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Review Article

Analysis and Assessment of Injuries Resulting from Electric Scooter - A Review Article

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Abstract

We have noted the changing patterns of injuries which are resulting from the usage of electric scooters, since its introduction since 2014 it has gained popularity both because of its ease and its low economic burden, this had led to a surge in its usage which range between 4 years to 74 years, this wide age group in usage have resulted in a varied patterns of injuries which we have evaluated and discussed in this paper we have noted that the Head injuries are commonest followed by Upper Limb injuries, the risk of serious intra-abdominal injuries are on a high as the speed of these vehicles have increased leading to an acceleration and deceleration pattern of trauma.

We have noted that with increasing age group and with more patients on anticoagulant therapy the complexity of trauma increases, the higher risk of rib fracture, liver lacerations and splenic injuries are on an increase and it is a matter of concerns as most of these vehicles operate on the pavements which increases the risk of injury to the pedestrians infact there are studies which have documented the increasing number of susceptible pedestrians.

We at our center at ASPH which is a tertiary frame unit for the region have been referred with patients around the region with an atypical tibial plateau fracture in younger age groups which we mostly see in high-speed road accidents, this has led to a higher number of circular frame surgeries in our unit.

Keywords: E Scooter; Injuries; UK legal issues

Introduction

The injury paradigm in e-scooters have shifted so rapidly that there was an urgent need for a literature review and assessing the various parameters which make the pattern of injury unique and exclusive as this was a prospective observational study and literature review no ethical approval was required.

There was a 77% rise in number injuries caused by e scooters for 2016 to 2017 compared to the time between 2013 to 2015 [4]. Compared with other modes of transport, number of patients visiting emergency department due to E scooter injuries are more [5]. Since there are no specific laws for this, there is no age restrictions.

The most common age group using this mode of transport is from 15 to 24. But surprisingly some articles have also recorded incidence of ED visits of patients less than 14 years with E scooter injuries [6]. Most common injuries associated with this is head injuries followed by orthopaedic injuries. Majority of them requiring either surgical interventions or prolonged hospital stays [3]. Rise in the number of cases and injury to the riders as well as other people can be attributed to unsafe riding practises like not using helmets and lack of protective gear, lack of balance, co-ordination and delayed reaction time both in very young and elderly age group predispose them to risk, use of recreational drugs, alcohol intoxication and riding on the pavement which is illegal [1-3].

Methodology

To do a Literature review on the topic to analyse the global impact of E-scooters throughout the world from 2017.

A thorough literature search has been done on different search engines like PubMed, google scholar Scopus and web of sciences. The abstract of the articles was reviewed manually by the authors and the appropriate articles were selected for the review process.

Inclusion criteria

All the studies published related to the topic after 2017 were taken into consideration to make sure that the latest numbers are included.

Only studies related to Electric scooter related injuries around the globe is included for the purpose of study. Original articles were used for the purpose of review.

Exclusion criteria

Case reports and research letters were excluded from the review process.

Review process

19 articles were chosen for the review process. Abstracts of these articles were reviewed by the authors and have gone through the full text. Further 6 more articles were excluded from the study because the data was not complete and some of them were case reports and research letters. The data from the 13 articles were extracted on an excel sheet and analysed.

Results

In UK the legal age of driving is from 18 years of age. Even riding E scooter requires a category Q driving licence to use it in the permitted public roads. Study conducted by Trivedi., *et al.* showed that out of 249 reported scooter injuries 61% of patients were in the age group between 18 to 40. Surprisingly the age range of patients extend from 8 to 89 among that 10.8% were younger than 18 years of age [3]. Similarly, a study conducted by Moftakhar., *et al.* contains patients who visited ED due to e scooter injuries ranged from 4-74 years. But it is seen that the injuries were more severe in those above 40 years of age compared to <18 years of age. They also mentioned that there is an increase of number cases by 892% over a period of one year (2018 - 2019) [8].

In the rest of the studies, it is seen that most of the patients are more than 15 years of age. But still the number of people using E scooter illegally (<18 years of age) is surprisingly high throughout the world.

We couldn't find any gender wise disparity among the patients who are coming with an E scooter injury. Figure 1 represents the gender wise distribution of cases seen in the studies.

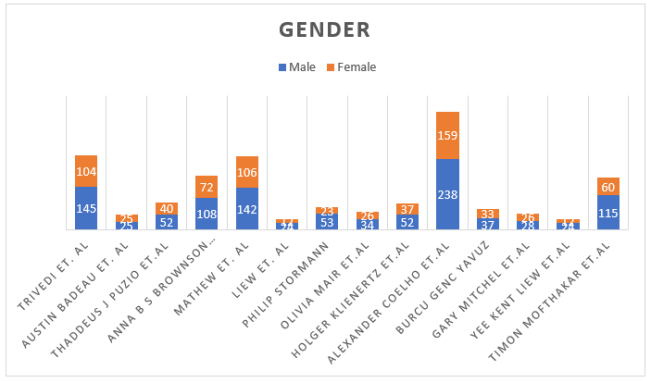

Figure 1: Gender distribution among different studies.

In most of the cases the common mechanism of injury is fall from the bike. But there are several studies which show presence of injuries for the pedestrians and other injuries due to the E scooter alone. Out of 175 injuries in the study conducted by Moftakhar., *et al.* 9 of them were non riders who was mostly injured by an E scooter [8].

In most of the cases the common cause is due to loss of balance or control. For instance, study conducted by Liew., *et al.* showed that 38.9% of cases were due to loss of balance or control. The other causes of fall can be accidents due to other vehicles or people, poor riding conditions or it can be even due to the non-riders. Use of E scooter on the payment could be one of the causes for increased incidence of cases in the last few years [9].

Electric scooter is basically meant for one person. In a study conducted by Alexander Coelho., *et al.* injury to 4 E scooter passengers were also reported. Along with those 18 pedestrians were reported as injured with in the same study which is quite surprising [10].

Interestingly in a study conducted by Holger., *et al.* showed that 5 patients were seen due to laceration caused by the initial push needed for the E scooter. Other causes were also documented in the study like fall, injuries due to stationary and moving objects [11].

Just like a normal bike or cycle, it is mandatory for those who are riding electric scooter to wear a helmet and to follow the rules. Studies conducted by Badeau., *et al*. Thaddeus J Puzio., *et al.* and Holger., *et al.* showed that none of the participants were wearing helmets or any safety equipment's [1,11,12]. Even though in other studies, the proportion of people wearing helmets Is very low. This could be one of the reasons why people are prone for head injuries because of an E scooter accident. Out of 249 patients in the study conducted by Trivedi., *et al.* only 10 were using the helmet which is 4.4% [3]. Similar study conducted by Alexander Coelho., *et al.* showed that 55 out of 397 wore helmet [10].

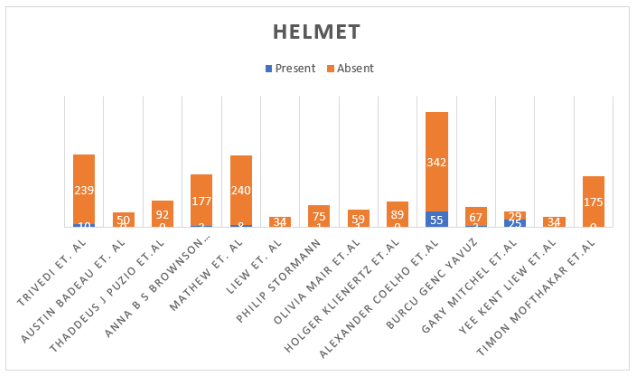

Figure 2: Helmet use seen in different studies.

Incidence of alcohol use is also reported in good proportion among those who had E scooter related injuries. In a study conducted by Brownson., *et al.* out of 180 patients 52 had documented evidence of alcohol abuse. Among that 13 of them had head injury also [13]. Figure 1 and 2 represents the helmet usage seen in the e scooter riders and the usage different substance including alcohol while driving which can be a contributing factor for the injuries.

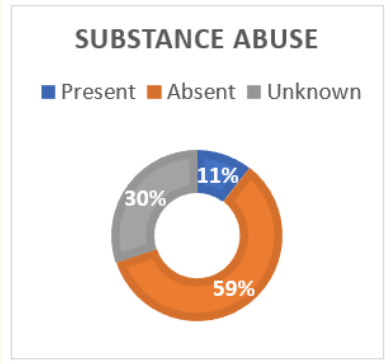

Figure 3: Substance abuse seen in electric scooter injuries in different studies.

Types of injuries

Injuries associated with E scooters can range from simple lacerations to orthopaedic or head injuries. Head injuries constituted around 40% and fractures around 37.1% according to the study conducted by Trivedi., *et al.* Other injuries like lacerations, contusions and minor head injuries were also mentioned, which constituted 27%. Distal upper extremity was the most common fracture seen. Major injuries documented in the study includes intra-abdominal injuries, pulmonary contusions, pneumothorax, and splenic injuries [3]. Figure 4 and 5 represents the proportion of head and orthopaedic injuries seen in e- scooter injuries.

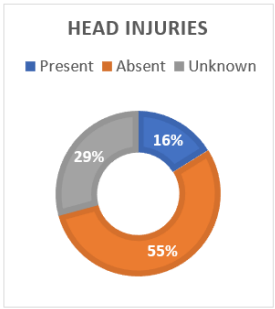

Figure 4: Proportion head injuries seen.

In a similar study conducted by Philip Storman., *et al.* also showed that the most common injuries were seen in the upper extremities followed by head injuries. In this out of 76 patients 43 suffered from at least one serious injuries and 2 with two serious injuries. More than 25% of them also required surgical management for recovery [14].

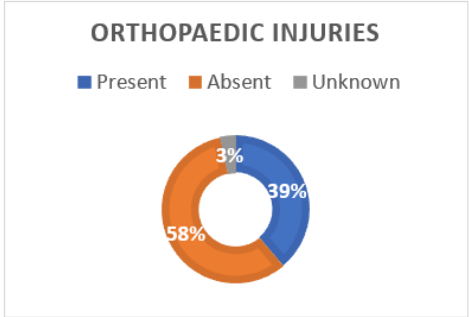

Figure 5: Proportion of orthopaedic injuries.

Interestingly, one of the studies conducted by Bercu Genc Yavuz., *et al.* showed that 45.7% of them had soft tissue injuries. Followed by head trauma in 40%. Orthopaedic injuries constituted only 18%. 3 ward admissions and one intensive care admissions were mentioned in this study [15]. Figure 6 represents the type of hospital.

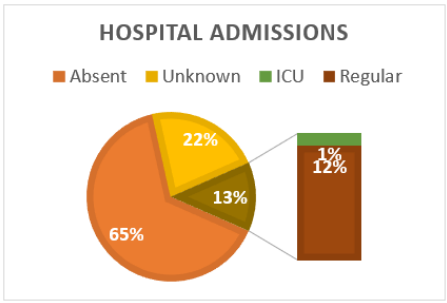

Figure 6: Hospital admissions seen in different studies.

Experience from our unit

We have been referred 58 patients to our unit through a centralised referral pathway called the referapatient.org during a period of July 2020 to Oct 2021, we have filtered out the data and the referrals based on the mechanism of history and we have found that 8 of these 58 referrals are due to electric scooter injury which is a substantial jump in the mechanism of the trauma which we had in the past. Due to this increase of the numbers we were inclined to review the literature and compare the overall impact.

As we are a tertiary referral for frame we were referred only those lower limb fractures which required frames and could not have been done at their local unit so all the 8 patients as they had a significant injury were treated with frame, as other injuries of the e scooter had been managed locally and in other specialities the overall impact is underestimated. Example 1, 2, 3 shown below are some of the radiological images of cases that came to our trust.

Example 1

Figure 7

Example 2

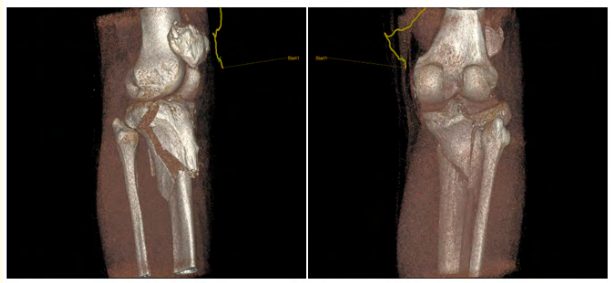

Figure 8

Example 3

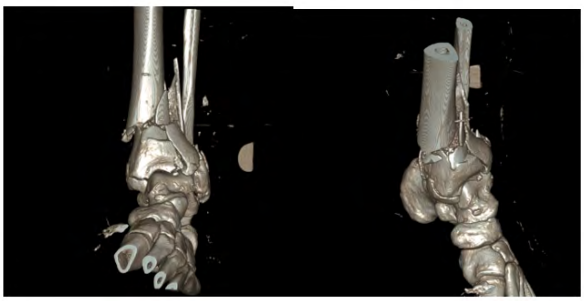

Figure 9

Discussion

Due to the advent of battery operated vehicles which has significantly improved our quality of life and in the future will have huge impact in reduction of global CO_2 emission which countries around the world are obliged to do as a part of global campaign for greener planet, the mechanism and impact it will have on the injuries are expected to change, therefore it is expected that we will start to see a new pattern of injury which we were not familiar with, as the global ecosystem is changing it is important for the trauma services to be regularly updated and be in sync with the developments.

Conclusion

It is a high time that government and local councils should lead a more proactive and teaching campaign towards these injuries and rules and laws should be formulated so that the menace of these intoxicated related injuries can be curbed we appreciate that as more vehicles emerge in the market these injuries will increase and hence it is urgent that national education campaign should be initiated by the government to overcome the overall impact it can have especially on its younger and more productive citizens.

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