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Shoulder impingement in the United States military

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Background: Little is known about the incidence and characteristics of primary, or external, shoulder impingement in an occupationally and physically active population. A longitudinal, prospective epidemiologic database was used to determine the incidence and risk factors for shoulder subacromial impingement in the United States (U.S.) military. Our hypothesis was that shoulder impingement is influenced by age, sex, race, military rank, and branch of service.

Methods: The Defense Medical Epidemiology Database was queried for all shoulder impingement injuries using International Classification of Disease, Ninth Addition, Clinical Modification code 726.10 within a 10-year period from 1999 through 2008. An overall injury incidence was calculated, and a multivariate analysis performed among demographic groups.

Results: In an at-risk population of 13,768,534 person-years, we identified 106,940 cases of shoulder impingement resulting in an incidence of 7.77/1000 person-years in the U.S. military. The incidence of shoulder impingement increased with age and was highest in the group aged ≥40 years (incidence rate ratio [IRR], 4.90; 95% confidence interval [CI], 4.61-5.21), was 9.5% higher among men (IRR, 1.10, 95% CI, 1.06-1.13), and compared with service members in the Navy, those in the Air Force, Army, and Marine Corps were associated with higher rates of shoulder impingement (IRR, 1.46 [95% CI, 1.42-1.50], 1.42 [95% CI, 1.39-1.46], and 1.31 [95% CI, 1.26-1.36], respectively).

Conclusions: The incidence of shoulder impingement among U.S. military personnel is 7.77/1000 person-years. An age of ≥40 years was a significant independent risk factor for injury.

Level of evidence: Level III, Cross Sectional Design, Epidemiology Study.

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Keywords: Shoulder; impingement; incidence; epidemiology; U.S. military; DMED

The Institutional Review Board at William Beaumont Army Medical Center (WBAMC Protocol #08/05; Keller Army Hospital, West Point Protocol #07/009) approved this study.

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Shoulder pain is a common condition associated with high societal cost and occupational burden for workers. In 2000, the direct costs for the treatment of shoulder dysfunction in the United States (U.S.) totaled $7 billion.[14] These shoulder disorders have multifactorial causes and can result from conditions such as bursitis, tendonitis, rotator cuff tear, adhesive capsulitis, avascular necrosis, glenohumeral osteoarthritis, or impingement sydrome.[14] Of these conditions, shoulder impingement can be particularly debilitating, affecting occupational function and health-related quality of life. In this study, we investigated the incidence of shoulder subacromial impingement in a physically active population.

Impingement syndromes in the shoulder are common in individuals with repetitive or prolonged overhead activities.[13] One proposed mechanical mechanism of shoulder impingement involves the narrowing of the subacromial space by subacromial spur formation or coracoacromial ligament hypertrophy, which reduces the space available for the rotator cuff.[16] The repetitive overhead motions of the arm in many sports and occupations can also lead to impingement in the vulnerable avascular region of the supraspinatus tendon.[6,8,15,20] One other proposed mechanism involves subacromial inflammation of the adjacent subacromial bursa in response to rotator cuff injury.

Despite the public health and occupational burden of shoulder impingement, little is known about the incidence of shoulder subacromial impingement in the general population. Although a limited number of reports have focused on shoulder impingement in tennis players[4,29] and different athletic groups,[13] as well as one report in an at-risk overhead occupational cohort of laborers,[7] the epidemiology of shoulder subacromial impingement in the general population, let alone in high-risk occupational and physically active populations, remains poorly studied.

The purpose of this study was to examine the incidence rate (IR) of primary, external shoulder impingement in a physically active population with particular occupational upper extremity demands. A secondary objective was to examine the relationship between demographic or occupational factors and the IR of shoulder impingement to identify specific groups that are susceptible to shoulder impingement. We hypothesized that a higher rate of shoulder impingement would be observed in certain populations and that the IR would be dependent on sex, race, age, military rank, or branch of U.S. military service. In this study, we queried a large administrative epidemiologic database to determine the incidence and the demographic risk factors for shoulder impingement across the 4 branches of U.S. military service.[1,21] Our study focused on primary or external shoulder subacromial impingement and its incidence in the active-duty military population of at-risk personnel.

Materials and methods

This study was conducted in accordance with good clinical practices. This retrospective cohort study used data collected between 1999 and 2008 to examine the IR for primary, external shoulder subacromial impingement in an active-duty U.S. military population. We used injury data from the Defense Medical Epidemiological Database (DMED). The DMED compiles International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) coding information for every patient encounter occurring in a U.S. military treatment facility or under civilian-contracted care. This database also contains patient demographics and military-specific data, which can be used to study epidemiology. In addition, the DMED maintains data on the total number of U.S. military personnel on active duty each year, which is obtained from the Defense Manpower Data Center. The structure, capabilities, and utility of this military database for public health surveillance and epidemiologic research have been previously described,[1,21] and injury data from the DMED have been used to study the epidemiology of a number of musculoskeletal injuries and conditions[2,9,17-19,23,30,32] as well as injuries to the shoulder specifically.[17] A secondary objective was to examine the association between demographic (eg, sex, age, race) and occupational (eg, branch of military service, rank) risk factors associated with the incidence of shoulder impingement during the study period.

To determine the number of incident cases of shoulder impingement, we queried the DMED by sex, age, race, branch of military service, and military rank for the years 1999 through 2008 using ICD-9-CM code 726.10 (unspecified disorders of shoulder tendons and bursae). The age categories were younger than 20, 20 to 24, 25 to 29, 30 to 34, 35 to 39, and 40 years and older. The race categories were white, black, and other. The service categories were U.S. Army, U.S. Marine Corps, U.S. Navy, and U.S. Air Force. The rank categories included junior enlisted (E1-E4), senior enlisted (E5-E9), junior officer (O1-O4), and senior officer (O5-O9). In-patient data were excluded to capture only ambulatory encounters with a primary diagnosis of shoulder impingement. Only the first occurrences for each patient were counted to exclude repeat coding of the same initial injury for all service members during the study period.[1]

The primary outcome of interest was the IR of shoulder impingement per 1000 person-years at risk of injury during the study period. The IR for an injury is defined as the number of new cases in a period of time in a population at risk for the injury. Incidence rates are calculated by dividing the total number of injuries observed in a population by a measure of exposure (person-time).[24] Accurate exposure data for IR calculations are available through DMED and are validated against Department of Defense personnel data obtained from the Defense Manpower Data Center.[1] The person-time at risk for injury during the current study period was calculated from the day each individual entered military service until he or she sustained an incident shoulder impingement injury, left military service, or reached the administrative end of the study on December 31, 2008. All IRs in this study are reported per 1000 person-years at-risk.

The overall incidence and 95% confidence interval (CI) of shoulder impingements in the study population was calculated by dividing the total number of injuries by the total person-years at risk, expressed as cases per 1000 person-years. We