

Epidemiology of Primary Shoulder Dislocations. A Cohort Study from a Large Health Maintenance Organization: 2004 to 2019

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ABSTRACT

Background: Previous epidemiological studies on shoulder instability evaluated specific and relatively small subgroups of patients.

Objectives: To determine the incidence rate of primary shoulder dislocations.

Methods: Cohort analysis of electronic health records from 2004 to 2019 was conducted in a urban district of a major health maintenance organization (HMO) in Israel. Patients presented with primary shoulder dislocation that was treated with closed reduction in any medical facility within the district. Overall incidence density rates (IDR) of primary shoulder dislocations and stabilization surgeries were determined.

Results: Over a period of 16 years 13,158 patients underwent closed reduction of primary shoulder dislocation. Of those, 712 shoulder stabilization surgeries were performed (5%). The IDR of primary shoulder dislocations were 124 per 100,000 person-years. The IDR of primary shoulder stabilizations were 7 per 100,000 person-years. The peak in the number of dislocations was observed in those 20–29 years old and ≥ 60 years of age. In patients under 59 years old, dislocations were more common in men. In those ≥ 60 years of age, dislocations were more common in women. Most shoulder stabilization surgeries were performed on young patients. The annual mean time from the first dislocation to stabilization surgery linearly declined to 6 months in 2019.

Conclusions: The IDR of primary shoulder dislocations calculated from the largest HMO in Israel were 124 per 100,000 person-years. Shoulder dislocations had bimodal age distribution. Overall, 5% of the patients (mainly young) with shoulder dislocations underwent shoulder stabilization surgery during the study period.

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KEY WORDS: epidemiology, shoulder dislocation, shoulder instability, shoulder reduction

Traumatic shoulder dislocations often result in pain, dysfunction, and delayed return to work and sport activities [1,2]. Despite comprehensive information in the literature regarding shoulder dislocations prognosis and treatment, basic epidemiological characteristics are still lacking. Previous studies were mainly single-institution case series with relatively small sample sizes followed for short-term follow-up periods. Only a few studies presented information retrieved from large databases regarding shoulder dislocations [3–6]. According to these reports, performed in North America and Europe, the incidence of shoulder dislocations in the general population varied from 12.3 to 26.2 per 100,000 person-years. In addition, previous studies lack information regarding the incidence of shoulder stabilization procedures. Since shoulder dislocations are relatively common and their management depends on various factors such as age, sex, and level of activity [7], it is clinically important to identify high-risk populations. Understanding the epidemiology of shoulder dislocations could improve patient care and help in developing prevention plans. The primary objective of this study was to determine the incidence rates and demographic characteristics of primary shoulder dislocations presenting to the largest maintenance organization in Israel. Another objective was to determine the incidence rates of stabilization procedures in this population.

PATIENTS AND METHODS

The study was performed in the largest health maintenance organization (HMO) in Israel (Clalit Health Services) that provides comprehensive healthcare to most of the Israeli population. Data were extracted from Clalit patient records of a major urban district (Tel Aviv) using Clalit's data sharing platform powered by MDClone (<https://www.mdclone.com>). With the use of the CHS computerized database we were able to identify all shoulder closed reduction procedures performed on patients during their visit in emergency departments or primary care clinics together with all shoulder stabilization surgeries between 1 January 2004 and 31 December 2019. Demographic information at

the patient level on age and sex was available. We identified the diagnosis and procedures using the International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) [8]. This study included all patients aged 10 years or older with a primary shoulder dislocation (ICD-9-CM code 831.X, dislocation of shoulder). The index date was set as the first episode of shoulder dislocation. Only patients who had a recorded episode of shoulder dislocation concomitant with receiving a closed reduction procedure (ICD-9-CM code 7971, closed reduction of dislocation of shoulder) were included. In addition, from those patients we identified patients who had surgery to treat shoulder instability (ICD-9-CM codes 8021 or 8182, arthroscopy of shoulder or repair of recurrent dislocation of shoulder, respectively) during the study period.

STATISTICAL ANALYSIS

Results were expressed using descriptive statistics. An overall incidence density rate (IDR) (per 100,000 person-years) of primary shoulder dislocations requiring closed reduction (CR) was determined for the entire cohort. The IDR was calculated by using the annual incidence of primary shoulder dislocations requiring CR (numerator) and the annual number of HMO members for that same period (denominator). Similarly, an overall IDR of primary

shoulder stabilizations was calculated by using the annual incidence of primary shoulder stabilizations (numerator) and the annual number of HMO members for that same period (denominator).

RESULTS

From an annual average of 661,851 members in Clalit during the study period of 16 years, we found 13,158 records for patients who underwent physician-performed closed reduction after a primary shoulder dislocation [Figure 1]. Of those, a total of 712 shoulder stabilization surgeries were performed (5%).

The IDR of primary shoulder dislocations was 124 per 100,000 person-years. The IDR of primary shoulder stabilizations was 7 per 100,000 person-years. The annual mean time from the first dislocation to stabilization surgery linearly declined from 62 months in 2004 to 6 months in 2019.

Overall, the mean patient age was 48 ± 22 years and 63% were males. Of the 712 patients who had stabilization surgeries during the study period, 565 (79%) were men.

The characteristics of first-time shoulder dislocation patients by age groups is shown in Table 1.

The peak in number of dislocations was observed in the age groups of 20–29 years and 60 years or older. In the age groups

Figure 1. Number of first-time shoulder dislocations and the time elapsed from the first dislocation to surgical stabilization during the study period

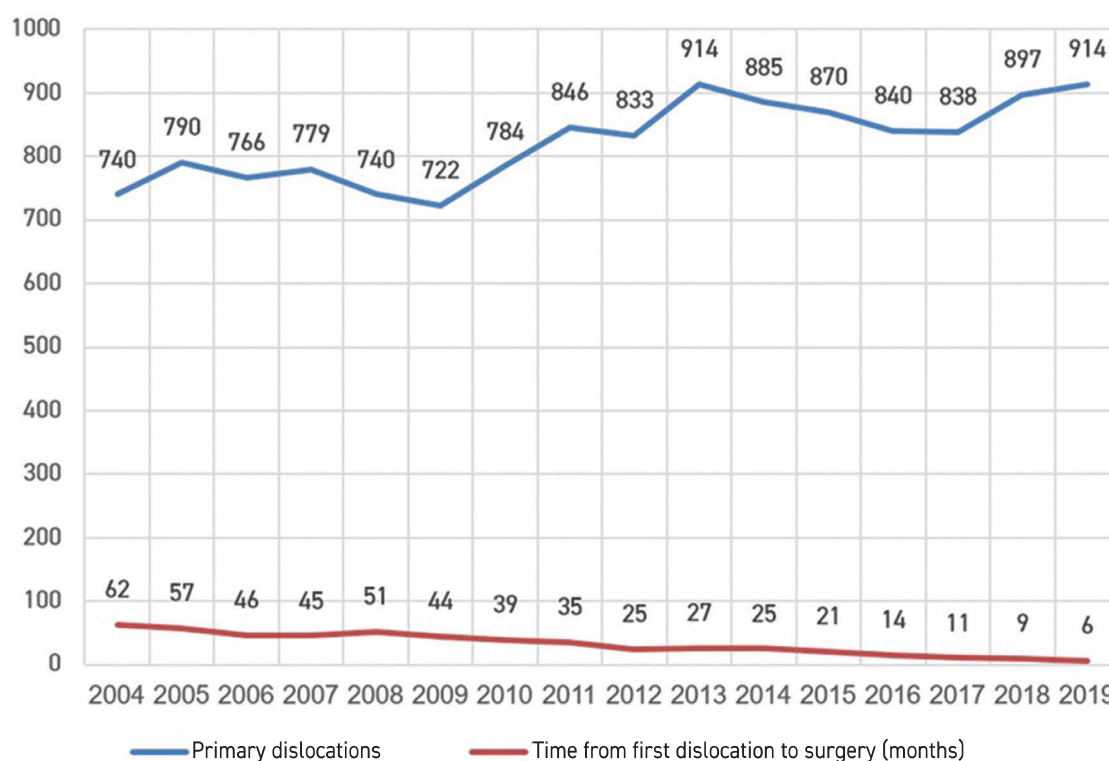


Table 1. Characteristics of first-time shoulder dislocation patients by age groups

Age group, years	First shoulder dislocation, n (%)	Male:Female (%)	Shoulder stabilization surgery, n (%)
10–19	1200 (9)	963:237 (80:20)	138 of 1200 (11)
20–29	2901 (22)	2450:451 (84:16)	263 of 2901 (9)
30–39	1711 (13)	1373:338 (80:20)	100 of 1711 (6)
40–49	1160 (9)	803:357 (69:31)	56 of 1160 (5)
50–59	1430 (11)	827:603 (58:42)	52 of 1430 (4)
≥ 60	4756 (36)	1846:2910 (39:61)	103 of 4756 (2)
All patients	13158 (100)	8262:4896 (63:37)	712 of 13158 (5)

under 59 years, dislocations were more common in men while in ages 60 years or older dislocations were more common in women. Most shoulder stabilization surgeries were performed in patients younger than 39 years.

DISCUSSION

The important epidemiological findings for this study were retrieved from the Clalit Health Services databases. Primary shoulder dislocations IDR was 124 per 100,000 person-years. Shoulder stabilization surgery IDR was 7 per 100,000 person-years. Shoulder dislocations had a bimodal distribution which peaked in two age groups (20–29 years and ≥ 60 years). However, shoulder stabilization surgeries were performed mainly in the younger population. In the age groups younger than 59 years, shoulder dislocations were more common among men while in older ages they were more common among women. The annual mean time from the first dislocation to surgery linearly declined during the study period.

IDR of shoulder dislocations in large populations has been previously studied [3–6,9–11]. IDR depends on various characteristics of a given population such as age, sex, and level of activity. Two large population-based studies in the United Kingdom and Canada showed that the IDR of primary anterior shoulder dislocation requiring closed reduction was highest among young male patients (80 and 98 per 100,000 person-years, respectively) [4,5]. Other studies demonstrated different IDR; however, they included both primary and recurrent events of dislocations together with related diagnoses such as acromioclavicular joint dislocations [6]. The IDR in the present study (124 per 100,000 person-years) is higher than the rates observed in the cohorts from Canada, the United States, and Oslo [4,6,9]. Differences in incidence rates may be explained by the inclusion of larger cohort of patients followed for longer periods in the current study. Health services in Israel are mainly public and available to provide immediate treatment to acute trauma in emergency departments or primary clinics. Therefore, almost all primary shoulder dislocations are treated and documented in these facilities, which may also explain higher rates than other countries. In addition, previous reports excluded patients over the age of 70 years when a second peak of primary

shoulder dislocations occurs. Another Israeli epidemiological study found the prevalence of recurrent shoulder dislocations to be 50–424 per 100,000 [12]. The study examined army recruits and reserves up to the age of 33 years between the years 1978–1995. Compared to the current study, they focused on a high-risk younger subpopulation. In addition, much has changed in military training methods, medical knowledge, injury prevention programs, demographics, and lifestyle since the 1980s and 1990s.

Most shoulder dislocations in the present study occurred in males (63%). This finding is like previous studies (53–78%) [3,13,14]. The mean age of patients with a shoulder dislocation in our study was 48 ± 22 years, which is higher than studies from the United States (mean age 35–36 years) and lower than a study from the United Kingdom (mean age 51 years) [6,13,15]. One possible explanation of the lower mean age in U.S. studies may be the high numbers of young men playing ice hockey and American football at schools and colleges. In the present study dislocations demonstrated an age-sex bimodal distribution with peaks in the 3rd and 7th decades of life. Most shoulder dislocations between the ages 20–29 years were among men and most dislocations in patients 60 years or older occurred among females. This phenomenon was seen in other large population cohorts [3,6,9,13]. Studies examining the etiology of shoulder dislocations showed dislocations in young males are related to sports and recreational activities [6], with male sex and young age being two of the main risk factors for injury [16–18]. Studies further dividing age groups 60 years or older found a gradual increase frequency with increasing age [9]. Older people most frequently dislocate their shoulder when they fall on their arm at home, whereas young people dislocate during sports activities [3,6]. In the present study the increase in shoulder dislocations seen in patients over the age of 60 years was mainly among women. This finding is supported by previous studies [4–6,15,19]. The reasons for this latter finding are unknown, but several explanations exist. One possible explanation is an age- and sex-related difference in both fall and injury risk [19]. There is evidence to suggest that older women (≥ 65 years) are at an increased risk for falls, injury, fracture, and hospitalizations compared to men of similar age.

Although the epidemiology of shoulder dislocations was previously investigated, evidence regarding the incidence of recurrent shoulder dislocations is lacking.

Data on shoulder dislocations were retrieved from the Clalit database where diagnoses are coded according to ICD-9-CM. Although the information regarding recurrent dislocations has clinical implications, there was no accurate method to calculate it. Although recurrent dislocations rates could not be estimated from the current cohort, we found that 5% of primary shoulder dislocations underwent shoulder stabilization surgery. As most recurrent dislocations are referred to surgical treatment, it is plausible that the recurrent dislocation rate is roughly 5% of all primary shoulder dislocations. This finding is in accordance with previously published data, which found an 8% shoulder re-dislocation rate in urban population [15].

To the best of our knowledge, this is the first study on the epidemiology of shoulder dislocations representing the Israeli population. Most previous studies were based on European or U.S. populations, which may differ from the Israeli population in treatment modalities [3,5,6,10]. The strengths of this study are its well-defined cohort analysis limited to the first occurrence of shoulder dislocation, and that it included a large population with a relatively long follow-up. Nevertheless, it has several limitations related mainly to the use of a computerized database. First, some patients who experience shoulder dislocation reduce the joint without presenting to a medical facility. As a result, the reported rate of shoulder dislocations in the general population may be underestimated. Another limitation is that coding for 'shoulder dislocation' potentially allows inclusion of related diagnoses such as acromioclavicular and sternoclavicular dislocations in the initial sample data. An attempt was made to minimize this effect by performing a line-by-line analysis and excluding erroneously coded injuries. An important limitation is the difficulty in determining a recurrent injury. It remains possible that some primary dislocations were in fact recurrent dislocation events. The presence of recurrences within the data set may have erroneously increased the incidence rate. Previous studies indicate that beyond a 2-year follow-up the incidence of re-dislocation plateaus [11]. Given the lengthy study period, we believe that few primary events were mislabeled. Databases are limited by their initial formatting. The coding protocols lacked information regarding the mechanism of injury, occupation, and participation in sports. Narrative sections could be utilized to characterize the latter variables, but the resulting data was inherently prone to reporting and interpretation bias and was not addressed in the study. Finally, the COVID-19 pandemic affected the epidemiology of hip fractures in Israel [20,21]. Since the study period was prior to the pandemic it would be interesting to explore the latest epidemiological changes in shoulder dislocations as well.

CONCLUSIONS

The IDR of primary shoulder dislocations calculated from the largest health maintenance organization in Israel was 124 per 100,000 person-years. Shoulder dislocations had bimodal age distribution. Over-

all, 5% of the patients (mainly young) with shoulder dislocations underwent shoulder stabilization surgery during the study period.

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