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Retrospective Study

The Epidemiology of Shoulder Dislocations Presenting to United States Emergency Departments: An Updated 10-Year Study

United States Shoulder Dislocation Epidemiology

Cole M Patrick, Josiah Snowden, Michael D Eckhoff, Clare K Green, John P Scanaliato, John C Dunn, Nata Parnes

Abstract

BACKGROUND

Glenohumeral dislocation is a common injury that may predispose patients to chronic pain and instability. However, there is a paucity of current data available regarding the epidemiological trends of this injury.

AIM

The purpose of this study is to provide an updated, comparative assessment of the epidemiology of shoulder dislocations presenting to emergency departments in the United States. We also sought to analyze patient demographic risk factors and consumer products associated with dislocation events.

METHODS

Data were obtained from the National Electronic Injury Surveillance System (NEISS) database for glenohumeral dislocations between 2012 and 2021. Incidence, age, sex, and

injury characteristics were analyzed using weighted population statistics as well as incidence rates and 95% confidence intervals (CI).

RESULTS

In total, an estimated 773,039 shoulder dislocations (CI 640,598 – 905,481) presented to emergency rooms across the United States during the study period. The annual incidence rate was 23.96 per 100,000 persons and the average patient age at the time of injury was 37.1 years. Significantly more male patients sustained dislocations than female patients (537,189, 69.5%, *vs* 235,834, 30.5%, $P < 0.001$). With regard to associated consumer products, sports and recreation equipment were involved in the highest proportion of incidents (44.31%), followed by home structures & construction materials (21.22%), and home furnishings, fixtures, and accessories (21.21%). Regarding product sub-groups, stairs, ramps, landings, floors was cited in the greatest number of cases (131,745).

CONCLUSION

The national annual incidence rate of glenohumeral dislocations throughout the study period was approximately 23.92 per 100,000 persons. Male adolescents sustained the highest proportion of dislocations, with a peak incidence in age group 15-20 years, predominantly secondary to participation in sporting and recreational activities. Conversely, women experienced a relatively consistent incidence of dislocation throughout their lifespan. After age 63, the incidence rate of dislocations in females was found to surpass that observed in males.

Key Words: Shoulder Dislocation; Epidemiology; United States; Emergency Department; Glenohumeral Dislocation; National Electronic Injury Surveillance System

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Core Tip: Shoulder dislocations occur in a bimodal distribution and are commonly seen in young men and older women. The national incidence of shoulder dislocations presenting to United States emergency departments has remained relatively stable compared to previous epidemiologic studies. Among young patients sustaining shoulder dislocations, sporting and recreational activities are the most commonly involved activities.

INTRODUCTION

The glenohumeral joint is the most mobile joint in the body, making it particularly vulnerable to dislocation.¹ This physiologic predisposition makes shoulder dislocation a common injury across age groups — especially in young, physically active men.²⁻⁵ Existing studies have estimated the incidence of shoulder dislocation to be 23.9 per 100,000 person-years in the general population, with rates as high as 169 per 100,000 person-years among young, active, and military populations.^{3,5,6,7} Patients with shoulder dislocations often experience lasting functional impairments and are known to be at high risk for recurrent injury.^{1,8} Despite the high incidence of shoulder dislocations experienced in the United States, there is a paucity of current epidemiological data available regarding general population risk factors and etiology.

While young populations have the highest incidence of shoulder dislocation, these injuries have a bimodal age distribution, affecting both the young and elderly at higher rates.^{6,9} Unsurprisingly, the etiology of shoulder dislocation varies with patients'

age as the activities they routinely engage in change. Older patients classically sustain shoulder dislocations as the result of a fall, whereas younger patients are more likely to experience injury while participating in sporting and recreational activities.⁶ Because of these observed differences in the mechanism of injury for shoulder dislocations across age groups, there is an interest in exploring the relationship between consumer products and patient demographics as it relates to shoulder dislocation events.

¹ The purpose of this study is to provide an updated, comparative assessment of ⁴ the epidemiology of shoulder dislocations presenting to emergency departments in the United States. We also sought to analyze patient demographic risk factors and consumer products associated with dislocation events. We hypothesized that consumer products involved with shoulder dislocations would vary depending on patient age and gender, with male adolescents utilizing sports and recreation equipment representing the highest incidence of dislocations.

MATERIALS AND METHODS

Database and Query

Data for this cross-sectional, epidemiologic study of glenohumeral dislocations that present to United States emergency departments was obtained from the National Electronic Injury Surveillance System (NEISS) database.^{10,11} The NEISS database collects de-identified patient demographics, injury characteristics, and associated consumer product information from approximately 100 emergency departments across the United States. Data was obtained by a hospital coordinator assigned to the facility and acquired from both clinical information and follow-up telephone communication as needed. These data points are then extrapolated to establish national estimates for each category after weighting each hospital. NEISS is managed by the Consumer Product Safety Commission, who have been responsible for collecting this data since 1999. This organization makes annual adjustments by weighting probabilities of each of the included emergency departments, then uses the number of annual emergency department visits to establish their calculated National Estimates.^{12,13}

The NEISS database was queried for a 10-year period between 2012 and 2021. All age groups were included in the study. “Shoulder (30)” was selected for body part and “Dislocation (55)” was selected for diagnosis for all queries. Information was further stratified by age, gender, product group, and product sub-group.

Statistical Analysis

When querying data from the NEISS database, 95% confidence intervals (CI) were calculated based on input requests. Following data acquisition, incidence rates were calculated per 100,000 persons. Unstable data, characterized by a national estimate of less than 1,200, number of cases less than 20, or coefficient of variation (CV) exceeding 33%, were excluded from data analysis, based on NEISS database outputs. Sub-group analysis was performed comparing ages over and under 40 years. This comparison essentially split life expectancy in half (currently ~79 years) and compared “early life” and “later life” with known bimodal distribution of patient age.¹⁴ Chi-squared tests were used to compare categorical variables between cohorts. A *P* value < 0.05 was used to determine statistical significance.

RESULTS

In total, an estimated 773,039 (CI 640,598 – 905,481) shoulder dislocations presented to emergency departments between 2012 – 2021 across the United States (Table 1). The annual incidence rate was 23.96 per 100,000 persons (CI 19.86 – 28.07). Average age at time of injury was 37.1 +/- 22.0 years. Male patients accounted for a greater proportion of shoulder dislocations than female patients (537,189, 69.5%, *vs* 235,834, 30.5%, *P* < 0.001). Young males accounted for the highest proportion of dislocations, with 17.70% of all dislocations occurring in males aged 15-20 years. ¹ The incidence rate for this demographic was observed to be 106.91 per 100,000 persons (95%CI 84.24 – 129.57).

The largest number of dislocations occurred in patients 17 years old (National Estimate 30,796, 3.98%). The peak age for dislocation was 18 years in males (National Estimate 26,661, 4.96% of males) and 66 years in females (National Estimate 4,833, 2.05% of females). Young males experienced a higher dislocation rate and reached a relative

plateau around age 40. Conversely, females had a relatively stable rate of dislocations throughout all age groups and the incidence increased in their later decades. The incidence rate of dislocations in females surpassed that of males at approximately age 63 years. The overall rate per year of shoulder dislocations by gender and age is seen in Figure 1.

The NEISS database divides consumer products into broad categories, which were analyzed to determine overall injury patterns (Table 2). Sports and recreation equipment were associated with 44.31% (365,348) of dislocations, followed by home structures & construction materials (21.22%), and home furnishings, fixtures, and accessories (21.21%).

In an analysis of sub-groups, stairs, ramps, landings, floors were associated with the greatest number of dislocations (131,745, 14.0%), with a predominance noted among patients ≥ 40 years (9.6% for ≤ 39 years, 28.4% for ≥ 40 years, $P < 0.001$) and females (12.0% for males, 28.6% for females, $P < 0.001$). Among sport and recreational activities, most dislocations occurred during basketball (56,600) followed by football (45,167). A more throughout breakdown of this information is seen in Table 3.

Specific analysis of males aged 15-20, previously identified as having the highest incidence of dislocation, was undertaken (Table 4). In this group of young males, 82.88% (113,421) of dislocations were associated with sports and recreation equipment.^{3,6} Specifically, basketball (18.60%) and football (18.59%) were involved in the greatest number and percentage of dislocations. Eight of the top ten subcategories for this age group involved sports and recreation equipment.

DISCUSSION

This study represents a current analysis of the ²epidemiology of shoulder dislocations presenting to emergency departments in the United States from 2012-2021. The national annual incidence rate throughout the study period held was approximately 23.92 per 100,000 persons. Male adolescents sustained the highest proportion of dislocations, with 17.70% of all dislocations occurring in males aged 15-20

years, predominantly resulting participation in Sports and Recreation Equipment. Conversely, women experienced a relatively consistent incidence of dislocation throughout their lifespan. After age 63, the incidence rate of dislocations in females surpassed that observed in males.

The findings of this study align with the existing literature. We observed an annual incidence rate of 23.92 per 100,000 throughout the study period. Similarly, Zacchilli *et al* noted an incidence of 23.9 per 100,000 person-years in a study analyzing NEISS data between 2002 and 2006.⁶ Of note, a study by Owens *et al* reported a much higher incidence rate of dislocations among United States Military Academy cadets at 169 per 100,000 person-years, although their study was comprised of primarily young, physically active males.³ Additionally, other studies have reported dislocation rates among young, physically active patients to be as high as seven times greater than that observed in the general population.^{6,9} These findings are in agreement with the results of our analysis, which noted male adolescents to account for the greatest number of shoulder dislocations presenting to emergency departments.

The current study found an estimated total reported cases of 136,844 men 15-20 years old, which made up for 17.70% of the total cases reported in this study, with an annual incidence of 106.91 per 100,000. These results are higher to those of similar studies in other countries which found men 16-20 years old to have an incidence of 80.5 per 100,000 in the UK and 98.3 per 100,000 in Canada.^{15,16} Studies have attributed this difference in rates of injury to the prevalence of competitive contact sports played among men within this age range in the US and Canada (American Football and ice hockey) compared with their peers in the UK.¹⁵ Further, it was observed that in this population, 113,421 (82.88%) of the injuries occurred while using sports and recreational equipment. This finding is consistent with prior studies that have analyzed the incidence of this injury among young athletes and military populations.^{3,4,17,18}

During our study period, women were found to account for less than one third of dislocations presenting to emergency departments and previous studies have reported a similarly low incidence of this injury in women when compared to men.^{7,15,16}

However, the incidence of shoulder dislocation in women was noted to surpass that of men after the age of 63. This aligns with existing data demonstrating a higher dislocation rate in women after the sixth decade.^{7,15} While this discrepancy is poorly understood, we hypothesize that it may be due to a combination of biological differences between men and women as they age, such as muscle bulk and tendon strength, as well differences in the rate of falls between sexes.^{19,20} Interestingly, over 60% of dislocations events in female patients were associated with home furnishings, fixtures, or structures. This suggests a need for separate preventative measures and strategies for older female patients from the already established sports-related strategies directed at young males. Further research is necessary to fully understand underlying differences in risk between patient demographics and may assist in the development of preventative measures aimed at decreasing the burden of shoulder dislocations associated with falls in the elderly.²¹

Of note, there were too few recorded cases of shoulder dislocation in children younger than 12 years to provide national estimates, suggesting that this is a relatively rare injury among this demographic. One existing study reporting on the epidemiology of pediatric shoulder dislocation in Italy demonstrated an incidence of 0.3 per 100,000 inhabitants less than age 14.²² The low incidence of shoulder dislocation in pediatric patients may be explained by skeletal immaturity as the mechanisms of injury generally associated with dislocation are more likely to cause proximal humerus fractures or physeal injury in patients whose physis has not yet closed.²³

¹ This study was not without its limitations. As with any database, the scope of this study is limited to variables obtained by data collectors and does not include patients who presented to primary care, urgent care, or sports medicine clinics. ² Because the provided totals are weighted estimates based on a probability sample of emergency room visits, the numerical estimates could be subject to sampling bias and therefore may not represent the true incidence of injury in the defined study population. Additionally, it is possible that errors were made while coding these injuries and their associated consumer products within the NEISS. Furthermore, logging products into broad

categories relies on the coder's judgment and this carries bias. Due to the nature of the NEISS database, we were unable to retrieve more detailed information regarding specific consumer products associated with injury, nor were we able to retrieve exact mechanism of injury. Lastly, the database did not differentiate between anterior and posterior shoulder dislocations, nor did it indicate whether dislocation events were primary or recurrent. It is possible that the presence of patients with multiple recurrent dislocations may contribute to a falsely elevated incidence rate.⁶

CONCLUSION

The national annual incidence rate throughout the study period was approximately 23.92 per 100,000 persons. Male adolescents sustained the highest proportion of dislocations, with peak incidence occurring in age 15-20 years, predominantly secondary to participation with Sports and Recreation Equipment. Conversely, women experienced a relatively consistent incidence of dislocation throughout their lifespan. After age 63, the incidence rate of dislocations in females was found to surpass that observed in males.

ARTICLE HIGHLIGHTS

Research background

This research was conducted to examine temporal trends regarding shoulder dislocations in the United States.

Research motivation

Shoulder dislocations are common among all populations, especially young men, and understanding the epidemiology is important for orthopedic surgeons.

Research objectives

To provide an updated assessment of the epidemiology of shoulder dislocations in the United States.

Research methods

Emergency department within the United States was collected using the National Electronic Injury Surveillance System (NEISS) database between 2012 and 2021, and epidemiologic data was collected and analyzed for shoulder dislocations.

Research results

The national annual incidence of shoulder dislocations in the United States was approximately 23.92 per 100,000 persons, with a predominance of dislocations occurring in male adolescents between the ages of 15-20.

Research conclusions

There is a bimodal distribution of shoulder dislocations in the United States. A large portion of male adolescent sustain this injuries between the ages of 15-20 sary to participation in sporting events. Conversely, women have a relatively consistent incidence of dislocations in their lifespan with an increase in their later decades of life.

Research perspectives

Future studies should help create measures to help lower the incidence of shoulder dislocations in at risk population, particularly adolescent males participating in sports.

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1	www.ncbi.nlm.nih.gov Internet	67 words — 2%
2	www.jsesinternational.org Internet	48 words — 2%
3	link.springer.com Internet	16 words — 1%
4	Michael A Zacchilli, Brett D Owens. "Epidemiology of Shoulder Dislocations Presenting to Emergency Departments in the United States", The Journal of Bone and Joint Surgery-American Volume, 2010 Crossref	13 words — < 1%