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Frequency of Different Patterns of Fractures Presented in Accidents and Emergency Department of Mayo Hospital Lahore

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ABSTRACT

Emergency departments encounter various fracture patterns that are influenced by factors such as age, injury mechanism, and underlying health conditions. **Objectives:** To investigate the frequencies of different fracture types and patterns, and thus assess the work burden observed in the emergency departments of Mayo Hospital, Lahore. **Methods:** This study was conducted at the Orthopedic Section of the Emergency Department of Mayo Hospital, Lahore between 1st January to 31st December 2022. Data were obtained from registers used to make entries of the patients in the Orthopedic section. All patients were divided into a pediatrics group (up to 12 years of age) and an adult group (above 12 years of age). The adult group was further divided into male and female groups. **Results:** 29190 (85.03%) were adults and 5136 (14.97%) were pediatric patients. Among the adult patients, 21048 (72.11%) were males and 8142 (27.89%) were females while in the pediatrics age group, 3378 (65.78%) were boys and 1758 (34.22%) were girls. Overall, the lower limb was more commonly fractured than the upper limb (52.88 % versus 32.16%) and the most frequently fractured bone was the tibia (19.99%). The leading cause of injury is Road Traffic Accidents (64.21%) followed by machine injuries (9.28%) and falls (7.85%). Patients aged 21 to 30 years were frequently affected (19.77%). **Conclusions:** It was concluded that daily, nearly one hundred fractures were reported to the Emergency department of Mayo Hospital Lahore. Resources need to be improved to cope with continuous quality care for these patients.

INTRODUCTION

Bone fractures, characterized by disruptions in bone continuity, pose a substantial threat to global musculoskeletal health. The reported incidence of fractures in the general population varies across studies. It ranges from 3.21 to 22.8 per 1000 annually [1]. In England, a self-report survey estimated an overall annual fracture incidence of 3.6 per 100 people [2]. This suggests fractures may be more common than previously thought. A study in Leicestershire, England found an estimated annual incidence of 100 per 10,000 for males and 81 per 10,000 for females across all fracture types [2]. In southern Sweden, the overall incidence rate of distal radius fractures was 26 per 10,000 person-years [3]. A study in South Wales found a much higher fracture rate of 36.1 per 1,000 children. [4]. The reasons for this higher rate require further investigation. Additionally, fracture incidence appears to vary geographically, with lower rates reported in Britain compared to North America and some Scandinavian countries. The occurrence of different fracture patterns in Emergency departments varies considerably based on factors like age, gender, and mechanism of injury [5]. A thorough review of various studies as mentioned above reveals distinct trends in fracture types and associated demographics. Fractures in healthy bones typically result from high-energy impacts or repetitive stress, whilst bones weakened by disease may fracture under normal loads or minor injuries [6]. The external causes of limb fractures, such as motor vehicle collisions, falls, sports

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injuries, and assaults, are generally similar worldwide. However, the distribution of these etiological factors varies between and within countries, depending on demographic profiles, socioeconomic conditions, and environmental factors [7]. Some studies indicate a predominance of falls as the external cause of fractures among pediatric and geriatric populations, as well as in regions with hilly terrain [8]. Other reports suggest that motor vehicle collisions are the primary external cause of fractures, particularly in areas where road traffic injuries are a neglected epidemic [9-11]. The type and pattern of limb fractures also vary with age, injury mechanism and severity, and involvement of surrounding tissues. The characteristics of limb fractures and the affected population have implications for treatment strategies and outcomes. Detailed information on etiological factors and characteristics of limb fractures in a specific setting can facilitate preventive and treatment strategies. However, data on limb fractures are limited. Recent reports indicate that limb fractures constitute 82.1%–94.7% of all fractures by anatomical region distribution [12, 13]. Cant *and* Faergemann, reported a total incidence of physical fractures of lower limbs in children as 35 per 100000 person-years [14]. The lack of comprehensive data and the diverse patterns of limb fractures in terms of types, causes, and demographic characteristics across sub-regions emphasize the importance of conducting this research. The rationale for this study was that understanding the frequencies of different fractures would provide better insight into fracture patterns, which can inform community health initiatives, especially in resource-limited settings. Future research should focus on validating fracture classifications and exploring the implications of an ageing population on fracture incidence.

This study aims to investigate the frequencies of different fracture types and patterns, and thus assess the work burden observed in the Emergency Departments of Mayo Hospital, Lahore.

METHODS

This cross-sectional analysis was conducted in the Orthopedic Section of the Emergency Department at Mayo Hospital, Lahore, Pakistan. Ethical approval was taken from the Institutional Review Board of King Edward Medical University Lahore vide letter number 182/RC/KEMU. Taking reference of the previous study [15], a minimum sample size of 2341 was calculated using World Health Organization (WHO) calculator 1.1 with a confidence level of 99 %, anticipated population proportion of 83% and absolute precision of 2%. A convenient sampling technique was used. Informed consent was taken. The study examined records of patients who presented with bone fractures between 1st January 2022 and 31st December 2022. Patients with soft tissue injuries, infections, and dislocations were excluded. The subjects were categorized into pediatric (up to and including 12 years) [16] and adult (over 12 years) groups. Adult patients were further subdivided by gender, affected region and bone, and age. Pediatric patients were classified based on the fractured bone and gender. The compiled data were analyzed using SPSS version 23.0, with frequencies and percentages calculated and illustrated using pie charts and graphs.

RESULTS

The study encompassed 34326 patients, comprising 29190 (85.03%) adults and 5136 (14.97%) children (Figure 1).

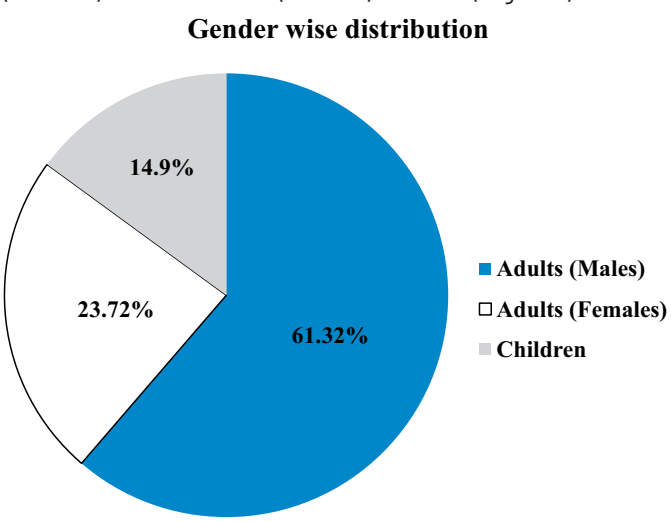

Figure 1: Gender Wise Distribution of the Patients

Among adults, 21048 (72.11%) were male and 8142 (27.89%) females, while the pediatric group consisted of 3378 (65.78%) boys and 1758 (34.22%) girls. Lower limb fractures were more prevalent than upper limb fractures (52.88% versus 32.16%). In adults, the most common lower limb fractures were the shaft of the tibia (2645, 7.71%), shaft of the femur (1994, 5.81%), and trochanteric (1661, 4.84%) (Table 1).

Table 1: Different Fractures and Their Frequencies in the Pelvic Girdle and Lower Limb (Adults)

Lower Limb Fractures	Frequency (%)
Pelvic, Acetabular ± HOF	724 (2.11%)
Neck of Femur	988 (2.88%)
Pertrochenteric and Sub-Trochenteric	1661(4.84%)
Shaft of Femur	1994 (5.81%)
Distal Femur (Intra-Articular)	1156 (3.37%)
Patella	1407 (4.10%)
Proximal Tibia (Intra-Articular)	1558 (4.54%)
Shaft of Tibia	2645 (7.71%)
Isolated Shaft of Fibula	81 (0.24%)
Distal Tibia (Intra-Articular)	943 (2.75%)
Single Malleolar	706 (2.06%)
Bi-Malleolar	1198 (3.49%)

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Tri-Malleolar	198 (0.58%)
Calcaneal	767 (2.23%)
Talar	84 (0.24%)
Jones / Pseudojones	113 (0.33%)
Metatarsal Shaft	184 (0.54%)
Lis' Franc Injuries	109 (0.32%)
Pharyngeal	387 (1.13%)
Multiple Fractures	1249 (3.64%)
Total Fractures of Lower Limb	18152 (52.88%)

For adult upper limb fractures, Distal Radius was most frequent (1708, 4.98%), followed by pharyngeal (1617, 4.71%) and metacarpals (1622, 4.22%) (Table 2).

Table 2: Different Fractures and Their Frequencies in Shoulder Girdle and Upper Limb (Adults)

Upper Limb Fractures	Frequency (%)
Clavicle	1034 (3.01%)
Scapula	16 (0.05%)
Proximal Humerus	678 (1.98%)
Shaft of Humerus	908 (2.65%)
Distal Humerus (Intra-Articular)	409 (1.19%)
Olecranon	414 (1.21%)
Radial Head	76 (0.22%)
Radius and Ulna	1385 (4.03%)
Distal Radius	1708 (4.98%)
Nightstick	762 (2.22%)
Scaphoid	87 (0.25%)
Carpels Other Than Scaphoid	9 (0.03%)
Metacarpals	1448 (4.22%)
Phalangeal	1617 (4.71%)
Total Fractures of Upper Limb	10551 (30.74%)
Maxillofacial, Head, Ribs and Spine Fractures	487(1.42%)

In children, supracondylar fracture was predominant (1332, 3.88%), followed by shaft of radius and ulna (945, 2.75%) and shaft of femur (565, 1.65%) (Table 3).

Table 3: Different Fractures and their Frequencies in the Pediatric Population

Pediatric Fractures	Frequency (%)
Facial Bones and Head Injuries	79 (0.23%)
Shaft of Humerus	97 (0.28%)
Supracondylar	1332 (3.88%)
Lateral Condyle	102 (0.30%)
Medial Condyle	7 (0.02%)
Shaft of Radius and Ulna	945 (2.75%)
Distal Radius	479 (1.40%)
Radial Head Subluxation	456 (1.33%)
Metacarpals And Phalanges	73 (0.21%)
Pelvic	3 (0.01%)
Neck Of Femur	96 (0.28%)
Shaft Of Femur	565 (1.65%)
Distal Femur	26 (0.08%)
Tibia	512 (1.49%)
Metatarsals And Pharyngeal	43 (0.13%)
Total Fractures In Pediatric Population	5136 (14.96%)
Total Number of Fractures of All Categories in the Year 2022	34526

Multiple bone fractures occurred in 1249 (3.64%) patients, while 487 (1.42%) had maxillofacial, head, ribs, and spine fractures. Tibia was the most frequently fractured bone in adults, accounting for 5146 cases (14.99% of all fractures), including proximal intra-articular (1558, 4.54%), shaft (2645, 7.71%), and distal intra-articular (924, 2.75%) fractures. The least common fractures in adults were metacarpals other than scaphoid (9 cases, 0.03%), while in children, pelvic bone fractures were rarest (3 cases, 0.01%). The most commonly affected age group was between 21 to 30 years with 6785 (19.77%) documented cases while the least frequently involved age group was above 80 years, having 256 (0.75%) patients. Most importantly, 16874 patients (49.15%) were from the earning population between 21 and 50 years of age (Table 4).

Table 4: Age Wise Frequency of fractures and Their Percentages

Age Category	Frequency (%)
Up to 12 Years	5136 (14.96%)
13-20 Years	3956 (11.52%)
20-30 Years	6785 (19.77%)
31-40 Years	5728 (16.69%)
41-50 Years	4361 (12.70%)
51-60 Years	3516 (10.24%)
61-70 Years	2921 (8.51%)
71-80 Years	1667 (4.86%)
>80 Years	256 (0.75%)
Total	34326 (100.00%)

Road Traffic Accidents (RTA) were the primary cause of injury, accounting for 22040 (64.21%) cases, followed by machine injuries (3185, 9.28%) and falls (2693, 7.85%), (Figure 2).

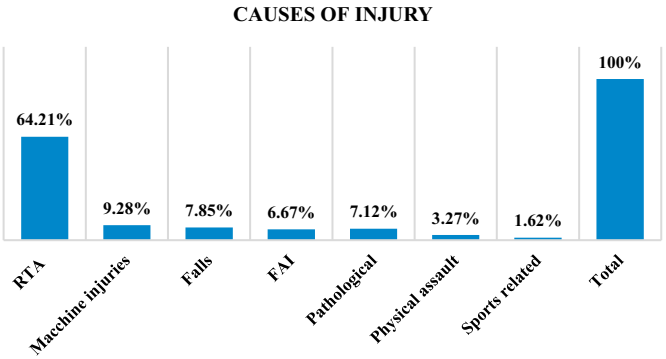

Figure 2: Causes of Injury among study participants

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DISCUSSION

This study encases the data of 34326 patients sustaining different types of fractures, of which more than twenty-nine thousand were adults and more than five thousand were children. More than two-thirds of the adult population were males and near one-third were females. Nearly similar trend was observed in pediatric population regarding gender. This doubled number of males is due to the more earning responsibilities over males in our society. Almigdad et al., also reported that male had more fractures than female [17]. Contrary to our study Reider *et al.*, observed that more women were involved in sustaining extremity fractures as compared to men [18]. A large number of patients had Road Traffic Accidents (RTAs), in which motorcycle was most frequently involved and almost all the cases of bike accidents were males. Omoke *et al.*, also found that RTA was the leading cause of fractures in Emergency department [19]. In more than half of the cases lower limb fractured was observed. Omoke also observed more fractures in lower limb than upper limb. Tibia was the most commonly fractured bone in lower limb, that is, every fifth or sixth patient had fracture of tibia and majority of these patients were younger than 50 years old. This high incidence of tibial fractures may be attributed to RTAs secondary to motorbike injuries and the working population [19]. Chaibi *et al.*, also reported a high incidence of 38% in tibia [20]. This is contrary to the results of a study published by Bergh *et al.*, which states that the proximal femur was the most frequent lower limb fracture [21]. The second and third most frequently fractured regions in lower limb bones were the shaft of the femur and peri-trochanteric (intertrochanteric and sub-trochanteric) region respectively. In the upper limb, the distal radius was the most commonly fractured bone with 1708 cases (4.98%). This is because distal radius fracture has a bimodal distribution. In young adults, it occurs from high energy trauma in active working males with fall on outstretched hand. In the elderly majority of distal radius fractures occur due to osteoporosis after trivial trauma. Bergh et al also reported distal radius fractures as high as 16.4% which is almost quadrupled as compared to our study [21]. Phalanx and metacarpal fractures were the second and third most frequent injuries of the upper limb in adults. More than 90% of these fractures were open and due to machine injuries including industrial machinery and grass cutters. Unfortunately, a wide majority of these victims were young males with ages below 30 years. The main reason for these injuries is the large number of press machinery in the vicinity of Mayo Hospital Lahore. Most of these patients had some degree of traumatic amputation at presentation with contaminated wounds. A vicious triad of poverty, disability and illiteracy was observed in these young patients which in turn increased the burden on the hospitals with negative income effect on the economic health of the country. Therefore, the government should make and implement proper legislation ensuring the safety protocols and compensation mechanism, in case of injury, of these poor industrial-machines workers. We observed more than twelve hundred multiple bone fractures. Unlike adults, children had more fractures in the upper limb as compared to the lower limb. Supracondylar fracture is the most frequent followed by both bone fractures of the forearm and shaft of femur in children. Merckaert *et al.*, also published that the pediatric population more frequently had upper extremity fractures but contrary to our study they found that the radius was the most frequently fractured bone in children [22]. Metacarpals (other than scaphoid) were the least commonly reported fractured bones. This is due to the relative stability of these small bones and the less expertise to diagnose their fracture with low-quality emergency department X-rays. Similarly, pediatric pelvic bone fractures were seen only in three patients. Regarding the cause of injury, it was RTA in about two-thirds of the cases followed by machine injuries (in every tenth patient) and falls in about every fourteenth or fifteenth patient. Algahtany, [23] also documented RTA as the leading cause of fractures but Rundgren *et al.*, reported simple falls as the most common cause of fractures [24]. This implies that strict compliance with the traffic rules should be ensured to avoid RTAs and proper legislation and protection should be ensured for machinery workers as discussed earlier. As far as the age group is concerned, the most affected age group was between 21 to 30 years and the least affected was above 80 years' age-group. Fayyaz *et al.*, also found that the peak age for fracture is between 15 and 44 years [25].

CONCLUSIONS

It was concluded that a total of 34326 patients with orthopedic fractures were recorded who visited the Emergency Department of Mayo Hospital in the year 2022 with about one hundred patients entertained daily. Every sixth patient is younger than 12 years. More than half of patients are from the earning age group, that is, between 21 and 50 years of age. The tibia is the most frequently fractured lower limb bone and distal radius in the upper limb in the adults while the supracondylar fracture is more frequently fractured in children. It is recommended that all tertiary care hospitals should be provided with enough human resources and equipment to cope with such a high burden of trauma and fractures. In this era of social media, awareness campaigns should be communicated to the public for their safety.

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Authors Contribution

Conceptualization: MKN
Methodology: MKN, KUI, MSN
Formal analysis: MSN, FM
Writing review and editing: MKN, KUI, SMRN, SNKN, AHS

All authors have read and agreed to the published version of the manuscript

Conflicts of Interest

The authors declare no conflict of interest.

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