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ORIGINAL ARTICLE

The associations of frozen shoulder in patients requiring arthroscopic capsular release

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ABSTRACT

Background Frozen shoulder is considered to be associated with diabetes, thyroid disease, heart disease, high cholesterol and Dupuytren's disease. However, these associations have been made without arthroscopic confirmation of frozen shoulder or comparison with a control group. The present study aimed to compare the incidence of co-morbidities in a group of arthroscopically proven frozen shoulder patients and an age- and sex-matched control group.

Methods One hundred and one patients with clinical and arthroscopically proven primary frozen shoulder and no other intra-articular pathology were identified. One hundred and one patients were recruited from a fracture clinic as an age- and sex-matched control group. Each patient was sent a questionnaire to document co-morbidities and frozen shoulder in siblings.

Results Only diabetes ($p = 0.002$) and a sibling with frozen shoulder ($p < 0.02$) were found to be risk factors for frozen shoulder.

Discussion This is the first large study to use a precise diagnosis and a well-matched control group to quantify the associations of frozen shoulder. It confirms the link of frozen shoulder with diabetes and adds to the argument for a genetic link in patients requiring an arthroscopic capsular release. It questions the association of heart disease, high cholesterol and thyroid disease with frozen shoulder.

INTRODUCTION

Frozen shoulder or adhesive capsulitis is a common condition presenting to the shoulder surgeon. Diabetes [1–4], thyroid disease [5–7], high cholesterol [8] and heart disease [9,10] are commonly cited to be associated with frozen shoulder, although most of these studies have not used a control group to compare the incidence within an age- and sex-matched population. These associations have been handed down from textbook to textbook, although they might be confounded by other risk factors such as age and sex.

A genetic link has been suggested, with case reports describing siblings having frozen shoulders [11,12] and, based on twin studies, the heritability of frozen shoulder has been proposed as 42% [13].

Previous studies have used a clinical diagnosis of frozen shoulder. However, the clinical picture can be misleading and may mimic impingement syndrome or stiffness relating to a rotator cuff disease or other intra-articular pathology that cannot be excluded with a plain radiograph. It is therefore important to determine that the diagnosis is accurate.

The present study aimed to record the prevalence of these co-morbidities in patients with clinical and arthroscopic evidence of frozen shoulder and with no other intra-articular pathology and to compare this with an age- and sex-matched control group.

MATERIALS AND METHODS

One hundred and forty-eight consecutive patients who had undergone an arthroscopic capsular release for frozen shoulder over a 5-year period were identified from our clinical database. Six patients with associated rotator cuff tears, five following previous surgery and three following proximal humeral fractures were excluded. This left 134 patients with primary frozen shoulder. This diagnosis was made using the American Shoulder and Elbow Surgeons consensus criteria of insidious onset of true shoulder pain, with night pain, a painful restriction of both active and passive forward elevation to less than 100 °C, and external rotation less than one half of normal [14]. All patients had a normal radiograph. All patients had arthroscopic findings consistent with frozen shoulder (reduced joint volume, thickened capsule, angiogenesis and a thickened medial glenohumeral ligament [15,16], and no other intra-articular pathology.

Each patient was sent a questionnaire to identify whether patients suffered from diabetes, high cholesterol, heart disease or thyroid problems, and to identify whether any of their siblings had been diagnosed with a frozen shoulder. One hundred and one patients responded to the questionnaire.

The same questionnaire was given to 101 patients attending a fracture clinic for a traumatic injury who were age- and sex-matched to the frozen shoulder patients. In the control group, patients were excluded if they had any current or past symptoms in either shoulder.

Prevalence rates were calculated for each co-morbidity and a 2×2 contingency square table was created to allow comparison between the two groups. Statistical analysis was performed using

Table 1 Prevalence and risk ratio for co-morbidity associations (95% confidence intervals)

	Diabetes		High cholesterol		Heart disease		Thyroid problems	
	Prevalence	Risk ratio	Prevalence	Risk ratio	Prevalence	Risk ratio	Prevalence	Risk ratio
Frozen shoulder	24		21		6		8	
Matched cohort	8	3.0 (1.4–6.4) $p = 0.002$	22	0.9 (0.6–1.6) $p = 0.86$	7	0.9 (0.3–2.5) $p = 0.81$	4	2.0 (0.6–6.4) $p = 0.23$

Pearson's uncorrected test and a risk ratio calculated with the 95% confidence interval (CI).

RESULTS

The frozen shoulder group had a mean (SD, range) age of 52 (11.3, 34–72) years and that of the matched control was 54 (10.6, 35–73) years. Sixty-three patients in each group were female.

Only diabetes had a statistically significant increased prevalence in the frozen shoulder group compared to the matched cohort (Table I). Eighteen of the 24 diabetics in the frozen shoulder group required insulin.

Eighty-seven of the frozen shoulder patients had one or more siblings, of which 14 (16%) had at least one sibling that reported being diagnosed with a frozen shoulder. This compared to four out of 83 (5%) patients in the control group (risk ratio = 3.3, 95% CI = 1.1–9.7, $p < 0.02$). None of the patients in either group who reported a sibling with a frozen shoulder were diabetic.

DISCUSSION

Diabetes has been reported to be prevalent in up to 38% of patients diagnosed with a frozen shoulder [1–4] and, in a further study, 71% of patients were diabetic or had a pre-diabetic state on blood testing [3]. The present study confirms that there is an increased prevalence of diabetes in patients with frozen shoulder compared to a control group.

Hypothyroid disease has been reported in up to 14% of patients with frozen shoulder [1,2,4]. All of these studies used a clinical diagnosis of frozen shoulder that may include patients with an incorrect diagnosis or some other intra-articular pathology. Only one of the studies included an age-matched control group [2] and concluded that there was no statistical difference in the prevalence of thyroid disease between the two groups as a whole, although it did show a significant difference in females. Eight percent of patients in the present study with frozen shoulder also suffered from hypothyroid disease compared to 4% in the control group. This shows a trend towards a higher incidence of thyroid disease in patients with frozen shoulder, although there was no statistical significant difference between patients with arthroscopically proven frozen shoulder and an age- and sex-matched control group. We consider that measurement of thyroid function in patients and controls is the only accurate method for settling the matter, although we could not obtain ethical approval for this.

Higher cholesterol and triglyceride levels have been found in patients with frozen shoulder compared to a control group [8]. That study again used a clinical diagnosis of frozen shoulder. The present study with arthroscopic confirmed frozen shoulder has shown that a similar percentage of patients are diagnosed with high cholesterol in both the frozen shoulder group and control groups.

Clinically diagnosed frozen shoulder was found in 3.3% of male post cardiac surgery patients [10] and a small study of 32 clinical diagnosed frozen shoulder patients suggested an increased prevalence of heart disease compared to a control group, although this was not statistically significant [9]. In the present study, heart disease was defined as any heart problem that required medication or intervention (excluding hypertension) and the definition was kept broad and has not been previously tightly defined. Using this definition, the present study found no statistical significance between the two groups in the prevalence of heart disease.

The genetic association for frozen shoulders has been suggested by case reports [11] or twin studies [12,13]. One study has suggested no increased risk of suffering from frozen shoulder even if a sibling does [17]. However, that study used a clinical diagnosis of frozen shoulder and used the patients spouse as the control group. This is neither sex- nor age-matched. Using an age- and sex-matched control group, we have found there is a statistically significant increased risk of suffering from frozen shoulder if a sibling has frozen shoulder. Furthermore, those patients who reported a positive sibling were not diabetic, suggesting this may be an independent factor rather than a reflection of a genetic diabetic trait. However the siblings were not contacted directly and the diabetic status of the siblings is not known. Therefore, the reporting of relatives with a frozen shoulder relies on the accurate diagnosis and recall by the patients, which could be a source of error. This is why we only asked about siblings and not the extended family in the present study.

Dupuytren's disease has been found in 52% of patients clinically diagnosed with frozen shoulder [18] and, in one study, 45% of patients with Dupuytren's disease had an associated frozen shoulder [19]. Dupuytren's disease was not included in the present study because a previous study showed that patients are often unaware of having early signs of the disease, such as pits or nodules that can be detected by a surgeon, although they are insignificant to the patient [18].

It is accepted that the present study has used a group of patients with frozen shoulder that require operative intervention as a result of the severity of their disease and may not reflect all patients who are diagnosed with frozen shoulder. However, this ensured that all of the patients had arthroscopic evidence of frozen shoulder and

therefore a precise diagnosis, and excluded all mimics or those with other pathology.

In conclusion, the present large study of primary frozen shoulder patients has demonstrated that diabetes mellitus is a statistically significant risk factor for frozen shoulder. It has also suggested that having a sibling who has suffered with frozen shoulder may be an independent risk factor for frozen shoulder and adds to the argument of a possible genetic link for frozen shoulder. The results relating to the other medical co-morbidities raise questions about the previous studies that did not include control groups. It is likely that the prevalence of these co-morbidities reflects the age of the patients involved and may not represent independent associations. More work needs to be conducted in this area and it is time that these conditions were no longer quoted in the literature without compelling evidence.

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