Comparison of Treatments for Frozen Shoulder
A Systematic Review and Meta-analysis

Dimitris Challoumas, MD; Mairiosa Biddle, MD; Michael McLean, MD; Neal L. Millar, MD, PhD

Abstract

IMPORTANCE There are a myriad of available treatment options for patients with frozen shoulder, which can be overwhelming to the treating health care professional.

OBJECTIVE To assess and compare the effectiveness of available treatment options for frozen shoulder to guide musculoskeletal practitioners and inform guidelines.

DATA SOURCES Medline, EMBASE, Scopus, and CINHAL were searched in February 2020.

STUDY SELECTION Studies with a randomized design of any type that compared treatment modalities for frozen shoulder with other modalities, placebo, or no treatment were included.

DATA EXTRACTION AND SYNTHESIS Data were independently extracted by 2 individuals. This study followed the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) reporting guideline. Random-effects models were used.

MAIN OUTCOMES AND MEASURES Pain and function were the primary outcomes, and external rotation range of movement (ER ROM) was the secondary outcome. Results of pairwise meta-analyses were presented as mean differences (MDs) for pain and ER ROM and standardized mean differences (SMDs) for function. Length of follow-up was divided into short-term (≤12 weeks), mid-term (>12 weeks to ≤12 months), and long-term (>12 months) follow-up.

RESULTS From a total of 65 eligible studies with 4097 participants that were included in the systematic review, 34 studies with 2402 participants were included in pairwise meta-analyses and 39 studies with 2736 participants in network meta-analyses. Despite several statistically significant results in pairwise meta-analyses, only the administration of intra-articular (IA) corticosteroid was associated with statistical and clinical superiority compared with other interventions in the short-term for pain (vs no treatment or placebo: MD, −1.0 visual analog scale [VAS] point; 95% CI, −1.5 to −0.5 VAS points; \( P < .001 \); vs physiotherapy: MD, −1.1 VAS points; 95% CI, −1.7 to −0.5 VAS points; \( P < .001 \)) and function (vs no treatment or placebo: SMD, 0.6; 95% CI, 0.3 to 0.9; \( P < .001 \); vs physiotherapy: SMD 0.5; 95% CI, 0.2 to 0.7; \( P < .001 \)). Subgroup analyses and the network meta-analysis demonstrated that the addition of a home exercise program with simple exercises and stretches and physiotherapy (electrotherapy and/or mobilizations) to IA corticosteroid may be associated with added benefits in the mid-term (eg, pain for IA corticosteroid with home exercise vs no treatment or placebo: MD, −1.4 VAS points; 95% CI, −1.8 to −1.1 VAS points; \( P < .001 \)).

CONCLUSIONS AND RELEVANCE The findings of this study suggest that the early use of IA corticosteroid in patients with frozen shoulder of less than 1-year duration is associated with better

(continued)
Abstract (continued)

outcomes. This treatment should be accompanied by a home exercise program to maximize the chance of recovery.

Introduction

Adhesive capsulitis, also known as frozen shoulder, is a common shoulder concern manifesting in progressive loss of glenohumeral movements coupled with pain. It is a fibroproliferative tissue fibrosis, and although the immunobiological advances in other diseases have helped dissect the pathophysiology of this condition, overall, the molecular mechanisms underpinning it remain poorly understood.2-5

Frozen shoulder manifests clinically as shoulder pain with progressive restricted movement, both active and passive, along with normal radiographic scans of the glenohumeral joint.6 It classically progresses prognostically through 3 overlapping stages of pain (stage 1, lasting 2-9 months), stiffness (stage 2, lasting 4-12 months), and recovery (stage 3, lasting 5-24 months).7 However, this is an estimated time frame, and many patients can still experience symptoms at 6 years.8 A primary care–based observational study estimated its incidence as 2.4 per 100 000 individuals per year,9 with prevalence varying from less than 1% to 2% of the population.10

A true evidence-based model for its medical management has not been defined, with a wide spectrum of operative and nonoperative treatments available. From the international to departmental level, management strategies vary widely, reflecting the lack of good-quality evidence.11 The British Elbow and Shoulder Society/British Orthopaedic Association (BESS/BOA) has published recommendations in a patient care pathway for frozen shoulder, with a step-up approach in terms of invasiveness advised.12 The UK Frozen Shoulder Trial, a randomized parallel trial comparing the clinical and cost-effectiveness of early structured physiotherapy, manipulation under anesthetic (MUA), and arthroscopic capsular release (ACR) is currently under way.13 The aim of this systematic review is to present the available evidence relevant to treatment and outcomes for frozen shoulder with the ultimate objective of guiding clinical practice, both in primary and secondary care.

Methods

The present systematic review has been conducted and authored according to the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) reporting guideline.14 Our patient, intervention, comparison, and outcome (PICO) was defined as follows: patients, patients with frozen shoulder of any etiology, duration, and severity; intervention, any treatment modality for frozen shoulder; comparison, any other treatment modality, placebo, or no treatment; and outcome, pain and function (primary outcomes) and external rotation range of movement (ER ROM) (secondary outcome) in the short term, midterm, or long term.

Eligibility

Included studies had a randomized design of any type and compared treatment modalities for frozen shoulder with other treatment modalities, placebo, or no treatment. Additionally, at least 1 of our preset outcome measures needed to be included in the study. Studies that compared different types, regimens, dosages, or durations of the same intervention were excluded (eg, different doses of corticosteroid or different exercise types). Those assessing the effectiveness of the same modality applied in different anatomical sites (eg, subacromial vs intra-articular [IA] corticosteroid) were included. Participants had to be older than 18 years with a clinical diagnosis of adhesive capsulitis. No formal diagnostic criteria were used to define frozen shoulder; however, the use of inappropriate or
inadequate diagnostic criteria was taken into account in risk-of-bias assessments. Duration of the condition was not a criterion nor were previous treatments and follow-up. Inclusion of patients with specific conditions (e.g., diabetes) was not an exclusion criterion, and it was not taken into account in analyses, provided that their proportion in the treatment groups was comparable.

Nonrandomized comparative studies, observational studies, case reports, case series, literature reviews, published conference abstracts, and studies published in languages other than English were excluded. Studies including patients with the general diagnosis of shoulder pain were also excluded even if a proportion of them had frozen shoulder. Studies assessing the effectiveness of different types of physiotherapy-led interventions, exercise, or stretching regimens were also excluded.

**Search Strategy**

A thorough literature search was conducted by 3 of us (D.C., M.B., and M.M.) via Medline, EMBASE, Scopus, and CINAHL in February 2020, with the following Boolean operators in all fields: (adhesive capsulitis OR frozen shoulder OR shoulder periarthritis) AND (treatment OR management OR therapy) AND random*. Relevant review articles were screened to identify eligible articles that may have been missed at the initial search. Additionally, reference list screening and citation tracking in Google Scholar were performed for each eligible article.

**Screening**

From a total of 73,299 articles that were initially identified, after exclusion of duplicate and noneligible articles, title and abstract screening, and the addition of missed studies identified subsequently, 65 studies were found to fulfil the eligibility criteria. Figure 1 illustrates the article screening process.

**Risk-of-Bias Assessment and Grading the Certainty of Evidence**

The internal validity (freedom from bias) of each included study was assessed with the Cochrane Collaboration's tool for assessing risk of bias in randomized trials separately by 2 of us (D.C. and M.B.), and a third independent opinion (M.M.) was sought when disagreements existed. Studies were
characterized as having low, high, or unclear overall risk of bias based on the following formula: low overall risk studies had high risk of bias in 2 or fewer domains; high overall risk studies had high risk of bias in more than 2 domains; unclear overall risk studies had unclear risk of bias in more than 2 domains, unless they also had high risk of bias in more than 2 domains, in which case they were labeled as high overall risk. Risk of bias was assessed separately for outcome measures that included patient reporting (pain, function) and those that did not (ROM); all studies with nonmasked participants were labeled as high risk in the masking of outcome measures domain for patient-reported outcomes given that the assessors were the participants themselves.

Certainty of evidence was graded with the Grading of Recommendations, Assessment, Development and Evaluations (GRADE) tool (eTable 1 in the Supplement).16 The scale starts with high, and depending on how many of the 5 possible limitations used in the GRADE tool were present in each comparison, the study could be downgraded to moderate, low, and very low. Grading of evidence was performed by 2 authors (D.C. and M.B.) independently and any disagreements were resolved by discussion and involvement of a third assessor (M.M.). Each outcome measure within each comparison had its own evidence grade. Our recommendations for clinical practice were based on results of either high or moderate quality evidence with both clinical and statistical significance.

Data Extraction
Two of us (D.C. and M.B.) performed data extraction. The key characteristics of each eligible article were extracted and inserted in tables in Microsoft Word version 16.43 (Microsoft Corp) to facilitate analysis and presentation. For missing data, attempts were made to contact the original investigators for included studies published less than 10 years ago.

For the presentation of results, outcomes were divided into short-term (≤12 weeks), mid-term (>2 weeks to ≤12 months), and long-term (>12 months) follow-up. When sufficient data existed, short-term follow-up was subdivided into early short-term (2-6 weeks) and late short-term (8-12 weeks). All short-term follow-up points were converted to weeks, and all mid-term follow-up points to months for consistency and easier analysis.

Comparisons of interventions reported by fewer than 3 studies were included in the supplementary results table and were not analyzed or included in the article. When 3 or more studies contributed data for outcome measures at similar follow up times (ie, 2-6 weeks, 8-12 weeks, and 4-6 months), pairwise meta-analyses were conducted. Raw mean differences (MDs) with their accompanying 95% CIs were calculated and used in the tests for each comparison of pain and ER ROM because the tools used across studies were the same. Standardized mean differences (SMDs) were used for function because different functional scores were used.

When pain results were reported in different settings (eg, at rest, at night, with activity) in studies, only pain at rest was used in results. When both active and passive ROM were used as outcome measures, passive ROM was used in our results to increase homogeneity given that most studies used passive ROM. Results for the following outcome measures were recorded in tables and combined qualitatively only based on direction of effect to yield an overall effect for each comparison: abduction ROM, flexion ROM, and quality of life. However, these were not included in the results nor was the quality of the relevant evidence graded.

Additionally, comparisons that yielded both clinically and statistically significant results (ie, greater than or equal to the minimal clinically relevant difference and P < .05) underwent trial sequential analysis (TSA) to rule out a type I error and further reinforce our recommendations for clinical practice. TSA is a quantitative method applying sequential monitoring boundaries to cumulative meta-analyses in a similar fashion as the application of group sequential monitoring boundaries in single trials to decide whether they could be terminated early because of a sufficiently small P value. TSA is considered an interim meta-analysis; it helps control for type I and II errors and clarifies whether additional trials are needed by considering required information size.17 The TSA graph includes 2 horizontal lines, representing the conventional thresholds for statistical significance (Z = 1.96; P < .05); 1 vertical line, representing required information size; a curved red line,
representing the TSA boundaries (ie, thresholds for statistical significance); and a blue line showing
the cumulative amount of information as trials are added. A significant result is denoted by a crossing
of the curved blue and red lines.

Finally, a network meta-analysis was conducted for treatments used by 3 or more studies for the
primary outcome (pain) at late short-term (8-12 weeks) and mid-term (4-6 months) follow-up. Both
direct and indirect comparisons were included in the model, and treatment rank probabilities were
produced for the 2 follow-up time periods. The certainty of evidence deriving from network meta-
analyses was not graded. Subgroup analyses for the effect of home exercise, different physiotherapy
interventions, and chronicity of frozen shoulder were conducted when possible.

Definitions
The term physiotherapy was used for any supervised, physiotherapist-led, noninvasive treatment
(mobilizations, application of ice and heat, diathermy, electrotherapy modalities). These were
grouped and analyzed together. Exercises and stretching that were performed by the participants
at home (home exercise program) or under a physiotherapist’s supervision were not included in
physiotherapy. Acupuncture and extracorporeal shock wave therapy (ESWT) were regarded as a
separate intervention to physiotherapy. Interventions that had accompanying physiotherapy were
grouped and analyzed separately from those that did not, regardless of intensity and frequency.
For example, studies with a treatment group who received IA corticosteroid plus physiotherapy
(eg, ice packs and diathermy) were included in the intervention category IA corticosteroid plus
physiotherapy; those with a treatment group receiving only IA corticosteroid (with or without
a home exercise program) were included in the IA corticosteroid category. Patients in the
following groups were considered control groups and were analyzed together: no treatment,
placebo, sham procedures, IA normal saline or lidocaine, simple analgesia, and home
exercise alone.

The following tools and questionnaires that were found in included studies represented our
function outcome measure: Shoulder Pain and Disability Index, American Shoulder and Elbow
Surgeons shoulder score, Constant-Murley, and the Strengths and Difficulties Questionnaire. All
patient-reported pain and function scales were uniformly converted to a scale from 0 to 10 and a
scale from 0 to 100, respectively.

Statistical Analysis
The Review Manager version 5 (RevMan) software was used for pairwise meta-analyses and their
accompanying forest plots and heterogeneity tests ($\chi^2$ and $I^2$). TSA software version 0.9β
(Copenhagen Trial Unit) was used for TSAs; random-effect models with 5% type I error and 20%
power and O’Brien-Fleming α-spending function were used for all TSA analyses. The required
information size was estimated by the software based on the power (20%), mean difference,
variance, and heterogeneity. Stata version 16.1 (StataCorp) with the mvmeta extension (multivariate
random-effects meta-regression) was used for network meta-analyses (frequentist approach).18

When exact mean and SD values were not reported in the included articles, approximate values
(to the nearest decimal place) were derived from the graphs. When only interquartile ranges (IQRs)
were reported, the SD was calculated as IQR divided by 1.35. When only the median was reported,
the mean was assumed to be the same. When CIs of means were reported, SDs were calculated by
dividing the length of the CI by 3.92 and then multiplying by the square root of the sample size. When
SEs of mean were given, these were converted to SDs by multiplying them by the square root of the
sample size. In studies in which only means and the population were given, the SD was imputed using
the SDs of other similar studies using the prognostic method (ie, calculating the mean of all SDs).19

Pooled means were calculated by adding all the means, multiplied by their sample size, and then
dividing this by the sum of all sample sizes. Pooled SDs were calculated with the following formula:
$$SD_{pooled} = \sqrt{\left( SD_1^2 \left[ n_1 - 1 \right] \right) + \left( SD_2^2 \left[ n_2 - 1 \right] \right) + \ldots + \left( SD_k^2 \left[ n_k - 1 \right] \right) / \left( n_1 + n_2 + \ldots + n_k - k \right)},$$
where $n$ indicates
sample size and \( k \), the number of samples. The following formula was used for the sample size calculation as part of GRADE’s assessment for imprecision:\(^2\)

\[
N = \frac{2(a + b)SD^2}{(x_1 - x_2)^2}
\]

In which \( N \) indicates the sample size required in each of the groups; \((x_1 - x_2)\) indicates the minimal clinically relevant difference (MCRD), defined as 1 point for VAS pain, effect size of 0.45 for functional scores, and 10° for ERROM; \( SD^2 \) indicates the population variance, calculated using pooled SD from our treatment groups; \( a = 1.96 \), for 5% type I error; and \( b = 0.842 \), for 80% power.

The MCRD for function on functional scales would have been set at 10 points. However, because SMDs were used, which produce effect sizes, rather than MDs, the 10 points were divided by the population SD (ie, 22) that was used to calculate the optimal information size (effect sizes can be converted back to functional scores when multiplied by SD).

Potential publication bias was evaluated by Egger test for asymmetry of the funnel plot in comparisons including more than 10 studies. Expecting wide-range variability in studies’ settings, a random-effects metasynthesis was employed in all comparisons.

Subgroup analyses were conducted with independent samples \( t \) tests in Graphpad version 8 (Prism) comparing pooled means and SDs. All statistical significance levels were set at \( P < .05 \), tests were 2-tailed, and clinical significance was defined as a MD or SMD being equal or higher than our predefined MCRD.

Results

Of the 65 eligible studies, a total of 34 studies\(^2\) were included in pairwise meta-analyses with a total of 2402 participants with frozen shoulder. Duration of symptoms ranged from 1 month to 7 years and length of follow-up from 1 week to 2 years, with most follow-up occurring at 6 weeks, 12 weeks, and 6 months.

Table 1 summarizes the main characteristics of the included studies.\(^2\) Table 2 in the Supplement shows the results of the risk-of-bias assessment.

Table 2 summarizes the findings of the present review. Where feasible (ie, results at similar follow-up times in at least 3 studies), pairwise meta-analyses were conducted. The results of abduction ROM, flexion ROM, and quality of life were pooled only based on direction of effect, and their certainty of evidence was not graded. eTable 3 in the Supplement summarizes the results of comparisons reported by 1 or 2 studies only. eTable 4 in the Supplement demonstrates how the strength of evidence for each outcome measure within each comparison was derived for all follow-up time categories, per GRADE. eTable 5 in the Supplement shows the heterogeneity for each comparison (\( I^2 \) statistic) and where studies were removed to reduce heterogeneity based on sensitivity analyses.

Pairwise Meta-analysis

We conducted pairwise meta-analysis comparing the effectiveness of each intervention with other interventions (or placebo/no treatment) in the short-term (early, 2-6 weeks; late, 8-12 weeks) and mid-term (4-6 months). Data for long-term follow-up (>12 months) were inadequate for analyses. Numerical data are only presented for the statistically significant comparisons; those for nonsignificant comparisons appear in the forest plots (eFigure 1, eFigure 2, and eFigure 3 in the Supplement).

IA Corticosteroid vs No Treatment or Placebo

Short-term | IA corticosteroid appeared to be associated with superior outcomes compared with control for early short-term pain (moderate certainty; MD, −1.4 visual analog scale [VAS] points; 95%
| Source       | Participants, No. (participants who completed study, No.) | Mean age, y | Duration of symptoms | Participants per treatment group, No. (participants per treatment group who completed study, No.) | Treatment duration (follow-up) | Outcome measures |
|--------------|----------------------------------------------------------|-------------|----------------------|-------------------------------------------------------------------------------------------------|--------------------------------|------------------|
| Arslan and Celiker, 2001a | 20 (20) | 56 | Mean, 4.1 mo | • IA corticosteroid; n = 10 (10)  
• Physiotherapy (hot pack, ultrasound, exercises) with NSAID; n = 10 (10)  
• Both groups received 12-wk home exercise program | Single IA corticosteroid injection; physiotherapy not stated for how long, likely 12 wk (0, 2, and 12 wk) | • AROM (ABD, FL, and IR)  
• PROM (ABD, FL, ER, and IR)  
• Pain (VAS, 0-10), unspecified |
| Bai et al, 2008a | 80 individuals with 82 shoulders (64) | 56.6 | Range, 6 wk-6 mo | • IA corticosteroid; n = 40 (40)  
• Sham injection (normal saline); n = 40 (24)  
• Both groups received 12-wk home exercise program | Single IA corticosteroid or normal saline injection (0, 2, and 12 wk) | • PROM (ABD, FL, ER, and IR)  
• Night pain (VAS, 0-100)  
• Functional disability (SPADI)  
• Treatment effectiveness (UCLA end-result score) |
| Binder et al, 1986 | 40 (unknown) | 54.8 | Mean (range), 5.5 mo (1-12 mo) | • Oral corticosteroid; n = 20 (unknown)  
• No treatment; n = 20 (unknown)  
• Both groups received home exercise program, which entailed 2-3 min of movement every hour | Oral prednisolone for 6 wk (0, 2, 4, and 6 wk then monthly to 8 mo) | • Pain (VAS, 0-10), at rest, at night, on movement  
• PROM (ABD, FL, ER) |
| Blockey et al, 1954 | 32 (30) | 55 | Mean, 5.6 mo | • Oral corticosteroid; n = 16 (14)  
• Oral placebo; n = 16 (16)  
• Both groups received home exercise program for 4 wk; patients who still had restricted ROM at 4 wk underwent MUA and further 4 wk treatment with oral corticosteroid or placebo, according to initial treatment allocation | Oral corticosteroid or placebo for 4 weeks (0, 1, 4, 5, 8, and 18 wk) | • Pain (0–3) at rest and on movement  
• ROM (total ABD, scapulohumeral ABD, total rotation), unclear whether active or passive |
| Buchbinder et al, 2004 | 50 (46) | 54.3 | Mean, 23.3 wk | • Oral corticosteroid; n = 24 (24)  
• Oral placebo; n = 26 (22)  
• Both groups received home exercise program of an unknown duration | Oral corticosteroid or placebo for 3 weeks (0, 3, 6, and 12 wk) | • Pain (VAS, 0-10) at night and activity-related  
• Functional disability (SPADI, Croft, DASH)  
• Function (HAQ)  
• QoL (SF-36)  
• Patient-rated improvement  
• AROM (ABD, FL, ER, and IR) |
| Buchbinder et al, 2004 | 46 (46) | 57.3 | Mean (range), 11.6 d (96–402 d) | • Arthrographic distension with IA corticosteroid; n = 25 (25)  
• Arthrography only (placebo); n = 21 (21)  
• Both groups received home exercise program of an unknown duration | Single injection (0, 3, 6, and 12 wk) | • Functional Disability (SPADI and PET)  
• Pain (SPADI and VAS, 0-10), overall (unspecified)  
• AROM (ABD, FL, ER, and IR) |
| Bulgen et al, 1984 | 45 (42) | 55.8 | Mean (range), 4.8 mo (1-12 mo) | • IA corticosteroid; n = 11  
• Mobilizations; n = 11  
• Ice with PNF; n = 12  
• No treatment; n = 8  
• All groups received home exercise program of unknown duration | IA corticosteroid injection weekly for 6 wk; mobilizations, ice, and PNF three times weekly for 6 wk (0, 1, 2, 3, 4, 5, 6, 7, 8, and 12 wk, 4, 5, and 6 mo) | • Pain (VAS, 0-10) at rest, at night, on movement  
• PROM (ABD, FL, ER) |
| Calis et al, 2006a | 95 shoulders (unknown) | 56.9 | >1 mo | • IA sodium hyaluronate; n = 27 (unknown)  
• IA corticosteroid; n = 26 (unknown)  
• Physiotherapy (hot pack, US, TENS, stretching); n = 22 (unknown)  
• No treatment; n = 20 (unknown)  
• All groups received home exercise program of unknown duration | IA sodium hyaluronate injection once weekly for 2 wk; single IA corticosteroid injection; physiotherapy for 10 d (0, 15 d, 3 mo) | • Pain (VAS, 0-10), unspecified  
• PROM (ABD and ER)  
• Function (CM) |
| Carette et al, 2003a | 93 (77) | 55.3 | Mean, 21.1 wk, everyone <1 yr | • IA corticosteroid IA with physiotherapy; n = 22 (20)  
• IA corticosteroid; n = 25 (16)  
• IA placebo with physiotherapy; n = 27 (23)  
• IA placebo n = 23 (22)  
• All groups received 3-mo home exercise program; physiotherapy included TENS, mobilizations, exercises, and ice for patients with acute disease and US, mobilizations, exercise, and ice for those with chronic disease | Single injections of IA corticosteroid and placebo, supervised physiotherapy 3 sessions weekly for 4 wk (0, 6 wk, 3 mo, 6 mo, 1 yr) | • Functional disability (SPADI)  
• Pain (SPADI, 0-100), unspecified  
• QoL (SF-36)  
• AROM and PROM (ABD, FL, and ER) |

(continued)
| Source | Participants, No. (participants who completed study, No.) | Mean age, y | Duration of symptoms | Participants per treatment group, No. (participants per treatment group who completed study, No.) | Treatment duration (follow-up) | Outcome measures |
|--------|------------------------------------------------|-------------|----------------------|-----------------------------------------------------------------------------------------------|-------------------------------|------------------|
| Cheing et al, 2008 | 74 (70) | 33-90, unknown mean | Mean (range), 7.2 mo (1-24 mo) | • EA; n = 25 (24) • IFE; n = 24 (23) • No treatment; n = 25 (23) • EA and IFE groups received 6-mo home exercise program | 10 sessions during 4 wk for EA and IFE (0, 1 mo, 3 mo, 6 mo) | • Function (CM) • Pain (VAS, 0-10), unspecified |
| Chen et al, 2014 | 40 (34) | 53.4 | >3 mo | • Oral corticosteroid; n = 20 (17) • ESWT; n = 20 (17) | Oral corticosteroid for 4 wk; 3 sessions of ESWT during 4 wk (0, 2, 4, 6, and 12 wk) | • Function (CM and OSS) • AROM, from CM (ABD, FL, ER, and IR) • Pain (CM), unspecified |
| Cho et al, 2016 | 126 (110) | Mean, 5 mo | • IA corticosteroid; n = 42 (36) • SA corticosteroid; n = 42 (37) • IA with SA corticosteroid, n = 42 (37) | All groups received home exercise program of unknown duration | Single injections (0, 3, 6, and 12 wk) | • Function (ASES shoulder score) • Pain (VAS, 0-10) with movement • PROM (ABD, FL, ER, and IR) |
| Dacre et al, 1989 | 66 (62) | 54.9 | >4 wk | • IA corticosteroid; n = 22 (22) • Physiotherapy (mobilizations); n = 22 (20) • IA corticosteroid with physiotherapy; n = 22 (20) • No home exercise program | Supervised physiotherapy for 4-6 wk (0, 6 wk, 6 mo) | • Pain (VAS, 0-10) day, night, and with movement • PROM (ABD, ER, and IR) |
| Dahan et al, 1999 | 34 (27) | Mean, 1 y | | Suprascapular nerve block with bupivacaine; n = 17 (15) • Placebo injection; n = 17 (12) | 3 injections over 2 weeks | • Pain (VAS, 0-10, MPQ short-form, Present Pain Index) • Function (SST) • AROM (ABD and FL) • PROM (ABD, FL and ER) |
| De Carli et al, 2012 | 46 (44) | Mean, 3 mo | | • MUA with ACR; n = 25 (23) • IA corticosteroid; n = 21 (21) • IA corticosteroid group received both supervised physiotherapy and home exercise program; MUA with ACR group started active strengthening 5 wk postoperation | Single MUA with ACR; IA corticosteroid once weekly for 3 wk (0, 3, 6, and 12 wk, 6 and 12 mo) | • Function (CM, UCLA, ASES, and SST) • PROM (ABD, FL, ER, and IR) • Treatment satisfaction (VAS) |
| Dehghan et al, 2013 | 75 (59); patients had diabetes | 54 | Not stated | • NSAID (naproxen, 1g/d); n = 35 (28) • IA corticosteroid; n = 40 (29) | Single injection of IA corticosteroid; NSAID of unknown duration (0, 2, 6, 12, and 24 wk) | • Pain (VAS, 0-10), unspecified • ROM (ABD, FL, ER, and IR), unknown if active or passive |
| Gallacher et al, 2018 | 50 (39) | Mean, 3 mo | | • Arthrographic distension with IA corticosteroid; n = 25 (20) • ACR with IA corticosteroid; n = 25 (19) • Both groups received home exercises and what authors described as standard physiotherapy regimen of unknown duration | Single treatment (0, 6 wk, 3 mo, 6 mo) | • Function (OSS) • Qol (EQ-5D) • PROM (ABD, FL, and ER) • Complications |
| Gam et al, 1998 | 22 (20) | Median, 5 mo | | • IA corticosteroid; n = 9 (8) • IA corticosteroid with arthrographic distension; n = 13 (12) • No home exercise program | 1 injection weekly for 6 wk or until no symptoms (0, 3, 6, and 12 wk) | • Pain (VAS, 0-10), at rest and with movement • PROM (FL, EXT, ABD, ELE, and ER) • Use of analgesics |
| Hsieh et al, 2012 | 70 (63) | Mean, 4.5 mo | | • IA sodium hyaluronate with physiotherapy (heat, electrotherapy, exercises); n = 35 (32) • Physiotherapy; n = 35 (31) • No home exercise program | Injection weekly for 3 wk; physiotherapy for 3 mo (0, 6, and 12 wk) | • AROM and PROM (FL, ABD, ER, and IR) • Pain (VAS, 0-100), unspecified • Functional disability (SPADI and SDQ) • Qol (SF-36) |
| Jacobs et al, 2009 | 53 (51) | Median, 17.5 mo | | • MUA; n = 28 (26) • IA corticosteroid with arthrographic distension; n = 25 (25) • Both groups received home exercise program of unknown duration | Single MUA; 3 IA corticosteroid injections over 18 wk (0, 2, 6, and 12 wk, 6, 12, 18, and 24 mo) | • Function (CM) • Pain (VAS, 0-100), unspecified • Qol (SF-36) |
| Source                      | Participants, No. (participants who completed study, No.) | Mean age, y | Duration of symptoms | Participants per treatment group, No. (participants per treatment group who completed study, No.) | Treatment duration (follow-up) | Outcome measures                                                                 |
|-----------------------------|----------------------------------------------------------|-------------|----------------------|-----------------------------------------------------------------------------------------------------------------|-------------------------------|----------------------------------------------------------------------------------|
| Jacobs et al, 1991          | 66 1991                                                  | 53.4        | Median (range), 6 mo (1-24 mo) | • Arthrographic distension; n = 14 (unknown)  
• IA corticosteroid; n = 15 (unknown)  
• Arthrographic distension with IA corticosteroid; n = 18 (unknown)  
• All groups received home exercise program of unknown duration | As many as 3 injections over 12 wk (0, 6, 12, 16) | • AROM (ABD, FL, and ER)  
• PROM (ABD, FL, and ER)  
• Strength (dynamometry)  
• Pain with daily activities (0-5) and with movement (0-3)  
• Use of analgesics |
| Jones and Chattopadhyay, 1999 | 30 (30)                                                  | 56.5        | Not stated           | • Suprascapular nerve block; n = 20 (15)  
• IA corticosteroid; n = 20 (15)  
• Both groups received home exercise program of unknown duration | Single suprascapular nerve block; ≤3 IA corticosteroid injections (0, 1, 3, 7, and 12 wk) | • Pain (VAS 0-5), unspecified  
• Use of analgesics |
| Khalla et al, 2018          | 40 (unknown)                                             | 47.3        | Mean, 1.5 mo         | • IA corticosteroid; n = 20 (unknown)  
• SA corticosteroid; n = 20 (unknown)  
• Both groups received 12-wk home exercise program | Single injection (0 and 12 wk) | • Pain (VAS 0-10), unspecified  
• Functional disability (SPADI)  
• PROM (FF, ER, IR, and EXT)  
• PROM (FF, ER, IR, and EXT) |
| Khan et al, 2005            | 36 (35)                                                  | Unknown     | Not stated           | • Physiotherapy (exercises, TENS, and IRR); n = 18 (unknown)  
• Physiotherapy with arthrographic distension and IA corticosteroid; n = 18 (unknown) | 8 wk (0, 1, 2, 3, 4, 5, 6, 7, and 8 wk) | • Pain (VAS 0-10), unspecified  
• Functional disability (SPADI)  
• PROM (ABD, FL, ER, and IR) |
| Kim et al, 2017             | 40 (30)                                                  | 55.2        | Mean, 4 mo           | • IA sodium hyaluronate; n = 20 (16)  
• IA sodium hyaluronate with IA tramadol; n = 20 (14)  
• Both received home exercise program of unknown duration | IA sodium hyaluronate weekly injections for 5 wk; IA tramadol for 3 wk (0, 1, 2, 3, 4, and 6 wk) | • Pain (VAS 0-10), unspecified  
• Functional disability (SPADI)  
• PROM (ABD, FL, ER, and IR) |
| Kivimäki and Pohjolainen, 2001 | 30 (24)                                                  | 51          | Mean (range), 7 mo (3-18 mo) | • MUA with IA corticosteroid n = 15 (13)  
• MUA; n = 15 (11)  
• No home exercise program | Single treatment (0, 1 d, 4 mo) | • PROM (ABD, FL, ER, and IR) |
| Kivimäki et al, 2007        | 125 (83)                                                 | 53          | Mean, 7.2 mo         | • MUA; n = 65 (38)  
• No treatment; n = 60 (45)  
• Both groups received home exercise program of unknown duration | Single MUA (0, 6 wk, 3, 6, and 12 mo) | • PROM (ABD, FL, ER, and IR)  
• Pain (VAS 0-10), unspecified  
• Functional disability (modified SDQ)  
• Function (working ability, 0-10)  
• Use of analgesics |
| Kłc et al, 2015              | 41 (41)                                                  | 58.4        | >1 mo                | • Suprascapular nerve block with physiotherapy; n = 19 (19)  
• Physiotherapy; n = 22 (22)  
• Physiotherapy included hot packs, exercises, stretching, TENS, and US; both groups received home exercise program of unknown duration | Physiotherapy, 5 sessions a week for 3 weeks; single suprascapular nerve block (0, 3, and 7 wk) | • Pain (BPI-SF)  
• Function (CM) |
| Koh et al, 2013             | 68 (unknown)                                             | 54.4        | Mean, 6 mo           | • Bee venom acupuncture with physiotherapy; n = 22 (unknown)  
• Higher dose bee venom acupuncture with physiotherapy; n = 23 (unknown)  
• Sham injection (normal saline) with physiotherapy; n = 23 (unknown)  
• Physiotherapy included TENS, TDP, and mobilizations; all groups received 2-mo home exercise program | 16 sessions during 2 mo (0, 2, 4, 8, and 12 wk) | • Disability (SPADI)  
• Pain (VAS 0-10), at rest, at night, and with movement  
• AROM (FL, EXT, ABD, ADD, and ER)  
• PROM (FL, EXT, ABD, ADD, and ER) |
| Kraal et al, 2018           | 21 (15)                                                  | 51.9        | >3 mo                | • IA corticosteroid with physiotherapy (mobilizations, stretching, ice and hot packs, and massage); n = 10 (unknown)  
• IA corticosteroid; n = 11 (unknown)  
• No home exercise program | Single injection but second given if no improvement at 6 wk; physiotherapy twice weekly ≤3 mo (0, 6, 12, and 26 wk) | • Functional disability (SPADI)  
• Pain (NPRS, 0-10), mean and at night  
• Qol (SF-36)  
• PROM (ABD and ER)  
• Patient satisfaction (0-5) |
| Source | Participants, No. (participants who completed study, No.) | Mean age, y | Duration of symptoms | Participants per treatment group, No. (participants per treatment group who completed study, No.) | Treatment duration (treatment follow-up) | Outcome measures |
|--------|-----------------------------------------------------|------------|---------------------|-------------------------------------------------------------------------------------------------|------------------------------------------|-----------------|
| Lee et al, 1974 | 65 (unknown) | 57.3 | Between 3 mo and 5 y | Physiotherapy (heat and exercises); n = 17 (unknown) | Details regarding number of injections and duration of physiotherapy and analogics not given (0, 1, 2, 3, 4, 5, and 6 wk) | AROM (ABD) |
| Lee et al, 2017 | 64 (64) | 54.9 | Mean, 8 mo | IA corticosteroid; n = 32 (32) | Single injection (0, 3, 6, and 12 wk) | Pain (VAS, 0-10), global | Functional disability (SPADI) | PROM (FL, EXT, ER, and IR) |
| Lee et al, 2017 | 30 (unknown) | 58.7 | Not stated | ESWT with physiotherapy (hot packs, US, and electrotherapy); n = 11 (unknown) | Both treatments 3 times weekly for 4 wk (0 and 4 wk) | Pain (VAS, 0-10), unspecified | ROM (FL, ER), unknown if active or passive |
| Lim et al, 2014 | 68 (62) | 53.8 | Mean, 7.3 mo | IA corticosteroid; n = 34 (33) | Single injection of IA corticosteroid; 3 injections sodium hyaluronate (0, 2, and 12 wk) | Pain (VAS, 0-10), unspecified | Function (ASES and CM) | AROM (FL, ER, and IR) |
| Lo et al, 2020 | 21 (unknown) | 59.6 | Everyone >3 mo | Electroacupuncture with physiotherapy; n = 11 (unknown) | 18 sessions during 6-9 wk (0, 1, 3, and 6 mo) | Pain (VAS, 0-10), with movement | AROM (FL, EXT, ABD, AD, ER, and IR) | PROM (FL, EXT, ABD, AD, ER, and IR) | Functional disability (SPADI) |
| Lorbach et al, 2010 | 40 (unknown) | 51 | Mean, 11 mo | IA corticosteroid; n = 20 (unknown) | IA corticosteroid 3 injections during 8 wk; oral corticosteroid for 25 d (0, 4, 8, and 12, 6 and 12 mo) | Function (CM, SST, and VAS) | Pain (VAS, 0-10), at rest and with movement | AROM (FL, EXT, ER, and IR) | PROM (FL, EXT, ER, and IR) | QoL (SF-36) | Patient satisfaction (VAS) |
| Ma et al, 2006 | 75 (unknown) | 54.8 | Mean, 25.8 wk, everyone >3 mo | Physiotherapy; n = 30 (unknown) | Acupuncture twice weekly for 4 wk; physiotherapy 5 times weekly for 4 wk (0, 2, and 4 wk) | Pain (VAS, 0-10), unspecified | AROM (FL, ER, and IR) | AROM (FL, ER, and IR) | Satisfaction (VAS) | PROM (FL, ER, and IR) |
| Maryam et al, 2012 | 87 (69) | 53.6 | Mean, 5.8 mo, everyone <1 y | Physiotherapy; n = 27 (8) | Single injection of IA corticosteroid single injection; 10 sessions of physiotherapy (0 and 6 wk) | Functional disability (SPADI) | Pain (SPADI, 0-100), unspecified | AROM (FL, ER) | PROM (FL, ER, and IR) |
| Mukherjee et al, 2017 | 60 (56) | 50.4 | Mean, 6.3 mo | ACR; n = 30 (28) | Single treatment (0, 4, 8, 12, 16, and 20 wk) | Pain (VAS, 0-10), unspecified | Function (CM) | | |
| Mun and Baek, 2016 | 136 (121) | 53 | Mean, 6.5 mo, everyone >3 mo | Arthrographic distension with IA corticosteroid and MUA; n = 67 (60) | Single injection (0, 2, 6, 12, 24, and 48 wk) | Pain (VAS, 0-10), unspecified | Function (CM) | Satisfaction (VAS) | PROM (FL, ER, and IR) |
| Oh et al, 2011 | 71 (58) | 57 | Mean, 6.6 mo | IA corticosteroid; n = 37 (31) | Single injection (0, 3, 6, and 12 wk) | Pain (VAS, 0-10), unspecified | Function (CM) | PROM (ABD, ER, and IR) |)

(continued)
| Source | Participants, No. (participants who completed study, No.) | Mean age, y | Duration of symptoms | Participants per treatment group, No. (participants per treatment group who completed study, No.) | Treatment duration (follow-up) | Outcome measures |
|--------|----------------------------------------------------------|-------------|----------------------|---------------------------------------------------------------------------------------------|-------------------------------|------------------|
| Park and Hwnag,40 2000a | 55 | 56.5 | Not stated | • IA corticosteroid with arthrographic distension; n = 28 (unknown) • IA corticosteroid; n = 27 (unknown) • Unclear whether home exercise program was used | Single injection (0, 1 wk, 1 mo) | Pain (VAS, 0-10) • AROM (ABD, FL, ER, and IR) • Cyriax stages of arthritis |
| Park et al,77 2013 | 90 (90) | 55.8 | Mean (range), 5.3 mo (3-9 mo) | • Arthrographic distension with sodium hyaluronate; n = 45 (45) • IA corticosteroid n = 45 (45) • Both groups received home exercise program of unknown duration | 3 injections during 4 wk (0, 2, and 6 wk) | Functional Disability (SPADI) • Pain (VAS and SPADI) • PROM (ABD, FL, and ER) • Complications |
| Park et al,78 2014 | 53 (unknown) | 56 | Range, 3-9 mo | • Arthrographic distension with IA corticosteroid, intensive mobilization, and general physiotherapy; n = 16 (unknown) • Arthrographic distension with IA corticosteroid and general physiotherapy; n = 12 (unknown) • Intensive mobilization with general physiotherapy; n = 16 (unknown) • General physiotherapy; n = 11 (unknown) • General physiotherapy included hot packs, TENS, and US; all groups received home exercise program of unknown duration | All treatments twice weekly for 4 wk (0 and 4 wk) | Pain (VAS, 0-10), unspecified • Functional disability (SPADI) • Function (CM) • AROM (ABD, FL, ER, and IR) |
| Park et al,41 2015 | 30 (unknown) | 53.5 | Not stated | • ESWT with physiotherapy; n = 15 (unknown) • Physiotherapy; n = 15 (unknown) • Physiotherapy included hot packs, US, and electrotherapy; no home exercise program | Twice weekly for 6 wk (0 and 4 wk) | Pain (VAS, 0-10), unspecified • Function (patient-specific functional scales) |
| Prestgaard et al,42 2015a | 122 (114) | 54.5 | Mean (range), 15 wk (1-6 mo) | • IA corticosteroid; n = 42 (39) • IA with rotator interval corticosteroid; n = 40 (39) • Sham injection (IA with rotator interval local anesthetic); n = 40 (36) • No home exercise program | Single injection (0, 3, 6, 12, and 26 wk) | Pain (VAS, 0-10), general and at night • Shoulder disability (SPADI) • AROM (ABD, FL, and ER) • Use of analgesics • QoL (EQ-5D) |
| Pushpasekaran et al,79 2017 | 85 (80) | 56.3 | Mean (range), 15.2 mo (2.5-49 mo) | • IA corticosteroid; n = 43 (40) • 3-site injection (IA, SA, and subcoracoid); n = 42 (40) • Both groups received NSAIDs, physiotherapy (US), and 4-wk home exercise program for prior to intervention | 2 treatments during 3 wk (0, 3, and 6 wk, 6 mo) | Function (CM) |
| Quaraishi et al,80 2007 | 36 individuals with 38 shoulders (33) | 55.2 | Mean (range), 33.7 wk (12-76 wk) | • Arthrographic distension; n = 19 (18) • MUA with IA corticosteroid n = 17 (15) • Both groups received home exercise program of unknown duration | Single treatment (0, 2 mo, 6 mo) | Pain (VAS, 0-10), unspecified • Function (CM) • PROM (ABD, FL, ER, and IR) • Satisfaction |
| Ranalletta et al,43 2015a | 74 (69) | 63.4 | Mean, 12 wk, everyone >1 mo | • IA corticosteroid; n = 36 (34) • NSAID; n = 38 (35) • Both groups received supervised exercises and 12-wk home exercise program | Single IA corticosteroid injection; NSAID twice a day for unknown duration (0, 2, 4, 8, and 12) | Pain (VAS, 0-10), overall • Function (ASES and CM) • Functional disability (pDASH) • PROM (ABD, FL, EXT, ER, and IR) • ROM (ABD, FL, EXT, ER, and IR) • unknown whether active or passive |
| Reza et al,44 2013a | 100 (100) | 59.5 | Mean, 115 d, everyone >3 mo | • IA corticosteroid; n = 50 (50) • Arthrographic distension with IA corticosteroid; n = 50 (50) • Both groups received home exercise program of unknown duration | Single injection (0, 2, d 12 wk) | Pain (VAS, 0-10), unspecified • ROM (ABD, FL, EXT, ER, and IR) • unknown whether active or passive |
| Rizk et al,45 1991a | 48 (44) | 55 | Mean (range), 13.2 wk (8-18 wk) | • IA corticosteroid; n = 16 (15) • Intrabursal (SA) corticosteroid; n = 16 (14) • IA LA; n = 8 (8) • Intrabursal (SA) LA; n = 8 (7) • All groups received home exercise program of unknown duration | 3 injections during 2 wk (weekly 0-11 wk, 15 wk, and 6 mo) | PROM (total ROM) • Pain (VAS, 0-5), unspecified |

(continued)
### Table 1. Main Characteristics of Populations, Interventions, and Outcome Measures of Included Randomized Trials (continued)

| Source          | Participants, No. (participants who completed study, No.) | Mean age, y | Duration of symptoms | Participants per treatment group, No. (participants per treatment group who completed study, No.) | Treatment duration (follow-up) | Outcome measures |
|-----------------|----------------------------------------------------------|-------------|----------------------|-----------------------------------------------------------------------------------------------|--------------------------------|------------------|
| Roh et al,2011a | 50 (45); patients with diabetes                         | 54.9        | Mean (range), 6.4 wk (4 wk-6 mo) | IA corticosteroid; n = 25 (23) No treatment; n = 25 (22) Both groups received home exercise program of unknown duration | Single injection (0, 4, 12, and 24 wk) | PROM (FL, ER, and IR) Pain (VAS, 0-10), unspecified Function (ASES) |
| Rouhani et al,2016 | 72 (64)                                                    | 52.8       | Not stated            | Calcitonin nasal spray with physiotherapy (details not stated); n = 36 (32) Placebo spray with physiotherapy (details not stated); n = 36 (32) Both groups received oral NSAIDs | Calcitonin and placebo spray for 6 weeks (0 and 6 wk) | Pain (VAS, 0-10), overall and at night Functional disability (DASH and SPADI QoL (HAQ) Functional disability (SDQ) QoL (SF-36) |
| Ryans et al,2005a | 80 (78)                                                    | 54.1        | Mean, 10.4 wk, everyone >4 wk | IA corticosteroid; n = 20 (20) IA placebo (normal saline) with physiotherapy; n = 20 (20) Both groups received oral NSAIDs | Single injection; physiotherapy of unknown duration (0, 6, and 16 wk) | AROM (ABD, FL, ER, and IR) PROM (ABD, FL, ER, and IR) Pain (VAS, 0-100), at rest Function (VAS and HAQ) Functional disability (DASH) QoL (SF-36) |
| Schröder et al,2017 | 60 (60)                                                   | 53.5        | Mean, 15.6 mo         | Acupuncture; n = 30 (30) No home exercise program | Single session (baseline and postsession) | Function (CM) Pain (CM, 0-15) |
| Schydlowsky et al,2012 | 18 (14)                                                | 51        | Everyone >3 wk        | IA adalimumab; n = 10 (6) IA corticosteroid; n = 8 (6) No home exercise program | 1 injection every 2 wk to 3 injections (0, 2, 4, 8, 12, and 24 wk) | Function (CM) Functional disability (SPADI) Pain (NRS, 0-10), mean PROM (ABD, and ER, IR) |
| Sharma et al,2016a | 106 (87)                                                   | 53        | Median (range), 6.8 mo (2-37 mo) | IA corticosteroid; n = 36 (34) IA corticosteroid with arthrographic distension; n = 34 (32) Treatment as usual (physiotherapy, analgesia, or no treatment); n = 36 (21) No home exercise program | 4 injections during 1 mo (0, 4 and 8 wk, 12 mo) | Functional disability (SPADI) Pain (NRS, 0-10), mean PROM (ABD, and ER, IR) |
| Shin and Lee,2013a | 191 (158)                                                  | 55.7        | >3 mo, mean 7.2 mo    | SA corticosteroid; n = 49 (41) IA corticosteroid; n = 48 (42) SA with IA corticosteroid; n = 47 (39) NSAID; n = 49 (36) All groups received home exercise program of >3-mo duration | Single SA and IA injection; oral NSAID for 6 wk (0, 2, 4, 8, 16, and 24 wk) | Function (ASES) Pain (VAS, 0-10), unspecified Treatment satisfaction (VAS) AROM (FL, ER, and IR) |
| Sun et al,2001 | 35 (30)                                                   | 56.3        | Mean, 6.5 mo          | No treatment; n = 22 (18) Acupuncture; n = 13 (12) Both groups received supervised exercises for 6 wk and home exercise program of unknown duration | Acupuncture twice weekly for 6 wk (0, 6, 20 wk) | Function (CM) |
| Sun et al,2018a | 97 (77)                                                   | 53.9        | Mean, 15.2 wk, everyone <9 mo | IA corticosteroid; n = 30 (24) SA corticosteroid; n = 34 (26) Rotor interval corticosteroid; n = 33 (27) All groups received home exercise program of unknown duration | Single injection (0, 4, 8, and 12 wk) | Pain (VAS, 0-10), unspecified Function (CM) Functional disability (DASH) PROM (ABD, FL, ER, and IR) |
| Tveitå et al,2008a | 76 (69)                                                   | 51.5        | Mean, 7 mo, everyone 3 mo -2 y | Arthrographic distension with IA corticosteroid; n = 39 (36) IA corticosteroid; n = 37 (33) No home exercise program | 3 injection during 4 wk (0 and 10 wk) | Functional disability (SPADI) AROM (FL, ER, and IR) PROM (ABD, FL, ER, and IR) |
| Valdatpour et al,2014a | 40 (36)                                               | 58.2        | Not stated            | ESWT; n = 20 (19) Sham ESWT; n = 20 (17) All patients had a single IA corticosteroid injection at time of inclusion in the study and received home exercise program | Once weekly for 4 wk (0, 4 and 12 wk, 6 mo) | Pain (SPADI 0-100), unspecified Functional disability (SPADI) PROM (ABD, FL, EXT, ER, and IR) |

(continued)
Table 1. Main Characteristics of Populations, Interventions, and Outcome Measures of Included Randomized Trials (continued)

| Source | Participants, No. (participants who completed study, No.) | Mean age, y | Duration of symptoms | Participants per treatment group, No. (participants per treatment group who completed study, No.) | Treatment duration (follow-up) | Outcome measures |
|--------|----------------------------------------------------------|-------------|---------------------|-------------------------------------------------------------------------------------------------|-----------------------------|-----------------|
| van der Windt, et al 1998a | 109 (103) | 58.5 | 82 with <6 mo; 27 with >6 mo | • Physiotherapy (mobilizations and exercises) n = 56 (54) • IA corticosteroid; n = 53 (48) • Physiotherapy group received ice and hot packs and electrotherapy at the physiotherapist’s discretion; no home exercise program | Physiotherapy for 6 wk; IA corticosteroid as many as 3 injections during 6 wk (0, 3, 7, 13, 26, and 52 wk) | • Satisfaction (0-5) • Pain (VAS, 0-100), during day and at night • Functional disability (SDQ) • PROM (ABD and ER) |
| Widiastuti-Samekto and Sianturi, 2004 | 28 (27) | 40-69 | Range, 1-6 mo | • IA corticosteroid with physiotherapy; n = 13 (13) • Oral corticosteroid with physiotherapy; n = 15 (14) • Physiotherapy was supervised and included 20 sessions of mobilizations and ice and hot packs; no home exercise program | Single IA corticosteroid injection; oral corticosteroid for 3 wk (0, 1, 2, and 3 wk) | • Treatment success (90% improvement in ABD and ER PROM) • Pain (VAS, 0-10), unspecified |
| Yoon et al, 2016a | 90 (86) | 55 | Mean, 9 mo | • IA corticosteroid; n = 30 (29) • SA corticosteroid; n = 30 (29) • Arthrographic distension with IA corticosteroid; n = 30 (28) • All groups received home exercise program of unknown duration | Single injection (0, 1, 3, and 6 mo) | • Pain (VAS, 0-10), unspecified • Function (SST and CM) • PROM (FL, ER, and IR) |

Abbreviations: ABD, abduction; ACR, arthroscopic capsular release; AROM, active range of movement; ASES, American Shoulder and Elbow Surgeons questionnaire; BPI-SF, Brief Pain Inventory–Short Form; CM, Constant-Murley score; DASH, Disabilities of the Arm, Shoulder, and Hand questionnaire; EA, electroacupuncture; ELE, elevation; EQ-5D, Euro-5 Dimensions questionnaire; ER, external rotation; ESWT, extracorporeal shock wave therapy; EXT, extension; FL, flexion; HAQ, Health Assessment Questionnaire; IA, intra-articular; IFE, interfascial electrotherapy; IR, internal rotation; IRR, infrared radiotherapy; LA, local anesthetic; MPO, McGill Pain Questionnaire; MUA, manipulation under anesthesia; NPRS, numerical pain rating scale; NSAID, nonsteroidal anti-inflammatory drug; OSS, Oxford Shoulder Score; PET, problem elicitation techniqe; PNF, proprioceptive neuromuscular facilitation; PROM, passive range of movement; qDASH, quick DASH; QoL, quality of life; SA, subacromial; SDQ, Shoulder Disabilities Questionnaire; SF-36, 36-item short-form survey; SPADI, Shoulder Pain and Disability Index; SRQ, self-reporting questionnaire; SST, Simple Shoulder Test; TDP, transcutaneous infrared thermotherapy; TENS, transcutaneous electrical nerve stimulation; UCLA, University of California Los Angeles questionnaire; US, ultrasound; VAS, visual analog scale.

*Studies included in meta-analyses.
Table 2. Results of Pairwise Comparisons of Interventions of the Included Studies

| Source | Pain Function | ROM ER | ROM ABD | ROM FL | Satisfaction or QoL |
|--------|---------------|--------|---------|--------|--------------------|
| Jacobs et al,41 1991 | NA | NA | No change at 4 mo | No change at 4 mo | No change at 4 mo | NA |
| Gam et al,29 1998 | No change at 3, 6, or 12 wk | NA | No change at 3 and 6 wk; increase at 12 wk | No change at 3, 6, or 12 wk | Increase at 3, 6, and 12 wk | NA |
| Tveitå et al,51 2008 | NA | No change at 10 wk | No change at 10 wk | No change at 10 wk | No change at 10 wk | NA |
| Reza et al,44 2013 | Decrease at 12 wk | NA | Increase at 12 wk | Increase at 12 wk | Increase at 12 wk | NA |
| Sharma et al,48 2016 | No change at 4 or 8 wk | No change at 4 or 8 wk | No change at 4 or 8 wk | No change at 4 or 8 wk | No change at 4 or 8 wk | NA |
| Park and Hwang,40 2000 | No change at 1 or 4 wk | No change at 1 or 4 wk | Increase at 1 wk; no change at 4 wk | Increase at 1 wk; no change at 4 wk | Increase at 1 and 4 wk | NA |
| Yoon et al,54 2016 | Increase at 4 wk; no change at 12 wk or 6 mo | Increase at 4 wk and 12 wk; no change at 6 mo | Increase at 4 wk; no change at 12 wk or 6 mo | NA | Increase at 4 wk; no change at 12 wk or 6 mo | NA |
| Lee et al,33 1974 | NA | NA | Increase at 1-6 wk | Increase at 1-6 wk | NA | NA |
| Bulgen et al,23 1986 | No change at 6 wk, 12 wk, 6 mo, or 12 mo | No change at 6 wk, 12 wk, 6 mo, or 12 mo | No change at 6 wk, 12 wk, 6 mo, or 12 mo | No change at 6 wk, 12 wk, 6 mo, or 12 mo | No change at 6 wk, 12 wk, 6 mo, or 12 mo | NA |
| Lee et al,33 1974 | NA | NA | Increase at early short-term; no change at late short-term | Increase at early short-term; no change at late short-term | NA | NA |
| Quality of evidence | Decrease at early short-term (high)^a; decrease at late short-term (high)^a | No change at early short-term (moderate)^a, b; decrease at late short-term (moderate)^a, b | Increase at early short-term (moderate)^a, b; decrease at late short-term (moderate)^a, b | Increase at early short-term (moderate)^a, b; decrease at late short-term (moderate)^a, b | Increase at early short-term; no change at late short-term | NA |
| Calis et al,24 2006 | No change at 2 or 12 wk | Decrease at 2 and 12 wk | Increase at 2 and 12 wk | Increase at 2 and 12 wk | NA | NA |
| Carette et al,25 2003 | No change at 6 wk, 12 wk, 6 mo, or 12 mo | No change at 6 wk, 12 wk, 6 mo, or 12 mo | No change at 6 wk, 12 wk, 6 mo, or 12 mo | No change at 6 wk, 12 wk, 6 mo, or 12 mo | No change at 6 wk, 12 wk, 6 mo, or 12 mo | NA |
| Bulgen et al,23 1986 | No change at 6 wk or 6 mo | No change at 6 wk or 6 mo | No change at 6 wk or 6 mo | No change at 6 wk or 6 mo | No change at 6 wk or 6 mo | NA |
| Lee et al,33 1974 | NA | NA | Increase at 1-6 wk | Increase at 1-6 wk | NA | NA |
| Quality of evidence | No change at early short-term | Increase at early short-term (moderate)^a, b | Increase at early short-term (moderate)^a, b | Increase at early short-term (moderate)^a, b | Increase at early short-term | NA |

IA corticosteroid vs IA no treatment or placebo

| Bai et al,22 2008 | No change at 2 wk or 12 wk | Increase at 2 wk; no change at 12 wk | Increase at 2 wk; no change at 12 wk | Increase at 2 wk; no change at 12 wk | No change at 2 wk or 12 wk | NA |
| Calis et al,24 2006 | No change at 2 wk; decrease at 12 wk | No change at 2 wk; decrease at 12 wk | No change at 2 wk; decrease at 12 wk | No change at 2 wk; decrease at 12 wk | No change at 2 wk or 12 wk | NA |
| Carette et al,25 2003 | Decrease at 6 wk or 12 mo; no change at 6 or 12 mo | Increase at 6 and 12 wk; no change at 6 or 12 mo | Increase at 6 and 12 wk; no change at 6 or 12 mo | Increase at 6 and 12 wk; no change at 6 or 12 mo | No change at 6 wk, 6 mo, or 12 mo; increase at 12 wk | NA |
| Bulgen et al,23 1986 | No change at 6 wk or 6 mo | NA | Increase at 6 wk; no change at 6 mo | Increase at 6 wk; no change at 6 mo | No change at 6 wk, 6 mo, or 12 mo | NA |
| Dehghan et al,28 2013 | No change at 2, 6, 12, or 24 wk | No change at 2, 6, 12, or 24 wk | No change at 2, 6, 12, or 24 wk | No change at 2, 6, 12, or 24 wk | No change at 6 wk, 6 mo, or 12 mo; increase at 12 wk | NA |
| Ranalletta et al,43 2015 | Decrease at 2, 4, and 8 wk; no change at 12 wk | Increase at 2, 4, 8, and 12 wk | Increase at 2 wk; no change at 4, 8, or 12 wk | Increase at 2, 4, 8, and 12 wk | No change at 2, 4, 8, and 12 wk | NA |
| Roh et al,46 2011 | Decrease at 4 wk; no change at 12 wk | Increase at 12 wk; no change at 4 wk or 6 mo | No change at 4 wk, 12 wk, or 6 mo | No change at 4 wk, 12 wk, or 6 mo | No change at 4 wk or 6 mo; increase at 12 wk | NA |
| Sharma et al,48 2016 | Decrease at 4 and 8 wk | Increase at 4 and 8 wk; no change at 12 mo | Increase at 4 and 8 wk; no change at 12 mo | Increase at 4 and 8 wk | Increase at 4 and 8 wk | NA |
| Shin and Lee,49 2011 | No change at 1-11 wk and 4 mo; no change at 6 mo | No change at 11 wk or 6 mo | No change at 11 wk or 6 mo | No change at 11 wk or 6 mo | No change at 11 wk or 6 mo | NA |
| Ryans et al,47 2005 | No change at 6 wk or 4 mo | No change at 6 wk or 4 mo | No change at 6 wk or 4 mo | No change at 6 wk or 4 mo | No change at 6 wk or 4 mo | NA |
| Prestgaard et al,44 2015 | Decrease at 6 and 12 wk; no change at 3 wk or 6 mo | Decrease at 3, 6, and 12 wk; no change at 3 wk or 6 mo | Decrease at 6 and 12 wk; no change at 3 wk or 6 mo | Decrease at 6 and 12 wk; no change at 3 wk or 6 mo | Decrease at 6 and 12 wk; no change at 3 wk or 6 mo | NA |

(continued)
| Source | Pain Function | ROM ER | ROM ABD | ROM FL | Satisfaction or QoL |
|--------|---------------|--------|---------|--------|---------------------|
| Quality of evidence | No change at early short-term (high)\(^a,b\); decrease at late short-term (moderate)\(^a,b\); no change at mid-term (moderate)\(^a\) | Increase at early short-term (moderate)\(^a\); increase at late short-term (moderate)\(^a,b\); increase at mid-term (moderate)\(^a\) | Increase at early short-term (moderate)\(^a\); increase at late short-term (moderate)\(^a\); no change at mid-term (moderate)\(^a\) | No change at early short-term; increase at late short-term; no change at mid-term | No change at early short-term; no change at mid-term |
| IA corticosteroid with physiotherapy vs no treatment or placebo | Ryans et al, \(^47\) 2005 | No change at 6 wk or 4 mo | Increase at 6 wk; no change at 4 mo | No change at 6 wk or 4 mo | No change at 6 wk or 4 mo |
| IA corticosteroid with physiotherapy | No change at 6 wk or 4 mo, or 12 mo | Increase at 6 wk; No change at 12 wk, 6 mo, or 12 mo | No change at 6 wk, 12 wk, 6 mo, or 12 mo | No change at 6 wk, 12 wk, 6 mo, or 12 mo | No change at 6 wk, 12 wk, 6 mo, or 12 mo |
| IA corticosteroid with physiotherapy vs placebo | Calis et al, \(^4\) 2006 | No change at 2 or 12 wk | No change at 2 or 12 wk | Decrease at 2 or 12 wk | No change at 2 or 12 wk |
| IA corticosteroid with physiotherapy vs physiotherapy | van der Windt et al, \(^5\) 1998 | No change at 6 wk or 6 mo | Increase at 6 wk, 7 wk, and 6 mo | No change at 6 wk, 7 wk, and 6 mo | No change at 6 wk, 7 wk, and 6 mo |
| Quality of evidence | No change at early short-term (moderate)\(^a\); decrease at late short-term (high)\(^b\); no change at mid-term (low) | Increase at early short-term (moderate)\(^a\); no change at late short-term (moderate)\(^a\); increase at mid-term (moderate)\(^a\) | No change at early short-term (moderate)\(^a\); no change at late short-term (moderate)\(^a\); increase at mid-term (moderate)\(^a\) | No change at early short-term; no change at late short-term; no change at mid-term | No change at early short-term; no change at mid-term |
| IA corticosteroid with physiotherapy vs IA corticosteroid only | Kraal et al, \(^23\) 2018 | No change at 6 wk, 12 wk, or 6 mo | Increase at 6 wk; no change at 12 wk or 6 mo | Increase at 6 wk and 12 wk; no change at 6 mo | Increase at 6 wk and 12 wk; no change at 6 mo |
| IA corticosteroid with physiotherapy vs physiotherapy only | Dacre et al, \(^27\) 1989 | No change at 6 wk or 6 mo | No change at 6 wk or 6 mo | No change at 6 wk or 6 mo | No change at 6 wk or 6 mo |
| Quality of evidence | No change at early short-term (moderate)\(^a\); decrease at late short-term (low)\(^a\); no change at mid-term (moderate)\(^a\) | Increase at early short-term (moderate)\(^a\); no change at late short-term (moderate)\(^a\); increase at mid-term (moderate)\(^a\) | No change at early short-term (moderate)\(^a\); no change at late short-term (moderate)\(^a\); increase at mid-term (moderate)\(^a\) | No change at early short-term; no change at late short-term; no change at mid-term | No change at early short-term; no change at mid-term |
| IA corticosteroid with physiotherapy | Carette et al, \(^25\) 2003 | Decrease at 6 and 12 wk; no change at 6 or 12 mo | Increase at 6 and 12 wk; no change at 6 or 12 mo | Increase at 6 wk, 12 wk, and 6 mo; no change at 12 mo | Increase at 6 wk, 12 wk, and 6 mo; no change at 12 mo |
| IA corticosteroid with physiotherapy vs placebo | Lee et al, \(^33\) 1974 | No change at 6 wk, 12 wk, and 6 mo, or 12 mo | No change at 6 wk, 12 wk, and 6 mo, or 12 mo | No change at 6 wk, 12 wk, and 6 mo, or 12 mo | No change at 6 wk, 12 wk, 6 mo, or 12 mo |
| IA corticosteroid with physiotherapy vs physiotherapy | Maryam et al, \(^38\) 2012 | No change at 6 wk or 6 mo | No change at 6 wk or 6 mo | No change at 6 wk or 6 mo | No change at 6 wk or 6 mo |
| Quality of evidence | No change at early short-term (moderate)\(^a\); decrease at late short-term (moderate)\(^a\); no change at mid-term (moderate)\(^a\) | Increase at early short-term (moderate)\(^a\); no change at late short-term (moderate)\(^a\); increase at mid-term (moderate)\(^a\) | No change at early short-term (moderate)\(^a\); no change at late short-term (moderate)\(^a\); increase at mid-term (moderate)\(^a\) | No change at early short-term; no change at late short-term; no change at mid-term | No change at early short-term; no change at mid-term |
| IA corticosteroid with physiotherapy vs physiotherapy only | Dacre et al, \(^27\) 1989 | No change at 6 wk or 6 mo | No change at 6 wk or 6 mo | No change at 6 wk or 6 mo | No change at 6 wk or 6 mo |
| Maryam et al, \(^38\) 2012 | No change at 6 wk or 6 mo | No change at 6 wk or 6 mo | No change at 6 wk or 6 mo | No change at 6 wk or 6 mo | No change at 6 wk or 6 mo |
| Source                        | Pain Function | ROM ER | ROM ABD | ROM FL | Satisfaction or QoL |
|------------------------------|---------------|--------|---------|--------|---------------------|
| Ryans et al, 2005            | No change at 6 wk or 4 mo | Increase at 6 wk; no change at 4 mo | No change at 6 wk or 4 mo | NA                | NA                  |
| Lee et al, 1974              | NA            | No change at 1, 3, 4, 5, or 6 wk; increase at 2 wk | No change at 1, 3, 4, 5, or 6 wk; increase at 2 wk | NA                | NA                  |
| Quality of evidence          | No change at early short-term (moderate); No change at mid-term (moderate) | Increase at early short-term (low); No change at mid-term (low) | No change at early short-term (moderate); No change at mid-term (moderate) | No change at early short-term; no change at mid-term | No change at mid-term |
| IA corticosteroid vs SA corticosteroid | Decrease at 4, 8, and 12 wk | Increase at 4, 8, and 12 wk | Increase at 4, 8, and 12 wk | Increase at 4, 8, and 12 wk | NA                  |
| Lo et al, 2020               | No change at 4 wk, 12 wk, or 6 mo | No change at 4 wk, 12 wk, or 6 mo | No change at 4 wk, 12 wk, or 6 mo | No change at 4 wk, 12 wk, or 6 mo | NA                  |
| Koh et al, 2013              | No change at 2, 4, or 12 wk; increase at 8 wk | No change at 2, 4, 12 wk, or 6 mo | No change at 2, 4, 12 wk, or 6 mo | No change at 2, 4, 12 wk, or 6 mo | NA                  |
| Ma et al, 2006               | Decrease at 4 wk | No change at 4 wk | No change at 4 wk | No change at 4 wk | NA                  |
| Quality of evidence          | No change at early short-term (low) | No change at early short-term (low) | No change at early short-term (low) | No change at early short-term (low) | NA                  |
| Acupuncture with physiotherapy only, with or without placebo acupuncture | Decrease at 4 wk, 12 wk, and 6 mo | Increase at 4 wk, 12 wk, and 6 mo | Increase at 4 wk, 12 wk, and 6 mo | Increase at 4 wk, 12 wk, and 6 mo | NA                  |
| Lee et al, 2017              | Decrease at 4 wk | No change at 4 wk | Increase at 4 wk | NA | Increase at 4 wk |
| Park et al, 2015             | Decrease at 4 wk | No change at 4 wk | No change at 4 wk | NA | NA |
| Quality of evidence          | Decrease at early short-term (very low) | NA | NA | NA | Increase at early short-term |

Abbreviations: ABD, abduction; ER, external rotation; ESWT, extracorporeal shock wave therapy; FL, flexion; IA, intra-articular; NA, not applicable; QoL, quality of life; ROM, range of movement; SA, subacromial.

b Results of meta-analysis clinically and statistically significant.

c Meta-analysis abandoned because of very high statistical inconsistency ($I^2 > 75\%$).
CI, −1.8 to −0.9 VAS points; P < .001), ER ROM (high certainty; MD, 4.7°; 95% CI, 2.7° to 6.6°; P < .001), and function (high certainty; SMD, 0.6; 95% CI, 0.3 to 0.9; P < .001) and late short-term pain (moderate certainty; MD, −1.0 VAS points; −1.5 to −0.5 VAS points; P < .001), ER ROM (high certainty; MD, 6.8°; 95% CI, 3.4° to 10.2°; P < .001), and function (moderate certainty; SMD, 0.6; 95% CI, 0.3 to 0.8; P < .001).

Mid-term | IA corticosteroid was associated with better outcomes than control only for function (moderate certainty; SMD, 0.3; 95% CI, 0.1 to 0.5; P = .01). However, effects for pain and ER ROM were similar (moderate certainty for both).

Physiotherapy vs No Treatment or Placebo

Physiotherapy was found to be associated with improved outcomes compared with control in the early short-term for ER ROM (moderate certainty; MD, 11.3°; 95% CI, 8.6° to 14.0°; P < .001). Data for other follow-up periods were insufficient for quantitative analysis.

IA Corticosteroid Plus Physiotherapy vs No Treatment or Placebo

Combined treatment with IA corticosteroid plus physiotherapy was associated with superior outcomes vs control for early short-term ER ROM (high certainty; MD, 17.9°; 95% CI, 12.1° to 23.7°; P < .001). Data for other follow-up periods were insufficient for quantitative analysis.

IA Corticosteroid vs Physiotherapy

Short-term | IA corticosteroid was associated with significant benefits compared with physiotherapy for early short-term function (moderate certainty; MD, 0.5; 95% CI, 0.2 to 0.7; P < .001) and late short-term pain (high certainty; MD, −1.1 VAS points; 95% CI, −1.7 to −0.5 VAS points; P < .001) only. Differences for early short-term pain (moderate certainty), late short-term function (moderate certainty), and early and late short-term ER ROM (moderate and high certainty, respectively) were insignificant.

Mid-term | IA corticosteroid was associated with better outcomes than physiotherapy for ER ROM (moderate certainty; MD, 4.6°; 95% CI, 0.7° to 8.6°; P = .02). However, no significant differences in pain (low certainty) or function (moderate certainty) were observed.

IA Corticosteroid Plus Physiotherapy vs IA Corticosteroid Only

Short-term | Compared with IA corticosteroid alone, combined treatment with IA corticosteroid plus physiotherapy was only associated with superior outcomes for early short-term ER ROM (moderate certainty; MD, 11.6°; 95% CI, 3.7° to 19.4°; P = .004). Pain and function in the early short-term (moderate and low certainty, respectively) and late short-term function (high certainty) were similar between groups.

Mid-term | No significant differences were found between the groups in pain, function, or ER ROM. These results had high, moderate, and high certainty, respectively.

IA Corticosteroid Plus Physiotherapy vs Physiotherapy Only

Short-term | Combined therapy with IA corticosteroid plus physiotherapy was associated with significant benefits compared with physiotherapy alone only for early short-term function (low certainty; SMD, 0.7; 95% CI, 0.3 to 1.0; P < .001). Differences for early short-term pain and ER ROM and late short-term function were not significant (moderate certainty for all).

Mid-term | No significant differences were found between the groups for pain, function, or ER ROM. These comparisons had moderate, low, and high certainty, respectively.
IA Corticosteroid vs Subacromial Corticosteroid

**Short-term** | Compared with subacromial administration, administering corticosteroid intra-articularly was only associated with superior outcomes for early short-term pain (moderate certainty; MD, −0.6 VAS points; 95% CI, −1.1 to −0.1 VAS points; \( P = .02 \)) and late short-term function (moderate certainty; SMD, 0.3; 95% CI, 0 to 0.6; \( P = .03 \)). Improvements in late short-term pain (moderate certainty) and ER ROM (high certainty) and early short-term function (high certainty) were similar with the 2 interventions.

**Mid-term** | No significant differences were found between the groups for pain or ER ROM. These comparisons had moderate and high certainty, respectively.

Arthrographic Distension Plus IA Corticosteroid vs IA Corticosteroid Only

Adding arthrographic distension to IA corticosteroid appeared to be associated with greater improvements in early and late short-term pain (early: high certainty; MD, −0.9 VAS points; −1.3 to −0.4 VAS points; \( P < .001 \); late: high certainty; MD, −0.8 VAS points; 95% CI, −1.1 to −0.5 VAS points; \( P < .001 \)). Early and late short-term function (moderate and high certainty, respectively) and early and late short-term ER ROM (high certainty for both) were similar with or without distension.

Acupuncture Plus Physiotherapy vs Physiotherapy Only

No differences were found with the addition of acupuncture to physiotherapy for early short-term pain and ER ROM. These comparisons had low and high certainty, respectively.

Clinically Significant Results and Trial Sequential Analysis

Despite several statistically significant differences in pairwise comparisons, most did not reach the threshold for MCRD. Only IA corticosteroid vs no treatment or placebo for early and late short-term pain and function, physiotherapy with and without IA corticosteroid vs no treatment or placebo for early short-term ER ROM, IA corticosteroid vs physiotherapy for early short-term function and late short-term pain, and combination therapy with IA corticosteroid plus physiotherapy compared with IA corticosteroid for early short-term ER ROM and with physiotherapy for early short-term function reached MCRD.

For the primary outcome measure, the clinically and statistically significant results underwent TSA, which confirmed the results ruling out a type I error in 2 comparisons (IA corticosteroid vs no treatment or placebo for early and late short-term pain) but not in the comparison of IA corticosteroid vs physiotherapy for late short-term pain. This suggests that more studies may be needed to confirm the benefit of IA corticosteroid compared with physiotherapy with more confidence.

eFigures 1 to 3 in the Supplement illustrate the results of the pairwise meta-analyses and associated forest plots for early short-term, late short-term, and mid-term follow-up for pain and ER ROM. eFigure 4 in the Supplement illustrates the forest plots for function, and eFigure 5 and eFigure 6 in the Supplement illustrate the TSA graphs.

Network Meta-analysis

Figure 2 and Figure 3 show the network maps and treatment rank probabilities for the primary outcome measure (pain) for late short-term (8-12 weeks) and mid-term (4-6 months) follow-up, respectively. eFigure 7 and eFigure 8 in the Supplement illustrates the network forest plots with their consistency tests.

In the late short-term, arthrographic distension plus IA corticosteroid had the highest probability (96%) of being the most effective treatment. IA corticosteroid had the highest probability (85%) of being the second most effective. Physiotherapy was the least effective treatment, followed by no treatment or placebo. No data existed in the late short-term for combined treatment with IA corticosteroid plus physiotherapy (Figure 2B).
In the mid-term, combined treatment with IA corticosteroid plus physiotherapy had the highest probability (43%) of being the best treatment with physiotherapy. IA corticosteroid had the highest probability (34%) of being the second best treatment. No treatment or placebo followed by subacromial corticosteroid had the highest probability of being the worst interventions (Figure 3B).

**Subgroup Analysis**

The potential benefit of home exercise was assessed by comparing the mean improvement in pain in patients who received (1) IA corticosteroid plus a home exercise program vs IA corticosteroid without home exercise, and (2) no treatment or placebo plus home exercise vs no treatment/placebo without home exercise. For the first comparison, a statistically significant (but clinically small) mean benefit of home exercise on pain improvement was identified at 8 to 12 weeks (MD, −0.5 VAS points; 95% CI, −0.9 to −0.1 VAS points; *P* = .01). The benefit of home exercise was much more substantial (clinically...
and statistically) in those receiving no treatment or placebo (MD, −1.4 VAS points; 95% CI, −1.8 to −1.1 VAS points; \( P < .001 \)). Both results are based on 10 studies\(^{22,24,25,28,42,43,45,46,48,49} \) with low overall risk of bias.

Similarly, we assessed for an effect of IA placebo by comparing samples who received IA placebo and no treatment from the IA corticosteroid vs no treatment or placebo comparison. Both subgroups received a home exercise program. Based on 9 studies\(^{22,24,25,28,42,43,45,46,49} \) with high overall risk of bias, IA placebo was associated with statistically and clinically significant effects on pain compared with no treatment (MD, −1.6 VAS points; 95% CI, −2.1 to −1.1 VAS points; \( P < .001 \)).

There was insufficient data for a similar subgroup analysis at mid-term follow-up. Subgroup analyses for the effect of chronicity on the effectiveness of treatment modalities could not be evaluated because studies including patients with mixed stages and chronicity of frozen shoulder did not include subgroup data. Finally, subgroup analyses according to physiotherapeutic interventions were not possible because of high clinical heterogeneity (various combinations of modalities and treatment durations used). Most studies used electrotherapy modalities (transcutaneous electrical nerve stimulation, therapeutic ultrasound, diathermy) combined with mobilizations, stretching, or exercises with or without heat and ice packs.

**Discussion**

To our knowledge, this is the first systematic review and network meta-analysis to comprehensively analyze all nonsurgical randomized clinical trials pertaining to the treatment of frozen shoulder as well as the largest systematic review ever published in the field. Based on the available evidence, it appears that the use of an IA corticosteroid for patients with frozen shoulder of duration less than 1 year is associated with greater benefits compared with all other interventions, and its benefits may last as long as 6 months. This has important treatment ramifications for the general and specialist musculoskeletal practitioner, providing them with an accessible, cost-effective\(^{88} \) and evidence-based treatment to supplement exercise regimes, which we anticipate will inform national guidelines on frozen shoulder treatments moving forward.

In the short-term, IA corticosteroid appeared to be associated with better outcomes compared with no treatment in all outcome measures. Adding arthrographic distension to IA corticosteroid may be associated with positive effects that last at least as long as 12 weeks compared with IA corticosteroid alone; however, these benefits are probably not clinically significant. Compared with physiotherapy, IA corticosteroid seemed to be associated with better outcomes, with clinically significant differences. Combination therapy with IA corticosteroid plus physiotherapy may be associated with significant benefits compared with IA corticosteroid alone or physiotherapy alone for ER ROM and function, respectively, at 6 weeks. Compared with control, combined IA corticosteroid plus physiotherapy appeared to be associated with an early benefit in ER ROM (as long as 6 weeks), with clinical significance. Subacromial administration of corticosteroid appeared to be as efficacious as IA administration. The addition of acupuncture to physiotherapy did not seem to be associated with any added benefits. Based on the network meta-analysis, arthrographic distension with IA corticosteroid was probably the most effective intervention for pain at 12 weeks follow-up. IA corticosteroid alone ranked second, and as demonstrated by the pairwise meta-analysis, the benefit of adding distension appeared clinically nonsignificant.

Most compared interventions appeared to be associated with similar outcomes at 6-month follow up, without significant differences. The only intervention that was associated with mid-term statistically significant benefits compared with control and physiotherapy (without reaching clinical significance) was IA corticosteroid for function and ER ROM. No mid-term data exist assessing the effectiveness of adding arthrographic distension to IA corticosteroid and acupuncture to physiotherapy or comparing physiotherapy (with or without IA corticosteroid) with no treatment. Our network meta-analysis found that combined therapy with IA corticosteroid and physiotherapy, physiotherapy alone, and IA corticosteroid alone were the most effective interventions for pain at 6
months follow-up. However, according to our pairwise meta-analyses, their clinical benefit compared with other treatments (or even no treatment) appeared very small.

A home exercise program with simple ROM exercises and stretches administered with or without IA corticosteroid appeared to be associated with short-term pain benefits. This was statistically significant but clinically nonsignificant compared with no treatment when accompanied by IA corticosteroid. It was both clinically and statistically significant on its own.

Several systematic reviews have been published assessing the effectiveness of therapeutic interventions for frozen shoulder. Sun et al.89 looked at the effectiveness if IA corticosteroid by comparing it with no treatment, and their findings were similar to ours, reporting that IA corticosteroid may be associated with benefits on pain, function, and ROM that are most pronounced in the short-term and can last as long as 6 months. The systematic review of both randomized and observational studies by Song et al.89 is also in agreement with our results, showing a possible early benefit of IA corticosteroid, which likely diminishes in the mid-term. An earlier systematic review by Maund et al.88 which was only based on limited evidence (meta-analyses of 2 and 3 studies), was largely inconclusive, demonstrating possible benefits of IA corticosteroid (with and without physiotherapy) in conjunction with a home exercise program. A Cochrane review on arthrographic distension91 was also in agreement with our results, showing that arthrographic distension with IA corticosteroid may be associated with short-term benefits in pain, ROM, and function. Their comparison of combined treatment vs IA corticosteroid alone yielded no significant differences; however, it was only based on 2 studies. A 2018 systematic review by Saltychev et al.92 also supports our findings, having demonstrated a small but clinically insignificant benefit of the addition of arthrographic distension to IA corticosteroid. In their systematic review, Catapano et al.83 reported that the addition of arthrographic distension to IA corticosteroid may be associated with a clinically significant benefit at 3 months; however, no quantitative analyses were conducted. Finally, a Cochrane review investigating the effects of manual therapy and exercise94 concluded that they are probably associated with worse outcomes compared with IA corticosteroid in the short-term, which is in accordance with the findings of the present review, and another study95 investigating the effectiveness of electrotherapy modalities was inconclusive because of lack of sufficient evidence.

In this review we aimed to assess the comparative effectiveness of all interventions for frozen shoulder, both surgical and nonsurgical; however, conclusions on the former could not be reached given that included studies did not assess the same interventions, which precluded pooling their results. The existing literature is conflicting regarding the superiority of arthroscopic capsular release (ACR) over nonoperative modalities; De Carli et al.62 reported no short-term or long-term benefits of ACR plus MUA compared with IA corticosteroid plus physiotherapy in function or ROM. Conversely, Mukherjee et al.7 found that ACR was associated with significant improvements in pain, function, and ROM compared with IA corticosteroid in the short-term and mid-term. Gallacher et al.63 demonstrated mixed results, concluding that compared with IA corticosteroid plus arthrographic distension, combined treatment with ACR and IA corticosteroid may be associated with improved function, external rotation, and flexion ROM but not quality of life and abduction ROM in the short-term and mid-term. The risk of complications, where reported, was not higher in the surgical groups.63 The existing evidence on MUA, which is not a surgical procedure per se although it is administered under general anesthesia, is more consistent, suggesting its lack of long-term superiority compared with other commonly used nonsurgical treatments or even no treatment.65,71,76

Because of the paucity of robust evidence, no firm recommendations exist for clinical practice. The National Institute of Health and Care Excellence (NICE) guidelines,96 influenced in turn by the BESS/BOA recommendations, recommend a stepped approach, starting with physiotherapy and only considering IA corticosteroid if there is no, or slow, progress.96 With our review, we provide convincing evidence that IA corticosteroid is associated with better short-term outcomes than other treatments, with possible benefits extending in the mid-term; therefore, we recommend its early
use with an accompanying home exercise program. This can be supplemented with physiotherapy to further increase the chances of resolution of symptoms by 6 months.

Most patients in the included studies had duration of symptoms of less than 1 year; therefore, our management recommendations are strongest for this subgroup, which includes patients most commonly encountered in clinical practice. Based on the underlying pathophysiology of the condition, usual practice is to only administer IA corticosteroid in the painful and not freezing phase (also advised by NICE guidance); however, this is not backed up by evidence. In our review, studies that included patients with symptoms for more than 1 year reported equally substantial improvements in outcome measures including ROM and function; therefore, the benefits of corticosteroids may also apply to the freezing phase of frozen shoulder.

Limitations

Despite the comprehensiveness and rigor of our methods, which include thorough risk of bias assessments and grading of evidence, we do recognize its limitations. Frozen shoulder of all chronicity was analyzed together; therefore, conclusions about specific stages and their most effective management could not be drawn. Most studies included a home exercise program, but its frequency, intensity, and duration were not taken into account in comparisons nor were separate analyses made adjusting for it. Finally, physiotherapy interventions, regardless of nature and duration, were grouped and analyzed together to minimize imprecision; in reality, some might be more effective than others. However, we only present findings that derived from thorough quantitative analyses, which were in turn substantially reinforced by the TSA, minimizing the risk for type I errors; most previous similar meta-analyses did not use TSA. Additionally, we present the first network meta-analysis including all conservative treatments for frozen shoulder. Furthermore, we based our recommendations on both statistically and clinically significant results.

Conclusions

Based on the findings of the present review, we recommend the use of IA corticosteroid for patients with frozen shoulder of duration less than 1 year because it appeared to have earlier benefits than other interventions; these benefits could last as long as 6 months. We also recommend an accompanying home exercise program with simple ROM exercises and stretches. The addition of physiotherapy in the form of an electrotherapy modality and supervised mobilizations should also be considered because it may add mid-term benefits and can be used on its own, especially when IA corticosteroid is contra-indicated. Implicated health care professionals should always emphasize to patients that frozen shoulder is a self-limiting condition that usually lasts for a few months but can sometimes take more than 1 year to resolve and its resolution may be expedited by IA corticosteroid. This should be offered at first contact, and an informed decision should be made by the patient after the risks and alternative therapies are presented to them. In the future, other interventions that have shown promising results and currently have inadequate evidence for definitive conclusions (eg, MUA, ACR, specific types of electrotherapy and mobilizations) should be assessed with large, well-designed randomized studies. Finally, future studies should include subgroup analyses assessing the effectiveness of specific interventions on frozen shoulder of different chronicity and stage.
Corresponding Author: Neal L. Millar, MD, PhD, Institute of Infection, Immunity, and Inflammation, College of Medicine, Veterinary and Life Sciences University of Glasgow, 120 University Ave, Glasgow G12 8TA, United Kingdom (neal.millar@glasgow.ac.uk).

Author Affiliations: Institute of Infection, Immunity and Inflammation, College of Medicine, Veterinary and Life Sciences, University of Glasgow, Scotland, United Kingdom.

Author Contributions: Dr. Challoumas had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

Concept and design: Challoumas, McLean, Millar.

Acquisition, analysis, or interpretation of data: All authors.

Drafting of the manuscript: All authors.

Critical revision of the manuscript for important intellectual content: Challoumas, Millar.

Statistical analysis: Challoumas.

Obtained funding: Millar.

Administrative, technical, or material support: Challoumas, McLean.

Supervision: Challoumas, Millar.

Conflict of Interest Disclosures: None reported.

Funding/Support: This work was funded by grant MR/R020515/1 from the Medical Research Council UK.

Role of the Funder/Sponsor: The funder had no role in the design and conduct of the study; collection, management, analysis, and interpretation of the data; preparation, review, or approval of the manuscript; and decision to submit the manuscript for publication.

REFERENCES

1. Grey RG. The natural history of “idiopathic” frozen shoulder. J Bone Joint Surg Am. 1978;60(4):564. doi: 10.2106/00004623-197860040-00029

2. Bunker TD, Anthony PP. The pathology of frozen shoulder: a Dupuytren-like disease. J Bone Joint Surg Br. 1995;77(5):677-683. doi: 10.1302/0301-620X.77B5.7599688

3. Hand GC, Athanasou NA, Matthews T, Carr AJ. The pathology of frozen shoulder. J Bone Joint Surg Br. 2007;89(7):928-932. doi: 10.1302/0301-620X.89B7.798719097

4. Lho YM, Ha E, Cho CH, et al. Inflammatory cytokines are overexpressed in the subacromial bursa of frozen shoulder. J Shoulder Elbow Surg. 2013;22(5):666-672. doi: 10.1016/j.jse.2012.06.014

5. Akbar M, McLean M, Garcia-Melchor E, et al. Fibroblast activation and inflammation in frozen shoulder. PLoS One. 2019;14(4):e0215301. doi: 10.1371/journal.pone.0215301

6. Linsell L, Dawson J, Zondervan K, et al. Prevalence and incidence of adults consulting for shoulder conditions in UK primary care; patterns of diagnosis and referral. Rheumatology (Oxford). 2006;45(2):215-221. doi: 10.1093/rheumatology/kei39

7. Reeves B. The natural history of the frozen shoulder syndrome. Scand J Rheumatol. 1975;4(4):193-196. doi: 10.3109/03009747509165255

8. Hand C, Clipsham K, Rees JL, Carr AJ. Long-term outcome of frozen shoulder. J Shoulder Elbow Surg. 2008;17(2):231-236. doi: 10.1016/j.jse.2007.05.009

9. van der Windt DA, Koes BW, de Jong BA, Bouter LM. Shoulder disorders in general practice: incidence, patient characteristics, and management. Ann Rheum Dis. 1995;54(12):959-964. doi: 10.1136/ard.54.12.959

10. Le HV, Lee SJ, Nazarian A, Rodriguez EK. Adhesive capsulitis of the shoulder: review of pathophysiology and current clinical treatments. Shoulder Elbow. 2017;9(2):75-84. doi: 10.1177/1758573216676786

11. Georgiannos D, Markopoulou G, Devetzi E, Bribinas I. Adhesive capsulitis of the shoulder: is there a consensus regarding the treatment? a comprehensive review. Open Orthop J. 2017;11:65-76. doi: 10.2174/187432501101100065

12. Rangan A, Goodchild L, Gibson J, et al. Frozen shoulder. Shoulder Elbow. 2015;7(4):299-307. doi: 10.1177/1758573215610045

13. Brealey S, Armstrong AL, Brooksbank A, et al. United Kingdom Frozen Shoulder Trial (UK FROST), multi-centre, randomised, 12 month, parallel group, superiority study to compare the clinical and cost-effectiveness of early structured physiotherapy versus manipulation under anaesthesia versus arthroscopic capsular release for patients referred to secondary care with a primary frozen shoulder: study protocol for a randomised controlled trial. Trials. 2017;18(1):614. doi: 10.1186/s13063-017-2352-2
35. Lee S, Lee S, Jeong M, Oh H, Lee K. The effects of extracorporeal shock wave therapy on pain and range of motion in patients with adhesive capsulitis. *J Phys Ther Sci*. 2017;29(11):1907-1909. doi:10.1589/jpts.29.1907

36. Lo MY, Wu CH, Luh JJ, et al. The effect of electroacupuncture merged with rehabilitation for frozen shoulder syndrome: a single-blind randomized sham-acupuncture controlled study. *J Formos Med Assoc*. 2020;119(1 Pt 1):81-88. doi:10.1016/j.jfma.2019.03.012

37. Ma T, Kao MJ, Lin IH, et al. A study on the clinical effects of physical therapy and acupuncture to treat spontaneous frozen shoulder. *Am J Chin Med*. 2006;34(5):759-775. doi:10.1142/S0192415X06004272

38. Mobini M, Kashi Z, Bahar A, Yaghubi M. Comparison of corticosteroid injections, physiotherapy, and combination therapy in treatment of frozen shoulder. *Pak J Med Sci*. 2012;28(4):648-651. Accessed November 30, 2020. http://pjms.com.pk/index.php/pjms/article/view/2059

39. Oh JH, Oh CH, Choi JA, Kim SH, Kim JH, Yoon JP. Comparison of glenohumeral and subacromial steroid injection in primary frozen shoulder: a prospective, randomized short-term comparison study. *J Shoulder Elbow Surg*. 2011;20(10):1034-1040. doi: 10.1016/j.jse.2011.04.029

40. Park GY, Hwnag SE. Comparison of intraarticular steroid injection with and without capsular distension in adhesive capsulitis of the shoulder. *J Korean Acad Rehabil Med*. 2000;24(6):1174-1179. Accessed November 30, 2020. https://www.koreamed.org/SearchBasic.php?RID=2323604

41. Park C, Lee S, Yi CW, Lee K. The effects of extracorporeal shock wave therapy on frozen shoulder patients’ pain and functions. *J Phys Ther Sci*. 2015;27(12):3659-3661. doi:10.1589/jpts.27.3659

42. Prestgaard T, Wormgoor ME, Haugen S, Harstad H, Mowinckel P, Brox JI. Ultrasound-guided intra-articular and rotator interval corticosteroid injections in adhesive capsulitis of the shoulder: a double-blind, sham-controlled randomized study. *Pain*. 2015;156(9):1683-1691. doi:10.1097/j.pain.0000000000000209

43. Ranalletta M, Rossi LA, Bongiovanni SL, Tanoira I, Elizondo CM, Maignon GD. Corticosteroid injections accelerate pain relief and recovery of function compared with oral NSAIDs in patients with adhesive capsulitis: a randomized controlled trial. *Am J Sports Med*. 2016;44(2):474-481. doi:10.1177/0363546515616238

44. Reza SS, Bijan F, Asghar HA, et al. Treatment of frozen shoulder: a double blind study comparing the impact of triamcinolone injection alone or in association with joint distention. *Res J Pharmaceut Biol Chem Sci*. 2013;4:226-234.

45. Rizk TE, Pinals RS, Talalver AS. Corticosteroid injections in adhesive capsulitis: investigation of their value and site. *Arch Phys Med Rehabil*. 1991;72(1):20-22.

46. Roh YH, Yi SR, Noh JH, et al. Intra-articular corticosteroid injection in diabetic patients with adhesive capsulitis: a randomized controlled trial. *Knee Surg Sports Traumatol Arthrosc*. 2012;20(10):1947-1952. doi:10.1007/s00167-011-1776-6

47. Ryans I, Montgomery A, Galway R, Kernohan WG, McKane R. A randomized controlled trial of intra-articular triamcinolone and/or physiotherapy in shoulder capsulitis. *Rheumatology (Oxford)*. 2005;44(4):529-535. doi:10.1093/rheumatology/keh535

48. Sharma SP, Bærheim A, Moë-Nilssen R, Kvåle A. Adhesive capsulitis of the shoulder, treatment with corticosteroid, corticosteroid with distension or treatment-as-usual; a randomised controlled trial in primary care. *BMC Musculoskelet Disord*. 2016;17:232. doi:10.1186/s12891-016-1081-0

49. Shin SJ, Lee SY. Efficacies of corticosteroid injection at different sites of the shoulder for the treatment of adhesive capsulitis. *J Shoulder Elbow Surg*. 2013;22(4):521-527. doi:10.1016/j.jse.2012.06.015

50. Sun Y, Liu S, Chen S, Chen J. The effect of corticosteroid injection into rotator interval for early frozen shoulder: a randomized controlled trial. *Am J Sports Med*. 2018;46(3):663-670. doi:10.1177/0363546517744171

51. Tveita EK, Tariq R, Sesseng R, Juel NG, Bautz-Holter E. Hydrodilatation, corticosteroids, and adhesive capsulitis: a randomized controlled trial. *BMC Musculoskelet Disord*. 2008;9:53. doi:10.1186/1471-2474-9-53

52. Vahdatpour B, Taheri P, Zade AZ, Moradian S. Efficacy of extracorporeal shockwave therapy in frozen shoulder. *Int J Prev Med*. 2014;5(7):875-881.

53. van der Windt DA, van der Heijden GJ, de Winter AF, Koes BW, Devillé W, Bouter LM. The responsiveness of the Shoulder Disability Questionnaire. *Ann Rheum Dis*. 1998;57(2):82-87. doi:10.1136/ard.57.2.82

54. Yoon JP, Chung SW, Kim JE, et al. Intra-articular injection, subacromial injection, and hydrodilatation for primary frozen shoulder: a randomized clinical trial. *J Shoulder Elbow Surg*. 2016;25(3):376-383. doi:10.1016/j.jse.2015.11.009

55. Binder A, Hazleman BL, Parr G, Roberts S. A controlled study of oral prednisolone in frozen shoulder. *Br J Rheumatol*. 1986;25(3):288-292. doi:10.1093/rheumatology/25.3.288
56. Blockey NJ, Wright JK, Kellgren JH. Oral cortisone therapy in periarthritis of the shoulder: a controlled trial. Br Med J. 1954;1(4877):1455-1457. doi:10.1136/bmj.1.4877.1455

57. Buchbinder R, Hoving JL, Green S, Hall S, Forbes A, Nash P. Short course prednisolone for adhesive capsulitis (frozen shoulder or stiff painful shoulder): a randomised, double blind, placebo controlled trial. Ann Rheum Dis. 2004;63(11):1460-1469. doi:10.1136/ard.2003.018218

58. Buchbinder R, Green S, Forbes A, Hall S, Lawler G. Arthrographic joint distension with saline and steroid improves function and reduces pain in patients with painful stiff shoulder: results of a randomised, double blind, placebo controlled trial. Ann Rheum Dis. 2004;63(3):302-309. doi:10.1136/ard.2002.004655

59. Cheing GL, So EM, Chao CY. Effectiveness of electroacupuncture and interferential electrotherapy in the management of frozen shoulder. J Rehabil Med. 2008;40(3):166-170. doi:10.2340/16501977-0142

60. Chen CY, Hu CC, Weng PW, et al. Extracorporeal shockwave therapy improves short-term functional outcomes of shoulder adhesive capsulitis. J Shoulder Elbow Surg. 2014;23(12):1843-1851. doi:10.1016/j.jse.2014.08.010

61. Dahan TH, Fortin L, Pelletier M, Petit M, Vadeboncoeur R, Suissa S. Double blind randomized clinical trial examining the efficacy of bupivacaine suprascapular nerve blocks in frozen shoulder. J Rheumatol. 2000;27(6):1464-1469.

62. De Carli A, Vadala A, Perugia D, et al. Shoulder adhesive capsulitis: manipulation and arthroscopic arthrolysis or intra-articular steroid injections? Int Orthop. 2012;36(1):101-106. doi:10.1007/s00264-011-1330-7

63. Gallacher S, Beazley JC, Evans J, et al. A randomized controlled trial of arthroscopic capsular release versus hydrodilatation in the treatment of primary frozen shoulder. J Shoulder Elbow Surg. 2018;27(8):1401-1406. doi:10.1016/j.jse.2018.04.002

64. Hsieh LF, Hsu WC, Lin YJ, Chang HL, Chen CC, Huang V. Addition of intra-articular hyaluronate injection to physical therapy program produces no extra benefits in patients with adhesive capsulitis of the shoulder: a randomized controlled trial. Arch Phys Med Rehabil. 2012;93(6):957-964. doi:10.1016/j.apmr.2012.01.021

65. Jacobs LG, Smith MG, Khan SA, Smith K, Joshi M. Manipulation or intra-articular steroids in the management of adhesive capsulitis of the shoulder? a prospective randomized trial. J Shoulder Elbow Surg. 2009;18(3):348-353. doi:10.1016/j.jse.2009.02.002

66. Jacobs LG, Barton MA, Wallace WA, Ferrousis J, Dunn NA, Bossingham DH. Intra-articular distension and steroids in the management of capsulitis of the shoulder. BMJ. 1991;302(6791):1498-1501. doi:10.1136/bmj.302.6791.1498

67. Jones DS, Chattopadhyay C. Suprascapular nerve block for the treatment of frozen shoulder in primary care: a randomized trial. Br J Gen Pract. 1999;49(438):39-41.

68. Khan AA, Mowlia A, Shakoor MA, Rahman MR. Arthrographic distension of the shoulder joint in the management of frozen shoulder. Mymensingh Med J. 2005;14(1):67-70.

69. Kim KH, Suh JW, Oh KY. The effect of intra-articular hyaluronate and tramadol injection on patients with adhesive capsulitis of the shoulder. J Back Musculoskelet Rehabil. 2017;30(4):913-920. doi:10.3233/BMR-160641

70. Kivimäki J, Pohlajainen T. Manipulation under anesthesia for frozen shoulder with and without steroid injection. Arch Phys Med Rehabil. 2001;82(9):1188-1190. doi:10.1053/apmr.2001.24169

71. Kivimäki J, Pohlajainen T, Malmivaara A, et al. Manipulation under anesthesia with home exercises versus home exercises alone in the treatment of frozen shoulder: a randomized, controlled trial with 125 patients. J Shoulder Elbow Surg. 2007;16(6):722-726. doi:10.1016/j.jse.2007.02.125

72. Kılç Z, Filiz MB, Çakr T, Toraman NF. Addition of suprascapular nerve block to a physical therapy program produces an extra benefit to adhesive capsulitis: a randomized controlled trial. Am J Phys Med Rehabil. 2015;94(10(suppl 1)):912-920. doi:10.1097/PHM.0000000000000336

73. Lim TK, Koh KH, Shon MS, Lee SW, Park YE, Yoo JC. Intra-articular injection of hyaluronate versus corticosteroid in adhesive capsulitis. Orthopedics. 2014;37(10):e860-e865. doi:10.3928/01474447-20140924-51

74. Lorbach O, Anagnostakos K, Scherf C, Seil R, Kohn D, Pape D. Nonoperative management of adhesive capsulitis of the shoulder: oral cortisone application versus intra-articular cortisone injections. J Shoulder Elbow Surg. 2010;19(2):172-179. doi:10.1016/j.jse.2009.06.013

75. Mukherjee RN, Pandey RM, Nag HL, Mittal R. Frozen shoulder—a prospective randomized clinical trial. World J Orthop. 2017;8(5):394-399. doi:10.5312/wjo.v8.i5.394

76. Mun SW, Baek CH. Clinical efficacy of hydrodistention with joint manipulation under interscalene block compared with intra-articular corticosteroid injection for frozen shoulder: a prospective randomized controlled study. J Shoulder Elbow Surg. 2016;25(12):1937-1943. doi:10.1016/j.jse.2016.09.021
77. Park KD, Nam HS, Lee JK, Kim YJ, Park Y. Treatment effects of ultrasound-guided capsular distension with hyaluronic acid in adhesive capsulitis of the shoulder. Arch Phys Med Rehabil. 2013;94(2):264-270. doi:10.1016/j.apmr.2012.10.002

78. Park SW, Lee HS, Kim JH. The effectiveness of intensive mobilization techniques combined with capsular distension for adhesive capsulitis of the shoulder. J Phys Ther Sci. 2014;26(11):1767-1770. doi:10.1589/jpts.26.1767

79. Pushpasekaran N, Kumar N, Chopra RK, Borah D, Arora S. Thawing frozen shoulder by steroid injection. J Orthop Surg (Hong Kong). 2017;25(1):2309499016684470. doi:10.1177/2309499016684470

80. Quraishi NA, Johnston P, Bayer J, Crowe M, Chakrabarti AJ. Thawing the frozen shoulder: a randomised trial comparing manipulation under anaesthesia with hydrodilatation. J Bone Joint Surg Br. 2007;89(9):1197-1200. doi:10.1302/0301-620X.89B9.18863

81. Rouhani A, Mardani-Kivi M, Bazavar M, et al. Calcitonin effects on shoulder adhesive capsulitis. Eur J Orthop Surg Traumatol. 2016;26(6):575-580. doi:10.1007/s00590-016-1816-5

82. Schydlowsky P, Szkudlarek M, Madsen OR. Treatment of frozen shoulder with subcutaneous TNF-alpha blockade compared with local glucocorticoid injection: a randomised pilot study. Clin Rheumatol. 2012;31(8):1247-1251. doi:10.1007/s10067-012-1993-5

83. Sun KO, Chan KC, Lo SL, Fong DY. Acupuncture for frozen shoulder. Hong Kong Med J. 2001;7(4):381-391.

84. Widiastuti-Samekto M, Sianturi GP. Frozen shoulder syndrome: comparison of oral route corticosteroid and intra-articular corticosteroid injection. Med J Malaysia. 2004;59(3):312-316.

85. Dogru H, Basaran S, Sarpel T. Effectiveness of therapeutic ultrasound in adhesive capsulitis. Joint Bone Spine. 2008;75(4):445-450. doi:10.1016/j.jbspin.2007.01.016

86. Kim SH, Kim YH, Lee HR, Choi YE. Short-term effects of high-intensity laser therapy on frozen shoulder: a prospective randomized control study. Man Ther. 2015;20(6):751-757. doi:10.1016/j.math.2015.02.009

87. Maund E, Craig D, Suekarran S, et al. Management of frozen shoulder: a systematic review and cost-effectiveness analysis. Health Technol Assess. 2012;16(11):1-264. doi:10.3310/hta16110

88. Schröder S, Meyer-Hamme G, Friedemann T, et al. Immediate pain relief in adhesive capsulitis by acupuncture—a randomised controlled double-blinded study. Pain Med. 2017;18(11):2235-2247. doi:10.1093/pm/pnx052

89. Buchbinder R, Green S, Youd JM, Johnston RV, Cumpston M. Arthrographic distension for adhesive capsulitis (frozen shoulder). Cochrane Database Syst Rev. 2008;(1):CD007005. doi:10.1002/14651858.CD007005

90. Saltychev M, Laimi K, Virolainen P, Fredericson M. Effectiveness of hydrodilatation in adhesive capsulitis of shoulder: a systematic review and meta-analysis of randomized controlled trials with trial sequential analysis. Am J Sports Med. 2017;45(9):2171-2179. doi:10.1177/0363546517707907

91. Song A, Higgins LD, Newman J, Jain NB. Glenohumeral corticosteroid injections in adhesive capsulitis: a systematic search and review. PM R. 2014;6(12):1143-1156. doi:10.1016/j.pmrj.2014.06.015

92. Catapano M, Mittal N, Adamich J, Kumbhare D, Sangha H. Hydrodilatation with corticosteroid for the treatment of adhesive capsulitis: a systematic review. PM R. 2018;10(6):623-635. doi:10.1016/j.pmrj.2017.10.013

93. Page MJ, Green S, Kramer S, et al. Manual therapy and exercise for adhesive capsulitis (frozen shoulder). Cochrane Database Syst Rev. 2014;(8):CD011275. doi:10.1002/14651858.CD011275

94. Page MJ, Green S, Kramer S, Johnston RV, McBain B, Buchbinder R. Electrotherapy modalities for adhesive capsulitis (frozen shoulder). Cochrane Database Syst Rev. 2014;(10):CD011324. doi:10.1002/14651858.CD011324

95. National Institute for Health and Care Excellence. Shoulder pain: scenario: frozen shoulder. Accessed November 13, 2020. https://cks.nice.org.uk/shoulder-pain#fiscenario1

SUPPLEMENT.
eTable 1. Explanation of the Components of the GRADE Tool and How They Were Assessed
eTable 2. Risk of Bias Assessments
eTable 3. Results of Comparisons of Interventions Assessed by Fewer Than 3 Studies and Were Not Pooled Qualitatively or Quantitatively
eTable 4. Results of Grading of the Certainty of Evidence According to the GRADE Tool for Each Comparison of Interventions
eTable 5. Results of Statistical Inconsistency Assessment for Each Pairwise Meta-analysis
eFigure 1. Results of Pairwise Meta-analyses with Respective Mean Differences for Early Short-term Outcomes
eFigure 2. Results of Pairwise Meta-analyses With Respective Mean Differences for Late Short-term Outcomes

eFigure 3. Results of Pairwise Meta-analyses With Respective Mean Differences for Mid-term Outcomes

eFigure 4. Results of Pairwise Meta-analyses With Respective Mean Differences for Function

eFigure 5. TSA Results for IA Corticosteroid vs No Treatment or Placebo for Early Short-term Pain

eFigure 6. TSA Results for IA Corticosteroid vs No Treatment or Placebo for Late Short-term Pain

eFigure 7. Network Forest Plots With Consistency Test for Late Short-term Pain

eFigure 8. Network Forest Plots With Consistency Test for Mid-term Pain