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Evaluation of the Effects of Concomitant Alcohol Positivity on the Characteristics and Severity of Injury in Geriatric Trauma Patients in the Emergency Department

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Abstract

Aim: This study aimed to evaluate whether concomitant alcohol positivity is an effective factor in trauma characteristics and severity in geriatric trauma patients and evaluate the relationship with poor composite outcomes in alcoholic patients.

Materials and Methods: Patients aged 60 and over who presented to the emergency department due to trauma and whose blood ethanol level was studied were included in the study. Patients were assigned to the poor composite outcome group according to the intensive care unit stay, need for emergency blood transfusion/operation, or in-hospital mortality, and the groups with and without poor composite outcomes were compared.

Results: Three hundred thirty-six patients with complete data were included in the study. There were 101 patients with an ethanol level of >0.5 mg/dL. Ethanol-positive patients had more head trauma, and their Injury Severity Scores and liver function tests were higher ($p<0.05$ for all values). 11.3% (n=11.3) of all patients and 15.8% (n=16) of ethanol-positive patients developed poor composite outcomes. When ethanol-positive patients were compared according to the poor composite outcome, it was observed that patients had more diabetes, more trauma to the head, abdomen, and extremities, higher creatine levels, and lower albumin and blood ethanol levels ($p<0.05$ for all values).

Conclusion: In this study, we showed that the majority of alcoholic geriatric trauma patients were male and single, that they had more frequent head trauma compared to the non-alcoholic group, that the presence of alcohol was associated with increased severity of injuries regardless of the ethanol level, but was not effective in terms of poor composite outcomes.

Keywords: Ethanol, alcohol, geriatric, trauma, poor outcome

Introduction

As life expectancy increases, the elderly population naturally expands, and the frequency of exposure to serious injury in the geriatric group also increases. Geriatric patients have high trauma-related morbidity and mortality rates due to comorbid diseases, age, and injury severity (1). Geriatric patients are more injured than young patients in similar accidents. Increased comorbidities and decreased physiological reserve due to changes in the physiological response to trauma in old age are the main causes of increased geriatric mortality (2). Geriatric trauma patients constitute an important and difficult case group for health professionals because of increased hospital admissions and high mortality (2,3). However, studies on the diagnosis and treatment process in trauma patients have generally focused on the young population, and there is not enough research on injury mechanisms, scoring systems, resuscitative variables, advanced treatment management, and many other issues in geriatric trauma patients.

Physiological changes that occur with advanced age (such as decreased liver function and decreased total body water) increase the susceptibility of elderly adults to side effects caused by substances such as drugs and alcohol (4,5). The relationship between ethanol consumption and trauma has been previously reported (5-8). Alcohol consumption may contribute to the risk of trauma because it can lead to gait and balance disorders and

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cognitive changes (5,6). In the literature, alcohol use has been shown to increase in the geriatric population. In a meta-analysis, it was reported that the average annual percentage increase in the prevalence of alcohol use and binge drinking (4 or more drinks for women and 5 or more drinks for men) was approximately 1% and 3.4%, respectively (2). With the improvement in health services and advances in the management of chronic diseases, elderly people who had to completely withdraw from social life at an earlier age participate more in active life today (7). This makes the geriatric population vulnerable to injury. Although there are relevant studies in the literature, our data on alcohol-related injuries in patients with geriatric trauma are insufficient.

This study aimed to evaluate whether concomitant alcohol positivity is an effective factor in trauma characteristics and trauma severity in geriatric trauma patients in the emergency department and to evaluate the relationship with poor composite outcomes in alcoholic patients.

Materials and Methods

The study design was retrospective. The current study was conducted in a tertiary care emergency department that receives approximately 250,000 patient admissions annually. Local ethics committee approval was obtained prior to the study. It received ethical approval from the University of Health Sciences Turkey, Ankara Atatürk Sanatorium Training and Research Hospital Clinical Research Ethics Committee (decision no: 2012-KAEK-15/789, date: 12.09.2023). Patients aged 60 years and older who presented to the emergency department due to trauma between 01.01.2018 and 31.12.2022 and whose blood ethanol level was studied were included in the study. Patients with missing data were excluded. In our emergency department, a blood ethanol test is requested for patients admitted due to traffic accidents and assault and violence-related conditions, those with physical examination findings incompatible with injury mechanisms, and those admitted with forensic conditions and whose change in consciousness cannot be explained by physical examination and laboratory findings. In this study, ethanol levels >0.5 mg/dL were considered ethanol-positive. Ethanol-positive and ethanol-negative patients were divided into two groups and compared.

Information on patients' demographic characteristics (age, sex, marital status, etc.), comorbid diseases (hypertension, cardiac disease, diabetes mellitus, chronic obstructive pulmonary disease and others), mechanisms of injury (fall from height and mechanical falls, motor vehicle collisions, pedestrian accidents, assault and penetrating trauma), injury sites (head/face, extremities/vertebra, thorax, abdomen/internal injury, hip/pelvis and superficial wound injury), ethanol level, laboratory [hemoglobin, platelet, aspartate aminotransferase (AST), alanine aminotransferase (ALT), international normalized ratio, albumin, creatine], blood transfusion and/or operation, and outcomes (discharge/hospitalization status and length of hospital stay, in-hospital mortality) was obtained from patient files by retrospective review. The occurrence was dated as weekdays from Monday to Friday and weekends on Saturday or Sunday.

Glasgow Coma Scale and Injury Severity Score (ISS) were calculated for all patients. In ISS scoring to determine prognosis in patients with multiple trauma, injuries are first calculated at the anatomical region according to the Abbreviated Injury Scale table and then submitted to the ISS system. The lowest score is 0, which indicates the best prognosis, and the highest score is 75, which indicates the most harm and the poorest prognosis (9). ISS scores were calculated retrospectively using tomography images and emergency department records, and radiologic imaging of the patients. Patients with an ISS score of 1-8 were considered mild trauma, and those with an ISS score of 9 and above were considered to have moderate to severe trauma. Patients were assigned to the poor composite outcome group according to intensive care unit stay, emergency blood transfusion/operation, or in-hospital mortality, and groups with and without poor composite outcomes were compared.

Statistical Analysis

The analysis of the study data was performed using the IBM SPSS 20.0 (Chicago, IL, USA) statistical software. The Kolmogorov-Smirnov test was used to investigate whether the distribution of discrete and continuous numerical data was in accordance with a normal distribution. Continuous numerical variables are presented as median (IQR 25-75), and categorical variables are presented as number of cases and (%). Categorical variables were evaluated using the chi-square and Fisher's exact tests, and continuous variables were evaluated using the Mann-Whitney U test. Results for $p<0.05$ were considered statistically significant.

Results

Within the study period, 351 geriatric trauma patients with ethanol levels were identified. A total of 336 patients with complete data were included in the study. A total of 101 patients had an ethanol level of >0.5 mg/dL. Of the patients, 9.8% were female, and the most common reason for admission was assault. The demographic data of all patients are presented in Table 1.

According to the comparison of ethanol-positive and ethanol-negative patients, most alcoholic patients were male and single. Ethanol-positive patients had more head trauma, and their ISS, AST, and ALT scores were higher ($p=0.021$, $p<0.001$, $p<0.001$, $p=0.001$, respectively) (Table 2). However, there was no statistically significant correlation between the ISS score and

ethanol level in the ethanol-positive group (p=0.560). When the data of 5 patients with liver injury were not included in the statistical analysis, AST and ALT levels were higher in the ethanol-positive group (p<0.001, p=0.003, respectively).

11.3% (n=38) of all patients and 15.8% (n=16) of ethanol-positive patients developed poor composite outcomes. Patients with poor composite outcomes had more cardiac disease, more frequent non-thoracic system injuries, and higher AST, ALT, and creatine values (p=0.021, p<0.001, p=0.007, p=0.039, p=0.005, respectively) (Table 3).

Table 1. Demographic data of all patients (n=336)

Sex, n (%)	
Female	33 (9.8%)
Age, median (IQR 25-75)	64 (62-68)
Marital status, n (%)	
Married	256 (76.2%)
Single	80 (23.8%)
Day, n (%)	
Mid-week	234 (69.6%)
Weekend	102 (30.4%)
Comorbidity, n (%)	
Hypertension	189 (56.3%)
Cardiac diseases	48 (14.3%)
Diabetes mellitus	39 (11.6%)
COPD	35 (10.4%)
Other	24 (7.1%)
Mechanism of injury (n (%)	
Assault	127 (37.8%)
Motor vehicle collisions	96 (28.6%)
Fall	91 (27.1%)
Pedestrian	22 (6.5%)
Penetrating	0 (0%)
GCS, median (IQR 25-75)	15 (14-15)
Ethanol level, median (IQR 25-75)	237 (156-293) 227±93.4
ISS, median (IQR 25-75)	2 (1-4)
ISS group, n (%)	
Mild	301 (89.6%)
Moderate-severe	38 (11.3%)
Injury area, n (%)	
Superficial wound injury	221 (65.8%)
Extremity/vertebra	50 (14.9%)
Thorax	27 (8%)
Head/face	26 (7.7%)
Abdomen	9 (2.7%)
Pelvis/hip	8 (2.4%)
Patient outcome, n (%)	
Discharge	293 (87.2%)
Hospitalization	20 (6%)
Intensive care unit	23 (6.9%)
Hospital length of stay, median (IQR 25-75)	4 (3-6)
In-hospital mortality, n (%)	6 (1.8%)

COPD: Chronic obstructive pulmonary disease, GCS: Glasgow Coma Scale, ISS: Injury Severity Score, IQR: Interquartile range

When ethanol-positive patients were compared according to the poor composite outcome, it was observed that patients had more diabetes, more trauma to the head, abdomen, and extremities, higher creatine levels, and lower albumin and blood ethanol levels (p=0.011, p<0.001, p=0.024, p<0.001, p=0.007, p=0.030, p=0.007, respectively) (Table 4).

Discussion

In this study, in which we evaluated whether concomitant alcohol positivity was effective on trauma characteristics and severity in geriatric trauma patients in the emergency department, we showed that the majority of alcoholic geriatric trauma patients were male and single, that they had more frequent head trauma compared with the non-alcoholic group, that the presence of alcohol was associated with increased severity of injuries regardless of the ethanol level, but was not effective in terms of poor composite outcomes.

The overall rate of ethanol intake was lower in the geriatric population. Data on the effects of alcohol on elderly patients are limited, these effects are potentially important (10,11). While the retardation in mental processes and the decline in limb coordination contribute to the formation of trauma, the decrease in self-care due to physical and psychological limitations and the inability to self-protection may pave the way for elder abuse and violence (12). The frequency of assault was high in our study. Ethanol levels are routinely requested in patients admitted to the emergency department due to assault. Consequently, this patient group is likely to have been alcohol-positive from the beginning. The frequency of falls and traffic accidents was similar in our patient group. In the literature, emergency admissions due to falls were higher among alcohol-positive elderly men than among elderly women (2,4). In our study, we observed that elderly men were more likely to drink alcohol than elderly women and that ethanol positivity was higher in single patients. Alcohol consumption may differ according to demographic and social factors, such as sex and marital status. Although alcohol-related trauma positivity increased in the younger age group during weekdays and weekends, no such difference was observed in the elderly (13).

It has been reported that the frequency of alcohol use among geriatric patients has increased, especially in the last 20-30 years. In the literature, some studies have examined the effect of alcohol on trauma and its severity in geriatric patient population has been examined (2,4,11,14). In a study conducted by Teichman to evaluate the effect of alcohol on geriatric trauma patients, young and elderly populations were compared, and it was shown that the morbidity and mortality rates of alcoholic geriatric patients were higher and their length of intensive care and hospital stay

Table 2. Comparison of ethanol-positive and ethanol-negative patients			
	Ethanol-positive (n=101)	**Ethanol-negative (n=235)**	**p-value**
Age median (IQR 25-75%)	64 (61.5-67)	64 (62-69)	0.072
Sex, n (%)			
Female	4 (4%)	29 (12.3%)	0.018
Male	97 (96%)	206 (87.7%)	
Marital status, n (%)			
Single	37 (36.6%)	43 18.3 (%)	<0.001
Married	64 (63.4%)	192 (81.7%)	
Day, n (%)			
Mid-week	70 (69.3%)	164 (69.8%)	0.930
Weekend	31 (30.7%)	71 (30.2%)	
Comorbidity, n (%)			
Hypertension	49 (49.5%)	96 (40.7%)	0.137
Diabetes	7 (7.1%)	33 (14%)	0.075
COPD	7 (7.1%)	29 (12.3%)	0.159
Cardiac diseases	14 (14.1%)	31 (13.1%)	0.805
Injury area, n (%)			
Head/face	13 (12.9%)	13 (5.5%)	0.021
Thorax	4 (4%)	23 (9.8%)	0.072
Abdominal	2 (2%)	7 (3%)	0.729
Pelvis/hip	0 (0%)	8 (3.4%)	0.111
Extremity/vertebra	11 (10.9%)	39 (16.6%)	0.178
Superficial wound injury	67 (66.3%)	154 (65.5%)	0.887
ISS, median (IQR 25-75)	3 (2-4)	1 (1-3)	<0.001
ISS groups, n (%)			
Mild	85 (84.2%)	213 (90.6%)	0.086
Moderate-severe	16 (15.8%)	22 (9.4%)	
Laboratory, median (IQR 25-75)			
Hemoglobin	15 (14-16)	14 (13-15)	0.077
Platelet	216 (180-262)	230 (190-270)	0.233
INR	1.1 (1-1.1)	1.1 (1-1.1)	0.360
Albumin	4.0 (3.6-4.2)	4.1 (3.9-4.2)	0.032
AST	30 (25-44)	22 (18-28)	<0.001
ALT	22 (17-31.5)	18 (14-25)	0.001
Creatinine	0.9 (0.9-1.09)	0.91 (0.90-1.1)	0.591
In-hospital mortality, n (%)	4 (4%)	2 (0.9%)	0.069
Poor composite outcome (n (%)	16 (15.8%)	22 (9.4%)	0.086
Length of hospital stay, median (IQR 25-75)	4.5 (3-5)	3 (2-5)	0.091

COPD: Chronic obstructive pulmonary disease, ISS: Injury severity score, INR: International normalized ratio, AST: Aspartate aminotransferase, ALT: Alanine aminotransferase, IQR: Interquartile range

Table 3. Comparison of patients according to poor composite outcome among all patients			
	Poor composite outcome (n=38)	**No-poor composite outcome (n=298)**	**p-value**
Age median (IQR 25-75%)	65.5 (62-69.2)	64 (62-68)	0.228
Sex, n (%)			
Female	3 (7.9%)	30 (10.1%)	1.00
Male	35 (92.1%)	288 (89.9%)	
Comorbidity, n (%)			
Hypertension	21 (55.3%)	126 (42.3%)	0.129
Diabetes	5 (13.2%)	34 (11.4%)	0.787
COPD	3 (7.9%)	32 (7.9%)	0.781
Cardiac diseases	10 (26.3%)	38 (79.2%)	0.024

Table 3. Continued			
	Poor composite outcome (n=38)	**No-poor composite outcome (n=298)**	**p value**
Injury area, n (%)			
Head/face	19 (50%)	7 (2.3%)	<0.001
Thorax	6 (15.8%)	21 (7%)	0.103
Abdominal	7 (18.4%)	2 (0.7%)	<0.001
Pelvis/hip	4 (10.5%)	4 (1.3%)	0.007
Extremity/vertebra	18 (47.4%)	32 (10.7%)	<0.001
Superficial wound injury	31 (81.6%)	190 (63.8%)	0.029
ISS, median (IQR 25-75)	17 (9.7-19.2)	2 (1-3)	<0.001
Ethanol level, median (IQR 25-75)	0 (0-106.7) 68.7±101.8	0 (0-134) 68.2±118	0.296
Laboratory, median (IQR 25-75)			
Hemoglobin	14 (13-15)	15 (13-15)	0.719
Platelet	216 (184-262.7)	222 (186-268)	0.508
INR	1.08 (1-1.1)	(1-1.1)	0.838
Albumin	4 (3.6-4.2)	4.1 (3.9-4.2)	0.146
AST	30 (20-80)	24 (19-32)	0.007
ALT	25 (14-48)	19 (15-26)	0.039
Creatinine	1.02 (0.9-1.22)	0.9 (0.87-1.08)	0.005
Length of hospital stay, median (IQR 25-75)	5 (3-6)	3 (1.5-4.5)	0.056

COPD: Chronic obstructive pulmonary disease, ISS: Injury severity score, INR: International normalized ratio, AST: Aspartate aminotransferase, ALT: Alanine aminotransferase, IQR: Interquartile range

Table 4. Comparison of patients according to poor composite outcome in the ethanol-positive group			
	Poor composite outcome (n=16)	**Non-poor composite outcome (n=85)**	**p-value**
Age median (IQR 25-75%)	64.5 (62-67)	64 (61-66.5)	0.432
Sex, n (%)			
Female	0 (4%)	4 (4.7%)	0.496
Male	16 (100%)	81 (95.3%)	
Comorbidity, n (%)			
Hypertension	10 (62.5%)	41 (48.2%)	0.295
Diabetes	4 (25%)	3 (3.5%)	0.011
COPD	1 (6.2%)	6 (7.1%)	1,000
Cardiac diseases	5 (31.2%)	12 (14.1%)	0.138
Injury area, n (%)			
Head/neck	10 (62.5%)	3 (3.5%)	<0.001
Thorax	2 (12.5%)	2 (2.4%)	0.117
Abdominal	2 (12.5%)	0 (0%)	0.024
Extremity/vertebra	7 (43.8%)	4 (4.7%)	<0.001
Superficial wound injury	11 (68.8%)	56 (65.9%)	0.824
ISS, median (IQR 25-75)	18 (11-65)	3 (2-3)	<0.001
Laboratory, median (IQR 25-75)			
Hemoglobin	15 (14-16)	15 (14-16)	0.858
Platelet	210 (166-249)	216 (182-262)	0.612
INR	1.09 (0.92-1.26)	1.1 (1-1.1)	0.957
Albumin	3.7 (3.6-4.07)	4.1 (3.8-4.2)	0.030
AST	35.5 (24-42.5)	29 (25-39)	0.108
ALT	30 (15-84)	20 (17-30)	0.075
Creatinine	1.06 (0.91-1.19)	0.91 (0.88-1.0)	0.007
Ethanol level, median (IQR 25-75)	127.5 (73.7-263.2)	242 (177-299.5)	0.007
Length of hospital stay, median (IQR 25-75)	4 (3-5)	3 (2-5)	0.099

COPD: Chronic obstructive pulmonary disease, ISS: Injury severity score, INR: International normalized ratio, AST: Aspartate aminotransferase, ALT: Alanine aminotransferase, IQR: Interquartile range

was longer compared with the young population (11). It has been suggested that higher mortality and morbidity rates are expected in patients with geriatric trauma, but alcohol does not play an important role in these results and that such results are related to age and comorbidities. In our study, we evaluated the effect of alcohol consumption in a patient population with similar age, comorbidities, and mechanism of trauma and showed that being alcoholic was associated with increased injury severity in the elderly regardless of alcohol consumption. According to our study results, alcohol consumption increases the severity of trauma, regardless of alcohol level. At the same time, comorbidities, such as diabetes mellitus, elevated creatine and low albumin levels, in the patient group with poor composite outcomes may have contributed to the poor outcome.

The effects of alcohol on traumatic brain injury (TBI) are controversial (14). It has been proposed that the overall mortality and complication rates in the presence of ethanol intoxication are potentially unaffected or increase (15-17). We observed that the incidence of head trauma was higher in the alcoholic group. Alcohol consumption impairs physical balance, movements, and responses and negatively affects self-defense responses, which restrict arm movements during falls. These conditions increase the risk of TBI, particularly in the geriatric population (18).

Although it has been suggested in the literature that most patients present with alcoholic liver disease (ALD) in their 50s and 60s, a study conducted in the United States showed that the highest incidence of alcoholic cirrhosis is in the seventh decade. Likewise, a study conducted in Britain showed that 28% of patients with ALD were aged over 60 (19,20). In humans, liver anatomy and physiology change with age. There is a reduction in liver size, reflecting a decrease in the number of hepatocytes and a decrease in hepatic blood flow, all of which have an impact on ethanol elimination. Age also affects the activity of alcohol-metabolizing enzymes (21). Increased age is associated with increased blood alcohol levels (20). Chronic alcohol consumption causes alcoholic fatty liver in 90-100% of cases, leading to elevated liver function tests (LFTs) and decreased albumin (22). In our study, the alcohol-positive group had higher LFTs. When patients with liver trauma were excluded from the analysis, LFT incidence was still higher among current alcohol users. Although we could not document the frequency of alcohol use in patients, high LFT levels and low albumin levels may be associated with alcoholic fatty liver disease.

Study Limitations

Our study has a retrospective design, and the consequent loss of data is one of our limitations. Our study population consisted of patients for whom ethanol level was requested. There may be missing data due to incorrect diagnosis code records. Another important limitation of our study is that the frequency and amount of alcohol use in patients was not documented. Additional complicating factors, such as delirium or alcohol withdrawal, whose medical data may have contributed to unfavorable outcomes in this patient population, could not be obtained.

Conclusion

This study aimed to better elucidate the effect of alcohol in patients with geriatric trauma. We showed that alcohol use in geriatric patients with ethanol-positive trauma was associated with increased injury severity regardless of alcohol level. Although alcohol use and related injuries are less common in geriatric trauma patients, who are a more privileged group, we believe that alcohol should be questioned in the evaluation of these patients and should be considered an important component of trauma management.

Ethics

Ethics Committee Approval: It received ethical approval from the University of Health Sciences Turkey, Ankara Atatürk Sanatorium Training and Research Hospital Clinical Research Ethics Committee (decision no: 2012-KAEK-15/789, date: 12.39.2023).

Informed Consent: Retrospective study.

Footnotes

Authorship Contributions

Surgical and Medical Practices: H.Ö.O., Ş.K.Ç., Y.Ç., Concept: E.E., Ş.K.Ç., Y.Ç., Design: E.E., H.Ö.O., Ş.K.Ç., Y.Ç., Data Collection or Processing: E.E., H.Ö.O., Ş.K.Ç., Y.Ç., Analysis or Interpretation: E.E., H.Ö.O., Ş.K.Ç., Y.Ç., Literature Search: E.E., H.Ö.O., Ş.K.Ç., Y.Ç., Writing: E.E.

Conflict of Interest: One author of this article, (Emine Emektar) is a member of the Editorial Board of the Eurasian Journal of Emergency Medicine. However, she did not take part in any stage of the editorial decision of the manuscript. The editors who evaluated this manuscript are from different institutions. The other authors declared no conflict of interest.

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