

RESEARCH ARTICLE

Epidemiology of Joint Dislocations and Ligamentous/Tendinous Injuries among 2,700 Patients: Five-year Trend of a Tertiary Center in Iran

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Abstract

Background: The epidemiology of traumatic dislocations and ligamentous/tendinous injuries is poorly understood. In this study, we aimed to evaluate the prevalence and distribution of various dislocations and ligamentous/tendinous injuries in a tertiary orthopedic hospital in Iran.

Methods: Musculoskeletal injuries in an academic tertiary health care center in Tehran February 2005 to October 2010 were recorded. The demographic details of patients with pure dislocations and ligamentous/tendinous injuries were extracted and the type and site of injuries were classified according to their specific age/gender groups.

Results: Among 18,890 admitted patients, 628 (3.3%) were diagnosed with dislocations and 2,081 (11%) with ligamentous/tendinous injuries. The total male/female ratio was 4.2:1 in patients with dislocations and 1.7:1 in patients with ligamentous/tendinous injuries. Shoulder was the most prevalent site of dislocation (50.6%), followed by fingers (10.1%), toes (7.6%), hip (7.3%), and elbow (6.5%). Ankle was the most common site of ligamentous/tendinous injury (53.5%), followed by midfoot (12.3%), knee (8.3%), hand (7%), and shoulder (5%). The mean ages of the patients in dislocations and ligamentous/tendinous injuries were 35.0 ± 18.2 and 31.3 ± 15.1 , respectively. There was no seasonal variation.

Conclusion: Shoulder dislocation and ankle ligamentous injury are the most frequent injuries especially in younger population and have different distribution patterns in specific age and sex groups. Epidemiologic studies can help develop and evaluate the injury prevention strategies, resource allocation, and training priorities.

Keywords: Developing countries, Dislocation, Epidemiology, Injury, Ligament, Tendon

Introduction

Musculoskeletal injuries impose an enormous burden of disability on individuals, society, and health care systems (1). Although the majority of such injuries are non-fatal, they cause substantial morbidity and suffering (1, 2). In the past decades, the growing global burden of injuries has demanded the attention of policy-makers in the public health arena all over the world. Currently, it is accepted that injuries are preventable and the burden should

be reduced with appropriate strategies, especially in low- and middle-income countries (1, 3). The first step of public health approach to injury prevention is to define the magnitude and characteristics of the problem (3).

Several studies have attempted to define the effect of age and gender on the incidence of musculoskeletal injuries, with an emphasis on fractures. The first work in this field was published in 1959 by Buhr and Cooke

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(4). They reported the epidemiology of fractures around Oxford, UK, between 1953 and 1957. Since then a number of studies have investigated the epidemiological pattern of fractures for individual fracture sites and a complete range of fractures (5–15). Despite numerous researches on epidemiology of fractures, studies with an exclusive focus on epidemiology of dislocations and ligamentous/tendinous injuries are scarce, especially in developing countries.

In this study, we aimed to evaluate the prevalence and distribution of various dislocations and ligamentous/tendinous injuries during 5 years in a tertiary orthopedic hospital in Iran.

Materials and Methods

All patients with musculoskeletal injuries admitted to the emergency department (ED) of Shariati hospital, an academic tertiary health care center (Tehran, Iran) between February 2005 to October 2010 were enrolled in this cross-sectional study. All records were analyzed for type of injury without any exclusion. Different injuries were classified as fractures, dislocations, ligamentous/tendinous injuries, soft tissue injuries, lacerations, and other injuries. The demographic details of patients with pure dislocations and ligamentous/tendinous injuries were extracted from the primary data for distribution analyses. The data for fractures, lacerations, soft tissue and other injuries were excluded from further analysis.

The obtained data were analyzed using SPSS (Version 19.0, Armonk, NY: IBM Corp) and presented as count, frequency and percentages. The types and sites of dislocations and ligamentous/tendinous injuries were classified according to specific age/gender groups and distribution patterns were determined. Chi-square test was used to determine the difference between males and females in different injuries. The study was approved by the ethical committee of Tehran University of Medical Sciences (TUMS Institutional Review Board).

Results

A total of 18,890 musculoskeletal injuries were recorded during the 5-year study period with a male/female ratio of 2.76:1 (13870 males and 5020 females). Fractures were the most frequent injuries (43.4%) followed by soft tissue injuries (21.1%), lacerations (12.8%), ligamentous/tendinous injuries (11%), and dislocations (3.3%). Other types of injuries including burns, amputations, foreign body and infections made up 8.4% of injuries.

Data of 2,709 patients with diagnosis of dislocations (628) and ligamentous/tendinous injuries (2,081) were extracted for the purpose of this study. From this point onward, only data of these two groups of injuries will be discussed.

The total M/F (male/female) ratio in patients with dislocations was 4.2:1, with 507 (80.7%) males and 121 (19.3%) females. The higher prevalence of injury in males was also present in patients with ligamentous/tendinous injuries with M/F ratio of 1.7:1, 1299

(62.4%) male patients and 782 (37.6%) females. Of the total number, 76.9% of the dislocations and 17.6% of the ligamentous/tendinous injuries were of the upper limbs. There was no seasonal variation in injury occurrence.

Dislocations

Shoulder was the most prevalent site of dislocation (50.6%), followed by fingers (10.1%), toes (7.6%), hip (7.3%), and elbow (6.5%). The highest M/F ratio among all dislocation subtypes was found in the shoulder dislocation (Table 1). The mean age of the patients with dislocation was 35.018.2± with a mode of 24 years. The mean age for males was 32.316.2± with a mode of 24 years and for females was 46.3221.5± with two modes of 55 and 60 years.

The highest number (24.3%) of all dislocations occurred in individuals between the ages of 21 and 25 years [Figure 1]. The age and gender distribution of the common types of dislocations are shown in Figure 2. Patients aged 80 years and older presented with dislocation of shoulder (3.4%, n=11, N=318), hip (4.3%, n=2, N=46), acromioclavicular joint (3.4%, n=1, N=29), MTP/Lisfranc (17.6%, n=3, N=17), and sternoclavicular joint (33.3%, n=1, N=3) [Table 1].

Ligamentous/tendinous injuries

Ankle was the most common site of ligamentous injury (53.5%), followed by midfoot (12.3%), knee (8.3%), hand (7%), and shoulder (5%). The highest M/F ratio was seen in hand and wrist [Table 2]. The mean age in patients with ligamentous/tendinous injuries was 31.315.1± with a mode of 20 years. The mean age for males was 29.513.6± with a mode of 23 years and for females was 34.516.8± with a mode of 20 years. The highest number (22.4%) of all ligamentous/tendinous injuries occurred between the ages of 21 and 25 [Figure 3]. The age and gender distributions of the common types of ligamentous/tendinous injuries are shown in Figure 4. Patients with 80 years and older presented with ligamentous/tendinous injury in the following sites: ankle (0.6%, n=7, N=1113), midfoot (0.4%, n=1, N=256), knee (2.3%, n=4, N=173), and shoulder (3.8%, n=4, N=105) [Table 2].

Discussion

The purpose of this study was to describe the epidemiology of all dislocations and ligamentous/tendinous injuries presented to a tertiary health care center. To the best of our knowledge, this study is the first to report the epidemiological features in a complete range of dislocations and ligamentous/tendinous injuries using a population-based approach in Iran.

Among 18,890 patients with musculoskeletal injuries admitted to the ED, 2,081 (14.3%) were diagnosed with dislocation or ligamentous/tendinous injuries. The prevalence of injuries were almost always higher in men; The M/F ratio was 4.2 in dislocations and 1.7 in ligamentous/tendinous injuries. The predominance of injury occurrences among males has been reported in previous studies (16–18). This higher prevalence can be

Table 1. Demography of the different dislocation subtypes

Dislocation	Total Number (%)	M/F Ratio (Male:Female)	Mean age (SD)			≥ 65y N (%)	≥ 80y N (%)	χ ²	P value *	Fisher's exact test *
			Total	Male	Female					
Shoulder	318 (50.6)	6.6 (276:42)	36.1 (18.9)	33.3 (17.0)	53.7 (20.3)	40 (12.5)	11 (3.4)	15.21	<0.0001	0.0001
Fingers (IP)	63 (10.1)	2.7 (46:17)	33.6 (15.7)	31.5 (15.4)	39.1 (15.7)	2 (3.1)	0	2.68	0.10	0.12
Toes (IP)	47 (7.6)	4.9 (39:8)	32.3 (16.3)	30.7 (15.0)	41.5 (21.5)	3 (6.3)	0	0.16	0.68	0.84
Hip	46 (7.3)	2.3 (32:14)	38.8 (19.4)	34.1 (15.5)	49.0 (23.0)	7 (15.2)	2 (4.3)	3.97	0.046	0.052
Elbow	41 (6.5)	3.1 (31:10)	25.9 (13.9)	24.4 (10.1)	30.7 (22.0)	0	0	0.74	0.38	0.41
AC	29 (4.6)	3.1 (22:7)	40.5 (19.8)	39.4 (19.7)	44.0 (21.9)	5 (17.2)	1 (3.4)	0.46	0.49	0.47
MCP/ CMC	20 (3.2)	2.3 (14:6)	32.4 (16.1)	32.2 (16.7)	N/A	1 (5.0)	0	1.53	0.21	0.24
Knee	18 (2.9)	3.5 (14:4)	31.6 (16.0)	26.4 (6.6)	43.5 (25.4)	3 (16.6)	0	0.10	0.74	0.76
MTP/ Lisfranc	17 (2.7)	2.4 (12:5)	45.6 (26.2)	33.5 (14.8)	53.6 (32.0)	3 (17.6)	3 (17.6)	1.15	0.28	0.34
Talar/ Subtalar	9 (1.4)	2 (6:3)	41.0 (26.7)	N/A	N/A	0	0	1.16	0.28	0.38
ST	5 (0.8)	- (5:0)	30.2 (22.9)	30.2 (22.9)	-	1 (20.0)	0	1.20	0.27	0.58
Patellar	4 (0.6)	3 (3:1)	21.5 (4.5)	23.3 (3.2)	16.0 (-)	0	0	0.08	0.77	0.57
Ankle	4 (0.6)	3 (3:1)	24.6 (6.6)	28.5 (0.7)	17.0 (-)	0	0	0.08	0.77	0.57
Carpal	4 (0.6)	3 (3:1)	30.0 (3.4)	28.0 (-)	34.0 (-)	0	0	0.08	0.77	0.57
SC	3 (0.5)	0.5 (1:2)	54.3 (28.9)	23.0 (-)	70.0 (14.1)	1 (33.3)	1 (33.3)	4.53	0.036	0.096
Total	628 (100)	4.2 (507:121)	35.0 (18.2)	32.3 (16.2)	46.32(21.5)	66 (10.5)	18 (2.8)	-	-	-

IP: Interphalangeal; AC: Acromioclavicular; MCP: Metacarpophalangeal; CMC: Carpometacarpal; MTP: Metatarsophalangeal; ST: Scapulothoracic; SC: Sternoclavicular; N/A: Not available, due to missing data.

* Difference in distribution between males and females

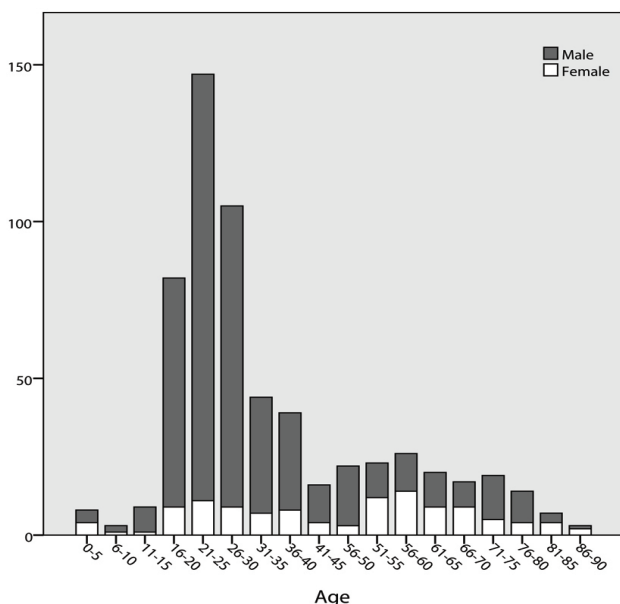


Figure 1. Age distribution pattern of all dislocations.

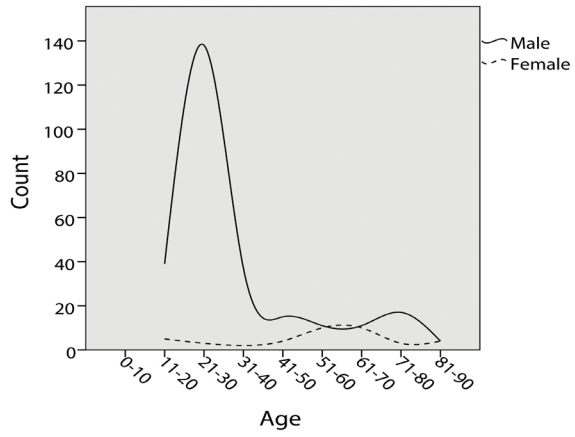
explained by activities performed by males which expose

them to a greater risk of injury (18).

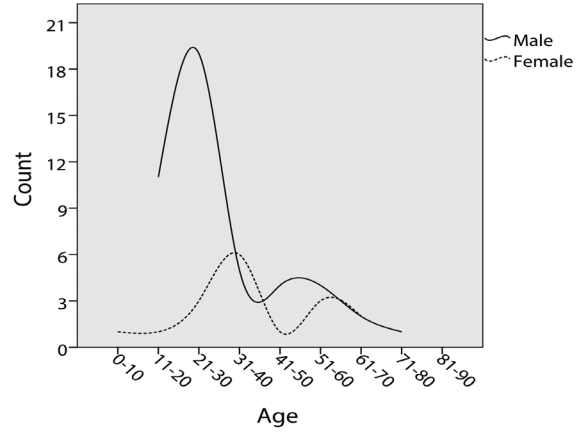
In accordance with other studies, shoulder was the most prevalent site of dislocation (19, 20). Shoulder dislocation was reported as the most prevalent site of dislocation with an average incidence rate of 15.3/100,000 in a retrospective cohort study by Yang et al. during 2000-2005 in Taiwan (19). Hindle et al. reported the glenohumeral joint as the most common site of dislocation with an incidence rate of 51.2/100,000 (20).

The mean age of the patients with shoulder dislocation in our study was 36.1 years (Male=33.3, female=53.7) and the M/F ratio was 6.6:1 (Males=86.8%). In a cross-sectional descriptive epidemiological study in American population, Zacchilli and colleagues reported a mean age of 35.4 with 71.8% male proportion (21). This finding was similar to the Norwegian study with 72.4% males and a median age of 34 (22). Various M/F ratios ranging from 53% to 92.5% have been reported for shoulder dislocation in previous studies (21-27). This variation in some cases was a result of different population samples. For instance, in the study of Owens and colleagues in the United States military, the basic population was predominantly male (85.9%); accordingly, the M/F ratio of the shoulder dislocations in such population was high (92.5%) (25).

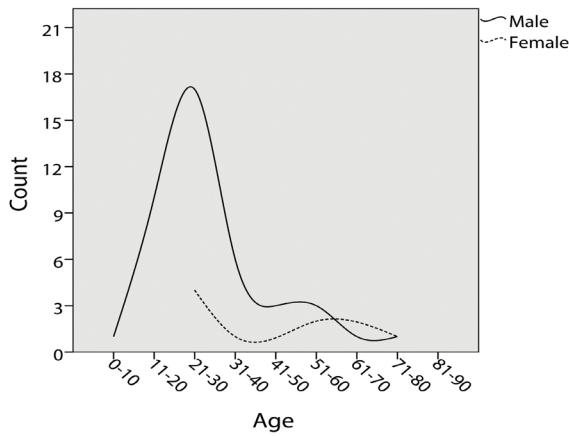
The elbow dislocation in our study was much less common, compared to the study of Yang, where the



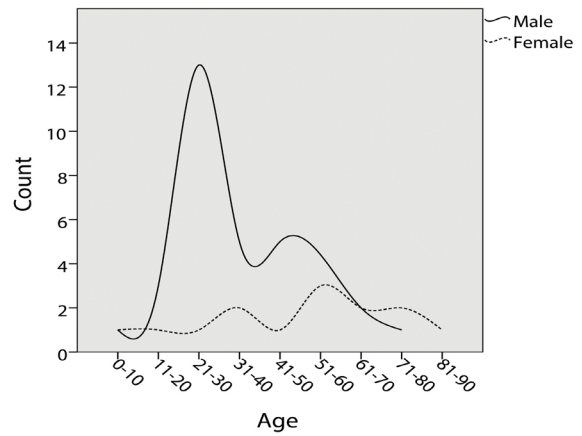
a. Shoulder



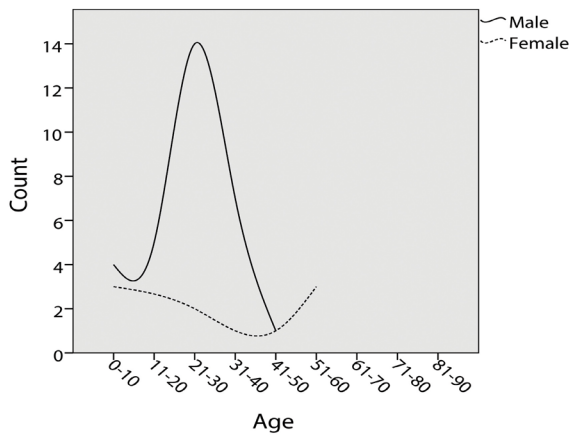
b. Fingers



c. Toes



d. Hip



e. Elbow

Figure 2. The distribution curves of the common dislocations.

Table 2. Demography of the different ligamentous/tendinous injuries

Injury	Total Number (%)	M/F Ratio (Male:Female)	Mean age (SD)		≥ 65y N (%)	≥ 80y N (%)	χ^2	P value †	
			Total	Male					Female
Ankle	1113 (53.5)	1.6 (679:434)	30.5 (14.3)	28.9 (12.9)	32.8 (15.9)	30 (2.7)	7 (0.6)	13.81	0.0002
Midfoot	256 (12.3)	1.6 (156:100)	32.5 (14.1)	29.5 (12.2)	37.1 (15.6)	8 (3.1)	1 (0.4)	0.27	0.60
Knee	173 (8.3)	1.8 (112:61)	35.1 (17.0)	33.6 (15.6)	38.0 (19.3)	13 (7.5)	4 (2.3)	0.43	0.51
Hand	147 (7)	2.6 (106:41)	32.3 (16.9)	31.6 (16.0)	34.0 (19.2)	15 (10.2)	0	6.32	0.01
Shoulder	105 (5)	1.8 (67:38)	39.5 (21.8)	36.6 (20.8)	44.4 (23.5)	19 (18.1)	4 (3.8)	0.09	0.76
Wrist/ Carpus	49 (2.4)	2.8 (36:13)	30.5 (16.6)	31.2 (16.6)	28.5 (17.1)	3 (6.1)	0	2.61	0.10
Elbow	46 (2.2)	1.6 (28:18)	29.5 (14.6)	26.7 (13.5)	34.4 (15.4)	1 (2.1)	0	0.04	0.82
AC	20 (1)	2.3 (14:6)	31.5 (10.6)	29.3 (8.3)	38.3 (12.2)	0	0	0.49	0.48
Others/Missing *	172 (8.3)	1.4 (101:71)	31.1 (16.0)	28.3 (13.8)	38.7 (19.2)	17 (9.8)	3 (1.7)	1.09	0.29
Total	2081 (100)	1.7 (1299:782)	31.3 (15.1)	29.5 (13.6)	34.5 (16.8)	106 (5.1)	19 (0.9)	-	-

* Other site of injury or missing classification data or diagnosis was not made. AC: Acromioclavicular.

† Difference in distribution between males and females

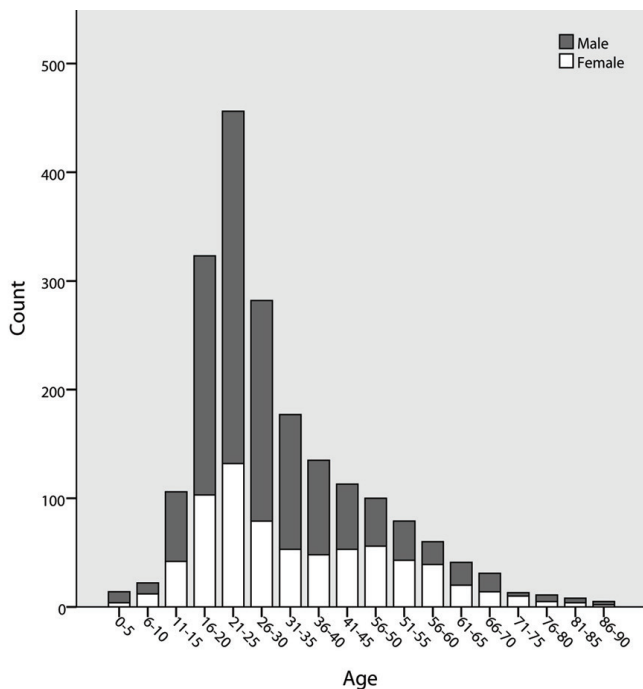


Figure 3. Age distribution pattern of all ligamentous/tendinous injuries

elbow was the second most common site of injury with incidence of 7.7/100,000 (19). However, our result was more consistent with the study of Hindle, in which the elbow was the seventh site of the dislocation with an incidence rate of 5.5/100,000 (20). Similar to both mentioned studies, fingers and hip dislocations were

relatively prevalent in our study. In contrast to both of them, toes dislocation was much more prevalent in our study (19, 20). This higher rate may be due to the higher number of motor-cyclists in developing countries, in which the most common site of injury is the lower limb (28–30).

While previous studies have reported a wide range of incidence rates from 2.29 to 69 per 100,000 for patellar dislocation, its incidence in our study was very rare (20, 31–35). This variability could be attributed to the difficulty in assessing the accurate incidence of the patellar dislocation, because most cases may reduce or resolve spontaneously before radiography (20).

Ankle dislocations also were very rare in our study in contrast to others (19, 20). The lower rate of some dislocations in our study could be explained by the point that only pure dislocations were included and in some cases such as ankle dislocation, the pure dislocation without fracture is very rare (36). For instance, in a study by Hindle et al., only 6% of the ankle dislocations did not have an associated fracture (20).

In this study, the most common site of ligamentous/tendinous injury was ankle. The exact epidemiology of ankle sprain is hard to define owing to the point that a number of patients may not seek health care or may be treated in alternative healthcare setting (37). Previous studies have reported ankle sprain as a common injury seen in emergency departments, especially in the athletic population (38–40). A systematic review of 227 epidemiological studies reporting injury pattern in 70 sports from 38 countries during 1977 to 2005 showed that ankle was the second most common injured body site and its sprain was the major ankle injury (38). The mean age of ankle injury in our study was higher than the study by Waterman et al. (30.5 vs. 26.2) (40). They evaluated the incidence of ankle sprain in the general population of the United States and found

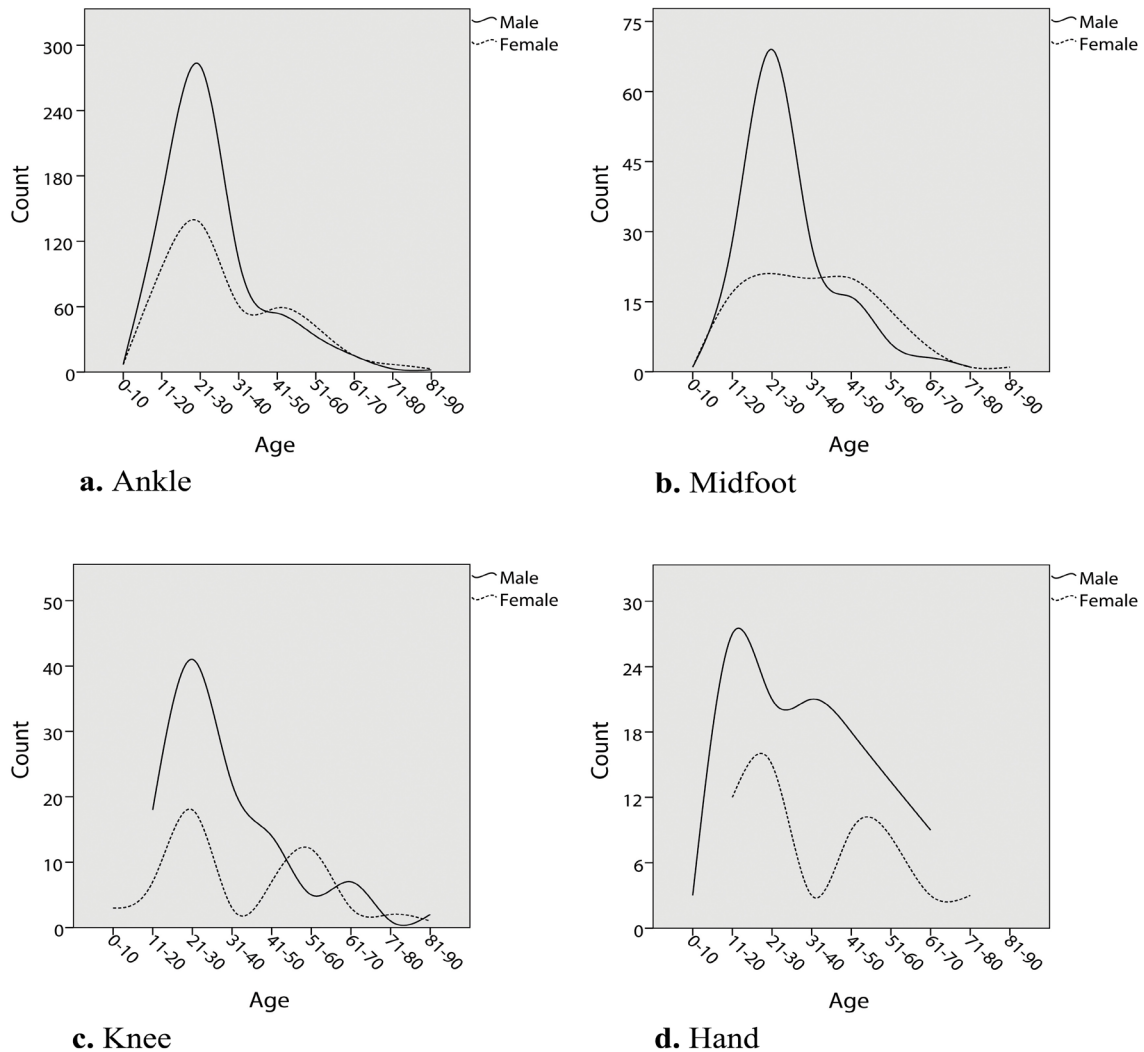


Figure 4. The distribution curves of the common ligamentous/tendinous injuries.

that the age range of 10-19 years was associated with higher rates of ankle sprain (40). They also reported that half of all ankle sprains occurred during sport activities (40).

Unlike dislocations, sprains were common in the midfoot as the second most prevalent site of Ligamentous/tendinous injuries. The midfoot area is a common area of foot to be injured in athletes and sprains are the most common pattern of injury (41-43). However, midfoot injury is less frequent in general population (44). The higher prevalence of midfoot sprain in our study may be due to overdiagnosis as the diagnosis of ligamentous/tendinous midfoot injuries in our hospital setting was based on abnormal physical examination and normal radiographs.

Ligamentous/tendinous injuries of the knee were more

prevalent than its dislocations in our study. This finding was in line with the results of Gage et al (45). In their comprehensive retrospective study, 6.6 million knee injuries were reviewed during 1999 to 2008 and a high incidence rate of 2.29 per 1,000 population for knee injuries was reported. The most common diagnosis was knee strain/sprains with 42.1% (45).

We found that the mean and mode of the age for the ligamentous/tendinous injuries were lower than the dislocations. In ligamentous/tendinous injuries, we found a peak in 20 years with a steep decline up to the eighth decade, which was very similar to what Clayton and colleagues reported for soft tissue injuries (46). In a 5-year prospective study on musculoskeletal tendinous and ligamentous injuries, they found a high peak incidence of 257/100,000 per year in males

in early adulthood with a steep decline up to the seventh decade. However, the pattern they found for females was different and less age-related (46). The high prevalence of ligamentous/tendinous injuries in early adulthood in our study was also present in the females.

Shoulder was found as a common site of injury in elderly patients in our study. Although the majority of shoulder dislocations occur in young people, the previous studies have reported a second mode in the elderly (21, 22, 47). This increase after 65 years may be due to weakness resulting from chronic illnesses or sarcopenia (age related decrease of skeletal muscle mass) which can lead to an increased rate of falls (48–50). In our study, 12.5% of the patients with shoulder dislocation and 18.1% of the patients with shoulder ligamentous/tendinous injury were ≥ 65 years old.

The distribution curves for the age and gender related incidence of fractures were previously described (14). Although our study reported the trend of injuries in one tertiary center without incidence analysis, we compare our distribution patterns with previously reported curves. Analysis of the different types of fractures showed eight curves including: A) unimodal distribution in young men and older woman; B) unimodal distribution in young men; C) unimodal distribution in young men and young women; D) unimodal distribution in young men, bimodal distribution in women; E) unimodal distribution in older women; F) unimodal distribution in older men and older women; G) bimodal distribution in men and unimodal distribution in older women; H) bimodal distribution in man and women (14). In our study, shoulder, toes, hip, and elbow dislocations roughly fitted into the type B distribution curve, while finger dislocations showed a type C curve. Type B pattern was much more common in dislocations compared to the

fractures (14, 51). In ligamentous/tendinous injuries, ankle injury fitted into the type C curve. The curves for the knee and hand injuries were similar to the type D curve. The distribution curve for midfoot did not fit into the eight patterns; however, it was similar to the pattern which was reported for Achilles tendon rupture previously (Types L distribution) (46).

The main limitation of this study was the lack of national registry system for trauma which is crucial to help researchers and decision makers in health policy.

Although this absence forced us to limit our study to one major tertiary center, the registry system of the selected hospital was trustworthy and technically reliable and the study population was relatively large.

In this study, shoulder dislocation and ankle ligamentous injury were the most frequent injuries. Both dislocations and ligamentous/tendinous injuries were more common in younger population and were likely to affect older women too. We believe that the epidemiology of dislocations and ligamentous/tendinous injuries is important, while the studies in this arena are scarce.

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