

# Trends and Patterns of Long Bone Fractures in Relation to The Road Traffic Accidents, Assaults, and Falls Among Patients Admitted to Emergency Treatment Unit in Teaching Hospital Karapitiya

Gunasinghe WKP\*, Warushahannadi J

Department of Forensic Medicine, Faculty of Medicine, University of Ruhuna.

## Abstract

**Introduction:** Long bone fractures pose an increasing challenge to the health care system and the financial status worldwide.


**Objectives:** To study long bone fracture (LBF) types, fracture patterns, prevalence, and associated factors in relation to road traffic accidents (RTA), assaults, and falls.

**Methodology:** The study was a descriptive cross-sectional, prospective study in patients aged 18- 60 years, over one-year period.

**Results:** The study group consisted of a total number of 300 patients. Most 78% (n=233) of the patients were males. The majority 26 % (n=77) were between 18 – 24 years of age. Most of the LBF patients 79% (n=236) were due to RTA. Male predominance was noted. The incidents of assaults (42) revealed, fractures were due to blunt forced weapons in 93% (n=39) and the majority 77% (n=17) of LBF occurred at 6-8 meters of height falls. In RTA the commonest victims of LBF 56% (n=132) were riders followed by drivers 31% (n=73). The tibia was the most fractured bone in riders 33% (n=113). In this study, 426 long bone fractures were revealed. Tibia was the most fractured bone 45% (n=191). Simple fractures were the commonest 98% (n= 417). Oblique fractures were the commonest 56% (n=235). There were (94% (n=399) of closed fractures. Lower limb bones are the most vulnerable bones in riders. In assaults and falls upper limb fractures could be seen frequently.

**Conclusion:** Young adult males are more vulnerable in long bone injuries especially following RTA.

**Keywords:** Limb fractures, oblique and closed fractures, road traffic accident

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## Introduction

Long bone fractures (LBF) pose a significant and increasing challenge to health care system and the financial status worldwide. According to WHO data, traumatic injuries including LBF are the one of main causes of mortality and morbidity in the world. 90% of LBF occurs in low and middle-income countries [1,2,3,4]. The LBF have a great influence on health and financial status in Sri Lanka.

A fracture is any loss in the continuity of a bone. Long bones in the body are Femur, Tibia, Fibula, Humerus, Radius, Ulna, and Clavicle. The distribution of LBF in the body is affected by many etiological factors such as type of weapons in assaults, type of vehicle, speed, the influence of alcohol, pedestrian, passenger, driver in road traffic accidents and height in falls [5] which varies from country to country and region to sub-region. It also has differences in prevalence and treatment

strategies. Over the last several years LBF is becoming increasingly common, because of RTA. In a study done on lower limb fractures, the tibial shaft was the most often fractured long bone of humans, in RTA at 37.5%, falls at 17.8%, assaults at 4.5%, and sports at 30.9% [6,7]. Some studies have indicated RTA cause 68.4% of LBF in low-middle-income countries and falls have prevalence of 21.87%. The burdens of LBF are impacted to society through loss of productivity and contribute to the low quality of life, morbidity, and mortality [6,8].

This study aimed to study the incidence and correlation of LBF following RTA, assaults, and falls and compare the prevalence among these three groups.

The study was a prospective study of all patients with LBF examined in the emergency treatment unit at the teaching hospital Karapitiya over one year period, from December 2021 to December 2022.

### Methodology

In this study, inward patients, aged between 18 – 60 years, admitted to the emergency treatment unit in teaching hospital Karapitiya during the above time period were included. The minimum sample size was calculated according to the equation (S.K. Lwanga and S. Lemeshow, 1991). The sample size (n) was calculated in the equation = 284.

Fractures were diagnosed according to the consultant orthopedic surgeon or consultant general surgeon's opinion and in doubtful clinical cases, X-ray or CT reporting was done to diagnose fractures by the consultant radiologists. The patients with bone diseases, pathological fractures, old fractures, and dislocations of bones were excluded. Also, the fractures due to blast injuries and firearm injuries were excluded as these fracture patterns are most of the time due to shock waves. The patients who are above 60 years were excluded, as adults' fractures are most of the time, related to some underlying pathologies and the patients under 18 years were excluded, as children's fracture pattern is different as they have growing bones. Most of the patients were recruited from wards during the medicolegal examination. Data was collected from the patients, bystanders, Bedhead tickets, X-ray images with the informed written consent of patients or bystanders and the authority of the director, teaching hospital Karapitiya. The data were recorded in a pre-designed data extraction sheet without the identification details of the person. Other relevant data was collected from eyewitnesses and police. All the data was coded and analysis was done by latest SPSS data analyzing software.

The ethical approval was obtained from the Ethical Review Committee (ERC), Faculty of Medicine, University of Ruhuna (ERC Ref. No. 2021.P.095 dated 27.08.2021)) before commencing the study. Absolute confidentiality of the information collected was ensured and the autonomy of the participants was preserved. Only the investigators have access to the personal data of research participants. The collected data will be kept up to five years under the custody of the principal investigator and then will be destroyed and deleted. The analysis and data were used only for scientific publications and academic purposes.

### Results

The study group consisted of a total number of 300 patients who were admitted to the hospital following assaults, falls, and road accidents. Most of the patients were males 78% (n=233) and 22% (n=67) were females. When considering the age distribution of the victims with LBF, the majority of them 26% (n=77) were between 18 – 24 years of age. Majority of male and female victims were between the age ranges of 18-24 years with 25% (n=58) and 28% (n=19) respectively as it is shown in Figure 1.

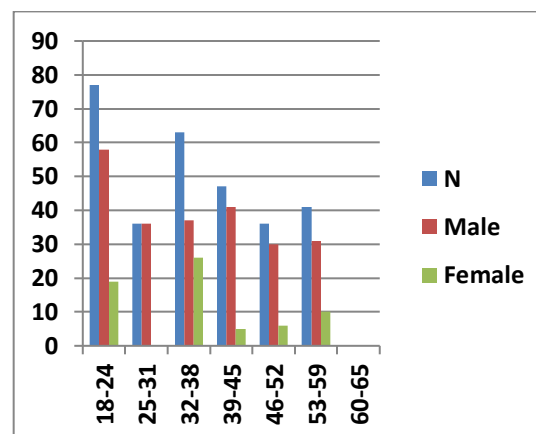


Figure 1. Age distribution of the patients

Out of the total, 79% (n=236) were injured due to RTA and 14% (n=42) were due to assaults as shown in Table 1.

Table 1. The relationship between the incident and long bone fracture frequencies

Incidents	N=300 n (%)
Assaults	42 (14)
Falls	22 (07)
RTA	236 (79)

The highest age range of patients with LBF in assaults and RTA was 18-24 years as shown in Table 2. When the gender and incidents were compared male predominance was noted in all three incidents as shown in Table 3 and it highlights that the major cause for LBF in both genders is following RTA.

Table 2. The relationship between age and incidents of long bone fractures

Age	Assaults N=42 n (%)	Falls N=22 n (%)	RTA N=236 n (%)	Total N=300 n (%)
18 - 24	21 (50)	00(00)	56 (24)	77 (26)
25 - 31	00(00)	00 (00)	36 (15)	36 (12)
32 - 38	08 (19)	05 (23)	50 (21)	63 (21)
39 - 45	06 (14)	00 (00)	41 (17)	47 (16)
46 - 52	00 (00)	10 (45)	26 (11)	36 (12)
53 - 59	07 (17)	07(32)	27 (11)	41 (14)
60 - 65	00 (00)	00 (00)	00 (00)	00 (00)

Table 3. The relationship between sex and incidents of long bone fractures.

Sex	Assaults N=42 n (%)	Falls N=22 n (%)	RTA N=236 n (%)	Total N=300 n (%)
Male	42 (14)	19 (06)	172 (57)	233(78)
Female	00 (00)	03 (01)	64 (21)	67 (22)

When the incidents of assaults (42) were considered it was revealed that most LBF were due to blunt forced weapon 93% (n=39) as shown in Table 4.

Table 4. The relationship between used weapons in an assault with long bone fractures

Weapon	N=42 n (%)
Blunt forced weapon	39 (93)
Sharp forced weapon	03 (07)

There were 22 patients with LBF following falls were in the cohort. Figure 2 illustrates the relationship of the height of fall with the prevalence of LBF.

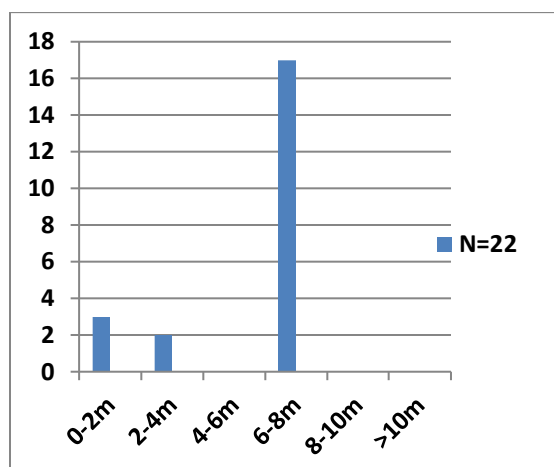


Figure 2. The relationship between heights in fall with long bone fracture

There were various types of LBF in victims of RTA. When the type of the road user was concerned the riders were the commonest victims of LBF 56%(n=132) followed by the drivers 31%(n=73). The riders are unrestrained victims who are easily thrown away from motorbike or foot cycles as these are the open vehicle without metal covers. The fractures in vehicle passengers were the lowest 01%(n=02). When it comes to the relationship between vehicles and LBF 66% (n=153) were motorcycles followed by three-wheelers 21 % (n=49) as shown in the Figure 3 and 4.

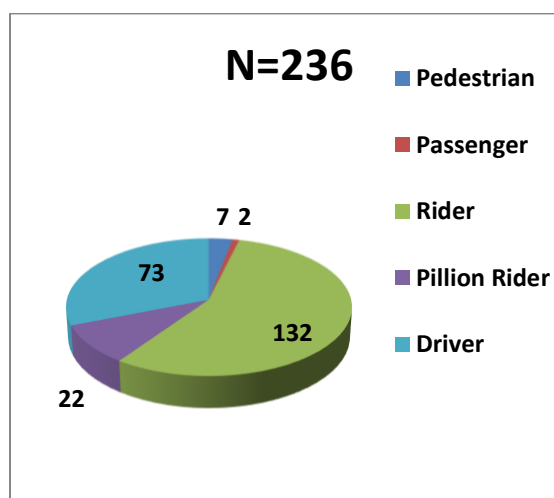


Figure 3. The relationship between the type of road user and LBF

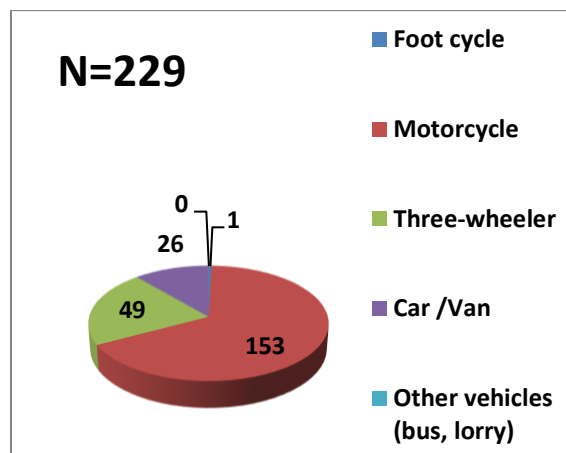


Figure 4. The relationship between the vehicle and LBF in RTA

Analysis of the LBF revealed different types of fractures and some victims had multiple fractures in different long bones. In 300 of cases including assaults, falls, and RTA, there were 426 LBF. Tibia was the commonest fractured bone 45%(n=191) followed by the radius 16%(n=70). The clavicle was the least frequently fractured bone (Figure 5).

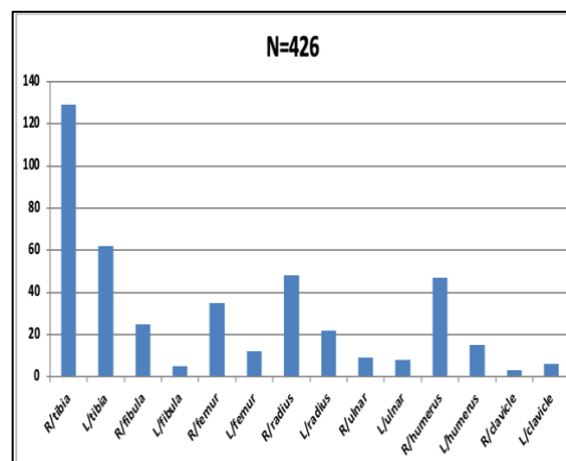


Figure 5. The name of long bone and fracture analysis

When analyzing the type of LBF simple fractures were the commonest 98%(n=417) and comminuted fractures were 02%(n=09). There were varieties in simple long bone fractures. The oblique fractures were 56%(n=235) and transverse fractures were 34%(n=138) as shown in Table 5. There were 94%(n=399) closed fractures and 06%(n=27) compound fractures in the study.

Table 5. The varieties in simple long bone fractures

Types of fractures	N=417 n (%)
Linear (longitudinal) fracture	42 (10)
Spiral fractures	02 (00)
Transverse fractures	138 (33)
Oblique fractures	235 (56)
Greenstick fractures	00 (00)
Stress fractures	00 (00)

The study compared the LBF with each incident. In RTA the tibia was the most fractured bone in riders 33% (n=113) and the femur been the second 08% (n=27). According to above findings lower limb bones are most vulnerable bones in riders. On the other hand, in drivers' the tibial fractures were seen in 17% (n=57) patients. The humerus fractures in riders and pillion riders were 03%(n=11) and 03% (n=09) respectively (Table 6).

Table 6. The analysis of different fractured bones with the type of road user in RTA

Bone	n (%)					Total N=339 n (%)
	Pedestrian n (%)	Rider n (%)	Pillion n (%)	Passenger n (%)	Driver n (%)	
R/tibia	07 (02)	86 (25)	02 (01)	00 (00)	34 (10)	129 (38)
L/tibia	00 (00)	27 (08)	10 (03)	02 (01)	23 (07)	62 (18)
R/fibula	04 (01)	15 (04)	00 (00)	01 (00)	02 (01)	22 (07)
L/fibula	00 (00)	02 (01)	00 (00)	00 (00)	03 (01)	05 (02)
R/femur	00 (00)	22 (06)	00 (00)	00 (00)	13 (04)	35 (10)
L/femur	00 (00)	05 (01)	00 (00)	01 (00)	06 (02)	12 (04)
R/radius	03 (01)	09 (03)	05 (01)	00 (00)	00 (00)	17 (05)
L/radius	00 (00)	03 (01)	05 (01)	00 (00)	00 (00)	08 (02)
R/Ulnar	00 (00)	00(00)	02 (01)	00 (00)	01 (00)	03 (01)
L/Ulnar	00 (00)	00 (00)	08 (02)	00 (00)	00 (00)	08 (02)
R/humerus	00 (00)	10 (03)	06 (02)	00 (00)	08 (02)	24 (07)
L/humerus	00 (00)	01 (00)	03 (01)	00 (00)	08 (02)	12 (04)
R/clavicle	00 (00)	00 (00)	00 (00)	00 (00)	01 (00)	01 (01)
L/clavicle	00 (00)	00 (00)	00 (00)	00 (00)	01 (00)	01 (01)

In assaults upper limb fractures could be seen frequently due to natural defense mechanisms to protect themselves using upper limbs. In this cohort, radial, ulnar, and humerus bone fractures were 54%(n=26), 13% (n=06), and 33% (n=16) respectively (Table 7).

Table 7. The analysis of fractured bone in patients following assaults

Name of bone	N= 48 n (%)
R/tibia	00 (00)
L/Tibia	00 (00)
R/fibula	00 (00)
L/fibula	00 (00)
R/femur	00 (00)
L/femur	00 (00)
R/radius	19 (40)
L/radius	07 (15)
R/ulnar	06 (13)
L/ulnar	00 (00)
R/humerus	16 (33)
L/humerus	00 (00)
R/clavicle	00 (00)
L/clavicle	00 (00)

Also, in falls upper limb fractures were noted as a natural tendency to use outstretched hand on ground in falls. There were radial, humerus and clavicle fractures in 49% (n=19), 26% (n=10), 18% (n=07) respectively (Table 8).

Table 8. The analysis of fractured bone with patients in falls

Name of bone	N=39 n (%)
R/tibia	00 (00)
L/Tibia	00 (00)
R/fibula	03 (08)
L/fibula	00 (00)
R/femur	00 (00)
L/femur	00 (00)
R/radius	12 (31)
L/radius	07 (18)
R/ulnar	00 (00)
L/ulnar	00 (00)
R/humerus	07 (18)
L/humerus	03 (00)
R/clavicle	02 (00)
L/clavicle	05 (00)

## Discussion

This study was undertaken 426 patients with LBF who were admitted to the hospital. It was observed that the highest number of patients admitted with LBF were young adults with significant male predominance which agrees with similar type of studies done locally and overseas [6, 9, 10, 11]. The sex difference may be due to the fact that males tend to exhibit more risky behavior and they involved in outdoor activities than females. A study on Mapping fractures from traffic accidents in Sweden that of done in Sweden points out that the males travel higher number of kilometers than females every day and eventually expose to RTA more frequently [11]. The mean age of patients enrolled in this study was 36.17 years, similar to 57.9 years in similar studies [9]. The present study revealed that the admission rates were the highest for young adults between the ages of 18 and 24 years 25% (n=58), similar to the

findings from other studies, indicating that the majority of people involved in RTA were in the productive young age groups [10, 12, 13]. Both the mean age and disproportionately higher admission rates for younger male adults could lead to a loss of productivity and negative impact on the economy.

The RTA was the most common determinant of fractures in this study. There were various types of LBF in victims of RTA. Simple and closed fractures were the commonest type of LBF, with oblique and transverse fractures being the commonest and second-commonest fractures in simple fractures respectively.

When the type of road user in RTA was concerned, the riders were the commonest victims of LBF followed by the drivers. Riders are unrestrained victims who are easily thrown away from motorbike or foot cycles which are two-wheeled and unstable vehicles on the road. The fractures in passengers were the lowest. The relationship between vehicles and long bone fractures 67% (n=153) of cases were motorcycles, 21% (n= 49) were three-wheelers and 11% (n=26) were cars and vans. Similar findings were observed in various publications. In a French study, motorcycle riders were involved in 30.2% of the accidents [14], while in India the percentage was 59.7% [15]. In Thailand, 80% of accidents involve motorcycles and in Malaysia more than 50% of those who die in traffic accidents are motor cyclists. A multi centric study conducted on persons injured in traffic accidents in Colombia describes that 81% of traffic accidents involved motorcycles [16]. The findings of these studies shows that the low socio economical countries the major cause for RTA involves with motor cycle and is compatible with the findings of our study. The two wheeled vehicles especially motor cycles are a common mode of transport among low middle class population due to their affordable prize and ability to beat traffic jams in urban areas constituting the largest proportion of vehicle which involved in RTA.

In our study the tibia and the femur were the most fractured bone which indicates that the lower limb bones are most vulnerable bones in riders and a similar finding were observed other various studies [13,17,18]. The findings in our study shows that not only riders and drivers, tibia was the most fractured bone in pedestrians, pillion riders, and passengers. The findings are compatible with the study conducted in Pakistan [18]. The Tibia is at the greatest risk probably due to superficiality and exposed position on motorcycle users as well as on pedestrians in impact with another vehicle. The reason for upper limb fractures in riders and pillion

riders may be due to secondary impact and secondary injuries. Upper limb fractures were the commonest in assaults as shown in this study could be due to natural defense mechanisms to protect themselves using upper limbs. The surveyed literature describes facial bone injuries as the common injuries in assaults [19, 20].

Also, in falls upper limb fractures were noted as a natural tendency to use outstretched hands on the ground in falls. In addition, the participants in the study had radial, humerus, and clavicle fractures and few had fibular fractures. These findings are consistent with the findings of the study where fracture patterns involved all aspects of the skeleton, with 98.9% exhibiting polytrauma [21].

### Limitations

All the patients with LBF during the indicated time period were included. But the actual number may be higher as the patients who were in the ICU in the unconscious state without a family member and patients who have not consented were excluded from the study.

### Conclusions

Young males were the most vulnerable group for LBF which could lead to a loss of productivity and a negative impact on the economy of the country. The RTA was the commonest cause and the riders were the commonest victims of LBF. Although the lower limb was the commonest fracture site in RTA, the upper limb was in assaults. Polytrauma was observed in falls.

Using personal protective measures, strict legal act implementations and improvement of injury surveillance were recommended to reduce preventable LBF.

### Disclosure statement

**Conflicts of interests:** The author declares that he has no conflicts of interest.

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