

Epidemiology of Traumatic Orthopedic Injuries: A Cross-Sectional Survey from Northern Tehran, Iran

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Abstract

Background: Trauma is a leading cause of death and morbidity in developing countries. Previous research has revealed that epidemiological features of fractures may change from one study to the next. National Trauma Registry of Iran (NTRI) was launched in 2015, but it did not include any centers in northern Tehran, Iran. This study aimed to evaluate the epidemiology of fractures in the only Level 1 Trauma Center in that area.

Methods: This retrospective cross-sectional study was performed on all patients with the primary diagnosis of orthopedic injury, from July to October 2019, who referred to the emergency department of Shohada Tajrish Hospital, Tehran. The patients' files and operation notes were reviewed for demographics, medical history, physical examination, referral time, mechanism of injury, hospital stay, level of education, and intensive care unit (ICU) hospitalization.

Results: 398 patients with orthopedic trauma were referred to the hospital with a mean age of 40.85 ± 21.03 years. 317 patients (79.65%) were men. The peak referral time was between 12 AM and 12 PM. A road traffic accident was the main cause of orthopedic trauma (39.4%). The mean days of hospital stay were 6.29 ± 5.36 days. The waiting time for surgery and days of hospital stay were related to the fracture site (high in lower extremity fractures) and older age.

Conclusion: Trauma in northern Tehran is primarily caused by motor vehicle accidents and falls, respectively. Patients with older age and lower extremity fractures need more time of hospitalization.

Keywords: Accidents; Epidemiology; Fractures; Wounds and Injuries

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Background

Trauma is a major cause of both death and morbidity, and consequently, financial difficulties in developing countries (1). A recent study showed that 30% mortality rate could be decreased to 9% by proper public health management (2).

The usage of medical data in registration dates back to 1968 and has been upgraded to include trauma registration. According to reports, this newer approach already shows significant benefits in several countries (3, 4). Data acquired from recording systems can lead to the alteration of legislation with impacts on society. In the United States (US), two basic techniques, including wearing driver seat belts or helmets while riding a motorcycle, helped reduce concussions by 50 percent (5). The National Trauma Registry of Iran (NTRI) was launched in 2015, after which fifteen university hospitals have been invited to join the project (6). Based on the analysis of these data, some research papers have been published (5, 7).

However, the epidemiologic aspects around trauma are diverse because of numerous items, including culture, population density, socioeconomic situations, and road safety. Previous studies have shown that the epidemiological characteristics of fractures may not be similar in different studies (8, 9). Therefore, to achieve

reliable data, it is necessary to collect them from many locations. However, the NTRI did not include any trauma centers of north and northeast districts of Tehran, Iran. The goal of this study was to evaluate the data from Shohada Tajrish Hospital in north and northeast districts of Tehran, the only Level 1 Trauma Center in that area.

Methods

In this retrospective cross-sectional study, all consecutive patients with the primary diagnosis of orthopedic injury, from July to October 2019, who referred to the emergency department of our tertiary center (Shohada Tajrish Hospital) were enrolled. All the patients' files in the database of this hospital were reviewed.

An attending physician's notes on demographic characteristics, history, physical examination, referral time, mechanism of injury, hospital stay, and intensive care unit (ICU) admission were compiled from the patients' files and operation notes. For completing the missing data, patients were contacted via a phone call. The senior author reviewed all radiographs and computed tomography (CT) scans of the studied patients. The anatomic region of the fractures was determined to confirm the registered diagnosis.

Statistical analysis was carried out using the SPSS

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software (version 16.0, SPSS Inc., Chicago, IL, USA). Descriptive data were reported as frequency, mean, and standard deviation (SD). Analysis of variance (ANOVA) and post-hoc analyses were performed to evaluate the age difference between the fracture groups.

Results

A total of 398 patients with a mean age of 40.85 ± 21.03 (range of 4 to 98 years) were referred to Shohada Tajrish Hospital, with a primary diagnosis of orthopedic trauma during the summer of 2019 (Figure 1). 317 patients (79.65%) were men and had a mean age of 37.48 ± 19.40 years, while the women had a statistically significant higher mean age of 54.04 ± 21.90 years ($P < 0.001$).

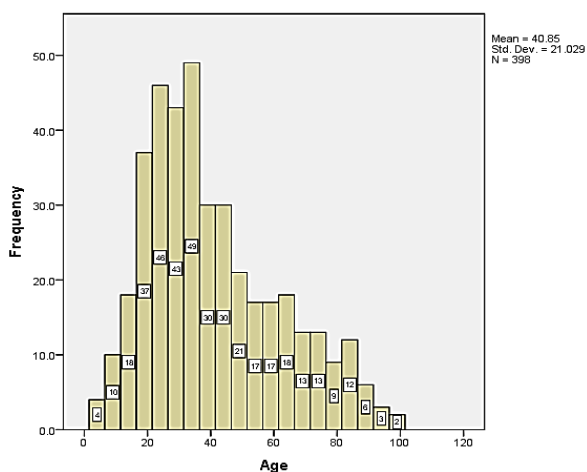


Figure 1. Age distribution of patients

Following evaluation of the referral time, it was noted that 285 (71.6%) patients were referred to the emergency department between 12 AM and 12 PM, while the least of them were between 0 to 6 AM (Figure 2).

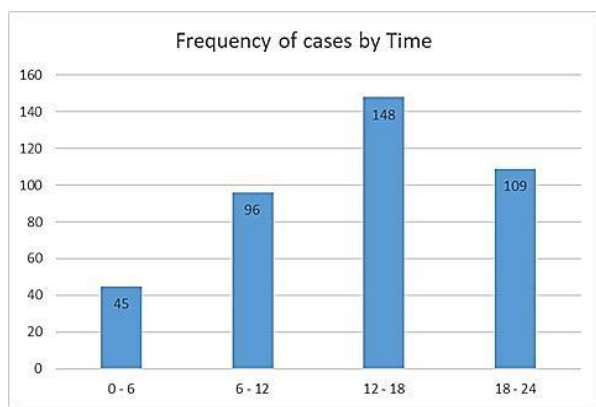


Figure 2. The patients' referral time distribution

There was no significant correlation between referral time and days of the week. Road accidents (pedestrian, car, and motor vehicle accidents) were the most common injury mechanisms, according to the current study, with a prevalence of 39.4%. The second most common mechanism of injury was falling and slipping. Table 1 shows the distribution of the mechanism of trauma in the studied cases. Figure 3 shows the relationship between the mechanism of injury and the referral time.

Table 1. The distribution of the mechanisms of trauma among the patients

Mechanism	n (%)	Total:
Falling and slipping	118 (29.6)	157 (39.4)
Traffic accidents		
Bike accidents	78 (19.6)	
Motor vehicle-to-pedestrian collision	51 (12.8)	
Motor vehicle-to-motor vehicle collision	28 (7.0)	
Street fight	16 (4.0)	
Work-related injury	10 (2.5)	
Others	97 (24.4)	

The mechanisms of orthopedic injuries were not correlated with the days of the week and holidays or workdays.

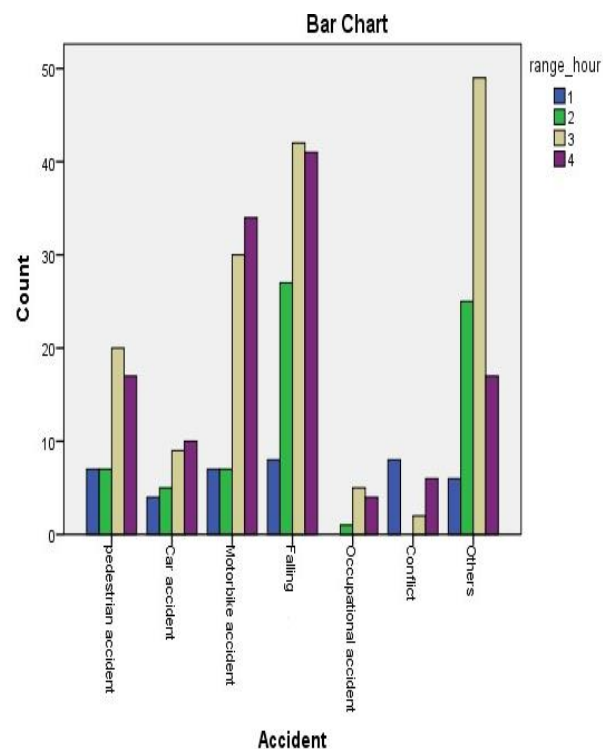


Figure 3. The relationship between the mechanism of injury and the referral time (1: 12 PM to 6 AM; 2: 6 AM to 12 AM; 3: 12 AM to 6 PM; 4: 6 PM to 12 PM)

A total of 504 accounts of bone fractures were reported in the patients, of which 160 (31.7%) had open fractures. Among 398 patients, 43 cases (10.8%) had neurovascular injuries. The two most common causes of neurologic deficit were spinal (35.71%) and humeral (31.03%) fractures. 28% (114 cases) of the patients had multiple fractures. Table 2 shows the distribution of fractures among the patients, while table 3 shows the fractures' distribution in the upper and lower extremities.

Table 2. The distribution of fractures

Location	Total	Open fractures [n (%)]	Closed fractures [n (%)]	P-value
Humerus	29	12 (41.3)	17 (58.6)	0.300
Radius	56	16 (28.5)	40 (71.4)	0.400
Ulna	35	11 (31.4)	24 (68.5)	0.800
Femur	79	19 (24.0)	60 (75.9)	0.055
Tibia	71	27 (38.0)	44 (61.9)	0.300
Fibula	50	22 (44.0)	28 (56.0)	0.080
Patella	7	4 (57.1)	3 (42.8)	0.170
Ankle	25	7 (28.0)	18 (72.0)	0.500
Spine	14	4 (28.5)	10 (71.4)	0.700
Pelvis	30	3 (10.0)	27 (90.0)	0.005
Hand	30	14 (46.6)	16 (53.3)	0.100
Foot	46	18 (39.1)	28 (60.8)	0.300
Scapula	8	1 (12.5)	7 (8.7)	0.200
Clavicle	24	2 (8.3)	22 (91.6)	0.008
Total	504	160	344	

Table 3. The distribution of the location of the fractures in the upper and lower extremities

Location	Humerus	Radius	Ulna	Femur	Tibia	Fibula
Proximal [n (%)]	11 (37.9)	3 (4.1)	8 (22.8)	48 (60.7)	25 (35.2)	7 (14.0)
Diaphysis [n (%)]	9 (31.0)	10 (13.6)	14 (40.0)	23 (29.1)	27 (38.0)	26 (52.0)
Distal [n (%)]	9 (31.0)	43 (58.9)	13 (37.1)	8 (10.1)	19 (26.7)	17 (34.0)
Total	29	56	35	79	71	50

The present study showed that open fractures were more common in the lower extremities. Overall, the distribution of patients in terms of fracture site showed that femoral fracture (16.73%) and tibial fracture (15.04%) were the most common fractures, most of which were proximal femoral fractures (60.75%), which occurred mainly in the elderly. 40.46% of fractures were related to the lower extremity, and 25% were related to the upper extremity. Moreover, the lowest frequency of fractures was related to the scapula (1.69%), patella (1.48%), and spine (2.96%).

The results also showed that a total of 42 (10.5%) patients had dislocations, of which the foot, knee, and wrist were the most common locations of the injuries with the frequency of 26.19%, 19.04%, and 14.28% of dislocations, respectively. The highest frequency of shoulder dislocations was in pedestrian accidents, with a rate of 55%. A percentage of 37.5% of knee dislocations and 36.36% of ankle dislocations had a neurovascular injury.

The mean hospital stay was 6.29 ± 5.36 days (between 1 and 35) with median of 5 days. 3.3% of patients required hospitalization in the ICU. The mean length of hospitalization was significantly associated with the fracture site and was significantly longer in the lower extremity fractures (7.27 days in the lower extremity versus 4.95 days in the upper extremity, $P < 0.001$). The average waiting time for surgery was 2.13 ± 2.25 days.

The mean waiting time for surgery was significantly related to the fracture site and patients' age. The mean waiting time for surgery in patients with lower extremity fractures was considerably longer than the upper extremity fractures. Meanwhile, each age unit increase can cause 3.83 hours longer waiting time for surgery. Table 4 shows the patients' education level. 57.8% of patients did not complete high school, 34.2% had a high school diploma, and only 8% had an academic degree.

Table 4. Patients' education level distribution

Education level	n (%)
Unknown	66 (16.6)
Illiterate	63 (15.8)
Middle school	101 (25.4)
High school diploma	136 (34.2)
Associate's degree	26 (6.5)
Bachelor's degree	6 (1.5)
PhD	0 (0)

The mean age of patients with blood transfusion was 40.85 ± 24.00 , which is not significantly different from patients who did not receive blood transfusion with a mean age of 39.87 ± 20.42 . The blood transfusion rate was not significantly different between men and women.

Discussion

In most countries, trauma is the leading cause of mortality and disability, and it has a considerable negative influence on life quality in the population. The productive generation of society faces a slew of health problems that result in early death, disproportionately among young people. Accidents and trauma are two of the leading causes of death and illness in our country. Therefore, population demographics are starting to be more critical.

As a result, it is critical to thoroughly understand the most prevalent forms of fractures to establish treatment options. As more young people become interested in sports, more injuries or changes in the incidence and severity of injuries are likely to occur (10, 11).

Therefore, we investigated this issue locally to shed a better light on epidemiological aspects of fractures in Iran.

According to the findings of this study, the majority of patients were men in their twenties. It is consistent with a cross-sectional study of 47295 trauma patients conducted on patients over the age of 15 in trauma referral hospitals of Shiraz, Iran (12). It could be because men, especially young men, conduct the most challenging and hazardous environments in developing countries (13, 14). However, depending on the age and gender distribution of the population in the study area and the inclusion criteria, the exact age and gender distribution of trauma patients can vary. It may also affect the fracture sites. For instance, the number of spinal fractures in our study is lower than in the literature, since our hospital has a specialized spine department, and most patients with spinal injuries are admitted to the neurosurgery service rather than the orthopedics service.

One of the most notable outcomes of the current study was the time of patients' visits. According to the findings, nearly 40% of patients received counseling in the afternoon or evening. Consequently, these insights may be valuable for concentrating medical staff during peak hours. On the other hand, the data demonstrated a link between injury mechanism and referral time. Patients with trauma from pedestrian, car, and motorcycle accidents or falls are primarily referred to hospital in the afternoon or evening. None of the patients who had occupational accidents were referred to the hospital at midnight.

Meanwhile, most patients admitted as a result of violence arrived after midnight. Heavy work shifts for personnel, particularly nurses, have been shown in studies to impair job efficiency and service quality, leading to staff and patient discontent (15, 16). The conclusions of this study can help with staff concentration, providing appropriate equipment and improving patient care.

The current study found that road accidents (pedestrian, car, and motor accidents) were the most common injury mechanisms with a prevalence of 39.4%, and falling ranked second with a prevalence of 30%. Similar investigations have identified these two mechanisms as the most common causes of injury (8, 12).

According to the World Health Organization (WHO), 1.35 million people die in traffic accidents every year, with more than 93% of these deaths occurring in developing countries with middle and low income. Approximately, 60% of the world's cars and motorcycles are used in these countries (17). Through appropriate traffic planning and reform and the application of standard legislation, industrialized countries were able to shift the most common mechanism of injury from road accidents in the 1990s to falls in 2013 (18). The occurrence of road accidents can be minimized with careful planning by the municipality and traffic police. The collection of reliable data from all parts of the country can aid in handling this critical issue.

Prior analyses have identified the lower extremities as the most common site of fractures, which is consistent with our findings (19, 20). It is worth noting that the most common fracture site changes depending on the study's inclusion criteria. The thorax and ribs were shown to be

the most common fracture site in people over the age of 50 in an epidemiological study in the US. Surprisingly, the hands and legs were the most common fractures among young people aged 18 to 49 (21, 22).

According to a recent study of trauma patients at Sina Hospital, Tehran, 16% of 3352 survivors required ICU care, and these patients stayed in the hospital for an average of 8.1 days (5). Furthermore, Sharif-Alhoseini et al. reported that the average length of stay in 117 trauma patients was 9.8 days, with 21.6% requiring ICU care (6). The results of these two studies, which were published based on data gathered from NTRI, do not match those of the current study in terms of these two parameters. This discrepancy in results could be attributed to variances in factors affecting hospitalization and the ICU, in addition to differences in inclusion criteria. According to the findings of this study, elderly patients spent more time in the hospital and in the ICU.

In a study of trauma patients conducted by Khatami et al. in 2014, the average hospitalization time was significantly related to the severity of the injury. In individuals with severe injuries, it took 9.2 days (23). According to a study of 14054 trauma patients in southern Iran who were involved in traffic accidents, male gender, older age, thoracic injuries, and infections were all factors that lengthened hospitalization (24). What matters is identifying high-risk groups that require more attention, so that patients can receive better care. In this study, the length of hospitalization was found to be influenced by older age and lower extremity fracture.

Delaying surgery lengthens hospital stays, leading to increased costs and the risk of complications such as nosocomial infection, vascular thrombosis, and bedsores (25). Identifying patients with longer surgery waiting time may lead to the development of new patient care strategies. It is worth mentioning that in some cases, the patient's critical condition and a lack of facilities prevent us from reducing the surgical wait time. Furthermore, orthopedic surgeons are advised to carefully cut down on this time by extensively assessing these patients.

Despite the fact that there have been numerous previous trauma surveys, the strength of this study was the separate assessment of orthopedic trauma patients. Since no centers in northern Tehran were included in the NTRI, the findings of this survey can be used to supplement national findings and improve health policymaking. According to the Statistical Center of Iran, 34% of Tehran population have academic degrees, but in the current study, only 8% of orthopedic trauma patients had academic degrees. It indicated that socioeconomic level could impact the risk of orthopedic trauma among the population. Our investigation was limited by short time intervals and the location of the study. Future studies with a longer time and across the country are recommended.

Conclusion

In northern Tehran, traffic accidents were the primary cause of trauma; therefore, it appears that a review of traffic rules and some traffic management innovations are required. Our research indicated that patients with older age and lower extremity fractures were likely to need longer hospitalizations. It is important to focus on patients with lower extremity fractures because of higher incidence and longer hospitalization. Adding patients' referral time to NTRI registration criteria could be beneficial for proper medical staff distribution planning, leading to burnout avoidance.

Conflict of Interest

The authors declare no conflict of interest in this study.

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