RESEARCH ARTICLE

Diabetes Management

Adhesive capsulitis in workers with shoulder injury: prevalence, characteristics and risk factors

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ABSTRACT

Background: The objectives of this study were to report the prevalence of adhesive capsulitis (AC) in injured workers seen at an Early Shoulder Physician Assessment (ESPA) Program and to explore patient characteristics and risk factors associated with this condition. Methods and Findings: This study involved a review of the electronic files of injured workers who were referred to an early assessment program within the 16 weeks of the injury or recurrence. The measure of disability was the Quick Disabilities of the Arm, Shoulder and Hand (QuickDASH). Data of 1000 consecutive patients, 443 (44%) females, 557(56%) males, (mean age=49, SD=11) were reviewed. Seventy eight (8%) patients were diagnosed with adhesive capsulitis based on the clinical examination. Risk factors for AC were a higher age (54 vs. 48, p<0.0001) and having a history of diabetes (18% vs. 9%, p=0.01). Sex was not an important factor in the development of the adhesive capsulitis (p=0.92) in the sample studied. Patients suffering from AC reported higher levels of QuickDASH as compared with the rest of the sample (61 vs. 55, p=0.01). However, despite a higher disability, there were no statistically significant differences in the consumption of medication between patients with and without adhesive capsulitis. Conclusions: The prevalence of AC in injured workers with shoulder complaints within the 16 weeks of the injury or recurrence was low at 8%. Considering an older age and presence of diabetes are risk factors for development of AC, patients over age of 50 and those with a history of diabetes mellitus should be monitored more closely, particularly in the early phase of injury or recurrence to ensure an effective and timely management.

Introduction

Frozen shoulder was originally described by Codman in 1934 [1] as a condition of idiopathic onset and painful restriction of movement with normal plain radiographs. The term Adhesive Capsulitis (AC) was later added to the Orthopedic vocabulary by Neviaser [2]. The hallmark of AC is the capsular pattern of restriction which involves restriction of external rotation followed by abduction and then flexion. The capsular fibrosis that leads to stiffness is reported to be caused by an inflammatory contracture of the shoulder joint capsule, commonly associated with inflamed synovium in the rotator interval region and thickened joint capsule [3-5].

The prevalence of AC in the general population is estimated at 2-4% affecting middle aged women more predominantly [6-8]. However, we are not aware of the prevalence or incidence of this condition in injured workers particularly within the early phase of injury. Investigating the subject is important as the cost of work-related shoulder pathologies is significant [9-12] and early diagnosis of this particular shoulder condition may help with prevention of chronic disability. The purpose of this study was two-fold: (1) to examine the prevalence of AC in workers within 16 weeks of a shoulder injury or recurrence and (2) to explore the characteristics and risk factors associated with this condition. Differences in wait time (injury date to date of examination), mechanism of injury, coexisting comorbidity, medication use and barriers to recovery were also explored.

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KEYWORDS

- workers' compensation
- adhesive capsulitis
- shoulder injury
- diabetes

Methods

Design

This study involved a review of the electronic files of injured workers seen at an Early Shoulder Physician Assessment (ESPA) Program. Approval for using the existent data was obtained from the Research Ethics Board of the local institute.

Subjects

Data of injured workers who had sustained a shoulder injury and were seen at an ESPA Program were extracted from standardized fillable PDF forms. These patients had not Returned to Work (RTW) or progressed in their RTW plan within 16 weeks of the injury or recurrence. The interview and clinical assessment were performed by an orthopedic surgeon with fellowship training in shoulder surgery and a specialized physical therapist.

Definition of adhesive capsulitis

Patients were diagnosed with AC if they demonstrated a capsular pattern of restriction in their shoulder joint with external rotation being the most restricted movement followed by abduction and flexion. The sample studied had no advanced osteoarthritis of the glenohumeral joint.

Patient-related outcome measures

Self-rated outcome measures were the numeric pain rating scale (NPRS) and the Quick Disabilities of the Arm, Shoulder and Hand (QuickDASH) [13]. The NPRS ranges from 0 to 10 with 0 being no pain and 10 being the worst imaginable pain. The QuickDASH documents disability related to the upper extremity with higher numbers indicating more disability. Both measures have established validity for clinical use [13-16].

Statistical analysis

Descriptive statistics were performed and an estimate of prevalence of AC was calculated as the number of patients with AC/total number of workers. The mechanism of injury was categorized in five categories as fall, direct trauma, repetitive activities, push/pull activities, and other. Co-morbidities were examined in three areas: Arthritis, cardiovascular and diabetes. Work status was classified as not working, working, modified duties and working full duties. The Chi square (χ^2) and Fisher's Exact tests were used for categorical data as appropriate and non-parametric Wilcoxon analyses examined group differences in continuous data. Statistical analysis was performed using SAS® version 9.1.3 (SAS® Institute, Cary, NC). Statistical results are reported using 2-tailed p values with significance set at $p<0.05$.

Results

Data of 1000 consecutive patients, 443 (44%) females, 557 (56%) males, (mean age=49, SD=11) were reviewed. Seventy eight (8%) patients had a diagnosis of AC based on presence of capsular pattern of restriction. Table 1 show the group differences in demographics, work status, pain and disability measures. Patients who suffered from AC were older (mean age 54 vs. 48, $p<0.0001$), reported a higher level of disability as measured by QuickDASH ($p=0.01$) and had a higher prevalence of diabetes (18% vs. 9%, $p=0.01$). Presence of AC was associated with less push and pull injury (29% vs. 42%) and less report of work-place issues (10% vs. 19%). Patients with AC were less likely to be referred for surgical consultation as compared with patients without AC.

Discussion

The present study demonstrated a prevalence of 8% AC in workers seen in the early stage of a shoulder injury or recurrence. Presence of AC was associated with an older age, higher levels of disability and presence of diabetes mellitus. To our knowledge, this is the first study with a relatively large sample size that has examined the prevalence of AC in the early stages of recovery following a compensable shoulder injury.

A number of risk factors are associated with presence of AC in the general population. Older age, female gender, history of trauma and diabetes mellitus could increase the chance of adhesive capsulitis in adult population [17-23]. Although our results are consistent with the literature in relation to age, associated diabetes and trauma (having a work-related injury rather than insidious onset), in our sample females were not necessarily more affected. This discrepancy may be related to the samples studied, being injured workers vs. general population. In a review of a large electronic medical record data of general practices across the UK (2,188,958 patients) which included patients between ages 40-79 years [24], the incidence of AC was 2.36 and 3.38 per 1,000 person-years for men and women, respectively. For each 10-year

Table 1: Characteristics of patients with and without adhesive capsulitis (AC).

Variables	Positive AC (N=78)	Negative AC (N=922)	Statistics P values
Age			
Mean (SD)	54 (6)	48 (11)	Z=7.85, p<0.0001
Sex (%)			
Female	35(45%)	408(44%)	x^2=0.01, p=0.92
Male	43(55%)	513(56%)	-
Wait time (months) Mean (SD)	2.60(0.70)	2.76(1.10)	t-test=1.63, p=0.10
Co-morbidity			
Diabetes	14(18%)	84(9%)	x^2=6.35, p=0.01
Cardiovascular	4(5%)	19(2%)	FET=0.97, p=0.09
Arthritis	1(1%)	47(5%)	FET=0.08, p=0.17
Smoking (%)	19(24%)	294(32%)	x^2=1.89, p=0.16
Mechanism of injury			
Repetitive activities	13(17%)	114(12%)	x^2=1.20, p=0.27
Fall	10(13%)	144(16%)	x^2=0.43, p=0.51
Direct trauma	11(14%)	89(10%)	x^2=1.58, p=0.20
Push/pull injury	23(29%)	389(42%)	x^2=4.79, p=0.03
Other	21(27%)	186(20%)	x^2=1.99, p=0.16
Medication use			
Analgesics	36(46%)	406(44%)	x^2=0.13 ,p=0.72
Anti-inflammatory	42(54%)	453(49%)	x^2= 0.64, p=0.42
Muscle relaxants	6(8%)	55(6%)	x^2= 0.37, p=0.54
Barriers to RTW			
Pre-existing medical factors	0(0%)	38(4%)	FET=0.04, p=0.07
Workplace factors	8(10%)	179(19%)	x^2=3.94, p=0.04
Psychosocial factors	2(3%)	5(6%)	FET=0.13, p=0.43
Subjective outcomes			
NPRS, mean (SD)	5.8(2)	6.1(2)	Z=1.22, p=0.22
QuickDASH, mean (SD)	61(20)	55(29)	Z=2.51, p=0.01
Work status			
Not-working	10(13%)	223(24%)	-
Working modified duties	54(69%)	579(63%)	x^2=5.62, p=0.06
Working regular duties	14(18%)	123(13%)	-
Candidacy for surgery	3(4%)	166(18%)	FET=0.001, p=0.001

Non parametric Wilcoxon scores were reported for continuous data, AC: Adhesive Capsulitis, FTE: Fishers Exact Test, Quick DASH: Quick Disabilities of the Arm, Shoulder and Hand, NPRS: Numeric Pain Rating Score, SD: Standard Deviation, χ^2: Chi-Square Statistics

increment in age, the incidence rate increased by 8% in women. There was no increase in AC incidence for men. This study did not provide any information on the mechanism of injury or onset of symptoms but confirmed a sex-related link with AC. There are two possibilities that our sample did not detect sex discrepancy in the prevalence of AC: 1) Our patients were younger within the range of working age, and 2) The onset of AC was related to an injury rather than a combination of traumatic, insidious onset or inflammatory conditions that is suspected in a large database of patients seen by general physicians.

In relation to diabetes mellitus, this condition is known to be associated with overproduction of pro-inflammatory factors [25,26]. Synovial inflammation and capsular fibrosis may occur as a result of inflammation and hyper vascular synovial proliferation, which may facilitate adhesive capsulitis. In a study by Boivin et al. [27], diabetic mice showed a significant increase in tendon diameter and a significant decrease in tendon elastic modulus compared to control mice which may explain the higher prevalence of AC in diabetes. In our sample, the prevalence of overall diabetes was 98/1000 (10%), while the prevalence of diabetes in the AC group was 18%. Based on a recent meta-analysis of the literature, the overall prevalence of AC in patients with diabetes mellitus was 13%. In our study the prevalence of diabetes in patients with AC was

14/78 (18%) while the prevalence of AC in workers with diabetes mellitus was 14/98 (14%), which is very close to the general population [3,5,21,28-30].

In our sample, patients with AC had less workplace-related complaints and were predominantly working modified duties potentially because this condition is less disabling than rotator cuff tears or osteoarthritis and often self-resolving, which may lead to less workplace issues. The AC group did not report a higher level of medication consumption. As expected, the AC patients do not often need surgical interventions unless there are other associated pathologies involved. In our study, the mechanism of injury was similar between groups in terms of falls, direct trauma, and repetitive injuries. The lower frequency of pull/push related injuries in patients with AC may not be clinically relevant and requires further investigation.

The significance of our results is that a small percentage of workers developed restricted range of motion in a capsular pattern within 16 weeks of a shoulder injury or recurrence and although the AC is associated with a higher level of disability, it does not appear to have a detrimental impact on consumption of medication or time away from work.

Conclusion

The prevalence of adhesive capsulitis in injured workers with shoulder complaints was low at 8% within the 16 weeks of the injury or recurrence. Considering an older age and presence of diabetes are risk factors for development of adhesive capsulitis, patients over age of 50 and those with a history of diabetes mellitus should be monitored more closely in the early phase of injury or recurrence to ensure an effective and timely management.

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