Section: Orthopaedics and Traumatology

Original Research Article

CLINICO-EPIDEMIOLOGICAL PROFILE OF ORTHOPEDIC TRAUMA IN A TERTIARY CARE HOSPITAL IN CENTRAL INDIA

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Received : 06/06/2025
Received in revised form : 22/07/2025
Accepted : 13/08/2025

Keywords:
Clinico-epidemiological profile, road traffic accidents, golden hour, black spots, orthopedic trauma.

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DOI: 10.47009/jamp.2025.7.4.256

Source of Support: Nil,
Conflict of Interest: None declared

Int J Acad Med Pharm
2025; 7 (4); 1343-1348

ABSTRACT

Background: The objective of present study was to analyze the clinico-epidemiological profile of orthopedic trauma patients, quantify the current burden of orthopedic trauma at a tertiary care center in central India, identify high-risk areas ("black spots") and design a pre-hospital emergency response system. **Materials and Methods:** A total of 2,041 patients presenting to the Emergency Medicine (Casualty) were included. Along with demographic variables; mode of injury, site, type of injury, affected body part, and time of reporting to the hospital were recorded. Data analysis was performed using SPSS for Windows. **Result:** 2,041 (12.8%) patients were referred to the Department of Orthopedics. The majority of these patients were male (66%). The predominant age group was 20-49 years. A significant number of patients (60%) resided in rural areas. Only 17% patients arrived at the Casualty within the "Golden Hour". The most common cause of injury was road traffic accidents (RTAs) (58%) followed by falls (33%). Within RTAs, the predominant type included head-on collisions (22%), collisions with fixed objects (22%) and side impacts (22%) with two-wheeler riders being the most affected demographic. The lower limb was the most frequently injured body part. The tibia was the most frequently fractured bone, followed by the fibula and clavicle. A history of alcohol consumption was reported in 11% of the trauma patients. Five high-risk areas, referred to as "black spots" were identified. **Conclusion:** Analyzing the clinico-epidemiological profile of orthopedic trauma patients is crucial for optimizing management practices, informing resource allocation, and developing effective preventive strategies. Categories: Epidemiology/Public Health, Trauma, Orthopedics.

INTRODUCTION

Orthopaedic trauma represents a substantial burden on healthcare systems globally, characterized by its clinical complexities and significant societal impact.[1] In the context of a tertiary care setting, where specialized resources and expertise converge, the evaluation of patients with orthopaedic trauma is of critical importance. Orthopaedic trauma encompasses a wide array of injuries, including fractures, dislocations, and soft tissue injuries, often resulting from accidents, sports activities or acts of violence. These injuries contribute to considerable morbidity, disability and socioeconomic repercussions.[2] A thorough understanding of the clinico-epidemiological profile of orthopaedic trauma patients is essential for effective management, optimal resource allocation and the development of preventive strategies.[3] Analyzing the clinical manifestations of these injuries such as their severity, anatomical distribution, associated complications and treatment outcomes is crucial for enhancing patient care and maximizing resource utilization.[4] This study aims to systematically evaluate the demographic characteristics, injury patterns and clinical presentations of orthopaedic trauma patients within our tertiary care facility. The epidemiological landscape of orthopaedic trauma is influenced by various factors, including demographic characteristics, socioeconomic status, geographic location and cultural practices. Recognizing these factors are vital for tailoring interventions and optimizing healthcare delivery to meet the specific needs of diverse patient populations. By conducting

ISSN (O): 2687-5365; ISSN (P): 2753-6556

a comprehensive analysis of the clinico-epidemiological profile of orthopaedic trauma patients, this research seeks to provide valuable insights that can inform evidence-based practices and improve patient outcomes. Utilizing a prospective observational design, we will gather data from medical records, radiological imaging and clinical assessments. The analysis will encompass demographic data, mechanisms of injury, anatomical sites of trauma, and associated injuries, with findings presented descriptively and statistically to create a detailed overview of the orthopaedic trauma landscape in our tertiary care setting. Ultimately, this research aspires to enhance our understanding of the epidemiology of orthopaedic trauma, guiding clinical decision-making, resource allocation, and preventive initiatives. The primary objective is to quantify the current burden of orthopaedic trauma at this institution, while the secondary objective is to identify high-risk areas, referred to as "black spots" and to design a pre- hospital emergency response system aimed at reducing the incidence of orthopaedic trauma in the region. By elucidating the clinico-epidemiological profile of orthopaedic trauma patients, we aim to contribute to the optimization of trauma care delivery and the promotion of musculoskeletal health within our community and beyond. Ultimately, this research endeavors to enhance trauma care and improve patient outcomes within the community.

MATERIALS AND METHODS

This prospective observational study was conducted at N.S.C.B. Medical College & Hospital in Jabalpur, Madhya Pradesh (India), from August 2022 to August 2024. This study got the approval from the Institutional Ethics committee of N.S.C.B. Medical College Jabalpur (M.P.) on 05-09-2022. The study included patients who were brought to the Emergency department (Casualty) requiring orthopaedic interventions. Exclusions were made for patients referred to other departments, those who refused to provide consent, and individuals unable to comprehend the questions without a caregiver to assist in providing complete information.

Sample size calculation: Sample size was estimated using formula of simple random sampling for infinite population and assumptions were considered based on the fact that in 53.3% cases RTA was the most common cause of trauma.[5] At 95% confidence intervals (5% α), 80% power and 5% absolute precision, a power analysis determined that a sample of minimum 383 subjects were required.

$z^2 \times p \times (1-p) / d^2 = S$

Confidence level: conventional = 95% = 1 - α; therefore, α = 0.05 and z (1-α/2) = 1.96 = value of the standard normal distribution corresponding to a significance level of 0.05 (1.96 for a 2-sided test at the 0.05 level).

A total of 2,041 patients presenting to the Casualty (Department of Emergency Medicine) were included in the study. Along with demographic variables, mode of injury, site, type of injury, affected body part, and time of reporting to the hospital were recorded. Data analysis was performed using SPSS (Statistical Package for Social Sciences) for Windows.

RESULTS

From January to March 2024, a total of 15,925 patients reported the Emergency Medicine at N.S.C.B. Medical College & Hospital in Jabalpur. Of these, 2,041 patients were referred to the Department of Orthopaedics, representing 12.8% (2041 out of 15925) of the total. Among the 2,041 66% (1352 out of 2041) were males and 34% (689 out of 2041) were females. The majority of patients were in the 20-29 age group (637 out of 2041; 31%), followed by those aged 40-49 (481 out of 2041; 24%) and 30-39 (351 out of 2041; 17%) [Table 1]. The mean age was 37.07 years, with a median of 35 years. In the male cohort, the most frequently affected age group was 20-29 years (546 out of 1352; 41%), while for females, it was 40-49 years (221 out of 689; 32%).

Table 1: Distribution of study patients according to age-group

Age group	No. Of patients	Percentage
New Born - 10 Years	26	1%
10 - 19 Years	130	6%
20 - 29 Years	637	31%
30 - 39 Years	351	17%
40 - 49 Years	481	24%
50 - 59 Years	182	9%
60 - 69 Years	169	8%
70 - 79 Years	39	2%
80 Years and above	26	1%
Total Patients	2041	100%

Most patients arrived at the casualty after 2:00 PM, with peak attendance between 2:00 PM and 4:00 PM (312 out of 2041; 15%), 6:00 PM and 8:00 PM (299 out of 2041; 15%), 8:00 PM and 10:00 PM (308 out of 2041; 15%), and 10:00 PM and 12:00 AM (307 out of 2041; 15%). Only 338 patients out of 2041 (17%) reached the casualty within the "Golden Hour" of one hour post-trauma.

The most common cause of injury was road traffic accidents (RTA), accounting for 1,183 patients out of 2041 (58%), followed by falls (689 out of 2041; 33%) [Table 2]. Within fall incidents, "fall from standing"

ISSN (O): 2687-5365; ISSN (P): 2753-6556

was the major contributor (377 out of 2041; 18%). The primary types of injuries from RTAs included head-on collisions, hitting fixed objects, and side impacts. Among RTA cases, two-wheeler riders constituted the largest affected group (780 out of 1183; 66%). Additionally, most trauma cases were classified as high- velocity trauma, with 1,326 out of 2,041 (65%). The majority of patients were brought to the casualty by their relatives.

Table 2: Distribution of study patients according to mode of injury

Mode of injury	No. Of patients	Percentage
Assault	78	4%
Fall from height	143	7%
Fall from stairs	169	8%
Fall from standing	377	18%
Fall in ditch	13	1%
Fall of heavy object over body	13	1%
Hit by animal	13	1%
Machine injury	39	2%
Railway tract accident	13	1%
RTA (Road traffic accident)	1183	58%
Total Patients	2041	100%

The lower limb was the most commonly affected area among trauma patients, with 858 out of 2041 cases (42%), followed by the upper limb at 728 out of 2041 cases (36%) [Table 3]. The most frequently injured body part was the leg (533 out of 2041; 26%), followed by the hand (299 out of 2041; 15%) and the back (247 out of 2041; 12%) [Table 4]. The tibia was the most commonly fractured bone (130 out of 2041 cases; 6%), followed by the fibula (104 out of 2041 cases; 5%) and the clavicle (78 out of 2041 cases; 4%) [Table 5]. 473 out of 2041 (23 %) cases had a single bone fracture, while 197 out of 2041 (9 %) cases had multiple fractures (more than one bone).

Table 3: Distribution of study patients according to site of injury

Site of injury	No. Of patients	Percentage
Back (spine)	234	11%
Chest	52	3%
Face	13	1%
Head	117	6%
Hip & pelvis	13	1%
Lower limb	858	42%
Pelvis	26	1%
Upper limb	728	36%
Total patients	2041	100%

Table 4: Distribution of study patients according to body part injured

Body part injured	No. Of patients	Percentage
Ankle	26	1%
Arm	26	1%
Back	247	12%
Chest	39	2%
Elbow	104	5%
Face	13	1%
Foot	78	4%
Forearm	52	3%
Hand	299	15%
Head	117	6%
Hip	117	6%
Knee	91	4%
Leg	533	26%
Neck	13	1%
Pelvis	26	1%
Shoulder	117	6%
Thigh	52	3%
Wrist	91	4%
Total patients	2041	100%

Table 5: Distribution of study patients according to type of injury (bone injured)

Type of injury	No. Of patients	Percentage
Dislocation shoulder	13	1%
Clavicle	78	4%
Humerus	13	1%
Radius	39	2%
Ulna	52	3%

ISSN (O): 2687-5365; ISSN (P): 2753-6556

Metacarpal	39	2%
Phalanx UL	65	3%
Vertebra	65	3%
Rib	26	1%
Dislocation hip	13	1%
Pubic ramus	39	2%
Femur	26	1%
Femur IT	52	3%
Femur neck	39	2%
Patella	13	1%
Tibia	130	6%
Fibula	104	5%
Calcaneum	26	1%
Metatarsal	13	1%
Phalanx LL	13	1%
Head injury	91	4%
Soft tissue injury	1092	54%
Total patients	2041	100%

A significant 46% of cases (949 out of 2,041) were referred from other health centers, where they received first aid before being brought to the casualty. Among the patients, 741 (36%) arrived by ambulance, while the remaining 1,300 (64%) were transported by private vehicles. Thirteen patients out of 2,041 (< 1 %) were hemodynamically unstable, presenting with a systolic blood pressure of less than 90 mmHg. Additionally, 11% (224 out of 2041) of the patients reported a history of alcohol consumption.

The majority of patients were from middle-class backgrounds (1429 out of 2041; 70%), with 62% (1261 out of 2041) residing in the Jabalpur district. The most common locations for trauma incidents within Jabalpur included Garha (234 cases; 11%), Sadar (143 cases; 7%), Tilwara (130 cases; 6%), Bhedaghat (91 cases; 4%), Ranjhi (65 cases; 3%), Adhartal (52 cases; 3%), Madan Mahal (52 cases; 3%), and Majholi (52 cases; 3%). Overall, the most prevalent sites for trauma incidents included Garha (234 cases; 11%), Mandla (195 cases; 13%), Tilwara (130 cases; 6%), Sadar (143 cases; 7%), and Bhedaghat (91 cases; 4%), along with other areas like Dindori (78 cases; 6%), Gorakhpur (65 cases; 3%), Raipura (65 cases; 3%), Shahpura (52 cases; 3%), and the various Jabalpur neighborhoods mentioned earlier.

DISCUSSION

Understanding the burden and patterns of injuries in populations is crucial for reducing morbidity and mortality through targeted prevention strategies. The objective of present study was to quantify the current orthopedic burden at N.S.C.B. Medical College in Jabalpur, Madhya Pradesh, and to identify critical areas for improvement, enabling the design of a pre-hospital emergency response system to mitigate orthopedic trauma in the region.

In the present analysis, majority of patients were male (1352 out of 2041; 66%), which aligns with findings from various studies that report male representation ranging from 63% to 87% and female representation from 13% to 37%.[5-8] The male-to-female ratio in our study was 2:1. The predominant mode of injury was road traffic accidents (RTA), with a significant proportion of vehicle riders being male. A meta-analysis of studies conducted on injuries in South Asia has indicated that approximately 80% of reported injuries occur in male individuals.[9] This may be attributed to the nature of work in the younger age group, who are often more engaged in outdoor labor.

Most patients came from rural areas (1222 out of 2041; 60%), reflecting the tertiary care nature of the institution, which frequently receives referrals from rural health centers. This contrasts with findings from Ranjana Singh et al., where urban victims outnumbered rural ones.[10] In another study Devarshi Rastogi, reported that the majority of injuries occurred in rural settings.[11] Furthermore, poor road conditions, limited visibility, and high speeds contribute to the increased incidence of road traffic accidents (RTAs) in rural areas.

Age distribution indicated that most patients were in the 20-29 age group (637 out of 2041; 31%), followed by 40-49 years (481 out of 2041; 24%) and 30-39 years (351 out of 2041; 17%). The mean age was 37.07 years, with a median of 35 years. Among males, the most affected age group was 20-29 years (546 out of 1352; 41%), while for females, it was 40-49 years (221 out of 689; 32%). These findings are consistent with existing literature, which identifies the 20-40 age groups as the most commonly affected demographic.[3,5,11-13]

Patients predominantly attended the casualty after 2:00 PM, with peak hours between 2:00 PM and 4:00 PM (312 out of 2041; 15%), 6:00 PM and 8:00 PM (299 out of 2041; 15%), 8:00 PM and 10:00 PM (308 out of 2041; 15%), and 10:00 PM and 12:00 AM (307 out of 2041; 15%). Only 338 patients (17%) were brought to the casualty within the "Golden Hour" of one hour post-trauma, a crucial time for improving recovery outcomes.

The leading mode of injury was RTA (1183 patients, 58%), followed by falls (689 patients, 33%), with falls from standing contributing significantly (377 patients, 18%).[5,11,14] The rising number of vehicles and traffic congestion, combined with the fast-paced

ISSN (O): 2687-5365; ISSN (P): 2753-6556

lifestyle in the region, may contribute to the increasing incidence of injuries. Most common types of injuries from RTAs included head-on collisions, hitting fixed objects, and side impacts. Notably, two-wheeler riders constituted the largest affected group (780 out of 1183 RTA cases; 66%).[5] This is attributed to the inherent instability of two-wheelers, the high speeds at which these vehicles are often driven, and the lack of adequate safety features.

Among trauma patients, lower limb injuries were most prevalent (858 patients, 42%), followed by upper limb injuries (728 patients, 36%). Regarding the injury pattern, the leg was the most frequently injured body part (533 patients, 26%), followed by the hand (299 patients, 15%) and back (247 patients, 12%).[15,16] This was in contrary to other series in literature, where the head and forearm are more commonly depicted as the regions of the body affected, rather than the lower limbs.[5,17] The most commonly fractured bones were the tibia (130 cases), fibula (104 cases), and clavicle (78 cases). A significant percentage of patients received first aid after the road traffic accident (RTA), which can be attributed to the government's efforts to improve infrastructure and policies at peripheral centers. In the current's study 46% (949 out of 2,041) of patients had received first aid at other health centers prior to arriving at the casualty. This is comparable to some other studies.[8] Only 36% (741 out of 2041) of the total patients arrived at the hospital by ambulance while 64% (1300 out of 2041) patients were transported either by personal or hired vehicles. In a study by Dutta et al., it was observed that just 8.3% of patients reached the hospital by ambulance, with another 3% arriving via police vehicle.[18] Enhanced ambulance services are recommended for improved patient outcomes.

In this study, we observed that 11% (224 out of 2041) of patients presenting to the Casualty reported a history of alcohol consumption. Research by Badrinarayan Mishra et al. indicated a positive correlation between alcohol use and road traffic accidents.[8] Similarly, a study by Amita Aggarwal et al. found that 26% of participants had a history of alcohol consumption.[19] Rajesh Kumar Rohilla et al. reported that 16.23% of patients were under the influence of alcohol at the time of their injury, while Mantu Jain et al. found that 25% of participants consumed alcohol.[5] Alcohol consumption impaired cognitive and motor functions, increases reaction times, and reduces decision-making ability, leading to a higher likelihood of crashes and severe injuries.

Furthermore, majority of patients ((1429 out of 2041; 70%) identified as belonging to the middle class, likely due to the availability of free services in the government sector. The authors speculated that individuals from higher socioeconomic classes may prefer to seek care at multispecialty hospitals.

Trauma incidents were most commonly reported in Garha (234 out of 2041 cases; 11%), Mandla (195 out of 2041 cases; 13%), and other areas such as Tilwara (130 out of 2041 cases; 6%) and Sadar (143 out of 2041 cases; 7%). Notably, the Ministry of Road Transport and Highways has identified 25 "black spots" in Madhya Pradesh, with five located in Jabalpur, highlighting areas with high fatality rates due to RTAs. These blackspots are frequently the result of inadequate road engineering, high-speed vehicles and driver negligence, turning and narrow roads, sharp turns, high population density, poor road conditions and the lack of pedestrian crossings, and they account for nearly two-thirds of fatalities resulting from road traffic accidents (RTAs). Therefore, it is crucial to strategically locate trauma care facilities within an accessible distance from these blackspots to ensure timely and definitive care for the injured within the critical "golden hour." In this context, when selecting healthcare facilities for upgrading under this initiative, priority should be given to existing hospitals within an 80-100 km radius of identified blackspots, particularly those with high mortality rates from RTAs despite the implementation of road safety measures. Establishing ambulances equipped with comprehensive first aid resources at strategic locations could facilitate the rapid transport of trauma victims to healthcare facilities while providing essential pre-hospital care en route. This approach aims to enhance patient outcomes by minimizing the time to treatment and addressing critical injuries prior to arrival at medical facilities.

CONCLUSION

Based on our critical observations, we recommend several essential strategies for designing a pre-hospital emergency response system to reduce the burden of orthopedic trauma and improve patient outcomes. First, it is crucial to ensure the availability of ambulances within 10 km of identified high-risk areas (black spots). Additionally, promoting education on safety regulations and the use of safety devices related to road traffic accidents (RTAs) is vital. Increasing awareness of the "Golden Hour" in trauma care can significantly impact patient survival and recovery. Moreover, developing appropriate healthcare infrastructure to minimize hospital stay durations will help alleviate time burdens on patients. Training ambulance personnel in Basic Life Support (BLS) is also essential. Establishing a Trauma Task Force near Community Health Centers (CHCs) and Primary Health Centers (PHCs) can enhance coordination in emergency response. Furthermore, implementing educational programs focused on traffic regulations and initiating community-based primary prevention initiatives will foster a safer environment. Lastly, strengthening the enforcement of traffic laws and establishing appropriate penalties at various levels are critical steps toward improving road safety.

Together, these strategies aim to enhance emergency response capabilities and improve outcomes for patients experiencing orthopedic trauma.

ISSN (O): 2687-5365; ISSN (P): 2753-6556

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ISSN (O): 2687-5365; ISSN (P): 2753-6556