Long-term outcome of frozen shoulder

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Two-hundred and sixty-nine shoulders in 223 patients with a diagnosis of primary frozen shoulder were studied. The main outcome measure was the Oxford shoulder score. The mean follow-up from symptom onset was 4.4 years (range, 2-20 years). The mean age at symptom onset was 53.4 years; with women affected more commonly than men (1.6:1.0).Twenty percent of patients reported bilateral symptoms, but there were no recurrent cases. In the long term, 59% of patients had normal or near normal shoulders and 41% reported some ongoing symptoms. The majority of these persistent symptoms were mild (94%), with pain being the most common complaint. Only 6% had severe symptoms with pain and functional loss.Those with the most severe symptoms at condition onset had the worst long-term prognosis, $P < .001$. *(J Shoulder Elbow Surg 2007;■:1-6.)*

Primary frozen shoulder is a common, severely debilitating condition that is frequently difficult to manage. Its prevalence is reported as 2-5%.[4,10,20] The diagnosis of frozen shoulder is made on clinical grounds utilizing a set of criteria described by Codman.[15] Shoulder stiffness may also occur after fracture or in association with joint diseases, such as osteoarthritis; this is commonly referred to as a secondary frozen shoulder.

There are few studies on the outcome of frozen shoulder, and these reports often involve small numbers of patients (range, 21-62 patients).[1,17,18,28,34,37] Interpretation is difficult if patients studied are in the nontreatment arm of a clinical study. Our understanding of the natural history of the condition is, therefore, based on limited information. This evidence suggests that this is a condition that affects more women than men; is most common in the 40–60-year-old age group; is characterized by pain and stiffness in the shoulder passing through three phases: pain, stiffness, and resolution; and invariably leads to full functional recovery.[1,17,28,34,37]

Frozen shoulder has been reported to be associated with a number of conditions: Dupuytren's disease,[8,23,38] thyroid disease,[2,44] Parkinson's disease,[35] osteoporosis and osteopaenia,[26,30] cardiorespiratory disease,[3,42] stroke,[22] hyperlipidaemia,[9] ACTH deficiency,[13] upper limb minor trauma,[39] cardiac[33,40] and neuro-surgery,[5] and diabetes, where the condition is often longer lasting and more difficult to treat.[4,24,27,32]. A genetic basis has also been suggested.[19]

The pathology of frozen shoulder remains unclear; however, there is evidence to suggest that there is an initial inflammatory process[7,29,36,41,43] leading to fibrosis.[8,20,25,29]

The aims of this study are to describe the medium and long-term outcome of primary frozen shoulder using a validated patient based questionnaire in a large clinic-based population of patients, and to identify any prognostic factors.

MATERIALS AND METHODS

Patients were identified from the register of diagnostic codes for a specialist shoulder clinic over a 5-year period (1997–2002). The diagnosis of frozen shoulder was confirmed from the patient records and was made using Codman's criteria; namely, shoulder pain that comes on slowly and is felt at the deltoid insertion; an inability to sleep on the affected side; atrophy of the spinati; and little in the way of local tenderness. In addition, there is restriction of both active and passive movement with painful and restricted elevation and external rotation. The pain is very trying, but the patient is able to continue with daily habits and routines. Shoulder radiographs are normal. Cases of secondary frozen shoulder and patients with a stiff shoulder associated with a fracture, arthritis, or any significant trauma were excluded. Cases where there was any doubt about the diagnosis existed were also excluded.Following ethical approval (AQREC A03.027), patients identified by the above criteria were sent a detailed questionnaire inquiring about their frozen shoulder. The questionnaire was designed to gather information on current level of symptoms, symptoms at presentation, and associated conditions. Two-hundred and twenty-three patients with primary frozen shoulder in 269 shoulders were evaluated.

The Oxford Shoulder Score (OSS) (Table I) was used as the outcome measure of the current level of symptoms.[16] It is completed by patients unaided and contains 12 questions, each of which has 5 response categories. Scores from

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Table I Categories of severity of shoulder symptoms

Near normal shoulder symptoms	= a score of	12 - 16	=	>90%
Mild to moderate symptoms	= a score of	17 - 36	=	50-90%
Severe symptoms	= a score of	≥37	=	<50%

questions are added to produce a single score with a range from 12 (least difficulties) to 60 (most difficulties). The score can also be expressed as a percentage, where 12 points = 100% and 60 points = 0%. The assessment is based on the symptoms experienced in the shoulder during the preceding 4 weeks and, therefore, reflects their condition at the time of completion of the questionnaire. The OSS has been shown to be internally consistent, reliable (reproducible), valid, and sensitive to clinical change (responsive).[16,31]

Patients were separated into 3 categories of severity of shoulder symptoms based on the OSS (Table I). Patients were asked about associated conditions and about the onset and severity of their symptoms. Onset of symptoms was assessed as either slow or sudden (within 1-2 days) and severity of symptoms in the first 6 months as either none, mild, moderate, severe, or unbearable. Episodes of related minor trauma were documented.

To investigate the genetics of frozen shoulder; patients were questioned about family history of frozen shoulder. They were asked if any of their siblings had been diagnosed by their GP or hospital as having a frozen shoulder. The same question was asked regarding the spouse (as a control) to allow relative risk calculations to be made. Relative risk (RR) was calculated using the formula below:

$$\text{Relative risk} = \frac{\%\ \text{siblings with frozen shoulder}}{\%\ \text{spouses with frozen shoulder}}$$

A ratio of greater than 1:1 suggested an increased risk to siblings.

Data analysis

The data from all completed questionnaires were entered onto a secure database (Microsoft Access 2002, Microsoft Corporation, Redmond, WA). Statistical tests were performed using SPSS 12.0 (SPSS Inc, Chicago, IL). The Oxford shoulder scores were not normally distributed (Shapiro-Wilk test); therefore, the Mann Whitney U test (Wilcoxon rank test) was used to analyze the OSS data.

RESULTS

Completed questionnaires from 223 patients with information on 269 shoulders were evaluated. The mean age of patients at condition onset was 53.4 years (range, 27-85 S.D. +/- 8.9). Of the 223 shoulders, 137 (61%) were female and 86 (39%) were male: (1.6:1.0). Mean time from onset of symptoms was 52.3 months (range, 24-240 months) with 90% of shoulders followed up at a minimum of 36 months.

Symptoms were reported as slow in onset in 61% (163 shoulders) and sudden in 39% (106 shoulders). Twenty percent of patients (45/223) reported bilateral symptoms (31 females and 15 males, a ratio of 2:1); none occurred simultaneously. Right shoulders were affected in 46% (124) and left in 54% (145). Two-hundred and forty-four patients were right-hand dominant and 25 left-hand dominant. The dominant arm was affected in 48% (129) and nondominant in 52% (140). In 22% (60 shoulders), a history of minor trauma to the limb was reported prior to the onset of symptoms. There were no recurrent cases. Of the 223 patients, 31 (14%) were diabetic; 7 (3%) had Dupuytren's contracture; 5 (2%) hyperthyroidism; 14 (6%) hypothyroidism; 6 (3%) osteoporosis; 38 (17%) high cholesterol; 5 (2%) stroke; 15 (7%) heart disease; 8 (4%) lung disease; and only 1 patient (0.5%) reported having Parkinson's disease.

The mean interval from symptom onset to completion of OSS was 4.4 years (52.3 months), range, 2-20 years. The mean OSS for all patients was 18 (87.5%), range, 12-54 points (standard deviation 9.2). In 59% of patients, symptoms were near normal, in 35% mild to moderate, and in 6% severe (Table II). The proportion of shoulders with these symptoms within each follow-up period is shown in Figure 1.In 35% of patients reporting persistent mild to moderate symptoms, the most common problems were related to pain (Q1, Q8, Q11, Q12) (Figure 2 and Table II). In 6% of patients with persistent severe symptoms, the reported problems were more varied and included functional as well as pain related issues (Figure 3).

Analysis of the severity of presenting symptoms yielded a subgroup at risk of a worse prognosis. Those patients who reported unbearable symptoms in the first 6 months had a significantly worse outcome compared to those who reported severe, moderate, or mild symptoms at presentation ($P = .009$). The mean OSS's for these groups were 24.02, 17.46, 16.60, and 16.25, respectively. Twenty-one percent of patients (9/42) with unbearable symptoms at onset went on to have persistent severe symptoms, compared to the 3.1% (7/227) without unbearable symptoms, $P < .001$ (chi-square test).

Patients received a variety of treatments and often received more than one modality of treatment; including no treatment (95); physiotherapy (55); steroid injection (139); manipulation under anesthesia (MUA) (5); MUA and arthroscopic release (5); and MUA and arthroscopic hydrodistension (20). This plurality of treatments leads to loss of independence between intervention groups and, unfortunately, makes meaningful comparisons among interventions impossible.

Patients were grouped according to a number of demographic factors (Table IV). The OSS of the subgroups closely approximate the overall mean. With regard to worse outcome, the greatest differences are seen in the diabetic and injury groups, which did not reach statistical significance, $P = .456$. Although

Table II Number of shoulders at final follow-up

Time from symptom onset in years	2	3	4	5	6	7	>7	Total
Near normal shoulder symptoms	11	49	34	20	24	16	3	159 (59%)
Mild/moderate symptoms	15	29	16	14	10	8	1	94 (35%)
Severe symptoms	1	9	1	1	3	0	1	16 (6%)

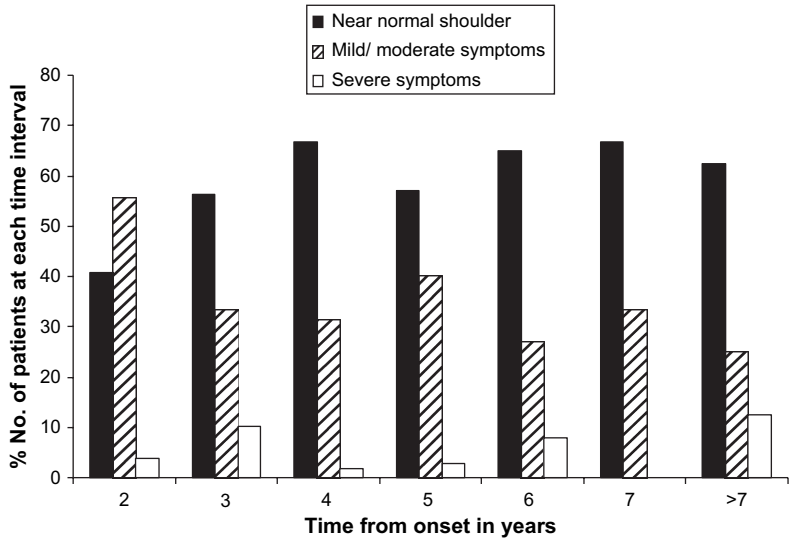

Figure 1 OSS at time from symptom onset.

more common in women, there was no difference in outcome between the sexes $P = .642$. There was also no significant difference in outcome for those with Dupuytren's disease or sudden versus slow onset, or for dominant arms. No significant difference in OSS was seen in those with a family history of the condition, $P = .211$.

Ninety-one percent of patients (203/223) were successfully contacted to confirm their marital status, number of siblings, and family history of frozen shoulder. There were 269 siblings and 176 spouses, of whom 13 and 10 reported a positive history of frozen shoulder, respectively. This gives a relative risk of 0.85.

DISCUSSION

This is the largest study of outcome in frozen shoulder to date. The OSS has been used as the principle outcome measure. Use of a patient based outcome measure rather than a physician based score gives a validated subjective score of the patients symptoms, free of clinician bias, but it does not give precise measurements of strength and range of movement.

The study confirms a female preponderance (1.6:1.0) and that symptom onset is most common in the 6th decade. Bilateral involvement was found in 20% of cases, but rates of up to 34% have previously been reported.[37]

Full resolution of symptoms does not always occur, but persistent symptoms are most commonly mild. At the mean follow-up of 52.3 months, 59% had a near normal shoulder, 35% had mild/moderate symptoms, and 6% had severe symptoms. These categories of the OSS were developed to ease interpretation of individual scores by grouping the data.

The most commonly reported problems in the 35% of patients reporting persistent mild to moderate symptoms were in response to the questions exclusively related to pain: questions 1, 8, 11, and 12 (Table II and Figure 2). The reported problems in the 6% of patients with persistent severe symptoms were more varied and included functional problems, as well as pain related issues (Figure 3). Fifty-six percent of shoulders reviewed at less than 3 years reported higher rates of mild/moderate symptoms than near normal shoulder symptoms (41%); however, near normal shoulder symptoms predominated thereafter (56% vs 33%). This suggests that symptoms improve in the first 3 years from onset and that this improvement then ceases.

We attempted to identify subgroups of patients who may have a worse or better prognosis (Table IV). Those patients who reported unbearable symptoms in the

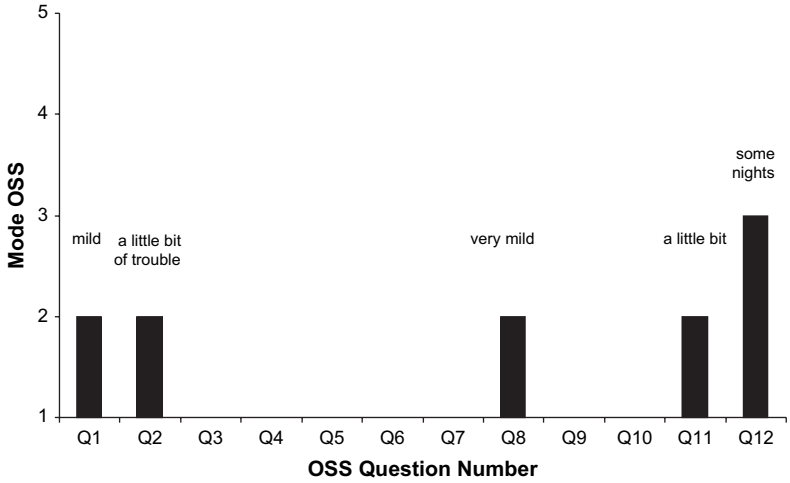

Figure 2 Most common OSS's for individual questions in the persistent mild/moderate symptoms group.

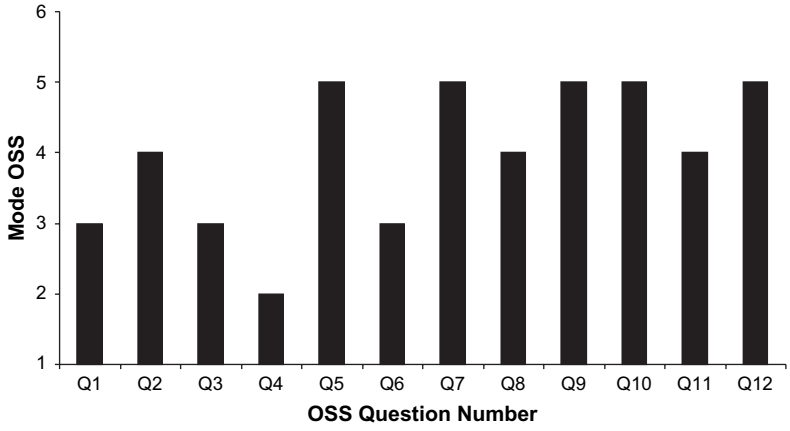

Figure 3 Most common OSS's for individual questions in the persistent severe symptoms group.

first 6 months from symptom onset—rather than severe, moderate, or mild symptoms—had a worse long-term outcome ($P < .01$). This is corroborated by the fact that 21% of patients (9/42) with unbearable symptoms at onset compared to 3.1% (7/227) without unbearable symptoms had persistent severe symptoms ($P < .001$). No other distinguishing characteristics to this subgroup were identified. Recall bias may have influenced this finding, in that patients with a poor outcome may have recalled their symptoms as initially being more severe.

Most of the subgroups had very similar scores to the overall mean.Those with a worse mean OSS of more than 1 point were the diabetic group (mean OSS = 19.7) and injury group (mean OSS = 19.1), but neither was statistically significantly different. Diabetics have been reported to be affected more commonly and to carry a worse prognosis.[4,24,27,32]Our study supports this but does not reach statistical significance, most probably due to the small subgroup size, $P = .456$ (n = 35/269).

Arm dominance has been suggested as affecting the prognosis,[6,14] but no evidence of a difference was found in this study. Minor trauma to the affected limb was noted in 22% of patients prior to the onset of their symptoms; this was most frequently in the form of a very mild soft tissue injury to the upper extremity.It did not preclude the diagnosis of primary frozen shoulder and did not influence the final outcome. Codman stipulated an insidious onset of symptoms in his diagnostic criteria; 61% of shoulders in this study group reported slow onset of symptoms and the remainder described a sudden onset within 1-2 days. There was no difference in outcome between these groups.

Frozen shoulder has been reported to be associated with a number of different conditions. Patients only reported comorbidity if their condition had been diagnosed by a hospital or family doctor. This

Table III OSS at final assessment; expressed as a mean score and as a % for various subgroups

	No. of shoulders	Mean OSS	Mean OSS as %
Total	269	18.1	87.3
Diabetes	35	19	85.4
Injury	60	19	85.1
Bilateral	45 (20%)	18.2	87.1
Right affected	124	18.6	86.3
Left affected	145	17.6	88.3
Dominant	129	18.1	87.3
Nondominant	140	18.7	86
Slow	163	18.2	87.1
Sudden	106	18	87.6
Female	167	18.2	87.1
Male	102	17.8	87.9
Sibling Hx	13	13.9	91.1
Dupuytren's	9	13.3	97.2

OSS, Oxford Shoulder Score

is a specialist clinic population and assessment of disease association is, therefore, subject to bias. Of particular note is the small number of patients with Dupuytren's disease (3%) seen in this study, compared to rates of up to 52% reported in the literature.[38] This low rate does not directly contradict these recent findings,[38] as the low rate could be due to under-reporting by patients who are often unaware that they have Dupuytren's disease.

A recent twin study has suggested that genetic factors may play a part in the etiology of frozen shoulder.[19]This is reportedly supported by the observed association with Dupuytren's disease, which is also believed to have a heritable component.[11] Sibling relative risk, using spouses as controls, was used in this study as a method of assessing the presence of a genetic etiology. The use of relative risk and spouses as controls is well established.[12,21] An increased sibling relative risk would indicate a possible genetic etiology to the condition.[12] We found a relative risk of .85, which suggests that genetic susceptibility is not an important factor in the etiology of frozen shoulder. However, the drawbacks to reaching a conclusion are twofold. First, the study relied on the patient's knowledge of sibling and spouse disease, which may lead to significant under reporting. This is a comparison of the two, and because the same reporting error exists for both, we believe the result has validity. Second, the study relies on the accurate diagnosis of frozen shoulder for the sibling and spouse population made outside of the specialist clinic.

CONCLUSION

This study shows that frozen shoulder occurs most commonly in the 6th decade and affects women more than men 1.6:1.0. It is most commonly of gradual onset (61%) but may develop rapidly over a 24-48 hour period (39%). It may be precipitated by minor trauma and is bilateral in 20% of cases. It does not appear to recur in the same arm. The OSS for patients with frozen shoulder peaks and improves during a 1-3 year period after onset.

In patients with frozen shoulder presenting to a shoulder clinic, more than 50% will have a near normal shoulder in the long term; 35% of patients will have persistent symptoms of mild pain and loss of function long term, with mild pain being the most common feature. Only 6% will have severe symptoms long term. Those patients with the most severe symptoms at onset carry the worst prognosis.

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