Original Research Article

RADIOGRAPHICALLY DIAGNOSED TYPES OF LONG BONES FRACTURES IN YOUNG AND OLD AGE PATIENTS WITH HISTORY OF RTA

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ABSTRACT

Background: Traffic injuries (road traffic accidents - RTA) are a significant cause of disability globally and account for a significant proportion of long bone fractures, especially amongst young adults and the working population. They can cause considerable disability and health care burdens. Insight into the X-ray patterns of long bone fractures in various age groups can help with early recognition, planning of treatment and prevention. The aim of this study was to estimate the incidence and radiography of the long bone fractures in the young and elderly following RTAs.

Materials and Methods: A cross-sectional study was designed to evaluate the patients over the last three months at Nishtar Hospital in Multan, Pakistan. One hundred patients with long bone fractures from RTAs were recruited by the convenience sampling method. Those patients with fall injuries, gunshot wounds, and non-traumatic fractures were excluded from the study. Data was obtained from the Orthopedic Outpatient Department, with digital radiography (Dell Medical Digital Radiography System). Data on age, sex, mechanism of fall, bone, fracture site and fracture type were collected. The data was analysed using SPSS statistical package and techniques of descriptive statistics, chi-square and frequency tables.

Results: Most of the patients were in their third decade of life (average age 31.56 years). The most common mechanism of injury was a motor vehicle accident, followed by pedestrian and motor vehicle accident. The most common bone fractured was the tibia/fibula (52%), followed by femur (32%), with the bones of the upper limb being less affected. The most frequent site was the distal fractures (71%, followed by the proximal [19%] and shaft [10%] fractures. Closed fractures were the most common (99%) and open fractures accounted for 1%. The majority (89%) of patients had long bone fractures without other associated fractures. Age, type of injury and fracture pattern showed no significant correlation ($p > 0.05$) when correlated using statistical tests.

Conclusion: In conclusion, long bone fractures from RTAs occur most often in the young and lower limbs are the most frequent locations of injuries, followed by tibia and fibula. Closed fractures to isolated sites are common, and are often the result of motorcycle crashes. While there are no statistically significant associations between demographic and injury features, the observed trends point to the need for road safety improvements, measures to protect vulnerable road users and better trauma care.

Keywords: Motor Vehicle Accidents, Long Bone Fractures, Tibia and Fibula, X-Rays, Fracture Patterns, Trauma, Cross-sectional Study.

INTRODUCTION

A bone fracture is a medical disorder when the continuity of the bone is broken, either completely or partially. Road traffic accidents (RTAs), the top cause of death for those between the ages of 15 and 29, are one of the factors contributing to bone fractures. The purpose of this study was to ascertain the prevalence of bone fractures among RTAs at Buraidah Central Hospital and to find correlations between fractures and age, gender, and fractures (Aloudah et al., 2020). Long bone injuries were most frequently caused by gunshot wounds and explosives in the past but in the twenty-first century, trauma primarily from road traffic accidents (RTAs) is the leading cause of long bone injuries. According to the World Health Organization, 1.25 million RTA-related deaths occur annually worldwide They are responsible for about one-third of the unnatural causes of mortality in India and RTAs cost the nation between 2% and 3% of its GDP, or 55,000 crore rupees, every year. The majority of fatalities take place at the scene of the incident or while the patient is being transported to a medical institution (Dkhar et al., 2019).

The burden of road-traffic injuries in terms of societal and economic costs is increasing significantly for the majority of the world's population, despite the fact that higher-income countries have seen a decline in the number of fatalities from road smashes in recent decades. Road traffic death rates by road user group differ significantly between epidemiological WHO subregions and between low-, middle-, and high-income nations (Pan et al., 2014). Despite being linked to a higher risk of injury than cars, motorcycles have grown in popularity as a form of mobility. Motorcycle deaths have continuously climbed over the last 11 years, whereas the annual incidence of passenger car fatalities in the United States of America (USA) has gradually decreased. As far as the author is aware, no published reports on motorbike injuries (MIs) in the USA over this 11-year period exist, despite the fact that MIs have been examined (Burns et al., 2015). The Golden Hour is a timeframe of 60 minutes after musculoskeletal trauma that is well-known to have a significant impact on patient prognosis as timely resuscitation and stabilization of injured individuals can reduce the chances of secondary complications such as hemorrhagic shock or systemic inflammatory reactions (Anghele et al., 2024). Regarding orthopedic trauma, prompt definitive care is necessary to avoid the long-term morbidity, especially in cases of patients who are hemodynamically unstable and who should be provided with timely care to increase the possibility of survival (Okada et al., 2020).

Patterns of fractures also differ across the types of road users; pedestrians and motorcyclists, known as vulnerable road users, do not have structural protective measures and are more likely to get more complicated lower-limb fractures (open tibia and femoral shaft fractures, etc.) than car occupants (Bezabih et al., 2022). The studies show that the direct-impact extremity fractures are especially prone to pedestrians, and they often comprise a significant percentage of orthopedic visits and possible life-long impairments (Mengistu et al., 2021). In addition to direct deaths, the actual cost of road traffic injuries is their long-term socioeconomic impacts, which can cost the economies of certain nations 1-3% of their GDP and force some vulnerable families into poverty because of the loss of productivity and expensive rehabilitation (Ryan-Coker et al., 2021). What is more, the physical injury is often accompanied by a persistent mental health load and psychiatric illnesses, which are frequently not fully addressed in the clinical procedure and compared with physical orthopedic interventions (Papadakaki et al., 2024).

The anisotropic character of the long bones is largely the main determinant of mechanical failure during the high energy road traffic accidents when the structural strength of the bone is dependent on the direction of the impact force. Kinetic energy transferred in RTAs is usually greater than the final tensile strength of the bone resulting into predictable fracture patterns depending on the type of load that transpired. Transverse or comminuted fractures are usually created by direct impacts, whereas the morphologies are spiral or oblique created by indirect torsional forces (Wescott, 2013). The strain rate or the speed at which the force is exerted during a collision, also has a big impact on the material behavior of the bone, inducing a ductile to brittle transition. Cortical bone becomes unable to dissipate energy by means of plastic deformation at the high rate of strain associated with vehicular impacts. The effect is quick fracture motion and increased fragmentation or "shattered" bone pieces than when the injury is caused by the low-speed (Hansen et al., 2008).

When it comes to frontal-impact collisions, lower limb fractures biomechanics usually depends on how the occupant interacts with the interior of the vehicle like dashboard bashing. These axial loading forces often pass through the femur resulting into certain clusters of injuries such as fracture of the femur shaft and dislocation of the posterior hip. These patterns of injuries are radio-graphically different as compared to those that pedestrians or motorcycles receive because the force vectors are different (Ammori et al., 2018). The strength of long bones to sustain the energy up to failure is considerably decreased in older populations because of alterations in the cross-linking of collagen and the mineral density. The "toughness" of the bone in younger patients enables it to experience micro-cracking that absorbs the kinetic energy of an RTA and usually creates easier fracture lines. As bone grows, however, it gets brittle, that is, loses this energy-dissipation mechanism, and when a high-energy impact takes place, the bone breaks almost instantly into several fragments, which radially appears as highly comminuted fractures (Cole at el.,2011).

The loading rate has a critical effect on the morphological complexity of the fractures of the long bones in road traffic accidents by determining the way the tissue absorbs the abrupt kinetic energy. The bone matrix of younger people has more viscoelasticity and therefore it can absorb much energy by internal deformation and then it reaches the failure point. In older patients however, the decrease in bone toughness and the augmentation of mineral crystallization makes the bone to act like a brittle substance; in an RTA this generates the discharge of energy that is generally radiographically visible as multi- fragmentary or comminuted fractures as opposed to easy displaced lines (Sarin et al., 2018). The degree of radiographic alteration of the long bone fractures in RTAs is essentially associated with the fracture toughness of the cortical bone which is the natural resistance of the material to the spread of cracks. Recent studies have shown that bone ageing impairs the accumulation of micro-damage and the quality of the organic matrix so that the bone finds it difficult to halt or stop a crack once it has started during a high-energy collision. Whereas the bone of a young patient can accommodate one, clean fracture line, because of the better ability of the bones to absorb the energy, the geriatric bone does not have such microscopic defenses; thus, the crack is separated almost immediately upon impacting, and this results in the extremely fragmented and comminuted fracture morphologies so common in geriatric trauma imaging (Turner 2002).

The Winquist-Hansen classification also tends to be used to grade the extent of comminution of the femoral shaft fracture during radiographic examination. Such system is specifically applicable in RTA research because it classifies fractures with Grade 0 fractures (no comminution), Grade I (minimal comminution with some contact between main fragments), Grade II (fracture with partial contact between main fragments), Grade III (fracture with complete lack of contact between main fragments), and Grade IV (fracture with total lack of contact among main fragments). Distinction of these grades radiographically is important to forecast surgical performance since a high degree of comminution in elderly individuals tends to indicate poor healing and increase the chance of non-union than the more consistent fracture patterns in younger adults (Pal et al., 2021). The Salter-Harris classification tool is the main instrument of evaluating the fracture of the epiphyseal (growth) plate in childhood and young adult trauma cases. Since younger bones are still developing, RTA commonly causes injuries to the metaphysis and distal bones, a process known as physeal injuries, which is radically unlike adult fractures; a Type II injury, that involves the metaphysis as well as the growth plate, is a frequent radiographic observation in young RTA victims. The application of this classification system is critical in the use of comparative studies since it helps to establish the physiological weak spots within the young bone which simply does not exist in the geriatric population in which the plates are already fused (Choudhry et al., 2025).

Multi-Detector Computed Tomography (MDCT) is often necessary to show complex patterns of injuries with a comprehensive radiographic evaluation of high-energy long bone fractures caused by road traffic accidents. Although the first screening tool is traditional radiography, MDCT with 3D reconstruction offers a better outlook of intra-articular extensions and small comminution which might not be detected on a conventional two-plane X-ray. The application of this high-end imaging is especially important in geriatric trauma, when co-occurring osteopenia might minimize the actual severity of structural damage on more film-based imaging (Sanal et al., 2016). Magnetic Resonance Imaging (MRI) has been most effective in identifying the presence of the so-called occult fractures, that is, the injuries that are clinically suspected but cannot be seen on the initial X-rays. MRI is commonly used to assess related soft tissue, ligamentous or physeal injuries that come with long bone trauma in young RTA victims but is used to identify faint stress or insufficiency fractures in older age groups. Since MRI can reveal the bone marrow edema, it becomes an ultimate way of confirming the fracture in patients who are still presenting with the symptoms yet showed negative results when subjected to primary radiographic tests (Mourad et al., 2023). Mobile C-arm fluoroscopy has contributed to intraoperative management of long bone fractures where real time radiographic management can be used during the fixation process. The technology is crucial in ensuring the right anatomical positioning of the bone and the accurate positioning of intramedullary nails or plates without the need of making huge incisions. This type of dynamic imaging is in place to provide instant feedback in the course of the Golden Hour of care provision in trauma care and minimizes the operation time as well as lower the chances of secondary complication in young and old patients (Norris et al., 1999).

Road traffic accidents (RTAs) are a significant cause of long bone fractures, particularly in young and active persons, with major disability and healthcare burden. It is important to understand the radiographic appearance of such fractures in various age groups, in order to make correct diagnosis and make appropriate treatment plans. Local data on comparison of type of fracture between young and elderly patients in RTA cases have limited data. The proposed study will address the said gap by examining the fracture patterns, frequency, and localization. The obtained results could be used to better the early diagnosis and clinical treatment as well as prevention strategies related to trauma care.

MATERIALS AND METHODS

It was a Cross-Sectional Study. This research was done at Nishtar Medical University and Hospital Multan, Pakistan. Data was collected at the Out-Patient Department of Orthopedics, Duration of this research was 3 Months (January – March 2026). We collected data of 100 patients and enlisted them. All the praticipants were informed verbally with all the possible benefits and expected Dangers, Clinical baseline data was collected after their permission and was entered in a prepared date collection sheet. The research proposal is based on the Age, Gender, Mode of RTA, Location of Fractures, Types of Fractures and Type of treatment or Surgical intervention to the injured patients.

Data Analysis Procedure

Data was analyzed and evaluated with SPSS. Frequency and percentages were calculated for quantitative variables. Mean and St deviation were calculated for quantitative variables. Bar chart and histogram were constructed. Independent T-tests were included. Chi-square was added as main test. Histogram and tables were added.

RESULTS

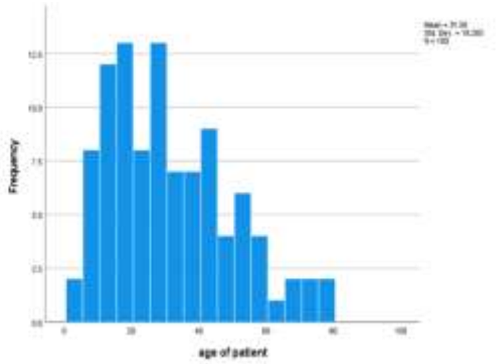


Figure 5.2.1 shows the age frequency Distribution of sample of 100 patients using a Histogram. It displays a exceptionally normal distribution, with the majority of participants being between the ages of 20 and 40, with a mean age of 31 to 56 years and a standard deviation of 18.27, the age distribution exhibits substantial variability. There are fewer elderly individuals in the sample. In general the histogram shows that the majority of the population being studied is youngsters to middle age.

Table 5.2.2: Statics of Age of Patient

Statistics		
Age of Patient		
N	Valid	100
	Missing	0
Mean		31.56
Median		28.00
Mode		18

Table 5.2.2 shows statics of age of patient. The Mean of 100 patients is 31.6, the Median of Patients is 28 and Mode is 18.

Table 5.2.3: Shows the frequency distribution of type of accident

type of accident			
	Frequency	Percent	Cumulative Percent
Car	13	13.0	13.0
Bike	60	60.0	73.0
Pedestrian	27	27.0	100.0
Total	100	100.0	

The Frequency Distribution of Type of Accident is displayed in Table 5.2.3. Out of 100 participants 13 were hit by Car, 60 were hit by Bike while 27 participants were Pedestrian and their cumulaive percentage was13,73 and 100 respectively.

Table 5.2.4: Frequency of Long Bones involved in Fracture at RTA

long bones involved in fracture			
Frequency	Percent	Cumulative Percent	
femur	32	32.0	32.0
humerus	8	8.0	40.0
radius/ulna	8	8.0	48.0
tibia fibula	52	52.0	100.0
Total	100	100.0	

Table 5.2.4 shows frequency of long Bones involved in fractur,32 femur Bones were fractured, 8 Humerus were Fractured and also 8 Radius/Ulna were Fractured, 52 Tibia/Fibula were Fractured.

Table 5.2.6: Frequency of type of fracture

type of fracture			
	Frequency	**Percent**	**Cumulative Percent**
closed	99	99.0	99.0
open	1	1.0	100.0
Total	100	100.0	

Table 5.2.6 shows type of Fracture of Participants with 99% frequency of closed Fracture with Cumulative percent of 99.0 and 1% of open Fracture with Cumulative percent of 100.0.

Table 5.2.7: Frequency of other injuries along long bone

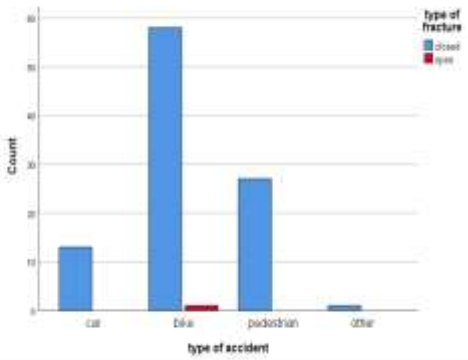
other injuries along with long bone fracture				
	Frequency		**Percent**	**Cumulative Percent**
yes	11	11.0	11.0	
no	89	89.0	100.0	
Total	100	100.0		

Table5.2.7 shows Frequency of other injuries along with long Bone Fracture. Out of 100 Participants 11% Participants got other injuries along with long bones fracture while 89% participants did'nt got any other injuries except long bone fracture.

Table 5.2.8: Frequency of site of fracture

site of bone where fracture occurs			
	Frequency	**Percent**	**Cumulative Percent**
proximal	19	19.0	19.0
shaft	10	10.0	29.0
distal	71	71.0	100.0
Total	100	100.0	

Figure 5.2.8 shows Frequency of Site of Bone where Fracture occurs. In 19 participants bone was fractured Proximal end, middle shaft was fractured in 10 participants and distal end was fractured in 71 participants.



The crosstab analysis examines the relationship between type of accident and type of fracture among one hundred cases, with no missing data reported. Most fractures were closed, accounting for nearly all observations, while open fractures were extremely rare. Bike accidents contributed the highest number of cases, followed by pedestrian and car accidents, indicating that two-wheeler incidents are the leading cause of fractures in this dataset. Car, pedestrian, and other accident categories showed only closed fractures, with no open cases recorded.

DISCUSSION

The purpose of the study was to analyse the type of radiographically diagnosed long bone fractures among younger and older people who were the victim of road traffic accidents. Figure 5.2.1 and Figure 5.2.2 show age distribution of the patients and they were mostly from the young and middle age. A total of 100 cases were analysed and none of the data was missing. The average age of the patients was 31.56, the median age of the patients was 28 years and the mode was 18 years of age. This indicates a higher occurrence of road traffic accident–induced long bone fractures in young people. The reduced number of older adults in the study population indicates a range of different factors, such as young adults are more active outside and commited to work, they travel more. This study agreed with the study conducted by Aloudah et al. (2020) which showed that the age was a significant difference for fracture patterns in road traffic accident victims. They found some fracture types such as radius shaft fracture and femoral fracture were significant in terms of age. In this study, however, the chi-square between patient's age and fracture type was not significant (Pearson Chi-Square 32.660, df 51, p-value 0.979). This suggests that although frequency distribution was associated with an increased number of younger patients who suffered from fractures, fracture type was not significantly associated with age in this study.

In the current study, the most frequent cause of injury was having a bike accident Figure 5.2.6 shows that in the present study, closed fractures were the only type of fracture found. A total of 99 patients had closed fractures 99.0% and only 1 patient had open fracture 1.0% of the 100 patients. This result indicates that, in this population, most long bone fractures didn't have any external communication between the fracture and skin. However, this finding is a little bit variable with the result as Bezabih et al. showed a higher percentage of open wounds and severe orthopedic injuries in traffic accident victims.

As shown in figure 5.2.7, 11 patients (11.0%) had other injuries in addition to long bone fracture and 89 patients (89%) had long bone fracture alone. Therefore, majority of patients in this study presented with isolated long bone fracture. This information is crucial since we demonstrated that although multiple injuries can be associated with road traffic accident, in most patients in this study, long bone fracture was the only injury present. This is a little different from Aloudah et al. (2020) where multiple or bilateral fractures were frequently found in the victims of RTA. We also note a difference from Bezabih et al. (2022), in which road traffic accidents had a high incidence of orthopedic injuries and open wounds.

Figure 5.1.8 shows that the most common site of fracture was the distal portion of the bone. There was 71 patients (71.0%) with distal fractures. A proximal fracture occurred in 19 patients, (19.0%) and a shaft fracture in 10 patients, (10.0%). This finding indicates that fractures occurred disproportionately along the bone. The distal part was much more likely to be fractured than the proximal part or shaft. This could be due to the position of the limb at the time of the accident, direct blow to the lower leg or fall following impact. Because bike accident was the most frequent trauma and tibia/fibula bone was most commonly fractured, distal lower limb fracture may have resulted as a result of direct impact, rotational force or sudden force on lower limb during trauma.

The association between the age of the patient and the fractured bone using chi-square test was Pearson Chi-Square 32.660 with 51 degrees of freedom and p-value of .979. The likelihood ratio value was 7.381 with p-value 1.000, and the linear-by-linear association value was 1.664 with p-value .197. As the p-value was above 0.05, there was no significant association between age and type of fracture. So here, the incidence of fracture type was not significantly impacted by age. But this test must be used with caution as 103 cells (99.0%) had expected counts less than 5 and the smallest expected count was 01. Thus, it may not be appropriate to use the chi-square test here. This finding differs from that of Aloudah et al. (2020), as their research showed significant differences between the types of fracture and age. This could be because the sample size in this study was small and the distributions of types of fractures were unbalanced (99.0% of closed fractures and 1.0% of open fractures).

There was also no significant association between the type of accident and type of fracture in the chi-square test. The Pearson Chi-Square test was .702 with 3 df, and a p-value of .873. The likelihood ratio was 1.062 with p-value .786 and linear-by-linear association was .062 and p-value .804. The p-value was greater than 0.05 so the association between type of accident and type of fracture was not statistically significant. Essentially, there weren't any statistically significant differences in open or closed fracture types for all the bike, car, pedestrian or other accident types. But note that this is somewhat misleading again because 5 cells (62.5%) had expected count less than 5, and minimum expected count is .01. This is because there was only 1 occurrence of open fracture, but 99 closed fractures. Thus, data was not adequate for chi-square analysis.

CONCLUSION

This study concludes that the incidence of long bone fractures from road traffic accidents is common among young and active people, due to greater risk of involvement in outdoor activities. Our results demonstrate that lower bones are more common as opposed to upper limb bones, with the most likely sites of injury during a trauma being distal. Two-wheel and pedestrian accidents seem to be the major causes of injury, suggesting that the vulnerable population is at greater risk. The majority of the fractures were closed with isolated injuries, implying that while there is a high incidence of accident, compound injuries were not very common. There were no significant statistical associations discovered between age, accident or fracture type, which may be due to the bias of unequal representation of data in individual age groups. So, the study presents important injury patterns which can aid in early recognition, treatment and prevention in cases of trauma.

Recommendation

It is critical to increase awareness on road safety among motorcyclists and pedestrians to prevent injury. Strict enforcement of traffic laws and use of safety equipment (helmets and padding) should be promoted. Early X-ray evaluation should be more readily available in emergencies for diagnosis and management. Facetility upgrades to improve the management of trauma cases in highly prevalent areas should be prioritised. Additional studies with more sample size and varied sample groups should be conducted for better understanding. Government health policies should emphasise prevention and education to prevent the burden of road traffic fractures.

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