Original Research Article

An Analysis of Head Injury in Fatal Motorized Two-Wheeler Accidents and its Association with Compliance with the Traffic Laws in a City in Central India

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Abstract

In developing nations, road traffic accident is the leading cause of mortality for people under the age of 50. 80,000 people die in road accidents every year, accounting for 13% of all deaths worldwide. The motorized two-wheelers are one of the most common mode of transport in India. Skull fracture is the most common type of head injury in fatal motorized two-wheeler accidents. Creating an effective enforcement campaign with targeted compliance rates, combined with a well-planned public awareness campaign, can increase compliance and save thousands of lives. Motorized Two-Wheelers should be subject to strict speed control regulations. The government should imply rules for increasing safety features in the Motorized Two-Wheelers, particularly of the cheaper ones. The sale and purchase of the used Motorized Two-Wheelers should be regulated through proper channels. Periodic testing of the Motorized Two-Wheelers should be made mandatory. In this study, we analyzed the head injuries sustained in fatal motorized two-wheeler accidents as seen in postmortem examination of the fatalities due to the mentioned cause. We hope that the results of this study contribute valuable insights which would further help in formulating necessary policies and work towards to a safer community by helping in reducing the toll of motorized two-wheeler accidents.

Keywords: Road traffic accident, motorized two-wheelers, head injury, helmet, compliance with the law

Introduction

Accident is an event that occurs suddenly, unexpectedly and inadvertently under some unforeseen circumstances. In developing nations, road traffic accident is the leading cause of mortality for people under the age of 50. The pattern of injury, fatal or not, varies a lot depending upon whether the victim is a vehicle occupant, a motorcyclist, a cyclist or a pedestrian. In spite of recent advancement in the

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fields of technology and medical sciences, death and deformities following road-traffic accidents are yet to be controlled successfully rather incidences of RTA have been increasing at an alarming rate everywhere.[1] As two-wheelers are very inexpensive to acquire and maintain compared to other vehicles, the number of two-wheeled vehicles is rising worldwide, especially in developing nations. The motorbike has become a common mode of transportation due to its mobility, speed, and ease of avoiding traffic jams on the road as well as its ability to maneuver over challenging terrain.[2] Traffic accidents cause the loss of thousands of lives and serious injuries to millions of people every year. In India itself, around 80,000 people die in road accidents every year, accounting for 13% of all deaths worldwide. The man behind the wheel plays an important role in most accidents.[3] Although the number of people killed in traffic accidents in high-income countries has declined in recent decades, the burden of traffic accidents on the majority of the world's population is increasing significantly in terms of social and economic costs. Injuries and deaths from road traffic accidents (RTA) are a major public health concern in developing countries, where more than of the 85% of all deaths and 90% of disability-adjusted life years are lost to road traffic injuries. The risk to the community from traffic accidents on the roads is serious. At the time of a road accident, several factors play a role, the main ones being human error in relation to the driver and the victim due to bad traffic feeling, driving on the wrong side of the road, speeding, mechanical failure of the vehicle, road and weather conditions, traffic congestion, interventions into the road, violating traffic rules, drunk driving, using mobile phones/headphones while driving, tripping, poor compliance with signs, poor lighting conditions, bad parking habits, not using the turn signal, allowing animals on the road etc.[4]

Aims & objectives:

1. To analyze the head injuries sustained in fatal motorized two-wheeler accidents.
2. To find out the association of compliance of the law and fatal motorized two-wheeler accidents.

Materials and Methods

The present study was conducted at Department of Forensic Medicine & Toxicology, Gandhi Medical College, Bhopal (M.P.) from September 2021 to August 2022. All the deaths pertaining to the fatal motorized two-wheeler accidents brought to the Gandhi Medical College Mortuary during this study period have been included. The history regarding the circumstances of the accidents and other relevant data was collected through the autopsy requisition form and through the thorough history taking from the police personnel, friends, relatives etc.

Study design:

A descriptive, observational, cross-sectional study.

Results

Present study was done in Department of Forensic Medicine & Toxicology, Gandhi Medical College, Bhopal, from January 2021 to August 2022. Out of 4590 autopsies performed in the Department of Forensic Medicine & Toxicology, Gandhi Medical College, Bhopal, over the study period, 878 cases of fatal motorized two-wheeler accidents were reported. Therefore, the proportion of deaths due to fatal motorized two-wheeler accidents is 19.13%.

Head injury was the cause of death in majority of the victims, (69%). Among all the victims, only 57 (6.5%) were wearing helmet at the time of the accident and all of them were driving. None of the pillion rider was wearing helmet at the time of accident. Even among the helmeted riders, traumatic head injury was the most common cause of mortality (56.1%).

Analysis of head injuries shows that skull fracture was the commonest form of injury seen (67.65%). The subdural haemorrhage (86.3%) was most common type of haemorrhage seen in the head injuries (Table 1), which was followed by the subarachnoid haemorrhage (56.9%). Linear fracture was the most common type of skull fracture in all the skull bones (table 2). Diastatic fracture of the sagittal suture was most common followed by the fracture of the coronal suture (Table 3).

In helmeted riders, skull fracture was observed in 22 out of 57 (38.6%) cases, the most common being the fracture of the base of skull. Anterior cranial fossa is the most common (n=21) followed by middle cranial fossa fracture (n=19).

Table 1: Internal injuries over head seen in fatal motorized two-wheeler accidents

Internal Injuries	Number
Subscalp haematoma	106
Extradural haemorrhage	163
Subdural haemorrhage	523
Subarachnoid haemorrhage	345
Blood in Ganglia	12
Blood in Ventricles	10
Blood in both ganglia and ventricles	12
Contusion necroses	77
Frontal bone fracture	211
Parietal bone fracture	204
Temporal bone fracture	179
Occipital bone fracture	64
Anterior cranial fossa fracture	217
Middle cranial fossa fracture	187
Posterior cranial fossa fracture	64
Diastatic fracture	183

Table 2: Types of skull bone fractures seen in fatal motorized two-wheeler accidents

Bone	Linear Fracture	Depressed Fracture	Comminuted Fracture
Frontal	148	32	31
Parietal	163	23	18
Temporal	179	3	10
Occipital	52	7	5

Table 3: Sutural fractures seen in fatal motorized two-wheeler accidents

Fracture	Number
Coronal	50
Sagittal	72
Squamous	33
Lamboid	28

Discussion

Analysis of head injuries shows that skull fracture was the commonest form of injury seen (67.65%). The subdural haemorrhage (86.3%) was most common type of haemorrhage seen in the head injuries, which was followed by the subarachnoid haemorrhage (56.9%). The frontal bone was most common bone fractured (34.8%), followed by parietal (33.7%) and temporal (29.5%) bones. Among the base of skull fractures, the anterior cranial fossa fracture was most common, accounting for 35.8%, followed by the middle cranial fossa (30.9%) and least common was posterior cranial fossa fracture (10.7%). Sutural or diastatic fractures were present in 30.2% of the cases with head injury. Linear fracture was the most common fracture encountered in all the skull bones (n=542). The 2nd most common fracture of temporal bone is comminuted fracture (n=10) while the depressed fracture is the 2nd most common in the remaining skull bones (n=59). Among the diastatic fractures, the fracture of the sagittal suture was the most common (39.3%), followed by the fracture of coronal suture (27.3%). The lambdoid suture fracture was the least common (15.3%). These findings are consistent with the findings done by Anand Menon et al[5] and K. Ravimuni et al.[6] However, in a study done by Nguyen Tuan Anh et al in Vietnam, it was observed that fractures of the temporal bone (68.6%) were most common and the fractures of the parietal bone were least common[7], which is in contrast to the findings of this study.

In helmeted riders, 22 out of 57 (38.6%) suffered any kind of skull fracture. The most common fracture in helmeted riders is fracture of the base of skull. Anterior cranial fossa is the most common (n=21) followed by middle cranial fossa fracture (n=19). The probable reason for that may be over speeding or sub-standard helmets. This finding is consistent with the findings of Tom Gibson et al who observed that in the majority of the cases, full-face helmets were worn and in 59% of these cases, base of skull fracture was present.[8] The prevalence of base of skull fracture could be primarily caused by due to the severity of the impact causing migration of the skull fracture to the base of the skull (and other regions of the head).

Anand Menon, Vishwas K Pai, A Rajeev in their study done in Mangalore found that there were skull fractures in 88.88% of the patients. In 88% of instances, vault fractures, skull fractures, or a combination of both were discovered. Fissured fractures were discovered in the majority of patients (23%). Subdural and subarachnoid haemorrhages made up the majority of intracranial haemorrhages (52.63% and 27.27%, respectively).[5] Wittayarungruengsri et al in Bangkok also reported that head injuries

accounted for 51.4% of the cause of death of victims of fatal motorcycle injuries in that series.[9] Kraus et al. revealed in a research conducted in California, USA, that brain damage accounted for 56% of fatally wounded motorcycle accident victims.[10] Deceleration forces, particularly rotational kinetics, are commonly responsible for brain damage.[11] Deceleration injuries, such as multifocal vascular injury, concussive brain injury, or diffuse axonal injury, may happen as a result of the differential movement of the body's fixed and non-fixed components, such as the skull and brain.[12] Serious traumatic brain injuries really cost 13 times more to treat than damage to other parts of the body.[13] Even among helmeted motorcyclists, traumatic brain injury remains the greatest cause of mortality.[9]

There are many different kinds of helmets for motorcycles; full-face, half-face, open-face, flip-up, and full-coverage helmets.[14] The effectiveness of the various types of helmets has not been thoroughly examined.[15] According to the US Centers for Disease Control, full face helmets provide the maximum protection, shielding the eyes with a face shield and safeguarding the chin.[16] Fitzharris et al. discovered in India that the chance of receiving a mild to severe head injury was 5 times higher if a helmet was not worn.[17]

Carasco et al, on the other hand, stated that, despite mandatory helmet wear in Brazil, head trauma was remained the most prevalent injury found.[18] According to the author, the trauma dynamics in a motorbike collision are so severe that even wearing a helmet is unable to safeguard against brain injury.

Fixed and non-fixed components of the body, such as the skull and brain, move differently at high speeds, and brain damage due to deceleration may occur.[19] Ritchter et al. also noted that if the chin strap is not tightly attached, a helmet might be lost at high speeds.[11]

Helmet use laws in India and their compliance:

Many people in India do not take helmet-wearing laws seriously. A third-party insurance policy for bikes is also required by the Indian Motor Vehicles Act, in addition to the helmet. The law requires pillion riders, as well as riders in the front, to wear helmets. If one does not follow the helmet rules in India, he/she may face hefty fines. The Motor Vehicles Amendment Act 2019 included 63 new clauses that increased penalties for a variety of traffic offences. One of the offences mentioned in the amendment was the failure to wear a helmet. Section 129 of this Act states that anyone over the age of four must wear "protective headgear" while riding a bike.[20]

Half helmets are not permitted under Indian helmet laws because they do not provide adequate head protection. The Government of India has issued guidelines requiring all helmet manufacturers in India to produce helmets that comply with the Bureau of Indian Standards (BIS). Certain regulations regarding the helmets include:[20]

a. The helmet's thickness should be 22-25mm, and good-quality foam should be used.

b. The helmet's weight limit was reduced from 1.5kg to 1.2kg.

c. The ISI (IS 4151:2015)[21] mark is mandated by law on all helmets.

d. The material of the eye-covering in the helmet must be completely transparent to avoid any kind of obstruction to driver's vision and all helmets must pass the BIS's prescribed tests. [20]

However, there are certain instances like limiting the helmet use for women and children and eliminating the helmet requirement for light capacity motorized two-wheelers by Karnataka Government, demonstrate that state governments have repeatedly acted outside the law within the scope of their rule-making authority and have made rules that are contrary to MVA Section 129.[22]

The Ministry of Road Transport and Highways published the Central Motor Vehicles (Second Amendment) Rules, 2022. The new rules state that the speed of a motorcycle with a child under the age of four years on the pillion cannot exceed 40 km/h. These rules will take effect one year after the Central Motor Vehicles (Second Amendment) Rules, 2022 are published.[23]

In a study done in Pune, Maharashtra, total of 769 motorcycle riders were observed, with 20% of them riding as pillion passengers. An examination

of the photographs revealed a dismal 16% use of helmets. Helmets were worn by only 2% of the pillion riders observed. The study also discovered a significant gender disparity in compliance, men (18%) are more than twice as likely to wear a helmet as women (8%). People wore helmets more in areas with a lot of commercial and educational establishments, possibly because they were travelling longer distances, whereas in quieter and residential areas, compliance was almost non-existent. In the same study, 110 interviews were also conducted, and the results show that weight, an unattractive and poor design, the belief that accidents were unlikely, and the belief that short distances and low speeds did not necessitate the wearing of helmets were the major reasons given for non-compliance. Feeling hot and uncomfortable was the main justification, followed by "restriction of vision." 59% of respondents said "tighter enforcement" would encourage helmet use, and 32% said "changes in helmet design" would have an effect. The rationale included a small increase in fines and more affordable pricing. 63% of two-wheeler riders felt unsafe riding their bikes in the city, and 70% did not believe that pillion riders needed to wear helmets.[24]

In another study done by S. Wadhiwa et al, it was found that in Hyderabad, India, self-reported helmet use is 1.3 times higher than actual helmet use. Men, young people, having less education, and not owning a helmet are linked to not wearing helmets. Male gender, youth, lack of education, riding a motorcycle with a smaller engine capacity, and using the motorcycle for leisure are all linked to over reporting of helmet use.[25]

Several countries have successfully implemented helmet laws, thereby reducing the mortality and morbidity due to motorized two-wheeler accidents. Some of the examples of such programmes are:

1. The wearing of helmets by motorcycle drivers and passengers was made mandatory nationwide in Thailand in 1994 with the implementation of a helmet law. Following the enactment, the helmet law was enforced in Bangkok for 90 days, for 180 days in other 17 provinces, and for 360 days in the remaining areas of the country. Within Khon Kaen province, the promotion of the helmet law was extensive, and these campaigns persisted even after fines were imposed by the police. As a result of the combined efforts of the helmet law, enforcement, and promotion, the rate of helmet usage in Khon Kaen increased by five times, while head injuries decreased by 41.4% and deaths decreased by 20.8%.[26]
2. In Italy, the law mandated that only motorcycle drivers (not passengers) had to wear helmets, while moped drivers over 18 were exempt. However, in 2000, a more extensive law was implemented, requiring all motorcycle and moped drivers as well as passengers to wear helmets regardless of age. This law was reinforced with enforcement and promotion efforts. As a result, helmet-wearing rates increased significantly, reaching up to 95% in some regions. There was a 66% decrease in hospital admissions for traumatic brain injury, and the occurrence of blunt head injuries (epidural haemorrhages) among motorcycle and moped riders was almost completely eradicated across the country.[27]
3. In 2007, a new helmet law was introduced by the Vietnamese government, requiring all motorcycle drivers and passengers to wear helmets on any road. According to national statistics, the enforcement and promotion of this helmet law resulted in an 18% decrease in road traffic fatalities within the initial three months, ultimately preventing around 1,557 fatalities and 2,495 severe injuries in the first year.[28] Another study found that from 2008 to 2013, the legislation stopped 20,609 fatalities and 412,175 severe injuries, with more than 90% of Vietnamese motorcyclists wearing helmets by 2013.[29]
4. A study conducted between June 2011 and December 2014 observed the use of helmets and found that the percentage of correct helmet use rose from 34.3% to 76.9% in Ha Nam, and from 68.9% to 72.2% in Ninh Binh. The increase was credited to the enforcement and promotion of laws, as well as the benefits of wearing standard helmets correctly.[30]
5. An in-depth analysis of 60 research papers from the United States discovered that the introduction of a mandatory helmet law (UHL) for all motorcycle riders and passengers led to a 47% rise in helmet usage,

along with a decrease in head injuries and fatalities among motorcyclists.[31]

Helmets for Hope is an initiative started by the UN and India to lower traffic deaths. The comprehensive initiative uses a multi-pronged strategy that includes manufacturer incentives, legislation, awareness campaigns, and private sector cooperation to standardize and compel the use of approved ventilated helmets for all two-wheeler riders worldwide. Another crucial area of concentration is making sure that buyers only purchase authentic, high-quality helmets.[32]

Conclusion

To ensure strict compliance, there should be a more focused and strategic plan for traffic law enforcement. This enforcement strategy must be comprehensive, with no exemptions. More public education campaigns are needed to raise awareness about the traffic law that prohibits the use of motorcycles on major roads and bridges. All prospective Motorized Two-Wheeler riders should have access to a well-coordinated training and licensing system. A motorcycle license should only be issued to someone who has successfully completed the required training program. The helmet rule has been enforced sporadically, with a few awareness campaigns that have had little success. Creating an effective enforcement campaign with targeted compliance rates, combined with a well-planned public awareness campaign, can increase compliance and save thousands of lives. Motorized Two-Wheelers should be subject to strict speed control regulations. The government should imply rules for increasing safety features in the Motorized Two-Wheelers, particularly of the cheaper ones. The sale and purchase of the used Motorized Two-Wheelers should be regulated through proper channels. Periodic testing of the Motorized Two-Wheelers should be made mandatory.

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References

1. Singh YN, Bairagi Kaustav kr and Das Kanak Ch. An epidemiological study of road traffic accident victims in medicolegal autopsies. Journal of Indian Academy of Forensic Medicine (JIAFM) 2005; 27 (3): 166-179.
2. Omran AR. The epidemiologic transition. A theory of the epidemiology of population change. Milbank Mem Fund Q 1971;49:509–38.
3. Salomon JA, Murray CJL. The epidemiologic transition revisited: compositional models for causes of death by age and sex. Popul Dev Rev 2002;28:205–28.
4. Gopalakrishnan S. A public health perspective of road traffic accidents. J Family Med Prim Care. 2012 Jul;1(2):144-50.
5. Menon A, Pai VK, Rajeev A. Pattern of fatal head injuries due to vehicular accidents in Mangalore. J Forensic Leg Med. 2008;15(2):75-77.
6. Ravimuni K, Malleswari M, Srinivas C. Pattern of injuries in two wheeler accidental deaths in and around Guntur City, Andhra Pradesh [Internet]. Available from: https://www.iosrjournals.org/iosr-jdms/papers/Vol16-issue3/Version-11/M1603115463.pdf
7. Anh NT, Hung LS, Xuan NT, Lap PD, Tuan DT, Kien VD. Skull Fracture Patterns and Morphologies Among Fatal Motorcycle Traffic Accident Victims in Vietnam. Am J Forensic Med Pathol. 2021;42(1):30-35.
8. Gibson T, Thai K, Anderson R. Motorcycle helmet protection and basilar skull fracture. J Biomech [Internet]. 2007;40:S92.
9. Wittayanrungruengsri N, Chirachariyavej T, Kusamran, T, Tiensuwan M. Causes of fatalities and injuries from motorcycle accidents in Bangkok by Autopsy Investigation. Paper presented at the 8th National Research Conference, Faculty of Graduate Studies, Mahidol University, Thailand. Sept 2007.
10. Kraus JF, Peek-Asa C, Cryer HG. Incidence, severity and patterns of intra-thoracic and intra-abdominal injuries in motorcycle crashes. J Trauma 2002; 52: 548-553.
11. Ritchter M, Otte D, Lehmann U, Chin B, Schuller E, Doyle D et al. Head injury mechanism in helmet-protected motorcyclists: prospective multicentre study. J Trauma 2001; 51: 949-958.
12. McSwain NE Jr. Mechanism of injuries in blunt trauma. In: McSwain NE, Kerstein MD (eds). Evaluation and Management of Blunt Trauma. East Norwalk, CT: Appleton-Century-Crofts, 1987; pp 1-24.

13. Cook IJ, Kerns T, Burch C, Thomas A, Bell E. Motorcycle Helmet use and Head and facial injuries: Crash outcomes in CODES-linked data: National Highway Traffic Safety Administration, US Department of Transportation, Washington DC; 2009.
14. National Centre for Injury Prevention and Control, Division of Unintentional Injury Prevention. Motorcycle Safety Book. Centre for Disease Control; Jun 2012.
15. Lin LR, Kraus JF. A review of risk factors and pattern of motorcycle injuries. Accid Anal Prev 2009; 41: 710-722.
16. National Centre for Injury Prevention and Control, Division of Unintentional Injury Prevention. Motorcycle Safety Book. Centre for Disease Control; Jun 2012.
17. Fitzharris M, Dandona R, Anil Kumar G, Dandona I. Crash characteristics and patterns of injuries among hospitalised motorised two-wheeled vehicle users in urban India. BMC public health 2009; 9: 11.
18. Carasco CE, Godinho M, Barros MB, Rizoli S, Fraga GP. Fatal motorcycle crashes: a serious public health problem in Brazil. World J Emerg Surg 2012; 7:S5
19. Viano DC, King AI, Melvin JW, Weber K. Injury biomechanics: an essential element in the prevention of trauma. J Biomech 1989; 22:403-417.
20. Helmet laws in India [Internet]. Tataaig.com. [cited 2022 Oct 18]. Available from: https://www.tataaig.com/knowledge-center/two-wheeler-insurance/helmet-laws-in-india.
21. Nic.in. [cited 2022 Oct 18]. Available from: https://morth.nic.in/sites/default/files/circulars_document/Helmet%20notification%20MoRTH.pdf
22. Current status of protective headgear in India [Internet]. Savelifefoundation.org. [cited 2022 Oct 18]. Available from: https://savelifefoundation.org/wp-content/uploads/2016/09/Helmet-Laws-in-India_SLF.pdf
23. LegalitySimplified. The Central Motor Vehicles (Second Amendment) Rules, 2022 [Internet]. Legality Simplified. 2022 [cited 2022 Oct 18]. Available from: https://legalitysimplified.com/2022/02/16/the-central-motor-vehicles-second-amendment-rules-2022/
24. Punekarnews.in. [cited 2022 Oct 18]. Available from: https://www.punekarnews.in/%E2%80%8Bstudy-shows-helmet-rule-compliance-at-a-dismal-16-only-8-women-and-2-pillion-riders-wear-a-helmet/
25. Wadhwaniya S, Gupta S, Mitra S, Tetali S, Josyula LK, Gururaj G, et al. A comparison of observed and self-reported helmet use and associated factors among motorcyclists in Hyderabad city, India. Public Health [Internet]. 2017;144S:S62–9.
26. Ichikawa M, Chadbunchachai W, Marui E. Effect of the helmet act for motorcyclists in Thailand. Accid Anal Prev [Internet]. 2003;35(2):183–9. Available from: http://dx.doi.org/10.1016/s0001-4575(01)00102-6
27. Helmets: a road safety manual for decision-makers and practitioners. P. 2006;19.
28. Passmore JW, Nguyen LH, Nguyen NP, Olivé J-M. The formulation and implementation of a national helmet law: a case study from Viet Nam. Bull World Health Organ [Internet]. 2010;88(10):783–7. Available from: http://dx.doi.org/10.2471/blt.09.071662.
29. Case study - Vietnam National Helmet Campaign [Internet]. Issuu. 2014 [cited 2024 Jul 2]. Available from: https://issuu.com/aipfoundation/docs/case_study_-_vietnam_national_helme.
30. Bao J, Bachani AM, Viet CP, Quang LN, Nguyen N, Hyder AA. Trends in motorcycle helmet use in Vietnam: results from a four-year study. Public Health [Internet]. 2017;144:S39–44. Available from: http://dx.doi.org/10.1016/j.puhe.2017.01.010.
31. Peng Y, Vaidya N, Finnie R, Reynolds J, Dumitru C, Njie G, et al. Universal motorcycle helmet laws to reduce injuries: A community guide systematic review. Am J Prev Med [Internet]. 2017;52(6):820–32. Available from: http://dx.doi.org/10.1016/j.amepre.2016.11.030
32. Express Drives Desk. UN and India launch Helmets for Hope campaign to reduce road fatalities. The Financial Express [Internet]. 2024 Jun 11 [cited 2024 Jul 2]; Available from: https://www.financialexpress.com/auto/bike-news/un-and-india-launch-helmets-for-hope-campaign-to-reduce-road-fatalities/3521281/