Management of frozen shoulder

Management of frozen shoulder: a systematic review and cost-effectiveness analysis

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Executive summary

Health Technology Assessment 2012; Vol. 16: No. 11
DOI: 10.3310/hta16110

Health Technology Assessment
NIHR HTA programme
www.hta.ac.uk

Executive summary

Background

Frozen shoulder is a condition in which movement of the shoulder becomes restricted. The condition can vary in severity from mild pain and/or less significant restriction of movement to severe pain and/or severely restricted movement. Key characteristics are gradual onset of shoulder stiffness, severe pain, especially at night, and restriction in active and passive range of movement of the shoulder. Frozen shoulder can be described as either primary (idiopathic), if the aetiology is unknown, or secondary, when it can be attributed to another cause. It is commonly a self-limiting condition, of approximately 1–3 years' duration, although incomplete resolution can occur.

Objectives

To (1) evaluate the clinical effectiveness of strategies currently used in the NHS for the management of primary frozen shoulder and identify the most appropriate intervention by stage of condition; (2) collate patients' views and experiences of the interventions by way of a systematic review; (3) assess the cost-effectiveness of the different interventions in order to inform the development of a decision model; (4) develop a decision-analytic model to estimate the cost-effectiveness of alternative treatment options for frozen shoulder; (5) make recommendations for clinical practice; and (6) identify any gaps in the evidence, undertake value of information analysis to assess the potential value of future research on interventions for frozen shoulder and make specific recommendations for further research.

Methods

Clinical effectiveness

A systematic review was undertaken. Nineteen databases, including MEDLINE, EMBASE and the Cochrane Central Register of Controlled Trials (CENTRAL), were searched up to March 2010 for published and unpublished studies and without language restrictions. The websites of relevant organisations were scanned. The reference lists of systematic reviews were also checked to identify studies. Updated searches of MEDLINE and EMBASE were undertaken in January 2011.

Randomised controlled trials (RCTs) evaluating physical therapies, arthrographic distension, steroid injection, sodium hyaluronate injection, manipulation under anaesthesia (MUA), capsular release or watchful waiting, alone or in combination, were eligible for inclusion. Patients with primary frozen shoulder (with or without diabetes) were included. Relevant comparators were any of the treatments, no treatment or placebo. Quasi-experimental studies were included in the absence of randomised trials. For MUA and capsular release, case series of at least 50 participants with primary frozen shoulder were also eligible in the absence of controlled study designs. The main outcomes of interest were pain, range of movement, function and disability, quality of life, time to recovery, return to work and recreation, and adverse events.

Two researchers independently screened studies for relevance based on the inclusion criteria. One reviewer extracted data and assessed study quality; this was checked by a second reviewer.

Final value data were extracted where available and if not change from baseline was extracted. Disagreements were resolved by consensus and, if necessary, a third researcher was consulted.

A narrative and tabular summary of key study characteristics, quality assessment and results was undertaken. Outcomes were reported as the mean difference (MD) and 95% confidence interval (CI), except for pain, for which the standardised mean difference (SMD) was calculated. Length of follow-up was classified as short term (4 weeks to 3 months), medium term (> 3 months and ≤ 6 months) and long term (> 6 months). Where appropriate, individual study results were combined in a pair-wise meta-analysis grouped by type of intervention and comparator. A mixed-treatment comparison (MTC) evaluating the effectiveness of the interventions compared with placebo was undertaken as an exploratory analysis. The MTC was performed for the outcome of pain up to 3 months only because this was the only outcome and time point for which a network was available. Comparisons were described as statistically significant (at the 5% level) when the credibility interval (CrI) did not cross 0 for the SMD.

Patients' views

MEDLINE, the Cumulative Index to Nursing and Allied Health Literature (CINAHL) and PsycINFO were searched in June 2010 to identify qualitative studies of patients' views of treatments, with searches being restricted to English-language papers published from 1980 onwards. The review processes followed those of the effectiveness review.

Economic analysis

A systematic review of full economic evaluations meeting the intervention and population inclusion criteria of the clinical review was performed. The intention was to develop a decision-analytical model; however, because of the paucity of evidence for key components of the modelling (including the structure) the development of a model was not possible. To provide some useful information for the decision-maker, we undertook a number of investigatory exercises. First, we elicited details on resource use from clinicians for the interventions of interest and produced cost estimates based on national sources. Second, we mapped two important clinical outcomes, pain [using visual analogue scale (VAS) 0–100 mm] and quality of life [using the Short Form questionnaire-36 items (SF-36) mental and physical component score], to the European Quality of Life-5 Dimensions (EQ-5D). This allowed us to estimate quality-adjusted life-years (QALYs) for some of the interventions included in the clinical effectiveness review. Finally, having these two components allowed us to present a tentative cost-effectiveness analysis for some of the included interventions.

Results

Clinical effectiveness

The searches yielded 8883 citations. Thirty-two relevant studies were identified, one of which was a cost–utility analysis conducted alongside a separately published study of effectiveness.

Data from studies with a low risk of bias were sparse, in particular for the more invasive treatments (MUA, distension and capsular release). Twenty-eight RCTs, one quasi-experimental study (for 'supervised neglect') and two case series (for capsular release) were included. A total of 18 studies did not report an adequate method of randomisation (therefore these studies described as RCTs may have been quasi-experimental studies); 24 did not report an adequate method of allocation concealment; and 13 did not have blinded outcome assessment. For most of the studies it was unclear whether they were adequately powered to detect a statistically significant difference between groups. Across most trials there did not appear to be systematic methods for recording of adverse events.

For most comparisons there were insufficient studies with a similar intervention and comparator to allow quantitative pooling. Primarily a narrative synthesis was undertaken. Because of the lack of data on stage of frozen shoulder and outcomes of patients with and without diabetes, it was not possible to undertake planned subgroup analyses.

Conservative interventions

A single quasi-experimental study, with a high risk of bias, reported significant short-, medium- and long-term benefit for function and disability with supervised neglect compared with physical therapy.

A further 11 studies investigated a physical therapy. The majority of these were various forms of physiotherapy. The comparators were an alternative physiotherapy modality or a control group. Most of the studies had a high risk of bias. Only single studies were available for specific modalities. The majority of studies comparing two active interventions reported no significant difference in outcome between therapies. For studies that did report a benefit with an intervention, this tended to be evident for some outcomes only within the study. This may reflect the effect of the intervention or may be related to poor study quality. There was evidence from one study of a statistically significant short-term benefit with short-wave diathermy (SWD) plus stretching compared with home exercise only. There was evidence from the same study for a benefit with SWD compared with a heat pack for range of movement; however, in the same study there was no evidence of benefit for function and disability. There was also evidence from a single study that laser therapy had benefit over placebo laser in the short and medium term for pain and function and disability. Both studies had some risk of bias. The content, intensity and quality of the background home exercise that all groups received was also unclear. A further study, also at some risk of bias, found marginally significant improvement for function and disability and range of movement with high-grade mobilisation techniques compared with low-grade mobilisation techniques; however, there was no evidence of benefit for pain or quality of life in this study.

Three RCTs compared acupuncture with another treatment and they all had a high risk of bias. It was possible to calculate the MD and 95% CI for only one of the studies, which compared electroacupuncture and inferential electrotherapy. There was no significant difference between the two groups in pain or function and disability at short-, medium- and long-term follow-up.

Six studies evaluated steroid injection. The majority of the available data were from two multi-arm studies that were of satisfactory quality, although one had some risk of bias. Both studies evaluated a single intra-articular steroid injection in patients with frozen shoulder of < 6 months' duration. The comparators were home exercise alone, physiotherapy alone (both with placebo injection) and steroid injection followed by physiotherapy. For pain there was a short-term statistically significant benefit with steroid injection compared with placebo (SMD –1.15, 95% CI –1.62 to –0.67; two RCTs).There was no difference compared with physiotherapy (SMD –0.22, 95% CI –0.65 to 0.20; two RCTs). When steroid injection was provided in conjunction with physiotherapy, there was an added benefit for pain over physical therapy alone (SMD –0.98, 95% CI –1.43 to –0.52; two RCTs). There was also benefit with the combined intervention over steroid injection alone (SMD –0.75, 95% CI –1.20 to –0.29; two RCTs), although there was substantial heterogeneity. The results for function and disability and range of movement were broadly consistent with the results for pain. Based on a single study, there was no statistically significant benefit for quality of life with a steroid injection alone compared with placebo or physiotherapy alone. However, there was a benefit for quality of life when physiotherapy was added to steroid injection compared with placebo and physiotherapy alone. There was no evidence of benefit for the combined intervention over steroid injection alone.

Invasive interventions

The data from high-quality RCTs of invasive interventions were even more limited than for conservative interventions. In addition, there was considerable variability between the studies in how the procedures were delivered, making comparability between studies difficult.

Four RCTs assessed MUA. A single, satisfactory-quality study compared MUA with home exercise alone. There was no significant difference between groups in pain, function and disability, range of movement or working ability at short-, medium- or long-term follow-up. A study with some risk of bias compared MUA with arthrographic distension. There was greater improvement in pain and function and disability at 6 months with arthrographic distension than with MUA in participants with adhesive-stage primary frozen shoulder. The remaining two studies had a high risk of bias.

Three RCTs investigated distension with steroid injection, two of which used arthrographic distension. A single satisfactory study reported a significant improvement in one of two function and disability measures with arthrographic distension including steroid compared with home exercise (plus placebo arthrography). There was no evidence of benefit for range of movement or pain. A second study, with some risk of bias, compared arthrographic distension including steroid with steroid alone. There was benefit with distension for a single range of movement measure at 6 weeks. There was no evidence of benefit for other outcomes.

Two case series of more than 50 participants were identified that investigated capsular release. The best-quality case series had an average length of follow-up of 10 months (range 3 to 29 months). There was a significant improvement in function and disability, working ability and a measure of range of movement amongst participants in this study.

Three RCTS, all at high risk of bias, investigated sodium hyaluronate. The best-quality study reported a benefit with two injections of sodium hyaluronate compared with home exercise. However, there was no consistent evidence across outcomes of a benefit compared with 10 daily sessions of physical therapy or a single steroid injection.

Mixed-treatment comparison

Nine interventions formed part of a connected network with placebo. Steroid combined with physiotherapy was the only treatment that showed a statistically and clinically significant beneficial treatment effect compared with placebo (SMD –1.58, 95% CrI –2.96 to –0.42). Overall, there was no clear difference in the treatment effects of any of the interventions, that is, the CrIs overlapped. This analysis was based on only a subset of the evidence, which may explain why the findings are only partly supportive of the main analysis. Given the possible heterogeneity of placebos and study populations, and the inclusion of poor-quality studies, there is some uncertainty regarding the results of the MTC.

Patients' views

No studies were identified from the searches that explored patients' views or experiences of treatments for frozen shoulder.

Cost-effectiveness

The review identified one economic evaluation, conducted in the Netherlands. High-grade mobilisation was compared with low-grade mobilisation, from a societal perspective. The evaluation failed to deal with parameter uncertainty and dismissed differences in QALYs based on statistical inference. The evaluation was of reasonable quality, with a risk of bias, but failed to provide an answer to the broader question being posed.

Based on resource-use estimates obtained from clinical experts, average costs were estimated for the interventions included in the review. The costs for an unguided steroid injection varied from £36.16 to £138.51 depending on the practitioner delivering the injection, the type of steroid used and where the practitioner is based (i.e. the setting). These costs suggest that a physiotherapist delivering treatment in a community setting is the cheapest option and a rheumatologist delivering treatment in a hospital setting is the most expensive. A guided steroid injection (considered less popular in the NHS than unguided) produced estimated costs ranging from £299.68 to £475.56. These costs were mainly influenced by who delivered the injection. Physiotherapy was estimated to cost between £98.75 and £126.75 dependent on setting. The addition of a steroid injection to physiotherapy presents a plethora of scenarios dependent on practitioner, steroid choice and setting; these costs range between £121.43 and £607.31.

Manipulation under anaesthesia was estimated to cost £1446 and capsular release £2204, both of which included rehabilitation physiotherapy. Arthrographic distension was estimated to cost approximately £114.84, depending on the choice of steroid injection. A range of other resource use and costing scenarios is presented.

A mapping analysis explored the relationship between pain measured with a pain VAS and the SF-36 mental and physical components [mental component summary (MCS) and physical component summary (PCS)] and the EQ-5D. Ordinary least squares (OLS) regression was used as the main statistical technique. The fit of all of the models was poor. However, the data suggest that all models (whether they are based on pain VAS or SF-36 PCS and MCS scores) estimate more accurate predictions for less severe health states, but overpredict the value of more severe EQ-5D states. Using the OLS model we mapped the reported mean pain VAS at baseline and at 3 months of follow-up onto the EQ-5D. The same was carried out for SF-36 PCS and MCS. The findings of the mapping suggest that there is a positive relationship between outcomes: a decreasing pain VAS score (less pain) is accompanied by an increasing (better) EQ-5D score; an increasing EQ-5D score (i.e. better health status) appears to be generally accompanied by increasing SF-36 scores (i.e. higher scores = a better quality of life). The estimates were then used to predict EQ-5D scores at baseline and 3 months for a subset of the trials included in the clinical effectiveness review. Subsequently this allowed the tentative estimation of QALYs and calculation of cost-effectiveness ratios. The results suggested that steroid alone may be more cost-effective than steroid plus physiotherapy or physiotherapy alone.

Conclusions

Implications for health care

- There may be short-term benefit from adding a single intra-articular steroid injection to home exercise for patients with primary frozen shoulder of < 6 months' duration. In the same population there may also be benefit from adding physiotherapy (including mobilisation in 8–10 sessions over 4 weeks) to a single steroid injection.
- Based on a single study, and for some outcomes only, there may be benefit from adding SWD to passive mobilisation and home exercise. Based on a single study, and for some outcomes only, high-grade mobilisation may be more effective than low-grade mobilisation in a population of patients who have already had physiotherapy and/or steroid injection.

Given the paucity of economic evidence it is not possible to make any conclusions regarding the most cost-effective interventions.

Recommendations for research

There are large gaps in the evidence for the effectiveness and cost-effectiveness of all of the interventions investigated. Taking into account the views of health-care professionals in a recent survey, and the interventions that are most commonly used in the NHS, we suggest that the following should be given priority in future high-quality RCTs assessing effectiveness and cost-effectiveness:

- A 'standard care' package of high-quality conservative management. This should be fully specified in any future trial and we suggest that it should involve a structured protocol of high-quality education, advice, home exercise and monitoring.
- Steroid injection, in particular an investigation of the effectiveness and cost-effectiveness of multiple injections and whether there is any added benefit from providing physiotherapy after steroid injection, over and above steroid injection plus standard care.
- Physical therapies, specifically physiotherapy interventions, which have a component that involves mobilisation or exercises. Research is required to establish whether there is any benefit from having physiotherapy alone, over and above a standard package of care
- Intensive interventions, specifically arthrographic distension, MUA and arthroscopic capsular release.
- Important subgroups in any future RCTs are phase of frozen shoulder and patients with diabetes. These trials should collect data on resource use and use a utility measure to allow assessment of cost-effectiveness. A systematic approach to recording adverse events will also be important.

The large number of treatment options for frozen shoulder and the limited evidence for their effectiveness and cost-effectiveness makes prioritisation of these difficult and they are not listed in order of importance. We suggest that an appropriate starting point would be a multi-arm trial that compares the effectiveness and cost-effectiveness of interventions of differing intensity and costs: high-quality conservative management, steroid injection (possibly in conjunction with arthrographic distension) and surgical management (MUA and capsular release).

Funding

Funding for this study was provided by the Health Technology Assessment programme of the National Institute for Health Research.

Publication

Maund E, Craig D, Suekarran S, Neilson AR, Wright K, Brealey S, *et al*. Management of frozen shoulder: a systematic review and cost-effectiveness analysis. *Health Technol Assess* 2012;**16**(11).

NIHR Health Technology Assessment programme

The Health Technology Assessment (HTA) programme, part of the National Institute for Health Research (NIHR), was set up in 1993. It produces high-quality research information on the effectiveness, costs and broader impact of health technologies for those who use, manage and provide care in the NHS. 'Health technologies' are broadly defined as all interventions used to promote health, prevent and treat disease, and improve rehabilitation and long-term care.

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The research reported in this issue of the journal was commissioned by the HTA programme as project number 09/13/02. The contractual start date was in March 2010. The draft report began editorial review in March 2011 and was accepted for publication in September 2011. As the funder, by devising a commissioning brief, the HTA programme specified the research question and study design. The authors have been wholly responsible for all data collection, analysis and interpretation, and for writing up their work. The HTA editors and publisher have tried to ensure the accuracy of the authors' report and would like to thank the referees for their constructive comments on the draft document. However, they do not accept liability for damages or losses arising from material published in this report.

The views expressed in this publication are those of the authors and not necessarily those of the HTA programme or the Department of Health.

ISSN 1366-5278 (Print)

ISSN 2046-4924 (Online)

ISSN 2046-4932 (DVD)

Published by Prepress Projects Ltd, Perth, Scotland (www.prepress-projects.co.uk), on behalf of NETSCC, HTA.

Printed on acid-free paper in the UK by the Charlesworth Group.