Treatment of frozen shoulder by manipulation under anaesthetic and injection

DOES THE TIMING OF TREATMENT AFFECT THE OUTCOME?

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The effect of timing of a manipulation under anaesthetic (MUA) and injection of corticosteroid and local anaesthetic for the treatment of frozen shoulder has attracted little attention to date. All studies describe a period of conservative treatment before proceeding to an MUA. Delay has been associated with a poorer outcome.

We present a retrospective review of a prospectively collected, single-surgeon, consecutive series of 246 patients with a primary frozen shoulder treated by MUA within four weeks of presentation. The mean duration of presenting symptoms was 28 weeks (6 to 156), and time to initial post-operative assessment was 26 days (5 to 126). The Oxford shoulder score (OSS) improved by a mean of 16 points (Wilcoxon signed-ranks test, p < 0.001) with a mean OSS at this time of 43 (7 to 48). Linear regression analysis showed no correlation between the duration of presenting symptoms and OSS at initial follow-up (R2 < 0.001) or peri-operative change in OSS (R2 < 0.001) or OSS at long-term follow-up (R2 < 0.03). Further analysis at a mean of 42 months (8 to 127) revealed a sustained improvement with a mean OSS of 44 (16 to 48).

A good outcome follows an MUA and injection of corticosteroid and local anaesthetic in patients with primary frozen shoulder, independent of the duration of the presenting symptoms, and this improvement is maintained in the long term.

The cause of frozen shoulder is poorly understood. It is a credit to Codman1 that his description is as true today as it was when he published it in 1934. He described the condition as being characterised by ‘slow onset, pain near the insertion of the deltoid, inability to sleep on the affected side, painful and restricted elevation and external rotation and a normal radiological appearance’.1 Reeves,2 in the original natural history study, determined a triphasic natural history: an initial ‘freezing phase’ characterised by worsening pain of insidious onset, followed by a painful and stiff ‘frozen phase’. Ultimately the shoulder symptoms resolve during a ‘thawing phase’. Each of these phases may last many months.2

In many patients with this condition it resolves quickly, without medical attention, or with simple measures. A few patients, however, are significantly disabled during the course of the disease, particularly during the frozen phase. Non-surgical forms of treatment include supervised neglect, analgesia, self-directed exercise, formal physiotherapy and intra-articular injections of corticosteroid, local anaesthetic or both, nerve blockade and hydrodistention.3 Further treatment, including surgery, is reserved for resistant cases or functionally compromised patients. Options include manipulation under anaesthesia4-6 with or without corticosteroid and local anaesthetic injection, arthroscopic release7 and open release.8 Our preference is for manipulation under anaesthetic (MUA) with a corticosteroid (depo-medrone) and local anaesthetic (bupivacaine) injection.

The effect of timing of treatment has had little attention in the literature to date. Most published studies describe a defined period of conservative management before proceeding to an MUA. Delay has been associated with a poorer outcome.9 We set out to evaluate the influence of timing of an MUA in relation to short- and long-term outcome in a cohort of patients with primary frozen shoulders, treated in the frozen phase. We tested the null hypothesis that there is no difference in outcome between frozen shoulders treated with MUA early in the course of the condition and those treated later.

Patients and Methods

We performed a retrospective review of a prospectively collected, single-surgeon, single institution, consecutive series of patients over a period from January 1999 to January 2010.
The notes were independently reviewed by two of the authors (WJCT, DAW). Institutional ethical approval was obtained. Our inclusion criteria for entry into the study were as follows: (1) patients with a frozen shoulder in the frozen phase, (2) insidious onset of symptoms without a definable cause and (3) normal radiographs.

Our exclusion criteria were: (1) non-primary frozen shoulder, (2) patients who were unfit for an anaesthetic and (3) patients who declined this form of treatment. We included diabetic patients. Patients were listed for MUA as soon as the inclusion criteria were met and no subject waited longer than four weeks for their procedure. The duration of symptoms was recorded at the time of initial consultation.

The procedure was performed as a day case and involved positioning the patient supine on a trolley in the anaesthetic room. A general anaesthetic is then administered. With one hand the scapula is stabilised and the range of gleno-humeral motion recorded. The surgeon’s other hand supports the proximal humerus and with a short lever arm to reduce risk of iatrogenic injury, the shoulder is manipulated sequentially through a range of motion (abduction, flexion, external rotation, cross body adduction and internal rotation). The final range of movement was recorded and 10 ml 0.5% bupivacaine and 80 mg of depo-medrone were injected into the glenohumeral joint via the direct anterior approach.

All patients were offered a rehabilitation programme that commenced on the day after surgery with one session of hydrotherapy. Subsequently, weekly routine physiotherapy continued until there was no further improvement in range of movement. The median number of sessions required was three. Patients were assessed at three weeks after MUA by the lead author (DAW). The treatment algorithm is shown in Figure 1.

Outcome measures included the Oxford shoulder score (OSS) assessed immediately before surgery, at each follow-up appointment and by postal questionnaire; the range of movement of the shoulder before and after manipulation; and the rate of complications.

Our experience has been that those who achieved a successful result reported significant improvement in pain within three to four days and improvement in stiffness within the first three weeks. Those who had persistent symptoms at the three-week appointment, with a change in OSS < 6, were considered unlikely to improve further and were offered a further MUA. A postal survey with follow-up telephone consultation was conducted to assess subsequent progress.

Statistical analysis. The collected data was compiled onto a secure database (Microsoft Excel 2007; Microsoft Corp., Redmond, Washington). Statistical tests were performed using SPSS 19.0 (SPSS Inc., Chicago, Illinois). The OSS data and intra-operative range of movement data were non-parametric in distribution (Shapiro-Wilk test). The Wilcoxon signed-ranks test was used for data analysis.

Results

A total of 315 consecutive patients with a frozen shoulder in the ‘frozen phase’ were referred to the lead author (DAW) during this period, and 242 patients (258 shoulders) met the inclusion criteria; 12 declined an MUA leaving 246 shoulders in 230 patients (in 110 men and 136 women) in the study. The three-week follow-up was attended by 228 patients with 244 shoulders (99%), and 184 patients with 200 shoulders (81%) were subsequently further assessed.

Of the 246 shoulders, 109 were affected on the right side and 137 on the left, 175 were right-handed and 23 were left-handed (48 unknown). The mean age was 57 years (27 to 80). A total of 30 patients (12%) were diabetic, of whom 18 (7%) were insulin-dependent.

The mean duration of symptoms before MUA was 28 weeks (6 to 156) (Fig. 2).

All patients were in the frozen phase of the disease, which was confirmed by a restricted range of shoulder movement on examination under anaesthetic. Manipulation resulted in a strongly significant improvement in range of movement (Wilcoxon signed-ranks test, p < 0.001) (Table I).

The three week appointment occurred at a mean 26 days (5 to 126) after MUA. Two patients did not attend early follow-up but both responded to the questionnaire.
There was a strongly significant improvement in the mean OSS of 16 points, recorded immediately before MUA and at the first follow-up (Wilcoxon signed-ranks test, \( p < 0.001 \)) with a mean first follow-up OSS of 43 (7 to 48) (Fig. 3). Before MUA there were no patients with normal or near normal symptoms (OSS > 43) and 67 of 244 (27.5%) reported severe symptoms (OSS < 25). At three weeks after MUA, 149 of 244 (61.1%) had regained normal or near normal symptoms with no reports of severe symptoms.

We performed linear regression analysis on a scatter plot of OSS at three week follow-up \( \text{versus} \) duration of presenting symptoms (Fig. 4) and change in OSS \( \text{versus} \) duration of symptoms (Fig. 5). We assumed a linear relationship between the variables. We found no correlation between the variables in either plot (regression coefficient \( R^2 < 0.001 \)).

There were no complications as a result of the MUA. There were no fractures or dislocations, no symptoms of acute rotator cuff tear and no neurological or other iatrogenic injuries.

In total, 47 shoulders (19%) required a further MUA, and three (1%) required a third manipulation. A total of 11 shoulders (4.5%) had not improved at initial follow-up (mean change of OSS +1.3 (-6 to 5)) and were re-manipulated at the next available opportunity. In all, 36 shoulders (14.7%) improved initially before recurrence and were re-manipulated at a mean of 113 days (35 to 550). These patients were not managed with further outpatient injections or physiotherapy once the symptoms had recurred. There was no difference in age, gender or hand-dominance between this cohort and the larger study group. There were, however, a much greater proportion of diabetics in the recurrence group. One half of the insulin controlled diabetics (9 of 18 shoulders) and one quarter of non-insulin controlled diabetics (3 of 12 shoulders) required a second MUA. This compares with 11% (24 of 216 shoulders) of non-diabetic cases.

The mean OSS before the second MUA was 27 (11 to 38), representing a mean fall in OSS between MUAs of 14 points. The mean follow up after the second MUA was 28 days (11 to 129), when the mean OSS was 44 (35 to 48), a mean improvement of 11 points.
A total of eight patients (3%) required subsequent surgery, comprising six subacromial decompressions, one subacromial decompression with rotator cuff repair and one arthroscopic release. Of the seven subacromial decompressions, four had a pre-MUA MRI to aid diagnosis which revealed a normal rotator cuff in three and in one a degenerative acromioclavicular joint with related supraspinatus tendon degeneration consistent with sub-acromial impingement. The diagnosis of impingement was made clinically in six patients with only one requiring a post-MUA MRI to aid diagnosis. This revealed supraspinatus tendonitis (unfortunately there was no prior MRI with which to compare). In six of the seven patients requiring a sub-acromial decompression a full recovery occurred with only one patient having persistent symptoms at discharge. A further patient, an insulin dependent diabetic, required arthroscopic release for a recurrence seven months after an initially successful MUA. This did not give long lasting relief and she chose to pursue a non-surgical course.

A total of 200 of 246 questionnaires were returned (81%). The mean follow-up was 42 months (8 to 127) with 90% of patients evaluated at more than one year by questionnaire. The mean OSS was 44 (16 to 48), a slight improvement compared with the three week follow-up (mean 43, SD 6).

Linear regression analysis on a scatter plot of OSS at long-term follow-up versus duration of presenting symptoms (Fig. 6) was performed and no significant correlation was found (regression coefficient $R^2 = 0.03$).

**Discussion**

We present the effects of the timing of an MUA and injection on the outcome of a large, consecutive series of patients with a primary frozen shoulder. With a mean improvement of 16 OSS points at a mean follow-up of 26 days, maintained at a mean 42 months, with no surgical complication, we conclude that this form of treatment is clearly beneficial. There was no association between the improvement in outcome and the duration of presenting symptoms, thus confirming the null hypothesis of the study.

Flannery, Mullett and Colville$^9$ reported 145 shoulders treated with MUA following three months of unsuccessful conservative management. They found significantly better OSS and range of movement in patients who were manipulated within nine months of the onset of symptoms. We cannot add weight to their conclusion that an MUA before nine months results in a better outcome.

There were no complications in our series. We note the arthroscopic finding of substantial soft-tissue trauma immediately following MUA described by Loew, Heichel and Lehner.$^{11}$ This did not appear to cause any short- or long-term adverse clinical outcomes in our patients.

Our study is retrospective and presents the work of a single surgeon, whose results may not be readily transferable to the wider orthopaedic community. As a case series, there was no randomisation and no blinding of the patients, surgeon or assessor. The single surgeon, single institution nature, however, eliminates interobserver error and reduces intra-observer error. Two independent reviews of the case notes reduce the effect of data collection error.

The duration of presenting symptoms relates to both the freezing and frozen phases of the condition. This was established by patient recall at the initial consultation which may introduce recall bias. One of the original natural history studies$^2$ demonstrate the variable duration of these phases (freezing phase a few weeks to nine months, frozen phase four to nine months). They are, however, not discrete periods of time but rather an evolution of symptoms and are as such, difficult to measure individually. This is reflected in clinical practice when vague shoulder pain is only confidently diagnosed as frozen once the stiffness of the frozen phase is encountered. Our study methodology and inclusion criteria reflect this practical difficulty.

The clinical relevance of our findings are that one can expect a significant and rapid improvement, unrelated to the timing of the presentation, in these patients. Little is lost by a period of further conservative management in terms of long-term outcome. We postulate, however, that the natural history of the condition is substantially shortened by an MUA, at least in the period immediately after the procedure, and commend this as an indication for early intervention in preference to further non-surgical treatments.

MUA is a safe procedure for the management of frozen shoulder during the frozen phase. The natural history of the condition is positively affected, particularly in the few weeks post intervention, with satisfactory maintenance of results in the long-term. This beneficial effect is not related to the duration of the presenting symptoms and so a further period of conservative management after referral, at the surgeon’s discretion, is not to the detriment of the ultimate outcome.

No benefits in any form have been received or will be received from a commercial party related directly or indirectly to the subject of this article.

**References**


