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Original Article

Examination of Emergency Department Patients Involved in E-Scooter Related Accidents

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ABSTRACT

Objective: The recent increased use of electric scooters (E-scooter) in daily life has generated a great deal of discussion involving various areas, such as infrastructure problems, legal issues, and rider safety. This study aimed to manage the analysis of the clinical and demographic characteristics of patients who were admitted to emergency departments due to e-scooter accidents, especially during post-legal regulations in Turkey.

Methods: The study is conducted as cross-sectional and descriptive research. The notice, data, and documents of the patients included in the study were scanned retrospectively, after which certain measurements were performed, such as the Injury Severity Score (ISS), Abbreviated Injury Scale (AIS), Trauma and Injury Severity Score (TRISS), and Pediatric Trauma Score (PTS) for children aged 15 years or under.

Results: The age of the patients included in this study varies from 5 to 76 years, with a mean age of 27.20±11.90 years. When the injury regions of the patients were examined, the results were revealed as follows: 49.6% (n=58) to the upper extremities, 45.3% (n=53) to the lower extremities, 35.0% (n=41) to the head/face, 8.5% 9% (n=10) to the thorax, 0.9% (n=1) to the cervical vertebra, and 0.9% (n=1) to the thoracic vertebra. Considering the correlation between age, hospital admission time, and accident rates in the accidents with trauma scores, no statistically significant association was found between age and AIS ($p>0.05$) or ISS ($p>0.05$), and a statistically significant negative correlation of 45.2% was found between age and TRISS ($p=0.001$; $p<0.01$).

Conclusion: Although it is revealed that E-scooter accidents lead to minor injuries to patients, the use is outside the target audience, causing injury due to mechanical deficiencies and noncompliance with legal rules.

INTRODUCTION

The electric scooter (E-scooter) was first introduced in the USA as a new means of short-distance transportation countrywide at the end of 2017. In Turkey, it was produced by a private company in 2019 before being presented to the public. The system that is connected with a mobile application is worked through a matching code to the E-scooter, which can be downloaded for free on IOS and Android operating systems on smartphones (Fig. 1).

Currently, there are five different E-scooter rental companies in Turkey. The system, which initially only served Istanbul, was operated in the capital city Ankara in February 2020 and is in use in nine provinces now. In recent years, apart from its recreational usage, it has also come to the fore in "short distance transportation." Although it has clear advantages, especially in dense traffic, it has also increased use-related accidents.[1]

In the latest regulations applicable in Turkey, it is stated that anyone over the age of 15 years, who has signed the mobile application contract, can ride E-scooters. Moreover, the use of protective equipment for riding has been given "totally" to the responsibility of the rider, emphasizing meeting traffic rules.[2] Interestingly, E-scooters are defined as "vehicles" in the mobile application contract framed by the rental companies; however, there are no regulations in this contract as there are for many such vehicles in the country, such as E-motorbikes. Although E-scooters have been used in Turkey since 2019, legal regulations were only declared in April 2021.[3]

Figure 1. E-scooters available in many different designs and colours.

Additionally, the E-scooter usage should be easily noticeable by other vehicle riders and pedestrians at night, with a headlight that will show white light at the front and illuminate at least 20 m forward, a lamp with a red light at the rear, and a red reflector, which can be seen from a distance of 30 m. In addition, it must be equipped with a bell, horn, or similar sound device that can make a sound.

The popularity of E-scooters has increased in Turkey as well as in other parts of the world, becoming a widely used means of transportation. Therefore, E-scooter accidents have increased and become a frequent reason for admission to emergency departments.[4]

The primary aim of this study, as endorsed in the above section, is to perform a retrospective analysis of the clinical and demographic characteristics of patients who were admitted to an emergency department due to an E-scooter accident. In this analysis, the correlation of the Abbreviated Injury Scale (AIS), Injury Severity Score (ISS), Trauma and Injury Severity Score (TRISS), and the Pediatric Trauma Score (PTS), which are commonly used in trauma patients, with patient demographic data and the occurrence of the accident will be determined. Moreover, the adequacy of the new legal regulations on the subject will be discussed.

MATERIALS AND METHODS

After obtaining approval from the local ethics committee of our hospital (Date: August 25, 2021, Protocol no.: 2021/514/208/14), the study was designed retrospectively as cross-sectional and descriptive research. A total of 117 patients who were admitted to the emergency trauma department of Dr. Lutfi Kirdar City Hospital in the Kartal district of Istanbul between June 1, 2021, and March 1, 2022, with complaints of E-scooter-related injuries, were included in the study. The aforementioned hospital is one of the major trauma and disaster centers on the Anatolian side in Istanbul and is 5 min away from a road used by vehicles next to a beach. The hospital has a bed capacity of 1195 and includes 24 clinics and 51 branches (operating in 16 different buildings and 5 different districts). The study was carried out from the third month after the legal regulations regarding E-scooters were declared.[3] First, the demographic data of the patients, mechanisms of injury, and prognosis were examined. After this, patient data were scanned through the electronic patient record management system (HIMS); the reports, documents, and images of the patients were evaluated and included in the study. While the patients were evaluated by two emergency medical specialists, ISS and AIS were measured according to the scaling system for organ-specific injuries guideline of the American Association for the Surgery of Trauma. The TRISS was measured with the TRISS Calculator-MDApp, and in addition, the PTS was measured for children aged 15 years and under.[5–7]

Statistical analysis

IBM SPSS Statics 26 (Chicago, IL) software was utilized for the statistical analysis. Normally distributed data were defined by mean and SD. Medians and interquartile ranges (IQRs) were employed to represent data that did not fit the normal distribution. Pearson's correlation analysis was used for normally distributed data, and Spearman's rho correlation analysis was used for nonnormally distributed data to determine the relationship between measurements. The significance was considered as $p<0.01$ and $p<0.5$.

RESULTS

The demographic data of the patients included in the study were examined; 35.9% (n=42) of the patients were females and 64.1% (n=75) were males. Their ages ranged from 5 to 76 years, with a mean age of 27.20±11.90 years, of which 13.7% (n=16) were 15 years old and under, and 86.3% (n=101) were 16 years old and over. The percentage distribution of accident days was as follows: Monday, 6.8% (n=8); Tuesday, 18.8% (n=22); Wednesday, 12.8% (n=15); Thursday, 14.5% (n=17); Friday 5.1% (n=6); Saturday, 29.2% (n=34); and Sunday, 12.8% (n=15). The patients who were admitted to the emergency department included 98.3% (n=115) outpatients and 1.7% (n=2) ambulances; none of these patients had been using alcohol. X-rays were requested for 23.3% of the patients, CT for 38.5%, USG for 1.7%, and blood examination (complete blood count, biochemistry parameters, and any coagulation parameters) for 3.4%, but MRI was not requested for any of them.

There were two types of victims involved in the accidents, as mentioned in the above section, of which 96.6% (n=113) were riders, and 3.4% (n=4) were passengers carried behind the rider on the E-scooters. When the accident dates were analyzed, it was determined that 41.9% (n=49) of the accidents had occurred at weekends, and 58.1% (n=68) were on weekdays; no protective equipment had been worn by the injured. Furthermore, it was revealed that 85.5% (n=100) of the accidents occurred on the beach, 6.0% (n=7) on the pavement, and 2.6% (n=3) in other places. Additionally, the speeds of the E-scooters had varied from 10 to 30 km/h, with the average being 24.36±6.28 prior to the accidents.

When the injury regions of the patients were examined, the results were revealed as follows: 49.6% (n=58) were

to the upper extremity; 45.3% (n=53) to the lower extremity; 35.0% (n=41) to the head/face; 8.5%–9% (n=10) to the thorax; 0.9% (n=1) to the cervical vertebra; and 0.9% (n=1) to the thoracic vertebra. Other details and percentages seen in these patients were calculated as follows: 4.3% (n=5) lower extremity fracture; 9.4% (n=11) upper extremity fracture; and 1.8% (n=2) dental fracture. Pelvic fracture or spinal fracture were not observed in any of the patients. While 91.5% (n=107) of the patients had no head injury, 7.7% (n=9) of them had soft tissue injury to the head, and 0.9% (n=1) of had intracranial bleeding.

It was detected that 13.7% of the patients (n=16) had a facial contusion, while 13.7% of them (n=16) had a facial laceration and 0.9% of them (n=1) had a facial fracture; 71.8% of the patients had no facial injury (n=84). Of the patients, 93.2% of them had no thoracic halving (n=109), 6.0% (n=7) had soft tissue injury due to thoracic injury, and 0.9% (n=1) suffered rib fracturing. In addition, 99.1% (n=116) of all of the patients had no abdominal injury, while 0.9% (n=1) had blunt abdominal trauma (Table 1).

When the consultations requested from other branches are evaluated in the emergency department management of the patients, consultation from any branch was not requested for 51.3% (n=60) of the patients. However, consultation was requested for orthopedics at 36.8% (n=43); neurosurgery for 4.3% (n=5); plastic and reconstructive surgery for 3.4% (n=4); otolaryngology (ENT) for 3.4% (n=4); and other branches for 0.9% (n=1). The rest of the period advised by the physicians for the patients to rest at home after their treatment varied between zero and 30 days, with an average of 3.35±6.61 days.

When the hospitalization status of the patients was evaluated, 96.6% (n=113) of the patients were discharged, and 3.4% (n=4) of them were hospitalized. With regard to the treatment applied to patients in the emergency department who were evaluated, 67.5% (n=79) received simple medical intervention (BTM), 13.7% (n=16) received primary incision suturing, 12.0% (n=14) splint, 4.3% (n=5) circular cast, and 2.6% (n=3) underwent surgical treatment.

Trauma scores were calculated in the patients after the emergency department phase. The AIS scores of the patients ranged from 1 to 3, with a mean of 1.32±0.57, while the ISS scores ranged from 1 to 11, with a mean of 2.52±2.15. The TRISS scores ranged from 98.18 to 99.70, with a mean of 99.64±0.24 (Table 2).

The correlation between age, hospital admission time, and accident rate in E-scooter accidents resulted in no statistically significant correlation between age and the AIS score ($p>0.05$) and the ISS score ($p>0.05$). However, a statistically significant negative correlation was found between age and the TRISS score at the level of 45.2% ($p=0.001$; $p<0.01$).

No statistically significant correlation was found between accident rate and the AIS score, ISS score, and TRISS score ($p>0.05$). In addition, no statistically significant correlation was found between the time of admission and the AIS score, ISS score, and TRISS score ($p>0.05$) (Table 3).

Table 1. Injury regions and types of injuries of the patients admitted to the emergency department after an E-scooter accident

Injury regions	Types of injuries	Yes (+)/ no (–)	n	%
Lower extremity	Fracture	+	112	95.7
		–	5	4.3
Upper extremity	Fracture	+	11	9.4
		–	106	90.6
Pelvic region	Fracture	–	117	100.0
Spinal region	Fracture	–	117	100.0
Dental	Fracture	–	115	98.3
		+	2	1.7
Head	Trauma	–	107	91.5
	Soft tissue injury	+	9	7.7
	Intracranial bleeding	+	1	0.9
Face	No trauma	–	84	71.8
	Contusion	+	16	13.7
	Laceration	+	16	13.7
	Fracture	+	1	0.9
Thorax	Soft tissue injury	+	7	6.0
	Fracture	+	1	0.8
	No	–	109	93.2
Abdomen	Trauma	+	1	0.9
		–	116	99.1

Table 2. Calculated trauma scores of the patients admitted to the emergency department due to an E-scooter accident

Trauma score	Mean±SD	Min–max (median)
AIS score	1.32±0.57	1–3 (1)
ISS score	2.52±2.15	1–11 (2)
TRISS score	99.64±0.24	98.18–99.70 (9.7)

AIS: Abbreviated Injury Scale; ISS: Injury Severity Score; TRISS: Trauma and Injury Severity Score; SD: Standard deviation.

Table 3. Correlation between age, hospital admission time, and accident rate in E-scooter accidents

		Age	Speed of the accident (km/h)	Admission time
AIS score	r	0.097	0.107	–0.017
	p	0.297	0.252	0.855
ISS score	r	0.102	0.150	–0.041
	p	0.274	0.107	0.663
TRISS score	r	–0.452*	–0.066	0.024
	p	0.000	0.480	0.800

r=Pearson's correlation. *P<0.01. AIS: Abbreviated Injury Scale; ISS: Injury Severity Score; TRISS: Trauma and Injury Severity Score.

It was seen that patients aged 15 years and younger included in the study constituted 13.7% (n=16) of the total number. The correlation of PTS values applied to this patient group with age was examined, and no statistically significant correlation was found between age and the PTS score ($p>0.05$, $p=0.110$, $r=0.464$ [Spearman's rho correlation]).

DISCUSSION

E-scooters can easily be rented without the requirement to purchase, and their use has become widespread, with the number of traumas related to E-scooters subsequently increasing. The 100% increase in the market share of E-scooters in one year, from 2018 to 2019, is one of the most important data showing that the use of these scooters has become widespread.[8] However, the infrastructure and rider issues are still unclear.

In previous studies, it can be seen that patients with E-scooter-related accidents were in their thirties, similar to this study.[9] Although the usage age in Turkey must be over 15 years according to the regulations, it was observed in this study that even 5-year-old children have been injured in these accidents.[3] The usage age for E-scooters differs from one country to another (for instance, it is 12 years in France, 14 years in Germany, and 16 years in the Netherlands).[10] In our study, it was concluded that the PTS calculated in children in the group of 15 years and below has not been correlated with age, and mild trauma cases were detected with higher PTS values. Despite this, the 14% rate of usage by individuals who are legally prohibited due to their age is one of the first reasons why the introduction of additional measures and inspections are required.

It can be seen that E-scooter-related accidents increase at weekends and in seaside areas. The reason for this could be the fact that people generally go to the seaside to socialize, especially at weekends. In addition, the safest place to ride an E-scooter is around the hospital, which is in a seaside area.[3] This outcome is considered to be a legal compliance indicator. In fact, a significant advantage emerges here. The frequency of accidents in certain areas, especially during a certain time of the week, reveals the necessity of useful measures and inspections in that area while facilitating existing inspections.

Although most of the patients are E-scooter riders, it was also noted that two people were often together on one such vehicle, even though E-scooters are designed for one person to ride, and it is prohibited to have a passenger. [3] This supports the idea that the legal regulations were inadequate, and it is necessary to carry out campaigns and inspections to prevent injuries caused by E-scooter accidents.

Another significant conclusion of our study relates to the aforementioned patients who had not worn protective equipment. User manuals or legal regulations for protective equipment are provided only for the user's consideration. Moreover, in the literature studies, which compare E-scooters with bicycles, it is reported that even the simplest protective measure, wearing headgear, is more common in bicycle usage, while it is almost absent with the E-scooter.[10]

Considering that the accident sites are predominantly pedestrian sidewalks or main streets, the use of E-scooters in these sites poses risks for traffic and pedestrians, creating risks that may increase the severity of the accident for riders.

Consistent with the literature, in this study, the most injured regions in E-scooter accidents were the lower and upper extremities, fractures being most common in the upper extremity.[11] In injuries related to vehicles with similar rules in traffic or E-scooter usage such as MTV (motorized two-wheeled vehicle) presented in the literature, the most common extremity injuries and the most severely damaged areas are similar in most recently conducted studies. This shows that protective equipment should be recommended and used, especially for E-scooter riders, and that it should protect vulnerable body areas. This reveals the necessity of implementing and monitoring the measures introduced in many similar items of legislation.[12]

E-scooter accidents, as shown in this study, often result in head and facial injuries and can be severe, while abdominal and thoracic injuries are less common. This result actually reveals the need to wear protective headgear for safer usage of the E-scooter.

A study conducted by Fedakar et al.,[13] for a similar population in Turkey on patients admitted to an emergency department due to trauma, has evaluated the injuries of patients with an ISS score age of 14 years and above as "life-threatening injuries." Although most of the patients were treated with BTM, serious accidents, such as intracranial bleeding, are also observed. One significant outcome of the study is that the age correlation of trauma scores pointing to the severity of the accident, especially with young E-scooter accident victims, was only correlated with the TRISS score, whereas the time of admission and the speed of the accident were not correlated with trauma scores.

However, it was revealed that both the PTS performed in the pediatric patient group and the AIS and ISS performed for adult patient traumas were not correlated with age in the E-scooter accidents. Similarly, in the E-scooter accidents, the trauma score of the patients was found to be lower, and no fatal accident was detected. However, it should not be thought that, because of the nonfatal nature of the accidents, the disabilities that develop in the patients do not deprive them of their work, school, and social lives.

CONCLUSION

It is clear that E-scooters are no longer vehicles for personal use and entertainment, having become popular through the attraction of national rental companies as an alternative to traffic, through simple and uncontrolled

rental. As it is a fast-growing sector that lacks infrastructure, there is a requirement to train society at an early stage, thereby raising awareness, implementation, and supervision of the legal regulations.

Ethics Committee Approval

This study approved by the Kartal Dr. Lütfi Kırdar City Hospital Clinical Research Ethics Committee (Date: 25.08.2021, Decision No: 2021/514/208/14).

Informed Consent

Retrospective study.

Peer-review

Internally peer-reviewed.

Authorship Contributions

Concept: S.Y., G.A., İ.U.; Design: S.Y., G.A., İ.U., M.K., M.K.E.; Supervision: M.K., M.K.E.; Fundings: S.Y., G.A., M.K.E.; Data: S.Y., G.A., İ.U.; Analysis: S.Y., G.A., İ.U., M.K., M.K.E.; Literature search: S.Y., M.K., İ.U.; Writing: S.Y., G.A., İ.U.; Critical revision: S.Y., G.A., İ.U., M.K., M.K.E.

Conflict of Interest

None declared.

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Elektrikli Mobilet (Scooter) Kazaları Nedeniyle Acil Servise Başvuran Hastalarının İncelenmesi

Amaç: Son yıllarda, elektrikli mobiletler-scooter (E-mobilet) sosyal hayatımız içerisine hızlı bir giriş yapmış olsa da altyapı sorunları, hukuki sorunlar ve kullanıcı güvenliği açısından birçok yeni sorun ortaya çıkarmıştır. Bu araştırmanın amacı, E-mobilet kazası nedeniyle acil servise (AS) başvuran hastaların klinik ve demografik özelliklerinin retrospektif analizini gerçekleştirmek, travma skorları ile korelasyonunu değerlendirmek ve E-mobilet ile ilgili yeni yapılan yasal düzenlemelerin yeterliliğini analiz etmektir.

Gereç ve Yöntem: Çalışmamız, enine kesitli tanımlayıcı bir çalışmadır. Çalışmaya alınan hastaların bilgileri, doküman ve belgeler geriye dönük olarak değerlendirildi, hastaların The Injury Severity Score (ISS), Abbreviated Injury Scale (AIS), Trauma Injury Severity Score (TRISS) ve 15 yaş ve altı çocuklar için Pediatric Trauma Score (PTS) hesaplandı.

Bulgular: E-mobilet kazası nedeniyle AS'ye başvuran hastaların yaş ortalaması 27.20±11.90'dir. Kazaların %41.9'u (n=49) hafta sonu gerçekleşmiş iken, %48.1'i (n=63) ise hafta içi gerçekleşmiştir. Başvuranların hiçbirinde koruyucu ekipman kullanımı görülmemiştir. E-mobilet ile kaza yapanların %96.6'sı (n=113) sürücü, %3.4'ü (n=4) ise sürücünün arka tarafına binen yolcudur. Kaza yerleri incelendiğinde ise; %85.5'i (n=100) sahilde, %6'sı (n=7) caddede, %3.4'ü (n=4) yolda, %2.6'sı (n=3) kaldırımda, %2.6'sı (n=3) ise diğer yerlede meydana gelmiştir. Kaza öncesinde E-mobilet hızları 10 ile 30 km/saat değişmekte olup; hız ortalaması, 24.36±6.28'dir. Hastaların yaralanma bölgeleri incelendiğinde %49.6'sının (n=58) üst ekstremite, %45.3'ünün (n=53) alt ekstremite, %35'inin (n=41) kafa/yüz, %8.5'inin %9'unun (n=10) toraks, %0.9'unun (n=1) servikal vertebra, %0.9'unun (n=1) torakal vertebra yaralanması mevcuttur. E-mobilet kazalarında yaş, hastane başvuru saati ve kaza hızlarının travma skorları ile arasındaki korelasyona bakıldığında; yaş ile AİS skoru ($p>0.05$) ve ISS skoru ($p>0.05$) arasında istatistiksel olarak anlamlı ilişki bulunamamış ve yaş ile TRISS skoru arasında negatif yönlü %45.2 düzeyinde istatistiksel olarak anlamlı ilişki bulunmuştur ($p=0,001$; $p<0.01$).

Sonuç: E-mobilet kazalarının hastalar üzerinde hafif yaralanmalara sebep olduğu görülse de teknik alt yapıdaki eksiklikler ve yasal kurallara uyulmaması nedeniyle hedef kitle dışında da kullanılmakta ve hasarlara neden olduğu görülmüştür.

Anahtar Sözcükler: Acil servis; elektrikli mobilet; travma; travma skoru.