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ORIGINAL RESEARCH

Drunk drivers and in road traffic accidents: association between alcohol levels and trauma scores

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Abstract

Background: A significant person-related cause of accidents is driving under the influence of alcohol. In this study, we aimed to examine the relationship between blood ethanol levels and trauma scores of drivers brought to the emergency department due to traffic accidents. **Methods**: The study was designed as a single-center, retrospective, cross-sectional study in the emergency department of a tertiary care hospital. Drivers brought to the emergency department due to traffic accidents (motor vehicles: car-motorcycle) were included in the study. The patients' New Injury Severity Score (NISS), Revised Trauma Score (RTS), and Trauma and Injury Severity Score (TRISS) trauma scores were calculated and their relationship with ethanol level was investigated. **Results**: 501 patients were included in the study. 31.5% of all patients were hospitalized in the ward and 4.8% in the intensive care unit. 57.3% of the drivers were motorcyclists and 42.7% were in cars. 31.1% of the patients had an alcohol level above 0.5 promil, which is the legal limit in Turkiye. The NISS trauma score with high ethanol levels was higher than the patient group with low ethanol levels, and TRISS were low and showed significant differences. TRISS score was more predictive, sensitive and specific than NISS in terms of hospitalization (Area Under Curve (AUC): 0.93, Sensitivity: 92%, Specificity: 77% $p < 0.001$). In the multivariate model, NISS, TRISS, and lactate levels were significant predictors of admission ($p < 0.001$, $p < 0.001$, $p = 0.008$, Odds Ratio (OR) = 0.158, OR = 5.014, OR = 0.375 respectively). The hospital stay was longer in the group with high ethanol levels ($p = 0.005$). **Conclusions**: In parallel with the worsening trauma scores of drivers involved in traffic accidents under the influence of alcohol, hospitalization rates and treatment durations increase.

Keywords

Traffic accidents; Ethanol levels; Trauma scores

1. Introduction

Violent and unintentional trauma injuries result in the deaths of 4.4 million people worldwide each year, accounting for approximately 8% of all deaths. Approximately one-third of these deaths are caused by road traffic accidents [1]. An average of 1.3 million people die in road traffic accidents each year [2].

Traffic accidents cause significant harm to individuals, families, and nations, stemming from treatment costs, lost productivity due to death or disability, and time taken by family members for post-accident care. Traffic accidents account for 3% of the gross domestic product of many countries [2].

In Türkiye, approximately 1 million 186 thousand traffic accidents occurred in 2021. Approximately 998 thousand of these accidents involved material damage, and 188 thousand involved fatal or injured traffic accidents. During the year, approximately 79% of fatal or injured traffic accidents occurred within residential areas, while approximately 21% occurred outside residential areas. In these traffic accidents, 5362 people lost their lives and 274,615 people were injured [3].

Road traffic accidents are still a major cause of death worldwide. This cause of death remains a concern, as the number of fatalities and resulting damages continue to pose a significant problem and challenge for most countries [4].

The rapid growth of urbanization and motorized transport in most cities in developing countries explains the high rates of morbidity and mortality from road traffic accidents [4]. The factors that cause traffic accidents are basically listed as human, road conditions, vehicle, and environmental conditions. These factors often interact to cause accidents. Getting into traffic after drinking alcohol is one of the human factors that cause accidents [5]. When traffic accidents are examined, important cognitive states are negatively affected, and driver behavior is impaired while under the influence of alcohol and drugs. Getting into traffic under the influence of alcohol and drugs is seen to be one of the important traffic problems as a cause of death [6].

These accidents constitute a significant portion of trauma patients in the emergency department [4]. Trauma patients due to traffic accidents can be evaluated with trauma scoring systems and their clinical severity in terms of mortality can be predicted [7].

Considering that drivers under the influence of alcohol tend to speed, are insensitive to using protective equipment, and have weak control mechanisms, it can be hypothesized that trauma severity increases during the accident. In this study, we aimed to determine the post-accident trauma scores of motor vehicle drivers involved in accidents with and without the influence of alcohol and to compare them in terms of prognosis.

2. Methods

Our study was designed as a retrospective, single-center, cross-sectional study with the approval of the ethics committee dated 20 September 2022 and numbered 3667.

Our study includes all motor vehicle drivers who were brought to the emergency department of University of Health Sciences Sisli Hamidiye Etfal Training and Research Hospital within the first hour after a traffic accident, with or without alcohol (national legal blood ethanol level $\leq$50 mg/dL). After the exclusion of ineligible patients (n = 283) due to the exclusion criteria, a total of 501 patients were included in the study (Fig. 1).

This study included motor vehicle drivers (cars or motorcycles) presenting to our hospital's emergency department between 01 January 2018–01 September 2022. Our hospital's patient information management system (HIMS) was used to collect data. Demographic characteristics of patients, including age and gender, vital signs, laboratory tests (hemogram biochemistry, blood gas, ethanol level), and radiological imaging were accessed from the patients' electronic files. Injury locations and severity were recorded from patient discharge reports, operating room notes, and forensic case reports. The Glasgow Coma Scale (GCS), Abbreviated Injury Scale (AIS), New Injury Severity Score (NISS), Revised Trauma Score coded (RTSc), and The Trauma Score and Injury Severity Score (TRISS) scores were calculated and recorded by two trauma clinicians.

RTS scores using respiratory rate (RR), systolic blood pressure (SBP), and GCS. Parameters are scored between 0–4. There are two types of RTS: triage and calculated form. In RTS, the scores given to each measurement are added together to obtain a score between 0–12. In the calculated form, each parameter is multiplied by its weighted coefficient, and the resulting values are added together to calculate RTSc (revised trauma score coded). The formula is: RTSc = 0.9368 $\times$ (GCS) + 0.7326 $\times$ (systolic blood pressure) + 0.2908 $\times$ (Respiratory Rate). The values obtained for RTSc are between 0–7.8408 [8, 9].

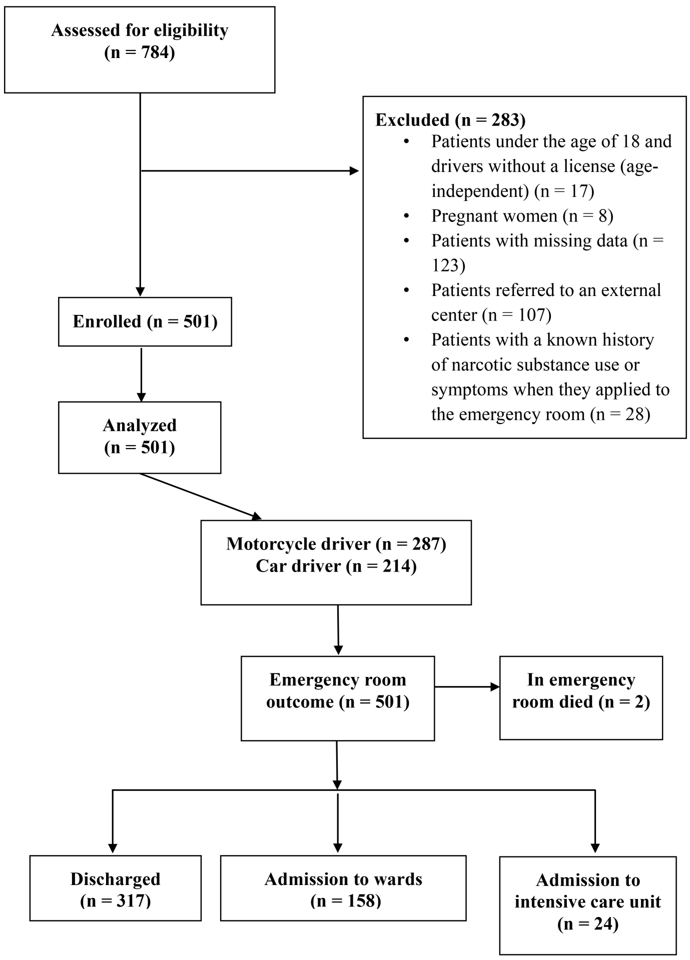

FIGURE 1. Study flow diagram.

AIS is a scoring system based on anatomical assessment created to determine the severity of trauma-related injuries. It shows the connection between post-traumatic injury and life-threatening situations, and the clinician is asked to give a score between 1 and 6 for each injury. It is expressed as (1): minor injury, (2): moderate, (3): serious (not life-threatening), (4): severe (life-threatening), (5): critical, (6): fatal [8, 10]. The Injury Severity Score (ISS) was derived to show the severity of injury in patients with multiple injuries. It is a trauma score system that divides the injury areas in patients presenting with multiple trauma into six anatomical areas: head-neck, face, extremities (including pelvis), thorax, abdomen, external, and is calculated by the scores of the three most damaged body areas based on the data obtained from physical examination findings and imaging studies.

ISS is found by adding the squares of the highest AIS values of the three body parts that are injured with the highest severity from the patient's anatomical regions.

NISS is a new version derived and modified from ISS. In NISS, the sum of the squares of the 3 highest AIS scores is obtained regardless of the injured region [11, 12].

TRISS is a scoring system that uses both anatomical and physiological parameters in combination. It gives different values for blunt and penetrating traumas. In predicting survival after trauma, TRISS scoring system uses ISS, RTS and age factor. With TRISS, the probability of survival due to trauma (Ps) is calculated using ISS and RTS. If the patient age $\leq$54, the age index is considered as 0 [8, 13].

3. Statistical analysis

Mean, standard deviation, median, minimum, maximum, frequency and ratio values were used in the descriptive statistics of the data. The distribution of variables was measured by Kolmogorov-Simirnov test. Independent sample t test and Mann-Whitney U test were used in the analysis of quantitative independent data. Chi-square test was used in the analysis of qualitative independent data, and Fisher's Exact Test was used when chi-square test conditions were not met. Spearman correlation analysis was performed for the correlation of continuous independent variable data. Univariate and multivariate logistic regression analyses were performed to evaluate the effects of variables and p value < 0.05 was considered statistically significant. Receiver operating characteristic (ROC) curve analysis was performed to evaluate the predictive ability of independent variables for categorical results. All statistical analyses were performed using SPSS software (version 28.0, IBM, Armonk, NY, USA).

4. Results

Descriptive statistics of 501 patients included in the study are presented in Tables 1a and 1b. The mean age was 33.5 $\pm$ 11.2, the median ethanol level was 5.39 (Q1: 2.48, Q3: 108.83), and the median length of hospital stay was 7 (Q1: 4, Q3: 10). When the seasonal distribution of arrival to the emergency department was examined, it was recorded as 20% spring, 30% summer, 30% autumn, and 20% winter. 86% of the patients were male and 14.3% female, 36.3% were hospitalized, 63.3% were discharged, 31.1% had high ethanol levels (>50 mg/dL), 42.7% had car accidents, and 1.2% died (2 patients in the emergency room, 4 in intensive care) (Table 1a). When the injury sites of all patients were classified, the most common was extremity injury (upper and lower 37%). It was determined that head-neck and facial traumas were followed, respectively (27%) (Table 1b).

Differences for specific variables according to accident type are examined in Table 2a. A relationship was found between

TABLE 1a. Descriptive statistics of patients' socio-demographic, laboratory, and clinical data.

	n	Mean/%	±SD	Median	Min	Max	Q1	Q3
Age (yr)	501	33.50	11.19	30	18	86	25	40
Ethanol Level	501	56.33	85.31	5.39	0.13	355.6	2.48	108.83
Length of hospital stay	183	8.77	7.84	7	1	43	4	10
Seasonal Distribution								
Spring	100	20%						
Summer	150	30%						
Autumn	149	30%						
Winter	102	20%						
Emergency department outcome								
Discharged	317	63.3%						
Ward	158	31.5%						
ICU	24	4.8%						
Ex	2	0.4%						

TABLE 1 a. Continued.

		n	Mean/%	±SD	Median	Min	Max	Q1	Q3
Gender									
	Female	72	14.3%						
	Male	429	85.7%						
Ethanol									
	≤50 mg/dL	345	68.9%						
	>50 mg/dL	156	31.1%						
Type of accident									
	Motorcycle	287	57.3%						
	Car	214	42.7%						
Exitus	+	6	1.2%						

ICU: Intensive Care Unit; SD: Standard deviation; Min: Minimum; Max: Maximum; Ex: Exitus. +: Death of patients.

TABLE 1 b. Frequency of injury sites in all patients*.

	n	%	Total
Head-Neck	135	27%	
Face	101	20%	
Thorax	85	17%	
Abdomen	90	18%	
Upper Extremity	97	19%	37%
Lower Extremity	88	18%	
Spine	42	8%	

**Some patients had multiple injuries.*

the seasonal distribution of accidents according to vehicle type (p = 0.010). In the pairwise comparisons, patients came to the emergency department with more motorcycle accidents in summer and autumn months and more car accidents in autumn. Car drivers had a higher rate of using personal protective equipment (seat belt) than motorcycle drivers (motorcycle helmet and vest), but there was no difference between the groups (p = 0.070). The rate of males (93.7%) in those with motorcycle accidents was found to be higher than the rate of males (74.8%) in those with car accidents ($p < 0.001$). Head injuries (33.2%) were higher in car accidents than in motorcycle accidents (22.3%) (p = 0.007). Upper and lower extremity injuries were seen more in motorcycle accidents. The median age of those with car accidents (M = 36.0) was found to be higher than those with motorcycle accidents (M = 28.0). NISS values ($p < 0.001$) were lower and TRISS values (p = 0.038) were higher in those with car accidents than in those with motorcycle accidents (Table 2b).

The means of TRISS and RTSc variables were lower and statistically significant in the hospitalized patients compared to the discharged patient group ($p < 0.001$, $p < 0.001$, respectively). NISS and ethanol level variables were higher and statistically significant in the hospitalized group compared to the discharged group ($p < 0.001$, $p < 0.001$, respectively) (Table 3).

Since our mortality rate was low, we evaluated the regression analysis of the independent variables in terms of immediate outcome (admission-discharge). In the univariate model, age, ethanol level, NISS, TRISS, and lactate levels were significant predictors of admission. In the multivariate model, NISS, TRISS and Lactate levels showed a significant difference ($p < 0.001$, $p < 0.001$, p = 0.008, Odds Ratio (OR) = 0.158, OR = 5.014, OR = 0.375 respectively) (Table 4a).

Receiver Operating Characteristic (ROC) analysis was performed to evaluate the predictive value of TRISS and NISS among trauma scores in terms of hospitalization and discharge. Both trauma scores were found to be predictive and statistically significant in terms of hospitalization. TRISS score was more predictive, sensitive, and specific NISS in terms of hospitalization (AUC: 0.93, Sensitivity: 92%, Specificity: 77% $p < 0.001$, DeLong Test p = 0.002) (Table 4b) (Fig. 2. ROC analysis of trauma scores in terms of hospitalization). Trauma scores were found to be predictive in the ROC analysis for hospitalization in the low and high ethanol level groups (Tables 4b-1,4b-2) (Fig. 3a,b). A statistically significant relationship was found in the correlation analysis of ethanol levels and trauma scores of all patients. However, correlation coefficients were low in all groups (Table 4c). Fig. 4a,b show the correlation and scatter plot of NISS and TRISS with ethanol according to ethanol levels (low-high).

When we divided the patients into two groups as low (≤50 mg/dL) and high (>50 mg/dL) ethanol levels, the means of the trauma scores GCS, TRISS and RTSc were found to be lower and statistically significant in the high ethanol group ($p < 0.001$, p = 0.001, $p < 0.001$ respectively). The NISS value was found to be higher and statistically significant in the high ethanol group ($p < 0.001$). In addition, the ratio of head-neck and facial traumas in patients with ethanol was found to be higher and statistically significant in patients with low ethanol levels (p = 0.017, $p < 0.001$, respectively). The rate of personal protective equipment use was higher in the group with ethanol ≤50 mg/dL than in the group with ethanol >50 mg/dL ($p < 0.001$) (Tables 5a and 5b).

TABLE 2a. Analysis of clinical and sociodemographic data of drivers involved in motorcycle and car accidents.

		Motorcycle (n = 287)		Car (n = 214)		*p*
		N	%	N	%	
Seasonal Distribution						
	Spring	47	16%	53	25%	
	Summer	98	34%	52	24%	0.010^{χ^2}
	Autumn	91	32%	58	27%	
	Winter	51	18%	51	24%	
Hospitalization Status	+	113	39%	70	32.7%	0.126^{χ^2}
Use of personal protective equipment	+	223	78.7%	181	84.6%	0.070^{χ^2}
Emergency outcome						
	Discharge	173	60.3%	144	67.3%	
	Service	96	33.5%	62	29.0%	0.169^{χ^2}
	ICU	17	5.9%	7	3.3%	
Gender						
	Female	18	6.3%	54	25.2%	$<0.001^{\chi^2}$
	Male	269	93.70%	160	74.8%	
Ethanol level						
	≤50 mg/dL	199	69%	146	68.2%	0.790^{χ^2}
	>50 mg/dL	88	31%	68	31.8%	
Exitus	+	2	1%	4	1.9%	0.409^{χ^2}
Head-Neck	+	64	22.3%	71	33.2%	0.007^{χ^2}
Face	+	52	18%	49	22.9%	0.187^{χ^2}
Thorax	+	46	16%	39	18.2%	0.517^{χ^2}
Abdomen	+	51	18%	39	18.2%	0.896^{χ^2}
Upper Extremity	+	72	25%	25	11.7%	$<0.001^{\chi^2}$
Lower Extremity	+	64	22%	24	11.2%	0.001^{χ^2}
Spine	+	21	7%	21	9.8%	0.319^{χ^2}

χ^2 Chi-square. +: Hospitalized patients. ICU: Intensive Care Unit.

TABLE 2b. Analysis of vital signs, clinical and hematological data of drivers involved in motorcycle and car accidents.

	Motorcycle (n = 287) Median (25–75)	Car (n = 214) Median (25–75)	*p*
Age, yr	28.0 (24.0–35.0)	36.0 (27.0–44.0)	$<0.001^{m}$
Ethanol, mg/dL	5.3 (2.4–114.1)	5.4 (2.4–97.5)	0.955^{m}
Length of hospital stay, d	0.0 (0.0–5.0)	0.0 (0.0–3.25)	0.123^{m}
Blood P., mmHg	120 (114–130)	120 (112–130)	0.678^{m}
Pulse, min	86 (76–95)	85 (76–90)	0.036^{m}
Resp. Rate, min	14 (13–16)	14 (13–16)	0.213^{m}
SO_2	98.0 (97–99)	97.5 (97–99)	0.521^{m}

TABLE 2b. Continued.

	Motorcycle (n = 287) Median (25–75)	Car (n = 214) Median (25–75)	*p*
GCS, point	15 (15–15)	15 (15–15)	0.210^{m}
NISS, point	2 (5–12)	1 (3–10)	$<0.001^{m}$
TRISS, point	99.61 (99.37–99.67)	99.65 (99.31–99.70)	0.038^{m}
RTSc, point	7.84 (7.84–7.84)	7.84 (7.84–7.84)	0.217^{m}
Lactate, mmol/L	2.0 (1.5–2.8)	2.0 (1.5–2.9)	0.655^{m}
HGB, g/dL	13.9 (12.2–15.2)	14.0 (12.5–15.0)	0.828^{m}

^{m}Mann-Whitney U: Respiratory Rate; Blood P.: Blood pressure; NISS: New Injury Severity Score; TRISS: Trauma and Injury Severity Score; RTSc: revised trauma score coded; Resp. Rate: Respiratory rate; GCS: Glasgow Coma Scale; HGB: Hemoglobin.

TABLE 3. Analysis of patients' vital signs, trauma scores, and hematological parameters at discharge or hospitalization (n = 499*).

	Discharge (n = 317) Median (25–75)	Hospitalization (n = 182) Median (25–75)	*p*
Age, yr	30 (25–39)	31 (26–44)	0.043^{m}
Ethanol, mg/dL	4.20 (2.18–53.07)	7.87 (2.86–146.0)	$<0.001^{m}$
Blood Press., mmHg	120 (119–130)	130 (110–133)	0.096^{m}
Pulse, min	85 (76–90)	76 (76–95)	0.027^{m}
Resp. Rate, min	14 (13–15)	15 (13–16)	$<0.001^{m}$
SO_2	97 (97–99)	99 (97–100)	0.541^{m}
GCS, point	15 (15–15)	15 (15–15)	$<0.001^{m}$
NISS, point	2 (1–4)	16 (7–27)	$<0.001^{m}$
TRISS, point	99.67 (99.61–99.70)	98.87 (97.52–99.42)	$<0.001^{m}$
RTSc, point	7.84 (7.84–7.84)	7.84 (7.84–7.84)	$<0.001^{m}$
Lactate, mmol/L	2.1 (1.5–2.9)	1.9 (1.5–2.5)	$<0.001^{m}$
HGB, g/dL	14.0 (11.9–15.2)	14.0 (12.7–15.0)	0.195^{m}

*^{m}Mann-Whitney U Test; *2 patients died in emergency room. Blood Press.: Blood pressure; NISS: New Injury Severity Score; TRISS: Trauma and Injury Severity Score; RTSc: revised trauma score coded; Resp. Rate: Respiratory rate; GCS: Glasgow Coma Scale; HGB: Hemoglobin.*

TABLE 4a. Multivariate regression analysis of variables found to be significant for hospitalization in univariate regression.

	Univariate				Multivariate			
	Odds Ratio	95% Confidence Interval		*p*	Odds Ratio	95% Confidence Interval		*p*
		Lower	Upper			Lower	Upper	
Age	1.031	1.014	1.048	<0.001	0.980	0.946	1.015	0.265
Ethanol	1.004	1.002	1.006	<0.001	1.002	0.997	1.005	0.569
NISS	1.321	1.228	1.362	<0.001	1.200	1.081	1.268	<0.001
TRISS	0.000	0.000	0.000	<0.001	0.005	0.001	0.072	<0.001
Lactate	2.037	1.667	2.458	<0.001	1.431	1.102	1.920	0.008

Logistic Regression (Nagelkerke Square 0.75), Hosmer and Lemeshow Test p = 0.411. NISS: New Injury Severity Score; TRISS: Trauma and Injury Severity Score.

TABLE 4b. ROC analysis to determine the predictive value of trauma scores in the entire patient group for hospitalization.

	AUC	Cut off	95% Confidence Interval Lower–Upper	Sensitivity	Specificity	*p*
TRISS%	0.930	99.5	0.907–0.953	0.920	0.770	<0.001
NISS	0.880	7.0	0.843–0.912	0.870	0.750	<0.001

NISS: New Injury Severity Score; TRISS: Trauma and Injury Severity Score; AUC: Area Under Curve.

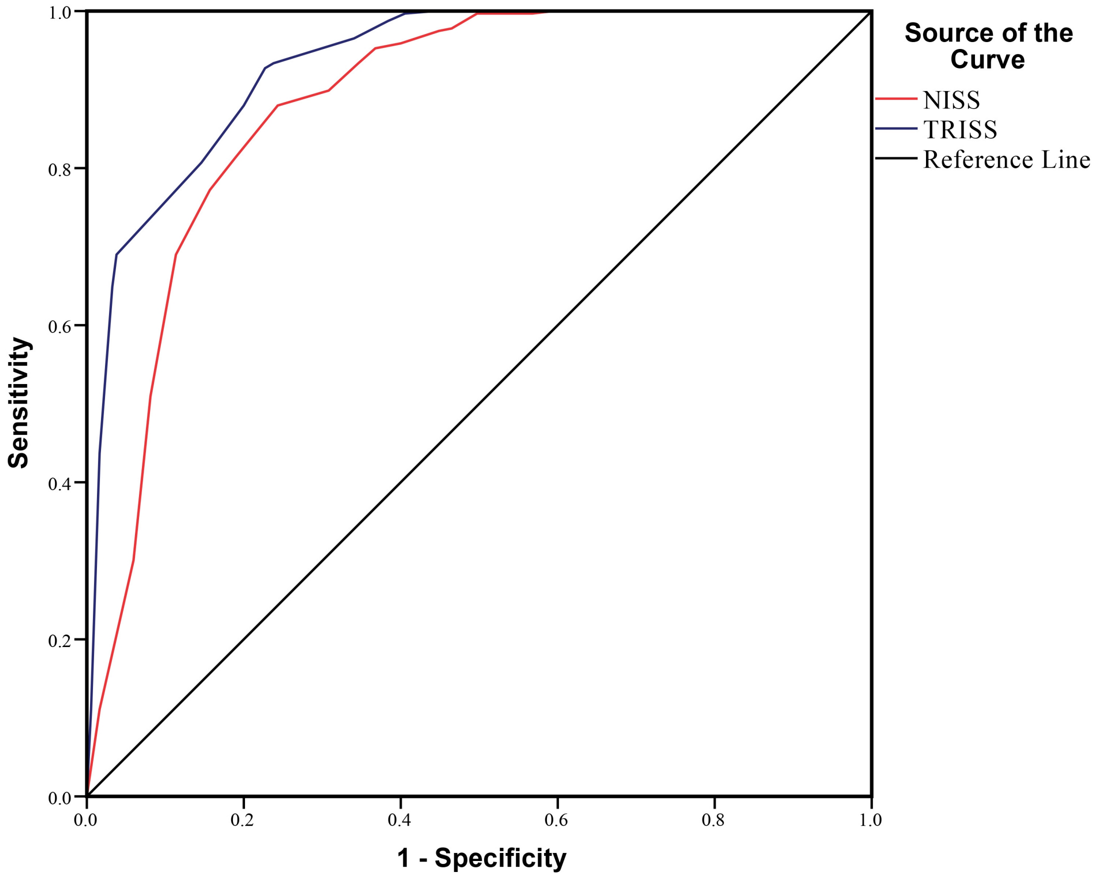

FIGURE 2. ROC analysis of trauma scores for hospitalization in the entire patient group. NISS: New Injury Severity Score; TRISS: Trauma and Injury Severity Score.

TABLE 4b-1. ROC analysis to determine the predictive value of trauma scores for hospitalization in the ethanol >50 mg/dL group.

	AUC	Cut off	95% Confidence Interval Lower–Upper	Sensitivity	Specificity	*p*
TRISS%	0.941	99.56	0.907–0.975	0.863	0.842	<0.001
NISS	0.912	5.5	0.867–0.958	0.800	0.882	<0.001

NISS: New Injury Severity Score; TRISS: Trauma and Injury Severity Score; AUC: Area Under Curve.

TABLE 4b-2. ROC analysis to determine the predictive value of trauma scores for hospitalization in the ethanol ≤50 mg/dL group.

	AUC	Cut off	95% Confidence Interval Lower–Upper	Sensitivity	Specificity	*p*
TRISS%	0.924	99.43	0.893–0.955	0.941	0.752	<0.001
NISS	0.858	7.0	0.810–0.906	0.894	0.725	<0.001

NISS: New Injury Severity Score; TRISS: Trauma and Injury Severity Score; AUC: Area Under Curve.

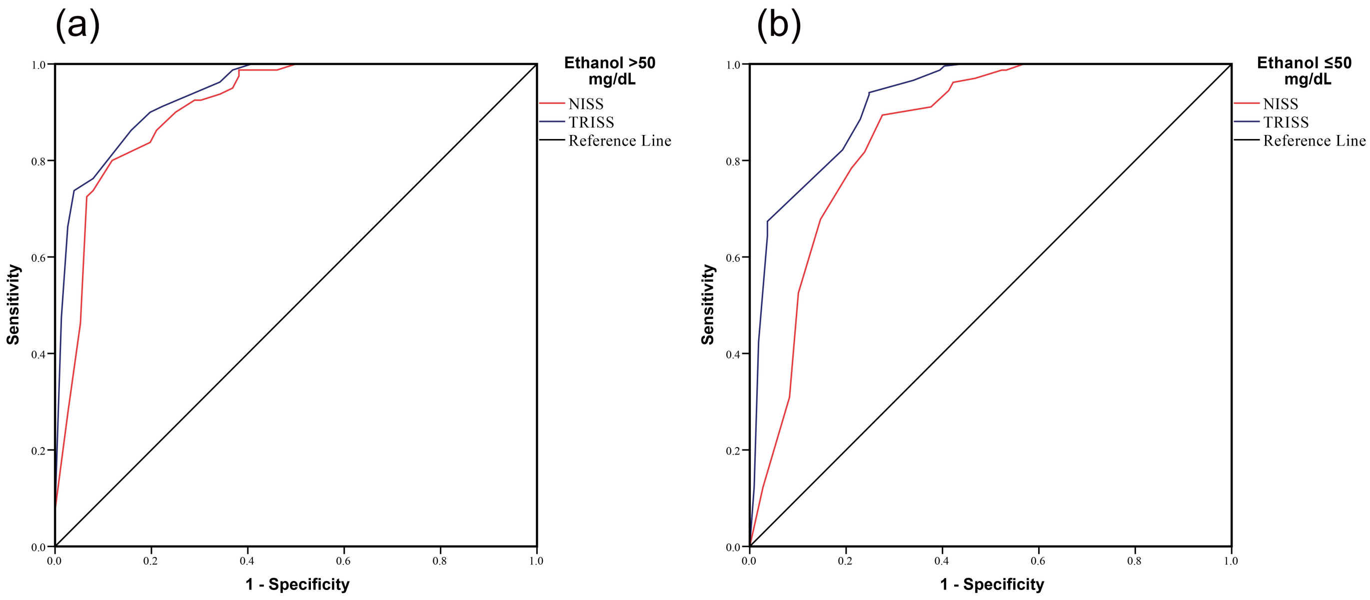

FIGURE 3. ROC analysis in terms of hospitalization in groups with high and low ethanol levels. (a) ROC analysis for hospitalization in the group with ethanol level >50 mg/dL. (b) ROC analysis for hospitalization in the group with ethanol level ≤50 mg/dL. NISS: New Injury Severity Score; TRISS: Trauma and Injury Severity Score.

TABLE 4c. Correlation analysis between ethanol level and trauma scores.

Spearman's Cor.	GCS	NISS	TRISS
Ethanol Level			
r	−0.226**	0.164**	−0.135**
p	<0.001	<0.001	0.002
N	501	501	501

***Correlation is significant at the 0.01 level (2-tailed).*
NISS: New Injury Severity Score; TRISS: Trauma and Injury Severity Score; Spearman's Cor.: Spearman's rho Correlation; GCS: Glasgow Coma Scale.

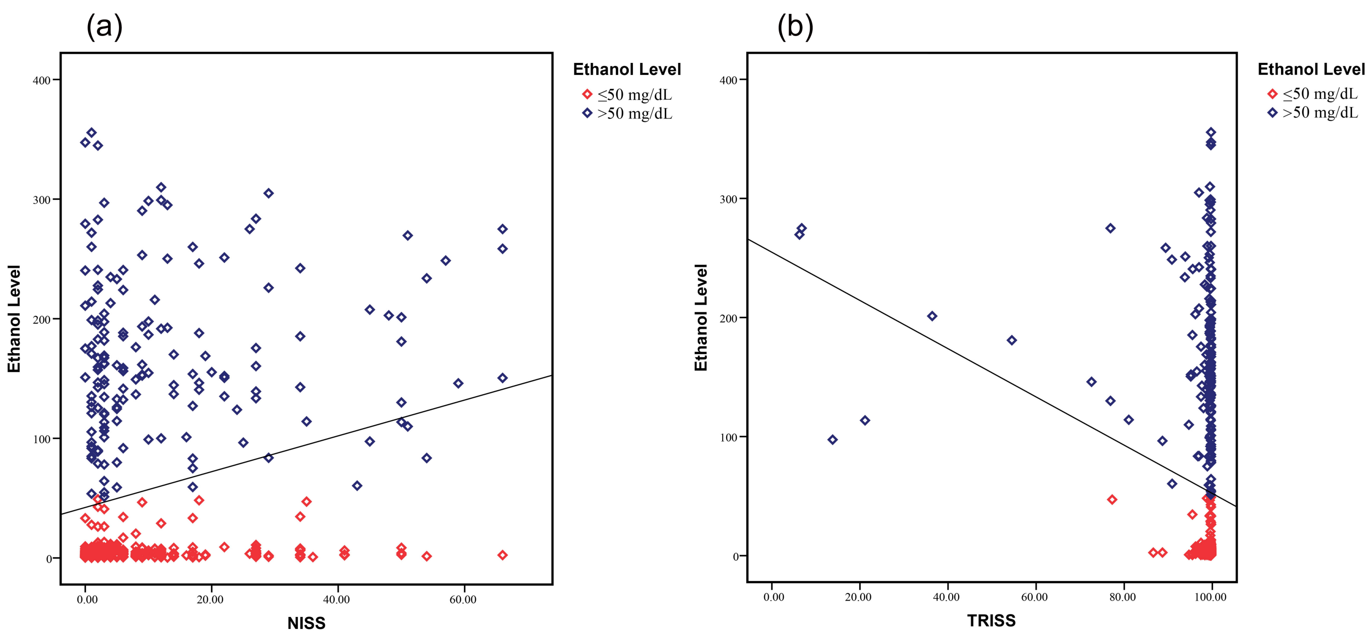

FIGURE 4. Correlation and scatter plot of ethanol with trauma scores according to ethanol levels. (a) Correlation and scatter plot of NISS with ethanol according to ethanol levels. (b) Correlation and scatter plot of TRISS with ethanol according to ethanol levels.

TABLE 5a. Socio-demographic and clinical data analysis of drivers with low and high ethanol levels.

		Ethanol ≤50 mg/dL (n = 345)		Ethanol >50 mg/dL (n = 156)		p
		n	%	n	%	
Seasonal Distribution						
	Spring	66	19.10%	34	21.8%	0.860^{χ^2}
	Summer	104	30.10%	46	29.5%	
	Autumn	102	29.60%	47	30.1%	
	Winter	73	21.20%	29	18.6%	
Emergency outcome						
	Discharged	237	68.7%	79	50.6%	$<0.001^{\chi^2}$
	Service	103	29.9%	58	37.2%	
	ICU	5	1.4%	19	12.2%	
Gender						
	Female	47	13.60%	25	16.0%	0.478^{χ^2}
	Male	298	86.40%	131	84.0%	
Type of Accident						
	Motorcycle	199	57.70%	88	56.4%	0.790^{χ^2}
	Car	146	42.30%	68	43.6%	
Use of personal protective equipment	+	293	84.9%	111	71.1%	$<0.001^{\chi^2}$
Exitus	+	2	0.60%	4	2.6%	0.079^{χ^2}
Head-Neck	+	82	23.80%	53	34.0%	0.017^{χ^2}
Face	+	46	13.30%	55	35.3%	$<0.001^{\chi^2}$
Thorax	+	57	16.50%	28	17.9%	0.694^{χ^2}
Abdomen	+	65	18.80%	25	16.0%	0.447^{χ^2}
Upper Extremity	+	59	17.10%	38	24.4%	0.057^{χ^2}
Lower Extremity	+	56	16.20%	32	20.5%	0.244^{χ^2}
Spine	+	27	7.80%	15	9.6%	0.503^{χ^2}

ICU: Intensive Care Unit. χ^2*: Chi-square; +: Patients using personal protective equipment.*

TABLE 5b. Vital-hematological parameter and trauma scores data analysis of drivers with low and high ethanol levels.

	Ethanol ≤50 mg/dL Median (25–75)	Ethanol >50 mg/dL Median (25–75)	p
Age, yr	30 (25–40)	31 (25–38)	0.947^{m}
Length of hospital stay, d	0.0 (0–4)	0.0 (0–6)	0.005^{m}
Blood press., mmHg	130 (119–137)	120 (11–125)	$<0.001^{m}$
Pulse, min	87 (76–95)	80 (75–90)	0.001^{m}
Resp. Rate, min	14 (13–16)	14 (13–15)	0.843^{m}
SO_2	98 (97–99)	98 (97–99)	0.396^{m}
GCS, point	15 (15–15)	15 (15–15)	$<0.001^{m}$
NISS, point	3 (2–9)	6 (2–18)	$<0.001^{m}$

TABLE 5b. Continued.

	Ethanol ≤50 mg/dL Median (25–75)	Ethanol >50 mg/dL Median (25–75)	p
TRISS, point	99.61 (99.42–99.70)	99.58 (98.77–99.67)	0.001^m
RTSc, point	7.84 (7.84–7.84)	7.84 (7.84 –7.84)	<0.001^m
Lactate, mmol/L	1.7 (1.4–2.3)	2.74 (2.1–3.4)	<0.001^m
HGB, g/dL	14.0 (12.3–15.2)	139.5 (11.7–15.0)	0.316^m

^{m}Mann-Whitney U. Resp. Rate: Respiratory Rate; Blood press.: Blood pressure; NISS: New Injury Severity Score; TRISS: Trauma and Injury Severity Score; RTSc: revised trauma score coded; GCS: Glasgow Coma Scale; HGB: Hemoglobin.

5. Discussion

Patients with traumatic injuries resulting from traffic accidents constitute a significant patient population presenting to the emergency department. When examining individual-related traffic accidents, driving under the influence of alcohol is a significant risk factor. In our study, we found that the trauma score of drivers involved in traffic accidents under the influence of alcohol was negatively affected. Hospitalization rates were higher in the patient group with higher ethanol levels due to worsening clinical conditions, consistent with trauma scores. Hospitalized patients in the group with higher ethanol levels had longer hospital stays, paralleling the severity of their injuries. The lack of differences in blood ethanol levels between patients driving two-wheeled (motorcycle) and four-wheeled (car) vehicles ensured homogeneity between the groups we compared. The higher frequency of extremity injuries in motorcycle drivers worsened their trauma scores and statistically differentiated them from car drivers. The higher frequency of head, neck, and facial trauma in car drivers is an important finding that emphasizes the importance of wearing seat belts in addition to driving without alcohol. The higher frequency of head, neck and facial traumas in car drivers is an important finding that reminds us of the importance of wearing seat belts as well as driving without alcohol. We believe that loss of speed control under the influence of alcohol and loss of trauma-relieving reflexes during an accident are other factors that increase the severity of trauma.

Many of the effects of alcohol, from sedation and anxiety relief to impairment of motor function and cognition, vary nonlinearly with dose and time [14]. Alcohol significantly alters the biological functions necessary for normal functioning and driving. Alcohol is a depressant that affects brain function. Alcohol impairs various abilities. When the cerebral cortex loses its ability to integrate and control, judgment and behavioral processes occur disorganized, and the proper functioning of behavioral tasks is impaired. Drivers who have consumed alcohol have a reduced field of vision, and it has been shown that intoxicated individuals cannot adequately shift their focus without impairing their senses. This loss of coordination increases drivers' risk of accidents and reduces their cognitive abilities, such as the use of protective equipment and the ability to comply with traffic laws [15]. In traffic accidents that occur without protective equipment are more likely to result in increased injury severity [16]. Injury severity increases in drunk drivers, and consequently, the risk of mortality rises [17].

In our study, we found that the drivers involved in the accidents were young-middle aged and the majority were male. In a study analyzing traffic accidents at the national state and metropolitan city level in India, it was found that the motor vehicle drivers involved in traffic accidents were young-middle aged, similar to our study [18]. Since the majority of the driving profession in private or commercial vehicles in developing countries is carried out by men, the accident frequency is higher in men than in women. In a study conducted by Varet *et al.* [19] consistently demonstrate that men commit more traffic violations than women and take greater traffic risks. It was thought that young and middle-aged drivers exhibited riskier behaviors in traffic and caused accidents by speeding.

When we examine the seasonal distribution of accidents, summer and autumn seasons have higher rates of traffic accidents. In summer, the good weather, increased traffic density, and drivers' tendency to drink alcohol due to the season increase traffic accidents. In autumn, traffic accidents increase due to the opening of public and private institutions after the holiday and the increase in the number of vehicles in traffic. In addition, the mood swings that develop in drivers due to bad weather in autumn have been found to be related to accidents. In a study conducted at the city level in Poland, it was determined that traffic accidents were more common in summer and autumn months [20].

The most common injuries among our riders were head, neck, and facial injuries. Limb injuries also account for a significant portion of motorcyclists. We attribute this high incidence of extremity injuries to the fact that motorcyclists outnumber car drivers. Drivers' habits of using personal protective equipment (motorcycle vest, helmet, *etc.*, seat belt) have had an impact on these rates. A meta-analysis examining motorcycle accidents found that the most common injury sites were the head and neck areas and emphasized the importance of wearing a motorcycle helmet as a personal protective equipment [21].

Two-wheeled vehicle use is common among young people, and the accident frequency is higher than car drivers. Middle and older age drivers are seen to use cars rather than two-wheeled vehicles depending on the socio-economic levels of the countries. This increases the average age of car drivers above the average age of drivers involved in motorcycle accidents. In our study, the NISS score among trauma scores was higher in motorcycle drivers and showed a statistical difference between the two groups. We associated this observation with the fact that extremity injuries in motorcycle accident drivers were higher than in car drivers. Ethanol levels and hospitalization-discharge status did not differ between the two groups [22, 23].

As trauma scores increase, the prognosis of patients worsens. This affects morbidity and mortality. In a study conducted in New Zealand using NISS and ISS scores on 1479 trauma patients, it was found that both scores successfully predicted mortality and survival, while among patients who died, the mortality rate increased as the difference between NISS and ISS scores increased. Again, when hospital stays were examined, it was seen that those with higher scores on ISS and NISS had significantly longer hospital stays [24]. In another study conducted in Lebanon, where ISS and NISS scores were used and 891 patients were examined, it was determined that ISS and NISS scores had equal predictive power in predicting survival in patients under 65 years of age. It was observed that ISS provided more significant results for patients who were admitted to intensive care and whose hospital stay was prolonged. However, it was stated that the predictive power of the scoring results was weakened in geriatric trauma patients over 65 years of age [12]. In a study conducted in Iran with trauma patients over 65 years of age, most of whom had traffic accidents, 352 patients were examined and the mortality predictive power of RTS from physiological scoring systems, ISS from anatomical scoring systems and TRISS from combined scoring systems was examined. TRISS was found to be reliable in predicting mortality with 95% sensitivity and 72% specificity [25]. In our study, since the number of mortalities was low, we compared the trauma scores between the groups that were hospitalized and discharged from the emergency department. Consistent with the literature, we found that TRISS and RTSc were lower in the hospitalized group than in the discharged group, and NISS was higher and statistically significant.

In a study conducted in Turkiye in which the blood alcohol level of drivers admitted as a result of traffic accidents was evaluated, it was seen that 97 of 544 traffic accident patients admitted in one year were motor vehicle drivers and 40.2% of them were under the influence of alcohol [26]. Driven by alcohol's allure, drunk driving remains a leading cause of accidents in many countries.

When we examined all our patients in two groups with ethanol levels below and above the legal limit of 0.5 per mille, trauma scores and hospitalization status showed statistical differences in the group with higher ethanol levels. Injuries in traffic accidents caused by alcohol consumption are more severe and increase trauma scores. Alcohol consumption encourages drivers to drive incorrectly by causing emotional and state changes such as expressing repressed emotions and courage. Since drunk drivers are more prone to speeding and driving without seat belts under the influence of ethanol, they cause more serious injuries after their accidents. There are studies in the literature reporting varying results on the trauma scores and prognosis of drunk drivers. Gonçalves *et al.* [27] found no correlation between drivers' ethanol levels and trauma scores in their study. However, they suggested that this may be due to the delay in measuring blood alcohol levels. Unlike this study, in our study, ethanol levels were measured in the blood of the patients immediately after the accident. Kılıc *et al.* [28] found a correlation between ethanol levels and trauma scores in their study.

6. Limitations

There were some limitations in our study. The most important of these was that our study was retrospective and the number of patients was limited. In our retrospective study, we could not obtain data on the drivers' acute and chronic alcohol intake. Since the number of patients with mortality was small, we could not evaluate the relationship between ethanol levels and trauma scores and mortality. Additionally, our study was single-center and included patients in urban areas. Because it did not include rural patients, it does not adequately reflect the geographic distribution, limiting its generalizability.

7. Conclusions

Traffic accidents are the leading cause of preventable traumas that present to the emergency department. In injuries resulting from traffic accidents, trauma scores are worse in drunk drivers. In order to prevent morbidity and mortality in drunk drivers brought to the emergency department due to traffic accidents, it is necessary to be proactive in determining the degree of injury and determining the prognosis of this patient group, and not to delay in initiating the intensive treatment process. Adequate triage should be implemented with rapid and accurate primary and secondary examination, and physiological parameters, anatomical injuries, and injury mechanisms should be documented. Appropriate medication, transfusion, and surgical treatment of these patients in the emergency department should not be delayed. Limiting blood alcohol levels in drivers is one of the measures that should be taken to reduce alcohol-related traffic accidents.

AVAILABILITY OF DATA AND MATERIALS

The datasets used and/or analyzed during the current study are available for sharing by the corresponding author upon request.

AUTHOR CONTRIBUTIONS

EE, NO—provided the main framework, identified, and organized primary materials, and collaborated in writing the manuscript. AM, UK—identified appropriate references and collaborated on the writing of the manuscript. SC, EA, DO—reviewed and contributed to drafting sections of the manuscript. All authors have read and agreed to the published version of the manuscript.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

The study was performed after the approval of institutional ethics committee (University of Health Sciences Sisli Hamidiye Etfal Training and Research Hospital Health Application and Research Center Clinical Research Ethics

Committee, decision no: 3667, dated: 20 September 2022) in accordance with the Declaration of Helsinki. Participation was voluntary and informed consent was obtained from all participants.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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