J Shoulder Elbow Surg (2014) 23, 1282-1288

ELSEVIER

Journal of Shoulder and Elbow Surgery

www.elsevier.com/locate/ymse

Comorbidities in rotator cuff disease: a case-control study

Andrew G. Titchener, MA, MRCS[a,*], Jonathan J.E. White, BSc, MRCS[a], Sally R. Hinchliffe, PhD[b], Amol A. Tambe, MS, FRCS[a], Richard B. Hubbard, DM, FRCP[c], David I. Clark, BMedSci, FRCS[a]

[a]*Department of Trauma and Orthopaedics, Royal Derby Hospital, Derby, UK*
[b]*Department of Research and Development, Royal Derby Hospital, Derby, UK*
[c]*Department of Epidemiology and Public Health, University of Nottingham, Nottingham City Hospital, Nottingham, UK*

Background: Rotator cuff disease is a common condition in the general population, but relatively little is known about its associated risk factors.

Materials and methods: We have undertaken a large case-control study using The Health Improvement Network database to assess and to quantify the relative contributions of some constitutional and environmental risk factors for rotator cuff disease in the community. Our data set included 5000 patients with rotator cuff disease who were individually matched with a single control by age, sex, and general practice (primary care practice).

Results: The median age at diagnosis was 55 years (interquartile range, 44-65 years). Multivariate analysis showed that the risk factors associated with rotator cuff disease were Achilles tendinitis (odds ratio [OR] = 1.78), trigger finger (OR = 1.99), lateral epicondylitis (OR = 1.71), and carpal tunnel syndrome (OR = 1.55). Oral corticosteroid therapy (OR = 2.03), oral antidiabetic use (OR = 1.66), insulin use (OR = 1.77), and ''overweight'' body mass index of 25.1 to 30 (OR = 1.15) were also significantly associated. Current or previous smoking history, body mass index of greater than 30, any alcohol intake, medial epicondylitis, de Quervain syndrome, cubital tunnel syndrome, and rheumatoid arthritis were not found to be associated with rotator cuff disease.

Conclusions: We have identified a number of comorbidities and risk factors for rotator cuff disease. These include lateral epicondylitis, carpal tunnel syndrome, trigger finger, Achilles tendinitis, oral corticosteroid use, and diabetes mellitus. The findings should alert the clinician to comorbid pathologic processes and guide future research into the etiology of this condition.

Level of evidence: Level III, Case-Control Design, Epidemiology Study.

Keywords: Rotator cuff; epidemiology; case control; tendinitis

Funding: This paper was supported by a research grant from the British Elbow and Shoulder Society.

Ethical approval: Information within The Health Improvement Network database is patient related but is anonymized for use in studies. The protocol was approved by the Nottingham Research Ethics Committee (Reference Number: 07/H0403/92) and the Derby Hospitals NHS Foundation Trust Research and Development Department (Reference: DHRD/2007/068).

*Reprint requests: Andrew G. Titchener, MA, MRCS, Department of Trauma and Orthopaedics, Royal Derby Hospital, Uttoxeter Road, Derby DE22 3NE, UK.

E-mail address: andytitch@gmail.com (A.G. Titchener).

1058-2746/$ - see front matter © 2014 Journal of Shoulder and Elbow Surgery Board of Trustees.
http://dx.doi.org/10.1016/j.jse.2013.12.019

Rotator cuff disease is common, but relatively little is known about its etiology and associated risk factors. Various patterns of associated pathologic processes and risk factors have been suggested.

Nirschl[20] suggested a ''mesenchymal syndrome'' to be involved in the etiology of rotator cuff tendinosis through a predisposition to tendinosis at multiple sites. These conditions included lateral and medial epicondylitis, carpal tunnel syndrome, de Quervain disease, and trigger finger. Lateral epicondylitis has been associated with rotator cuff disease by a number of other studies.[7,24,25,32,35,36] Comparison has also been shown histologically between rotator cuff tendinopathy, lateral epicondylitis,[7] and Achilles tendinopathies.[15]

Constitutional risk factors have been shown to be associated with rotator cuff pathologic processes in other studies. These include diabetes mellitus,[19,23,26] and this effect has been reported to be related to the severity of diabetic disease.[28] Obesity has also been reported as a risk factor,[38] although it is unclear if its main pathologic effect is through a mechanical or biochemical mechanism. Smoking has been shown to be associated with rotator cuff disease.[3,6,30]

Previous epidemiologic studies examining risk factors for rotator cuff disease have generally assessed workers in occupational groups[4,5,9,10,14,21,27,34,40] or limited population studies,[23,39] whereas others have examined heritability only.[31] All these studies have methodologic limitations, and in light of this we have undertaken a large case-control study using The Health Improvement Network (THIN) database to quantify the relative contributions of these risk factors for rotator cuff disease in the community.

Materials and methods

THIN database was used for this study. The data represent the computerized recordings of routine patient care from 479 general practices in the United Kingdom. The total number of patient records held is approximately 9.15 million, with 3.36 million current active patients representing 5.7% of the U.K. population.

Diagnosis

Numerous pathologic processes can account for pain around the shoulder; our definition of rotator cuff disease includes all Read codes relating to rotator cuff tendinitis, subacromial bursitis, subacromial impingement, rotator cuff tears, and calcific tendinitis of the rotator cuff. These conditions are all difficult to accurately discriminate clinically, and so it seems sensible to include them in the umbrella term. Codes relating to biceps tendon disease, frozen shoulder, and glenohumeral osteoarthritis were not included.

Patients

We randomly selected 5000 patients from approximately 32,000 with a recorded diagnosis of rotator cuff disease within THIN database since the year 2000 with more than 6 months of follow-up data. Cases were selected only if their date of diagnosis was more than 6 months after their date of first registration with the general practice to exclude a potential source of bias whereby historical diagnoses are erroneously coded as occurring at the time of registration. Controls were individually matched to each patient by age (± 3 years), sex, and general practice. In total, 5000 controls were matched.

Each case was assigned a date of diagnosis defined as the date of first recording of rotator cuff disease, and matching controls were assigned an identical ''pseudo date of diagnosis.'' Each matched case and control were assigned a common registration date for data collection, defined as the date at which the practice started to contribute data to THIN or the date that the case or control registered with the practice after 2000, whichever was later.

The data were extracted by use of Read codes and Additional Health Data (AHD), both of which are contained within THIN database. Read codes are a National Health Service patient data coding system used in U.K. general practices. These map other coding systems including the *International Classification of Diseases, Ninth Revision,* and the *Classification of Surgical Operations and Procedures, Fourth Revision*. AHD contains details of prescriptions and of miscellaneous data, such as smoking status. Read codes and AHD records used were specific for the conditions studied.

Data

Demographic data were extracted for all patients in the study, including body mass index (BMI), alcohol consumption, deprivation level (an index of socioeconomic status), and smoking habits, before the date of first diagnosis with rotator cuff disease. The deprivation level was based on the Townsend score.[33] This represents an index of deprivation from 1 to 5, with high scores relating to higher deprivation or lower socioeconomic status.

The BMI was coded according to the World Health Organization classification for obesity[1]: underweight, BMI <18.5; normal weight, BMI 18.5 to 25; overweight, BMI 25.1 to 30; obese, BMI 30.1 to 40; and morbidly obese, BMI >40.1.

All potential risk factors for rotator cuff disease were recorded between the registration date and the date of diagnosis of rotator cuff disease; data were extracted on all recorded diagnoses of lateral epicondylitis, medial epicondylitis, de Quervain disease, carpal tunnel syndrome, cubital tunnel syndrome, trigger finger, Achilles tendinitis, rheumatoid arthritis, antidiabetic drug use, insulin use, and oral steroid intake. Both the AHD records and the Read codes were used for crosschecking of extracted data about alcohol habits and consumption, smoking habits, and BMI.

Statistical analysis

The data were analyzed by use of Stata version 11 software (StataCorp LP, College Station, TX, USA). The association between rotator cuff disease and each exposure was analyzed by conditional univariate logistic regression. A multivariate model was then considered to adjust for mean annual consulting rates to assess the impact of ascertainment bias. The mean consultation rate was estimated as the mean number of general practice consultations per year during the total registration period. As this is a large case-control study using a retrospective database of anonymized patient records, it was difficult to postulate the clinical