Title: *Epidemiology of joint dislocations and ligamentous/tendinous injuries among 2,700 patients: Five-year trend of a tertiary center in Iran*

Abstract

Purpose: 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: During 5 years, musculoskeletal injuries of an academic tertiary health care center in Tehran were recorded. Demographic details of patients with diagnosis of pure dislocations and ligamentous/tendinous injuries were extracted. Type and site of injuries were classified according to specific age/gender groups.

Result: Of 18,890 admitted patients, 628 (3.3%) were diagnosed with dislocations and 2,081 (11%) were diagnosed 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. The most prevalent site of dislocation was shoulder (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 age of the patients was 35.0 (SD = 18.2) in dislocations and 31.3 (SD = 15.1) in ligamentous/tendinous injuries. There was no seasonal variation.

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

Keywords: Epidemiology, Dislocations, Tendons, Ligaments, Injury, Developing Countries

Introduction

Musculoskeletal injuries impose an enormous burden of disability on individuals, society and the health care system (1). Although the majority of such injuries are non-fatal, the morbidity and suffering they cause are substantial (1). In the past decades, the growing global burden of injuries have 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 (1,2). The first step of public health approach to injury prevention is to define the magnitude and characteristics of the problem (2).

Several studies have attempted to define the effect of age and gender on incidence of musculoskeletal injuries, with an emphasis on fractures. The first work in this field was published in 1959 by Buhr and Cooke (3). 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 (4–10) and complete range of fractures (11–14). Despite numerous research 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

In this cross-sectional study, patients with musculoskeletal injuries admitted to the emergency department (ED) of Shariati hospital (Tehran, Iran) were recorded from February 2005 to October 2010. The hospital is an academic tertiary health care center in Tehran, the capital of Iran. 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. Demographic details of patients with diagnosis of pure dislocations and ligamentous/tendinous injuries were extracted from the primary data for distribution analyses. 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. Type and site of dislocations and ligamentous/tendinous injuries were classified according to specific age/gender groups and distribution patterns were determined. The 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 Medial 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). Of this total number, the most frequent injuries were fractures with 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. Higher prevalence of injury in males was also present in patients with ligamentous/tendinous injuries. In this group, M/F ratio was 1.7:1, with 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

The most prevalent site of dislocation was shoulder (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 35.0 (SD = 18.2) with a mode of 24 years. The mean age for males was 32.3 (SD = 16.2) with a mode of 24 years and for females was 46.32 (SD = 21.5) with two modes of 55 and 60 years.

It was found that the highest number (24.3%) of all dislocations occurred in individuals between the ages of 21 and 25 years (Fig. 1). 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). In patients with ligamentous/tendinous injuries, the mean age was 31.3 (SD = 15.1) with a mode of 20 years. The mean age for males was 29.5 (SD = 13.6) with a mode of 23 years and for females was 34.5 (SD = 16.8) with a mode of 20 years. The highest number (22.4%) of all ligamentous/tendinous injuries occurred between the ages of twenty-one and twenty-five (Fig. 3). Age and gender distribution 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 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 complete range of dislocations and ligamentous/tendinous injuries using a population-based approach in Iran.

Among 18,890 patients admitted to the ED with musculoskeletal injuries, 2,081 (14.3%) were diagnosed with dislocation or ligamentous/tendinous injury. Prevalence of injuries were almost always higher in men; 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 (15–17). This higher prevalence can be explained by activities performed by males which expose them to a greater risk of injury (17).

The most prevalent site of dislocation was shoulder. This finding was in accordance with other studies (18,19). In the retrospective cohort study of Yang and his colleagues during 2000-2005 in Taiwan, the shoulder dislocation was the most prevalent dislocation with average incidence rate of 15.3/100,000 (18). Hindle et al. reported the glenohumeral joint dislocation as the most common dislocation with an incidence rate of 51.2/100,000 (19). 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 (20). This finding was similar to the Norwegian study with 72.4% males and a median age of 34 (21). Various M/F ratios were reported for shoulder dislocation in the previous studies, ranged from 53 to 92.5% (20–26). This variation was in some cases a result of the 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 dislocation in such population was high (92.5%) (24).

The elbow dislocation in our study was much less common, compared with the study of Yang, where the elbow dislocation was the second most common site of injury with incidence of 7.7/100,000 (18). 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 (19). Similar to both of the studies, we found that fingers and hip dislocations are relatively prevalent. In contrast to both of them, toes dislocation was much more prevalent in our study (18,19). 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 lower limb (27–29).

In this study, the patellar dislocation was very rare. Previous studies reported various incidence rates for patellar dislocation. In a review of literature, we found a wide range of 2.29 to 69 per 100,000 (19,30–34). This variability could be attributed to the difficulty in assessing the accurate incidence of the patellar dislocation, because most of them may reduce or resolve spontaneously before radiography (19).

Ankle dislocation was very rare in our study in contrast to others (18,19). 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 (35). For instance, in the study of the Hindle et al., only 6% of the ankle dislocations did not have an associated fracture (19).

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 (36). Previous studies reported that ankle sprain is a common injury seen in emergency departments, especially in the athletic population (37–39). 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 ankle sprain was the major ankle injury (37). The mean age of ankle injury in our study was higher than the mean age in the study of Waterman et al (30.5 vs. 26.2) (39). They evaluated incidence of the ankle sprain in the general population of the United States and found that the age of ten to nineteen years was associated with higher rates of ankle sprain (39). They also reported that half of all ankle sprains occurred during athletic activity (39).

Unlike dislocations, sprains were common in the midfoot. It was the second most prevalent site of Ligamentous/tendinous injury. The midfoot area is a common area of foot to be injured in

athletes and sprains are the most common pattern of injury (40–42). However, in general population, the midfoot injury is less frequent (43). The higher prevalence of midfoot sprain in our study may be due to overdiagnosis. In our hospital setting, the diagnosis of ligamentous/tendinous injury of the midfoot was based on abnormal physical examination and normal radiographs.

Ligamentous/tendinous injuries of the knee were more prevalent than dislocations. This finding was similar to the results of Gage et al (44). In a comprehensive retrospective study, they reviewed 6.6 million knee injuries during 1999 to 2008 and reported the high incidence rate of 2.29 per 1,000 population for knee injuries. The most common diagnosis was knee strain/sprains with 42.1% (44).

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 (45). In a 5-year prospective study on the 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 (45). In our study, high prevalence of the ligamentous/tendinous injuries in the early adulthood was also present in the females.

In elderly patients, shoulder was a common site of injury. Although the majority of shoulder dislocations occur in young people, previous studies have reported a second mode in the elderly (20,21,46). 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 (47–49). In our study, 12.5% of the patients with shoulder dislocation and 18.1% of the patients with shoulder ligamentous/tendinous injury were $\geq$ 65 years old.

Distribution curves for the age and gender related incidence of fractures were previously described (13). 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 which are: 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 (13). In our study, shoulder, toes, hip and elbow dislocations roughly fitted into the type B distribution curve,

while fingers dislocation showed a type C curve. Type B pattern was much more common in dislocations compared to the fractures (13,50). 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 the 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) (45).

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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