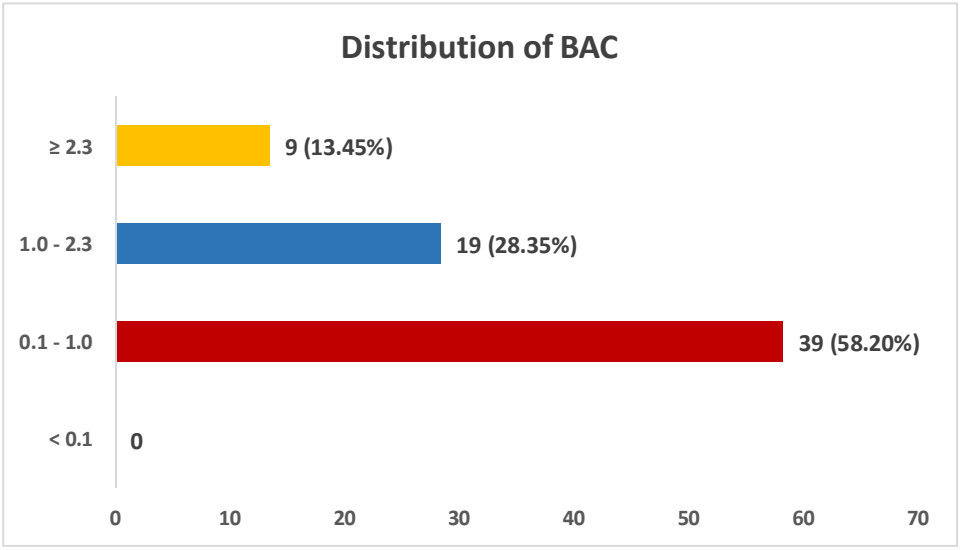

Figure 3: Distribution of Blood Alcohol Concentration (BAC) Categories among Study Patients

Blood Alcohol Concentration (BAC) of the 67 subjects is presented in Figure 3. All subjects had a BAC concentration of more than 0.1 g/L (normal). The largest number of patients (39; 58.20%) had low BAC concentrations (0.1 to 1.0 g/L). Moderate BAC concentrations (1.0 to 2.3 g/L) were found in 19 subjects (28.35%), whereas high BAC concentrations (≥2.3 g/L) were seen in 9 subjects (13.45%).

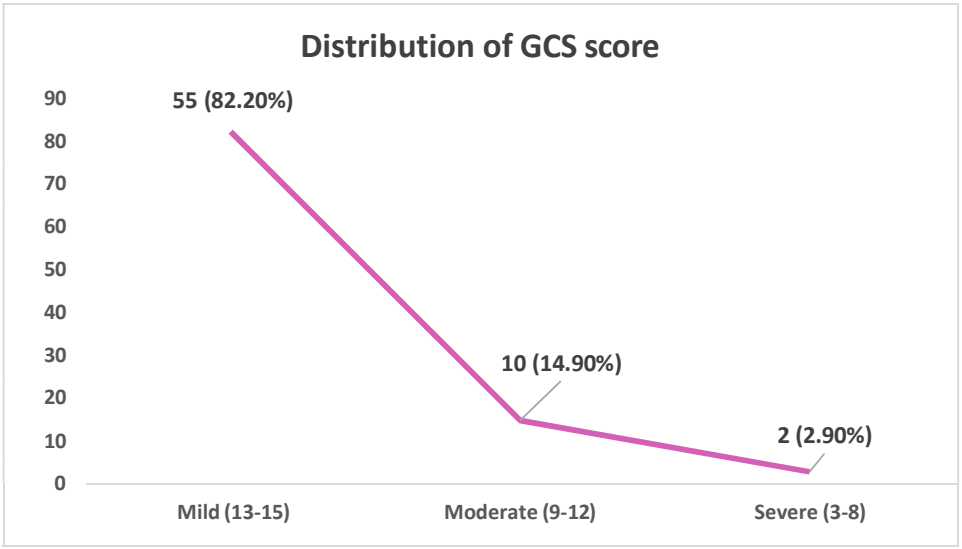

Figure 4: Frequency Distribution of GCS Scores in the Patients (N = 67)

In Figure 4, it can be seen that the distribution of Glasgow Coma Scale (GCS) scores in the 67 patients. The most common GCS score in the patients is mild impairment, which was found in 55 patients (82.20%). The moderate and severe impairment cases were found to be 14.90% and 2.90%, respectivel

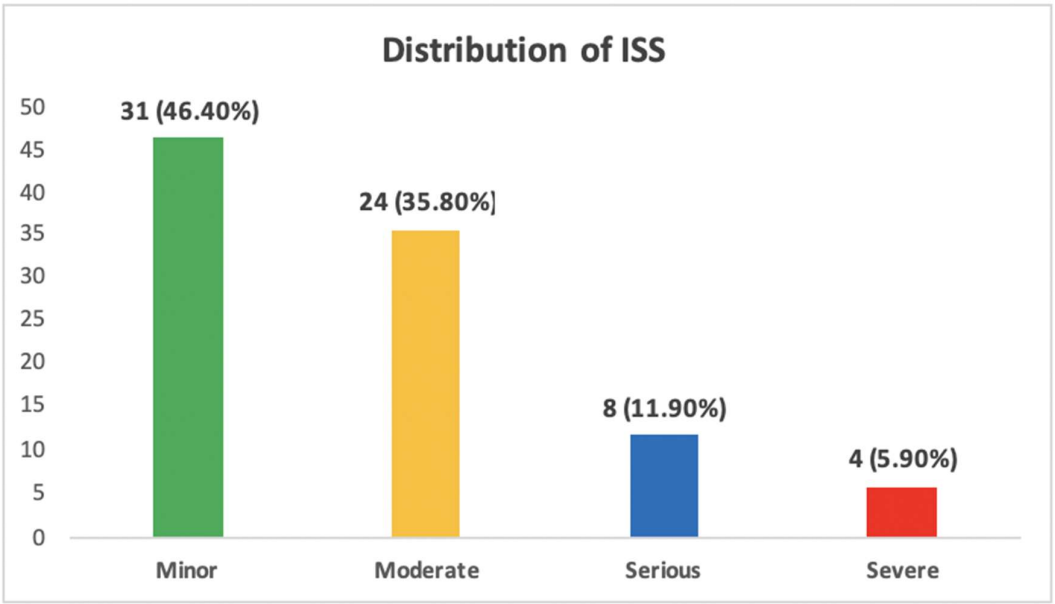

Figure 5: Frequency Distribution of Injury Severity Score (ISS) Categories among the Study Patients (N = 67)

Figure 5 represents the classification of ISS categories within the 67 patients. About half of the patients (31; 46.40%) had minor injuries, which is the highest ISS category among the subjects. Twenty-four patients (35.80%) had moderate injuries, whereas 8 patients (11.90%) had serious injuries. Severe injuries were the least prevalent with only 4 patients (5.90%) having severe injuries.

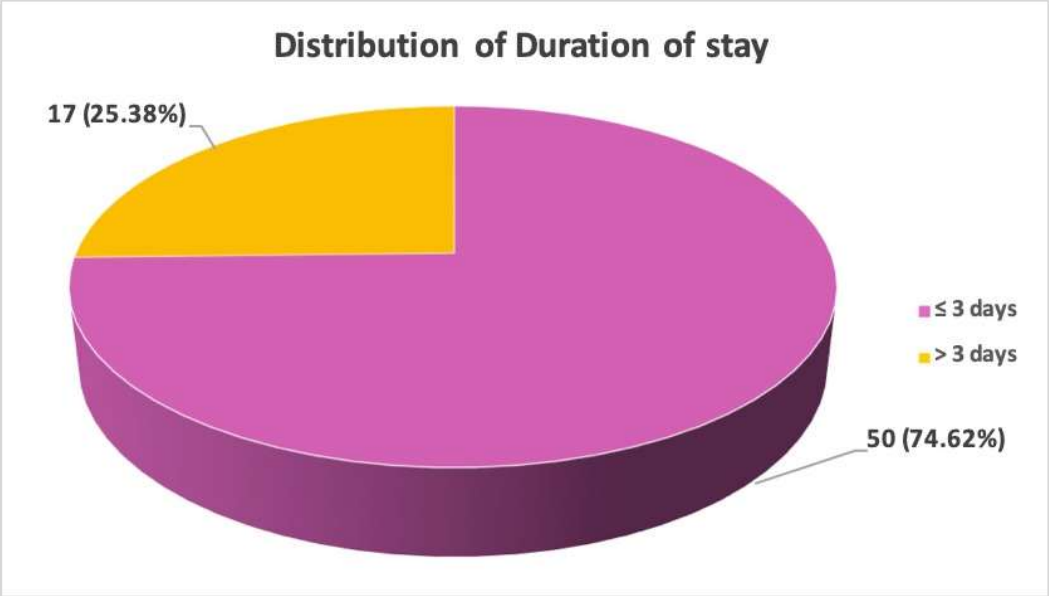

Figure 6: **Frequency Distribution of duration of stay in hospital among the Patients (N = 67)**

The distribution of the duration of hospital stay is presented in Figure 6; 74.62% of the patients (50) had hospitalization that was ≤3 days, while 25.38% of the patients (17) had hospitalization for more than 3 days.

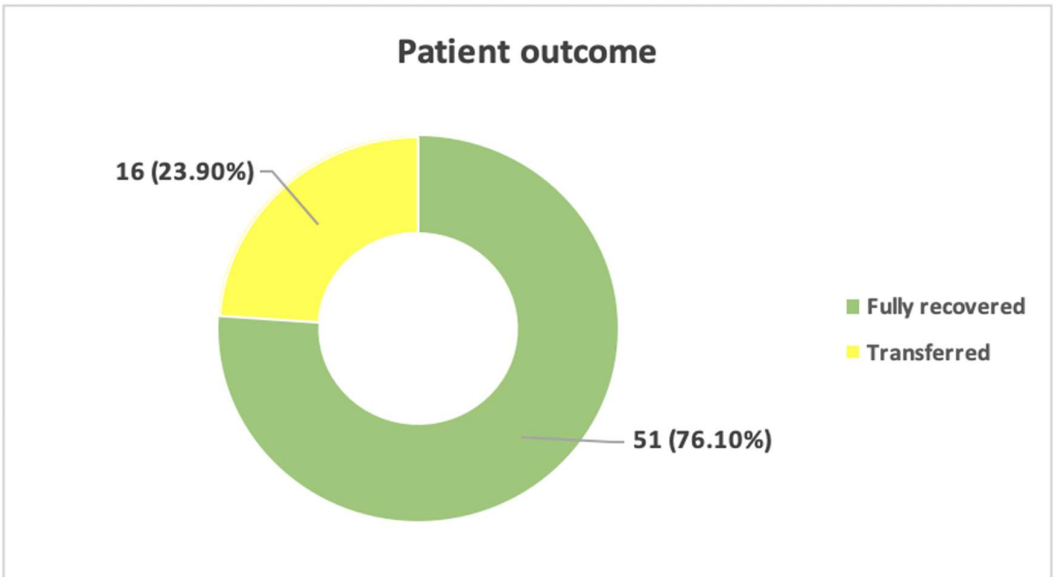

Figure 7: Frequency Distribution of Patient Outcome Post Hospitalisation (N=67)

Figure 7 presents the frequency distribution of the patients' outcomes at hospital discharge, considering the 67 patients involved in the study. It is evident that most of the patients (51;76.10%) were completely healed and discharged from the hospital. On the other hand, 16 patients (23.90%) were referred to other healthcare facilities.

Table 1: Distribution of Injury Pattern among Study Patients (N = 67)

Type of Injury	Frequency (n)	Percentage (%)
Lower limb fractures	26	38.80
Upper limb fractures	16	23.90
Head injury (SDH/SAH/Contusion/Cerebral edema)	10	14.90
Facial bone fractures	9	13.40
Vertebral fractures	4	6.00
Rib fractures	2	3.00
Soft tissue injuries (without fracture)	16	23.90

*Since many patients sustained multiple injuries, the total frequency exceeds the total number of study participants

The distribution of injury patterns for all the 67 patients involved in this study is listed in table 1 below. The most common type of injury was that involving lower limb fractures with a total of 26 patients (38.8%) suffering from this kind of injury. Other injuries included upper limb fractures and soft tissue injuries without fractures, which each had 16 cases (23.9%). Injuries to the head involving subdural hematoma (SDH), subarachnoid hemorrhage (SAH), cerebral contusion, and cerebral edema occurred in 10 cases (14.9%). Nine patients (13.4%) had facial bone fractures, whereas four patients (6.0%) and two patients (3.0%) had vertebral and rib fractures, respectively.

Table 2. Distribution of Imaging modalities among Study Patients (N = 67)

Investigation	Frequency (n)	Percentage (%)
X-ray only	18	26.90
X-ray + eFAST	29	43.30
X-ray + eFAST + CT Brain	18	26.90
X-ray + CT Brain	2	3.00

Table 2 represents the frequency of investigations done on the study participants (n = 67). The combination of investigations that was performed most often was X-ray and eFAST; this was done for 29 participants (43.30%). Other combinations performed equally included X-ray alone and X-ray in combination with eFAST and CT Brain, each being done for 18 participants (26.90%). X-ray and CT Brain was the least performed investigation; this was done for 2 patients (3.00%).

Table 3. Association between Blood Alcohol Concentration (BAC), Glasgow Coma Scale (GCS), Injury Severity Score (ISS) and Hospital Stay among Trauma Patients (N = 67)

VARIABLES	VARIABLES	BAC	BAC	BAC	P – Value (Chi square)
VARIABLES	VARIABLES	Low	Moderate	High	P – Value (Chi square)
GCS	Mild	36 (65.50%)	15 (27.30%)	4 (7.30%)	0.001 (18.850)*
GCS	Moderate	3 (30.00%)	4 (40.00%)	3 (30.00%)	0.001 (18.850)*
GCS	Severe	0 (0.0%)	0 (0.0%)	2 (100.00%)	0.001 (18.850)*
ISS	Minor	31 (100.00%)	0 (0.0%)	0 (0.0%)	0.001 (85.460)*
ISS	Moderate	8 (33.30%)	16 (66.70%)	0 (0.0%)	0.001 (85.460)*
ISS	Serious	0 (0.0%)	3 (37.50%)	5 (62.50%)	0.001 (85.460)*
ISS	Severe	0 (0.0%)	0 (0.0%)	4 (100.00%)	0.001 (85.460)*
STAY	≤3 days	36 (72.00%)	8 (16.00%)	6 (12.00%)	0.001 (17.353)*
STAY	> 3 days	3 (17.60%)	11 (64.80%)	3 (17.60%)	0.001 (17.353)*

*Fischers exact test done

Table 3 shows a significant association between BAC levels and GCS, ISS, and hospital stay duration among trauma patients. Higher BAC levels were associated with worsening GCS severity, with all severe GCS cases having high BAC levels (p = 0.001). A significant relationship was observed between BAC and ISS, where patients with severe injuries predominantly had high BAC levels (p = 0.001). Patients with low BAC levels had shorter hospital stays (≤3 days), whereas moderate BAC levels were more common among those with prolonged stays (>3 days) (p = 0.001). Overall, increased BAC concentration was associated with greater injury severity and longer hospitalization.

Table 4. Multivariable Logistic Regression Analysis for Predictors of Poor Outcome

Variables	B	Adjusted Odds Ratio (AOR)	95%Confidence Interval	P value
Blood Alcohol Concentration (BAC)	-0.675	0.509	0.052 – 4.978	0.562
Injury severity Score (ISS)	0.278	1.321	0.985 – 1.771	0.063
Glasgow Coma Scale (GCS)	0.650	1.915	1.085 – 3.380	0.025

Multivariable logistic regression analysis was performed to identify independent Predictors of poor clinical outcome among trauma patients. After adjusting for Injury Severity Score (ISS) and Glasgow Coma Scale (GCS), blood alcohol concentration (BAC) was not significantly associated with poor clinical outcome (AOR = 0.509; 95% CI: 0.052–4.978; p = 0.562). Although increasing ISS was associated with a 32.1% increase in the odds of poor outcome (AOR = 1.321; 95% CI: 0.985–1.771), this association did not reach statistical significance (p = 0.063). In contrast, worsening Glasgow Coma Scale category was found to be an independent predictor of poor clinical outcome. Patients with increasing GCS severity category had approximately 1.9 times higher odds of poor outcome compared with those in lower severity categories (AOR = 1.915; 95% CI: 1.085–3.380; p = 0.025).

Table 5. Spearman Correlation between BAC, ISS, GCS and Hospital Stay

Variables	r value	p value
BAC vs ISS	0.896	<0.001
BAC vs GCS	−0.485	<0.001
BAC vs Hospital stay	0.360	0.003
ISS vs GCS	−0.576	<0.001
ISS vs Hospital stay	0.440	<0.001
GCS vs Hospital stay	−0.033	0.794

Spearman's correlation analysis demonstrated a positive correlation between BAC and ISS ($\rho = 0.896$, $p < 0.001$), indicating that increasing blood alcohol concentration was associated with greater injury severity. BAC also showed a negative correlation with GCS ($\rho = -0.485$, $p < 0.001$), suggesting that higher BAC was associated with poorer neurological status. In addition, BAC demonstrated a positive correlation with hospital stay ($\rho = 0.360$, $p = 0.003$). ISS was positively correlated with hospital stay ($\rho = 0.440$, $p < 0.001$) and negatively correlated with GCS ($\rho = -0.576$, $p < 0.001$). No significant correlation was observed between GCS and hospital stay ($\rho = -0.033$, $p = 0.794$).

DISCUSSION

Trauma remains a major public health concern worldwide, contributing significantly to mortality, disability and socioeconomic burden. Alcohol consumption is an important preventable risk factor associated with road traffic injuries and trauma due to impairment of judgement, coordination, reaction time and behavioural control. The present study evaluated the association between blood alcohol concentration (BAC), Glasgow Coma Scale (GCS), Injury Severity Score (ISS), duration of hospital-stay and clinical outcome among 67 trauma patients admitted to a tertiary care hospital.

In the present study, the majority of trauma patients belonged to the 19–29 years age group (55.2%), followed by 30–39 years (25.4%). This indicates that young adults represented the most affected population. Trauma among young adults is a consistent finding worldwide and reflects increased exposure to road traffic, occupational hazards, recreational activities and risk-taking behaviours. Similar findings were reported by Agrawal et al., who observed that trauma predominantly affects younger age groups in India, leading to considerable loss of productive years of life. Young males are particularly vulnerable due to greater mobility, vehicle usage and higher prevalence of alcohol consumption.[6] The present study demonstrated marked male predominance, with 95.6% of patients being males. Similar male predominance has been reported in several trauma epidemiological studies. Males are more frequently exposed to high-risk activities, including driving, outdoor occupation and alcohol-related behaviours, contributing to increased trauma occurrence.[7]

However, studies from developed countries have reported a relatively increasing proportion of female trauma victims due to changing social roles and increased participation in outdoor activities.[8] The difference may be attributed to cultural factors, occupational patterns and differences in exposure. In the present study, all trauma patients had detectable alcohol levels, with the majority having low BAC levels (0.1–1.0 g/L) (58.2%), followed by moderate BAC (28.4%) and high BAC (13.4%). This finding highlights the important contribution of alcohol use among trauma patients.

Alcohol increases trauma risk by impairing cognitive function, reducing reaction time, altering judgement and increasing risk-taking behaviour. Alcohol-related impairment may also increase the likelihood of high-energy trauma mechanisms, resulting in more severe injuries. Afshar et al. evaluated alcohol exposure among trauma patients and reported that alcohol-positive patients had significantly increased severity of injury, lower admission GCS scores and worse clinical outcomes compared with alcohol-negative patients.[9] Similarly, Cherpitel demonstrated a strong association between alcohol consumption and emergency department trauma presentations, supporting alcohol as an important modifiable risk factor for injury prevention.[4]

BAC levels and trauma outcomes, however, have been found to be inconsistently associated in some studies. According to some researchers, alcohol may affect the occurrence of trauma but may not be a significant factor in determining death once damage severity and physiological factors have been taken into account.[10] This could help to explain the results of the current investigation, which showed that BAC was not an independent predictor of bad outcome but was highly correlated with severity characteristics. BAC and GCS severity categories were shown to be significantly correlated in this study (p=0.001). All severe GCS instances had high BAC levels, and patients with higher BAC levels had worse neurological condition. BAC and GCS had a strong negative connection ($\rho = -0.485$, $p<0.001$), according to Spearman correlation analysis. Alcohol is a central nervous system depressant that modifies inhibitory neurotransmission to alter awareness. Therefore, high BAC levels may contribute to impaired consciousness and reduced GCS scores.

Similar findings were reported by Afshar et al., where alcohol-positive trauma patients had increased frequency of depressed GCS scores compared with alcohol-negative patients.[9] The Glasgow Coma Scale, developed by Teasdale and Jennett, remains one of the most widely used clinical tools for assessing consciousness and predicting neurological outcomes in trauma patients.[11] However, interpretation of GCS in intoxicated patients requires caution because alcohol-induced altered consciousness may mimic neurological injury. Some studies have suggested that intoxication may result in falsely low initial GCS scores, which improve after alcohol metabolism.[12] Despite this limitation, the current study found that GCS remained a significant predictor of outcome even after adjusting for BAC and ISS..

The current study revealed that lower limb fractures constituted the most common type of injuries (38.8%), followed by upper limb fractures and soft tissue injuries. Head injuries made up 14.9% of the injuries. The high prevalence of limb injuries is in keeping with the kind of injuries seen in road traffic accidents due to the fact that they tend to cause injuries to the limbs due to direct impact or falling. According to the World Health Organization, injuries caused by road traffic accidents include injuries to the extremities, head and spine.[13]

In the multivariable logistic regression model, the BAC was not an independent predictor of poor outcome (AOR=0.509; p=0.562). Despite its statistically significant association with GCS, ISS, and hospitalization period, the association was lost in the presence of indicators of severity. This implies that alcohol influences indirectly through injury severity and does not influence the prognosis directly. The ISS exhibited higher odds ratio for poor outcome (AOR=1.321); however, the results did not reach statistical significance (p=0.063). This may be due to the limited sample size and a smaller number of cases of severe trauma. On the other hand, the GCS turned out to be the only independent predictor of poor outcome (AOR=1.915; 95% CI:1.085–3.380; p=0.025). The results are consistent with

previous literature findings confirming that admission GCS is a good predictor of mortality and neurologic prognosis after trauma.[11,14]

The present study demonstrates that alcohol exposure is strongly associated with increased trauma severity. Higher BAC levels were associated with poorer neurological status, increased injury severity and prolonged hospital stay. However, after adjustment for severity parameters, BAC was not an independent predictor of poor outcome. Instead, GCS emerged as the strongest predictor, emphasizing the importance of early neurological assessment in trauma care. Therefore, prevention strategies targeting alcohol-related risky behaviour, strict enforcement of road safety measures and early trauma assessment using validated scoring systems may help reduce morbidity among trauma patients.

LIMITATIONS OF THE STUDY

The current research was carried out in one tertiary care hospital using only a few numbers of trauma patients (67), which can be a limiting factor for the results of the study, making them hard to generalize to other medical facilities and larger patient samples. Multicenter research including different trauma patient samples would give better information in this case. In this study, only those patients who came to the hospital and were evaluated by doctors were selected, and thus, there is the presence of selection bias, since those patients who died prior to coming to the hospital or were treated in peripheral health centers were not included. In addition, the moment when BAC was determined is important, since the passage of time between alcohol consumption and trauma affects the BAC level.

RECOMMENDATION

BAC measurement, together with the use of tools like GCS and ISS in the assessment of trauma patients, can be adopted to allow for risk stratification in the early stages of the diagnosis process. Efforts should be made in the area of public health to ensure that there is prevention of injuries resulting from alcohol use as well as measures for road safety. Early detection of high-risk trauma patients will help in the prompt management of the patients. Further research using multicentric studies involving larger samples and follow-up periods is suggested to determine the importance of BAC in predicting prognosis.

CONCLUSION

In the present study, it was found that higher BAC was significantly related to more severe injuries, worse neurological condition and longer hospitalization period in trauma patients. There was found to be a strong positive correlation between BAC and ISS and a negative correlation between BAC and GCS, demonstrating the effect of alcohol on the severity of trauma. But BAC was not found to be an independent predictor of poor outcome after controlling for injury severity variables. GCS was a significant predictor of poor outcome, which stressed the importance of neurologic evaluation.

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