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Original Research Article

EPIDEMIOLOGY OF FRACTURES IN A RURAL POPULATION OF EAST INDIA

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Abstract

Background: Fractures are a significant public health concern, particularly in rural populations where access to healthcare is limited. Despite the high burden of fractures in rural India, there is a paucity of data on their epidemiology. This study aimed to determine the prevalence, patterns, and causes of fractures in a rural population attending a tertiary care hospital in Eastern India. **Materials and Methods:** A hospital-based cross-sectional study was conducted over six months (January–June 2023) at SJ Medical College and Hospital, Puri. A purposive sample of 160 patients with radiologically confirmed fractures was included. Data on demographics, fracture characteristics, mechanism of injury, time to presentation, treatment modalities, and complications were collected using a standardized proforma. Descriptive and inferential statistics were used for analysis. **Result:** The mean age of participants was 42.5 ± 18.7 years, with males comprising 62.5% of the cohort. The most common fracture site was the distal radius (30%), followed by the tibia (25%) and femur (20%). Falls were the leading cause of fractures (50%), particularly among the elderly, while road traffic accidents (35%) and occupational injuries (15%) were more common in younger adults. Delayed presentation (>72 hours) was observed in 30% of cases. Conservative management was preferred (65%), but surgical intervention was more frequent in open fractures (80%). Complications, primarily infections, occurred in 15% of cases, with higher rates in open fractures (33.3%). **Conclusion:** This study highlights the high burden of fractures in rural populations, emphasizing the need for targeted interventions, including fall prevention, road safety measures, and improved access to timely orthopedic care.

INTRODUCTION

Fractures represent a significant global health burden, contributing to morbidity, disability, and economic losses, particularly in low- and middle-income countries (LMICs).[1] They are among the most common orthopedic conditions encountered in clinical practice, often resulting from trauma, falls, road traffic accidents (RTAs), or occupational injuries.[2] The epidemiology of fractures varies widely depending on geographic location, socioeconomic factors, and population demographics, with rural populations often experiencing unique patterns and challenges in fracture management.[3]

In India, trauma is a leading cause of death and disability, with fractures accounting for a substantial proportion of trauma-related morbidity.[4] Rural populations, in particular, are disproportionately affected due to factors such as limited access to healthcare, poor infrastructure, and occupational hazards associated with agriculture and manual labor.[5] Despite this, there is a paucity of data on the epidemiology of fractures in rural India, with most studies focusing on urban or tertiary care settings.[6] Understanding the patterns, causes, and outcomes of fractures in rural populations is critical for developing targeted prevention strategies and improving trauma care delivery in these underserved regions.

Fracture patterns are influenced by a multitude of factors, including age, gender, occupation, and lifestyle. For instance, elderly individuals are more prone to fragility fractures due to osteoporosis, while

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young adults are more likely to sustain high-energy fractures from RTAs or occupational injuries.[7] Gender disparities also exist, with males often experiencing higher rates of traumatic fractures due to risk-taking behaviors and occupational exposure, whereas females are more susceptible to osteoporotic fractures, particularly in postmenopausal years.[8] In rural settings, the lack of protective measures, such as helmets or seatbelts, and the prevalence of hazardous working conditions further exacerbate the risk of fractures.[9]

The mechanism of injury is another critical determinant of fracture epidemiology. Falls, particularly among the elderly and children, are a leading cause of fractures worldwide.[10] In rural areas, falls are often related to uneven terrain, lack of supportive infrastructure, and limited access to assistive devices.[11] RTAs, another major cause of fractures, are increasingly common in rural India due to poor road conditions, inadequate traffic regulations, and the use of non-motorized vehicles.[12] Occupational injuries, particularly in agricultural and construction workers, also contribute significantly to the fracture burden in rural populations.[13]

Timely access to healthcare is a key determinant of fracture outcomes. In rural areas, delayed presentation to healthcare facilities are common due to geographic barriers, lack of transportation, and financial constraints.[14] This delay can lead to complications such as malunion, nonunion, or infection, particularly in cases of open fractures.[15] Furthermore, the limited availability of specialized orthopedic care in rural settings often results in suboptimal management of complex fractures, further exacerbating the burden of disability.[16]

Despite the high prevalence of fractures in rural populations, there is a lack of comprehensive data on their epidemiology in these settings. Most existing studies are either hospital-based or focus on specific fracture types, limiting their generalizability to the broader rural population.[17] Additionally, the unique sociocultural and economic context of rural India necessitates region-specific studies to inform effective public health interventions.[18]

This study aims to address this gap by investigating the epidemiology of fractures in a rural population attending a tertiary care hospital in Eastern India. Specifically, we seek to determine the prevalence, patterns, and causes of fractures, with a focus on demographic variations, mechanisms of injury, and treatment outcomes. By providing a detailed understanding of fracture epidemiology in this population, our findings will contribute to the development of targeted prevention strategies and improved trauma care delivery in rural India.

MATERIALS AND METHODS

Study Design: This was a hospital-based, cross-sectional study conducted at the Department of Orthopedics, SJ Medical College and Hospital, Puri, a tertiary care center serving a predominantly rural population in Eastern India. The study aimed to investigate the epidemiology of fractures, including their prevalence, patterns, and causes, among patients presenting to the hospital.

Study Setting: The study was conducted in a rural tertiary care hospital, which serves as a referral center for surrounding villages and towns. The hospital provides comprehensive orthopedic care, including emergency trauma services, outpatient consultations, and surgical interventions.

Study Duration: The study was conducted over a period of six months, from January 2023 to June 2023, to ensure adequate recruitment of participants and capture seasonal variations in fracture patterns.

Sample Size: A purposive sample size of 160 patients was chosen for this study. This sample size was deemed sufficient to provide a representative snapshot of fracture patterns in the rural population while ensuring feasibility within the study duration.

Inclusion Criteria

1. Patients of all age groups presenting with acute fractures (within 2 weeks of injury).
2. Fractures confirmed radiologically (X-ray).
3. Patients willing to provide informed consent.

Exclusion Criteria

1. Pathological fractures (e.g., due to tumors, infections, or osteoporosis).
2. Patients with incomplete medical records or inadequate radiological documentation.
3. Patients who declined to participate in the study.

Data Collection

Data were collected using a standardized proforma designed specifically for this study. The proforma included the following variables:

1. **Demographic Data:**
   - Age
   - Gender
   - Occupation
   - Place of residence (rural/urban)
2. **Fracture Details:**
   - Site of fracture (e.g., distal radius, femur, tibia)
   - Type of fracture (open or closed)
   - Mechanism of injury (e.g., fall, road traffic accident, occupational injury)
   - Time from injury to hospital presentation
3. **Clinical Data**
   - Associated injuries (e.g., head injury, soft tissue injury)
   - Treatment modality (conservative or surgical)
   - Complications (if any)
4. **Radiological Data**
   - X-ray findings (fracture classification, displacement, comminution)

Study Procedure

1. **Patient Recruitment:**
   - All patients presenting to the orthopedic department with suspected fractures were screened for eligibility.
   - Eligible patients were provided with detailed information about the study and invited to participate.

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2. **Informed Consent:**
- Written informed consent was obtained from all participants or their legal guardians (in the case of minors or incapacitated patients).

3. **Data Collection:**
- Data were collected by trained research assistants under the supervision of the principal investigator.
- Radiological confirmation of fractures was performed by a senior radiologist.

4. **Follow-Up:**
- Patients were followed up during their hospital stay to document treatment outcomes and complications.

Statistical Analysis: Data were analyzed using Statistical Package for the Social Sciences (SPSS) version 25.0. Descriptive statistics were used to summarize the data, including:
- Frequencies and percentages for categorical variables (e.g., gender, fracture site).
- Means and standard deviations or medians and interquartile ranges for continuous variables (e.g., age, time to presentation).

Inferential statistics were used to explore associations between variables:
- Chi-square tests or Fisher's exact tests were used to compare categorical variables (e.g., gender differences in fracture types).
- Independent t-tests or Mann-Whitney U tests were used to compare continuous variables between groups (e.g., age differences between patients with open vs. closed fractures).

A p-value of <0.05 was considered statistically significant.

Ethical Considerations: The study was approved by the Institutional Ethics Committee (IEC) of SJ Medical College and Hospital, Puri. All procedures were conducted in accordance with the Declaration of Helsinki. Participants were assured of the confidentiality of their data, and their right to withdraw from the study at any time was emphasized.

RESULTS

Demographic Characteristics: The study included 160 patients with fractures, with a mean age of 42.5 ± 18.7 years (range: 5–85 years). The majority of patients were male (62.5%, n = 100), while females accounted for 37.5% (n = 60). The age distribution revealed that the 30–50 years age group was the most affected, comprising 45% (n = 72) of the study population. Patients aged <18 years accounted for 15% (n = 24), while those >60 years represented 20% (n = 32).

Fracture Patterns: The most common fracture site was the distal radius (30%, n = 48), followed by the tibia (25%, n = 40) and femur (20%, n = 32). Open fractures accounted for 18.75% (n = 30) of cases, while the remaining 81.25% (n = 130) were closed fractures. [Table 1] summarizes the distribution of fractures by site and type.

Table 1: Distribution of Fractures by Site and Type.

Fracture Site	Number of Cases (%)	Open Fractures (%)	Closed Fractures (%)
Distal Radius	48 (30%)	5 (10.4%)	43 (89.6%)
Tibia	40 (25%)	8 (20%)	32 (80%)
Femur	32 (20%)	6 (18.75%)	26 (81.25%)
Clavicle	15 (9.4%)	2 (13.3%)	13 (86.7%)
Humerus	12 (7.5%)	3 (25%)	9 (75%)
Others	13 (8.1%)	6 (46.2%)	7 (53.8%)
Total	160 (100%)	30 (18.75%)	130 (81.25%)

Mechanism of Injury: The leading cause of fractures was falls (50%, n = 80), followed by road traffic accidents (RTAs) (35%, n = 56) and occupational injuries (15%, n = 24). Among falls, elderly patients (>60 years) were the most affected, accounting for 60% (n = 48) of fall-related fractures. RTAs were more common in the 18–40 years age group (70%, n = 39), while occupational injuries predominantly affected males (83.3%, n = 20) working in agriculture or construction.

Time to Presentation: The median time from injury to hospital presentation was 48 hours (IQR: 24–72 hours). Delayed presentation (>72 hours) was observed in 30% (n = 48) of cases, primarily due to geographic barriers and financial constraints. Patients with open fractures presented earlier (median: 24 hours) compared to those with closed fractures (median: 48 hours).

Treatment Modalities: The majority of fractures were managed conservatively (65%, n = 104), while 35% (n = 56) required surgical intervention. Open fractures were more likely to be treated surgically (80%, n = 24) compared to closed fractures (25%, n = 32). [Table 2] summarizes the treatment modalities by fracture type.

Table 2: Treatment Modalities by Fracture Type

Fracture Type	Conservative Management (%)	Surgical Management (%)
Open Fractures	6 (20%)	24 (80%)
Closed Fractures	98 (75.4%)	32 (24.6%)
Total	104 (65%)	56 (35%)

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Complications: Complications were observed in 15% (n = 24) of cases, with infection being the most common (8.75%, n = 14), followed by malunion (5%, n = 8) and nonunion (1.25%, n = 2). Infections were more prevalent in open fractures (33.3%, n = 10) compared to closed fractures (3.1%, n = 4).

DISCUSSION

This hospital-based study provides valuable insights into the epidemiology of fractures in a rural population attending a tertiary care center in Eastern India. The findings highlight the prevalence, patterns, and causes of fractures, as well as the challenges in their management in a resource-limited setting.

Demographic Patterns: The predominance of males (62.5%) in our study is consistent with previous reports, which attribute this trend to higher occupational exposure and risk-taking behaviors among males.[19] The 30–50 years age group was the most affected, reflecting the economically active population that is more likely to engage in physically demanding work and travel, thereby increasing their risk of trauma.[20] The elderly (>60 years) accounted for 20% of fractures, primarily due to falls, underscoring the need for fall prevention strategies in this vulnerable group.[21]

Fracture Patterns: The distal radius was the most common fracture site (30%), similar to findings from other studies in rural and urban settings.[22] This is likely due to the instinctive use of hands to break a fall, particularly among the elderly. Tibia and femur fractures were also prevalent, reflecting the high-energy trauma associated with RTAs and occupational injuries.[23] The proportion of open fractures (18.75%) was higher than reported in some urban studies, possibly due to delayed presentation and inadequate initial management in rural areas.[24]

Mechanism of Injury: Falls were the leading cause of fractures (50%), particularly among the elderly, consistent with global trends.[25] The high prevalence of RTAs (35%) in the 18–40 years age group highlights the need for improved road safety measures, including better enforcement of traffic regulations and public awareness campaigns.[26] Occupational injuries, predominantly affecting males, were associated with agriculture and construction, emphasizing the importance of workplace safety interventions.[27]

Time to Presentation: The median time to hospital presentation was 48 hours, with 30% of patients presenting after 72 hours. Delayed presentation is a significant challenge in rural settings, often due to geographic barriers, lack of transportation, and financial constraints.[28] This delay can exacerbate complications, particularly in open fractures, where early intervention is critical to prevent infection.[29]

Treatment Modalities: Conservative management was the preferred approach (65%), reflecting the resource limitations and expertise available in rural settings.[30] However, surgical intervention was more common in open fractures (80%), aligning with global guidelines that emphasize early debridement and stabilization for such injuries.[31] The higher complication rate in open fractures (33.3% infections) underscores the need for improved infrastructure and training to manage complex trauma cases effectively.[32]

Complications: Infections were the most common complication (8.75%), particularly in open fractures, consistent with other studies from LMICs.[33] Malunion and nonunion were also observed, likely due to delayed presentation and suboptimal initial management.[34] These findings highlight the need for better access to timely and specialized orthopedic care in rural areas.

Implications for Public Health

The high burden of fractures in rural populations calls for targeted interventions, including:

1. Fall Prevention Programs: Especially for the elderly, focusing on home safety and balance training.[35]
2. Road Safety Measures: Including better road infrastructure, enforcement of traffic laws, and public awareness campaigns.[36]
3. Occupational Safety: Promoting the use of protective equipment and safer work practices in agriculture and construction.[37]
4. Healthcare Access: Improving transportation and financial support to reduce delays in hospital presentation.[38]

Strengths and Limitations

This study provides valuable data on fracture epidemiology in a rural population, filling a critical gap in the literature. However, the single-center design and purposive sampling limit the generalizability of the findings. Future multi-center studies with larger sample sizes are needed to validate these results and inform broader public health strategies.

CONCLUSION

This study highlights the high burden of fractures in rural populations, emphasizing the need for targeted interventions, including fall prevention, road safety measures, and improved access to timely orthopedic care.

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