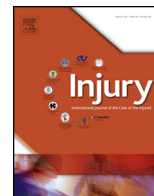




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Shoulder injuries from birth to old age A 1-year prospective study of 3031 shoulder injuries in an urban population

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ABSTRACT

Introduction: Shoulder injuries are commonly encountered in emergency departments. In spite of this, the epidemiology is only partly known, and soft tissue injuries in particular remain unclear. The aim of this study was to obtain an overview of shoulder injuries in a general population cohort, and to estimate the relative proportion of the main injury categories soft tissue injuries, fractures and dislocations, as well as their variation with age and gender.

Patients and Methods: We registered prospectively all patients admitted with a suspected shoulder injury at a combined casualty and primary health care facility during one year. The facility serves all hospitals and all citizens of Oslo. The patient-reported questionnaires, electronic patient records and radiology reports were examined.

Results: 3031 shoulder injuries were registered from May 2013 through April 2014. The median age was 37 years (range 14 days–102 years), 51 years in women and 31 years in men ($p < 0.001$), 60% were male. The male/female shoulder injury incidence rate ratio in the 20–34 years age group was 3.6 (95%CI, 3.0 to 4.3; $p < 0.001$). Contrary, the female/male rate ratio above 75 years was 2.1 (95%CI, 1.6–2.8; $p < 0.001$). Almost half of the injuries were soft tissue injuries, 35% were fractures and 17% were dislocations. The age-stratified incidence rates differed substantially in men and women. Fractures dominated in children up to 10 years and in adults over 60 years, soft tissue injuries in the ages between. The highest dislocation incidence rates were found in young males. A rotator cuff tear was diagnosed in 4% of the injuries.

Conclusion: Which shoulder structures that are affected by injury vary substantially with age and gender. The shoulder injury incidence rates of young men and the elderly are high. The findings are important for the understanding of the shoulder and the diagnostic process in A&Es.

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Introduction

Although shoulder injuries are commonly encountered in emergency departments and primary health care, previous epidemiological studies are limited to fractures and dislocations [1–4], conditions that can normally be visualised on plain radiographs. Clinicians and researchers have pointed out that the diagnostic process in patients with acute soft tissue injuries is

often challenging and delayed due to the lack of adequate clinical tests and easily available low cost imaging to identify injuries like acute rotator cuff tears [5–7]. Consequently, there is little known about the epidemiology of soft tissue shoulder injuries and how they compare to fractures and dislocations. Previous studies including all types of shoulder injuries have been cohort studies on athletes in specific sports [8,9]. There are to our knowledge only three prospective studies on acute rotator cuff tears [5,6,10], and none providing an overview of shoulder injuries in the general population including all age groups and injury categories.

In the light of the ongoing debate on rotator cuff repairs and the increasing numbers that undergo surgery [11,12], it is of interest to estimate the volume of soft tissue injuries to the shoulder and what ages and gender that are mostly affected. By investigating

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soft tissue injuries in addition to fractures and dislocations, it may also be possible to explore how the shoulder responds to trauma at different ages. Our aim was therefore to study the relative proportion of the main shoulder injury categories in a general population cohort with symptoms of a degree that result in A&E attendance. Secondly, to analyse the injury categories regarding age and gender, and to provide incidence rates for the most common shoulder injuries. In this paper we report the results of a one year prospective registration of all shoulder injuries admitted at a large A&E.

Patients and methods

Study population

From May 2013 through April 2014 we registered prospectively all shoulder injuries admitted at Department of Orthopaedic Emergency, Oslo University Hospital. The total number of patients admitted with acute physical injury during the study period was 58,158. The population of Oslo was 632,990 with a mean age of 37 years (October 2013).

The orthopaedic A&E provides services for all injured patients in Oslo. It serves as a diagnostic unit for all three public hospitals admitting acute surgical patients, and also provides primary health care services for minor injuries. Patients with severe injuries are brought directly to the regional trauma centre [13]. Previous studies including data from private out-patient emergency medical centres and the three relevant public hospitals, have shown that between 83 and 86% of the catchment population use the department in case of injury to the upper extremity [14,15].

Data collection

Patients who reported symptoms from the shoulder region, received a questionnaire including items from the national accident registration assessing injury time and mechanism. The national accident registration is mandatory and is recorded as a structured element of the electronic patient record. In patients who did not fill in the questionnaire, the physician filled in the national accident registration based on information provided during the history interview.

We collected information from the electronic patient record system by sorting the department's arrival lists by the relevant International Classification of Diseases (ICD-10) codes. In order to detect cases of missed shoulder injuries, we systematically reviewed patients with ICD-10 M codes (diseases of the musculo-skeletal system and connective tissue) as well as all cases that had filled in the questionnaire. Data from the questionnaires, medical records including physician notes and accident registration, radiology reports and in some cases images, were reviewed by the first or second author and entered in the database.

Inclusion and exclusion criteria

Patients who qualified for an ICD-10 S4 (injuries of shoulder and upper arm) diagnosis of the shoulder were included if caused by a trauma during the last three months that coincided with an acute onset of symptoms. Injuries of the middle and distal third of the humeral bone and adjacent soft tissues and patients with uncertainty regarding history due to drug abuse, mental state, language problems or other, were excluded from registration.

Variables

We defined three main categories of shoulder injuries: fractures, dislocations and soft tissue injuries. The fracture

category included fractures of the clavicle, proximal third of the humerus and scapula. Dislocations included glenohumeral, acromioclavicular and sternoclavicular dislocations and separations. Soft tissue injuries included contusions, distortions, open wounds and tendon, nerve and vessel injuries.

Conventional radiographs were routinely taken of all injuries. The other imaging modalities available were computed tomography (CT) and magnetic resonance imaging (MRI). We corrected the diagnosis given at the first visit if imaging and clinical findings at a later stage clearly concluded differently. The imaging modalities were the gold standard for diagnosing fractures. Minor Hill Sachs and Bankart fractures were not registered. Patients that described shoulder dislocation and pre-hospital reduction, and cases where only MRI revealed recent dislocation, were recorded as glenohumeral dislocations. Symptoms localised to the acromioclavicular joint without fracture, were classified as a dislocation/separation if the radiologist described dislocation or abnormal widening of the joint space or coracoclavicular distance on anteroposterior radiographs (grade II to VI) [16]. Other cases were diagnosed as sprains (grade I) [16,17]. We registered open wounds as a shoulder injury only if the ICD-10 S4.10 code (open wound of shoulder) had been used, unless the patient record clearly stated that an open wound affected the shoulder area.

We informed the department's physicians repeatedly about the clinical algorithm for follow-up of soft tissue injuries and referral to MRI during the year of registration¹, and registered rotator cuff tears according to MRI-findings.

In addition to the diagnosis and injury mechanism, we recorded age, gender, date and time of injury and consultation, additional injuries (secondary diagnoses), MRI, follow-up and hospitalisation.

Bias

Oslo is organized in fifteen districts. Although relatively homogenous, some differ concerning age and socio-economic profile. District residency was registered to control for potential bias. Statistical data concerning the districts were supplied by the City of Oslo, all other population data from Statistics Norway [18]. The Oslo University Hospital Trauma Registry provided information on the number of Oslo citizens that were admitted directly to the trauma centre with a shoulder injury during the registration year to control for bias concerning the most serious traumas.

Statistical analysis

We performed data analyses using IBM SPSS Statistics Version 23. P-values < 0.05 were considered statistically significant. When presenting incidence rates, only patients with a permanent Oslo address were included in the analysis. We applied the Mid-P exact test using Miettinen's (1974d) modification in OpenEpi.com to calculate the 95% confidence interval (CI) for incidence rates and rate ratios. Age in each gender and in specific shoulder conditions were skewed as assessed with box plots, histograms and Q-Q plots. We have consequently reported medians, and used the Mann-Whitney *U* test to compare age in males and females.

In accordance with Norwegian procedure, the study was approved by the Data Protection Officer of Oslo University Hospital, and performed in accordance with the revised Helsinki declaration.

¹ See Supplemental Material with the online version for the department's clinical algorithm.

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