DOI: https://doi.org/10.53350/pjmhs02024181507

ORIGINAL ARTICLE

Injury Severity and Disability Outcomes Following Motorized Two-Wheeler Crashes in Lahore, Pakistan: A Follow-Up Study

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ABSTRACT

Background: Road traffic crashes are a leading global cause of mortality and disability, with motorized two-wheeler riders among the most vulnerable road users. In Pakistan, rising motorcycle use has been accompanied by increased crash-related injuries, particularly head and neck trauma, resulting in long-term social and economic consequences.

Objective: To determine the severity of injuries and disability outcomes among victims of motorized two-wheeler crashes through a follow-up study.

Methods: This prospective cohort study was conducted at the trauma centers of Mayo Hospital, Jinnah Hospital, and Lahore General Hospital, Lahore, between April and June 2022. Using non-probability convenience sampling, 295 injured or deceased two-wheeler riders were included. Riders of any age or gender involved in road traffic crashes were eligible, while non-road trauma cases were excluded. Patients were followed for one month to assess post-injury outcomes, including incapacity, disability, disfigurement, and recovery.

Results: Of the participants, 49.2% sustained head and neck injuries, 46.8% had multiple body injuries, and 4.1% had limb injuries only. At one-month follow-up, 51.0% were incapacitated, 17.0% developed disabilities affecting routine work, 14.6% had disfigurement, and 7.1% reported scarring. Complete recovery was achieved in only 5.4% of cases. Middle-aged adults constituted the most affected group.

Conclusion: Motorized two-wheeler crashes are associated with high rates of head and neck injuries, long-term incapacity, and disability. Middle-aged adults are disproportionately affected, reflecting major socioeconomic implications. Preventive measures, especially strict helmet enforcement and road safety interventions, are urgently needed.

Keywords: Motorized two-wheeler crashes; Injury severity; Disability outcomes; Head and neck injuries; Road traffic accidents.

INTRODUCTION

Worldwide 49% of expiries due to road traffic accidents occur among those who use the roads but are susceptible including motorcyclists. Even in developed countries, chances of killing motorized two-wheelers users are four times high as comparison to car drivers [1].

Globally, road traffic crashes are responsible for more than 1.35 million deaths annually, with nearly half of these fatalities occurring among vulnerable road users, motorcyclists (28%), pedestrians (23%), and bicyclists (3%) [2].

Among 1.35 million deaths in the world, 28% were triggered by motorized two wheelers, depicting a foremost tenacious public health apprehension[1]. Motorcycle riders have thirty times more chances to face death, as a result of elevated power transfer to their collided bodies. Among hospitalized trauma patients, motorcycle related injuries bear high mortality in any healthcare of world[3].

During 2019, research was undertaken in Lucknow, India during. Authors found that as a result of motorized two-wheeler crash, traumatic brain injury is one of the foremost causes of death in children[5]. They led a descriptive study in the Trauma Centre of a tertiary care hospital. Along with demographic profile, they also recorded the radiological findings of each patient under study. Patients were classified from GCS 13-15, GCS 9-12 and GCS 8 or less. Patients with GCS eight or less were labelled with severe head injury. After resuscitating the patients, they were again assessed and their GCS score was recorded. This GCS was considered as baseline. All patients were followed up and their status was re-evaluated after the 3 months. Head injury victims suffer from more disability and mortality. In this study, 172 patients were driving motorized two-wheelers[4,6].

Researchers conducted a study in New Delhi, India to see the head injury pattern and severity among motorized two-wheeler riders. They inferred that injury severity, age distribution and driving experience of victims did not correlate with results of those studies conducted in developed countries[3]. Most of head injuries were in temporal, parietal and facial regions. Range of severity was from simple abrasions to multiple fractures. It indicates that motorcycle riders take fewer protective measures and got minor to fatal accidents[7].

Researchers did not find any difference between the severity of injuries in motorcycle drivers and pillion riders[2]. This study was conducted in Bangalore, India. Authors observed that severity and pattern of injuries in previous studies were not frequently examined. Motorcycle drivers are more exposed, pillion riders are less secure and easily fall from motorcycle. They studied 102 pairs of drivers and pillion riders. They did not find significant difference in Glasgow Coma Scale (GCS) score of motorcycle drivers and pillion riders[5,7].

A retrospective record-based study was conducted in Utter Pradesh, India during 2014. They examined the medical record of 347 victims from causality department of a tertiary care hospital. Extremities were injured in 53.54% cases; maxillofacial regions were injured in 19.31% cases. The bones on right side were more commonly (55.55%) fractured. Skull injuries were mostly on frontal regions and less common in parietal region[8,9].

Research was conducted in Spain to see severity of injuries in powered two-wheeler users. Out of 977,557 injured patients, 80% of lower extremity injured patients exhibit functional disability after one year of discharge[10]. The patients who got traumatic brain injuries (18.5%) lost more functional disability. Cerebral concussion was observed in 56% of head injuries. Among the head injuries, 48% were due to translational impact and 37% were because of rotational mechanism[4].

A cross-sectional descriptive study was conducted in West Bengal, India during 2018. They selected 295 road traffic injured persons admitted in the hospital. Among the victims, 32.86% were professional drivers. 87.18% had no protective device at the time of crash. 45.20% of the victims were under influence of alcohol. 12.2% were distracted by use of mobile phone. Among all victims, 40% were motorized two-wheeler riders[3,5]. 65.69% victims got extremity injuries causing walking inability. 34.24% faced fatal outcome disability and death.

Singh et al., (2011) conducted a cross-sectional study in India. Researchers found that most of the accidents occurred during evening hours[6]. This signifies the use of more motorized

Received on 22-08-2023
Accepted on 23-12-2023

two-wheelers in time pressure, fatigued condition and quest to go home from work at the earliest. Young riders received more severe injuries ranging from single to multiple fractures. Among the respondents 88.87% belonged to younger age group. 41.52% were the motorized two-wheelers[7]. At the time of accident, many drivers admitted that they were careless about signal lights, use of indicators and observing the proper lane. Lack of coordination and sluggish reactive responses were also the contributory factors. Commonly, victims did not perceive the danger just before the accident[9].

In a retrospective study based on records from the Regional Transport Authority and Traffic Police stations in Mangalore, researchers reported that the majority of victims died at the scene of the crash[10]. Most victims (77%) were within the (18–44) year age group, highlighting the vulnerability of individuals in their most productive years. The accident rate was considerably higher among males (83%) compared to females (17%). Among the victims, 5% (n = 75) succumbed to their injuries, with 45 fatalities occurring on the spot[10]. Geared motorcycles accounted for the majority of crashes (81%), and the highest number of accidents occurred between 6:00 p.m. and 10:00 p.m. More deaths at spot indicated the severity of injuries. As the victims died at spot and record of their autopsies were not examined, extent of injuries could not be summarized or evaluated. However, data indicates the severe outcome in the motorized two-wheeler accidents[9,8].

A study was conducted in Doha, Qatar during 2009. Researchers selected 6,709 patients suffering from head and neck injuries from a tertiary care hospital, 27.80% accidents took place during weekends[10]. Head and neck injury ratio among male to female was 6.1:1. Among the total, 5.5% got severe injuries. Authors found remarkable that 22-44 years affected the most and suffered from head and neck injuries[3].

A researcher conducted a study during 2018 to see the severity and extent of eye injuries, due to motorized two-wheeler accidents. This study revealed that among the eye injuries, a large number of intraocular hemorrhages, optic nerve trauma and retinal detachment had been seen. All these injuries were severe[4]. 50 patients were selected from an emergency department of a termitary care hospital. All age group and gender were included in the study. 70 patients had subconjunctival hemorrhages. 66% patients reported ecchymosis and lid edema, 42% patients revealed conjunctival chemosis and 10% reported anterior dislocation of les. Among the total, 64% belong to motorized two-wheeler accidents. 6% of the patients got bilateral eye injury. It was concluded that male adults, right eye was mostly affected and motorized two-wheelers were mainly suffered[6,8]. On the gross scale, it is the blindness which gives the disability and loss of working of an individual.

Researchers conducted a study in Hyderabad, India during 2013. They wrote that head injuries are chief reason of deaths in road traffic crashes especially due to motorized two-wheeler accidents[12]. A hospital that provides advanced medical care in Hyderabad was chosen for this study. The research included patients who had head injuries caused by accidents involving motorized two-wheelers. It revealed that 100 RTA cases are being increased yearly in this hospital. Deaths due to two-wheeler accidents in year 2010 were 39% of total road traffic accidents and during next year 2011, 41% of total road traffic accidents. As result of decreased usage of helmet by the motorcyclists, head is foremost region to get injured. Mostly head injuries are severe and give rise to prolonged illness and disability. On spot deaths are also not uncommon. Road traffic accidents cost billions to world economy[11,13].

A scientist conducted a study in Andhra Pradesh, India during 2017. A mortuary of a tertiary care hospital was selected. Total 100 cases of head trauma deaths were reported during study period[10]. They studied 70 cases where people died because of a road traffic accident. In most of these cases, there was bleeding under the brain covering, which happened in 68.13% of the cases. Some people also had bleeding inside the brain, which was seen in 12.89% of the cases. The study found that head injuries were common in accidents involving motorized two-wheelers, especially when the people involved weren't wearing helmets[12].

Another team of researchers conducted a study in Rohtak district, Haryana, India. This region is situated near to New Delhi, capital of India, therefore facing high road traffic. Researchers observed that multiple parts were injured almost in every case[13]. Their focus was to get the injuries to thoracic, abdomen and pelvic regions, as injuries to these regions are second cause of death after head injuries. In road traffic accidents, especially in motorized two-wheeler accidents, crush injuries had been found. Whenever thoracic, abdomen and pelvic regions are involved, many viscera had been found ruptured. 55% of total cases, involved injuries belong to thoracic, abdomen and pelvic regions[14]. They also referred many studies where findings correlate with their study. It is not uncommon to see the accidents of motorized two-wheeler where motorcycle is fell down due to slippery road or inaccurate action of motorcyclist like use of sudden brake and other vehicles crush the riders of the motorcycle. In such cases, usually multiple rib fractures and burst abdomen have been reported. Many such injuries are serious injuries and usually prove fatal. Therefore, most injuries to thoracic, abdomen and pelvic regions are cause of disability or mortality[12].

MATERIALS AND METHODS

This cross-sectional descriptive study was conducted over a three-month period (April–June 2022) at the trauma centers of three tertiary care hospitals in Lahore: Mayo Hospital, Jinnah Hospital, and General Hospital. A non-probability convenience sampling technique was employed, and a total of 295 motorized two-wheeler riders who were injured or deceased following road traffic crashes were included. Riders of any age or gender were eligible for inclusion, provided informed consent was obtained from the injured individuals or the relatives of deceased victims. Patients presenting with non-road traffic trauma (e.g., falls, assaults) were excluded. The study population comprised all motorized two-wheeler riders in Lahore, representing the city's active riding community.

RESULTS

Table 1 presents the distribution of injury types among the study participants. Nearly half of the victims (49.2%) sustained head and neck injuries, while 4.1% had injuries limited to the limbs. Multiple injuries involving the whole body were reported in 46.8% of cases.

Table 1**:** Body Injury - Frequency and Percentage

	Frequency	Percent	Valid Percent	Cumulative Percent	
Valid	head neck	145	48.2	49.2	49.2
	limbs	12	4.0	4.1	53.2
	multiple whole body	138	45.8	46.8	100.0
	Total	295	98.0	100.0	
Missing	System	6	2.0		
Total	301	100.0			

Table 2: Injury Outcomes After One Month – Frequency and Percentage

	Frequency	Percent	Valid Percent	Cumulative Percent	
Valid	Normal	16	5.3	5.4	5.4
	Scarrin	21	7.0	7.1	12.6
	Disfigurement	43	14.3	14.6	27.2
	Disability not affecting routine work	14	4.7	4.8	32.0
	Disability affecting routine work	50	16.6	17.0	49.0
	Incapable	150	49.8	51.0	100.0
	Total	294	97.7	100.0	
Missing	System	7	2.3		
Total	301	100.0			

Table 2 summarizes the outcomes of injuries after one month. The majority of victims (51.0%) were rendered incapable of performing work, while 17.0% experienced disabilities affecting their routine work. Disfigurement was reported in 14.6% of cases, and 7.1% had scarring. Only 5.4% recovered without any lasting impairment. Disabilities not affecting routine work were observed in 4.8% of cases.

Figure 1 illustrates the distribution of injured individuals by age, showing that middle-aged adults constituted the largest proportion of victims. Figure 2 depicts the percentage distribution of injury outcomes after one month, reinforcing the finding that incapacity was the most frequent outcome, followed by disability affecting routine work.

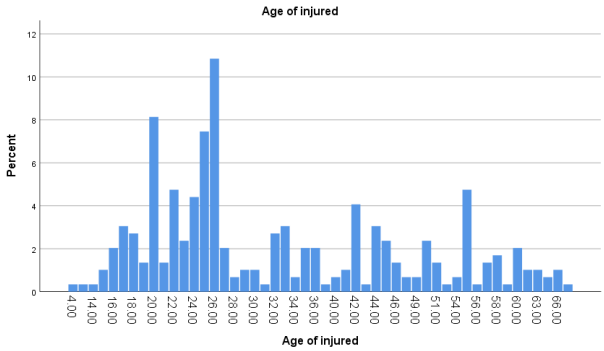

Figure 1: Distribution of injured individuals by age

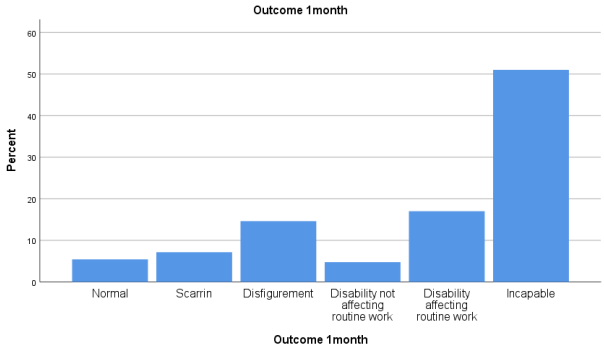

Figure 2: Percentage Distribution of Victims' Outcomes at One Month Post-Injury

DISCUSSION

The present study highlights the substantial burden of severe injuries and long-term disability resulting from motorcycle-related road traffic crashes among the study population[9]. Almost half of the victims sustained head and neck injuries (49.2%), while multiple injuries involving the whole body were reported in 46.8% of cases. The results are similar to other research outcomes conducted in Pakistan and other "low- and middle-income countries (LMICs)", which consistently identify head trauma as the most common and life-threatening injury type among motorcyclists[11] .The high prevalence of head injuries accentuates the critical role of helmet use in mitigating injury severity, a measure that remains inconsistently practiced, as indicated in the knowledge and practice results of this study[7].

The functional impact of these injuries was profound. After one month, more than half of the victims (51.0%) were unable to perform work, reflecting a significant economic and social toll[3,5]. Disabilities affecting daily routine were reported in 17.0% of cases, while disfigurement (14.6%) and scarring (7.1%) added to the long-term psychosocial burden. Only 5.4% recovered without lasting impairment, indicating that the majority experienced residual disability of varying severity[12,13]. These findings are consistent with the "Global Burden of Disease estimates", which emphasize that road traffic injuries are not only a leading cause of death but also a major cause of "disability-adjusted life years (DALYs) lost in LMICs" .The pattern observed suggests that beyond immediate trauma care, post-injury rehabilitation and vocational support should be integral components of road safety policy[14].

Age distribution analysis revealed that middle-aged adults were disproportionately affected. This age group typically represents the most economically productive segment of society, and their injury-related incapacity has broader socioeconomic implications for families and communities. Similar demographic patterns have been observed in other South Asian studies, reflecting both higher exposure to motorcycle use and increased involvement in occupational or commuting travel[11,15].

Environmental factors appeared to influence injury severity. The study found that seasonal variations and foggy conditions were associated with higher rates of severe outcomes, particularly incapacity. Poor visibility in fog increases crash risk and may exacerbate injury severity due to higher impact forces and delayed emergency response[16]. Additionally, people gatherings and local festivals were linked to more severe outcomes, likely reflecting increased traffic congestion, reduced adherence to traffic rules, and heightened exposure to risk. These discoveries are constant with the literature documenting spikes in crash incidence and severity during festive periods in South Asia[17].

Overall, these results emphasize the urgent need for multifaceted interventions targeting both prevention and post-crash care[18]. Helmet promotion and enforcement, improved visibility measures in fog-prone seasons, crowd and traffic management during large gatherings, and investment in trauma rehabilitation services are all essential to reducing the long-term burden of motorcycle-related injuries. Moreover, tailoring safety campaigns to the most affected demographic, middle-aged adults may increase their effectiveness in reducing both crash incidence and severity[10,14].

The results further demonstrated that selected risk factors, including helmet use, time of accident, and vehicle speed, were significantly associated with the severity of injuries among motorcycle crash victims. Consequently, the null hypothesis was rejected and the alternate hypothesis accepted[8,14]. Notably, helmet use was shown to substantially reduce injury severity, while crashes occurring during night-time hours and at higher speeds were associated with worse outcomes. These results reinforce existing evidence that helmets remain one of the most effective protective measures against head injuries, and that crash dynamics play a critical role in determining injury severity[15].

High proportion of head and neck injuries and long-term incapacity observed in this study directly reflects the behavioral and attitudinal gaps identified earlier. Despite high awareness of traffic rules, a considerable proportion of respondents reported inconsistent helmet use, citing discomfort, laziness, and underestimation of short-distance risk as primary reasons[16]. This mismatch between knowledge and practice likely contributed to the elevated incidence of severe head trauma and residual disability. Furthermore, the widespread use of mobile phones while driving, as reported in the KAP section, may have compounded crash severity by reducing reaction times in already hazardous environmental conditions such as fog or congested gatherings. These findings reinforce the critical need for interventions that go beyond awareness campaigns to address comfort-related barriers, risk perception, and enforcement of safety behaviors, particularly helmet compliance to decrease both the incidence and severity of injuries[17,18].

CONCLUSION

This study emphasizes the substantial problem of motorcycle-related road traffic crashes, marked by high rates of head and neck injuries, long-term incapacity, and significant social and economic consequences. Middle-aged adults were disproportionately affected, amplifying the broader societal impact.

Conflict of Interest: The study has no conflict of interest to declare by any author
Source of Funding: None
Authors' Contributions: AIB: Study conception, design, data collection, manuscript drafting. MSR: Data analysis, interpretation, critical review of manuscript. EAQ: Literature review, data validation, final approval of manuscript.
Acknowledgement: The authors sincerely acknowledge the support of the trauma centers and staff at Mayo Hospital, Jinnah Hospital, and Lahore General Hospital, Lahore, for their assistance in data collection and patient follow-up. We are also grateful to the patients and their families for their cooperation during the study.

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This article may be cited as: Burq AI, Rana MS, Qureshi EA; Injury Severity and Disability Outcomes Following Motorized Two-Wheeler Crashes in Lahore, Pakistan: A Follow-Up Study. Pak J Med Health Sci, 2024; 18(1): 507-510.