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Research Article

EPIDEMIOLOGY OF INJURIES IN VICTIMS OF TWO-WHEELER ACCIDENTS PRESENTING IN ACCIDENT AND EMERGENCY DEPARTMENT IN A TERTIARY CARE HOSPITAL IN A RURAL SETTING

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ABSTRACT

Introduction: Two-wheeler accidents constitute a major proportion of road traffic injuries in India, particularly in rural settings where infrastructure and trauma care systems remain underdeveloped.This study was aimed to evaluate profile of road traffic accident cases attending accident and emergency department in Maharaja Agrasen Medical College, Agroha, Hisar.

Methods: A hospital-based cross-sectional observational study was conducted in Maharaja Agrasen Medical College, Agroha, over a period of 6 months i.e. May 2024 to November 2024. A total of 300 patients presenting within 24 hours of two-wheeler accidents were included. Data regarding sociodemographic profile, accident characteristics, injury patterns and outcomes were collected and analyzed using SPSS version 25.

Results: The majority of victims were males (83.9%) and belonged to the 21–30-year age group (35%). Drivers constituted 90% of cases. Motorcycles were involved in 72.6% of accidents. Helmet usage was observed in only 43.3% of drivers. Alcohol consumption was reported in 24.3% of cases. Most accidents occurred on village roads (53%) and during daytime hours. Fractures were the most common injury (49%), predominantly involving lower limbs (43.3%). A significant association was found between helmet non-use and head injury ($p<0.001$). Orthopedic surgical intervention was required in 45.7% of cases.

Conclusion: Two-wheeler accidents in rural areas predominantly affect young males and are associated with modifiable risk factors such as helmet non-use, over-speeding and alcohol consumption. Strengthening road safety enforcement and improving rural infrastructure are essential to reduce injury burden.

Keywords*: Two-wheeler accidents; Road traffic injuries; Rural tertiary care hospital; Epidemiology; Helmet use.*

INTRODUCTION

Road transportation stands as the most economically efficient mode for both freight and passenger transport in India, especially considering its extensive reach in densely populated areas[1]. The country faces a heightened exposure to challenging traffic conditions due to rapid motorization and increasing urbanization, propelled by robust economic growth. Consequently, the incidence of road accidents, traffic injuries and fatalities has remained elevated. Globally, road accidents rank among the leading causes of death, primarily affecting individuals aged 15 to 49 years[2]. Given that road accidents result from a complex interplay of multiple factors, The multifactorial etiology of road traffic accidents necessitates a comprehensive and integrated approach to effectively diminish both the frequency of collisions and the resultant fatalities[3].Recent years have witnessed a disconcerting surge in the number of two-wheeler accidents across the country. According to data from the Ministry of Road Transport and Highways, a significant portion of road accidents in India involves two-wheelers, with an alarming increase in the associated injuries and fatalities. Understanding the gravity

of the situation necessitates a closer examination of the contributing factors, ranging from infrastructure challenges to behavioral aspects, to formulate effective strategies for prevention and mitigation.As per the Ministry of Road Transport and Highways, States and Union Territories collectively reported 461,312 road accidents in the calendar year 2022, resulting in 168,491 fatalities and injuries to 443,366 individuals. On average, this data corresponds to 1,264 accidents and 462 deaths daily or 53 accidents and 19 deaths per hour nationwide. For the second consecutive year, two-wheelers remained predominant in both total accidents and fatalities in 2022, with light vehicles like cars, jeeps, and taxis following behind. Regarding road-user categories, two-wheeler riders constituted the highest proportion of total fatalities in 2022, accounting for 44.5%, followed by pedestrian road-users, comprising 19.5% of those killed in road accidents[4].Rural environments exhibit distinct challenges and attributes when compared to urban areas, encompassing variations in traffic flow, roadway quality, availability of emergency medical services and the sociodemographic characteristics of injured individuals. Consequently, analyzing the epidemiology of injuries resulting from two-wheeler accidents in rural tertiary care institutions yields important insights that can guide the development of context-specific preventive strategies and enhance trauma care services in these underserved settings.

MATERIAL AND METHODS

The present study was a hospital-based cross-sectional observational study conducted at the Department of Orthopedics, Maharaja Agrasen Medical College (MAMC), Agroha, Hisar district, Haryana. The study was undertaken in the Accident and Emergency Department of this tertiary care hospital. All the patients presenting due to injuries acquired because of two-wheeleraccidents within 24 hours were included and a total of 300 patients presented.Data regarding sociodemographic profile, accident characteristics, injury patterns, site and type of injury, type of fracture (if any), treatment modality and outcomes were collected using a fixed preformed questionnaire and analyzed using SPSS version 25.

RESULTS

A total of 270 two wheeler accidents occurred, involving 300 patients presented during the 6-month period. The age-wise distribution showed a predominance of young adults. The highest number of victims belonged to the 21–30-year age group (105; 35.0%), followed by 31–40 years (66; 22.0%). Adolescents and young adults ≤20 years constituted 46 cases (15.2%). Individuals aged 41–50 years accounted for 48 cases (16.1%), while those above 50 years formed the smallest group (35; 11.7%).Sex-wise analysis demonstrated a marked male predominance. Out of 300 victims, 252 (83.9%) were males, while only 48 (16.1%) were females.Married individuals constituted the majority of accident victims, accounting for 178 cases (59.2%), while 122 (40.8%) were unmarried.Farmers formed the largest occupational group affected (100; 33.2%), followed by laborers (82; 27.4%) and students (51; 17.0%). Service workers accounted for 39 cases (13.0%), while other occupations contributed 28 cases (9.4%).Drivers constituted the majority of victims (270; 90%), while pillion riders accounted for only 30 cases (10%).Motorcycles were involved in the majority of accidents (218; 72.6%), followed by scooters/scooties (55; 18.4%). Bicycles (16; 5.4%) and electric two-wheelers (11; 3.6%) contributed to a smaller proportion.Among 270 drivers, only 117(43.3%) were wearing helmets at the time of accident, while 153 (56.7%) were not.Among helmet users, only 12 drivers sustained head injuries, whereas 39 head injuries were noted among non-helmeted riders.Alcohol consumption at the time of accident was reported in 24.3% of victims.Most accidents occurred during daytime hours, with 33.3% between 12 PM–6 PM and 30.6% between 6 AM–12 PM. Evening hours accounted for 28.0% of accidents,Village roads accounted for 52.9% of accidents, followed by city roads (38.1%). Highways contributed to only 9.0%.Collision with four-wheelers was the most common mechanism (38.6%), followed by skid and fall (27.3%). Stray animals contributed to 17.6% of accidents, highlighting rural-specific hazards.Over-speeding was the leading cause (31.6%), followed by wrong-side driving (22.0%). Poor visibility and stray animals were also significant contributors.Fractures were the most common injury pattern (49%), followed by lacerations (25%) and abrasions (18.3%). Multiple injuries were observed in 7.7% of cases, indicating high-energy trauma.Lower limbs were the most commonly affected site (43.3%), followed by upper limbs (23.4%). Head and facial injuries constituted 51(17.0%) of cases.Among fracture cases, tibia/fibula fractures were most common (40.1%), followed by femur fractures (25.9%).Closed fractures constituted 76.2% of fracture cases, while open fractures accounted for 23.8%, indicating significant trauma severity.More than half of the victims were managed conservatively (163; 54.3%), while 137 patients (45.7%) required surgical intervention.

Table 1- Age distribution of victims of two wheeler accidents

Age group (years)	Number	Percentage
≤20	46	15.2
21–30	105	35.0
31–40	66	22.0
41–50	48	16.1
>50	35	11.7

Total	**300**	**100**

Figure 1- Bar graph showing age distribution of victims of two wheeler accidents

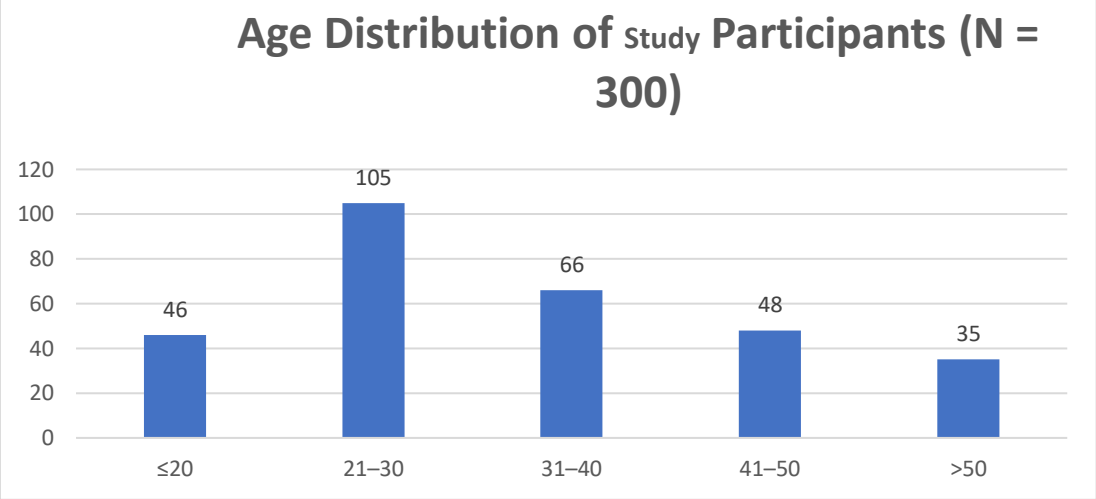


Table 2- Type of injury sustained by two wheeler accident victims

Injury type	Number	Percentage
Fracture	147	49.0
Laceration	75	25.0
Abrasion	55	18.3
Multiple injuries	23	7.7

Figure 2- Bar graph showing type of injury sustained by two wheeler accident victims

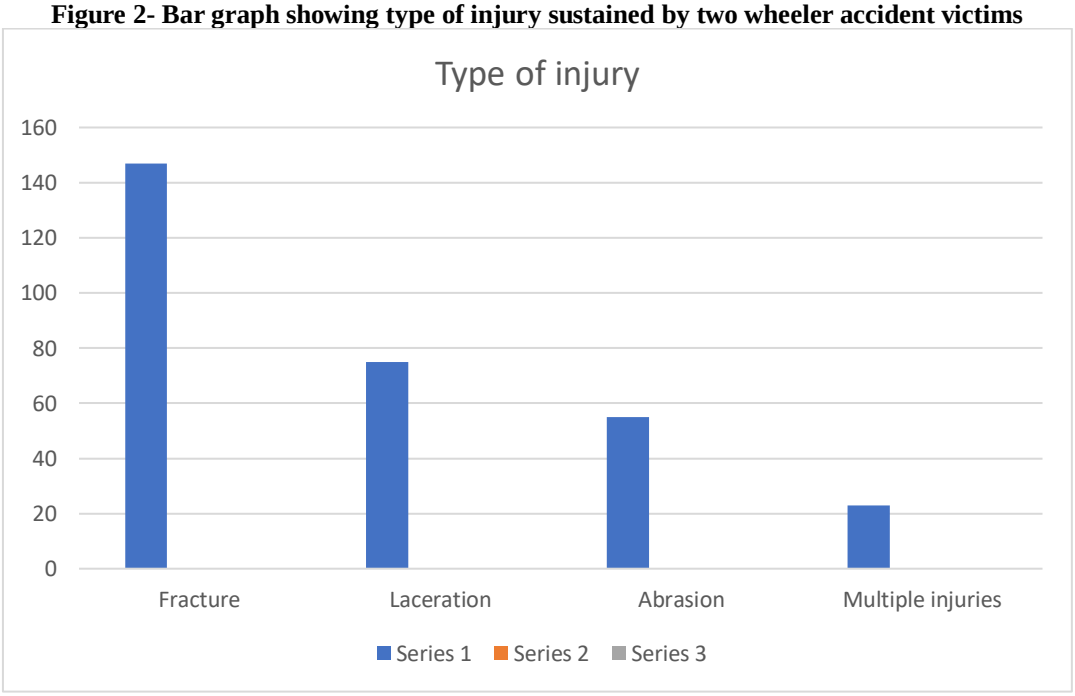


Table 3- Bone involved in fractures acquired by two wheeler accident victims

Bone involved	Number	Percentage
Tibia/Fibula	59	40.1
Femur	38	25.9

Radius/Ulna	28	19.0
Chest (Clavicle/ Ribs/Vertebrae)	22	15.0

Figure 3- Bar graph showing bone involved in fractures acquired by two wheeler accident victims

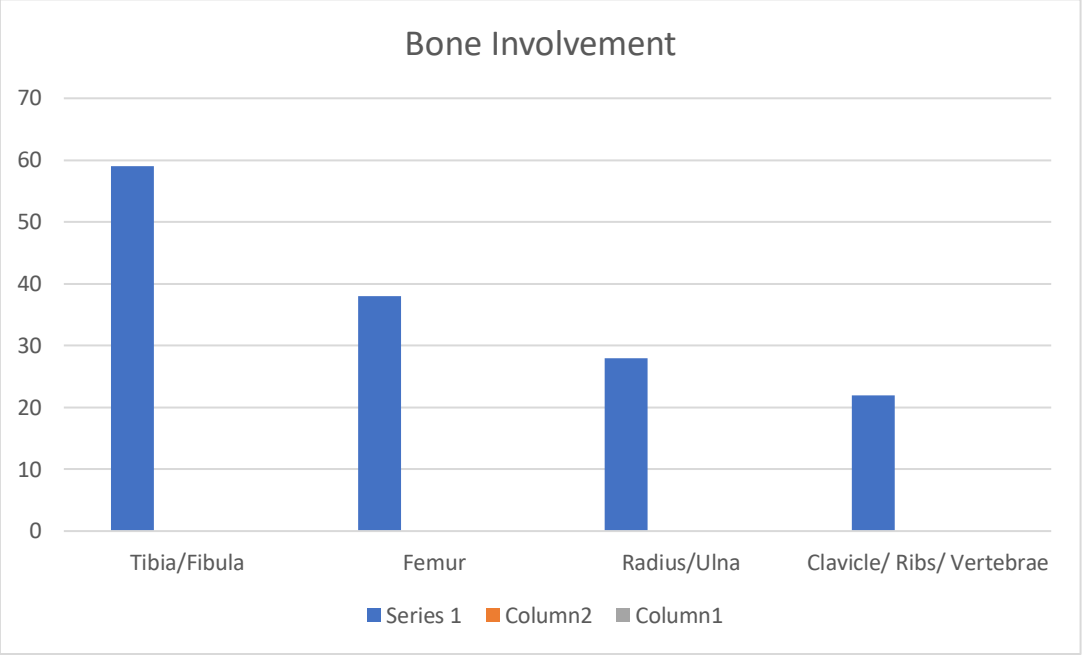


Table 4- Nature of fracture attained by victims of two wheeler accident

Type	Number	Percentage
Closed	112	76.2
Open	35	23.8

Figure 4- Pie chart showing nature of fracture attained by victims of two wheeler accident

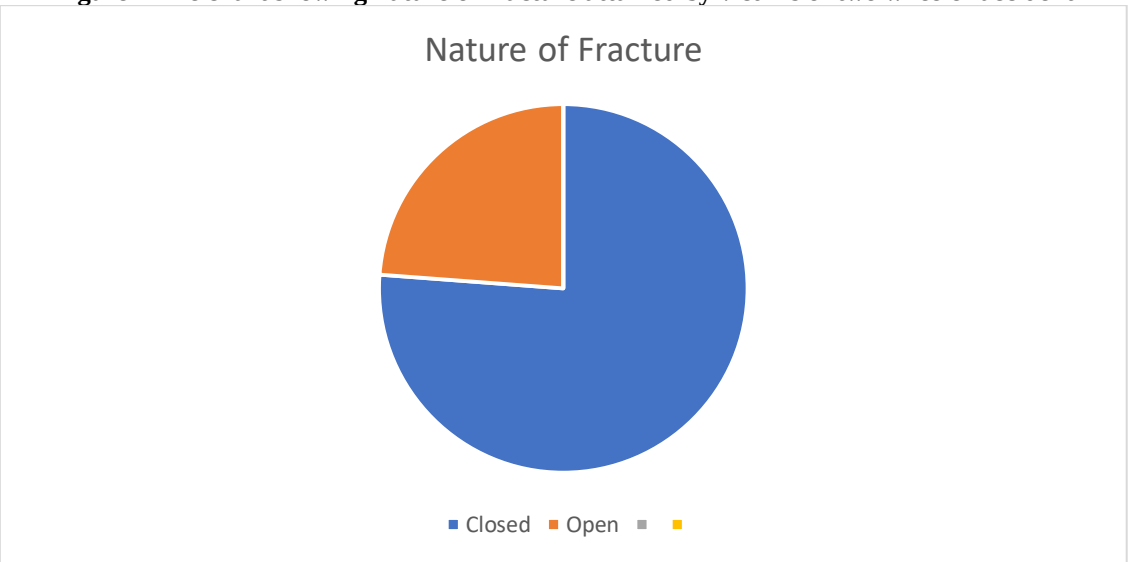
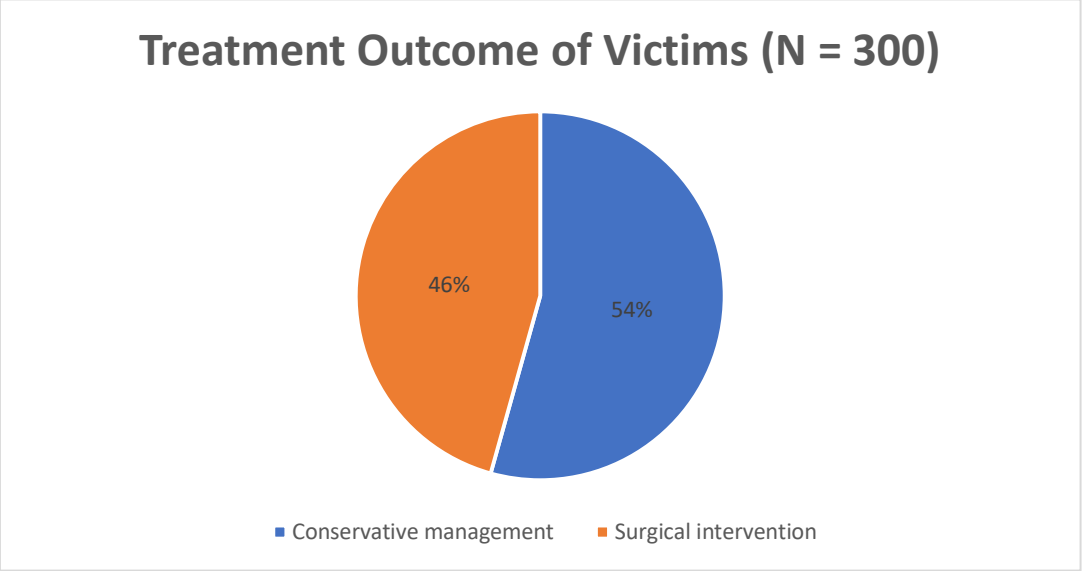


Table 5- Treatment outcome of victims of two wheeler accidents

Outcome	Number	Percentage
Conservative management	163	54.3
Surgical intervention	137	45.7
Total	**300**	**100**

Figure 5- Pie Chart showing treatment outcome of victims of two wheeler accidents



DISCUSSION

The significance of this study lies in its focus on a rural tertiary care setting, where two-wheelers are the primary mode of transportation and where road infrastructure, traffic regulation and prehospital care services are often inadequate.

The present study demonstrated a clear predominance of young adults among victims of two-wheeler accidents,this age distribution highlights the disproportionate burden of road traffic injuries on economically productive age groups in rural settings, where two-wheelers serve as the primary mode of transport for occupational, educational and agricultural activities.The findings are consistent with the previous studies done by Mahajan et al. (2016)[5] (21-30 years, 31.4%), Sahu VK et al. (2019)[6] (18-30 years, 34.16%), Salam et al. (2023)[7] (21-30 years,32.7%).The predominance of younger age groups may be attributed to several factors, including increased need for outdoor activity, occupational demands, peer influence, risk-taking behavior, over-speeding and limited adherence to safety practices.

The present study revealed a striking male predominanceconstituting 83.9% (252 cases). This also aligns with studies done by Misra et al. (2017)[8] (Male 84%),Singh et al. (2017)[9] (Male 75.5%), Chaurasia et al. (2019)[10] (Male 83.7%), Parashar et al. (2020)[11] (Male 85.2%), Kundavaram et al. (2022)[12] (Male 76.6%).The male predominance observed in the present study can be explained not only by increased exposure but also by behavioral factors such as over-speeding, rash driving, non-compliance with helmet use and driving under the influence of alcohol.

In the present study, over-speeding emerged as the leading cause of two-wheeler accidents, accounting for 31.6% of cases which is similar to study done by Parashar et al. (2020)[11] (Rash driving/ Over speeding- 34.25%). Overall, the causes identified in this study are largely preventable. Strengthening enforcement against over-speeding and wrong-side driving, improving visibility through better lighting and addressing animal-related hazards could substantially reduce accident incidence in rural areas.

The present study revealed that the lower limbs were the most commonly affected site (43.3%) which corelates with study by Jain et al.(2020)[13] (Extremity Fracture 54%).This anatomical distribution reflects the biomechanics of two-wheeler accidents, where riders are directly exposed during collisions and falls.Among the 147 fracture cases in the present study, tibia and fibula fractures were the most common, accounting for 40.1%, followed by femur fractures (25.9%), radius and ulna fractures (19.0%) and clavicle/ribs/vertebrae fractures (15.0%). This pattern reflects the exposure of lower limbs during two-wheeler accidents and the direct transmission of impact forces.Femur fractures, accounting for one-quarter of fracture cases, are clinically significant due to associated blood loss, prolonged immobilization and higher surgical demand.Upper limb fractures, including radius and ulna, reflect protective mechanisms during falls, while clavicle/ribs/vertebrae fractures often result from shoulder impact. The fracture

distribution observed underscores the need for well-equipped orthopaedic trauma services, particularly in rural tertiary care centres.

Helmet usage among drivers in the present study was notably poor, with only 43.3% of drivers wearing helmets at the time of the accident, while 56.7% were non-helmeted which is comparable to previous studies Sahu VK et al. (2019)[6] 41.5%, Jain et al. (2020)[13] 30%. This low compliance is concerning given the well-established protective role of helmets in preventing head and facial injuries. In rural areas, helmet non-use may be influenced by factors such as lack of enforcement, perceived discomfort, short travel distances, and underestimation of risk on village roads.

In the present study, 54.3% (163 cases) of two-wheeler accident victims were managed conservatively, while 45.7% (137 cases) required orthopedic surgical intervention.The substantial proportion of patients requiring surgical intervention in the present study reflects the severity of two-wheeler injuries in rural settings. Strengthening trauma care services, ensuring availability of orthopedic and surgical expertise and improving prehospital care are crucial to improving outcomes.

CONCLUSION

The present study provides a comprehensive overview of the epidemiology, injury patterns and outcomes of two-wheeler accidents in a rural tertiary care setting. The findings clearly demonstrate that two-wheeler accidents predominantly affect young, economically productive males, leading to significant individual, familial and societal consequences.Male predominance among accident victims reflects greater exposure to road traffic, occupational mobility and risk-taking behaviors such as over-speeding, alcohol consumption and non-compliance with safety measures.Motorcycles emerged as the most commonly involved vehicles, reinforcing their central role in rural mobility and road traffic injuries. The overwhelming involvement of drivers compared to pillion riders highlights the increased vulnerability associated with vehicle operation and decision-making at the time of travel. Inadequate helmet usage and alcohol consumption were identified as critical modifiable risk factors, with both showing statistically significant associations with injury severity. These findings emphasize that a large proportion of injuries sustained in two-wheeler accidents are preventable through improved safety compliance and behavioral change.The predominance of fracturesreflects the severity of injuries sustained and the number of fractures requiring surgical intervention highlight the substantial burden placed on orthopedic and trauma care services. Village roads were identified as high-risk environments for severe injuries, pointingtoward infrastructural deficiencies, poor visibility and inadequate traffic regulation in rural areas. Hence, A multipronged approach involving policy implementation as proved in study by Sasmal et al. (2020)[14], community education and healthcare system strengthening is required to mitigate the burden of two-wheeler accidents and improve outcomes for rural populations.

Founding: Nil
Conflict of Interest: No Conflict of Interest

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