

RESEARCH ARTICLE

The Prevalence of Lower Extremity Injuries in Mashhad: A Five-Year Study

Khalil Kimiafar, PhD¹; Majid Khadem-Rezaian, MD²; Mohsen Saberifar, MD³; Mahdi Mohammadi, MD³; Mohammadsadeh Zarei, MD³; Alireza Omranzadeh, MD³; Masoumeh Sarbaz, PhD¹; Ali Moradi, PhD^{4,5}

Research performed at Mashhad University of Medical Sciences, Mashhad, Iran

Received: 28 July 2019

Accepted: 08 February 2020

Abstract

Background: Injury is one of the leading causes of death and disability worldwide. Lower extremity injuries put a heavy burden on communities. The aim of this study is to assess the prevalence of lower extremity injuries in Mashhad, Iran.

Methods: The data from 57430 patients with lower extremity injuries from all traumatology hospitals in Mashhad were analyzed in this retrospective descriptive cross-sectional study to determine the prevalence of lower extremity injuries in Mashhad, Iran, between March 2011 and March 2015.

Results: The prevalence of lower extremity injury in the general population of Mashhad was 0.34%. The mean age of the casualties was 33.7 ± 19.8 years, and 77.9% were male. Knee and lower leg injuries had the highest frequency (61%). The mean hospitalization period was 7.7 ± 12.6 days. The highest mortality rate (MR) (2%) and discharge against medical advice (DAMA) (11%) were observed in hip and thigh injuries. DAMA (8.8% vs. 6.7%, $P < 0.001$) and MR (1.7% vs. 1.5%, $P = 0.005$) was higher in females. However, males had a longer hospitalization period (8 ± 13) compared to females (6.8 ± 10.1 days) ($P < 0.001$). The prevalence rate was declining during the study period.

Conclusion: The downward trend of lower extremity injuries is promising; however, the higher mortality rate in females needs more attention. These findings can be used for better management of traumatic patients.

Level of evidence: III

Keywords: Injury, Lower extremity, Prevalence

Introduction

The world health organization reports that more than 391000 children aged 0-14 died from unintentional injuries in 2012. In other words, every day, 2000 families suffer from a child loss due to unintentional injuries. However, awareness of the problem and its preventability remains unacceptably low (1). For example, injury accounts for an estimated 40 deaths per day in the UK (2). Lower extremity injuries put a heavy burden on society as half of the patients cannot make a complete recovery after one year (3). Hip fracture, a kind of lower extremity injury,

is responsible for 1.4% of disability-adjusted life years (DALYs) and is associated with 740,000 deaths annually (4). It is estimated that lower extremity injuries constitute approximately 27.7% of all injury cases in Iran (5).

A retrospective analysis in Poland found that patients with proximal femoral fractures had an average hospital stay of 22 days (6). Johnell and Kanis estimated that nearly 4.5 million people were suffering from the outcomes of hip fracture in 1990. These consequences affected women 2.7 times more than men (4).

Corresponding Author: Masoumeh Sarbaz, Department of Medical Records and Health Information Technology, School of Paramedical Sciences, Mashhad University of Medical Sciences, Mashhad, Iran

Email: sarbazm@mums.ac.ir



THE ONLINE VERSION OF THIS ARTICLE
ABJS.MUMS.AC.IR

Tibial and fibular fractures constitute 20% of all admissions in an orthopedic department in northern Tanzania (7). Iranian people as the target population of this study have shown the highest rate of hip fracture in Asia (8). Karbakhsh et al. reported that lower extremity injuries constitute 33.8% of all injury cases in Kermanshah (west of Iran) in 2009 (4). A previous cross-sectional study in northern Iran has reported a higher incidence of injuries in June and July (9). Short study time has been one of the weaknesses of these Iranian reports (5, 9).

Although some studies have been designed to determine the prevalence of general injuries and some specific types of lower extremity injuries, very few have focused on a reliable estimation of the prevalence of all kinds of lower extremity injuries especially in Mashhad (Northeast of Iran) which can be generalizable to the population of the city. The aim of the current study was to evaluate the prevalence and pattern of lower extremity injuries.

Materials and Methods

This cross-sectional study was performed in all four academic governmental traumatology hospitals (namely Imam Reza, Taleghani, Kamyab, and Hasheminejad) affiliated to Mashhad University of Medical Sciences. The Institutional Review Board of Faculty of Paramedical Sciences approved this study. Mashhad, the capital of Khorasan Razavi province and the second most populated city in Iran, has an estimated population of over 3 million people (10). The data of all admitted patients to the aforementioned hospitals due to trauma were retrieved from the hospital information system (HIS) between March 2011 and March 2015. Gender, age, admission and discharge dates, length of hospital stay, diagnosis, and final in-hospital outcomes were extracted based on a predefined checklist. The following age categorization was used for the casualties: infant (0-2 years); preschool child (2-5 years); child (5-12 years); adolescent (12-19 years); adult (19-65 years); and aged (≥ 65 years). According to the International

Classification of Diseases 10th revision (ICD-10) the injuries in this study were: a) hip and thigh (S70-S79); b) knee and lower leg (S80-S89); and c) ankle and foot (S90-S99) (11).

Data were analyzed by SPSS version 11.5. Descriptive (frequency, mean, and standard deviation) and inferential analyses (Chi-square and ANOVA tests) were performed. All tests were 2-tailed considering $P < 0.05$ as statistically significant.

Results

The annual prevalence of lower extremity injuries was 0.34% ($n=57430$). Majority (77.9%, $n=44727$) of the admitted patients were male. The mean age was 33.7 ± 19.8 years. After age categorization, it was revealed that the majority of admitted patients (67.8%) were adults followed by adolescents (13.2%), aged (8.9%), children (5.7%), preschool children (3.0%) and infants (1.5%). The hospitalization period was 7.7 ± 12.6 days. The highest frequency of lower extremity injuries (61%) was related to the knee and lower leg injuries while the lowest frequency (14.4%) was related to the hip and thigh injuries.

Hip and thigh injuries were observed mostly at two ends of age spectrum, namely 48.1% of infants and 49.7% of aged patients while knee and lower leg injuries were mostly observed in the middle of age spectrum, namely 57.3% of preschool children, 60.4% of children, 63.8% of adolescents and 64.1% of adults ($P < 0.001$).

Lower extremity injuries were found to be more prevalent in men with dominance in knee and lower leg injuries ($P < 0.001$). The highest in-hospital mortality rate (2%) and discharge against medical advice (DAMA) (11%) were observed in hip and thigh injuries. Patients with hip and thigh injuries were older than others (44.4 ± 28.2 years) and had a longer hospital stay (8.5 ± 9 days) (both $P < 0.001$) [Table 1].

Women showed a significantly higher tendency to DAMA, hip and thigh injury, knee and lower leg injury, and ankle and foot injury compared to men. The overall

Table 1. Basic characteristics of admitted patients based on the source of lower extremity injuries

	Hip and thigh (S70-S79)	Knee and lower leg (S80-S89)	Ankle and foot (S90-S99)	P value
Age (years)*	44.4 $\pm$ 28.2	32.2 $\pm$ 17.7	30.8 $\pm$ 19.8	<0.001
Hospitalization (days)*	8.5 $\pm$ 9.0	8.4 $\pm$ 13.8	5.6 $\pm$ 11.1	<0.001
Male**	5515 (66.6%)	27861 (79.6%)	11351 (80.4%)	<0.001
Death**	167 (2.0%)	532 (1.5%)	150 (1.1%)	0.005
DAMA***	922 (11.1%)	2282 (6.5%)	923 (6.5%)	<0.001
Total**	8285 (14.4%)	35016 (61.0%)	14122 (24.6%)	-

* Data represented as Mean $\pm$ SD, ** Data represented as frequency (percentage), ***DAMA: discharge against medical advice

and hip and thigh injury-related mortality rates were also significantly higher in females; however, the knee and lower leg injury and ankle and foot injury-related mortality rates were nonsignificantly higher in females compared to males [Figure 1].

Females with lower extremity injuries (40.5 ± 24)

were significantly older than males (31.7 ± 17.9 years) ($P < 0.001$); however, males had a longer hospital stay than females (8 ± 13 vs 6.8 ± 10.1 days, $P < 0.001$). This pattern was observed in all lower extremity injury categories. Figure 1 indicates the highest frequency of any kind of injury in each category [Figure 2].

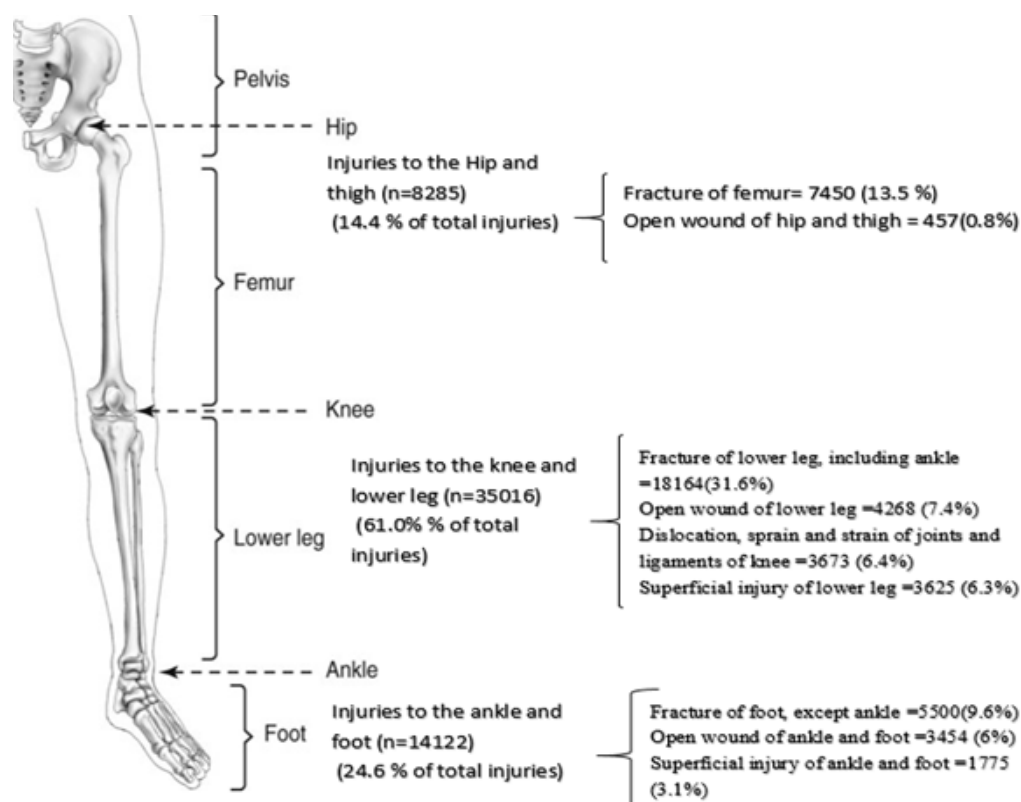


Figure 1. The highest rates of any injury in each category in descending order.

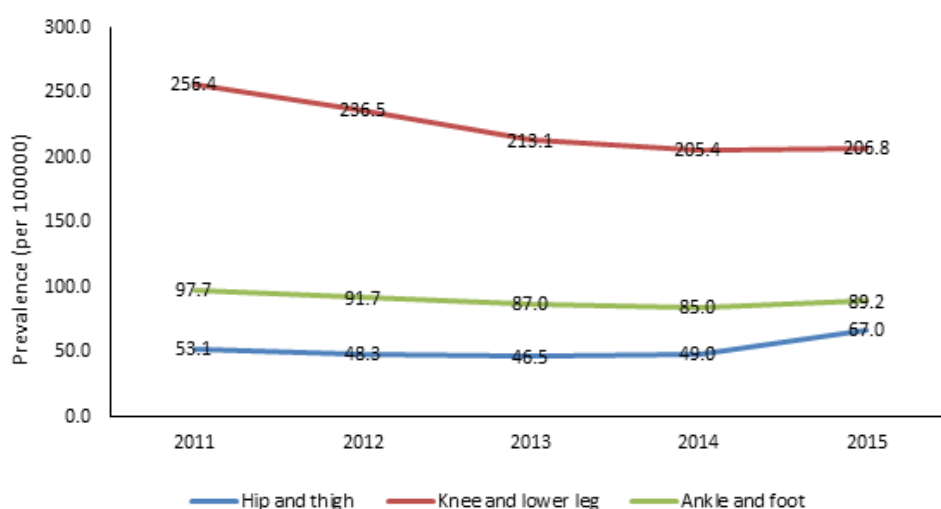


Figure 2. Prevalence of lower extremity injuries in 5 years period in Mashhad.

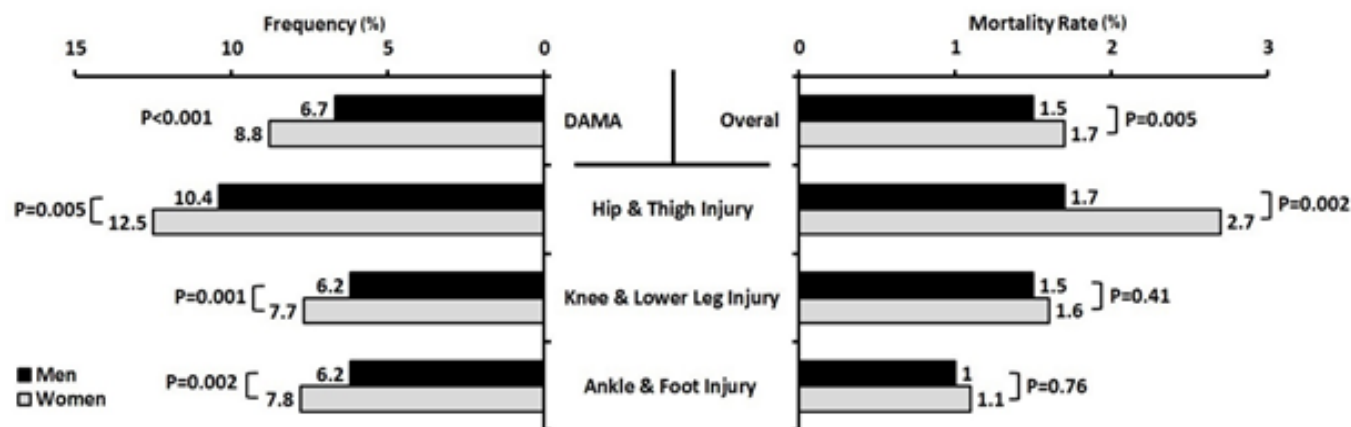


Figure 3. Comparison between the frequencies (%) and mortality rates of various lower extremity injuries among female and male patients.

Figure 3 compares the trend of injuries from 2011 to 2015. The prevalence of knee and lower leg injuries had declined; hip and thigh had a rise in recent years; and ankle and foot injuries were approximately constant ($P < 0.001$).

The prevalence of all three categories of lower extremity injuries was significantly higher in summer (30% of hip and thigh, 29% of knee and lower leg and 31% of ankle and foot, $P < 0.001$). Most injuries happened on September (11.3% of hip and thigh, 10.4% of knee and lower leg and 10.8% of ankle and foot, $P < 0.001$).

Discussion

The prevalence of lower extremity injuries in Mashhad as the second most populous city in Iran was unknown. Our findings showed that the prevalence of lower extremity injuries in a 5-year period in Mashhad was 3.4 per 1000 persons with dominance in men (M/F ratio=3.52). However, the recovery rate was greater in males, too. The duration of hospital stay was also found to be correlated with the kind of injury. Finally, the mean age of patients with hip and thigh injury was significantly higher than other patients.

Higher prevalence of lower extremity injuries in men matches those observed in earlier studies regarding all kinds of injury (5, 12). Knee and lower leg injury had the highest prevalence among lower extremity injuries. These findings may partly be explained by the fact that motorcycle accidents are highly frequent in developing countries (12). Since most of the motorcyclists are young men, lower extremity injuries, especially those affecting the long bone diaphysis, are more prevalent in men (12). The same mechanism is applicable in explaining the higher incidence of lower extremity injuries in warm months of the year. The increased incidence of lower extremity injuries in summer can be explained by a higher rate of traffic especially motorcycle accidents in the warm season (13).

Lower extremity injuries were more frequent in

males, with an M/F ratio of 2 for hip and thigh injuries, 3.9 for knee and lower leg injuries, and 4.1 for ankle and foot injuries. Conversely, Johnell and Kanis reported an F/M ratio of 1.4 in patients with hip fracture in Middle East Crescent (4). Also, hip and thigh injuries were more frequent in elder people. These findings may be explained by the fact that osteoporosis is a major risk in post-menopausal women (13). Because of osteoporosis, fractures of weight-bearing hip and femur bones are more prevalent in women (14). However, the dominance of lower extremity injuries in males from one side, and the knee and lower leg from the other side, might be best explained by the high traffic accidents.

Our results showed an overall mortality rate of 1.5-1.7% which is almost two times higher than Zamani et al. report on mortality rate of patients with all kinds of injury (14). However, the short period of investigation (one month) in their study can be a possible reason for this controversy. This mortality rate was similar to a recent report of an overall mortality rate of 1.95% in motorcyclist trauma patients in the same setting (15). The significantly higher mortality rate in females has also been reported in patients with burn injuries (16). Contrary to the findings of the previous reports, women in our study showed a significantly higher DAMA rate. This outcome is related to DAMA problems (17, 18). It seems that these results are due to the including patients who were injured in road and traffic accidents and referred to a single hospital. As mentioned above, most of the motorcycle riders are young men who usually even do not use helmets (12, 19, 20). Therefore, it is more likely to include severely injured men to the study who cannot be discharged against medical advice. As a result, the DAMA rate in men can decrease to a great extent.

This study had its own limitations. For example, the time of admission had a lot of missing data, which prevented us from including this variable to the study. It should be noted that investigating only the admitted

patients will result in underestimation of all lower extremity injuries. On the other hand, the extended period of study, including four specialized injury hospitals and focusing on a specific anatomical point (lower extremity) are among the strengths of this study. Besides, our sample size was much higher than the previously reported studies which can lead to a more accurate estimation of outcomes.

The downward trend of lower extremity injuries is promising. However, the higher mortality rate among female casualties (especially in hip injuries) needs more attention. These findings can be used for more efficient management of traumatic patients.

Acknowledgement

We are thankful to the health information technology students who cooperated in data gathering. Besides, the supports from the **Clinical Research Development Units of Akbar and Ghaem Hospitals** are highly appreciated.

Khalil Kimiafar PhD¹
Majid Khadem-Rezaian MD²
Mohsen Saberifar MD³
Mahdi Mohammadi MD³
Mohammadsadegh Zarei MD³
Alireza Omranzadeh MD³
Masoumeh Sarbaz PhD¹
Ali Moradi PhD^{4,5}

1 Department of Medical Records and Health Information Technology, School of Paramedical Sciences, Mashhad University of Medical Sciences, Mashhad, Iran

2 Clinical Research Development Unit of Akbar Hospital, Faculty of Medicine, Mashhad University of Medical Sciences, Mashhad, Iran

3 Student Research Committee, Faculty of Medicine, Mashhad University of Medical Sciences, Mashhad, Iran

4 Orthopedic Research Center, Mashhad University of Medical Sciences, Mashhad, Iran

5 Clinical Research Development Unit, Ghaem Hospital, Mashhad University of Medical Sciences, Mashhad, Iran

References

1. Inheriting a sustainable world? Atlas on children's health and the environment [Internet]. Geneva: World Health Organization; 2017. [cited 2020 August 20]. Available from: <https://apps.who.int/iris/rest/bitstreams/1080871/retrieve>
2. M. Airey, SM Chell, AS Rigby, A. Tennant, JB Connolly C. The epidemiology of disability and occupation handicap resulting from major traumatic injury. Disability and rehabilitation. 2001; 23(12):509-15.
3. Rouleau DM, Place A, Bérubé M, Laflamme YG, Feldman D. Rehabilitation after lower limb injury: development of a predictive score (RALLI score). Canadian Journal of Surgery. 2015; 58(4):278.
4. Johnell O, Kanis JA. An estimate of the worldwide prevalence, mortality and disability associated with hip fracture. Osteoporosis International. 2004; 15(11):897-902.
5. Karbakhsh M, Zandi NS, Rouzrokh M, Zarei MR. Injury epidemiology in Kermanshah: the national trauma project in Islamic Republic of Iran. EMHJ-Eastern Mediterranean Health Journal, 15 (1), 57-64, 2009.
6. Niedziółka J, Hoszowski K, Gawron J, Lachowicz W, Wachowiak A, Lorenc RS. Epidemiology of proximal femur fracture and results of therapy in patients treated at the Orthopedic-Trauma Ward of the Railway Hospital in Warsaw in the years 1986-1990. Polski tygodnik lekarski (Warsaw, Poland: 1960). 1993; 48:61-4.
7. Clelland SJ, Chauhan P, Mandari FN. The epidemiology and management of tibia and fibula fractures at Kilimanjaro Christian Medical Centre (KCMC) in Northern Tanzania. The Pan African medical journal. 2016; 25.
8. Cheng SY, Levy AR, Lefavre KA, Guy P, Kuramoto L, Sobolev B. Geographic trends in incidence of hip fractures: a comprehensive literature review. Osteoporosis International. 2011; 22(10):2575-86.
9. Moosazadeh M, Nasehi MM, Mirzajani M, Bahrami MA. Epidemiological study of traumatic injuries in emergency departments of Mazandaran hospitals, 2010. Journal of Mazandaran University of Medical Sciences. 2013; 23(98):144-54.
10. Statistical Center of Iran [Internet]. Results of the 2016 National Population and Housing Census. Tehran: Presidency of IRI Plan and Budget Organization. [Date Unknown] [cited 2020 May 05]. Available from: <https://www.amar.org.ir/english/Population-and-Housing-Censuses>.
11. World Health Organization [Internet]. International statistical classification of diseases and related health problems, 10th revision, Fifth edition, Geneva: World Health Organization; 2016.[cited 2020 August 20]. Available from: <https://apps.who.int/iris/handle/10665/246208>
12. Mehrpour SR, Nabian MH, Zanjani LO, Foroughmand-Araabi MH, Kamrani RS. Descriptive epidemiology of traumatic injuries in 18890 adults: a 5-year-study in a tertiary trauma center in Iran. Asian journal of sports medicine. 2015; 6(1).
13. Heydari ST, Hoseinzadeh A, Ghaffarpasand F, Hedjazi A, Zarenezhad M, Moafian G, et al. Epidemiological characteristics of fatal traffic accidents in Fars province, Iran: a community-based survey. Public health. 2013; 127(8):704-9.
14. Zamani M, Esmailian M, Mirazimi MS, Ebrahimian M, Golshani K. Cause and final outcome of trauma in patients referred to the emergency department: a cross sectional study. Iranian journal of emergency medicine. 2014; 1(1):22-7.
15. Hoseinian SH, Ebrahimzadeh MH, Peivandi MT,

- Bagheri F, Hasani J, Golshan S, et al. Injury patterns among motorcyclist trauma patients: a cross sectional study on 4200 patients. Archives of bone and joint surgery. 2019; 7(4):367.
16. O'Keefe GE, Hunt JL, Purdue GF. An evaluation of risk factors for mortality after burn trauma and the identification of gender-dependent differences in outcomes. Journal of the American college of surgeons. 2001; 192(2):153-60.
17. Einsiedel LJ, van Iersel E, Macnamara R, Spelman T, Heffernan M, Bray L, et al. Self-discharge by adult Aboriginal patients at Alice Springs Hospital, Central Australia: insights from a prospective cohort study. Australian Health Review. 2013; 37(2):239-45.
18. Kaplan GG, Panaccione R, Hubbard JN, Nguyen GC, Shaheen AA, Ma C, et al. Inflammatory bowel disease patients who leave hospital against medical advice: predictors and temporal trends. Inflammatory bowel diseases. 2009; 15(6):845-51.
19. Sarbaz M, Kimiafar K, KhademRezaian M, Banaye Yazdipour A. Epidemiology of transport accidents based on international statistical classification of diseases (ICD-10) in Mashhad, Iran. International Electronic Journal of Medicine. 2018; 7(1):23-9.
20. Dadgarmoghaddam M, Khajedaluae M, Niroumand S, Rezaian MK, Abrishami M, Juya M, et al. Seatbelt and helmet use and associated factors in a metropolitan area. International Journal of High Risk Behaviors and Addiction. 2016; 5(4).