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Corticosteroid injections for shoulder pain (Review)

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[Intervention Review]

Corticosteroid injections for shoulder pain

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ABSTRACT

Background

While many treatments, including corticosteroid injections in and around the shoulder, are advocated to be of benefit for shoulder pain, few are of proven efficacy. This review of corticosteroid injections for shoulder pain is one in a series of reviews of varying interventions for shoulder disorders.

Objectives

To determine the efficacy and safety of corticosteroid injections in the treatment of adults with shoulder pain.

Search methods

MEDLINE, EMBASE, CINAHL, Central and Science Citation Index were searched up to and including June 2002.

Selection criteria

Randomised and pseudo-randomised trials in all languages of corticosteroid injections compared to placebo or another intervention, or of varying types and dosages of steroid injection in adults with shoulder pain. Specific exclusions were duration of shoulder pain less than three weeks, rheumatoid arthritis, polymyalgia rheumatica and fracture.

Data collection and analysis

Trial inclusion and methodological quality was assessed by two independent reviewers according to predetermined criteria. Results are presented separately for rotator cuff disease, adhesive capsulitis, full thickness rotator cuff tear and mixed diagnoses, and, where possible, combined in meta-analysis.

Main results

Twenty-six trials met inclusion criteria. The number, site and dosage of injections varied widely between studies. The number of participants per trial ranged from 20 to 114 (median 52 participants). Methodological quality was variable.

For rotator cuff disease, subacromial steroid injection was demonstrated to have a small benefit over placebo in some trials however no benefit of subacromial steroid injection over NSAID was demonstrated based upon the pooled results of three trials.

For adhesive capsulitis, two trials suggested a possible early benefit of intra-articular steroid injection over placebo but there was insufficient data for pooling of any of the trials. One trial suggested short-term benefit of intra-articular corticosteroid injection over physiotherapy in the short-term (success at seven weeks RR=1.66 (1.21, 2.28).

Authors' conclusions

Despite many RCTs of corticosteroid injections for shoulder pain, their small sample sizes, variable methodological quality and heterogeneity means that there is little overall evidence to guide treatment. Subacromial corticosteroid injection for rotator cuff disease and intra-articular injection for adhesive capsulitis may be beneficial although their effect may be small and not well-maintained.

There is a need for further trials investigating the efficacy of corticosteroid injections for shoulder pain. Other important issues that remain to be clarified include whether the accuracy of needle placement, anatomical site, frequency, dose and type of corticosteroid influences efficacy.

PLAIN LANGUAGE SUMMARY

Corticosteroid injections for shoulder pain

Corticosteroid injections may be of limited short-term benefit for shoulder pain

The available evidence from randomized controlled trials supports the use of subacromial corticosteroid injection for rotator cuff disease, although its effect may be small and short-lived, and it may be no better than non-steroidal anti-inflammatory drugs. Similarly, intra-articular steroid injection may be of limited, short-term benefit for adhesive capsulitis. Further trials investigating the efficacy of corticosteroid injections for shoulder pain are needed. Important issues that need clarification include whether the accuracy of needle placement, anatomical site, frequency, dose and type of corticosteroid influences efficacy.

BACKGROUND

This review is one in a series of reviews aiming to determine the evidence for efficacy of common interventions for shoulder pain. This series of reviews form the update of an earlier Cochrane Review of all interventions for shoulder disorders (Green 1998a, Green 1998b).

Shoulder pain is common with a reported prevalence of 6.9 to 34% in the general population and 21% in those over 70 years of age (Chard 1991). Shoulder disorders account for 1.2% of all general practice encounters, being third only to back and neck complaints as musculoskeletal reasons for primary care consultation (Rekola 1993). They are also a cause of significant morbidity (Chard 1991, Croft 1996). Although there are many accepted standard forms of conservative therapy for shoulder disorders, evidence of their efficacy is not well established. Our previous systematic review of randomized controlled trials investigating these treatments concluded that there was very little evidence to either support or refute the efficacy of interventions commonly used to treat shoulder pain. Furthermore, the interpretation of results of studies that have been performed is often hampered by the fact that these disorders are labelled and defined in diverse and often conflicting ways. In our previous review we also undertook a methodological review of the selection criteria used in these studies and concluded that more research is needed to establish a uniform method of defining shoulder disorders.

Since our previous review many new clinical trials, studying a diverse range of interventions, have been performed. In order to update our review we have therefore subdivided it into a series of reviews investigating the evidence for efficacy of single interventions. We have also broadened our review to include all randomised or pseudo-randomised clinical trials regardless of whether outcome assessment was blinded.

This review examines the evidence for efficacy and safety of corticosteroid injections for the treatment of adults with shoulder pain. Corticosteroid injections are a commonly used modality to treat shoulder pain irrespective of underlying aetiology. Corticosteroid may be injected into the glenohumeral joint via an anterior or posterior approach, into the subacromial space, tendon sheaths of specific tendons, or locally into trigger or tender points. These are usually performed by the clinician who uses anatomical landmarks to guide blinded placement of the needle. Apart from placement of the injection into various anatomical sites, other variations in the use of steroid injections include single or multiple injections over time; injection of different sites at one time; use of different corticosteroid preparations, different volumes and types of local anesthetic; and different total volumes of injection. This review aims to review the evidence of efficacy and safety of steroid injections in the treatment of shoulder pain taking into account these issues.

OBJECTIVES

To determine the efficacy and safety of corticosteroid injections in the treatment of patients with shoulder pain.

METHODS

Criteria for considering studies for this review

Types of studies

This review was conducted following a peer reviewed a priori protocol.
a) Randomised or pseudo-randomised controlled trials. Studies where participants were not randomised into intervention groups were excluded from the review.

b) Trials in which allocation to treatment or control group was not concealed from the outcome assessor were not excluded. A sensitivity analysis including and excluding these trials was planned, because foreknowledge of treatment allocation may lead to biased assessment of outcome.

c) Studies in all languages were translated into English and considered for inclusion in the review. A sensitivity analysis including and excluding foreign language trials was planned to test the effect of inclusion of these trials.

Types of participants

Inclusion in this review was restricted to trials with participants meeting the following criteria:

All studies which primarily concerned pain arising from the shoulder in adult populations (greater than 18 years of age) were included irrespective of diagnostic label. For studies that included various regional painful disorders such as shoulder and elbow pain, we included their data if the results for shoulder pain were presented separately or if 90% or more of the study participants had shoulder pain. Specific exclusions were duration of shoulder pain less than three weeks, rheumatoid arthritis, polymyalgia rheumatica and fracture.

In our previous review, we performed a methodological review of the selection criteria used in the included studies (Green 1998b). Study populations were broadly able to be categorised as either adhesive capsulitis (which included frozen shoulder and periarthritis) or rotator cuff disease (which included supraspinatus tendonitis, infraspinatus tendonitis, rotator cuff tendonitis, rotator cuff lesion, bursitis or subscapularis tendonitis) based upon the diagnostic labels and/or definitions of these labels when described. Some trials did not specify a diagnosis and some trials gave no selection criteria or study population definition (Green 1998b). For this review we were broadly able to categorise the participants as adhesive capsulitis (including frozen shoulder and periarthritis), rotator cuff disease, full thickness rotator cuff tear and mixed diagnoses (more than one diagnostic label or definition of study population not clearly specified).

Types of interventions

All randomised controlled comparisons of corticosteroid injections versus placebo, or another modality, or of varying types and dosages of steroid injection were included, and comparisons established according to intervention. Studies that included steroid injection in more than one arm were not included unless they provided information about the benefit of steroid injection. For example trials that compared steroid injection plus another intervention to steroid injection alone do not provide any information about the benefit of steroid injection eg. Thomas et al

compared steroid injection and manipulation under anaesthesia to steroid injection alone (Thomas 1980). This has been included in the surgery review.

Types of outcome measures

No studies were excluded on the basis of outcome measure used. Reported outcomes included pain (at night, at rest, and on movement), range of motion (active and/or passive: flexion, abduction, external rotation, internal rotation and hand behind back), function, strength, and return to work or school.

Search methods for identification of studies

We searched MEDLINE, EMBASE, CINAHL (includes all major physiotherapy and occupational therapy journals from U.S.A., Canada, England, Australia and New Zealand), and Science Citation Index (SCISEARCH) up to and including June 2002 . The Cochrane Musculoskeletal Review Group's "optimally sensitive search strategy" (see below) was used to identify all possible randomised controlled trials. Keywords gained from previous reviews and all relevant articles were searched as text terms and any additional keyword identified from subsequent articles was searched again. As this review is one of a series concerning different interventions for shoulder pain, various interventions were included in the search strategy and all searches combined as a single endeavour.

1 Shoulder Pain/ (376)
2 Shoulder Impingement Syndrome/ (351)
3 Rotator Cuff/ (931)
4 exp Bursitis/ (419)
5 ((shoulder$ or rotator cuff) adj5 (bursitis or frozen or impinge$ or tendinitis or tendonitis or pain$)).mp. (1911)

6 rotator cuff.mp. (1253)
7 adhesive capsulitis.mp. (69)
8 or/1-7 (3122)
9 exp INJECTIONS/ (39394)
10 ((steroid$ or corticosteroid$ or sub-acromial or subacromial) adj5
inject$).mp. (1121)
11 or/9-10 (39957)
12 Clinical trial.pt. (137491)
13 random$.mp. (133940)
14 ((single or double) adj (blind$ or mask$)).mp. (23539)
15 placebo$.mp. (30562)
16 or/12-15 (224241)
17 8 and 11 and 16 (60)
18 from 17 keep 1-60 (60)

Further electronic searches for key authors identified were made, and a record of these searches kept. Print outs of all search strategies were compiled and stored for future reproduction and review if required.

In addition, the Cochrane Controlled Trials Register (CCTR) Issue 2, 2002 was searched.

Data collection and analysis

Following identification of potential trials for inclusion by the previously outlined search strategy, the methods sections of all identified trials were reviewed independently according to predetermined criteria (see selection criteria), by two of three investigators (RB, SG, JY). All articles were coded and details of source, intervention, population and funding recorded. The investigator compiling the references (RB) decided on potentially relevant trials (based on the article being a randomised controlled trial of a steroid injection for the treatment of shoulder pain), excluding those where it was clear the intervention and population did not meet the inclusion criteria. There were no disagreements with respect to inclusion of trials into the review.

Trials meeting inclusion criteria were collated, and the methods and results sections were re-assessed by the same two of three reviewers (RB, SG, JY) for assessment of validity.

ASSESSMENT OF VALIDITY

Validity of included trials was assessed by comment on whether they met key criteria (appropriate randomisation, allocation concealment, blinding, number lost to follow up and intention to treat analysis). These criteria were selected on the basis of being important for potentially biasing the overall outcome of trials. The only scoring was given for allocation concealment, ranked as:

A: adequate
B: unclear
C: inadequate
D: not used

Whether or not trials were appropriately randomised (as described in the Cochrane Handbook, Clarke 2000), included blinded participants, care providers and outcome assessor, had complete follow up and used an intention to treat analysis was recorded on a pre-piloted data extraction sheet and later transposed into the "Characteristics of Included Studies" table. Validity of trials was assessed in this way as opposed to using a numerical or summary scale due to concerns regarding the validity of such scales and lack of information about whether all the criteria included in such scales impact on the overall outcome of the trial (Juni 1999).

DATA EXTRACTION AND ANALYSIS

In order to assess efficacy, raw data for outcomes of interest (means and standard deviations for continuous outcomes and number of events for binary outcomes) were extracted where available from the published reports. All standard errors of the mean were converted to standard deviation, and, when necessary, standard deviation was imputed from the range by division by four. Wherever reported data was converted or imputed, this was recorded in the notes section of the included studies table. For trials where the required data was not reported or able to be calculated, further details were requested from first authors. If no further details were provided, the trial was included in the review and fully described, but not included in the meta-analysis (i.e. no pooling of study data). An entry to that effect was made in the notes section of the included studies table.

When trial results were not normally distributed and so reported as median and range, the trial was not included in the meta-analysis but results presented in Additional Tables.

Meta-analysis was facilitated by RevMan 4.1. The following choices of statistic and 95% confidence intervals were presented for all outcomes.

CONTINUOUS OUTCOMES:
Weighted mean difference using a fixed effects model was selected when outcomes were measured on standard scales. When outcomes were reported on non standard scales, using differing units and methods of assessment (for example disability scales), a standardised mean difference was selected. Possible clinical reasons for heterogeneity were explored, and in the presence of significant heterogeneity, trial results were not combined.

DICHOTOMOUS OUTCOMES:
Relative risk using a fixed effects model was selected for interpretation of dichotomous outcome measures in this review as this is the most appropriate statistic for the interpretation when the event is common (Deeks 1998). Reasons for heterogeneity were evaluated and in the event of significant heterogeneity trial results were not pooled.

SENSITIVITY ANALYSIS
Three sensitivity analyses were planned.
1. Trials in which the outcome assessor was not blinded were to be excluded to assess the possible effect of detection bias.
2. Trials published in languages other than English were to be excluded to assess the possible effect of publication bias.
3. Trials for which the method of randomisation was unclear were to be excluded to assess their effect upon the conclusion of the review.

RESULTS

Description of studies

Forty potential trials were identified and 26 met the inclusion criteria. Reasons for study exclusion were lack of randomization (n=7), heterogeneous study population or included rheumatoid arthritis (n=3), did not provide any information about the value of steroid injection per se (n=3), or no outcome data reported (n=1). The 13 excluded trials and details of why they failed to meet the inclusion criteria for this review are outlined in the Table of Characteristics of Excluded Studies.

Details of the 26 included trials are given in the Table of Characteristics of included Studies. Twenty-five of the 26 included trials were published in English, and one was published in German (Strobel 1996). The number of participants per trial ranged from 20 to 114 (median 52 participants) and one trial did not specify number of participants (Williams 1975).

STUDY POPULATION
Based upon review of the diagnostic labels and/or definitions of the study populations, the included trials could be broadly categorised as studying adhesive capsulitis (including 'periarthritis' and 'frozen shoulder') (12 trials) (Arslan 2001, Bulgen 1984, Dacre 1989, de Jong 1998, Gam 1998, Jacobs 1991, Kivimäcki 2001, Lee 1973, Rizk 1991, van der Windt 1998, White 1996, Williams 1975); rotator cuff tendonitis (including impingement, subacromial bursitis, partial rotator cuff tears)(10 trials) (Adebajo 1990, Berry 1980, Blair 1996, Kirkley 1999, Petri 1987, Plafki 2000, Strobel 1996, Vecchio 1993, White 1986, Withrington 1985); full thickness rotator cuff tear (1 trial) (Shibata 2001); or a combination of diagnoses (3 trials) (Hollingworth 1983, Richardson 1975, Winters 1997). The lack of uniformity in the way shoulder disorders are labelled and defined was highlighted in our previous review (Green 1998a, Green 1998b) and similar issues are applicable to the current review.

DESCRIPTION OF INTERVENTIONS ACCORDING TO STUDY POPULATION
1. ADHESIVE CAPSULITIS
For adhesive capsulitis, intra-articular steroid injection was compared to placebo in one trial (Rizk 1991); no treatment in one trial (Lee 1973); physiotherapy in one trial (van der Windt 1998); physiotherapy and non-steroidal anti-inflammatory drug in one trial (Arslan 2001); capsular distension in two trials (Gam 1998, Jacobs 1991); ice in one trial (Bulgen 1984); infra-red irradiation in one trial (Lee 1973); and stellate ganglion block in one trial (Williams 1975). One trial compared a combination of both intra-articular and subacromial steroid injection to no treatment and to physiotherapy (Bulgen 1984); one trial compared high versus low dose intra-articular steroid injection (de Jong 1998); and the anterior and posterior intra-articular approach was compared in one trial (White 1996). Intra-articular steroid injection was compared to subacromial and intrabursal injections in one trial (Rizk 1991), and bicipital injection in one trial (Lee 1973). One trial compared steroid injected 'anteriorly around the shoulder joint' to physiotherapy (Dacre 1989) (this was included within the intra-articular steroid versus physiotherapy comparisons). There were three trials that studied intra-articular steroid injection combined with another intervention (with physiotherapy versus physiotherapy alone (Dacre 1989); with capsular distension versus capsular distension alone (Jacobs 1991); with manipulation under anaesthesia versus manipulation under anaesthesia alone (Kivimäcki 2001). One trial also compared steroid injected into the synovial sheath surrounding the bicipital tendon with no treatment (Lee 1973).

2. ROTATOR CUFF DISEASE
For rotator cuff disease, there were seven trials that compared subacromial steroid injection to placebo (Adebajo 1990, Blair 1996, Kirkley 1999, Petri 1987, Plafki 2000, Strobel 1996, Vecchio 1993) and one trial that compared supraspinatus tendon injection to placebo (Withrington 1985). There were three trials that compared subacromial steroid injection to non-steroidal anti-inflammatory medication (Adebajo 1990, Petri 1987, White 1986) and one trial that compared combination subacromial steroid injection and anti-inflammatory medication to non-steroidal anti-inflammatory medication alone (Petri 1987). One trial compared crystalline versus lipoid subacromial steroid injection (Plafki 2000). One 5-arm trial compared intra-articular steroid injection to placebo, physiotherapy and acupuncture and also compared intra-articular steroid injection and non-steroidal anti-inflammatory medication to placebo (Berry 1980).

3. FULL THICKNESS ROTATOR CUFF TEARS
For full thickness rotator cuff tears, there was one trial that compared intra-articular steroid injections to intra-articular injections of hyaluronate (Shibata 2001).

4. MIXED POPULATION OF SHOULDER PAIN
For the mixed population of patients, one trial compared tender or trigger point injections to anatomical steroid injections (site determined by clinical features) (Hollingworth 1983); one trial compared a combination of both intra-articular and subdeltoid bursal injections to placebo (Richardson 1975); and one trial compared intra-articular injections to manipulation or physiotherapy (Winters 1997).

STEROID PREPARATION, FREQUENCY OF INJECTION AND VOLUMES

There was a wide variation in the corticosteroid preparation used, the dosage, number of injections given and their timing. Twelve trials (46.2%) used triamcinolone: a single 80 mg triamcinolone hexacetomide injection (one trial: Adebajo 1990); a single 40 mg triamcinolone acetonide injection (three trials: Blair 1996, Petri 1987, White 1986); a single 20 mg triamcinolone hexacetomide injection (two trials Dacre 1989, Strobel 1996); a single 10mg triamcinolone acetonide injection (one trial Plafki 2000); up to six injections (at weekly intervals) of 20 mg triamcinolone hexacetomide (one trial Gam 1998); three injections (at six week intervals) of 40mg triamcinolone acetonide (one trial Jacobs 1991); three injections (at a one week then two week interval) of either 10 mg or 40mg triamcinolone actonide (one trial de Jong 1998); no more than three injections over six weeks of 40mg triamcinolone acetonide (one trial van der Windt 1998); and one to nine injections (one to three initially then one to three one week later, then one to three, two weeks later) of 40mg triamcinolone (one trial Winters 1997). Seven trials (26.9%) used methylprednisolone: a single 40mg injection of methylprednisolone acetate (four trials Arslan 2001; Berry 1980; Hollingworth 1983, Vecchio 1993); a single 80 mg methylprednisolone injection (one trial Withrington 1985); three injections (at weekly intervals) of 20mg methylprednisolone (one trial Bulgen 1984); and three injections (at weekly intervals) of 40 mg methylprednisolone (one trial Rizk 1991). Three trials (11.5%) used hydrocortisone: a single injection of 25mg hydrocortisone acetate (two trials Lee 1973; White 1996); and three injections (at weekly intervals) of 50mg hydrocortisone (one trial Williams 1975). Two trials used dexamethasone (7.7%): a single injection of 2.5 mg dexamethasone (Plafki 2000) (note: Plafki et al compared triamcinolone to dexamethasone), and up to five injections (at weekly intervals) of 2mg dexamethasone (Shibata 2001). Two trials (7.7%) used a single injection of 6mg betamethasone (Kirkley 1999, Kivimäcki 2001); one trial used two injections (a fortnight apart) of 50 mg prednisolone acetate (Richardson 1975). The total volume injected varied between two and 25 mls and the use of local anaesthetic also varied widely.

ANATOMICAL SITE OF INJECTION

Injections were placed into the glenohumeral joint via a posterior approach in eight trials (Arslan 2001, de Jong 1998, Gam 1998, Jacobs 1991, Richardson 1975, van der Windt 1998, White 1996, Winters 1997); an anterior approach in five trials (Berry 1980, Bulgen 1984, Lee 1973, Rizk 1991, White 1996); a superior approach in one trial (Strobel 1996); and the approach was not described in four trials (Hollingworth 1983, Kivimäcki 2001, Shibata 2001, Williams 1975). Injections were placed into the subacromial space (or bursa) in 11 trials (Adebajo 1990, Blair 1996, Hollingworth 1983, Kirkley 1999, Petri 1987, Plafki 2000, Richardson 1975, Rizk 1991, Vecchio 1993, White 1986, Winters 1997). Other sites included anteriorly around the shoulder joint (Dacre 1989); acromioclavicular joint (Hollingworth 1983, Winters 1997); supraspinatus tendon (Hollingworth 1983, Withrington 1985); infraspinatus and subscapularis tendons (Hollingworth 1983) and bicipital tendon sheath (Lee 1973).

Most studies (22/26, 84.6%) did not confirm the accurate placement of the injection. Two studies used ultrasound to confirm needle placement (intra-articular Gam 1998; sub-acromial Plafki 2000). Richardson performed an arthrogram following steroid injection and reported that the injection was intra-articular 'only inconstantly' when intra-articular injection was performed using the posterior approach, but 'readily obtained' when subacromial injection was performed (Richardson 1975). White et al mixed urograffin with the corticosteroid preparation and took post-injection plain films. They reported that 10/20 (50%) intra-articular injections using the posterior approach were correctly placed, compared to 19/20 (95%) using the anterior approach (White 1996).

OUTCOME ASSESSMENT

Our previous review highlighted the wide variation in assessment of outcome in clinical trials investigating the efficacy of interventions for painful shoulder (Green 1998a, Green 1998b) and similar issues are applicable to the current review. Of the 26 included trials, 23 trials (88.5%) included some measure of pain and 23 trials (88.5%) reported at least one measure of shoulder range of movement. The method of assessment of shoulder range of movement, including description of the instrument used, and how end of range was defined was recorded for only a minority of studies. Function was assessed in nine studies (34.6%) measured by simple four or six-point scales in three trials (Adebajo 1990, de Jong 1998, Petri 1987); work status in one trial (Strobel 1996) and incorporated within an overall score in two trials (Patte score Plafki 2000; UCLA score Shibata 2001). Two trials used a previously validated shoulder disability index (Shoulder Disability Questionnaire (van der Windt 1998); Disabilities of the Arm, Shoulder and Hand (DASH Kirkley 1999) while one trial developed their own shoulder disability index based upon ability to perform five activities of daily living (Blair 1996). The clinimetric properties of this instrument were not reported. The final assessment for efficacy ranged from four weeks to one year (median 12 weeks).

Risk of bias in included studies

The included studies were of varying methodological quality. A description of the methodological quality of each of the included trials is displayed under the Methods heading of the Table of Characteristics of included studies.

Only four trials were considered to have adequate allocation concealment (Adebajo 1990, de Jong 1998, Petri 1987, van der Windt 1998). Allocation concealment was inadequate in two trials, unclear in 17 trials and not used in three trials.

Outcome assessment was blinded in 19 trials (73.1%) (Adebajo 1990, Berry 1980, Blair 1996, Bulgen 1984, Dacre 1989, de Jong 1998, Gam 1998, Hollingworth 1983, Jacobs 1991, Kirkley 1999, Petri 1987, Plafki 2000, Richardson 1975, Rizk 1991, van der Windt 1998, Vecchio 1993, White 1986, Winters 1997, Withrington 1985), unclear in four trials (15.4%) (Arslan 2001, Kivimäcki 2001, Shibata 2001, Strobel 1996), and not blinded in three trials (11.5%) (Lee 1973, White 1996, Williams 1975).

Participants were blinded in 13 trials (50%) (Adebajo 1990, Blair 1996, de Jong 1998, Gam 1998, Hollingworth 1983, Kirkley 1999, Petri 1987, Plafki 2000, Richardson 1975, Rizk 1991, Vecchio 1993, White 1986, Withrington 1985); not blinded in eight trials (30.8%) (Arslan 2001, Bulgen 1984, Dacre 1989, Lee 1973, van der Windt 1998, White 1996, Williams 1975, Winters 1997); unclear in four trials (15.4%) (Jacobs 1991, Kivimäcki 2001, Shibata 2001, Strobel 1996); and partially blinded in one trial (3.9%) (Berry 1980).

Five trials did not specify whether there was any loss to follow-up (Blair 1996, Bulgen 1984, Kirkley 1999, Lee 1973, Williams 1975). Loss to follow up was greater than 20% in at least one treatment

group in four trials that reported loss to follow up (Kivimäcki 2001, Strobel 1996, White 1986, Winters 1997).

Twelve trials (46.2%) performed an intention to treat analyses (Adebajo 1990, Arslan 2001, Berry 1980, Hollingworth 1983, Jacobs 1991, Petri 1987, Plafki 2000, Rizk 1991, van der Windt 1998, White 1986, Winters 1997, Withrington 1985); seven (26.9%) reported a completers analyses only (Dacre 1989, Gam 1998, Kivimäcki 2001, Richardson 1975, Shibata 2001, Strobel 1996, Vecchio 1993) the appropriateness of the analysis was unclear in five trials (26.9%) (Blair 1996, Bulgen 1984, de Jong 1998, Kirkley 1999, Williams 1975); data was only presented graphically in one (3.9%) (Lee 1973); and no analysis was reported in one trial (3.9%) (White 1996).

Only 12 trials (46.2%) presented sufficient data to be included in meta-analysis.

Effects of interventions

The results of the 12 trials with sufficient data to be included in the meta-analyses are displayed in the Table of Comparisons and Data and are described below.

A summary of the results of the included trials with insufficient data to be included in meta-analyses are displayed in the Table of Characteristics of included studies and are also described below where applicable.

INTRA-ARTICULAR STEROID INJECTION VERSUS PLACEBO FOR ROTATOR CUFF DISEASE

One trial that compared a single intra-articular steroid injection (of 40mg methylprednisolone) to placebo for rotator cuff disease provided sufficient data for meta-analysis (Berry 1980). No benefit of steroid injection over placebo was demonstrated at four weeks with respect to pain, range of abduction or success of therapy (Berry 1980). Participants in this trial were only blinded to some interventions. There were no other trials comparing intra-articular steroid injection to placebo for rotator cuff disease.

INTRA-ARTICULAR STEROID INJECTION VERSUS PLACEBO OR NO TREATMENT FOR ADHESIVE CAPSULITIS

Neither of the two trials that compared intra-articular steroid injection to either placebo (Rizk 1991) or no treatment (Lee 1973) in adhesive capsulitis provided sufficient data for meta-analysis. The outcome of these trials varied, with Rizk et al reporting no differences between intra-articular steroid injection and placebo with respect to pain and range of movement up to six months (double-blind, intention to treat analysis) (Rizk 1991); and Lee et al reporting significant benefit of injection over analgesia alone up to six weeks (unblinded, results only displayed graphically) (Lee 1973). Lee et al also reported significant benefit of bicipital tendon sheath injection over analgesia alone.

INTRA-ARTICULAR AND SUB-ACROMIAL STEROID INJECTION VERSUS NO TREATMENT FOR ADHESIVE CAPSULITIS

One trial that compared a combination of intra-articular and subacromial steroid injection to no treatment for adhesive capsulitis did not provide sufficient data for meta-analysis (Bulgen 1984). It reported little difference with respect to long-term outcome but some early benefit of injection with respect to pain and range of movement (only outcome assessment blinded, statistical analysis unclear).

SUB-ACROMIAL STEROID INJECTION VERSUS PLACEBO FOR ROTATOR CUFF DISEASE

The results of two trials involving a total of 45 participants that compared subacromial steroid injection to placebo in rotator cuff disease could be pooled (Adebajo 1990, Petri 1987) (comparison 2). There was a small benefit of subacromial steroid injection over placebo at four weeks with respect to pain (SMD 0.83, 95% CI 0.39, 1.26), function (SMD 0.63 ((95% CI 0.20, 1.06) and range of active abduction (SMD 0.82, 95% CI 0.39, 1.25) (Adebajo 1990, Petri 1987). Both of these trials were double-blind (participants and outcome assessment), no loss to follow-up was reported and an intention to treat analysis was performed.

It was not possible to combine the results of the other five trials that compared subacromial steroid injection to placebo for rotator cuff disease. Two of these trials reported some benefit of injection over placebo (Blair 1996, Plafki 2000). Blair et al however found no difference with respect to performance of activities of daily living (double-blind but analysis and loss to follow up unclear) (Blair 1996). Plafki at al reported benefit after six months of steroid injection in 19 of 40 participants in one of the two groups that received steroid injection, although another eight participants in the steroid groups required surgery (double blind, study stopped after first 10 participants in placebo group failed to improve and aggravation of symptoms in four participants) (Plafki 2000). Two double-blind trials reported no differences between the treatment groups (Kirkley 1999, Vecchio 1993), although one has only been reported in abstract thus far (Kirkley 1999). One trial favoured the placebo group with respect to improvement in pain at three and 12 months although more participants in the steroid injection group resumed work at 12 months (Strobel 1996). However the blinding of this study was unclear, the analysis included completers only and there was a large loss to follow up in both groups (30 and 15% in the injection and placebo groups respectively) (Strobel 1996).

ANATOMICAL STEROID INJECTION (SITE DETERMINED BY CLINICAL FEATURES) VERSUS TRIGGER OR TENDER POINT INJECTION FOR GENERAL SHOULDER PAIN AND SUBGROUP EXCLUDING ADHESIVE CAPSULITIS

One trial demonstrated that anatomical steroid injection was superior to trigger or tender point injection with respect to success rate after one week for 43 participants with general shoulder pain (RR = 2.96, 95% CI 1.62, 5.42), as well as in a subgroup of 33 participants excluding adhesive capsulitis (RR = 2.55, 95% CI 1.45, 4.47) (Hollingworth 1983). This trial was double-blind, there was no reported loss to follow-up and an intention to treat analysis was performed.

HIGHER DOSE VERSUS LOWER DOSE INTRA-ARTICULAR STEROID INJECTION FOR ADHESIVE CAPSULITIS

One trial compared two doses of intra-articular steroid injection in adhesive capsulitis. While a trend favouring higher dose intra-articular steroid injection was found with respect to improvement in pain at six weeks (WMD=-18.10, 95% CI -37.11, 0.91), no differences were found between the higher and lower dose steroid injection with respect to improvement in sleep disturbance, functional impairment or improvement in external rotation (57 participants) (de Jong 1998). No statistically significant differences were found with respect to frequency of adverse effects. Both participants and outcome assessment were blinded in this trial, the method of analysis was unclear, and four patients (12.5%) dropped out of the low-dose group.

INTRA-ARTICULAR STEROID INJECTION FOR ADHESIVE CAPSULITIS: COMPARISON OF ANTERIOR TO POSTERIOR APPROACH

The one trial (involving 40 participants) that compared anterior to posterior intra-articular steroid injection for adhesive capsulitis did not provide any comparative data, although reported a significantly higher level of injection accuracy with the anterior approach (19/20, 95% versus 10/20 50%, p < 0.02) (White 1996).

INTRA-ARTICULAR STEROID INJECTION VERSUS PHYSIOTHERAPY FOR ADHESIVE CAPSULITIS

Only one of the three trials comparing intra-articular steroid injection to physiotherapy contained sufficient data for meta-analysis (56 participants) (van der Windt 1998). At seven weeks, treatment success favoured steroid injection (RR=1.66, 95% CI 1.21, 2.28). At three and seven weeks, all outcomes measured favoured steroid injection (including improvement in severity of main complaint, pain during the day, pain at night, pain as rated by an observer, functional disability and abduction). By 13 weeks, benefit favouring steroid injection remained statistically significant only for improvement in severity of main complaint. No difference in outcome was demonstrated for any of the measured outcomes at 26 weeks and a small benefit favouring steroid injection was found for improvement in severity of main complaint at 52 weeks. No statistically significant differences were found with respect to frequency of adverse effects in the two treatment groups apart from facial flushing which was more common in the steroid injection group (RR=9.0, 95% CI 1.18, 68.74). While participants in this were unblinded, the study population included 109 participants, there was a low withdrawal rate (3.6% and 7.5% from the physiotherapy and steroid injection groups respectively) and an intention to treat analysis was performed.

It was not possible to combine the results of the other two trials that compared intra-articular steroid injection to physiotherapy for adhesive capsulitis. Bulgen compared a combination of both intra-articular and subacromial steroid injection to physiotherapy and reported little difference between groups with respect to long-term outcome but some early benefit of the combined injections with respect to pain and range of movement (only outcome assessment blinded, statistical analysis unclear) (Bulgen 1984). Dacre et al, which compared steroid injection placed anteriorly around the shoulder joint to physiotherapy reported no significant differences between groups at 6 weeks and 6 months (only outcome assessment blinded, four patients of unspecified group lost to follow-up and a completers analysis only) (Dacre 1989).

INTRA-ARTICULAR STEROID INJECTION VERSUS PHYSIOTHERAPY AND NON-STEROIDAL ANTI-INFLAMMATORY MEDICATION (NSAID) FOR ADHESIVE CAPSULITIS

No difference with respect to pain was demonstrated between intra-articular steroid injection versus physiotherapy and NSAID at two and 12 weeks following treatment in one trial of 20 participants (Arslan 2001). However participants were unblinded in this study and it was unclear whether outcome assessment was blinded.

INTRA-ARTICULAR STEROID INJECTION VERSUS CAPSULAR DISTENSION WITH AIR FOR ADHESIVE CAPSULITIS

No difference with respect to improvement in abduction at 16 weeks was found in one trial of 29 participants comparing intra-articular steroid injection to capsular distension with air for adhesive capsulitis (Jacobs 1991). In this trial outcome assessment was blinded but it was unclear whether participants were blinded. There was no loss to follow up reported and an intention to treat analysis was performed.

INTRA-ARTICULAR STEROID INJECTION VERSUS CAPSULAR DISTENSION WITH LIGNOCAINE AND STEROID FOR ADHESIVE CAPSULITIS

The one trial (involving 22 participants) that compared intra-articular steroid injection to capsular distension with lignocaine and steroid did not provide sufficient data for meta-analysis (Gam 1998). They reported a benefit favouring the capsular distension group with respect to range of movement and analgesic use, no difference with respect to pain at rest but a trend favouring the distension group for pain with activity (double-blind, one patient in each group lost to follow-up, completers analysis only).

INTRA-ARTICULAR STEROID INJECTION VERSUS STELLATE GANGLION BLOCK FOR ADHESIVE CAPSULITIS

The one trial (involving an unknown number of participants) that compared intra-articular steroid injection to stellate ganglion block for adhesive capsulitis did not provide sufficient data for meta-analysis (Williams 1975). It reported no differences in outcome between treatment groups at four weeks and three months.

INTRA-ARTICULAR STEROID INJECTION VERSUS ULTRASOUND FOR ROTATOR CUFF DISEASE

No difference with respect to pain, range of abduction or success of therapy at four weeks was found in one trial of 24 participants comparing intra-articular steroid injection to ultrasound for rotator cuff disease (Berry 1980).

INTRA-ARTICULAR STEROID INJECTION VERSUS ACUPUNCTURE FOR ROTATOR CUFF DISEASE

No difference with respect to pain, range of abduction or success of therapy at four weeks was found in one trial of 24 participants comparing intra-articular steroid injection to acupuncture for rotator cuff disease (Berry 1980).

INTRA-ARTICULAR STEROID INJECTION VERSUS HYALURONATE INJECTION FOR FULL THICKNESS ROTATOR CUFF TEAR

No difference with respect to satisfaction with treatment at 4 weeks was found in one trial of 78 participants comparing intra-articular steroid injection to hyaluronate injection for full thickness rotator cuff tears (Shibata 2001).

SUB-ACROMIAL STEROID INJECTION VERSUS NON-STEROIDAL ANTI-INFLAMMATORY MEDICATION (NSAID) FOR ROTATOR CUFF DISEASE

The results of three trials with a total of 120 participants with rotator cuff disease that compared subacromial steroid injection to NSAID could be pooled (Adebajo 1990, Petri 1987, White 1986) (comparison 11). No benefit of subacromial steroid injection over NSAID with respect to improvement in pain, function or range of shoulder abduction at four or six weeks was demonstrated. One of the trials also failed to demonstrate any difference between sub-acromial steroid injection and NSAID in improvement in global assessment score at six weeks (White 1986).

INTRA-ARTICULAR, SUB-ACROMIAL AND ACROMIOCLAVICULAR STEROID INJECTIONS VERSUS PHYSIOTHERAPY (NOT MANIPULATION) FOR GENERAL SHOULDER PAIN (MIXED DIAGNOSES)

A benefit favouring steroid injections over physiotherapy (not manipulation) with respect to pain at the end of treatment

(when patient left study or 11 weeks post-randomisation) was demonstrated in one trial of 82 participants with general shoulder pain (mixed diagnoses)(WMD -2.30, 95% CI -4.10, -0.50) (Winters 1997).

INTRA-ARTICULAR, SUB-ACROMIAL AND ACROMIOCLAVICULAR STEROID INJECTIONS VERSUS MANIPULATION FOR GENERAL SHOULDER PAIN (MIXED DIAGNOSES)
A benefit favouring steroid injections over manipulation with respect to pain at the end of treatment (when patient left study or 11 weeks post-randomisation) was demonstrated in one trial of 77 participants with general shoulder pain (mixed diagnoses)(WMD -3.40, 95% CI -5.46, -1.34) (Winters 1997).

INTRA-ARTICULAR STEROID INJECTION AND NON-STEROIDAL ANTI-INFLAMMATORY MEDICATION (NSAID) VERSUS PLACEBO FOR ROTATOR CUFF DISEASE
No difference with respect to pain or success of therapy at four weeks was found in one trial of 24 participants comparing intra-articular steroid injection and NSAID to placebo for rotator cuff disease and range of abduction at four weeks favoured the placebo group (WMD -27.60, 95% CI -49.99, -5.21) (Berry 1980).

INTRA-ARTICULAR STEROID INJECTION AND MANIPULATION UNDER ANAESTHESIA VERSUS MANIPULATION UNDER ANAESTHESIA ALONE FOR ADHESIVE CAPSULITIS
One trial of 24 participants demonstrated no difference with respect to range of abduction at four months between participants who had received an intra-articular injection of steroid with manipulation under anaesthesia compared to those who had manipulation under anaesthesia alone (Kivimäcki 2001).

SUB-ACROMIAL STEROID INJECTION AND NON-STEROIDAL ANTI-INFLAMMATORY MEDICATION (NSAID) VERSUS NSAID ALONE FOR ROTATOR CUFF DISEASE
There was no added benefit of subacromial steroid injection over NSAID alone in one trial of 50 participants with respect to improvement in pain, function, range of abduction and remission at four weeks (Petri 1987).

INTRA-ARTICULAR AND SUB-ACROMIAL STEROID INJECTION VERSUS PLACEBO FOR SHOULDER PAIN (MIXED DIAGNOSES)
The one trial (involving 101 participants) that compared a combination of both intra-articular and sub-acromial steroid injection to placebo for shoulder pain (mixed diagnoses) did not provide sufficient data for meta-analysis (Richardson 1975). It reported a trend towards the steroid injections being more effective than placebo at two and six weeks (double-blind, unclear if completers only analysis and loss to follow-up was 16 and 13% in the steroid injections and placebo groups respectively).

SUPRASPINATUS INJECTION VERSUS PLACEBO FOR ROTATOR CUFF DISEASE (SUPRASPINATUS TENDINITIS)
The single trial that compared supraspinatus steroid injection to placebo for rotator cuff disease (supraspinatus tendinitis)(25 participants) did not provide sufficient data for meta-analysis (Withrington 1985). It reported no difference with respect to pain or analgesics consumption at two and eight weeks follow up.

DISCUSSION

This review specifically sought to determine the evidence for efficacy of corticosteroid injections for shoulder pain. Despite a lack of uniformity in the way shoulder disorders are labelled and defined we broadly categorised the trial populations into adhesive capsulitis, rotator cuff disease, full thickness rotator cuff tear and a mixed population of patients with shoulder pain based upon the information provided in the trials. Nevertheless the degree to which the results of different trials could be compared and/ or pooled was still limited particularly by the heterogeneity of the interventions and comparisons studied, varying methodological quality, inadequate reporting of results and small sample sizes.

For rotator cuff disease, the pooled results of two small studies suggested a small benefit of subacromial steroid injection over placebo measured at four weeks. However the results of five further trials, of varying methodological quality, that were unable to be pooled reported varying results (benefit favouring steroid injection in two trials, no difference in two trials and benefit favouring placebo in one trial). In addition, the pooled results of three trials found no difference in outcome between subacromial steroid injection and NSAID; one trial found no additional benefit of subacromial steroid injection over NSAID alone; one trial reported no difference in outcome between intra-articular steroid injection, placebo, ultrasound and acupuncture; and one trial reported no difference in outcome between supraspinatus injection of steroid and placebo. Based upon these findings, it is difficult to draw any firm conclusions about the short- or long-term benefit of subacromial steroid injection for rotator cuff disease. It is not known whether benefit is dependent upon accurate placement of steroid into the subacromial space although one trial which included a general population of patients with shoulder pain demonstrated that anatomical steroid injection may be superior to trigger or tender point injection with respect to success rate after one week for general shoulder pain. While two studies have verified accurate placement of subacromial steroid injection, no trials have compared blind injection to radiologically-guided injection with respect to outcome.

For adhesive capsulitis, we were unable to pool the results of any trials comparing intra-articular steroid alone or in combination with subacromial steroid injection to placebo or no treatment. Two trials suggested a possible early benefit and none of the trials demonstrated any longer term benefit. One trial did demonstrate a trend favouring higher dose over lower dose intra-articular steroid injection for pain improvement at six weeks in adhesive capsulitis although there were no differences with respect to improvement in sleep disturbance, functional impairment or improvement in external rotation. One trial suggested that the anterior approach may be more accurate but no trials have compared the efficacy of anterior versus posterior intra-articular injection. No trials have compared blind injection to radiologically-guided injection with respect to outcome although one trial found no benefit of injection around the anterior shoulder joint versus placebo and one trial demonstrated that anatomical steroid injection may be superior to trigger or tender point injection with respect to success rate after one week for general shoulder pain. One trial did demonstrate that intra-articular steroid injection is more beneficial than physiotherapy in terms of pain, functional disability and range of abduction at three and seven weeks, although this benefit was no longer apparent by 26 and 52 weeks. While this was supported by one trial that compared a combination of intra-articular and sub-acromial steroid injection to physiotherapy, another trial found no difference between steroid injection versus physiotherapy and NSAID. One trial suggested that distension of the shoulder joint with

steroid and lignocaine conferred a benefit over steroid injection alone with respect to range of movement and pain with activity but not pain at rest whereas another trial reported no difference in abduction when steroid injection was compared to distension of the shoulder joint with air alone. Finally one trial demonstrated no additional benefit of intra-articular steroid injection over manipulation under anaesthesia alone. Based upon the findings of these studies, it is difficult to draw any firm conclusions about the value of intra-articular steroid injection for adhesive capsulitis.

We were able to locate only one trial that specifically studied the value of steroid injection for full thickness rotator cuff tear. It reported no difference in outcome between those who received intra-articular steroid versus those who received hyaluronate at four weeks. With the increasing availability of ultrasound and MR imaging, it should be possible to perform trials investigating the efficacy of other interventions for this subset of patients.

Two previous reviews of steroid injections for shoulder pain (Van Der Heijden 1996) and for rotator cuff tendinitis (Goupille 1996) have been performed. Goupille and Sibilia concluded that steroid injection is effective in the treatment of rotator cuff tendinitis. However, this conclusion cannot be verified by the presented results. Their review included non-randomized studies, reported results of primary studies only as significant or not significant and they made no attempt to quantify effect sizes or pool results. We verified the conclusions of the review by Van Der Heijden et al regarding the overall poor methodological quality of reviewed trials, however our review differs in several important respects. Firstly, we attempted to differentiate studies based upon the nature of the populations being studied, recognizing that the benefits of therapy may vary for different underlying causes of shoulder pain. Secondly, we calculated effect sizes for the same reported outcome measures in different trials. This enables a direct comparison between studies using the same outcome measurement, although it is important to note that if one effect size is larger than another it may be because in the different studies, the numerator (the treatment effect) is larger, the denominator (the variability between subjects in each group) is smaller, or some combination of the two. In the previous studies, the overall efficacy of interventions was compared based upon calculation of success rates for each intervention group. These were determined by dividing the number of documented "successes" (defined as recovery or substantial improvement from baseline, according to the patient) at the end of the intervention period by the number allocated to the intervention by randomization. The exact definition of "success" therefore differed between papers and is, in essence, subjective. Both previous reviews did not attempt to pool the results of different trials because of valid concerns regarding the biased conclusions that may be drawn when combining studies of poor methodological quality. However, we pooled the results of the two steroid injection studies that received the highest methodological ranking in their reviews, adding further weight to the conclusions of our review.

This updated review of steroid injections for shoulder pain has again highlighted issues that need to be considered in order to determine the value of this intervention for shoulder pain. Less than half of the 26 trials that fulfilled inclusion criteria contained sufficient data for meta-analysis (12/26, 46.2%) and data from only three trials, included in our original review, could be pooled. Further work is needed in developing standard criteria to define shoulder disorders and a minimum core set of outcome measures that should be used in all clinical trials of shoulder pain. Other issues include the importance of accurate placement of the injection, the frequency, dose and type of steroid injected and choice of comparator.

AUTHORS' CONCLUSIONS

Implications for practice

There is little evidence to either support or refute the efficacy of steroid injections for shoulder pain. While there are many randomised controlled trials of corticosteroid injections for shoulder pain, their small sample sizes, variable methodological quality and heterogeneity in terms of population studied, injection modality employed and choice of comparator results in little overall evidence to guide treatment. There is evidence to support the use of subacromial corticosteroid injection for rotator cuff disease although its effect may be small and not well-maintained, and it may be no better than NSAID. There is a suggestion that intra-articular steroid injection may be beneficial in the short-term for adhesive capsulitis but again the effect may be small and not well-maintained.

Implications for research

There is a need for further trials investigating the efficacy of corticosteroid injections for shoulder pain. Further work in needed in developing standard criteria to define shoulder disorders and a minimum core set of outcome measures. Other important issues that remain to be clarified include whether the accuracy of needle placement, anatomical site, frequency, dose and type of corticosteroid influences efficacy.

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REFERENCES

References to studies included in this review

Adebajo 1990 *{published data only}*

* Adebajo A, Nash P, Hazleman B. A prospective double blind dummy placebo controlled study comparing triamcinolone hexacetonide injection with oral diclofenac in patients with rotator cuff tendonitis. *J Rheumatol* 1990;**17**:1207-1210.

Arslan 2001 *{published data only}*

Arslan S, Çeliker R. Comparison of the efficacy of local corticosteroid injection and physical therapy for the treatment of adhesive capsultitis. *Rheumatol Int* 2001;**21**:20-3.

Berry 1980 *{published data only}*

* Berry H, Fernandes L, Bloom B, Clarke R, Hamilton E. Clinical study comparing acupuncture, physiotherapy, injection and oral anti-inflammatory therapy in the shoulder. *Current Medical Research Opinion* 1980;**7**:121-126.

Fernandes L, Berry H, Clark RJ, Bloom B, Hamilton EBD. [Clinical study comparing acupuncture, physiotherapy, injection and oral anti-inflammatory therapy in shoulder cuff lesions]. *Lancet* 1980:208-9.

Blair 1996 *{published data only}*

* Blair B, Rokito AS, Cuomo F, Jarolem K, Zuckerman JD. Efficacy of injections of corticosteroids for subacromial impingement syndrome. *Journal of Bone and Joint Surgery Am* 1996;**78**(11):1685-1689.

Bulgen 1984 *{published data only}*

* Bulgen D, Binder A, Hazleman B, Dutton J, Roberts S. Frozen shoulder: prospective clinical study with an evaluation of three treatment regimes. *Ann Rheum Dis* 1984;**43**:353-360.

Dacre 1989 *{published data only}*

* Dacre J, Beeney N, Scott D. Injections and physiotherapy for the painful, stiff shoulder. *Ann Rheum Dis* 1989;**48**:322-332.

de Jong 1998 *{published data only}*

* de Jong BA, Dahmen R, Hogeweg JA, Marti RK. Intra-articular triamcinolone acetonide injection in patients with capsulitis of the shoulder: a comparative study of two dose regimens. *Clinical Rehabilitation* 1998;**12**(3):211-215.

Gam 1998 *{published data only}*

* Gam AN, Schydlowsky P, Rossel I, Remvig L, Jensen EM. Treatment of "frozen shoulder" with distension and glucocorticoid compared with glucocorticoid alone. *Scand J Rheumatol* 1998;**27**:425-430.

Hollingworth 1983 *{published data only}*

* Hollingworth G, Ellis R, Shattersley T. Comparison of injection techniques for shoulder pain: results of a double blind randomised study. *BMJ* 1983;**287**:1339-1341.

Jacobs 1991 *{published data only}*

* Jacobs L, Barton M, Wallace W, Ferrousis J, Dunn W, Bossingham D. Intra-articular distension and steroids in the management of capsulitis of the shoulder. *BMJ* 1991;**302**:1498-1501.

Kirkley 1999 *{published data only}*

* Kirkley A, Litchfield R, Alvarez C, Herbert S, Griffin S. Prospective double blind randomized clinical trial of subacromial injection of betamethasone and xylocaine versus xylocaine alone in rotator cuff tendinosis. J Bone Joint Surg [Br]. 1999; Vol. 81-B supp I:107.

Kivimäcki 2001 *{published data only}*

* Kivimäcki J, Pohjolainen T. Manipulation under anaesthesia for frozen shoulder with and without steroid injection. *Arch Phys Med Rehabil* 2001;**82**:1188-1190.

Lee 1973 *{published data only}*

* Lee M, Haq A, Wright V, Longton E. Periarthritis of the shoulder: A controlled trial of physiotherapy. *Physiotherapy* 1973;**59**:312-315.

Petri 1987 *{published data only}*

* Petri M, Dobrow R, Neiman R, Whiting-O'Keefe Q, Seaman W. Randomised double blind placebo controlled study of the treatment of the painful shoulder. *Randomised double blind placebo controlled study of the treatment of the painful shoulder* 1987;**30**:1040-1045.

Plafki 2000 *{published data only}*

* Plafki C, Steffen R, Willburger RE, Wittenberg RH. Local anaesthetic injection with and without corticosteroids for subacromial impingement syndrome. *International Orthopaedics* 2000;**24**:40-42.

Richardson 1975 *{published data only}*

* Richardson AT. The painful shoulder. *Proc Royal Soc Med* 1975;**68**(11):731-736.

Rizk 1991 *{published data only}*

* Rizk T, Pinals R, Talaiver A. Corticosteroid injections in adhesive capsulitis: investigation of their value and site. *Arch Phys Med* 1991;**72**:20-22.

Shibata 2001 *{published data only}*

* Shibata Y, Midorikawa K, Emoto G, Naito M. Clinical evaluation of sodium hyaluronate for the treatment of patients with rotator cuff tear. *Shoulder Elbow Surg* 2001;**10**:209-216.

Strobel 1996 *{published data only}*

* Strobel G. Therapeutic effects of an injection of either mepivacaine hydrochloride (MVH) or of a combination of MVH and triamcinolone hexacetonide in chronic periarticular disorder of the shoulder with regard to pain, mobility, and working ability [Therapeutische langzeitwirkung unterschiedlicher intraartikularer injektionsbehandlung der schmerzhaften schulter - Auswirkung auf achmerz, beweglichkeit und arbeitsfahigheit]. *Rehabilitation* 1996;**35**:176-178.

van der Windt 1998 *{published data only}*

* van der Windt DAWM, Koes BW, Deville W, Boeke AJP, de Jong BA, Bouter LM. Effectiveness of corticosteroid injections versus physiotherapy for treatment of painful stiff shoulder in primary care: randomised trial. *BMJ* 1998;**317**:1292-1296.

Vecchio 1993 *{published data only}*

* Vecchio PC, Hazleman BL, King RH. A double-blind trial comparing subacromial methylprednisolone and lignocaine in acute rotator cuff tendonitis. *Br J Rheum* 1993;**32**:743-745.

White 1986 *{published data only}*

* White R, Paull D, Fleming K. Rotator cuff tendonitis: comparison of subacromial injection of long acting corticosteroid versus indomethacin therapy. *J Rheumatol* 1986;**13**:608-613.

White 1996 *{published data only}*

* White AET, Tuite JD. The accuracy and efficacy of shoulder injections in restrictive capsulitis. *Journal of Orthopaedic Rheumatology* 1996;**9**:37-40.

Williams 1975 *{published data only}*

* Williams NE, Seifert M, Cuddigan J, Wise R. Treatment of capsulitis of the shoulder. Rheum and Rehab (Abstract). 1975; Vol. 14:236.

Winters 1997 *{published data only}*

* Winters JC, Sobel JS, Groenier KH, Arendzen HJ, Meyboom-de-jong, B. Comparison of physiotherapy, manipulation, and corticosteroid injection for treating shoulder complaints in general practice: Randomized, single blind study. *British Medical Journal* 1997;**314**:1320-1325.

Withrington 1985 *{published data only}*

* Withrington R, Crirgis F, Seifert M. A placebo-controlled trial of steroid injections in the treatment of supraspinatus tendonitis. *Scand J Rheum* 1985;**14**:76-78.

References to studies excluded from this review

Blyth 1993 *{published data only}*

* Blyth TH, Hunter JA. Treatment of the rheumatoid shoulder with intra-articular steroid: comparison of superior and anterior routes of injection. *Br J Rheumatol* 1993;**32**:69.

Corbeil 1992 *{published data only}*

* Corbeil V, Dussault RG, Leduc BE, Fleury J. Adhesive capsulitis of the shoulder: comparative study of distensive and nondistensive arthrography in combination with intra-articular steroid injection [Capsulite rétractile de l'épaule: étude comparative de l'arthrographie avec corticothérapie intra-articulaire avec ou sans distension capsulaire]. *Canadian Association of Radiologists Journal* 1992;**43**(2):127-30.

Gado 1996 *{published data only}*

* Gado K, Emery P. Intra-articular guanethidine injection for resistant shoulder pain: A preliminary double-blind study of a novel approach. *Annals of Rheumatic Diseases* 1996;**55**:199-201.

Hardy 1986 *{published data only}*

* Hardy D, Vogler J, White R. The shoulder impingement syndrome: Prevalence of Radiographic findings and Correlation with response to therapy. *Am J Roentgenology* 1986;**147**(3):557-561.

Lloyd-Roberts 1959 *{published data only}*

* Lloyd-Roberts GC, French PR. Periarthritis of the shoulder. A study of the disease and its treatment. *British Medical Journal* 1959;**2**:1569-1571.

Mardjuadi 1978 *{published data only}*

* Mardjuadi A, Dequeker J. Double-blind trial comparing bufexamac infiltrations with triamcinolone acetonide infiltrations in patients with periarthritis of the shoulder. *Current Medical Research and Opinion* 1978;**5**(5):401-405.

Murnaghan 1955 *{published data only}*

* Murnaghan G, McIntosh D. Hydrocortisone in painful shoulder. A controlled trial. *The Lancet* 1955:798-800.

Quin 1965 *{published data only}*

* Quin CE. Frozen shoulder: Evaluation of treatment with hydrocortisone injections and exercises. *Ann Phys Med* 1965;**8**:22-29.

Rovetta 1998 *{published data only}*

* Rovetta G, Monteforte P. Intraarticular injection of sodium hyaluronate plus steroid versus steroid in adhesive capsulitis of the shoulder. *Int J Tissue React* 1998;**20**(4):125-130.

Shanahan 200x *{unpublished data only}*

Shanahan EM, Ahern M, Smith M, Wetherall M, Bresnihan B, Fitzgerald O. Suprascapular nerve block in chronic shoulder pain.

Thomas 1980 *{published data only}*

* Thomas D, Williams RA, Smith DS. [The frozen shoulder: A review of manipulative therapy]. *Rheumatology and Rehabiltiation* 1980;**19**:173-9.

Valtonen 1974 *{published data only}*

Valtonen E. Subacromial Betamethasone therapy. *Annals Chirurgiae et Gynaecologiae Fenniae* 1974;**63**(Supplement 188):9-16.

Valtonen 1978 *{published data only}*

Valtonen E. Double acting betamethasone in the treatment of supraspinatus tendinitis. *J Int Med Res* 1978;**6**:463-467.

Weiss 1978 *{published data only}*

Weiss JJ, Ting M. Arthrography-Assisted Intra-articular Injection of Steroids in Treatment of Adhesive Capsulitis. *Arch Phys Med Rehab* 1978;**59**:285-287.

Additional references

Chakravarty 1993

Chakravarty K, Webley M. Shoulder Joint Movement and Its Relationship to Disability in the Elderly. *J Rheumatol* 1993;**20**:1359-61.

Chard 1991

Chard MD, Hazleman R, Hazleman BL, King RH, Reiss BB. Shoulder disorders in the elderly: a community survey. *Arthritis Rheum* 1991;**34**:766-769.

Clarke 2000

Clarke M, Oxman AD, editors. Cochrane Reviewers' Handbook 4.1. Version 4.1. Oxford: The Cochrane Collaboration, 2000.

Croft 1996

Croft P, Pope D, Silman A. The clinical course of shoulder pain: prospective cohort study in primary care. *BMJ* 1996;**313**:601-2.

Deeks 1998

Deeks J. Odds ratios should be used only in case-control studies and logistic regression analysis (letter). *BMJ* 1998;**317**:317.

Goupille 1996

Goupille P, Sibilia J. Local corticosteroid injections in the treatment of rotator cuff tendinitis (except for frozen shoulder and calcific tendinitis).. *Clin Exp Rhematol* 1996;**14**(5):561-6.

Green 1998a

Green S, Buchbinder R, Forbes A, Glazier R. Interventions for shoulder pain (Cochrane Review). *Cochrane Database of Systematic Reviews* 2002, Issue 4.

Green 1998b

Green S, Buchbinder R, Forbes A, Glazier R. Systematic review of randomised controlled trials of interventions for painful shoulder: selection criteria, outcome assessment, and efficacy. *BMJ* 1998;**16**:354-60.

Juni 1999

Juni P, Witschi A, Bloch R, Egger M. The hazards of scoring the quality of clinical trials for meta-analysis. *JAMA* 1999;**282**(11):1054-60.

Lundberg 1969

Lundberg B. The frozen shoulder. *Acta Orthopaedica Scandinavia* 1969;**Suppl 119**.

Rekola 1993

Rekola KE, Keinanen-Kiukaanniemi S, Takala J. Use of primary health services in sparsley populated country districts by patients with musculoskeletal symptoms: consultations with a physician. *J Epidemiol Commumity Health* 1993;**47**:153-157.

Van Der Heijden 1996

Van Der Heijden GJMG, Van Der Windt DAWM, Kleijnen J, Koes B, Bouter L. Steroid injections for shoulder disorders: a systematic review of randomised clinical trials. *Br J Gen Pract* 1996;**46**:309-16.

* Indicates the major publication for the study

CHARACTERISTICS OF STUDIES

Characteristics of included studies *[ordered by study ID]*

Adebajo 1990

Methods	Randomised, controlled trial. Blinding: both participants and outcome assessors were blinded. Loss to follow-up: 0 patients Appropriate statistical analysis: yes, intention to treat analysis.
Participants	60 patients. Inclusion criteria: symptoms less than 3 months and rotator cuff tendonitis according to Cyriax's criteria: 1. pain exacerbated by: resisted movement: on abduction (supraspinatus tendinitis) with a painful arc; on external rotation (infraspinatus tendinitis) 2. active range frequently limited by pain and passive range always > active range of movement 3. normal glenohumeral range of passive movement Exclusion criteria: Systemic inflammatory arthropathy; recent peptic ulceration or gastrointestinal bleeding or sensitivity to NSAID or triamcinolone; shoulder injection within previous 3 months; glenohumeral arthritis, acromioclavicular arthritis, bicipital tendinitis or a suspected rotator cuff tear (weak arm elevation, positive "drop arm sign" or a high riding humerus seen radiologically); local infection. NSAIDs stopped at least one week before study entry.
Interventions	Group 1(20 patients): 50 mg diclofenac 3 times a day for 28 days + subacromial injection of 3ml of 0.5% lignocaine

Adebajo 1990 *(Continued)*

	Group 2 (20 patients): diclofenac placebo tablets + subacromial injection of 2ml 0.5% lignocaine & 1ml of 80mg/ml triamcinolone hexacetomide. Group 3 (20 patients): diclofenac placebo tablets + subacromial injection of 3ml 0.5% lignocaine. All patients instructed in pendulum and wall climbing exercises to perform at home.
Outcomes	Outcome assessed at baseline and 4 weeks 1) Overall pain severity assessed by 10cm VAS (0 = no pain, 10 = severe pain) 2) Limitation of function on 4-point scale (0 = no 1 = mild, 2 = moderate and 3 = severe limitation of function respectively) 3) Range of active and passive shoulder movement measured to the nearest 5 degrees with a pendulum goniometer.
Notes	See analyses 2, 11. Standard error of means converted to standard deviations.

Risk of bias

Bias	Authors' judgement	Support for judgement
Allocation concealment?	Low risk	A - Adequate

Arslan 2001

Methods	Randomised controlled trial. Blinding: participants were not blinded. Unclear if outcome assessment was blinded. Loss to follow-up: None reported. Appropriate statistical analysis:appears to be intention to treat analysis
Participants	20 patients. Inclusion criteria: 1. Total range of motion less than 50% of normal range 2. No previous injections in the involved shoulder 3. No history of allergy to local anesthetics or steroids 4. Absence of coagulation diseases 5. Absence of polyarthritis or neurological diseases that may lead to shoulder pain Exclusion criteria: significant glenohumeral arthritis, cervical radiculopathy, stroke, suspected rotator cuff tear, bicipital tendinitis, in receipt of anticoagulants or non-steroidal anti-inflammatory drugs.
Interventions	Group1 (10 patients): intra-articular injection of 40mg methylprednisolone acetate (1ml) with 1ml 2% lidocaine Group 2 (10 patients): physiotherapy (hot pack application for 20 minutes, ultrasonic therapy at 3.5 W/cm2 for 5 minutes, and passive glenohumeral joint stretching exercises to the patient's tolerance, followed by Codman exercises and wall climbing) and a nonsteroidal anti-inflammatory drug (acemethazine 120 mg/day). Unclear how many physiotherapy sessions were given. All patients received same home exercise program.
Outcomes	Outcome assessed at baseline, 2 and 12 weeks 1) pain severity using a VAS 2) range of motion using a goniometer
Notes	See analyses 6. No measures of variance reported for range of motion so only pain considered in meta-analysis.

Risk of bias

Bias	Authors' judgement	Support for judgement

Arslan 2001 *(Continued)*

Allocation concealment?	Unclear risk	B - Unclear

Berry 1980

Methods	Randomised, controlled trial. Blinding: Blinded outcome assessor, participants blinded to some treatments only. Loss to follow-up: none Appropriate statistical analysis: appears to be intention to treat analysis.
Participants	60 patients. Inclusion criteria: rotator-cuff lesion defined as "pain on resisted movements of the shoulder with loss of passive movement, mainly abduction". Exclusion criteria included: frozen shoulder (not defined); fracture; inflammatory arthritis.
Interventions	12 patients in each group Group 1: 400mg tolmetin sodium 3x day plus anterior injection 40mg methyl prednisolone with 2ml 2% lignocaine. Group 2: placebo tolmetin sodium 3x day plus injection as above Group 3: acupuncture once per week Group 4: physiotherapy in form of ultrasound (8 sessions of 10min) Group 5: placebo tolmetin sodium plus placebo ultrasound.
Outcomes	Assessed at baseline, 2, 4 weeks 1) Pain using a 100mm VAS. 2) Pain using a 4- point scale (none, mild, moderate and severe). 3) Shoulder abduction using a goniometer. 4) Comparative assessment by patient and assessor scored as 'much better', 'better', 'same', 'worse', 'much worse'. 5) Success or failure at end of 4 weeks, defined in the opinion of the assessor as the need for a steroid injection. 6) Adverse effects
Notes	See analyses 1, 8, 9, 14. Comparison of steroid injection plus NSAID versus steroid injection alone is included in NSAID review

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Allocation concealment?	Unclear risk	B - Unclear

Blair 1996

Methods	Randomised, controlled trial. Blinding: both participants and outcome assessors were blinded. Loss to follow-up: Can't tell Appropriate statisticial analysis: unclear
Participants	40 patients. Inclusion criteria: 1. at least 3 months of symptoms 2. diagnosis of subacromial impingement syndrome on the basis of the lidocaine injection test 3. no previous subacromial corticosteroid injections 4. no evidence of os acromiale on plain X-Ray 5. not involved in workers' compensation claim related to the shoulder

Blair 1996 *(Continued)*

	6. no clinical or radiographic evidence of full thickness rotator cuff tear
Interventions	Group 1(21 patients): 6ml of 1% lidocaine without epinephrine. Group 2 (19 patients): 2ml containing 40 mg of triamcinolone acetonide per ml with 4 ml of 1% lidocaine without epinephrine. All patients underwent a standardized program of physiotherapy.
Outcomes	Assessed at baseline and every 4 weeks until completion of study (not defined) - (mean duration of follow up was 33 weeks (range: 12-55) and 28 weeks (range: 12-52) in corticosteroid and placebo groups respectively). 1. Performance of 5 activities of daily living (ability to use back pocket, wash opposite axilla, eat with utensils, wash or comb hair, perform toilet functions). Assessed by outcome assessor. Three-point scale for each item (0=unable to do, 1 -with difficulty, 2- without difficulty). Mean overall score out of 10 2. Overall subjective assessment of pain on 4 point scale (0=no, 1=mild, 2=moderate, 3=severe pain) and whether pain was decreased, unchanged or worse compared to before the injection. 3. Detailed physical examination documenting muscle atrophy, areas of localised tenderness, ROM using a goniometer (forward flexion, external rotation and internal rotation), presence of impingement (as described by Neer).
Notes	Met inclusion criteria for review, however the exact timing of comparisons between groups is not provided ('most recent follow-up'), and no measure of variance reported and no means of calculating it. Therefore not included in the meta-analysis. Results: At the most recent follow-up evaluation, at a mean of 33 weeks in corticosteroid group and 28 weeks in placebo group, the corticosteroid group was significantly better with respect to pain and range of motion but there was no significant difference between the two groups with respect to improvement in performance of activities of daily living.

Risk of bias

Bias	Authors' judgement	Support for judgement
Allocation concealment?	Unclear risk	B - Unclear

Bulgen 1984

Methods	Randomised trial Blinding: outcome assessment was blinded. Participants do not appear to have been blinded. Loss to follow- up: unclear (see notes) Appropriate statistical analysis: unclear (see notes)
Participants	42 patients Inclusion criteria: "frozen shoulder": pain in shoulder for at least 1 month, sleep disturbance due to night pain, inability to lie on affected side, restriction of active and passive shoulder movements, restriction in external rotation of at least 50% Exclusion criteria: sensory symptoms or signs in the affected arm or radiation of pain to the neck, generalised arthritis, fractures or dislocations of humerus, cervical spondylosis, evidence of referred pain.
Interventions	Group 1(11 patients): intra-articular steroid injection by anterior route Group 2 (11 patients): mobilisation Group 3(12 patients): ice therapy Group 4(8 patients): no treatment
Outcomes	Assessed at baseline, weekly for 6 weeks and monthly for further 6 months 1) Night pain,

Bulgen 1984 *(Continued)*

	pain on movement and rest pain during the day measured on 10cm VAS, and as "better", "worse", "the same" on follow up assessments 2) Passive movements measured to nearest 5 degrees including external rotation; total abduction, flexion and rotation; glenohumeral abduction and flexion; hand behind back. Range of motion was reported by recovery curves 3) Number of analgesics
Notes	Met inclusion criteria for review, however no means or standard deviations reported so included in review but not in meta-analysis. Results: Reported little difference between groups with respect to long term outcome but some benefit with respect to pain and range of motion in early stages with use of intra-articular steroid injection (no pain data presented). Another 3 patients withdrew (one after arthrogram, one received physiotherapy elsewhere and one failed to attend). Unclear when these 3 patients withdrew and no data about them presented.

Risk of bias

Bias	Authors' judgement	Support for judgement
Allocation concealment?	Unclear risk	D - Not used

Dacre 1989

Methods	Randomised, controlled trial Blinding: outcome assessment was blinded. Participants do not appear to have been blinded. Loss to follow-up: 4 patients of unspecified group allocation (failed to attend at 6 weeks or 6 months). Appropriate statistical analysis: Analysis based upon completers only (62/66)
Participants	66 patients. Inclusion criteria: Periarthritis (Painful stiff shoulder for at least 4 weeks, inability to use the affected arm with restriction of movement and loss of full function, pain at night causing sleep disturbance with inability to lie on the affected side. Exclusion criteria: stroke, generalised arthritis, cervical spondylosis, highly localised lesion such as bicipital tendinitis.
Interventions	Group 1(22 patients): Local steroid injections of 20mg triamcinolone with 1 ml 2% lignocaine injected anteriorly around the shoulder joint by 1 physician. Group 2(20 patients): Four to six weeks of "physiotherapy thought most appropriate", performed by one therapist and mainly comprised of mobilisation. Group 3(20 patients): Both physiotherapy and injection as above.
Outcomes	Outcome assessed at baseline, six weeks and six months 1) Day pain, night pain and pain during active and passive movement each assessed on 10cm VAS. 2) Range of passive movement: complete shoulder abduction, glenohumeral abduction and external rotation measured with goniometer; passive internal rotation measured by hand behind back. 3) Treatment costs.
Notes	While included in review, data presented with no measure of variance and no means of calculating it. Therefore not included in the meta-analysis. Results: All groups demonstrated improvement in pain at six weeks, but with no significant differences between groups.

Risk of bias

Dacre 1989 *(Continued)*

Bias	Authors' judgement	Support for judgement
Allocation concealment?	Unclear risk	B - Unclear

de Jong 1998

Methods	Randomised controlled trial. Blinding: Both participants and outcome assessors were blinded. Loss to follow-up: 4 patients (12.5%) in low-dose (10mg) group and 1 patient (4%) in high-dose (40mg) group. Appropriate statistical analysis: Can't tell
Participants	57 patients. Inclusion criteria: Adhesive capsulitis based upon following criteria: 1) pain in shoulder and arm, either of spontaneous onset, or precipitated by a relatively minor trauma. 2) restriction of passive movement of glenohumeral joint according to capsular pattern with greater than 45 degrees restriction of passive external rotation 3) waking at night due to pain when lying on affected shoulder 4) no clinical or radiological evidence of other pathology which could account for similar symptoms. Exclusion criteria: evidence of cervical radiculopathy, paresis or other neurological changes in the upper limb on involved side, insulin dependent diabetes.
Interventions	Group 1(32 patients): 3 intra-articular injections of 10mg triamcinolone actonide. Group 2 (25 patients): 3 intra-articular injections of 40mg of triamcinolone actonide. One week between first and second injections and two weeks between second and third injections. Patients received no other treatments and were instructed to use the shoulder and arm normally within the limits of pain.
Outcomes	Assessed at baseline, 1 week, 3 and 6 weeks after initial injection. 1) Pain intensity scored on VAS ranging from 0 = no pain to 100 = maximal pain. 2) Disturbance of sleep at night scored by patient on 4-point ordinal scale. 3) Impairment of ability to use the shoulder and arm, scored by patient on 4-point ordinal scale. 4) Restriction of range of passive glenohumeral movement. External rotation was measured with simple goniometer and scored on 4-point scale where 0 = no restriction; 1 = restriction of less than 45 degrees; 2 = more than 45 degrees but less than 60 degrees; 3 = restriction of more than 60 degrees.
Notes	See analyses 4

Risk of bias

Bias	Authors' judgement	Support for judgement
Allocation concealment?	Low risk	A - Adequate

Gam 1998

Methods	Randomised controlled trial. Blinding: both participants and outcome assessors were blinded. Loss to follow-up: 1 patient (11.1%) in steroid alone group and 1 patient (7.7%) in steroid + distension group. Appropriate statistical analysis: Based upon completers only analysis (20/22)
Participants	22 patients. Inclusion criteria:

Gam 1998 *(Continued)*

	1) age between 18 and 70 yrs; 2) frozen shoulder of more than 6 weeks duration; 3) nocturnal accentuation of pain; 4) passive range of external rotation in shoulder less than 50% of opposite shoulder; 5) no effusion in glenohumeral joint; 6) normal x-ray of affected shoulder; 7) normal ESR, haemoglobin, leucocytes, alkalic phosphates and negative IgM rheumatoid factor; 8) no trauma to shoulder in last 6 months that caused pain or restricted movement of the shoulder within one week (acceptance of trivial minor injuries); 9) no diabetes; 10) no other treatment for frozen shoulder except analgesics in study period.
Interventions	Group 1(13 patients): distension with 19ml of 0.5% lidocaine and 20mg triamcinolone hexacetonid. Group 2 (9 patients): 20mg triamcinolone hexacetonid injection alone. The intraarticular injection in the glenohumeral joint was carried out by a posterior approach and confirmed by ultrasound. The treatment was repeated once a week for a maximum of 6 weeks or until no symptoms.
Outcomes	Assessed at baseline, 3, 6 and 12 weeks. 1) physician judgement of severity of disorder (severe = 1, moderate = 2, light pain = 3) from patients' verbal expression of pain and function (undressing); 2) passive flexion, extension, abduction, external rotation, and elevation of affected shoulder in comparison with opposite shoulder (i.e. 0-25% = 1, 25-50% = 2, 50-75% = 3, 75-100% = 4). Elevation performed with fixed scapulae; 3) Pain at rest and on function using VAS (where 0 = no pain and 10 = unbearable pain). Patients recorded their average pain every day in study period and mean score of each week was used for evaluations; 4) Daily usage of analgesics; 5) type and number of side effects.
Notes	This article met the inclusion criteria for this review but the data was not presented in a format which allowed meta-analysis. Randomisation according to the envelope method. Results: Signficant improvement in range of motion and analgesic use in group treated with distension with local anesthetis and steroid vs steroid alone. There was no difference in pain at rest but a trend favouring the distension group for pain with activity.

Risk of bias

Bias	Authors' judgement	Support for judgement
Allocation concealment?	Unclear risk	B - Unclear

Hollingworth 1983

Methods	Randomised controlled trial Blinding: both participants and outcome assessors were blinded Loss to follow-up: none reported Appropriate statistical analysis: yes, intention to treat.
Participants	77 patients Inclusion criteria: diagnosis of pain of soft tissue origin, shoulder or upper arm pain of any duration and of spontaneous or traumatic origin, positive signs on selective tissue tension examination of shoulder structures classified on basis of clinical criteria as: 1. Supraspinatus tendonitis 2. Infraspinatus tendonitis 3. Subscapularis tendonitis 4. Bursitis 5. A.C. joint sprain 6. Capsulitis.

Hollingworth 1983 *(Continued)*

	Exclusion criteria: patients with predominantly neck pain, paraesthesiae or neurological signs in arms or hands, specific arthritis (septic, gout, pseudogout), polyarthritis and generalised disease relevent to the symptoms, radiological evidence of osteoarthritis or other bone disease, overt or predominant psychological overlay
Interventions	Group 1(38 patients): Tender or trigger point injection of 2ml, 40 mg methylprednisolone acetate mixed with 1% lignocaine. The most tender point which reproduced the patients pain was identified by deep palpation. Group 2 (39 patients): "Functional" injection, the site of the injection being the anatomical area (ie rotator cuff tendon, subacromial bursa) indicated by the selective tissue tension examination. The same injection solution was used. At one week, if the pain had not cleared completely or considerably diminished, the alternative (cross over) injection was given. If the crossover injection was not effective after one week then the original injection was given again (recrossover).
Outcomes	Assessed at baseline, 1, 4 weeks. Success defined as reduction in pain from severe to mild or nil, with corresponding clearing of signs on objective examination.
Notes	Patients randomly assigned to treatment group by physician giving the injections. Crossover and recrossovers after one and two weeks as per protocol. Only 1 week data included in review - see analyses 3. Ten of the "successes" at 1 week had a different pattern of pain at one week. All patients who were considered "success" at 1 week maintained their relief at 4 and 8 weeks apart for the 5 patients who presented with new injuries or spontaneous recurrences.

Risk of bias

Bias	Authors' judgement	Support for judgement
Allocation concealment?	High risk	C - Inadequate

Jacobs 1991

Methods	Randomised controlled trial. Blinding: Outcome assessment was blinded. Unclear if patients were blinded. Loss to follow-up: none reported Appropriate statistical analysis: Yes, appears to be intention to treat analysis.
Participants	47 patients. Inclusion criteria: capsulitis of the shoulder defined by abduction and forward flexion of less than 90 degrees, external rotation less than 20 degrees, an intact rotator cuff clinically and normal shoulder radiographs
Interventions	Group 1(14 patients): shoulder distension with air (6ml 0.25% bupivacaine + 3ml air = 9ml total) Group 2 (15 patients): intra-articular steroid injection (40mg triamcinolone acetonide in 1ml injection) Group 3 (18 patients): distension with air and steroid (40mg triamcinolone acetonide in 1ml + 6ml 0.25% bupivacaine + 3ml air = 10ml total)
Outcomes	Assessment at baseline, 6, 12 and 16 weeks. 1) Analgesic use 2) severity of pain in relation to daily activities (on a 6-point scale from 0=none to 5 = severe, interferes with sleep) 3) severity of pain with resisted shoulder movement (on a 4-point scale from 0 = none to 3 = severe, with pain inhibition) 4) range of active and passive abduction and forward flexion using a hydrogoniometer and external rotation of the shoulder according to Cyriax method 5) strength using a isokinetic shoulder dynanometer

Jacobs 1991 *(Continued)*

Notes	Improvement in symptoms (pain was not reported separately by treatment group. See analyses 7 for comparison of improvement in range of movement by treatment group. Comparison of distension with air plus steroid versus steroid injection alone is included in the hydrodilatation review.

Risk of bias

Bias	Authors' judgement	Support for judgement
Allocation concealment?	Unclear risk	B - Unclear

Kirkley 1999

Methods	Randomised controlled trial. Blinding: both patients and outcome assessors were blinded. Loss to follow-up: unclear Appropriate statistical analysis: unclear
Participants	52 patients - reported on first 41 patients Inclusion criteria: rotator cuff tendinitis or partial rotator cuff tears who have failed to improve with non-surgical treatment. Exclusion criteria: full thickness tear, cuff arthopathy, previous surgery, greater than one subacromial steroid injection, injection within 3 months, inflammatory arthritis or shoulder instability.
Interventions	Group 1: (20 patients) 5ml subacromial injection of 2% lidocaine via posterior approach. Group 2 (21 patients): injection as above of 4ml 2% lidocaine and 1ml 6mg betamethasone.
Outcomes	Assessed at baseline, 2, 6 weeks, 3, 6 months. 1) Western Ontario Rotator Cuff index (WORC) 2) American shoulder and elbow surgeons (ASES) 3) Disabilities of the Arm, Shoulder and Hand (DASH) 4) active forward elevation 5) internal and external rotation at 90 degrees of shoulder abduction 6) Neer's impingement sign
Notes	Abstract only - no results presented that could be used for meta-analysis. Results showed that both groups improved compared with baseline assessment but no difference between the two treatments.

Risk of bias

Bias	Authors' judgement	Support for judgement
Allocation concealment?	Unclear risk	B - Unclear

Kivimäcki 2001

Methods	Randomised controlled trial. Blinding: unable to determine whether patients and/or outcome assessors were blinded. Loss to follow-up: 2(13%) of manipulation + steroid patients and 4(26%) of manipulation only patients Appropriate statistical analysis: no, not intention to treat analysis, only completers (24/30)
Participants	30 patients

Kivimäcki 2001 *(Continued)*

	Inclusion criteria: Frozen shoulder defined as: typical anamnesis and restriction of passive joint movements. Required glenohumeral flexion < 140 degrees
Interventions	Group 1(15 patients): manipulation under anaesthesia (Patient's arm was first moved toward flexion while the scapular was fixed. Thereafter, the arm was stretched in inner and outer rotation) and intra-articular injection of 1ml betamethasone (6mg/ml) and 4ml lidocaine (10mg/ml). Group 2 (15 patients): manipulation as above but no steroid injection.
Outcomes	Assessed at baseline, 1 day, 4 months. 1) patients opinion whether the procedure had been useful, harmful, neither 2) patient evaluation of length of time shoulder pain had hindered dressing or sleeping after manipulation 3) range of passive flexion, abduction, internal and external rotation
Notes	See analyses 15

Risk of bias

Bias	Authors' judgement	Support for judgement
Allocation concealment?	Unclear risk	B - Unclear

Lee 1973

Methods	Randomised controlled trial Blinding: neither patients nor outcome assessment blinded. Loss to follow-up: not reported Appropriate statistical analysis: no data presented.
Participants	80 patients Inclusion criteria: periarthritis of shoulder with pain associated with limitation of passive movement of shoulder joint Exclusion criteria: arthritis of any kind, bone or neurological disease.
Interventions	Group 1(20 patients): Infra red irradiation 10 mins and exercises Group 2(20 patients): Intra-articular hydrocortisone acetate 25mg injection via anterior approach and exercises Group 3(20 patients): Bicipital sheath injection of hydrocortisone acetate 25mg and exercises Group 4(20 patients): Analgesics only
Outcomes	Outcome assessed at baseline, and weekly up to 6 weeks 1) active abduction 2) passive abduction 3) active internal rotation 4) active external rotation
Notes	Reported all groups improved significantly over analgesic only, with no difference between injection and infra-red. Results presented graphically only therefore included in review but not in meta-analysis

Risk of bias

Bias	Authors' judgement	Support for judgement
Allocation concealment?	Unclear risk	B - Unclear

Petri 1987

Methods	Randomised, controlled trial Blinding: both participants and outcome assessors were blinded. Loss to follow-up: no loss reported Appropriate statistical analysis: yes, intention to treat.
Participants	100 patients Inclusion criteria: Rotator cuff tendonitis defined as having at least 2 of: 1. painful abduction at any degree of motion 2. painful arc of movement from 45 to 120 degrees 3. tenderness of supraspinatus tendon insertion. Exclusion criteria: significant glenohumeral arthritis, supraspinatus injection during preceding 3 months, reason to suspect rotator cuff tear, contraindication to NSAIDS, allergy to lidocaine; frozen shoulder as defined by marked restriction of both active and passive motion that did not improve with lidocaine injection
Interventions	Group 1(25 patients): 500mg naproxen 2 x day for 30 days plus subacromial bursa injection 4cc 1% lidocaine Group 2(25 patients): 500mg naproxen 2x day for 30 days plus subacromial bursa injection of 3cc 1% lidocaine + 1cc 40mg/ml triamcinolone. Group 3(25 patients): placebo pill 2x day for 30 days plus injection with 3cc 1% lidocaine + 1cc 40mg/ml triamcinolone Group 4(25 patients): placebo pill 2x day for 30 days plus injection with 4cc 1% lidocaine. All patients received instructions in range-of-motion exercises
Outcomes	Assessed at baseline, 2 and 4 weeks 1) Pain on a linear scale where 0 = worst and 5 = best 2) Patient grading of limitation of function on linear scale where 0=worst and 5=best 3) degree of active abduction 4) clinical index - 3 above factors combined, with equal weight (abduction range in degrees divided by 36) where high clinical index represents good outcome 5) remission defined as perfect score in active abduction, pain and limitation of function
Notes	See analyses 2, 11, 16. Standard error of means converted to standard deviations.

Risk of bias

Bias	Authors' judgement	Support for judgement
Allocation concealment?	Low risk	A - Adequate

Plafki 2000

Methods	Randomised controlled trial Blinding: both participants and outcome assessors were blinded. Loss to follow up: not reported but treatment in in Group 1 discontinued after interim analysis of first 10 patients found lack of efficacy in all patients and pain aggravation in 4 patients. Appropriate statistical analysis: yes, intention to treat.
Participants	50 patients: Inclusion criteria: painful disabling impingement syndrome for at least 3 months duration. Diagnosis based on patient's history and positive impingement signs according to Neer and Hawkins. Exclusion criteria: concomitant cervical cervical radiculopathy, prior subacromial corticosteroid injection, adhesive capsulitis, full or partial-thickness rotator cuff tears, calcifying tendinitis, disorders of acromioclavicular joint, shoulder instability, involvement in workers compensation claims.

Plafki 2000 *(Continued)*

Interventions	Group 1(10 patients): 10ml injection of pure 0.5% bupivacaine Group 2(20 patients): 10mg injection of triamcinolone acetonide (crystalline corticosteroid) with 10ml 0.5% bupivacaine Group 3(20 patients): 4mg injection dexamethasone-21-palmitat (lipoid corticosteroid, equivalent to 2.5mg dexamethasone) with 10 ml of 0.5% bupivacaine. All injections were into subacromial bursae with positioning verified by ultrasound. All patients received standardized physiotherapy program consisting of cryotherapy and active strengthening o the rotator cuff muscles.
Outcomes	Assessed at baseline, 1, 6 and 26 weeks 1) impingement signs 2) pain scale 3) Patte score - judges subjective estimation of pain, function, force and overall handicap (excellent when score > 85%) 4) Ultrasound examination
Notes	No data presented that could be used for meta-analysis. Reported that 'favourable' results were achieved in 19 out of 40 participants who received steroid injection.

Risk of bias

Bias	Authors' judgement	Support for judgement
Allocation concealment?	Unclear risk	B - Unclear

Richardson 1975

Methods	Randomised controlled trial Blinding: patients and outcome assessors blinded Loss to follow-up: 15 pateints withdrew - 9(16%) in steroid group and 6(13%) in placebo group. Appropriate statistical analysis: unclear if completers analysis only
Participants	101 patients 1) pain on resisted abduction and/ or external rotation and/or 2) loss of passive movement of glenohumeral joint Exclusion criteria: polymyalgia rheumatica, biceps tendonitis, as judged by pain on resisted forearm supination, polyarthritis with shoulder involvement, abnormal neurological signs or shoulder/hand syndrome, arthritis acromioclavicualr joint as judges by joint tenderness
Interventions	Group 1(54 patients): Intra-articular (1 ml) and subdeltoid bursa (1ml) steroid injection of prednisolone acetate (single skin puncture at baseline and 2 weeks. Group 2(47 patients): saline injection as per steroid group. Arthrogram checked placement and indicated correct placement in subacromial bursa but not joint
Outcomes	Assessed at baseline, 2 and 4 weeks 1) Pain 2) Night pain 3) Pain on resisted abduction or external rotation 4) Loss of passive abduction external, and/or internal rotation. 5) At 2 and 6 weeks, degree of improvement on 5-point scale (1=worse, 2=no change, 3=slight improvement, 4=definite improvement, 5=complete recovery) for pain, night pain, pain with resisted abduction or external rotation (mean score) and loss of passive abduction, external and internal rotation (mean score)
Notes	Met inclusion criteria for review, but no means or standard deviations reported.

Richardson 1975 *(Continued)*

	Reported percent of patients with definite improvement or complete recovery (scores of 4 or 5) at 2 and 6 weeks but unclear if all patients included in analysis or just completers so not included in meta-analysis. Reported a trend toward steroid injections being more effective than placebo.

Risk of bias

Bias	Authors' judgement	Support for judgement
Allocation concealment?	High risk	C - Inadequate

Rizk 1991

Methods	Randomised controlled trial Blinding: both patients and outcome assessors were blinded Loss to follow-up: Four patients withdrew before study completion: 1(6%) in lidocaine groups, 2(12%) in intra-articular group, 1(6%) in intrabursal group. Appropriate statistical analysis: yes, intention to treat analysis.
Participants	48 patients Inclusion criteria: Total passive range of motion < 50 percent of normal, shoulder pain less than 6 months, pain worse at night, no effusion in glenohumeral joint, no history of recent trauma and no previous injections in involved shoulder, no history of allergy to local anaesthetics or steroids. Exclusion criteria included: polyarthritis or neurologic diseases which may lead to shoulder pain, cervical radiculopathy, evidence of alternative cause of shoulder pain revealed in shoulder x-rays including osteoarthritis, fracture, metastases, accromioclavicular pathology
Interventions	Group 1(16 patients): intra-articular (anterior approach) methyl prednisolone 40mg 1ml and lidocaine 2ml 1% Group 2(16 patients): Subacromial bursa methylpredisolone and lidocaine Group 3(8 patients): intra-articular lidocaine 3ml 1% Group 4(8 patients): intra-bursal lidocaine 3ml 1% Each patient received 3 injections in same location at intervals of one week and all patients received same home exercise program and standardized weekly physical therapy treatment for 11 weeks consisting of ultrasound and therapeutic exercises. All were adivsed to continue NSAIDs.
Outcomes	Assessed at baseline, weekly for 11 weeks, week 15 and 6 months. 1) Pain on a 6- point rating scale (0=none and 5=extreme) 2) Shoulder passive range of motion expressed as the sum of shoulder motion in 3 planes (internal rotation- external rotation, flexion- extension, adduction- abduction).
Notes	Met inclusion criteria for review but insufficient data presented (ie. no measure of variance or data from which it could be calculated), therefore not included in meta-analysis. Concluded no significant difference between groups for pain or range of movement.

Risk of bias

Bias	Authors' judgement	Support for judgement
Allocation concealment?	Unclear risk	B - Unclear

Shibata 2001

Methods	Randomised controlled trial Blinding: unclear Loss to follow-up: none at 4 weeks, Appropriate statistical analysis: intention to treat only for satisfaction with treatment at 4 weeks
Participants	78 patients Inclusion criteria: full thickness rotator cuff tear diagnosed by arthography or MRI. Exclusion criteria: prior intra-articular injection of any drugs, abnormal hepatic or renal function, pregnancy, severe osteoarthritic changes of affected shoulder joint, symptoms resulting from cervical lesions
Interventions	Group 1(38 patients): intra-articular injections of 25mg hyaluronate plus 3ml 1% lidocaine Group 2(40 patients): intra-articular injections of 2mg dexamethasone plus 3ml lidocaine. Injections were performed once weekly for 5weeks or earlier if shoulder disability resolved during treatment period. All patients were prescribed loxoprofen (180mg/day) and physical therapy which included heat and cuff-strengthening exercise.
Outcomes	Assessed at baseline and 4 weeks after final injection 1) active abduction, external and internal rotation 2) patient's assessment of improvement of symptoms, satisfaction with treatment, desire for surgery for rotator cuff repair. 3) UCLA score incorporating pain, function, active forward flexion, manual muscle testing and satisfaction of patients.
Notes	See analyses 10.

Risk of bias

Bias	Authors' judgement	Support for judgement
Allocation concealment?	Unclear risk	B - Unclear

Strobel 1996

Methods	Randomised controlled trial reported in German. Blinding: unclear Loss to follow-up: 3(15%) in placebo group and and 6(30%) in steroid injection group did not participate in follow up Appropriate statistical analysis: not intention to treat analysis, completers analysis only
Participants	40 patients Inclusion criteria: chronic painful shoulder caused by chronic subacromial bursitis or supraspinatus tendinitis - criteria for diagnoses not reported Exclusion criteria: not stated
Interventions	Group 1(20 patients): 5ml 0.5% mepivacainhydrochloride (MVH) injection Group 2(20 patients): 5ml 0.5% MVH plus 20mg triamcinolone hexacetonid (THA) injection
Outcomes	Assessed at baseline, 14, 90 and 360 days 1) Pain (either no pain, low pain, strong pain, very strong pain) 2) angle of abduction reported by patient after eduction in front of a mirror

Strobel 1996 *(Continued)*

	3) work status
Notes	Met inclusion criteria for review but insufficient data presented (ie. no measure of variance or data from which it could be calculated), therefore not included in meta-analysis. Reported greater reduction in pain in placebo group at 90 and 360 days but more patients in treated group were able to work after one year.

Risk of bias

Bias	Authors' judgement	Support for judgement
Allocation concealment?	Unclear risk	B - Unclear

van der Windt 1998

Methods	Randomised controlled trial. Blinding: Only outcome assessors were blinded. Patients unable to be blinded since comparing steroid injections to physiotherapy. Loss to follow-up: 2 (3.6%) patients withdrew from physiotherapy treatment group and 4 (7.5%) withdrew from injection group Appropriate statistical analysis: Yes - intention to treat analysis.
Participants	109 patients Inclusion criteria: 1) painful restriction of glenohumeral mobility - lateral rotation must be relatively more limited than abduction and medial rotation and must be no clear signs (painful arc, positive resistance tests, loss of power) that shoulder pain is caused by another condition; 2) 18 yrs or older; 3) informed consent. Exclusion criteria: 1) bilateral shoulder symptoms; 2) treatment with physiotherapy or corticosteroid injections during preceding 6 months; 3) contra indications to treatment; 4) surgery, dislocation or fracture of shoulder area; 5) insulin dependent diabetes mellitus; 6) systemic disorders of musculoskeletal system or neurological disorders.
Interventions	Group 1 (53 patients) Intra-articular injections of 40mg triamcinolone acetonide, posterior route, by mostly trained general practitioners. No more than 3 injections were given during 6 week treatment period. Group 2 (56 patients): 12 sessions of physiotherapy over 6 weeks, consisting of 30 minutes of passive joint mobilisation and exercise treatment. Ice, hot packs, or electrotherapy could also be used to reduce pain. No ultrasound, acupuncture or high velocity thrust manipulations were allowed under the protocol. Treatment could be adjusted according to severity of symptoms. All patients in both groups allowed to could continue taking drugs for pain if they had started before enrollment; drugs could also be prescribed if pain was severe. All other interventions were to be avoided during study.
Outcomes	Assessments made at baseline, 3, 7, 13, 26 and 52 weeks. 1) Patients scored their improvement on a 6-point Likert scale. For analysis of success rates for each treatment, patients who rated themselves as having made a complete recovery or as having much improved were counted as successes. 2) Patients were asked to score the pain associated with their main complaint 3) severity of their pain during the day and at night on 100mm visual analogue scale (VAS) where 0 = no pain and 100 = very severe pain.

van der Windt 1998 *(Continued)*

	4) Functional disability was assessed using shoulder disability questionnaire, a 16-item scale consisting of common situations which migh cause shoulder pain. Scores on this ranged from 0 (no disability) to 100 (severe disability). 5) Independent observer scored overall clinical severity of the disorder on VAS. Using the healthy shoulder as a reference, the observer measured the restriction of mobility during passive lateral rotation and glenohumeral abduction with a digital inclinometer (EDI-320, Cybex, Ronkonkoma, New York).
Notes	See analyses 5.

Risk of bias

Bias	Authors' judgement	Support for judgement
Allocation concealment?	Low risk	A - Adequate

Vecchio 1993

Methods	Randomised controlled trial Blinding: both patients and outcome assessors were blinded Loss to follow-up: 1 patient from each group failed to complete 12 week assessment period Appropriate statistical analysis: completers analysis only
Participants	57 patients Inclusion criteria: clinically defined rotator cuff tendonitis (shoulder pain exacerbated by resistance in at least one of abduction, external or internal rotation, and normal passive motion). Duration of symptoms was less than 12 weeks. Exclusion criteria: Adhesive capsulitis, rotator cuff tears, biceps tendinitis, acromioclavicular arthritis, local infection and previous steroid injections into shoulders
Interventions	Group 1 (28 patients): subacromial injection of 1% lignocaine, 1ml. Group 2 (29 patients): subacromial injection of 40mg methylprednisolone plus 1ml 1% lignocaine NSAIDS were discontinued one week prior to study
Outcomes	Outcome was assessed at baseline and every 2 weeks for 12 weeks 1) Pain at rest, night and on movement on a 10 cm visual analogue scale 2) Active and passive range of abduction, flexion, internal and external rotation using spirit level goniometer, recorded to nearest 5 degrees.
Notes	Met inclusion criteria for review but no reported means or standard deviations and no information from which to calculate them. Reported median change. Therefore included in review but not in meta-analysis Author contacted but data no longer available. RESULTS: Median changes in clinical variables between 0 and 2 weeks, 0 and 4 weeks and 0 and 12 weeks were presented with interquartile ranges. Reported no statistically significant differences between the treatment and placebo groups.

Risk of bias

Bias	Authors' judgement	Support for judgement
Allocation concealment?	Unclear risk	B - Unclear

White 1986

Methods	Randomised, controlled trial Blinding: both participants and outcome assessors were blinded Loss to follow-up: 5(25%) patients in each group. Appropriate statistical analysis: yes, intention to treat
Participants	40 patients Inclusion criteria: "Rotator cuff tendonitis" Painful arc between 40-120 degrees abduction, shoulder pain less than 12 weeks duration, no signs of acute calcific tendinitis, no evidence of a systemic inflammatory arthritis or frozen shoulder (defined as external rotation < 30 degrees, abduction <90 degrees) Exclusion criteria: active peptic ulcer disease, recent gastrointestinal bleed, contraindication to NSAIDS, evidence of symptomatic acromioclavicular arthritis or bicipitis tendinitis or major rotator cuff tear
Interventions	Group 1 (20 patients): Subacromial injection of 40mg triamcinalone acetonide plus placebo indomethacin tablets 4x daily Group 2 (20 patients): 25mg indomethacin 4x daily plus placebo (1cc saline) injection. Repeat injection and refill of medication was given after 3 weeks, if necessary. All patients were instructed to begin home exercise program of Codman pendulum exercies. 10-15 min twice daily and slow shoulder abduction exerceises using finger-up-the-wall technique.
Outcomes	Assessed at baseline and 3 weeks (final assessment if prompt response) and 6 weeks (for remaining patients) 1) Day and night pain on 9cm VAS scales; 2) overall severity judged by patient on a 0-3 point scale (0=none, 3=severe) 3) Range of abduction measured with a goniometer. 4) Physician's estimate of overall severity of pain and overall severity of motion deficit using 0-3 point scales where 0=none and 3=severe. 5) global assessment score = sum of patient's and physician's estimate of severity of pain and severity of motion deficit (0 - 9 points)
Notes	See analyses 11.

Risk of bias

Bias	Authors' judgement	Support for judgement
Allocation concealment?	Unclear risk	B - Unclear

White 1996

Methods	Randomised controlled trial Blinding: no. Loss to follow-up: none reported Appropriate statistical analysis: no statistical analysis comparing efficacy of two interventions
Participants	40 patients Inclusion criteria: Restrictive capsulitis as defined by 1. shoulder pain of spontaneous onset, worse at night 2. Restriction of abduction of less than 100 degrees 3. 50% reduction in external rotation compared to contralateral side 4. Intact rotator cuff clinically Exclusion criteria: cervical spine pathology, polyarthropathy, history of significant trauma to the shoulder, history of allergic reaction to any of the injected substances, any other apparent cause of their shoulder pain

White 1996 *(Continued)*

Interventions	Group 1 (20 patients): Anterior approach injection of hydrocortisone 25mg, lignocaine 1% 4ml and urografin 370, 4ml (radio-opaque marker) Group 2 (20 patients): Same injection via posterior intra-articular approach.
Outcomes	Outcome assessed at baseline and 6 weeks 1) pain severity on 10 point scale 2) active abduction 3) external rotation (with elbow at 90 degrees) Response criteria: Good: no pain and no analgesia and restoration of abduction to 160 degrees or above: moderate: reduction in pain and analgesics (if previously taken), and 30 degree increase in abduction; poor response: persistent nocturnal pain and abduction less than 100 degrees.
Notes	Met inclusion criteria for review but no results comparing treatment groups. Reported significantly higher level of injection accuracy with anterior approach - 19/20 (95%) vs 10/20 (50%) with posterior approach ($p < 0.02$). Reported response for intra-articular (good 5/29, moderate 10/29 and poor 14/29) and extra-articular injections (good 0/11, moderate 3/11 and poor 8/11).

Risk of bias

Bias	Authors' judgement	Support for judgement
Allocation concealment?	Unclear risk	D - Not used

Williams 1975

Methods	Randomised controlled trial. Blinding: no. Loss to follow-up: unclear Appropriate statistical analysis: unclear
Participants	Number of patients in study not reported. Inclusion criteria: restriction of abduction and external rotation of shoulder for more than one month
Interventions	Group 1: 50mg hydrocortisone acetate injection into glenohumeral joint weekly for 3 weeks Group 2: stellate ganglion block with 10ml of 0.5% Marcaine weekly for 3 weeks. All patients were shown active shoulder exercises to perform at home and patients were allowed to continue NSAIDs.
Outcomes	Assessed at baseline, weekly for 4 weeks and at 3 months 1) active elevation of shoulder 2) passive external rotation 3) night pain 4) analgesic consumption 5) patient's assessment of their condition from 0-100% whether for better or for worse.
Notes	Abstract only. No data reported, thus included in review but not in meta-analysis. Reported that half patients in both group assessed their improvement as 75% or more, a quarter as more than 25% improved and one fifth as no improvement at all with similar findings reported for range of movement. There were no reported differences in outcome between treatment groups at 4 weeks and 3 months.

Risk of bias

Bias	Authors' judgement	Support for judgement
Allocation concealment?	Unclear risk	D - Not used

Winters 1997

Methods	Randomised controlled trial Blinding: patients unable to be blinded but outcome assessors were blinded Loss to follow-up: Synovial group: 19(59%) of manipulation group, 18(51%) of physio group, 7(15%) of steroid injection group Appropriate statistical analysis: yes, intention to treat.
Participants	114 patients. Inclusion criteria: Shoulder complaints defined as pain localised in region of deltoid muscle, acromioclavicular joint, superior part of trapezoid muscle and scapula). Radiation of pain in the arm could be present, and, besides the pain, the range of movement of the upper arm or shoulder girdle could be limited. Exclusion criteria included: treatment for shoulder complaint in prior 6 months, bilateral shoulder complaints, presence of specific rheumatic disorders (polymyalgia rheumatica, rheumatoid arthritis systemic lupus erythematosus & fibromyalgia), acute severe trauma such as fracture, dislocation, cuff rupture, and herniated cervical disc. There were 3 diagnostic groups (synovial, shoulder girdle and combination). Only the synoivial group is considered in this review. The synovial group consisted of 114 patients with pain or limited movement in one or several directions of the glenohumeral joint. These complaints orignated from disorders of the subacromial structures, the acromioclavicular joint, the glenohumeral joint, or combinations of these (the synovial structures).
Interventions	First week: All received 50 mg diclofenac sodium three times daily. Then on the basis of reassessment they were divided into diagnostic groups. Within the synovial group, patients were allocated to group A (47 patients): corticosteroid injection (1-3 injections as needed at baseline, 1 week and after 2 weeks, of 1 ml of 40 mg/ml triamcinolone acetonide with 9 ml of 10 mg/ml lignocaine) into 2 out of 3 synovial structires (glenohumeral joint capsule, subacromial space, and acromioclavicular joint; Group B (32 patients): manipulation and mobilisation of cervical spine, upper thoracic spine, upper ribs, acromioclavicular joint, glenohumeral joint once weekly with a maximum of 6 treatments); Group C (35 patients): physiotherapy twice a week. Could use exercise therapy, massage, physical applications but no mobilisation or manipulative techniques were allowed.
Outcomes	Assessment at baseline and 2, 6, 11 weeks. 1) Pain assessed by the shoulder pain score (6 item questionnaire and and 101 point numerical pain scale) (7 points = no pain to 28 =severe pain) 2) active and passive range of movement of glenohumeral joint, cervical spine, upper thoracic spine, palpating the muscle tendons on the head of humerus, the AC joint, and the upper ribs 3) felt "cured" (defined as disappearance of shoulder complaints or a decrease to such an extent that they were no longer inconvenient, did not need treatment, or no longer interfered with normal working) or if treatment failed
Notes	See analyses 12, 13.

Risk of bias

Bias	Authors' judgement	Support for judgement
Allocation concealment?	Unclear risk	B - Unclear

Withrington 1985

Methods	Randomised controlled trial Blinding: both patients and outcome assessor were blinded. Loss to follow-up: none

Withrington 1985 *(Continued)*	
	Appropriate statistical analysis: yes, intention to treat.
Participants	25 patients Inclusion criteria: Supraspinatus tendonitis defined as a clinical entity of tenderness over the supraspinatus tendon, pain on resisted abduction and normal passive gleno humeral range. Exclusion criteria: past history or clinical evidence of inflammatory arthritis
Interventions	Group 1(12 patients): affected supraspinatus tendon injected with 80mg methylprednisolone diluted in 2 ml 2% lignocaine (a total of 4 ml) Group 2(13 paitents): Placebo injection 4ml 0.9% normal saline at the same site. All patients encouraged to move shoulders through full range of movement in subsequent days but no formal physiotherapy
Outcomes	Assessed at baseline, 2 and 8 weeks 1) Pain on 10cm VAS 2) Paracetomol count
Notes	Met inclusion crieria of review but insufficient data presented (ie. no measure of variance or data from which it could be calculated), therefore not included in meta-analysis. Reported no difference in improvement in pain or analgesic consumption between the two groups at 2 and 8 weeks of follow-up.

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Allocation concealment?	Unclear risk	B - Unclear

Characteristics of excluded studies *[ordered by study ID]*

Study	**Reason for exclusion**
Blyth 1993	Excluded on basis of population (rheumatoid arthritis was an exclusion criterion for review)
Corbeil 1992	Randomised controlled trial of distension and non-distension arthrography in combination witth intra-articular injection of corticosteroid. Included in hydrodilatation review.
Gado 1996	Population included 6 patients (33% of total population) with rheumatoid arthriritis (excluded from review).
Hardy 1986	Is a randomised trial of indomethacin (NSAID) with cortico-steroid injection, but no treatment out-come reported. Aim of study was to assess use of X-Ray as a prognostic indicator of outcome.
Lloyd-Roberts 1959	Trial not randomised.
Mardjuadi 1978	Trial not randomised.
Murnaghan 1955	Trial not randomised. Patients allocated to study groups by day of presentation.
Quin 1965	Trial not randomised. Patients allocated to treatment groups alternately.
Rovetta 1998	Randomised controlled trial comparing intra-articular steroid injection and sodium hyaluronate versus intra-articular steroid injection alone. No information about the benefit of intra-articular steroid injection.

Study	Reason for exclusion
Shanahan 200x	Randomised controlled trial but study population included xx patients (%) with rheumatoid arthritis. Data not presented separately
Thomas 1980	Randomised controlled trial comparing manipulation under anaesthesia and intra-articular steroid injection versus intra-articular steroid injection alone for adhesive capsulitis. No information about benefit of intra-articular steroid injection. Included in the surgery review.
Valtonen 1974	Trial not randomised. Patients paired off then given placebo or intervention in series.
Valtonen 1978	Trial not randomised. Patients allocated to treatment group according to birth date.
Weiss 1978	Not a randomised controlled trial.

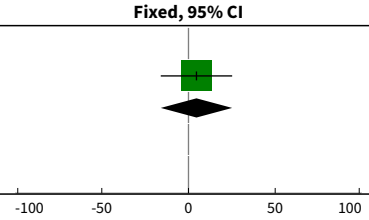
DATA AND ANALYSES

Comparison 1. INTRA-ARTICULAR STEROID INJECTION VS PLACEBO

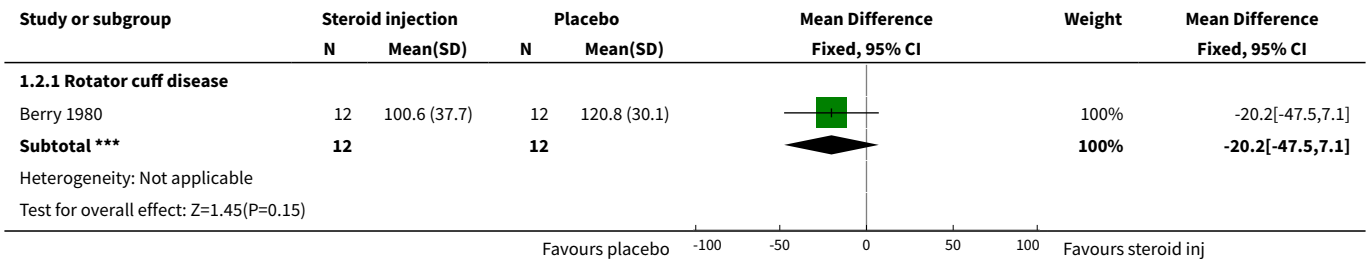
Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Pain at 4 weeks	1		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
1.1 Rotator cuff disease	1	24	Mean Difference (IV, Fixed, 95% CI)	4.60 [-15.99, 25.19]
2 Range of abduction at 4 weeks	1		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
2.1 Rotator cuff disease	1	24	Mean Difference (IV, Fixed, 95% CI)	-20.20 [-47.50, 7.10]
3 Success rate at 4 weeks	1		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
3.1 Rotator cuff disease	1	24	Risk Ratio (M-H, Fixed, 95% CI)	0.67 [0.35, 1.28]

Analysis 1.1. Comparison 1 INTRA-ARTICULAR STEROID INJECTION VS PLACEBO, Outcome 1 Pain at 4 weeks.

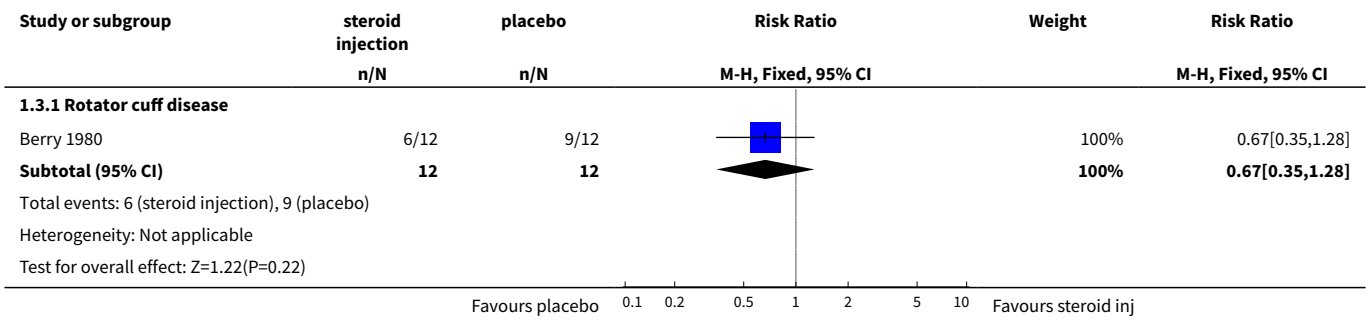
Study or subgroup	steroid inj N	steroid inj Mean(SD)	placebo N	placebo Mean(SD)	Mean Difference Fixed, 95% CI	Weight	Mean Difference Fixed, 95% CI
1.1.1 Rotator cuff disease							
Berry 1980	12	26.6 (22.5)	12	22 (28.6)		100%	4.6[-15.99,25.19]
Subtotal ***	**12**		**12**			**100%**	**4.6[-15.99,25.19]**
Heterogeneity: Not applicable							
Test for overall effect: Z=0.44(P=0.66)							



Analysis 1.2. Comparison 1 INTRA-ARTICULAR STEROID INJECTION VS PLACEBO, Outcome 2 Range of abduction at 4 weeks.



Analysis 1.3. Comparison 1 INTRA-ARTICULAR STEROID INJECTION VS PLACEBO, Outcome 3 Success rate at 4 weeks.



Comparison 2. SUBACROMIAL STEROID INJECTION VS PLACEBO

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Improvement in pain at 4 weeks	2	90	Std. Mean Difference (IV, Fixed, 95% CI)	0.83 [0.39, 1.26]
1.1 Rotator cuff disease	2	90	Std. Mean Difference (IV, Fixed, 95% CI)	0.83 [0.39, 1.26]
2 Improvement in function at 4 weeks	2	90	Std. Mean Difference (IV, Fixed, 95% CI)	0.63 [0.20, 1.06]
2.1 Rotator cuff disease	2	90	Std. Mean Difference (IV, Fixed, 95% CI)	0.63 [0.20, 1.06]
3 Improvement in range of active abduction at 4 weeks	2	90	Std. Mean Difference (IV, Fixed, 95% CI)	0.82 [0.39, 1.25]
3.1 Rotator cuff disease	2	90	Std. Mean Difference (IV, Fixed, 95% CI)	0.82 [0.39, 1.25]
4 Remission at 4 weeks	1		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
4.1 Rotator cuff disease	1	50	Risk Ratio (M-H, Fixed, 95% CI)	3.5 [0.80, 15.23]

Analysis 2.1. Comparison 2 SUBACROMIAL STEROID INJECTION VS PLACEBO, Outcome 1 Improvement in pain at 4 weeks.

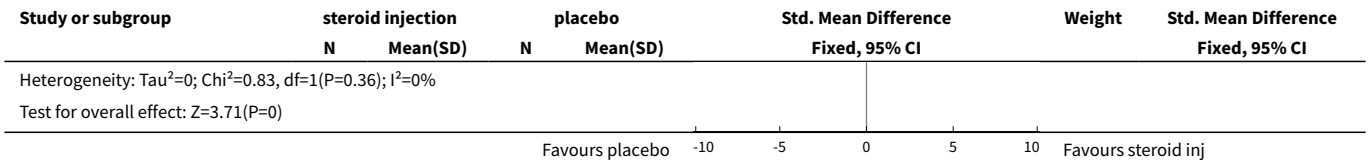
Study or subgroup	Steroid injection N	Steroid injection Mean(SD)	placebo N	placebo Mean(SD)	Std. Mean Difference Fixed, 95% CI	Weight	Std. Mean Difference Fixed, 95% CI
2.1.1 Rotator cuff disease							
Adebajo 1990	20	5 (3.3)	20	1.4 (3.3)		42.22%	1.07[0.4,1.73]
Petri 1987	25	2 (1.6)	25	1 (1.6)		57.78%	0.65[0.08,1.22]
Subtotal ***	**45**		**45**			**100%**	**0.83[0.39,1.26]**
Heterogeneity: Tau^2=0; Chi^2=0.86, df=1(P=0.35); I^2=0%							
Test for overall effect: Z=3.73(P=0)							
Total ***	**45**		**45**			**100%**	**0.83[0.39,1.26]**
Heterogeneity: Tau^2=0; Chi^2=0.86, df=1(P=0.35); I^2=0%							
Test for overall effect: Z=3.73(P=0)							

Analysis 2.2. Comparison 2 SUBACROMIAL STEROID INJECTION VS PLACEBO, Outcome 2 Improvement in function at 4 weeks.

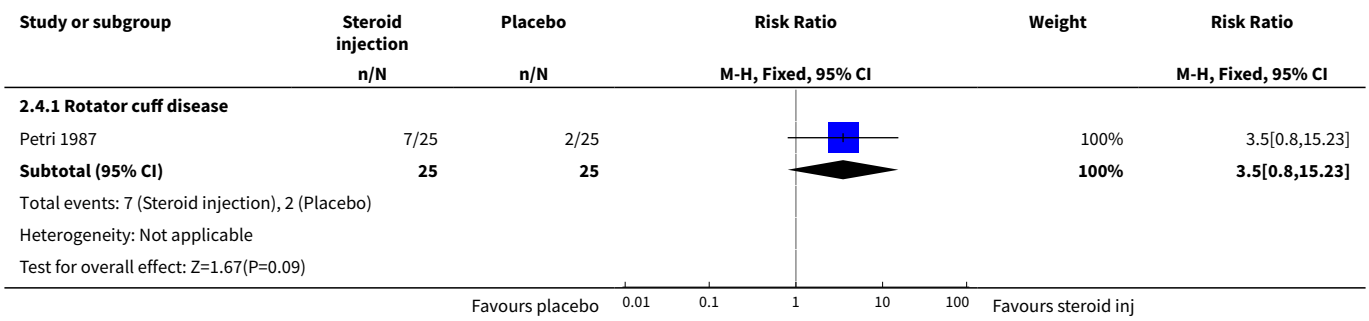
Study or subgroup	Steroid injection N	Steroid injection Mean(SD)	placebo N	placebo Mean(SD)	Std. Mean Difference Fixed, 95% CI	Weight	Std. Mean Difference Fixed, 95% CI
2.2.1 Rotator cuff disease							
Adebajo 1990	20	0.9 (0.7)	20	0.3 (0.4)		42.06%	0.95[0.29,1.61]
Petri 1987	25	1.6 (1.3)	25	1 (1.8)		57.94%	0.4[-0.16,0.96]
Subtotal ***	**45**		**45**			**100%**	**0.63[0.2,1.06]**
Heterogeneity: Tau^2=0; Chi^2=1.59, df=1(P=0.21); I^2=36.99%							
Test for overall effect: Z=2.89(P=0)							
Total ***	**45**		**45**			**100%**	**0.63[0.2,1.06]**
Heterogeneity: Tau^2=0; Chi^2=1.59, df=1(P=0.21); I^2=36.99%							
Test for overall effect: Z=2.89(P=0)							

Analysis 2.3. Comparison 2 SUBACROMIAL STEROID INJECTION VS PLACEBO, Outcome 3 Improvement in range of active abduction at 4 weeks.

Study or subgroup	steroid injection N	steroid injection Mean(SD)	placebo N	placebo Mean(SD)	Std. Mean Difference Fixed, 95% CI	Weight	Std. Mean Difference Fixed, 95% CI
2.3.1 Rotator cuff disease							
Adebajo 1990	20	50.4 (36)	20	5.4 (46.8)		42.27%	1.06[0.39,1.72]
Petri 1987	25	1.6 (1.2)	25	0.8 (1.2)		57.73%	0.65[0.08,1.22]
Subtotal ***	**45**		**45**			**100%**	**0.82[0.39,1.25]**
Heterogeneity: Tau^2=0; Chi^2=0.83, df=1(P=0.36); I^2=0%							
Test for overall effect: Z=3.71(P=0)							
Total ***	**45**		**45**			**100%**	**0.82[0.39,1.25]**



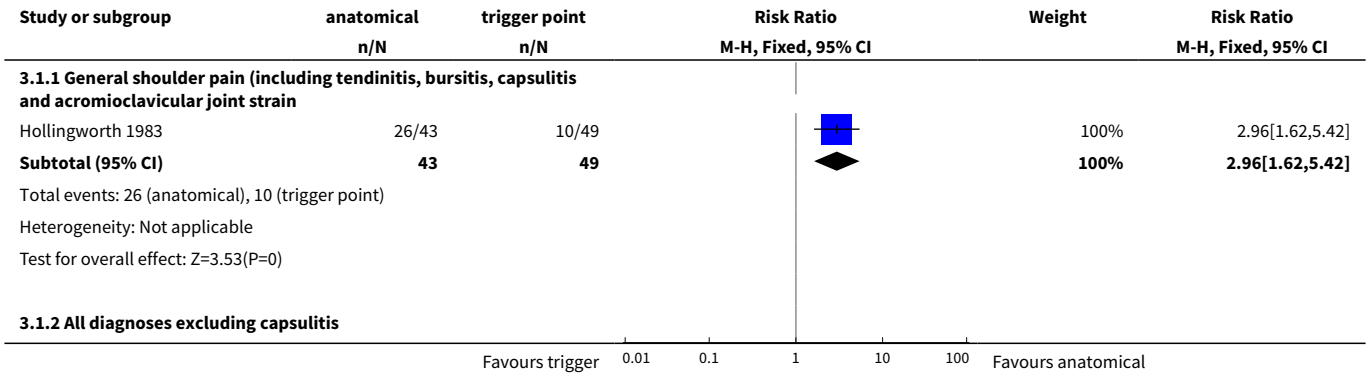
Analysis 2.4. Comparison 2 SUBACROMIAL STEROID INJECTION VS PLACEBO, Outcome 4 Remission at 4 weeks.

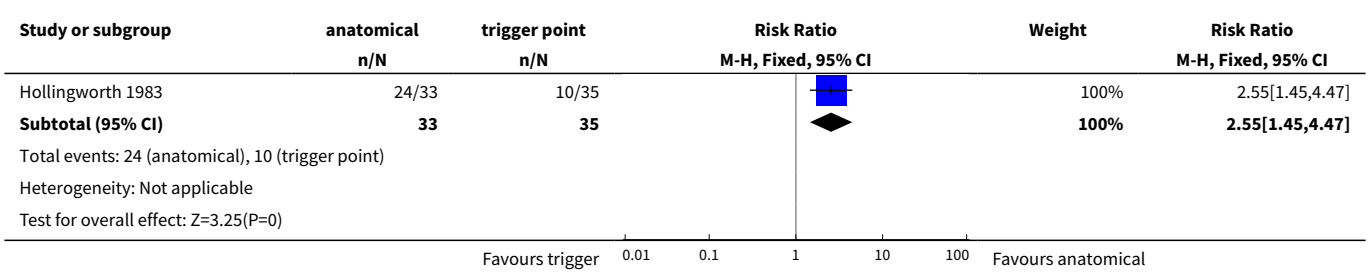


Comparison 3. ANATOMICAL STEROID INJECTION (SITE DETERMINED BY CLINICAL FEATURES) VS TRIGGER POINT STEROID INJECTION

Outcome or subgroup title	No. of studies	No. of partici-pants	Statistical method	Effect size
1 Success rate at 1 week	1		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
1.1 General shoulder pain (including tendinitis, bursitis, capsulitis and acromioclavicular joint strain	1	92	Risk Ratio (M-H, Fixed, 95% CI)	2.96 [1.62, 5.42]
1.2 All diagnoses excluding capsulitis	1	68	Risk Ratio (M-H, Fixed, 95% CI)	2.55 [1.45, 4.47]

Analysis 3.1. Comparison 3 ANATOMICAL STEROID INJECTION (SITE DETERMINED BY CLINICAL FEATURES) VS TRIGGER POINT STEROID INJECTION, Outcome 1 Success rate at 1 week.





Comparison 4. INTRA-ARTICULAR STEROID INJECTION - HIGHER DOSE (40 mg TRIAMCINOLONE ACTONIDE) VS LOWER DOSE (10 MG)

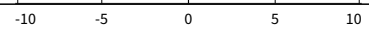
Outcome or subgroup title	No. of studies	No. of partici-pants	Statistical method	Effect size
1 Improvement in pain at 6 weeks	1		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
1.1 Adhesive capsulitis	1	57	Mean Difference (IV, Fixed, 95% CI)	-18.10 [-37.11, 0.91]
2 Improvement in disturbance of sleep at 6 weeks	1		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
2.1 Adhesive capsulitis	1	57	Mean Difference (IV, Fixed, 95% CI)	0.0 [-0.40, 0.40]
3 Improvement in functional impairment at 6 weeks	1		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
3.1 adhesive capsulitis	1	57	Mean Difference (IV, Fixed, 95% CI)	-0.60 [-1.05, -0.15]
4 Improvement in external rotation at 6 weeks	1		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
4.1 Adhesive capsulitis	1	57	Mean Difference (IV, Fixed, 95% CI)	-0.40 [-0.79, -0.01]
5 Frequency of adverse effects	1		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
5.1 Pain	1	57	Risk Ratio (M-H, Fixed, 95% CI)	0.98 [0.29, 3.26]
5.2 Flush reaction	1	57	Risk Ratio (M-H, Fixed, 95% CI)	0.47 [0.12, 1.78]
5.3 Menstrual irregularities	1	57	Risk Ratio (M-H, Fixed, 95% CI)	5.52 [0.30, 102.08]
5.4 Headache	1	57	Risk Ratio (M-H, Fixed, 95% CI)	7.09 [0.40, 125.84]
5.5 Rash	1	57	Risk Ratio (M-H, Fixed, 95% CI)	0.26 [0.01, 6.18]

Analysis 4.1. Comparison 4 INTRA-ARTICULAR STEROID INJECTION - HIGHER DOSE (40 mg TRIAMCINOLONE ACTONIDE) VS LOWER DOSE (10 MG), Outcome 1 Improvement in pain at 6 weeks.

Study or subgroup	Low dose injection N	Mean(SD)	high dose injection N	Mean(SD)	Mean Difference Fixed, 95% CI	Weight	Mean Difference Fixed, 95% CI
4.1.1 Adhesive capsulitis							
de Jong 1998	32	31.2 (49.3)	25	49.3 (21.3)		100%	-18.1[-37.11,0.91]
Subtotal ***	**32**		**25**			**100%**	**-18.1[-37.11,0.91]**
Heterogeneity: Not applicable							
Test for overall effect: Z=1.87(P=0.06)							

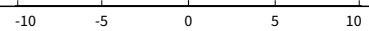
Analysis 4.2. Comparison 4 INTRA-ARTICULAR STEROID INJECTION - HIGHER DOSE (40 mg TRIAMCINOLONE ACTONIDE) VS LOWER DOSE (10 MG), Outcome 2 Improvement in disturbance of sleep at 6 weeks.

Study or subgroup	low dose steroid inj N	Mean(SD)	high dose steroid N	Mean(SD)	Mean Difference Fixed, 95% CI	Weight	Mean Difference Fixed, 95% CI
4.2.1 Adhesive capsulitis							
de Jong 1998	32	1.7 (0.7)	25	1.7 (0.8)		100%	0[-0.4,0.4]
Subtotal ***	**32**		**25**			**100%**	**0[-0.4,0.4]**
Heterogeneity: Not applicable							
Test for overall effect: Not applicable							



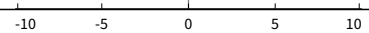
Analysis 4.3. Comparison 4 INTRA-ARTICULAR STEROID INJECTION - HIGHER DOSE (40 mg TRIAMCINOLONE ACTONIDE) VS LOWER DOSE (10 MG), Outcome 3 Improvement in functional impairment at 6 weeks.

Study or subgroup	low dose inj N	Mean(SD)	high dose N	Mean(SD)	Mean Difference Fixed, 95% CI	Weight	Mean Difference Fixed, 95% CI
4.3.1 adhesive capsulitis							
de Jong 1998	32	0.7 (0.8)	25	1.3 (0.9)		100%	-0.6[-1.05,-0.15]
Subtotal ***	**32**		**25**			**100%**	**-0.6[-1.05,-0.15]**
Heterogeneity: Not applicable							
Test for overall effect: Z=2.62(P=0.01)							

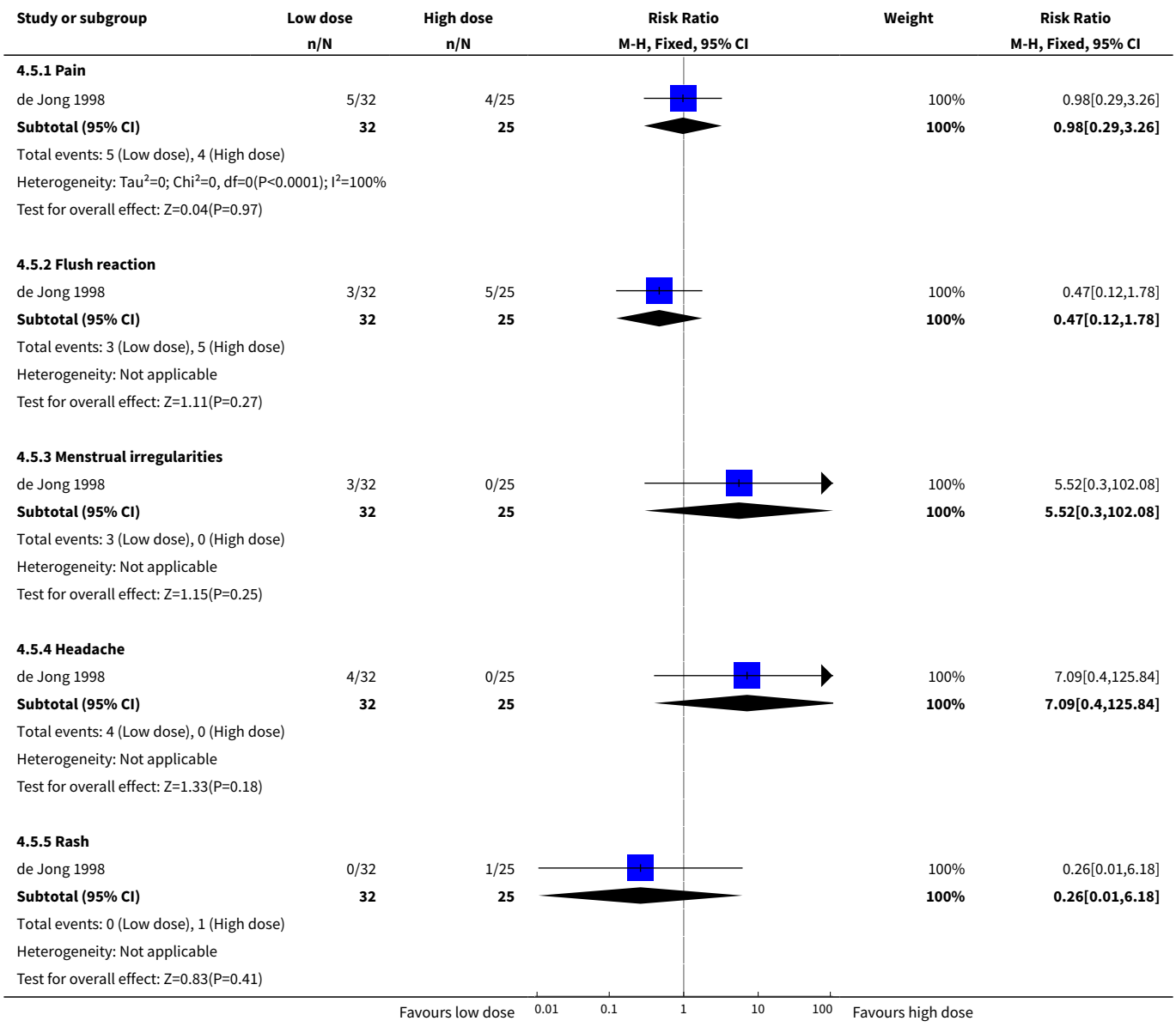


Analysis 4.4. Comparison 4 INTRA-ARTICULAR STEROID INJECTION - HIGHER DOSE (40 mg TRIAMCINOLONE ACTONIDE) VS LOWER DOSE (10 MG), Outcome 4 Improvement in external rotation at 6 weeks.

Study or subgroup	low dose N	Mean(SD)	high dose N	Mean(SD)	Mean Difference Fixed, 95% CI	Weight	Mean Difference Fixed, 95% CI
4.4.1 Adhesive capsulitis							
de Jong 1998	32	0.7 (0.8)	25	1.1 (0.7)		100%	-0.4[-0.79,-0.01]
Subtotal ***	**32**		**25**			**100%**	**-0.4[-0.79,-0.01]**
Heterogeneity: Not applicable							
Test for overall effect: Z=2.01(P=0.04)							



Analysis 4.5. Comparison 4 INTRA-ARTICULAR STEROID INJECTION - HIGHER DOSE (40 mg TRIAMCINOLONE ACTONIDE) VS LOWER DOSE (10 MG), Outcome 5 Frequency of adverse effects.



Comparison 5. INTRA-ARTICULAR STEROID INJECTION VS PHYSIOTHERAPY

Outcome or subgroup title	No. of studies	No. of partici-pants	Statistical method	Effect size
1 Treatment success at 7 weeks	1		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
1.1 Adhesive capsulitis	1	108	Risk Ratio (M-H, Fixed, 95% CI)	1.66 [1.21, 2.28]

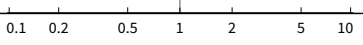
Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
2 Improvement in severity of main complaint at 3 weeks	1		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
2.1 Adhesive capsulitis	1	107	Mean Difference (IV, Fixed, 95% CI)	15.0 [6.01, 23.99]
3 Improvement in pain during day at 3 weeks	1		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
3.1 Adhesive capsulitis	1	107	Mean Difference (IV, Fixed, 95% CI)	12.0 [5.27, 18.73]
4 Improvement in pain at night at 3 weeks	1		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
4.1 Adhesive capsulitis	1	107	Mean Difference (IV, Fixed, 95% CI)	12.0 [2.68, 21.32]
5 Improvement in pain as rated by an observer at 3 weeks	1		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
5.1 Adhesive capsulitis	1	107	Mean Difference (IV, Fixed, 95% CI)	13.00 [6.37, 19.63]
6 Improvement in functional disability at 3 weeks	1		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
6.1 Adhesive capsulitis	1	107	Mean Difference (IV, Fixed, 95% CI)	13.0 [3.64, 22.36]
7 improvement in abduction at 3 weeks	1		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
7.1 Adhesive capsulitis	1	107	Mean Difference (IV, Fixed, 95% CI)	5.0 [0.26, 9.74]
8 Improvement in severity of main complaint at 7 weeks	1		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
8.1 Adhesive capsulitis	1	108	Mean Difference (IV, Fixed, 95% CI)	26.0 [15.25, 36.75]
9 Improvement in pain during day at 7 weeks	1		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
9.1 Adhesive capsulitis	1	108	Mean Difference (IV, Fixed, 95% CI)	26.0 [15.25, 36.75]
10 Improvement in pain at night at 7 weeks	1		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
10.1 Adhesive capsulitis	1	108	Mean Difference (IV, Fixed, 95% CI)	12.0 [3.69, 20.31]
11 Improvement in pain as rated by observer at 7 weeks	1		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
11.1 Adhesive capsulitis	1	108	Mean Difference (IV, Fixed, 95% CI)	15.0 [7.45, 22.55]

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
12 Improvement in functional disability at 7 weeks	1		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
12.1 Adhesive capsulitis	1	108	Mean Difference (IV, Fixed, 95% CI)	25.0 [14.81, 35.19]
13 Improvement in abduction at 7 weeks	1		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
13.1 Adhesive capsulitis	1	108	Mean Difference (IV, Fixed, 95% CI)	5.0 [0.27, 9.73]
14 improvement in severity of main complaint at 13 weeks	1		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
14.1 Adhesive capsulitis	1	107	Mean Difference (IV, Fixed, 95% CI)	19.0 [7.43, 30.57]
15 Improvement in pain during day at 13 weeks	1		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
15.1 Adhesive capsulitis	1	107	Mean Difference (IV, Fixed, 95% CI)	9.0 [-1.82, 19.82]
16 Improvement in pain at night at 13 weeks	1		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
16.1 Adhesive capsulitis	1	107	Mean Difference (IV, Fixed, 95% CI)	9.0 [-1.82, 19.82]
17 Improvement in shoulder disability at 13 weeks	1		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
17.1 Adhesove capsulitis	1	107	Mean Difference (IV, Fixed, 95% CI)	10.00 [-1.94, 21.94]
18 Improvement in severity of main complaint at 26 weeks	1		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
18.1 Adhesive capsulitis	1	105	Mean Difference (IV, Fixed, 95% CI)	9.0 [-1.52, 19.52]
19 Improvement in pain during day at 26 weeks	1		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
19.1 Adhesive capsulitis	1	105	Mean Difference (IV, Fixed, 95% CI)	0.0 [-10.14, 10.14]
20 Improvement in pain during night at 26 weeks	1		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
20.1 Adhesive capsulitis	1	105	Mean Difference (IV, Fixed, 95% CI)	1.0 [-13.74, 15.74]
21 Improvement in pain as rated by observer at 26 weeks	1		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
21.1 Adhesive capsulitis	1	105	Mean Difference (IV, Fixed, 95% CI)	2.0 [-7.76, 11.76]

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
22 Improvement in functional disability at 26 weeks	1		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
22.1 Adhesive capsulitis	1	105	Mean Difference (IV, Fixed, 95% CI)	12.0 [-0.25, 24.25]
23 Improvement in abduction at 26 weeks	1		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
23.1 Adhesive capsulitis	1	105	Mean Difference (IV, Fixed, 95% CI)	2.0 [-3.60, 7.60]
24 Improvement in severity of main complaint at 52 weeks	1		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
24.1 Adhesive capsulitis	1	103	Mean Difference (IV, Fixed, 95% CI)	11.0 [0.55, 21.45]
25 Improvement in pain during day at 52 weeks	1		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
25.1 Adhesive capsulitis	1	103	Mean Difference (IV, Fixed, 95% CI)	3.0 [-6.46, 12.46]
26 Improvement in pain at night at 52 weeks	1		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
26.1 Adhesive capsulitis	1	103	Mean Difference (IV, Fixed, 95% CI)	2.0 [-11.91, 15.91]
27 Improvement in shoulder disabiltiy at 52 weeks	1		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
27.1 Adhesive capsulitis	1	103	Mean Difference (IV, Fixed, 95% CI)	4.0 [-8.95, 16.95]
28 Frequency of adverse effects	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
28.1 Pain after treatment lasting more than 2 days	1		Risk Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]
28.2 Facial flushing	1		Risk Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]
28.3 Irregular mestrual bleeding	1		Risk Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]
28.4 Fever reported by patient	1		Risk Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]
28.5 Skin irritation	1		Risk Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]
28.6 Overall frequency of adverse reactions	1		Risk Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]

Analysis 5.1. Comparison 5 INTRA-ARTICULAR STEROID INJECTION VS PHYSIOTHERAPY, Outcome 1 Treatment success at 7 weeks.

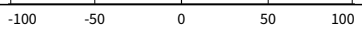
Study or subgroup	Steroid injections n/N	Physiotherapy n/N	Risk Ratio M-H, Fixed, 95% CI	Weight	Risk Ratio M-H, Fixed, 95% CI
5.1.1 Adhesive capsulitis					
van der Windt 1998	40/52	26/56		100%	1.66[1.21,2.28]
Subtotal (95% CI)	**52**	**56**		**100%**	**1.66[1.21,2.28]**
Total events: 40 (Steroid injections), 26 (Physiotherapy)					
Heterogeneity: Tau^2=0; Chi^2=0, df=0(P<0.0001); I^2=100%					
Test for overall effect: Z=3.11(P=0)					



Favours physio — Favours steroid injs

Analysis 5.2. Comparison 5 INTRA-ARTICULAR STEROID INJECTION VS PHYSIOTHERAPY, Outcome 2 Improvement in severity of main complaint at 3 weeks.

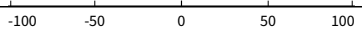
Study or subgroup	Steroid injections N	Steroid injections Mean(SD)	Physiotherapy N	Physiotherapy Mean(SD)	Mean Difference Fixed, 95% CI	Weight	Mean Difference Fixed, 95% CI
5.2.1 Adhesive capsulitis							
van der Windt 1998	52	32 (26)	55	17 (21)		100%	15[6.01,23.99]
Subtotal ***	**52**		**55**			**100%**	**15[6.01,23.99]**
Heterogeneity: Not applicable							
Test for overall effect: Z=3.27(P=0)							



Favours physio — Favours steroid injs

Analysis 5.3. Comparison 5 INTRA-ARTICULAR STEROID INJECTION VS PHYSIOTHERAPY, Outcome 3 Improvement in pain during day at 3 weeks.

Study or subgroup	Steroid injections N	Steroid injections Mean(SD)	Physiotherapy N	Physiotherapy Mean(SD)	Mean Difference Fixed, 95% CI	Weight	Mean Difference Fixed, 95% CI
5.3.1 Adhesive capsulitis							
van der Windt 1998	52	22 (20)	55	10 (15)		100%	12[5.27,18.73]
Subtotal ***	**52**		**55**			**100%**	**12[5.27,18.73]**
Heterogeneity: Not applicable							
Test for overall effect: Z=3.5(P=0)							



Favours physio — Favours steroid injs

Analysis 5.4. Comparison 5 INTRA-ARTICULAR STEROID INJECTION VS PHYSIOTHERAPY, Outcome 4 Improvement in pain at night at 3 weeks.

Study or subgroup	Steroid injections N	Steroid injections Mean(SD)	Physiotherapy N	Physiotherapy Mean(SD)	Mean Difference Fixed, 95% CI	Weight	Mean Difference Fixed, 95% CI
5.4.1 Adhesive capsulitis							
van der Windt 1998	52	21 (26)	55	9 (23)		100%	12[2.68,21.32]
Subtotal ***	**52**		**55**			**100%**	**12[2.68,21.32]**
Heterogeneity: Not applicable							

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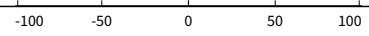
Study or subgroup	Steroid injections N	Mean(SD)	Physiotherapy N	Mean(SD)	Mean Difference Fixed, 95% CI	Weight	Mean Difference Fixed, 95% CI
Test for overall effect: Z=2.52(P=0.01)							

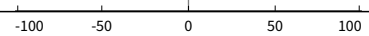
Analysis 5.5. Comparison 5 INTRA-ARTICULAR STEROID INJECTION VS PHYSIOTHERAPY, Outcome 5 Improvement in pain as rated by an observer at 3 weeks.

Study or subgroup	Steroid injections N	Mean(SD)	Physiotherapy N	Mean(SD)	Mean Difference Fixed, 95% CI	Weight	Mean Difference Fixed, 95% CI
5.5.1 Adhesive capsulitis							
van der Windt 1998	52	13 (17)	55	0 (18)		100%	13[6.37,19.63]
Subtotal ***	**52**		**55**			**100%**	**13[6.37,19.63]**
Heterogeneity: Tau^2=0; Chi^2=0, df=0(P<0.0001); I^2=100%							
Test for overall effect: Z=3.84(P=0)							



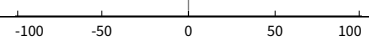
Analysis 5.6. Comparison 5 INTRA-ARTICULAR STEROID INJECTION VS PHYSIOTHERAPY, Outcome 6 Improvement in functional disability at 3 weeks.

Study or subgroup	Steroid injections N	Mean(SD)	Physiotherapy N	Mean(SD)	Mean Difference Fixed, 95% CI	Weight	Mean Difference Fixed, 95% CI
5.6.1 Adhesive capsulitis							
van der Windt 1998	52	19 (27)	55	6 (22)		100%	13[3.64,22.36]
Subtotal ***	**52**		**55**			**100%**	**13[3.64,22.36]**
Heterogeneity: Not applicable							
Test for overall effect: Z=2.72(P=0.01)							



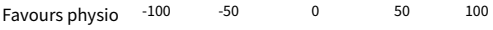
Analysis 5.7. Comparison 5 INTRA-ARTICULAR STEROID INJECTION VS PHYSIOTHERAPY, Outcome 7 improvement in abduction at 3 weeks.

Study or subgroup	Steroid injections N	Mean(SD)	Physiotherapy\ N	Mean(SD)	Mean Difference Fixed, 95% CI	Weight	Mean Difference Fixed, 95% CI
5.7.1 Adhesive capsulitis							
van der Windt 1998	52	2 (12)	55	-3 (13)		100%	5[0.26,9.74]
Subtotal ***	**52**		**55**			**100%**	**5[0.26,9.74]**
Heterogeneity: Not applicable							
Test for overall effect: Z=2.07(P=0.04)							



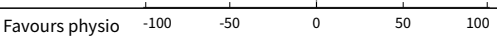
Analysis 5.8. Comparison 5 INTRA-ARTICULAR STEROID INJECTION VS PHYSIOTHERAPY, Outcome 8 Improvement in severity of main complaint at 7 weeks.

Study or subgroup	Steroid injection		Physiotherapy		Mean Difference	Weight	Mean Difference
	N	Mean(SD)	N	Mean(SD)	Fixed, 95% CI		Fixed, 95% CI
5.8.1 Adhesive capsulitis							
van der Windt 1998	52	58 (28)	56	32 (29)		100%	26[15.25,36.75]
Subtotal ***	**52**		**56**			**100%**	**26[15.25,36.75]**
Heterogeneity: Not applicable							
Test for overall effect: Z=4.74(P<0.0001)							



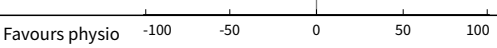
Analysis 5.9. Comparison 5 INTRA-ARTICULAR STEROID INJECTION VS PHYSIOTHERAPY, Outcome 9 Improvement in pain during day at 7 weeks.

Study or subgroup	steroid injections		Physiotherapy		Mean Difference	Weight	Mean Difference
	N	Mean(SD)	N	Mean(SD)	Fixed, 95% CI		Fixed, 95% CI
5.9.1 Adhesive capsulitis							
van der Windt 1998	52	58 (28)	56	32 (29)		100%	26[15.25,36.75]
Subtotal ***	**52**		**56**			**100%**	**26[15.25,36.75]**
Heterogeneity: Not applicable							
Test for overall effect: Z=4.74(P<0.0001)							



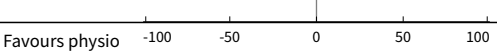
Analysis 5.10. Comparison 5 INTRA-ARTICULAR STEROID INJECTION VS PHYSIOTHERAPY, Outcome 10 Improvement in pain at night at 7 weeks.

Study or subgroup	steroid injections		Physiotherapy		Mean Difference	Weight	Mean Difference
	N	Mean(SD)	N	Mean(SD)	Fixed, 95% CI		Fixed, 95% CI
5.10.1 Adhesive capsulitis							
van der Windt 1998	52	35 (20)	56	23 (24)		100%	12[3.69,20.31]
Subtotal ***	**52**		**56**			**100%**	**12[3.69,20.31]**
Heterogeneity: Not applicable							
Test for overall effect: Z=2.83(P=0)							



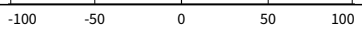
Analysis 5.11. Comparison 5 INTRA-ARTICULAR STEROID INJECTION VS PHYSIOTHERAPY, Outcome 11 Improvement in pain as rated by observer at 7 weeks.

Study or subgroup	Steroid injections		Physiotherapy		Mean Difference	Weight	Mean Difference
	N	Mean(SD)	N	Mean(SD)	Fixed, 95% CI		Fixed, 95% CI
5.11.1 Adhesive capsulitis							
van der Windt 1998	52	24 (20)	56	9 (20)		100%	15[7.45,22.55]
Subtotal ***	**52**		**56**			**100%**	**15[7.45,22.55]**
Heterogeneity: Not applicable							
Test for overall effect: Z=3.89(P<0.0001)							



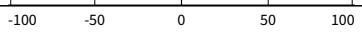
Analysis 5.12. Comparison 5 INTRA-ARTICULAR STEROID INJECTION VS PHYSIOTHERAPY, Outcome 12 Improvement in functional disability at 7 weeks.

Study or subgroup	Steroid injection N	Steroid injection Mean(SD)	Physiotherapy N	Physiotherapy Mean(SD)	Mean Difference Fixed, 95% CI	Weight	Mean Difference Fixed, 95% CI
5.12.1 Adhesive capsulitis							
van der Windt 1998	52	39 (27)	56	14 (27)		100%	25[14.81,35.19]
Subtotal ***	**52**		**56**			**100%**	**25[14.81,35.19]**
Heterogeneity: Not applicable							
Test for overall effect: Z=4.81(P<0.0001)							



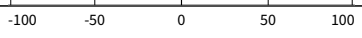
Analysis 5.13. Comparison 5 INTRA-ARTICULAR STEROID INJECTION VS PHYSIOTHERAPY, Outcome 13 Improvement in abduction at 7 weeks.

Study or subgroup	Steroid injections N	Steroid injections Mean(SD)	Physiotherapy N	Physiotherapy Mean(SD)	Mean Difference Fixed, 95% CI	Weight	Mean Difference Fixed, 95% CI
5.13.1 Adhesive capsulitis							
van der Windt 1998	52	4 (11)	56	-1 (14)		100%	5[0.27,9.73]
Subtotal ***	**52**		**56**			**100%**	**5[0.27,9.73]**
Heterogeneity: Not applicable							
Test for overall effect: Z=2.07(P=0.04)							



Analysis 5.14. Comparison 5 INTRA-ARTICULAR STEROID INJECTION VS PHYSIOTHERAPY, Outcome 14 improvement in severity of main complaint at 13 weeks.

Study or subgroup	Steroid Injections N	Steroid Injections Mean(SD)	Physiotherapy N	Physiotherapy Mean(SD)	Mean Difference Fixed, 95% CI	Weight	Mean Difference Fixed, 95% CI
5.14.1 Adhesive capsulitis							
van der Windt 1998	52	66 (28)	55	47 (33)		100%	19[7.43,30.57]
Subtotal ***	**52**		**55**			**100%**	**19[7.43,30.57]**
Heterogeneity: Not applicable							
Test for overall effect: Z=3.22(P=0)							



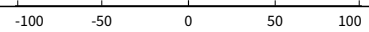
Analysis 5.15. Comparison 5 INTRA-ARTICULAR STEROID INJECTION VS PHYSIOTHERAPY, Outcome 15 Improvement in pain during day at 13 weeks.

Study or subgroup	Steroid injections N	Steroid injections Mean(SD)	Physiotherapy N	Physiotherapy Mean(SD)	Mean Difference Fixed, 95% CI	Weight	Mean Difference Fixed, 95% CI
5.15.1 Adhesive capsulitis							
van der Windt 1998	52	36 (26)	55	27 (31)		100%	9[-1.82,19.82]
Subtotal ***	**52**		**55**			**100%**	**9[-1.82,19.82]**
Heterogeneity: Not applicable							

Study or subgroup	Steroid injections N	Mean(SD)	Physiotherapy N	Mean(SD)	Mean Difference Fixed, 95% CI	Weight	Mean Difference Fixed, 95% CI
Test for overall effect: Z=1.63(P=0.1)							

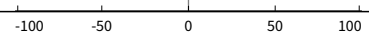
Analysis 5.16. Comparison 5 INTRA-ARTICULAR STEROID INJECTION VS PHYSIOTHERAPY, Outcome 16 Improvement in pain at night at 13 weeks.

Study or subgroup	Steroid injections N	Mean(SD)	Physiotherapy N	Mean(SD)	Mean Difference Fixed, 95% CI	Weight	Mean Difference Fixed, 95% CI
5.16.1 Adhesive capsulitis							
van der Windt 1998	52	36 (26)	55	27 (31)		100%	9[-1.82,19.82]
Subtotal ***	**52**		**55**			**100%**	**9[-1.82,19.82]**
Heterogeneity: Not applicable							
Test for overall effect: Z=1.63(P=0.1)							



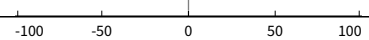
Analysis 5.17. Comparison 5 INTRA-ARTICULAR STEROID INJECTION VS PHYSIOTHERAPY, Outcome 17 Improvement in shoulder disability at 13 weeks.

Study or subgroup	Steroid injections N	Mean(SD)	Physiotherapy N	Mean(SD)	Mean Difference Fixed, 95% CI	Weight	Mean Difference Fixed, 95% CI
5.17.1 Adhesove capsulitis							
van der Windt 1998	52	38 (31)	55	28 (32)		100%	10[-1.94,21.94]
Subtotal ***	**52**		**55**			**100%**	**10[-1.94,21.94]**
Heterogeneity: Tau^2=0; Chi^2=0, df=0(P<0.0001); I^2=100%							
Test for overall effect: Z=1.64(P=0.1)							



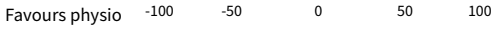
Analysis 5.18. Comparison 5 INTRA-ARTICULAR STEROID INJECTION VS PHYSIOTHERAPY, Outcome 18 Improvement in severity of main complaint at 26 weeks.

Study or subgroup	Steroid injections N	Mean(SD)	Physiotherapy N	Mean(SD)	Mean Difference Fixed, 95% CI	Weight	Mean Difference Fixed, 95% CI
5.18.1 Adhesive capsulitis							
van der Windt 1998	51	63 (21)	54	54 (33)		100%	9[-1.52,19.52]
Subtotal ***	**51**		**54**			**100%**	**9[-1.52,19.52]**
Heterogeneity: Not applicable							
Test for overall effect: Z=1.68(P=0.09)							



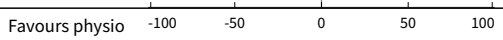
Analysis 5.19. Comparison 5 INTRA-ARTICULAR STEROID INJECTION VS PHYSIOTHERAPY, Outcome 19 Improvement in pain during day at 26 weeks.

Study or subgroup	Steroid injections N	Steroid injections Mean(SD)	Physiotherapy N	Physiotherapy Mean(SD)	Mean Difference Fixed, 95% CI	Weight	Mean Difference Fixed, 95% CI
5.19.1 Adhesive capsulitis							
van der Windt 1998	51	32 (25)	54	32 (28)		100%	0[-10.14,10.14]
Subtotal ***	**51**		**54**			**100%**	**0[-10.14,10.14]**
Heterogeneity: Not applicable							
Test for overall effect: Not applicable							



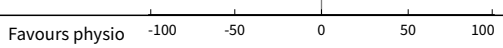
Analysis 5.20. Comparison 5 INTRA-ARTICULAR STEROID INJECTION VS PHYSIOTHERAPY, Outcome 20 Improvement in pain during night at 26 weeks.

Study or subgroup	Steroid injection N	Steroid injection Mean(SD)	Physiotherapy N	Physiotherapy Mean(SD)	Mean Difference Fixed, 95% CI	Weight	Mean Difference Fixed, 95% CI
5.20.1 Adhesive capsulitis							
van der Windt 1998	51	34 (36)	54	33 (41)		100%	1[-13.74,15.74]
Subtotal ***	**51**		**54**			**100%**	**1[-13.74,15.74]**
Heterogeneity: Not applicable							
Test for overall effect: Z=0.13(P=0.89)							



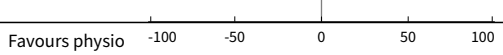
Analysis 5.21. Comparison 5 INTRA-ARTICULAR STEROID INJECTION VS PHYSIOTHERAPY, Outcome 21 Improvement in pain as rated by observer at 26 weeks.

Study or subgroup	Steroid injections N	Steroid injections Mean(SD)	Physiotherapy N	Physiotherapy Mean(SD)	Mean Difference Fixed, 95% CI	Weight	Mean Difference Fixed, 95% CI
5.21.1 Adhesive capsulitis							
van der Windt 1998	51	29 (24)	54	27 (27)		100%	2[-7.76,11.76]
Subtotal ***	**51**		**54**			**100%**	**2[-7.76,11.76]**
Heterogeneity: Not applicable							
Test for overall effect: Z=0.4(P=0.69)							



Analysis 5.22. Comparison 5 INTRA-ARTICULAR STEROID INJECTION VS PHYSIOTHERAPY, Outcome 22 Improvement in functional disability at 26 weeks.

Study or subgroup	Steroid injections N	Steroid injections Mean(SD)	Physiotherapy N	Physiotherapy Mean(SD)	Mean Difference Fixed, 95% CI	Weight	Mean Difference Fixed, 95% CI
5.22.1 Adhesive capsulitis							
van der Windt 1998	51	45 (30)	54	33 (34)		100%	12[-0.25,24.25]
Subtotal ***	**51**		**54**			**100%**	**12[-0.25,24.25]**
Heterogeneity: Not applicable							
Test for overall effect: Z=1.92(P=0.05)							

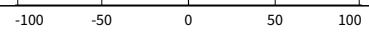


Analysis 5.23. Comparison 5 INTRA-ARTICULAR STEROID INJECTION VS PHYSIOTHERAPY, Outcome 23 Improvement in abduction at 26 weeks.

Study or subgroup	Steroid injections N	Mean(SD)	Physiotherapy N	Mean(SD)	Mean Difference Fixed, 95% CI	Weight	Mean Difference Fixed, 95% CI
5.23.1 Adhesive capsulitis							
van der Windt 1998	51	9 (12)	54	7 (17)		100%	2[-3.6,7.6]
Subtotal ***	**51**		**54**			**100%**	**2[-3.6,7.6]**
Heterogeneity: Not applicable							
Test for overall effect: Z=0.7(P=0.48)							

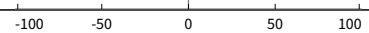
Analysis 5.24. Comparison 5 INTRA-ARTICULAR STEROID INJECTION VS PHYSIOTHERAPY, Outcome 24 Improvement in severity of main complaint at 52 weeks.

Study or subgroup	Steroid injections N	Mean(SD)	Physiotherapy N	Mean(SD)	Mean Difference Fixed, 95% CI	Weight	Mean Difference Fixed, 95% CI
5.24.1 Adhesive capsulitis							
van der Windt 1998	49	70 (24)	54	59 (30)		100%	11[0.55,21.45]
Subtotal ***	**49**		**54**			**100%**	**11[0.55,21.45]**
Heterogeneity: Not applicable							
Test for overall effect: Z=2.06(P=0.04)							



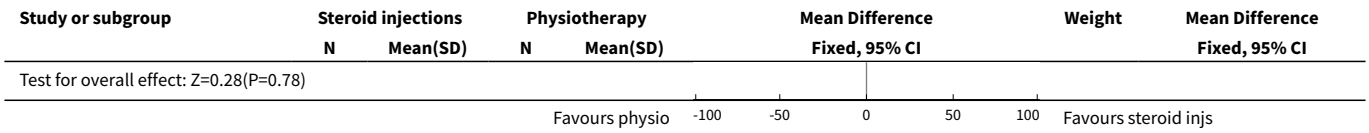
Analysis 5.25. Comparison 5 INTRA-ARTICULAR STEROID INJECTION VS PHYSIOTHERAPY, Outcome 25 Improvement in pain during day at 52 weeks.

Study or subgroup	Steroid injections N	Mean(SD)	Physiotherapy N	Mean(SD)	Mean Difference Fixed, 95% CI	Weight	Mean Difference Fixed, 95% CI
5.25.1 Adhesive capsulitis							
van der Windt 1998	49	38 (23)	54	35 (26)		100%	3[-6.46,12.46]
Subtotal ***	**49**		**54**			**100%**	**3[-6.46,12.46]**
Heterogeneity: Not applicable							
Test for overall effect: Z=0.62(P=0.53)							

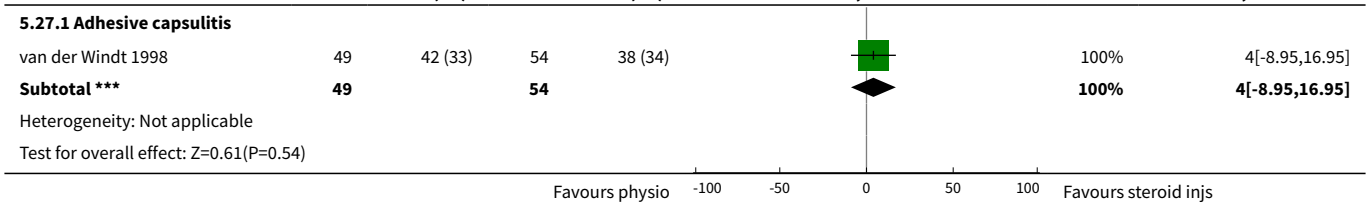


Analysis 5.26. Comparison 5 INTRA-ARTICULAR STEROID INJECTION VS PHYSIOTHERAPY, Outcome 26 Improvement in pain at night at 52 weeks.

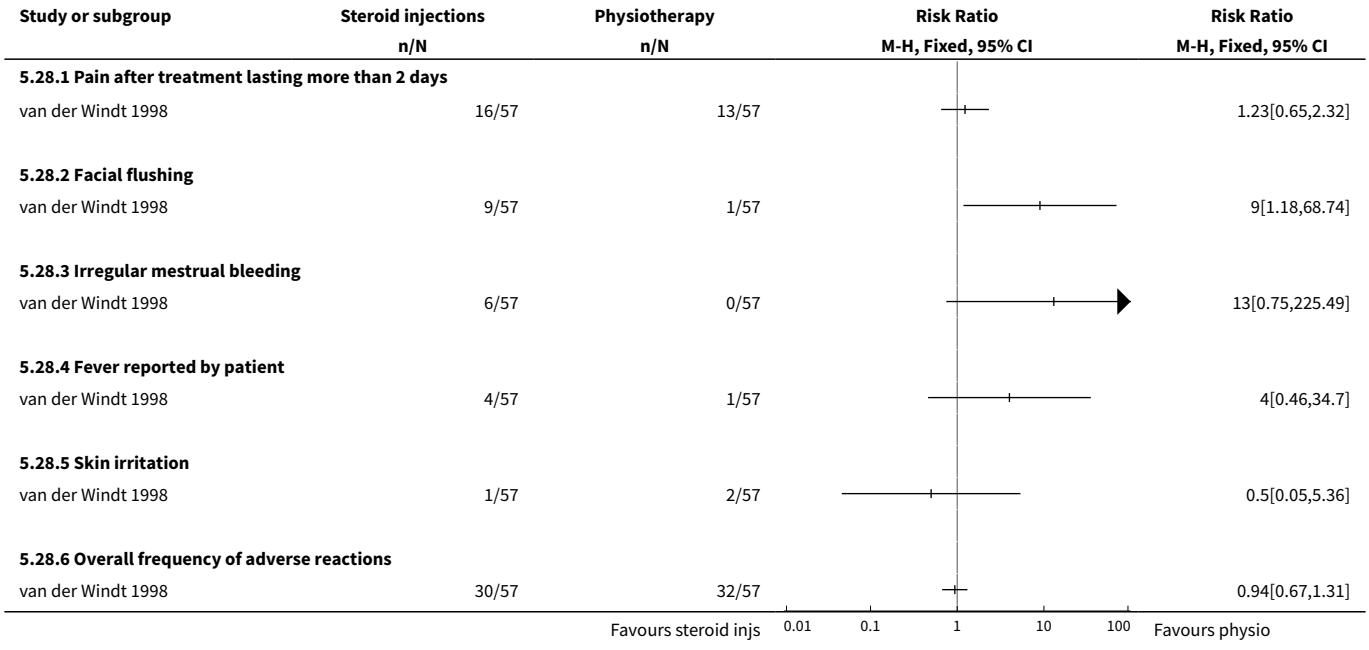
Study or subgroup	Steroid injections N	Mean(SD)	Physiotherapy N	Mean(SD)	Mean Difference Fixed, 95% CI	Weight	Mean Difference Fixed, 95% CI
5.26.1 Adhesive capsulitis							
van der Windt 1998	49	37 (33)	54	35 (39)		100%	2[-11.91,15.91]
Subtotal ***	**49**		**54**			**100%**	**2[-11.91,15.91]**
Heterogeneity: Not applicable							



Analysis 5.27. Comparison 5 INTRA-ARTICULAR STEROID INJECTION VS PHYSIOTHERAPY, Outcome 27 Improvement in shoulder disabiltiy at 52 weeks.



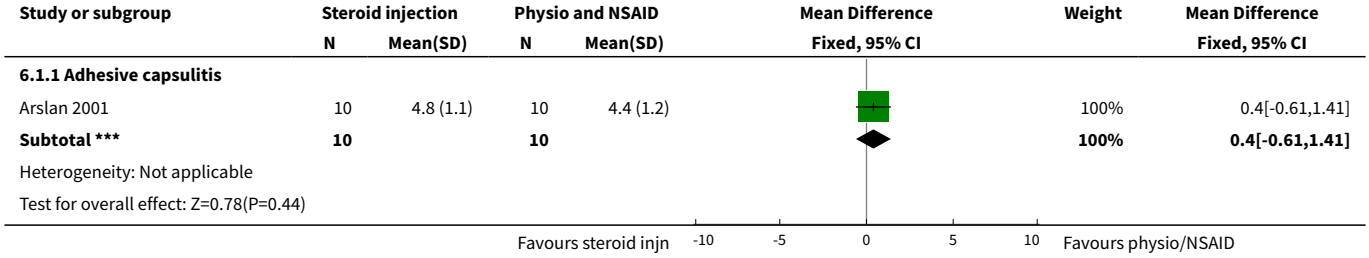
Analysis 5.28. Comparison 5 INTRA-ARTICULAR STEROID INJECTION VS PHYSIOTHERAPY, Outcome 28 Frequency of adverse effects.



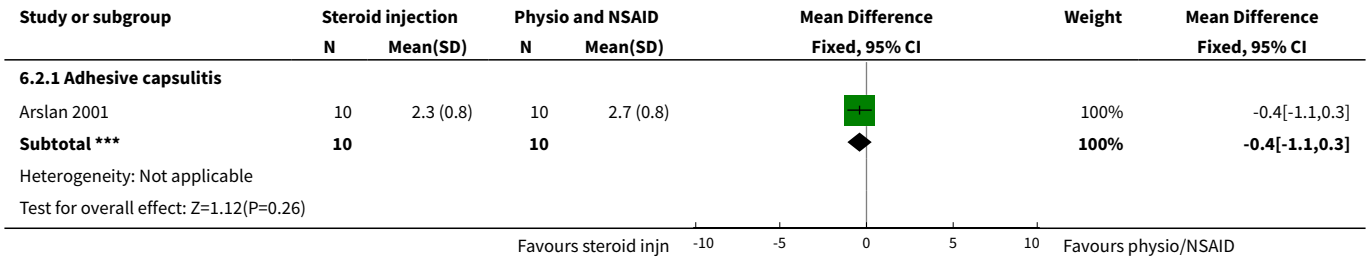
Comparison 6. INTRA-ARTICULAR STEROID INJECTION VS PHYSIOTHERAPY AND NSAID

Outcome or subgroup title	No. of studies	No. of partici-pants	Statistical method	Effect size
1 Pain at 2 weeks	1		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
1.1 Adhesive capsulitis	1	20	Mean Difference (IV, Fixed, 95% CI)	0.40 [-0.61, 1.41]
2 Pain at 12 weeks	1		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
2.1 Adhesive capsulitis	1	20	Mean Difference (IV, Fixed, 95% CI)	-0.40 [-1.10, 0.30]

Analysis 6.1. Comparison 6 INTRA-ARTICULAR STEROID INJECTION VS PHYSIOTHERAPY AND NSAID, Outcome 1 Pain at 2 weeks.



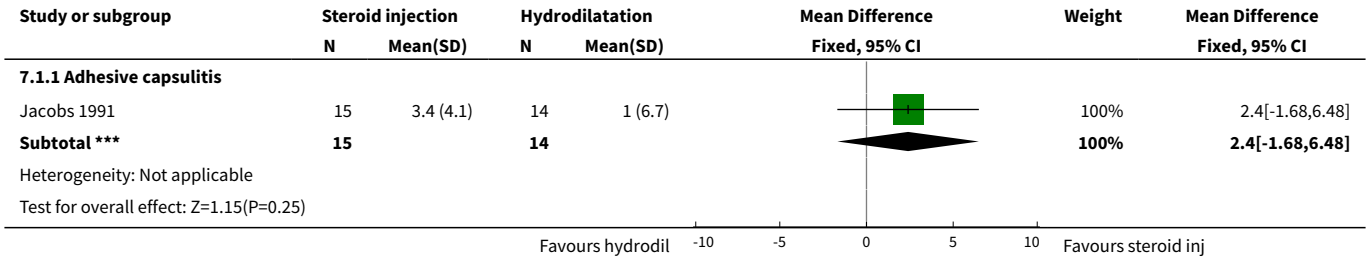
Analysis 6.2. Comparison 6 INTRA-ARTICULAR STEROID INJECTION VS PHYSIOTHERAPY AND NSAID, Outcome 2 Pain at 12 weeks.



Comparison 7. INTRA-ARTICULAR STEROID INJECTION VS CAPSULAR DISTENSION WITH AIR

Outcome or subgroup title	No. of studies	No. of partici-pants	Statistical method	Effect size
1 Improvement in abduction at 16 weeks	1		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
1.1 Adhesive capsulitis	1	29	Mean Difference (IV, Fixed, 95% CI)	2.4 [-1.68, 6.48]

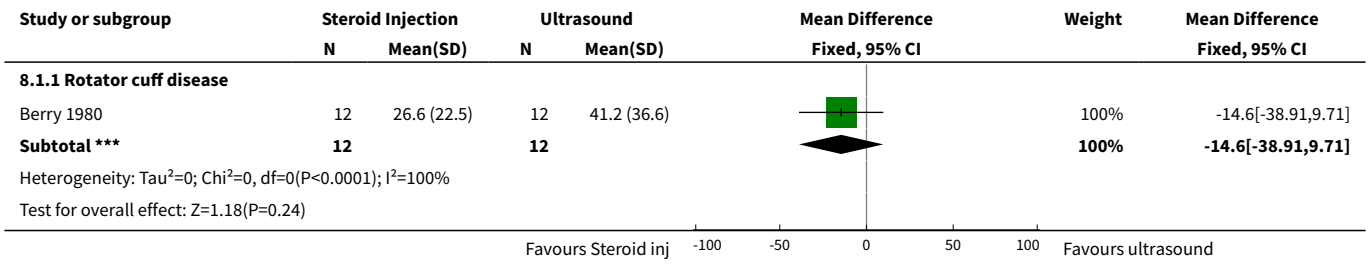
Analysis 7.1. Comparison 7 INTRA-ARTICULAR STEROID INJECTION VS CAPSULAR DISTENSION WITH AIR, Outcome 1 Improvement in abduction at 16 weeks.



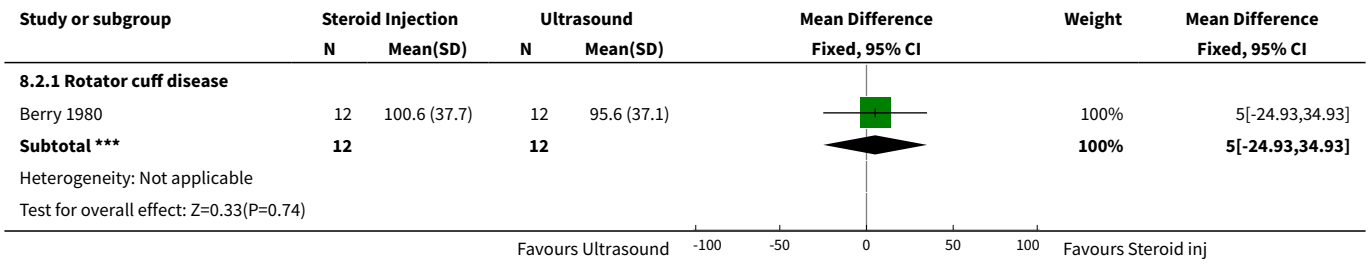
Comparison 8. INTRA-ARTICULAR STEROID INJECTIONS VS ULTRASOUND

Outcome or subgroup title	No. of studies	No. of partici-pants	Statistical method	Effect size
1 Pain at 4 weeks	1		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
1.1 Rotator cuff disease	1	24	Mean Difference (IV, Fixed, 95% CI)	-14.60 [-38.91, 9.71]
2 Range of abduction at 4 weeks	1		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
2.1 Rotator cuff disease	1	24	Mean Difference (IV, Fixed, 95% CI)	5.0 [-24.93, 34.93]
3 Success rate at 4 weeks	1		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
3.1 Rotator cuff disease	1	24	Risk Ratio (M-H, Fixed, 95% CI)	1.0 [0.45, 2.23]

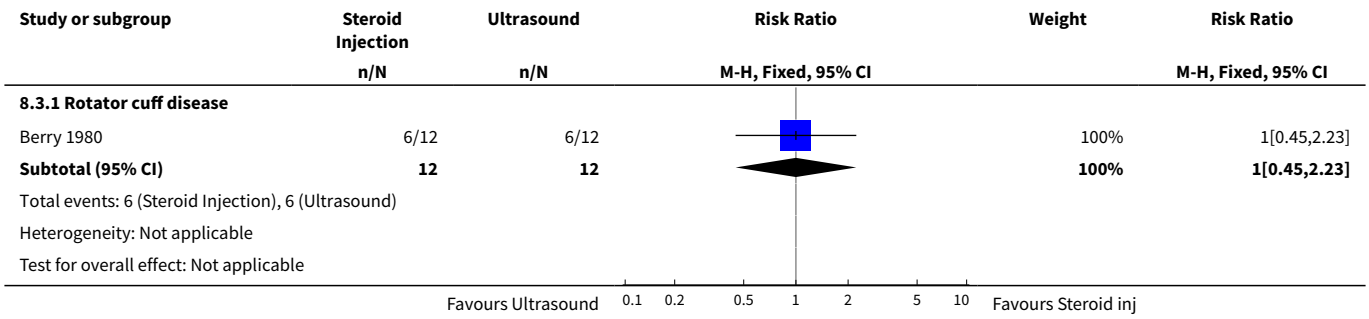
Analysis 8.1. Comparison 8 INTRA-ARTICULAR STEROID INJECTIONS VS ULTRASOUND, Outcome 1 Pain at 4 weeks.



Analysis 8.2. Comparison 8 INTRA-ARTICULAR STEROID INJECTIONS VS ULTRASOUND, Outcome 2 Range of abduction at 4 weeks.



Analysis 8.3. Comparison 8 INTRA-ARTICULAR STEROID INJECTIONS VS ULTRASOUND, Outcome 3 Success rate at 4 weeks.

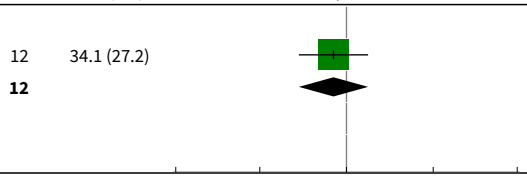


Comparison 9. INTRA-ARTICULAR STEROID INJECTION VS ACUPUNCTURE

Outcome or subgroup title	No. of studies	No. of partici-pants	Statistical method	Effect size
1 Pain at 4 weeks	1		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
1.1 Rotator cuff disease	1	24	Mean Difference (IV, Fixed, 95% CI)	-7.5 [-27.47, 12.47]
2 Range of abduction at 4 weeks	1		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
2.1 Rotator cuff disease	1	24	Mean Difference (IV, Fixed, 95% CI)	-2.90 [-32.63, 26.83]
3 Success rate at 4 weeks	1		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
3.1 Rotator cuff disease	1	24	Risk Ratio (M-H, Fixed, 95% CI)	0.83 [0.35, 2.00]

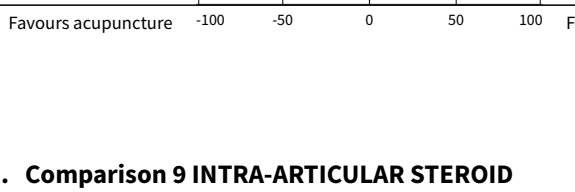
Analysis 9.1. Comparison 9 INTRA-ARTICULAR STEROID INJECTION VS ACUPUNCTURE, Outcome 1 Pain at 4 weeks.

Study or subgroup	Steroid Inj N	Steroid Inj Mean(SD)	acupuncture N	acupuncture Mean(SD)	Mean Difference Fixed, 95% CI	Weight	Mean Difference Fixed, 95% CI
9.1.1 Rotator cuff disease							
Berry 1980	12	26.6 (22.5)	12	34.1 (27.2)		100%	-7.5[-27.47,12.47]
Subtotal ***	**12**		**12**			**100%**	**-7.5[-27.47,12.47]**
Heterogeneity: Not applicable							
Test for overall effect: Z=0.74(P=0.46)							



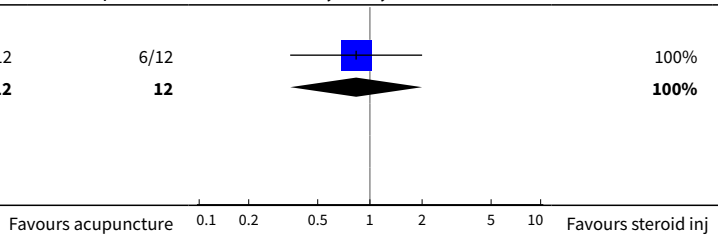
Analysis 9.2. Comparison 9 INTRA-ARTICULAR STEROID INJECTION VS ACUPUNCTURE, Outcome 2 Range of abduction at 4 weeks.

Study or subgroup	steroid inj N	steroid inj Mean(SD)	acupuncture N	acupuncture Mean(SD)	Mean Difference Fixed, 95% CI	Weight	Mean Difference Fixed, 95% CI
9.2.1 Rotator cuff disease							
Berry 1980	12	100.6 (37.7)	12	103.5 (36.6)		100%	-2.9[-32.63,26.83]
Subtotal ***	**12**		**12**			**100%**	**-2.9[-32.63,26.83]**
Heterogeneity: Not applicable							
Test for overall effect: Z=0.19(P=0.85)							



Analysis 9.3. Comparison 9 INTRA-ARTICULAR STEROID INJECTION VS ACUPUNCTURE, Outcome 3 Success rate at 4 weeks.

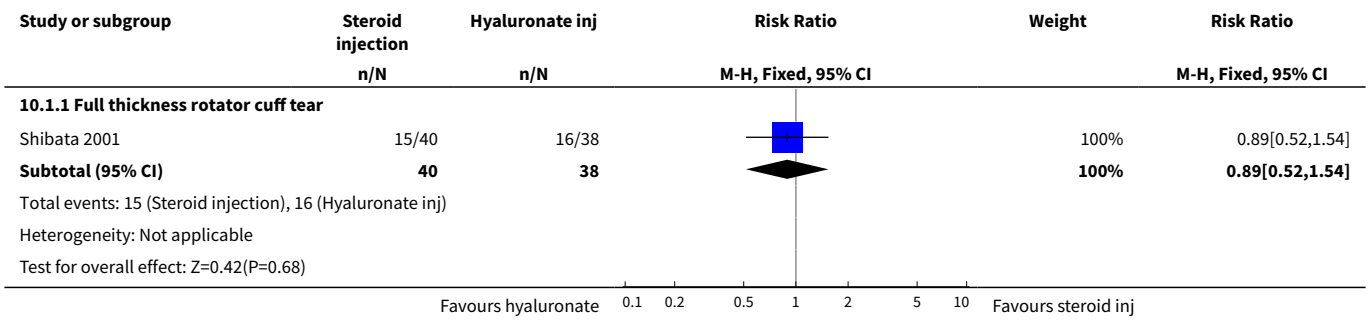
Study or subgroup	Steroid inj n/N	acupuncture n/N	Risk Ratio M-H, Fixed, 95% CI	Weight	Risk Ratio M-H, Fixed, 95% CI
9.3.1 Rotator cuff disease					
Berry 1980	5/12	6/12		100%	0.83[0.35,2]
Subtotal (95% CI)	**12**	**12**		**100%**	**0.83[0.35,2]**
Total events: 5 (Steroid inj), 6 (acupuncture)					
Heterogeneity: Not applicable					
Test for overall effect: Z=0.41(P=0.68)					



Comparison 10. INTRA-ARTICULAR STEROID INJECTION VS HYALURONATE INJECTION

Outcome or subgroup title	No. of studies	No. of partici-pants	Statistical method	Effect size
1 Satisfaction with treatment at 4 weeks	1		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
1.1 Full thickness rotator cuff tear	1	78	Risk Ratio (M-H, Fixed, 95% CI)	0.89 [0.52, 1.54]

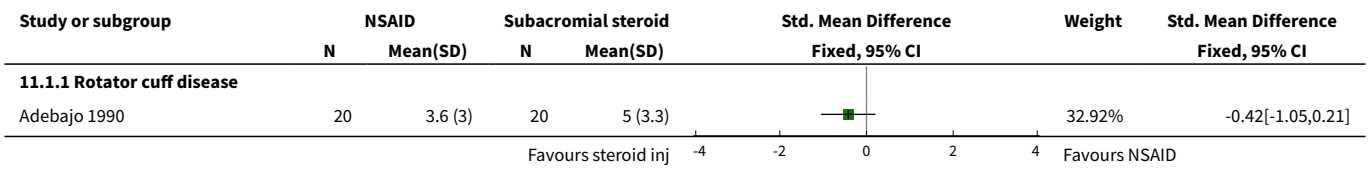
Analysis 10.1. Comparison 10 INTRA-ARTICULAR STEROID INJECTION VS HYALURONATE INJECTION, Outcome 1 Satisfaction with treatment at 4 weeks.

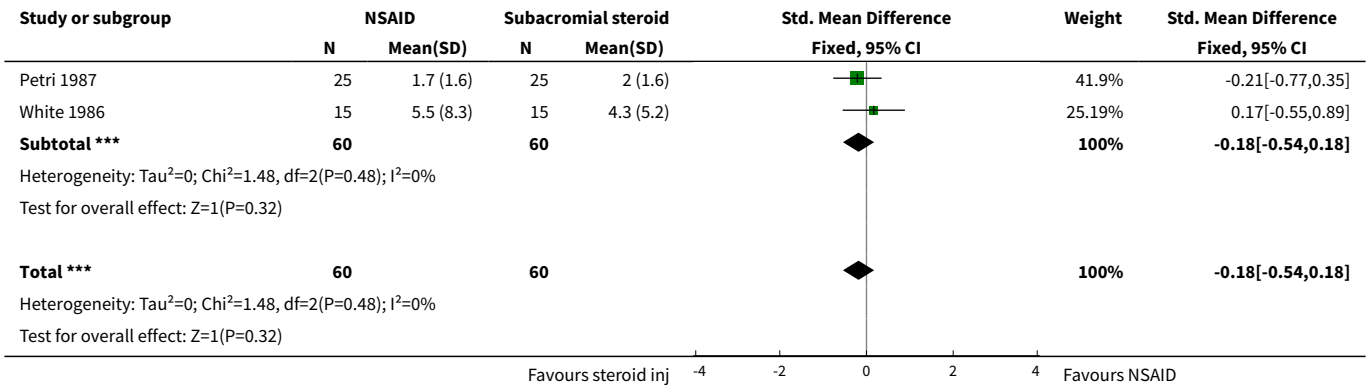


Comparison 11. SUBACROMIAL STEROID INJECTION VS NSAID

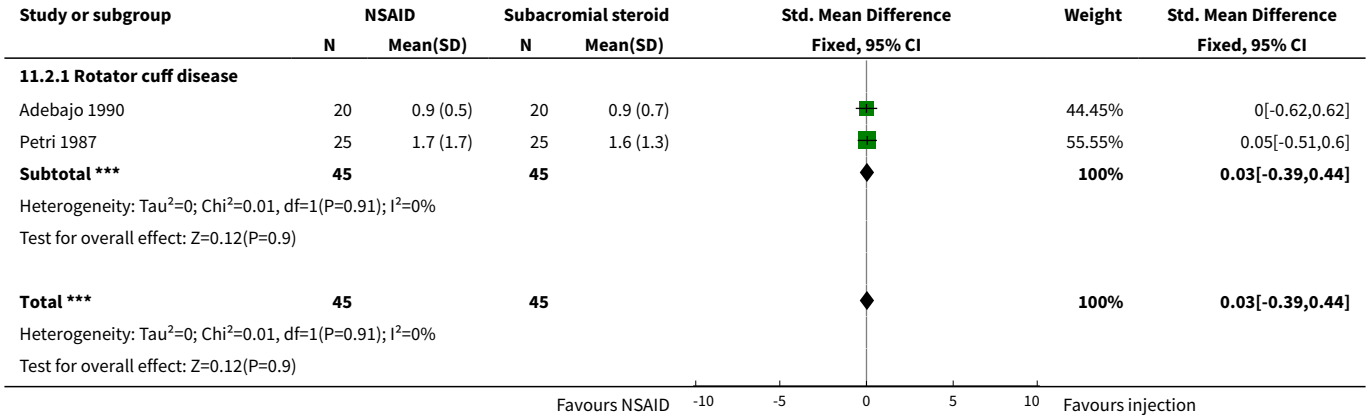
Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Improvement in pain at 4 or 6 weeks	3	120	Std. Mean Difference (IV, Fixed, 95% CI)	-0.18 [-0.54, 0.18]
1.1 Rotator cuff disease	3	120	Std. Mean Difference (IV, Fixed, 95% CI)	-0.18 [-0.54, 0.18]
2 Improvement in function at 4 or 6 weeks	2	90	Std. Mean Difference (IV, Fixed, 95% CI)	0.03 [-0.39, 0.44]
2.1 Rotator cuff disease	2	90	Std. Mean Difference (IV, Fixed, 95% CI)	0.03 [-0.39, 0.44]
3 Improvement in range of shoulder abduction at 4 or 6 weeks	3	120	Std. Mean Difference (IV, Fixed, 95% CI)	-0.17 [-0.53, 0.19]
3.1 Rotator cuff disease	3	120	Std. Mean Difference (IV, Fixed, 95% CI)	-0.17 [-0.53, 0.19]
4 Improvement in global assessment score at 6 weeks	1		Std. Mean Difference (IV, Fixed, 95% CI)	Subtotals only
4.1 Rotator cuff disease	1	30	Std. Mean Difference (IV, Fixed, 95% CI)	-0.03 [-0.75, 0.68]

Analysis 11.1. Comparison 11 SUBACROMIAL STEROID INJECTION VS NSAID, Outcome 1 Improvement in pain at 4 or 6 weeks.

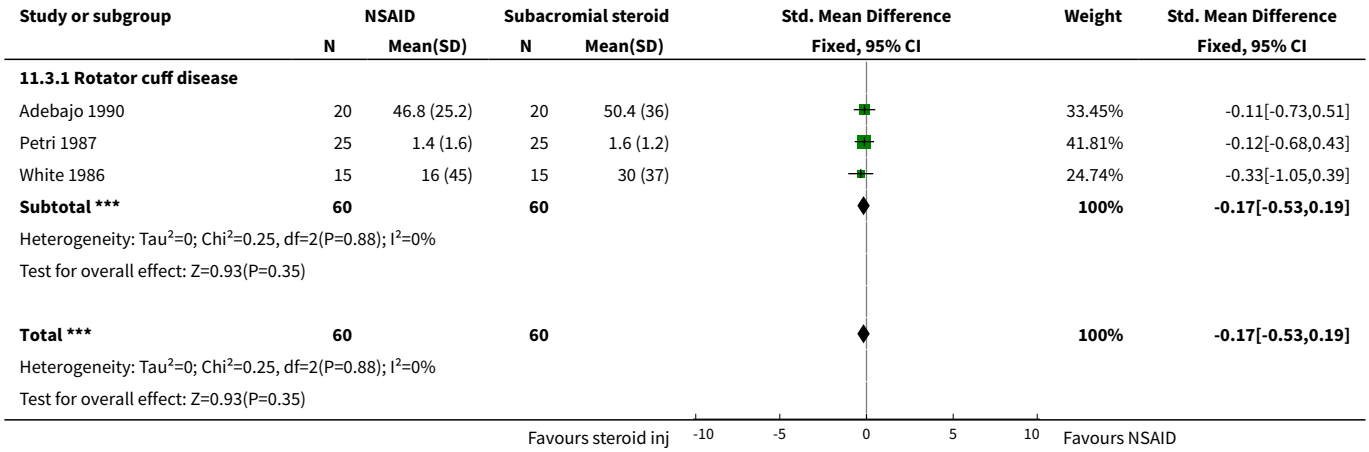




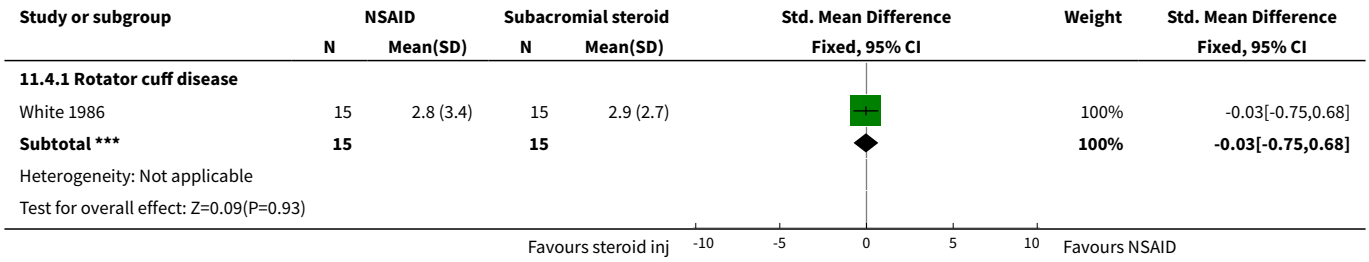
Analysis 11.2. Comparison 11 SUBACROMIAL STEROID INJECTION VS NSAID, Outcome 2 Improvement in function at 4 or 6 weeks.



Analysis 11.3. Comparison 11 SUBACROMIAL STEROID INJECTION VS NSAID, Outcome 3 Improvement in range of shoulder abduction at 4 or 6 weeks.



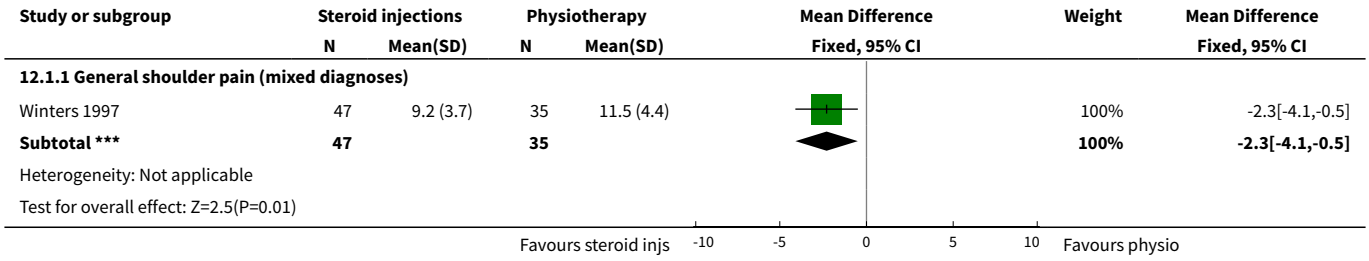
Analysis 11.4. Comparison 11 SUBACROMIAL STEROID INJECTION VS NSAID, Outcome 4 Improvement in global assessment score at 6 weeks.



Comparison 12. INTRA-ARTICULAR, SUBACROMIAL AND ACROMIOCLAVICULAR STEROID INJECTIONS VS PHYSIOTHERAPY (NOT MANIPULATION)

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Pain at end of treatment (when patient left study or 11 weeks after randomisation)	1		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
1.1 General shoulder pain (mixed diagnoses)	1	82	Mean Difference (IV, Fixed, 95% CI)	-2.30 [-4.10, -0.50]

Analysis 12.1. Comparison 12 INTRA-ARTICULAR, SUBACROMIAL AND ACROMIOCLAVICULAR STEROID INJECTIONS VS PHYSIOTHERAPY (NOT MANIPULATION), Outcome 1 Pain at end of treatment (when patient left study or 11 weeks after randomisation).

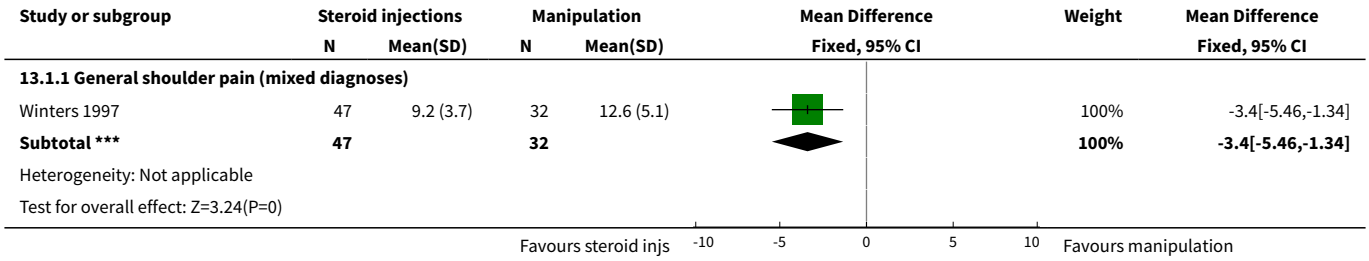


Comparison 13. INTRA-ARTICULAR, SUBACROMIAL and ACROMIOCLAVICULAR STEROID INJECTIONS VS MANIPULATION

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Pain at end of treatment (when patient left study or 11 weeks after randomisation)	1		Mean Difference (IV, Fixed, 95% CI)	Subtotals only

Outcome or subgroup title	No. of studies	No. of partici-pants	Statistical method	Effect size
1.1 General shoulder pain (mixed diagnoses)	1	79	Mean Difference (IV, Fixed, 95% CI)	-3.40 [-5.46, -1.34]

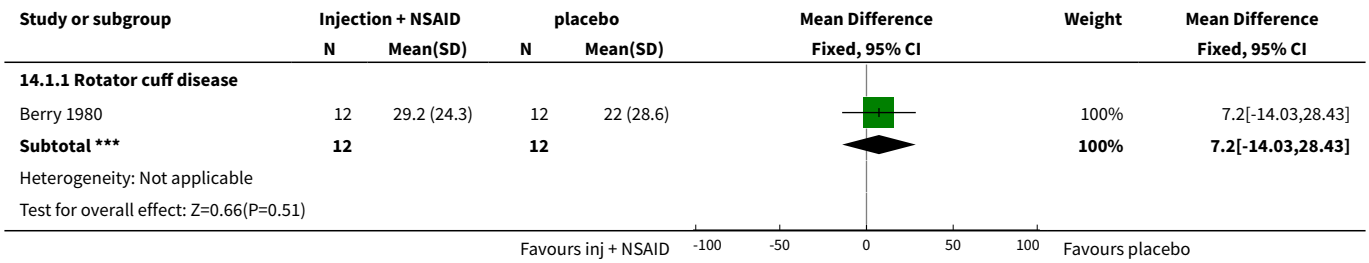
Analysis 13.1. Comparison 13 INTRA-ARTICULAR, SUBACROMIAL and ACROMIOCLAVICULAR STEROID INJECTIONS VS MANIPULATION, Outcome 1 Pain at end of treatment (when patient left study or 11 weeks after randomisation).



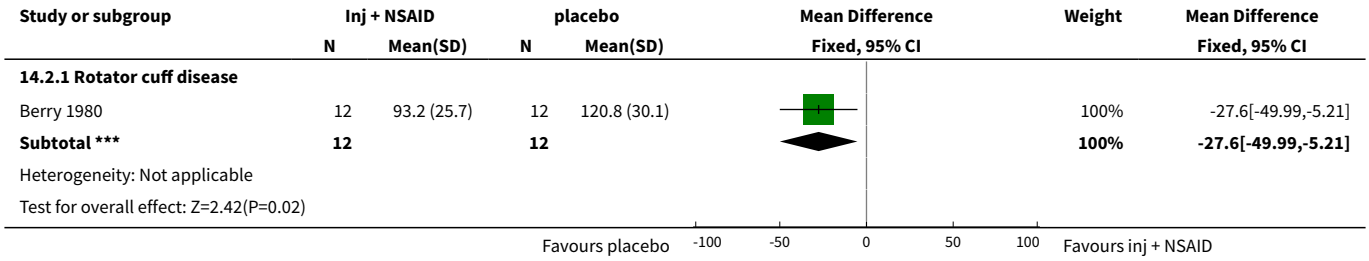
Comparison 14. INTRA-ARTICULAR STEROID INJECTION PLUS NSAID VS PLACEBO

Outcome or subgroup title	No. of studies	No. of partici-pants	Statistical method	Effect size
1 Pain at 4 weeks	1		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
1.1 Rotator cuff disease	1	24	Mean Difference (IV, Fixed, 95% CI)	7.20 [-14.03, 28.43]
2 Range of abduction at 4 weeks	1		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
2.1 Rotator cuff disease	1	24	Mean Difference (IV, Fixed, 95% CI)	-27.60 [-49.99, -5.21]
3 Success rate at 4 weeks	1		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
3.1 Rotator cuff disease	1	24	Risk Ratio (M-H, Fixed, 95% CI)	0.56 [0.26, 1.17]

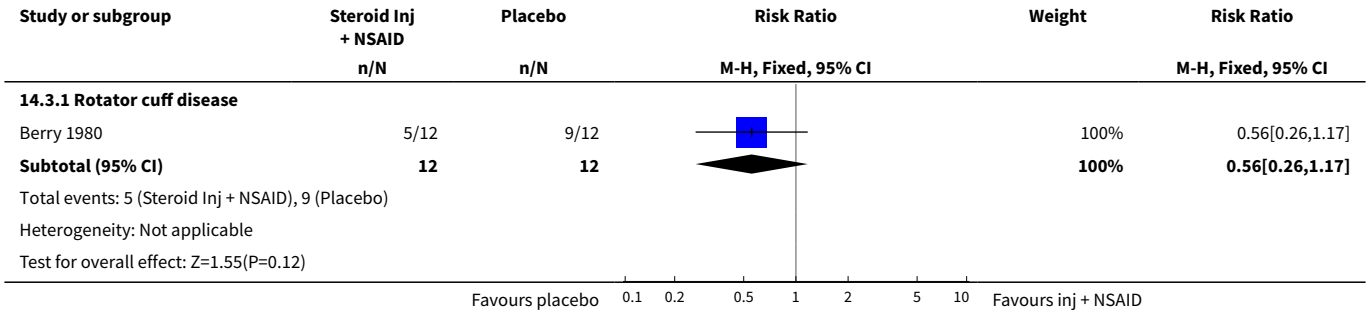
Analysis 14.1. Comparison 14 INTRA-ARTICULAR STEROID INJECTION PLUS NSAID VS PLACEBO, Outcome 1 Pain at 4 weeks.



Analysis 14.2. Comparison 14 INTRA-ARTICULAR STEROID INJECTION PLUS NSAID VS PLACEBO, Outcome 2 Range of abduction at 4 weeks.



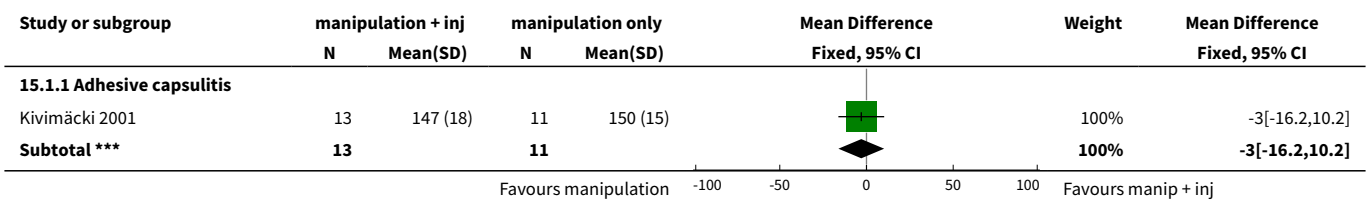
Analysis 14.3. Comparison 14 INTRA-ARTICULAR STEROID INJECTION PLUS NSAID VS PLACEBO, Outcome 3 Success rate at 4 weeks.

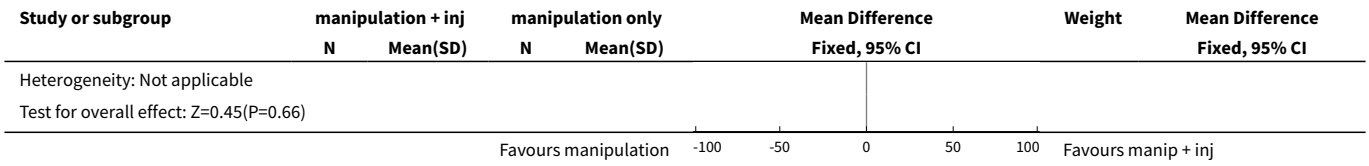


Comparison 15. INTRA-ARTICULAR STEROID INJECTION PLUS MANIPULATION UNDER ANAESTHESIA VS MANIPULATION UNDER ANAESTHESIA ALONE

Outcome or subgroup title	No. of studies	No. of partici-pants	Statistical method	Effect size
1 Range of abduction at 4 months	1		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
1.1 Adhesive capsulitis	1	24	Mean Difference (IV, Fixed, 95% CI)	-3.0 [-16.20, 10.20]

Analysis 15.1. Comparison 15 INTRA-ARTICULAR STEROID INJECTION PLUS MANIPULATION UNDER ANAESTHESIA VS MANIPULATION UNDER ANAESTHESIA ALONE, Outcome 1 Range of abduction at 4 months.

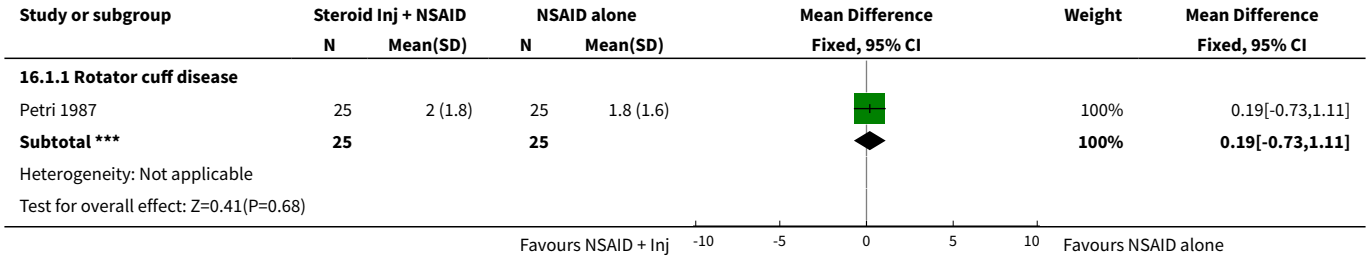




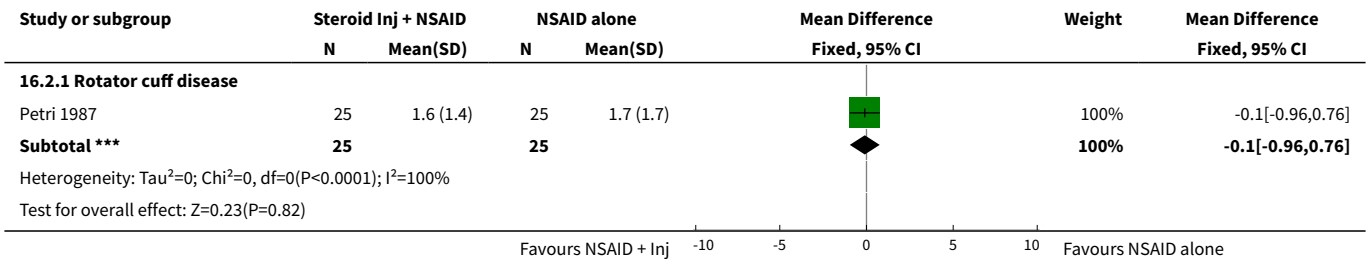
Comparison 16. SUBACROMIAL STEROID INJECTION PLUS NSAID VS NSAID ALONE

Outcome or subgroup title	No. of studies	No. of partici-pants	Statistical method	Effect size
1 Improvement in pain at 4 weeks	1		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
1.1 Rotator cuff disease	1	50	Mean Difference (IV, Fixed, 95% CI)	0.19 [-0.73, 1.11]
2 Improvement in function at 4 weeks	1		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
2.1 Rotator cuff disease	1	50	Mean Difference (IV, Fixed, 95% CI)	-0.10 [-0.96, 0.76]
3 Improvement in range of abduction at 4 weeks	1		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
3.1 Rotator cuff disease	1	50	Mean Difference (IV, Fixed, 95% CI)	0.56 [-0.15, 1.27]
4 Remission at 4 weeks	1		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
4.1 Rotator cuff disease	1	50	Risk Ratio (M-H, Fixed, 95% CI)	1.0 [0.41, 2.43]

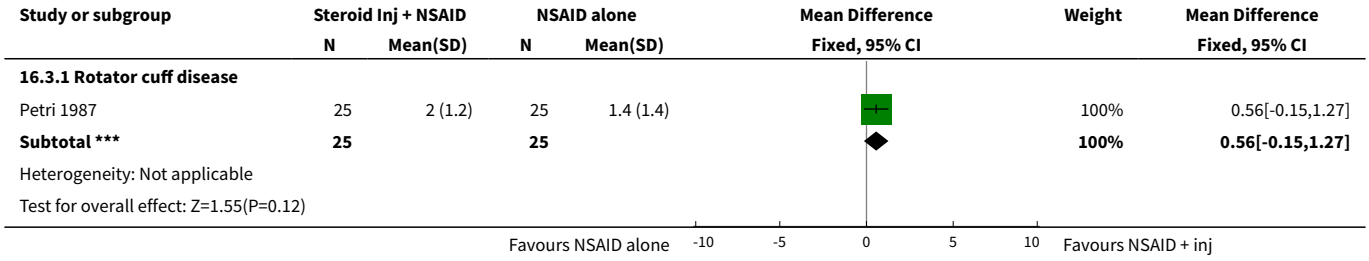
Analysis 16.1. Comparison 16 SUBACROMIAL STEROID INJECTION PLUS NSAID VS NSAID ALONE, Outcome 1 Improvement in pain at 4 weeks.



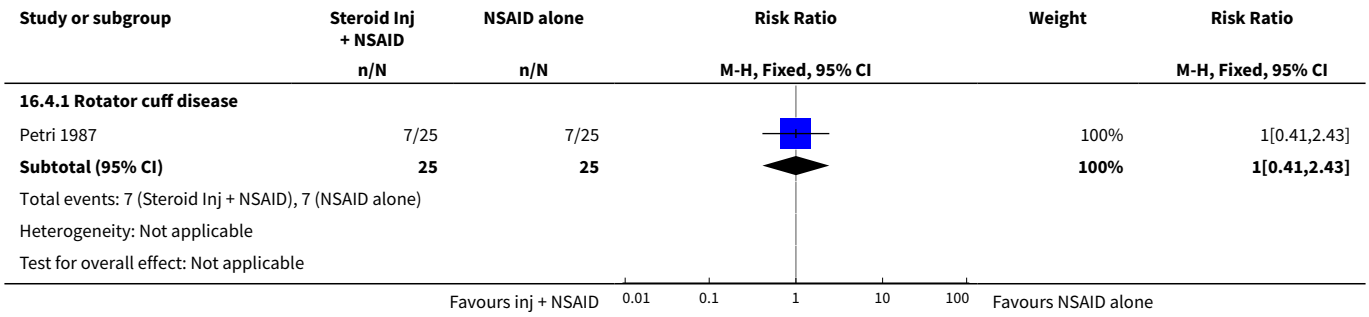
Analysis 16.2. Comparison 16 SUBACROMIAL STEROID INJECTION PLUS NSAID VS NSAID ALONE, Outcome 2 Improvement in function at 4 weeks.



Analysis 16.3. Comparison 16 SUBACROMIAL STEROID INJECTION PLUS NSAID VS NSAID ALONE, Outcome 3 Improvement in range of abduction at 4 weeks.



Analysis 16.4. Comparison 16 SUBACROMIAL STEROID INJECTION PLUS NSAID VS NSAID ALONE, Outcome 4 Remission at 4 weeks.



WHAT'S NEW

Date	Event	Description
22 September 2008	Amended	Converted to new review format. C020-R

CONTRIBUTIONS OF AUTHORS

All reviewers contributed to the development of this review.

DECLARATIONS OF INTEREST

None known.

SOURCES OF SUPPORT

Internal sources

- Department of Clinical Epidemiology, Cabrini Hospital, Melbourne, Australia.
- Monash University Department of Epidemiology and Preventive Medicine, Melbourne, Australia.

External sources

- No sources of support supplied

INDEX TERMS

Medical Subject Headings (MeSH)

*Rotator Cuff Injuries; Adrenal Cortex Hormones [*therapeutic use]; Anti-Inflammatory Agents, Non-Steroidal [therapeutic use]; Bursitis [*drug therapy]; Injections, Intra-Articular; Randomized Controlled Trials as Topic; Shoulder Pain [*drug therapy]

MeSH check words

Adult; Humans