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ORIGINAL ARTICLE

Epidemiological Profile of Fractures Resulting from Bike Accidents

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ABSTRACT

Background: Cycling is increasingly promoted as a sustainable and healthy mode of transportation, but it is also associated with a significant risk of traumatic injuries, particularly fractures.

Objective: To analyze the demographic patterns, mechanisms of injury, anatomical distribution, treatment modalities, and complications associated with fractures sustained in bike-related accidents.

Methods: This retrospective observational study was conducted at Department of health and population THQ level hospital Kot Chutta District Dera Ghazi Khan during November 2021 to March 2023. The study included a total of 280 patients who presented to the emergency or orthopedic departments with confirmed fractures resulting from bike accidents. Patient data were obtained from the hospital's electronic medical records and trauma registry databases.

Results: Out of 280 patients, 198 (70.7%) were male and the mean age was 34.8 years. The most common mechanism of injury was falling from the bicycle (47.1%), followed by vehicle collisions (35%). Upper limb fractures were the most prevalent (53.2%), with distal radius and clavicle being the most commonly affected sites. Surgical treatment was required in 60.4% of cases, and the average hospital stay was 6.3 days. Complications occurred in 13.6% of patients, though no fatalities were recorded. Helmet usage was observed in only 31.8% of the cohort and was associated with a lower incidence of facial fractures.

Conclusion: It is concluded that bike-related fractures are common and often serious, particularly among young male cyclists. Upper limb fractures dominate injury profiles, and surgical intervention is frequently necessary.

Keywords: Accidents, Patients, Epidemiological, Fractures, Bike

INTRODUCTION

Cycling, once primarily a recreational activity, has evolved into a globally embraced mode of transportation, widely adopted for commuting, fitness, and sustainability. People living in both affluent and developing nations adopt cycling as their transportation method because it satisfies their needs for health benefits and environmental sustainability[1]. The increase in bicycle usage resulted in a corresponding exponential rise in injuries which were predominantly expressed as orthopedic trauma. Among bicycle-related injuries, fractures stand as the most commonly diagnosed medical problem which demands prompt medical care as well as lasting rehabilitation[2]. The study of bike accident fractures among cyclists must include details about their occurrence patterns and origins together with risk aspects because this knowledge provides an essential foundation for designing effective preventive measures against the public health impact of these injuries[3]. Research indicates that accidents involving bike activity lead to an increasing number of patients entering emergency treatment centers and data shows half of these cases involve bone breaks[4]. The clavicle together with the wrist, elbow, and forearm comprise the most frequently damaged areas of the upper limbs during bike accidents. Cyclists usually extend their arms during falls to catch themselves and consequently develop these fractures. The combination of high-impact car collisions results in lower limb fractures that target the femoral bone and pelvic region[5]. The specific nature along with the degree of fracture injuries depends on numerous factors including how the accident occurred combined with the positional body stance and external factors during the event. Children together with adolescents are classified as a vulnerable population group since their development affects their judgment skills motor control abilities and lack of experience[6]. The risk of pediatric bone fractures concentrates mostly in the distal forearm and elbow sections, particularly among male patients[7]. Older cyclists experience increased vulnerability to hip and femoral fractures because their lower bone density combines with slower response times during accidents. As the worldwide population ages the increasing participation of elderly people in cycling for exercise or recreational purposes requires new approaches to fracture management methods. Helmets significantly protect the head but show minimal success in reducing fractures that occur in the body areas below the head[8]. Protective gear including gloves alongside elbow pads and knee pads provides some protection against wounding during fall accidents. The combination of road surface quality with traffic levels and bike lane availability along with adverse weather conditions achieves a significant impact on both accidents and fractures among bikers[9]. The risk for cyclists to experience falls and subsequent injuries sharply increases when they ride on surfaces that are not properly maintained or show slippery conditions. The combined factors of daytime and weather conditions with improper bike rider behavior together with traffic visibility determine how injuries occur. Understandings about fracture patterns within epidemiological research derive additional information from how the injuries initially occurred[10]. The combination of simple falls that happen without vehicle collisions typically results in less severe bone fractures that affect primarily the upper body parts. Vehicle crashes and high-velocity accidents together lead to double or worse bone injuries which affect the femur, pelvis, and spine sections[11]. Severe fractures become more likely when bicyclists participate in competitive races or mountain biking events since they encounter faster speeds and challenging terrain. Modern technological approaches have started to provide insights into cycling-associated fractures while also helping prevent their occurrence. The use of modern GPS technology alongside crash detection systems helps find dangerous cycling areas and traits that lead to injuries. Research using national trauma databases and electronic health records enables longitudinal studies that track trends together with performance evaluations for safety interventions[12].

Objective: To analyze the demographic patterns, mechanisms of injury, anatomical distribution, treatment modalities, and complications associated with fractures sustained in bicycle-related accidents.

METHODOLOGY

This retrospective observational study was conducted at Department of health and population THQ level hospital Kot Chutta District Dera Ghazi Khan during November 2021 to March 2023. The study included a total of 280 patients who presented to the

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emergency or orthopedic departments with confirmed fractures resulting from bike accidents.

Inclusion Criteria

- Patients of all genders aged 5 years and above.
- Bicycle-related trauma resulting in at least one confirmed bone fracture.
- Cases where injury mechanism was documented as a bicycle accident (fall, collision, skid, or impact).
- Complete medical records including diagnostic imaging and clinical documentation.

Exclusion Criteria

- Patients with polytrauma where the cause was not exclusively bicycle-related.
- Soft tissue injuries without fractures.
- Incomplete medical records or missing diagnostic imaging.
- Recurrent admissions for the same injury or post-operative follow-up visits.

Data Collection: Patient data were obtained from the hospital's electronic medical records and trauma registry databases. The data include demographic information such as age, gender, and use of protective gear (helmet, pads), along with details of the accident, including the mechanism of injury, time and place of the incident, and whether it occurred in an urban or rural setting. Clinical data captured included the anatomical location and type of fracture (simple, compound, comminuted), presence of associated injuries, treatment modality (conservative vs. surgical), length of hospital stay, and patient outcome. Environmental factors such as road condition, visibility, and lighting at the time of the accident were also noted when available.

Data Analysis: Data were analyzed using SPSS v26. Descriptive statistics were applied to summarize the patient demographics, types and locations of fractures, and injury mechanisms. Frequencies and percentages were calculated for categorical variables, while means and standard deviations were used for continuous variables. A p-value of less than 0.05 was considered statistically significant for all analyses.

RESULTS

A total of 280 patients were included in the study. Among them, 198 (70.7%) were males and 82 (29.3%) were females, with a mean age of 34.8 ± 17.2 years. Pediatric patients (≤15 years) made up 18.2% of the sample, while elderly individuals (≥65 years) comprised 9.3%. Falls from bike were the most common mechanism of injury, accounting for 47.1% of cases, followed by collisions with vehicles (35.0%) and skids or loss of control (17.9%).

Table 1: Demographic Distribution of Patients (N = 280)

Variable	N (%) or Mean ± SD
Total Patients	280
Males	198 (70.7%)
Females	82 (29.3%)
Mean Age (years)	34.8 ± 17.2
Pediatric (≤15 years)	51 (18.2%)
Elderly (≥65 years)	26 (9.3%)
Mechanism of injury	
Fall from bike	132 (47.1%)
Collision with vehicle	98 (35.0%)
Skid/Loss of control	50 (17.9%)

Upper limb fractures were the most frequently observed, affecting 149 patients (53.2%), followed by lower limb fractures in 86 patients (30.7%). Less common sites included the pelvis (5.0%), skull or facial bones (4.6%), and the spine (3.2%). Among specific fracture types, distal radius (n=42) and clavicle fractures (n=39) were most prevalent, indicating a high incidence of impact-related upper extremity injuries. Femoral (n=28), tibial (n=24), and humerus fractures (n=26) were also commonly noted. In terms of classification, simple (closed) fractures were predominant, comprising 69.3% of all injuries. Compound (open) fractures accounted for 30.7%, of which 24.4% were classified as Grade III open fractures, indicating high-energy trauma and greater clinical severity.

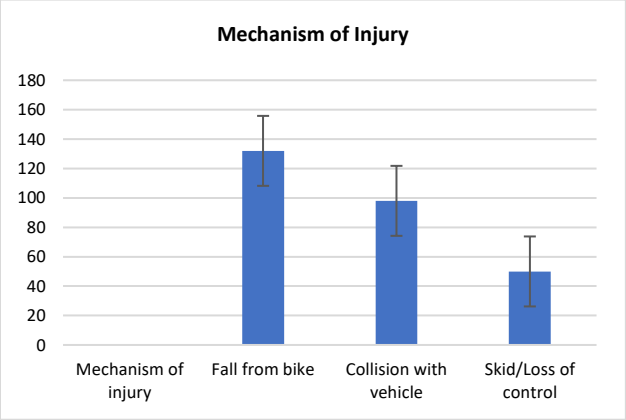

Figure 1:

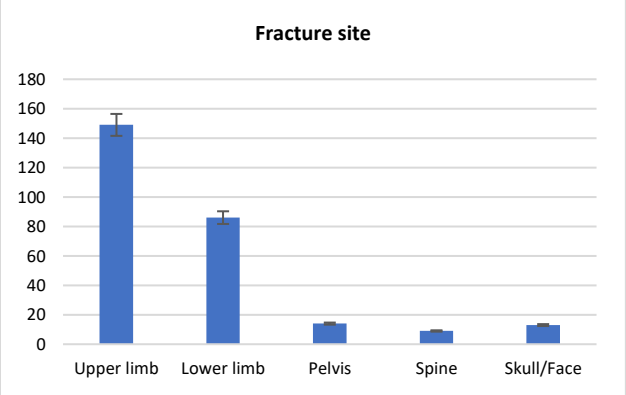

Figure 2:

Table 2: Fracture Site Distribution

Fracture Site	N (%)
Upper limb	149 (53.2%)
Lower limb	86 (30.7%)
Pelvis	14 (5.0%)
Spine	9 (3.2%)
Skull/Face	13 (4.6%)
Fracture Type	
Distal Radius	42
Clavicle	39
Humerus	26
Femur	28
Tibia	24
Fracture Classification	
Simple (Closed)	194 (69.3%)
Compound (Open)	86 (30.7%)
Grade III Open	21 (24.4% of open)

Table 3: Treatment and Outcomes

Variable	N (%) or Mean ± SD
Surgical Treatment	169 (60.4%)
Conservative Treatment	111 (39.6%)
Mean Hospital Stay (days)	6.3 ± 2.9
Complications	38 (13.6%)
Mortality	0

Out of the total patients, 169 (60.4%) underwent surgical treatment, while 111 (39.6%) were managed conservatively, reflecting a high need for operative intervention due to the severity or complexity of fractures. The mean hospital stay was 6.3 ± 2.9 days, with longer durations typically associated with surgical

cases. Complications were observed in 38 patients (13.6%), including infections and delayed healing, although no fatalities were reported during the study period.

DISCUSSION

The findings offer valuable insight into the demographics, injury mechanisms, anatomical distribution, treatment modalities, and associated complications of cycling-related fractures. Most of the evaluated patients were men who composed 70.7% of the total sample. The existing literature demonstrates that men participate in risky cycling behaviors including fast bicycling alongside off-road trails and competitive cycling because of which they encounter more severe trauma. The exposure rates for cycling both during urban commuting and recreational activities are higher among males than among females[13].

Young adults aged 21 to 30 constituted the biggest demographic segment, with adolescents and teenagers closely behind them in numbers. The research population included 18% of pediatric patients and 9.3% of the elderly demographic (over 65 years old). The results demonstrate the dual risk situation faced by youthful cyclists owing to their limited experience and dangerous behavior, and by mature riders because of balance issues and slow responses, and possible health problems, including osteoporosis, which lead to serious injuries, particularly femoral fractures[14]. Out of all bicycle injuries, this study found that falling during bike usage proved to be the most common scenario in 47.1% of cases. The occurrence demonstrates that poor control due to unsmooth terrain unexpected braking and wet slippery conditions represent a shared danger for cyclists[15]. More than one-third of cases involved bicycle-vehicle collisions, as cycling through busy mixed-traffic environments continues to be hazardous for cyclists regardless of insufficient infrastructure for biking across urban areas[16]. The examined fractures showed an upper limb injury pattern which was the most commonly diagnosed condition at 53.2% and included distal radius, clavicle, and humerus fractures[17]. Several other research studies show that riders often use their arms during falls to break their impact but such actions result in traumatic injuries affecting their upper limbs. Thirty-seven percent of injuries occurred in the lower limbs while the femur and tibia received the most fractures among these patients during severe collisions[18]. Pelvic spinal and cranial fractures occurred sparingly in patients yet proved difficult to treat, mainly due to their seriousness, because patients needed surgical procedures that required lengthy hospital stays. The necessity for surgical intervention became evident in the medical treatment of more than sixty percent of these patients because of their severe injuries[19]. Internal fixation using placing plates and rods or inserting screws proved to be the most frequently used approach. Among the entire patient cohort, conservative management through casting or an immobilization approach was used for 39.6% of patients. Patients required medical care for an average of six days, but surgical patients stayed in the hospital approximately one day longer than other cases. Emergency and orthopedic services face significant resource strain when treating patients who sustain cycling-related traumas within urban trauma centers. Complications developed in 13.6% of the patients, while surgical site infections, along with delayed union, occurred most frequently among them. Even though no deaths occurred in this research, the finding of neurovascular injuries among selected patients strengthens the argument for potential long-term medical problems in common bicycle accidents[20]. The study did not have enough power to measure the relation between low helmet usage (31.8%) with limb fractures in this population. The protective effects of helmets on head injuries do not directly affect orthopedic trauma patterns. The use of helmets resulted in fewer incidences of facial bone fractures, according to this research and other published studies about facial skeleton protection from headwear. The research contains multiple constraints that should be considered. Its retrospective design restricts causal inferences and is dependent on the completeness and accuracy of hospital records. There was also no long-term follow-up to assess recovery outcomes or functional limitations post-discharge. Furthermore, behavioral variables such as alcohol consumption, riding speed, or cycling experience could not be fully accounted for. Despite these limitations, the findings provide a robust baseline for injury surveillance and prevention initiatives in the cycling population.

CONCLUSION

It is concluded that bicycle-related fractures represent a significant and growing public health concern, particularly among young adults and male cyclists who are disproportionately affected. The majority of these injuries result from falls and collisions in urban settings, with upper limb fractures being the most prevalent. A substantial portion of patients required surgical management, reflecting the severity of many of these injuries and the burden on trauma and orthopedic services. Age, mechanism of injury, and urban exposure were found to be major factors influencing the type and severity of fractures.

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