Original Article

DOI: 10.14235/bas.galenos.2025.86158
Bezmialem Science 2025;13(3):214-21

Evaluation of Injuries Due to Traffic Accidents with Trauma Scoring Systems

Trafik Kazalarına Bağlı Yaralanmaların Travma Skorlama Sistemleri ile Değerlendirilmesi

Erdem HÖSÜKLER[1], Zehra Zerrin EKOL[1], Aziz YILMAZ[2], Ebru ŞEN[1]

[1]Bolu Abant İzzet Baysal University Faculty of Medicine, Department of Forensic Medicine, Bolu, Türkiye
[2]Ankara Etlik City Hospital, Clinic of Forensic Medicine, Ankara, Türkiye

ABSTRACT

Objective: The purpose of this study was to examine the common traits of individuals admitted to our Forensic Medicine Clinic as a result of traffic accidents and the seriousness of their injuries.

Methods: This study covered the cases at the Forensic Medicine Clinic between 2015 and 2021 where a forensic report was made due to a traffic accident.

Results: In this study, 802 cases were included: 69.20% (n=555) of the cases were male with the mean age of 36.10±19.62 years (min.:1, max.:90). Seat belts were not buckled up in 62.30% (329/528) of the in-vehicle traffic accident cases. In 71.43% (55/77) of the motorcycle accident cases, helmets and safety gear were not used. A significant difference was noted in injury severity across various age groups ($p<0.001$). Motorcycle and off-vehicle traffic accidents had significantly higher Injury Severity Score (ISS) and New ISS values ($p<0.001$).

Conclusion: The findings of this research indicated that most individuals involved in traffic accidents did not utilize seat belts, helmets, or safety gear. This demonstrates the apparent necessity for social education and advertisements to be increased, road safety policies should be re-evaluated, and safety belt and helmet checks in traffic should be increased to ensure seat belts, helmets, and safety gear use.

Keywords: Traffic accident, injury, trauma scores, seat belt, helmet, forensic medicine

ÖZ

Amaç: Bu çalışmada, Adli Tıp Kliniği'mize trafik kazası nedeniyle başvuran olguların genel karakteristik özelliklerinin ve travma skorlama sistemleri kullanılarak yaralanma şiddetlerinin değerlendirilmesi amaçlanmıştır.

Yöntemler: 2015-2021 yılları arasında Adli Tıp Kliniği'nde trafik kazası nedeniyle adli rapor düzenlenen olgular çalışmaya dahil edildi.

Bulgular: Çalışmaya 802 olgu dahil edilmiş olup, %69,20'si (n=555) erkek, yaş ortalaması 36,10±19,62'dir (min.:1, max.:90). Araç içi trafik kazası geçiren mağdurların %62,30'unda (329/528) emniyet kemeri takılı değildi. Motosiklet kazası geçiren olguların %71,43'ünde (55/77) kask ve koruyucu ekipman bulunmamaktaydı. Yaş grupları ile yaralanma şiddeti arasında istatistiki olarak anlamlı bir farklılık tespit edilmiştir ($p<0,001$). Araç dışı trafik kazalarında ve motosiklet kazalarında Yaralanma Ciddiyeti Skoru (YCS) ve Yeni YCS şiddeti anlamlı derecede daha yüksekti ($p<0,001$).

Sonuç: Bu çalışmanın sonuçları, trafik kazası mağdurlarının çoğunluğunun emniyet kemeri, kask veya koruyucu ekipman kullanmadığını göstermiştir. Bu nedenle emniyet kemeri, kask ve koruyucu ekipman kullanımının yaygınlaştırılması için toplumsal eğitimlerin ve reklamların arttırılması, karayolu güvenlik politikalarının yeniden değerlendirilmesi ve trafikte emniyet kemeri ve kask denetimlerinin daha da sıklaştırılması gerektiği düşüncesindeyiz.

Anahtar Kelimeler: Trafik kazası, yaralanma, travma skorları, emniyet kemeri, kask, adli tıp

Address for Correspondence: Erdem Hösükler, Assoc. Prof. Bolu Abant Izzet Baysal University Faculty of Medicine, Department of Forensic Medicine, Bolu, Türkiye
E-mail: drerdemhmakale@gmail.com **ORCID ID:** orcid.org/0000-0002-7736-748X

Cite this article as: Hösükler E, Ekol ZZ, Yılmaz A, Şen E. Evaluation of injuries due to traffic accidents with trauma scoring systems. Bezmialem Science. 2025;13(3):214-21

Received: 04.11.2024
Accepted: 08.06.2025
Published date: 31.07.2025

Introduction

Traffic accident-related deaths and injuries are major public health issues (1). While traffic accident deaths increase each year in middle- and low-income countries, they are decreasing significantly in high-income countries such as Germany due to strict road safety measures (2). In Türkiye, traffic accidents cause injuries of tens of thousands and the deaths of thousands of people every year. According to the data from the Turkish Statistical Institute, a total of 983,808 road accidents took place in Türkiye in 2020, 4,866 people lost their lives and 226,266 people were injured (3). Excessive speed, poor road conditions, young drivers, carelessness, distraction, alcohol or drug use, not using a helmet or seat belt, and lack of airbags are among the most important causes of serious injuries, including death in traffic accident (4,5).

The reduction of serious injuries due to road traffic accidents may only be possible by determining the causes and applying road safety policies in this context (2). Trauma scoring systems like Injury Severity Score (ISS) and New ISS (NISS) help determine the degree of trauma (6). AIS is an anatomical-based coding system developed by the Association for the Advancement of Automotive Medicine in the mid-1960s to track injuries in automotive and aircraft accidents. It rates each type of damage on a six-point scale based on body region (7). The squares of the Abbreviated Injury Score (AIS) scores for the three body parts with the most severe injuries are summed to determine the ISS [ISS= (AIS body resgion 1)^2 + (AIS body resgion 2)^2 + (AIS body resgion 3)^2] (8). Regardless of which body part is injured, the NISS represents the sum of the squares of the three most severe injuries. Thus, NISS may be equal to or greater than ISS (9). Li and Ma (10) reported that NISS was more valuable than ISS in predicting mortality in patients with severe blunt trauma. Evaluation of traffic accident victims' injuries using trauma scores may help to better understand the circumstances that lead to severe trauma and to define the necessary precautions to avoid severe injuries. This study's objective was to determine the general characteristics of forensic cases admitted to a forensic medicine clinic due to traffic accidents and to evaluate the injury severity in these cases.

Methods

This research was conducted at the Forensic Medicine Clinic of Bolu Abant Izzet Baysal University's Faculty of Medicine. We did not establish an informed consent form because our study was designed retrospectively. Approval for the study was granted by the Clinical Research Ethics Committee of Bolu Abant Izzet Baysal University (decision number: 2022/105, dated: 26.04.2022). Our research adhered to the ethical criteria outlined in the Helsinki Declaration of 1964, as revised in 2013.

This retrospective cohort study analyzed 802 forensic cases from January 01, 2015, to December 31, 2021. Cases were excluded if there was no traumatic injury or data were incomplete. The records of the hospital automation system, the records of the forensic medicine clinics, and the medical files of the cases featured in the study were reviewed retrospectively.

Simple demographic data (age, gender), injury characteristics, victims' position, the use of safety belts, helmets, and safety gear, extent of forensic trauma, and trauma scores were evaluated. The AIS 2008 update was used to calculate the ISS and NISS.

Statistical Analysis

Statistical Package for Social Science (SPSS) for Windows, version 21.0 software (IBM Corporation., Armonk, NY, USA) was used to analyze the study's data. Using the analytical (Kolmogorov-Smirnov / Shapiro-Wilk test) and visual (histograms, plots) approaches were used to determine whether the variables' distributions were normal. The frequency, percentage, mean, median, and standard deviation values were displayed in descriptive statistics.

The chi-square test was used to compare categorical variables. The non-parametric Mann-Whitney U test and the Kruskal-Wallis test (post-hoc: Dunn-Bonferroni test) were used to compare groups that did not exhibit a normal distribution. The categorical variables were reported as frequency and percentage, and the continuous variables as median interquartile range values. A significance level of $p<0.05$ was considered statistical.

Results

The study included 802 cases: 69.20% (n=555) of the cases were male, with the mean age of the cases was 36.10±19.62 (min.:1, max.:90). The age range from 21 to 30 was the most prevalent group (n=171, 21.30%) (Table 1). More than one site of injury was reported in 36.28% of the cases (n=291) (Table 1). Considering all the injuries separately after multiple site injuries were distributed, 58.98% of the victims suffered extremity injuries (n=473), 46.23% had head and neck injuries (n=371), 24.68% had chest injuries, and 5.36% had abdominal injuries.

Passengers (36.29%) and drivers (29.55%) were the most often injured in traffic accidents (Table 1). Seat belts were not buckled up in 62.30% (329/528) of the in-vehicle traffic accident cases. In 71.43% (55/77) of the motorcycle accident cases, helmets and protective equipment were not used. Life-threatening trauma was detected in 21.93% of the cases (Table 1).

Upper extremity fractures occurred in 16.58% (n=133) of the cases followed by lower extremity fractures in 16.33% (n=131), skull bone fractures in 5.60% (n=45), rib fractures in 10.83% (n=87), internal organ injury in 12.09% (n=97), and cerebral hemorrhage (epidural, subdural, etc.) in 2% (n=16). The distribution of injuries according to the type of traffic accident is displayed in Table 2. Motorcycle accident cases had more severe bone trauma than in-vehicle accident victims ($p<0.05$) (Table 3).

ISS and NISS Score

The mean ISS was 6.45±8.22, and the mean NISS was 8.44±10.69. There was no remarkable difference among gender in terms of ISS and NISS values ($p>0.05$) (Table 4). A significant difference was noted in injury severity across various age groups. Cases aged ≥60 years were determined with significantly more severe trauma than those aged ≤10 years and the 21-30 and 31-

40 years age groups (p<0.001) (Table 4). Compared to instances with isolated head-neck damage, isolated extremities injury, and isolated abdominal-chest injury, those with multiple traumas had substantially higher ISS and NISS values (p<0.001) (Table 4). The ISS and NISS values were also significantly higher in abdominal-chest trauma than in head-neck and extremity injuries (p<0.001). Motorcycle and off-vehicle traffic accidents had significantly higher ISS and NISS values (p<0.001) (Table 4). The ISS and NISS values escalated with an increasing extent of forensic trauma (p<0.001). ISS value ≥8.5 (sensitivity: 92%, specificity: 86.6%) and NISS value ≥9.5 (sensitivity: 86.4%, specificity: 87.2%) may be useful in defining life-threatening injuries (Table 5).

Table 1. Characteristics of traffic accidents

	In-vehicle driver		Passenger		Off-vehicle pedestrian		Bicyclist		Motorcycle rider		p-value
Gender	n	%	n	%	n	%	n	%	n	%	
Male	211	26.31	140	17.46	109	13.59	25	3.12	70	8.73	<0.001
Female	26	3.24	151	18.83	60	7.48	3	0.37	7	0.87	
Age	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	
0-10 years	0	0.00	30	3.74	29	3.62	6	0.75	3	0.37	<0.001
11-20years	9	1.12	52	6.48	22	2.74	11	1.37	35	4.36	
21-30 years	66	8.24	68	8.48	17	2.12	2	0.25	18	2.25	
31-40 years	45	5.61	49	6.11	21	2.62	2	0.25	8	1.00	
41-50 years	44	5.48	31	3.87	16	1.99	2	0.25	8	1.00	
51-60 years	40	4.99	34	4.24	17	2.12	2	0.25	3	0.37	
>60 years	33	4.11	27	3.37	47	5.86	3	0.37	2	0.25	
Injury site	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	
Isolated head-neck	59	7.36	76	9.48	25	3.12	7	0.87	13	1.62	<0.001
Isolated extremity	62	7.73	82	10.23	72	8.98	13	1.62	30	3.74	
Isolated chest-abdomen	30	3.74	35	4.36	5	0.62	0	0.00	2	0.25	
Multiple	86	10.72	98	12.22	67	8.35	8	1.00	32	3.99	
Degree of forensic injuries	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	
Cured by simple medical intervention	117	14.59	145	18.08	62	7.73	9	1.12	22	2.74	<0.01
Not cured by simple medical intervention	70	8.73	95	11.85	61	7.61	14	1.75	31	3.87	
Life-threatening	50	6.23	51	6.36	46	5.73	5	0.62	24	2.99	
Total	237	29.55	291	36.29	169	21.07	28	3.49	77	9.60	

Table 2. Distribution of injuries in traffic accident victims

	In-vehicle driver		Passenger		Off-vehicle pedestrian		Bicyclist		Motorcycle rider		p-value
Upper extremity fracture	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	
Yes	26	3.24	52	6.49	36	4.49	5	0.62	14	1.74	0.071
No	211	26.31	239	29.80	133	16.58	23	2.87	63	7.86	
Lower extremity fracture	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	
Yes	24	2.99	27	3.37	50	6.23	4	0.50	26	3.24	<0.001
No	213	26.56	264	32.92	119	14.84	24	2.99	51	6.36	
Skull fracture	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	
Yes	7	0.87	7	0.87	13	1.62	3	0.37	15	1.87	<0.001
No	230	28.68	284	35.42	156	19.45	25	3.12	62	7.73	

Table 2. Continued

	In-vehicle driver		Passenger		Off-vehicle pedestrian		Bicyclist		Motorcycle rider		p-value
Rib fracture	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	
Yes	32	3.99	33	4.11	16	1.99	1	0.12	5	0.62	0.334
No	205	25.56	258	32.17	153	19.08	27	3.37	72	8.98	
Visceral organ injuries	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	
Yes	26	3.24	29	3.61	27	3.37	2	0.25	13	1.62	0.183
No	211	26.31	262	32.67	142	17.70	26	3.24	64	7.98	
Cerebral heamorrhage	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	
Yes	4	0.50	2	0.25	6	0.75	0	0.00	4	0.50	0.053
No	233	29.05	289	36.04	163	20.32	28	3.49	73	9.10	
Total	237	29.55	291	36.29	169	21.07	28	3.49	77	9.60	

Table 3. Distribution of bone fracture score according to traffic accident types

Mean		Bone fracture score					p-value[1]
		SD	Median	25th per	75th per		
Traffic accident	In-vehicle	3.47	1.62	3.00	2.00	5.00	0.023
	Off-vehicle	3.79	1.60	4.00	2.00	5.00	
	Motorcycle	4.13	1.62	4.00	3.00	6.00	

[1]Kruskal-wallis test, per: Percentile, SD: Standard deviation

Table 4. Distribution of ISS and NISS according to gender, age group, injury site, traffic accident, degree of forensic injuries.

		Injury Severity Score (ISS)					p-value[1]
		Mean	SD	Median	25th per	75th per	
Gender	Male	6.66	±8.57	4.00	1.00	9.00	0.600
	Female	5.97	±7.35	3.00	1.00	9.00	
Age group	0-10 years	5.88	±8.87	1.00	1.00	5.75	<0.001
	11-20years	8.06	±10.82	4.00	1.00	9.00	
	21-30 years	4.64	±5.72	2.00	1.00	6.00	
	31-40 years	4.27	±5.32	2.00	1.00	5.00	
	41-50 years	6.85	±7.20	4.00	1.00	9.00	
	51-60 years	7.66	±8.79	4.00	1.00	12.25	
	60 years and older	8.71	±9.50	4.50	1.00	13.00	
Injury site	Isolated head–neck	2.77	±3.88	1.00	1.00	4.00	<0.001
	Isolated Extremity	3.71	±4.23	1.00	1.00	4.00	
	Isolated chest-abdomen	6.58	±6.00	4.00	1.00	9.00	
	Multiple	11.12	±10.75	8.00	3.00	17.00	
Traffic accident	In-vehicle	5.23	±6.51	2.00	1.00	9.00	<0.001
	Off-vehicle	8.29	±10.17	4.00	1.00	9.50	
	Motorcycle	10.03	±10.94	8.00	2.50	13.50	
Degree of forensic injuries	Cured by simple medical intervention	1.34	±.60	1.00	1.00	2.00	<0.001
	Not cured by simple medical intervention	6.07	±4.40	4.00	4.00	9.00	
	Life-threatening	17.33	±10.32	13.00	9.00	22.00	

Table 4. Continued

		New Injury Severity Score (NISS)					p-value[2]
		Mean	SD	Median	25th per	75th per	
Gender	Male	8.80	±11.07	4.00	1.00	12.00	0.201
	Female	7.63	±9.76	3.00	1.00	10.00	
Age group	0-10 years	7.80	±12.22	2.00	1.00	7.50	<0.001
	11-20 years	10.27	±13.00	4.00	2.00	13.00	
	21-30 years	6.29	±8.34	3.00	1.00	9.00	
	31-40 years	5.87	±8.01	3.00	1.00	6.00	
	41-50 years	9.42	±10.04	5.00	2.00	12.50	
	51-60 years	9.77	±11.77	4.00	1.00	16.00	
	60 years and older	10.83	±11.21	8.00	2.00	17.00	
Injury site	Isolated head-neck	4.77	±8.34	1.00	1.00	4.00	<0.001
	Isolated extremity	4.78	±5.36	3.00	1.00	8.00	
	Isolated chest-abdomen	8.63	±8.09	8.00	1.00	12.75	
	Multiple	13.91	±13.45	10.00	3.00	22.00	
Traffic accident	In-vehicle	6.94	±9.11	3.00	1.00	9.00	<0.001
	Off-vehicle	10.39	±12.41	5.00	2.00	13.50	
	Motorcycle	13.67	±13.37	9.00	3.00	22.00	
Degree of forensic injuries	Cured by simple medical intervention	1.64	±0.83	1.00	1.00	2.00	<0.001
	Not cured by simple medical intervention	7.97	±5.83	6.00	4.00	12.00	
	Life-threatening	22.96	±12.78	22.00	13.00	27.00	

[1]Mann-Whitney U test, [2]Kruskal-wallis test, per: Percentile, SD: Standard deviation, ISS: Injury Severity Score, NISS: New Injury Severity Score

Table 5. Distribution of ISS and NISS according to degree of forensic injuries

		Injury Severity Score (ISS)					p-value[1]
		Mean	S.D.	Median	25th per	75th per	
Degree of forensic injuries	Cured by simple medical intervention	1.34	±0.60	1.00	1.00	2.00	<0.001
	Not cured by simple medical intervention	6.07	±4.40	4.00	4.00	9.00	
	Life-threatening	17.33	±10.32	13.00	9.00	22.00	
		New Injury Severity Score (NISS)					p-value[1]
		Mean	S.D.	Median	25th per	75th per	
Degree of forensic injuries	Cured by simple medical intervention	1.64	±0.83	1.00	1.00	2.00	<0.001
	Not cured by simple medical intervention	7.97	±5.83	6.00	4.00	12.00	
	Life-threatening	22.96	±12.78	22.00	13.00	27.00	

		Sensitivity (%)	Specifity (%)	Positive predictive value (%)	Negative predictive value (%)
ISS	Cut off : 8.5	92	86.6	65.9	97.5
NISS	Cut off: 9.5	86.4	87.2	61.4	98.3

[1]Kruskal-wallis test, per: Percentile, SD: Standard deviation

Discussion

In a study conducted in Korea, females (52.4%) constituted more than half of traffic accident injury cases (11). Males (78%) constituted the majority of the victims who presented at hospital due to traffic accidents in India (12) and in another study in Nepal, the majority of people injured in traffic accidents were male (13). According to research conducted in Türkiye, the majority of people injured in traffic accidents were male (1,14-17). In this study, the majority of the traffic accident victims (69.20%) were male, which was consistent with the literature.

In Helsinki, the mean age of seriously injured traffic accident victims was 44.3±20.2 years old (18). Traffic accident victims in Athens were most frequently in the 25-34 years age group (28.4%) (5) and in Ethiopia, mostly in the 20-29 age group (33.7%) (12). In a previous study in Türkiye, the mean age of traffic accident fatalities in Aydın was 44.39 years old, and they

were most frequently in the 21-30 years age group (16). Similarly, in this study, the mean age of the cases was 36.10±19.62 years old (min.:1, max.:90) and the most common age group was 21-30 years old (n=171, 21.30%).

In general, the most injured body parts due to traffic accidents are the extremities and the head (19). In a study conducted in Korea, major injuries were determined most frequently in the extremities (36.8%) and head (35.9%) (11). Yaşar and Büken (15) reported that traffic accident victims frequently suffered injuries in the extremities (43%) and head and neck region (30.22%). In a study involving 1,338 traffic accident victims, the most common injury sites were the extremities (45.9%) and head and neck region (53.1%) (14). In this study, 36.29% (n=291) of the cases had multiple site injuries, in line with the literature, extremity injuries were determined in 58.98% (n=473) and head-neck injuries in 46.23% (n=371).

In a study conducted in Singapore, the majority of traffic accident victims were motorcyclists (50.10%), pedestrians (21.80%), and cyclists (9.90%) (20). In Nepal, most traffic accident-related injuries appeared to motorcyclists and pedestrians (13). In Yemen, the most frequent injuries as a result of traffic accidents were invehicle passengers (38%) and pedestrians (32%) (21). In Helsinki, severely injured cases due to traffic accidents were most often the drivers or passengers (38.60%) (18). The previous study in Aydın, Türkiye, reported that traffic accident deaths were most frequent in pedestrians (32.90%) and motorcyclists (20.10%) (16). In this study, passengers (36.29%) and drivers (29.55%) were most frequently injured due to traffic accidents.

In Aydın, 13.5% of the cases who died as a result of traffic accidents had upper extremity fractures, 37.7% had rib fractures and, 34.8% had lower extremity bone fractures (16). In a study of 1338 traffic accident cases, 7.62% of the cases (n=102) had extremity fractures, 2.16% (n=29) had rib fractures, 1.35% (n=18) had intracranial hemorrhage, and 0.90% (n=12) had skull fractures (14). In another study involving 1567 cases, 6.2% of the cases (n=99) had lower extremity fractures, %6 (n=95) had upper extremity fractures, 3.8% (n=60) had rib fractures, 3.5% (n=56) had skull fractures, 2.7% (n=43) had lung contusion, 2.4% (n=39) had intracranial haemorrhage (22). In this study, upper extremity fractures were determined in 16.58% (n=133) of the cases, followed by lower extremity fractures in 16.33% (n=131), skull bone fractures in 5.60% (n=45), rib fractures in 10.83% (n=87), internal organ injury in 12.09% (n=97), and cerebral haemorrhage (epidural, subdural, etc.) in 2% (n=16). Skull fractures were more common in motorcycle-related traffic accidents in Athens (5). The development of skull fractures varied greatly among the cases in this study, with motorcycle riders having a much greater incidence of both skull and lower extremities fractures. Moreover, motorcycle accident victims had more severe bone trauma than in-vehicle accident victims.

Among the victims of traffic accident injuries in Athens, only 29.80% of motorcycle drivers and only 5.70% of motorcycle passengers wore helmets, while 26.30% of automobile drivers and only 14.10% of automobile passengers wore seat belts (5). In a study conducted in Yemen, none of the traffic accident victims wore a seat belt or helmet (21). While 84.50% of motorcycle accident victims in Iran were not using a helmet, 77.20% did not have a driver's licence (23). Aygencel et al. (17) reported that 93.10% of cases presenting at the emergency service due to traffic accidents were not wearing seat belts. In this study, seat belts were not buckled up in 62.30% (329/528) of the in-vehicle traffic accident cases and in 71.43% (55/77) of motorcycle accident cases, helmets and safety gear were not available. While it is legally required in Türkiye for motorcyclists to wear helmets and for drivers and passengers to buckle up, the evidence gathered for this study indicates that society does not enforce these laws. Therefore, there is a clear need for the provision of public education and for traffic checks to be increased to ensure the use of helmets and seat belts.

Atik et al. (24) reported that the mean ISS value of 453 traffic accident victims aged 0-17 years was 3.32±3.76. The median ISS value of 1,063 traffic accident victims in Helsinki was 22, and the median NISS score was 27 (18). In an another study (25) of 162,695 traffic accident victims, the average ISS value was eight. In this study, the mean ISS value was 6.45±8.22, and the mean NISS value was 8.44±10.69. Kong et al. (26) demonstrated that the incidence of serious injury in small motor vehicle accidents was 1.6 times higher in elderly patients than in non-elderly. In a study conducted in Korea, there was a significant difference between age groups and ISS in adult traffic accident cases, and the ISS values increased after the age of 40 years (11). In this study, a significant difference was noted in injury severity across various age groups. Cases aged ≥60 years were determined with significantly more severe trauma than those aged <10 years age and in the 21-30 and 31-40 years age groups. In addition, it is noteworthy that the ISS and NISS values increased with age after 30 years, which may be related to the fact that people are more fragile with age and thus suffer more severe injuries.

Varlık et al. (14) reported that the males mortality rate was higher in traffic accidents. Atik et al. (24) discovered no statistically significant variation in ISS across genders among children who sustained injuries from traffic incidents. Mogaka et al. (27) also reported no discrepancy in the severity of injuries between male and female traffic accident cases. In this study, there was no remarkable difference among gender in terms of ISS and NISS values.

Dirlik et al. (16) reported that the leading cause of death due to traffic accidents was multiple injuries (44.3%). In this study, the ISS and NISS values of the cases with multiple injuries were significantly higher (Table 4).

In Helsinki, of cases with serious traffic accident injuries, the highest NISS values were determined in pedestrians, followed by cyclists, motorcyclists, and motor vehicle passengers (18). Mogaka et al. (27) reported that unprotected road users (pedestrians and two-wheelers) had a significantly higher median ISS value than those injured inside vehicles. In this study, motorcycle and off-vehicle traffic accidents had significantly higher ISS and NISS values (Table 4).

Bilgin et al. (28) demonstrated that evaluation of injury severity using the ISS was a useful method for distinguishing between life-threatening and non-life-threatening conditions. According to Fedakar et al. (29) the ISS and NISS may be used to identify life-threatening injuries stated in the Turkish Penal Code, and those were more effective in proving them than the Glasgow Coma Scale, revised trauma score, and trauma and injury score. In this study, the ISS and NISS values escalated with an increasing extent of forensic trauma and an ISS value >8.5 (sensitivity: 92%, specificity: 86.6%) and NISS >9.5 (sensitivity: 86.4%, specificity: 87.2%). These values may be useful in defining life-threatening parameters. The ISS and NISS can be employed to ascertain whether a life-threatening situation is present, particularly in instances where the guidelines applied in Türkiye are inadequate.

Study Limitations

This study had some limitations. First, it was prepared retrospectively, conducted in a single clinic, and only included forensic cases. Therefore, it cannot be said that it represents the entire trauma population resulting from traffic accidents. The study included cases that had survived the traffic accident, not the individuals who died after the traffic accident. Therefore, while the results provide information about the severity of trauma in traffic accident injuries, they cannot provide information about the mortality rate.

Conclusion

The consequences of this study demonstrated that among the victims of traffic accidents, those who had out-of-vehicle and motorcycle accidents were exposed to more severe trauma. Motorcyclists had a higher incidence of skull and lower extremity fractures and more severe bone fractures. We found that the majority of the victims did not use seat belts, helmets and safety gear. Therefore, there is a need to increase social education and advertisements, road safety policies should be re-evaluated, and seat belt and helmet checks in traffic should be increased to ensure seat belts, helmets and safety gear use. The ISS and NISS can be considered a useful evaluation method in traffic accident injuries to determine both the life-threatening injuries and simple medical interventions specified in the Turkish Penal Code.

Ethics

Ethics Committee Approval: Approval for the study was granted by the Clinical Research Ethics Committee of Bolu Abant İzzet Baysal University (decision no: 2022/105, dated: 26.04.2022).

Informed Consent: Did not establish an informed consent form because our study was designed retrospectively.

Footnotes

Authorship Contributions

Surgical and Medical Practices: E.H., Z.Z.E., A.Y., Concept: E.H., Z.Z.E., E.Ş., Design: E.H., Z.Z.E., A.Y., Data Collection or Processing: E.H., Z.Z.E., E.Ş., Analysis or Interpretation: E.H., Z.Z.E., A.Y., E.Ş., Literature Search: E.H., Z.Z.E., A.Y., E.Ş., Writing: E.H., Z.Z.E.

Conflict of Interest: No conflict of interest was declared by the authors.

Financial Disclosure: The authors declared that this study received no financial support.

References

1. Caglayan C, Hamzaoglu O, Yavuz CI, Yüksel S. Traffic accidents resulting in death and injury on an international road passing through a city in Kocaeli, Türkiye. Arch Environ Occup Health. 2010;65:59-64.
2. Ernstberger A, Joeris A, Daigl M, Kiss M, Angerpointner K, Nerlich M, et al. Decrease of morbidity in road traffic accidents in a high income country - an analysis of 24,405 accidents in a 21 year period. Injury. 2015;46 Suppl 4:S135-43.
3. Turkish Statistical Institute. Road Traffic Accident Statistics, 2020. Turkish Statistical Institute, 25 May 2021, https://data.tuik.gov.tr/Bulten/Index?p=Road-Traffic-Accident-Statistics-2020-37436&dil=2. Accessed 5 May 2023.
4. Qirjako G, Burazeri G, Hysa B, Roshi E. Factors associated with fatal traffic accidents in Tirana, Albania: cross-sectional study. Croat Med J. 2008;49:734-40.
5. Pikoulis E, Filias V, Pikoulis N, Daskalakis P, Avgerinos ED, Tavernarakis G, et al. Patterns of injuries and motor-vehicle traffic accidents in Athens. Int J Inj Contr Saf Promot. 2006;13:190-3.
6. Deng Q, Tang B, Xue C, Liu Y, Liu X, Lv Y, et al. Comparison of the ability to predict mortality between the ınjury severity score and the new injury severity score: a meta-analysis. Int J Environ Res Public Health. 2016;13:825.
7. Loftis KL, Price J, Gillich PJ. Evolution of the Abbreviated Injury Scale: 1990-2015. Traffic Inj Prev. 2018;19:109-13.
8. Dehouche N. The injury severity score: an operations perspective. BMC Med Res Methodol. 2022;22:48.
9. Javali RH, Krishnamoorthy, Patil A, Srinivasarangan M, Suraj S. Comparison of injury severity score, new injury severity score, revised trauma score and trauma and injury severity score for mortality prediction in elderly trauma patients. Indian J Crit Care Med. 2019;23:73-7.
10. Li H, Ma YF. New injury severity score (NISS) outperforms injury severity score (ISS) in the evaluation of severe blunt trauma patients. Chin J Traumatol. 2021;24:261-5.
11. Lee HY, Youk H, Ii Lee J, Kang CY, Kong JS, Sung S, et al. Injury analysis of patients according to impact patterns involved in pedestrian traffic crashes. Traffic Inj Prev. 2018;19:153-7.
12. Jha R, Pathak P, Koirala P, Maharjan B, Panthi S. Road traffic accidents presenting to the emergency department of a tertiary care center: a descriptive cross-sectional study. JNMA J Nepal Med Assoc. 2021;59:1081-5.
13. Karkee R, Lee AH. Epidemiology of road traffic injuries in Nepal, 2001-2013: systematic review and secondary data analysis. BMJ Open. 2016;6:e010757.

14. Varlık M, Eroğlu SE, Özdemir S, Kahraman HA, Yıldız MN, Bozan Ö. Evaluation of patients who applied to the emergency department by intra-vehicle traffic accident. Fırat Med J. 2019;24:186-92.
15. Yaşar ZF, Büken B. Examination of forensic cases that are consulted to the Başkent University Ankara Hospital because of traffic accident. Bull Leg Med. 2015;20:132-7.
16. Dirlik M, Bostancıoğlu BÇ, Elbek T, Korkmaz B, Çallak Kallem F, Gün B. Features of the traffic accidents happened in the province of Aydın between 2005 and 2011. Turk J Trauma Emerg Surg. 2014;20:353-8.
17. Aygencel G, Karamercan M, Ergin M, Telatar G. Review of traffic accident cases presenting to an adult emergency service in Turkey. J Forensic Leg Med. 2008;15:1-6.
18. Airaksinen NK, Handolin LE, Heinänen MT. Severe traffic injuries in the Helsinki trauma registry between 2009-2018. Injury. 2020;51:2946-52.
19. Calil AM, Sallum EA, Domingues Cde A, Nogueira Lde S. Mapping injuries in traffic accident victims: A literature review. Rev Lat Am Enfermagem. 2009;17:120-5.
20. Wee CPJ, He DX, Win W, Ong MEH. Geospatial analysis of severe road traffic accidents in Singapore in 2013-2014. Singapore Med J. 2021;62:353-8.
21. Alfalahi E, Assabri A, Khader Y. Pattern of road traffic injuries in Yemen: a hospital-based study. Pan Afr Med J. 2018;29:145.
22. Alpaslan M, Baykan N. Retrospective analysis of traffic accidents related injuries in a tourism region. Arch Curr Med Res. 2023;4:123-30.
23. Yadollahi M, Jamali B. Severity and injury characteristics among matched hospitalized motorcycle drivers and their passengers. Chin J Traumatol. 2019;22:223-7.
24. Atik D, Cander B, Dikmetaş C, Bulut B, Sert E, Kaya H, et al. Evaluation of accident types and trauma scores in pediatric patients admitted with traffic accident. J Uludag University Med Fac. 2020;46:47-52.
25. Monchal T, Ndiaye A, Gadegbeku B, Javouhey E, Monneuse O. Abdominopelvic injuries due to road traffic accidents: characteristics in a registry of 162,695 victims. Traffic Inj Prev. 2018;19:529-34.
26. Kong JS, Hyun Kim O, Youk H, Youk H, Young Lee H, Young Kang C, et al. Analysis of injury mechanism of the elderly and non-elderly groups in minor motor vehicle accidents. Traffic Inj Prev. 2018;19:151-3.
27. Mogaka EO, Ng'ang'a Z, Oundo J, Omolo J, Luman E. Factors associated with severity of road traffic injuries, Thika, Kenya. Pan Afr Med J. 2011;8:20.
28. Bilgin NG, Mert E, Camdeviren H. The usefulness of trauma scores in determining the life threatening condition of trauma victims for writing medical-legal reports. Emerg Med J. 2005;22:783-7.
29. Fedakar R, Aydiner AH, Ercan I. A comparison of "life threatening injury" concept in the Turkish Penal Code and trauma scoring systems. Ulus Travma Acil Cerrahi Derg. 2007;13:192-8.