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A one year analysis of e-scooter injuries: more than half require specialist follow-up

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Abstract

Aims

Since the mass introduction of e-scooters in Ireland, a rise in scooter related injuries and deaths has followed. This study aims to measure the number of e-scooter related injuries presenting to a level 3 tertiary referral centre over a year and investigate the outcomes for each presentation.

Methods

This is a retrospective analysis of all patients presenting to our hospital between 1st August 2021 and 31st July 2022 with an e-scooter related injury. Datapoints measured included mechanism of injury, type of injury, use of safety equipment, outcome of emergency presentation, admission length, surgery type and follow-up.

Results

105 patients were included in the final analysis. 10 (9.5%) patients were admitted for orthopaedic operations, four (3.8%) patients were admitted under other surgical teams and four (3.8%) patients were transferred to other units for emergency surgery. Mean length of stay was 2.3 days. A total of 54 patients were referred to orthopaedics (51.4%). This generated a mean of 3.4 clinic appointments and 4.2 physiotherapy appointments per patient.

Discussion

10% of patients presenting with a e-scooter related injury required emergent orthopaedic intervention. Greater than 50% of patients required orthopaedic clinic follow-up. This generates an extra workload on already busy departments. With the increasing popularity of e-scooters, alongside government legislation legalising their use, these numbers will likely increase.

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Introduction

E-scooters and their associated injuries have become an ever increasingly highlighted issue across the world, resulting in some authorities, such as Paris, France, to ban the usage of rental e-scooters[1]. In Ireland, according to the Road Safety Authority (RSA), electronic scooters, or e-scooters are were responsible for 42 serious injuries and two deaths on Irish roads between 2020 and 2022, however, these are only the numbers reported to police[2]. In June 2024, shortly following their legalisation, Ireland suffered three child fatalities following a collision between a larger vehicle and e-scooters[3,4].

From May 2024, legislation was introduced to legalise e-scooters in Ireland. Users are required to be 16 years or older, obey a speed limit of 20km/h and are banned from footpaths. Electric scooters cannot carry passengers but are legally allowed to be used on national roads. The RSAs definition of an electric scooter is as follows; "An electric scooter or e-scooter is a vehicle with a small standing platform and no seat, for use by one person only, with two or more wheels and propelled by an electric motor. The rider can also propel the e-scooter forward by pushing off the ground" (5). This updated legislation was expected, however initially top speeds were expected to be set at 25 km/h[2].

E-scooters became popularised in 2017 when a company placed thousands of the transport devices on Santa Monica streets as part of a monetised ride sharing system[6]. By 2018 there was an estimated 38 million e-scooter trips annually[7]. Whilst Ireland has not yet had the introduction of citywide e-scooter rental companies, there is a growing body of evidence suggesting that e-scooter related trauma has an impact on our health service. Previous studies have shown 36-60% of patients presenting with e-scooter related injuries required operative intervention[8,9].

With the mass introduction of e-scooters, and their updated government legislation, the aim of this study is to analyse the e-scooter related injuries presenting to a university teaching hospital in a suburban catchment area over a one-year period.

Methods

We performed a retrospective analysis of all patients presenting to our adult emergency department with e-scooter related injuries. Our hospital is a university teaching hospital in a suburban catchment area serving a population of over 450,000 people[10]. We searched our electronic triage database for all triage notes containing the word "scooter", "e-scooter" or "escooter" between 1st August 2021 and 31st July 2022. The records of those identified were

reviewed and excluded if their injury was not associated with e-scooter use. Datapoints measured included mechanism of injury, type of injury, collision vs fall, use of safety equipment, outcome of emergency presentation, admission length (if admitted), surgery (if required) and follow-up.

Ethical approval was sought for this study but not required by our institution's ethics board due to the retrospective nature of the study. It was approved as an audit by the institution's audit and ethics board.

This is a descriptive study of a case series. We report on proportions, calculate means and standard deviations for normally distributed data and calculate medians and interquartile ranges for data that is not normally distributed.

Results

Initially 111 patients were identified through the electronic search. Following chart review a total of 105 patients with e-scooter related injuries were included in the study. The mean age was 33.6 years (SD 12.1). The youngest patient was 16 years old, the eldest patient was 72 years old and was a pedestrian whereby an electric scooter collided with them. A total of 62.9% of patients were male (n = 66). 25.7% (n = 27) patients presented following a collision with another vehicle/person, 71.4% (n = 75) following a fall and three patients presented with injuries after being hit by an e-scooter themselves (see Table 1 for demographics). Unfortunately, there was a paucity of documentation regarding whether the patient was under the influence of alcohol or recreational drugs. For the 14 patients where it was documented, 42.9% (n = 6) were under the influence.

Table 1: Demographics	N
Total Patients	105
Mean age (SD)	33.6 (12.1)
Minimum age	16
Maximum age	72
Male (%)	66 (62.8%)
Mechanism	
Fall	75 (71.4%)

Collision whilst on e-scooter	27 (25.7%)
Pedestrian, hit by an e-scooter	3 (2.9%)

The injuries received by the e-scooter patients are outlined in Table 2. The format of the table has been adapted from Trivedi et al. (6). The most common injury was a fracture with 56.2% (n = 59) of patients being treated for one. This was followed by soft tissue injuries, 37.1% (n = 39) patients were treated for an isolated soft tissue injury (including sprains, contusions or lacerations). There were six patients with head injuries of which two (1.9%) had suffered intracranial haemorrhage.

Table 2: Breakdown of injury types

Injury type[a]	Patients (n = 105) No. (%)
Fracture	59 (56.2%)
Upper extremity	34 (32.4%)
Distal	29 (27.6%)
Proximal	5 (4.8%)
Lower extremity	17 (16.2%)
Distal	11 (10.5%)
Proximal	0
Facial	6 (5.7%)
Vertebral Column	0
Thoracic	2 (1.9%)
Head Injury	
Minor[b]	4 (3.8%)
Intracranial haemorrhage	2 (1.9%)
Contusions / sprains / lacerations with no fracture or head injury	39 (37.1%)

Dislocations	
Major	2 (1.9%)
Minor[c]	1 (0.9%)
Lacerations	10 (9.5%)
Major intra-abdominal/intrathoracic injuries[d]	1 (0.9%)

[a]Categories are not mutually exclusive
[b]Minor head injuries are classified as all recorded head injuries that did not result in fracture or haemorrhage
[c]Minor dislocations are those of the fingers and toes
d"Major intra-abdominal or intrathoracic injuries are defined as any internal injury of the thorax, abdomen, and pelvis represented by the *International Classification of Diseases, Ninth Revision,* codes 860 to 869". The case included was a splenic laceration. Adapted from Trivedi et al. (6)

The outcome for each patient's emergency attendance is detailed in Table 3. 13.3% (n = 14) patients required admission. For patients who were admitted, the mean length of stay was 3.3 days (range 1 - 11 days). Four patients were transferred to a tertiary unit for specialist emergency surgery, two for maxillofacial surgery and two for plastic surgery. Only 12.4% of patients (n = 13) required no follow up and were discharged from the emergency department. A total of 68.5% (n = 75) required hospital follow-up and 61.9% (n = 65) required specialist consultant follow-up.

Table 3: Outcome of Emergency Department Attendance

Outcome	N (%)
VFAC (virtual fracture clinic)	41 (39%)
Face-to-Face Fracture clinic	3(2.9%)
Admitted to hospital	14 (13.3%)
Transferred to other specialist unit	4 (3.8%)
Physiotherapy	5 (4.8%)

Wound management clinic	7 (6.7%)
Emergency Department review clinic	3 (2.9%)
GP	20 (19%)
Ear Nose & Throat Nasal trauma clinic	3 (2.9%)
No follow up	13 (12.4%)
Total	105

A total of 54 (51.4%) patients were referred to orthopaedics, 10 (9.5%) of patients required an orthopaedic operation. 39% (n = 41) patients were referred to the virtual fracture clinic and a further 2.9% (n = 3) patients were referred directly to a face-to-face clinic. A list of the orthopaedic operations can be seen in Table 4. Patients referred to orthopaedics generated a mean number of 1.9 face-to-face clinic appointments per patient. Additionally, they generated a mean number of 3.3 therapy (physiotherapy or occupational therapy) appointments per patient.

Table 4: List of operations performed
Open reduction internal fixation (ORIF) distal radius and 1st metacarpal percutaneous fixation
Washout and percutaneous fixation of 4th metatarsal
Radial head ORIF
Tibial plateau ORIF
Intramedullary nailing of tibia
ORIF radioulnar shaft
ORIF olecranon
ORIF distal radius
Exploration and washout of knee wound
Ulnar Collateral Ligament repair

Discussion

This is the largest e-scooter related study based in Ireland to our knowledge to date, and may reflect the growing popularity of this new mode of transport. Our data shows that, of the 105 e-

scooter related injuries, 68.5% (n = 75) required follow-up with hospital services. 61.9% (n = 65) required specialist consultant input into their care. A further 19% (n = 20) required follow-up in primary care.

The results of this study are largely in keeping with international results. The majority of patients were male, in their 30s and the majority of injuries were fractures, followed by soft tissue injuries. Over half (56.2%) of patients suffered a fracture. Of these, the majority were fractures of the upper limb (64%). This is in keeping with other studies findings and fits with the picture of patients falling off their scooters as the predominant mechanism of injury[11]. A recurring hypothesis as to why this occurs is due to the design of an e-scooter, whereby an individual is stood upright on a narrow platform with locked knees and the inability to lean to shift the centre of balance during turning, as one would do whilst riding bicycles and motorbikes. This position in addition to the small wheels and lack of suspension mean one cannot accommodate for sudden changes in the road surface, further putting the rider at risk of falling[12].

With 51.4% of patients requiring orthopaedic referral and follow-up, this represents a large proportion of e-scooter related injuries. Whilst we do not have formal costing statistics available, O'Reilly et al. previously reported VFAC (virtual fracture clinic) appointments as costing €28 per patient and face-to-face appointments. Costing €129 per patient[13]. Using these figures as estimates, there is an additional cost of €924 for the VFAC appointments and €12,900 for the face-to-face appointments alone. That is not accounting for other costs the e-scooter patient has incurred along the way, such as ambulance, emergency department or operating theatre costs.

Lavoie-Gagne et al. reported a median cost of e-scooter related injuries requiring admission in their trauma centre as $50,432[14]. Bloom et al. reported a median cost of $1213. Both are studies based in the USA. The difference in median costing is likely due to the fact that Bloom et al. included all e-scooter patients presenting to their hospital service, including those were seen through the outpatient setting or did not require a trauma call or admission. Therefore, Bloom et al. may give a more accurate estimate on the cost of an emergency department attendance that does not require surgical intervention or admission[12], whereas Lavoie-Gagne et al. shows how costly injuries requiring intervention can be to treat[14].

Compared to previous Irish based studies, we found a lower rate of patients requiring operative intervention. O'Halloran et al. reported 60% of patients required operative intervention for their injuries whilst Grace et al. reported 36% of patients required surgery. This disparity in results is likely multifactorial but may be related to the comparatively

smaller sizes of those studies, including 15 and 22 patients respectively (8, 9). A recent systematic review of over 5000 e-scooter related injures found that 17.2% of patients required surgical intervention[11].

There were no deaths reported in this study, however as stated previously, there are a growing number of e-scooter related deaths in Ireland to date. It is even more concerning that since the updated legislation, there have been fatalities in children who are not legally allowed to ride an electric scooter[2-4].

Nevertheless, we the authors do acknowledge that the rise of e-scooters is likely related to a number of socioeconomic issues including, but not limited to, rising fuel costs, unreliable public transport and lack of efficient transport infrastructure[15]. E-scooters in themselves provide a low cost and easily accessible method of transport from point A to point B[16] and whilst we are seeing increasing e-scooter related injuries, one would expect these numbers to continue to rise until a valid and viable alternative is put in place.

The main limitation of this study is the retrospective nature. There may have been patients missed who were not triaged as being an e-scooter related injury. There was a paucity of documentation regarding safety equipment worn by riders and whether the riders had taken any drugs or alcohol before their journey.

In conclusion, e-scooters usage can result in severe accidents and injuries. The number of patients being treated have increased dramatically since previous Irish studies. The majority of patients required specialist hospital follow-up, over 50% of patients required orthopaedic care and one in ten patients required an operation. E-scooter use can result in life changing injuries and death, the incidence of which is likely to increase following their legalisation. They are not a form of transport without risk and governments should consider the impact of related injuries and fatalities on their population.

Declarations of Conflicts of Interest:
None declared.

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