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Frozen shoulder: a long-term prospective study

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SUMMARY As the natural history of frozen shoulder is poorly documented, a prospective study of 40 patients followed up for 40–48 months (mean 44 months) is described. The range of movement was significantly less than age- and sex-matched controls. Objective restriction was severe in five patients and mild in a further 11. Patients were often unaware that shoulder range was impaired. Dominant arm involvement, manual labour, and mobilisation physiotherapy were associated with a less satisfactory outcome. We conclude that, while objective restriction persists, there is little functional impairment in the late stage of frozen shoulder.

The prognosis for recovery and effectiveness of therapy of frozen shoulder remain uncertain. Hazleman[1] in a retrospective survey of 130 patients with painful stiff shoulder found 15% to have persistent disability. Simmonds[2] reported 15 of his 21 patients (71%) to be symptomatic after 3 years. Clarke *et al.*[3] retrospectively reviewed 48 patients after a period of 6 years and found 20 (42%) to have some range deficit. A prospective 5–10-year study of 49 patients by Reeves[4] showed 3 patients to have severe and 22 mild persistent disability. Dickson and Crosby[5] and Meulencracht and Schwartz[6] also reported prolonged disability in many patients. On the other hand Watson-Jones[7] reported less than 5% of his 26 patients with frozen shoulder to have any disability by 6 months, although simple pendular exercise was the only therapy given. Grey[8] also found recovery of 24 of 25 patients with 'untreated' frozen shoulder followed up for two years. Withers,[9] Haggart *et al.*,[10] and Lundberg[11] also reported a favourable outcome. These conflicting reports probably reflect on both patient selection and the criteria used for diagnosis and recovery.

The aims of this study were to record the long-term outcome and to try to assess whether any particular clinical features at presentation or the type of therapy given influenced this.

Patients and methods

Forty of the 42 patients included in the therapeutic study[12] attended for review 40–48 months (mean 44 months) after initial presentation. One patient could not be traced and one patient was excluded owing to a recent mastectomy on the affected side. The criteria used for the diagnosis of frozen shoulder in the initial study and the exclusion factors have previously been reported.[12]

History. At review, persistent or recurrent pain and/or restriction of movement was recorded. The occupation and type of activity performed in the convalescent phase was also noted.

Examination. The passive range of movement was measured in an identical manner to that of the initial study by means of a spirit goniometer.[13]

The 75 normal people of similar age used in the initial study also provided a control group for passive range in each decade (40–70) in this study. Forty of the controls were carefully matched for age and sex with the patients. Student's *t* tests were used for statistical analysis unless otherwise stated.

Results

Residual symptoms. Although 18 patients (45%) had residual symptoms at review (Table 1), these were severe in only one case. Seven patients (18%) had developed symptoms in the opposite shoulder, four having a frozen shoulder.

Table 1 *Symptoms at review (40 patients)*

	n	% *of total*
Mild ache	7	18
Mild restriction	4	10
Mild ache and restriction	6	15
Severe pain and restriction	1	3

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Passive range. Comparison of the mean range of passive movement at 'discharge' (at eight months follow-up) with the mean range at 'review' (mean follow-up 44 months) by paired *t* tests (Table 2) showed significant improvement in all movements, though five patients had shown some deterioration of range during this time. But when the range at review was compared with that in the 'control' group (Table 3) significant restriction in range of all movements except glenohumeral abduction and flexion was still present.

Of the 11 patients (28%) who considered their range restricted at review (Table 1) only five were found to have this on objective testing. However, many other patients who regarded their range as normal were found to have significant restriction. Sixteen of the 40 (40%) patients at review had not attained a range of total flexion, abduction, and rotation comparable with the minimum range of all the controls of similar age and sex. Five of the patients still had significant (more than 25%) reduction in the total range.

Age and sex. The range in the male patients was less than in the females and showed a proportionately larger decrease with age, but the difference did not reach statistical significance and was similar to the differences reported in the control group.

Arm dominance. At review the patients with non-dominant arm involvement had a better range (Table 4) than those with the dominant arm involved. The

Table 2 *Improvement in range of movement from eight months (discharge) to review*

Movement	*At 8 months, mean (range)*	*At review, mean (range)*	*Mean improvement between visits*	*Paired t test*	
				t	*p*
Total flexion	144° (80–160°)	156° (90–175°)	+12°	4·52	0·0001
Glenohumeral flexion	69° (50–80°)	89° (60–100°)	+20°	6·25	0·0001
Total abduction	134° (60–175°)	146° (70–175°)	+12°	3·58	0·0009
Glenohumeral abduction	66° (30–85°)	80° (55–90°)	+14°	5·36	0·0001
External rotation	40° (0–70°)	52° (15–85°)	+12°	4·58	0·0001
Total rotation	99° (50–140°)	147° (60–180°)	+48°	11·3	0·0001

Table 3 *Comparison of range at review with that in matched controls*

Movement	*At review, mean (range)*	*Controls, mean (range)*	*Mean difference*	*Paired t test (DF = 78)*	
				t	*p*
Total flexion	156° (90–175°)	167° (145–180°)	11°	4·06	0·0002
Glenohumeral flexion	89° (60–100°)	90° (65–105°)	1°	0·9	NS
Total abduction	146° (70–175°)	163° (140–180°)	17°	5·29	0·0001
Glenohumeral abduction	80° (55–90°)	83° (60–100°)	3°	1·1	NS
External rotation	52° (15–85°)	65° (40–90°)	13°	3·67	0·0007
Total rotation	147° (60–180°)	164° (140–180°)	17°	3·98	0·0003

NS = not significant.

Table 4 *Comparison of range at review with dominant and non-dominant arm involvement*

Movement	*Dominant group, mean (range) n = 21*	*Non-dominant group, mean (range) n = 19*	*Main difference*	*Student's t test*	
				t	*p*
Total flexion	151° (90–170°)	161° (150–175°)	10°	2·09	0·050
Total abduction	141° (70–160°)	153° (130–175°)	12°	2·05	0·044
External rotation	49° (15–75°)	56° (30–85°)	7°	1·32	0·194*
Total rotation	140° (60–175°)	155° (140–180°)	15°	1·88	0·067*

*Not significant.

Table 5 *Comparison of mean recovery in range in dominant and non-dominant groups from eight months to review*

Movement	*Mean recovery*		*Student's t test*	
	Non-dominant n=19	*Dominant n=21*	*t*	*p*
Total flexion	19°	5°	2·74	0·009
Total abduction	25°	0·7°	2·75	0·009
External rotation	17°	7°	1·84	0·073*
Total rotation	57°	40°	2·12	0·041

*Not significant.

difference was just significant (at the 5% level) for total abduction and total flexion, but not rotation. During the first eight months the dominant arm had consistently shown a better (but not significant) range. Comparison of the recovery from eight months to review (Table 5) showed that the accelerated recovery of the non-dominantly affected group was a later development.

Manual work. The patients who had resumed manual labour or strenuous activity in the convalescent phase also had a significantly more restricted range (Table 6) at review.

Duration of symptoms at presentation and mode of onset. The 18 patients who presented early—i.e., within three months of onset of symptoms—showed no advantage over the 22 who presented between four and 12 months with regard to the rate or extent of recovery. The 12 patients who reported trivial trauma as a precipitating factor also showed no difference from those (29 cases) in whom symptoms arose spontaneously.

Special investigations at presentation. Although 17 patients (44%) had increased immune complex levels, 10 (25%) increased C-reactive protein levels, and eight (20%) raised sedimentation rates at presentation,[14] these abnormalities did not appear to be associated with any difference in outcome. Technetium disphosphonate scan uptake, arthrographic features, and plain *x*-ray degenerative changes[15] have also been shown to have no value in predicting eventual recovery.

Therapy. The patients who received Maitland mobilisations as part of physiotherapy treatment in the first 6 weeks[16] had greater restriction in range at review (Table 7) than the groups who received steroid injections, ice, or no specific therapy. While analysis of variance did not show a significant difference between the groups, contrasting the range at review in the mobilisation group with the range in the other groups (general linear models procedure) showed a significant difference (at the 5% level) for all movements. At presentation only total rotation had been significantly more restricted in the mobilisation group.

Discussion

This study has concentrated on the assessment of

Table 6 *Comparison of mean range at review in manual and sedentary workers*

Movement	*Manual workers, mean (range) n=12*	*Sedentary, mean (range) n=28*	*Difference*	*Student's t test*	
				t	*p*
Total flexion	150° (90–175°)	164° (135–170°)	14°	2·00	0·050
Total abduction	137° (70–175°)	152° (130–165°)	15°	2·01	0·050
External rotation	44° (15–70°)	57° (40–85°)	13°	2·68	0·010
Total rotation	132° (60–165°)	157° (125–180°)	25°	2·87	0·010

Table 7 *Comparison of mean range at review in the four treatment groups*

	Mobilisation group, mean (range) n=11	*Steroid injection group, mean (range) n=10*	*Ice therapy group, mean (range) n=11*	*Non-treatment group, mean (range) n=8*
Total flexion	147° (90–170°)	161° (140–175°)	156° (140–175°)	163° (160–170°)
Total abduction	135° (70–175°)	150° (110–165°)	152° (130–175°)	151° (140–165°)
External rotation	46° (15–80°)	52° (40–75°)	55° (30–70°)	57° (40–80°)
Total rotation	132° (70–180°)	153° (120–175°)	152° (130–170°)	154° (125–180°)

both the subjective and objective outcome after at least three years, as the long-term prognosis in frozen shoulder remains uncertain.

We have shown a marked discrepancy between the patient's subjective awareness of residual range deficit and measurable (objective) restriction in comparisons with a normal control group of similar age and sex. Only half of the patients (5/11) who regarded their range as abnormal were found to have any reduction in total range. However, 40% of the entire patient group (16/40) had some range deficit on objective measurement. While one patient complained of severe pain and restriction, five were considered to have severe (greater than 25%) restriction. That so many patients with range deficits regarded their recovery as complete shows the excellent adaptation to this minor disability achieved by most of them. This difference in subjective and objective assessment of recovery, plus the variation in the diagnostic criteria for frozen shoulder and the length of follow-up required, probably accounts for the conflicting reports with regard to prognosis and therapy. We have shown that significant improvement continued after eight months but that the mean range at review was still markedly less than in an age- and sex-matched control group.

We have confirmed the observations of Clarke *et al.*[13] that age and sex affect the range of movement in both patients and controls. We have also confirmed that dominant arm involvement is associated with a less satisfactory recovery, although interestingly this phenomenon was a later development. We have also found that manual labour in the convalescent phase may retard the recovery. The mobilisation group was not directly comparable with the other treatment groups, as total rotation was always significantly more restricted. At review, however, all movements were more reduced in this group. This may reflect a detrimental effect of active physiotherapy in the acute stage in a similar way to an increased stress caused by manual work or dominant arm involvement. Treatment with steroid injection, ice, or pendular exercise produced no differences in the rate or extent of late recovery.

We have not confirmed that the duration of symptoms before therapy[1] or the mode of onset affect the long-term prognosis. While differences found in the sedimentation rates and immunological and radiological investigations in the acute stage may reflect differences in the underlying pathology, they bear no relation to prognosis.

We have therefore found five patients (12%) with severe and 11 (28%) with mild shoulder restriction on objective testing after three years. However, only one patient regarded symptoms as severe. This accords with the experience of Clarke *et al.*,[13] who retrospectively assessed their patients. This review forms part of a prospective study of a closely defined group of patients who have all had detailed examination, investigation, and close follow-up. We conclude that, although the range of movement remains objectively restricted, there is little functional impairment in the late stage of frozen shoulder.

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