Image guided therapeutic intra-articular joint injections with corticosteroids with/without local anaesthetic for the treatment of joint pain

Questions to be addressed

1. In adults with a painful joint due to osteoarthritis, is image guided intra-articular corticosteroid injection clinically effective compared to non-image guided intra-articular corticosteroid injection?
2. In adults with a painful joint due to osteoarthritis, is image guided intra-articular corticosteroid injection cost effective compared to non-image guided intra-articular corticosteroid injection?

Reason for review

NHS Birmingham and Solihull CCG and Sandwell and West Birmingham CCG, in partnership with Walsall, Wolverhampton and Dudley CCGs, requested a rapid evidence review of the clinical and cost effectiveness of image guided intra-articular corticosteroid injections compared to non-image guided intra-articular corticosteroid injections to inform their decisions on commissioning policy development.

Options for commissioners:

3. The Committee considers that due to the lack of high quality evidence of clinical and cost effectiveness for image guided intra-articular corticosteroid injections compared to non-image guided intra-articular corticosteroid injections; its use should be considered a low priority.
4. The Committee recommend that image guided intra-articular corticosteroid injections should be offered ONLY to patients who have failed to respond to conventional pharmacological and non-pharmacological interventions due to the limited quality of evidence of its clinical and cost effectiveness.
5. The Committee considers that there is insufficient evidence to suggest that image guided intra-articular corticosteroid injections are more or less effective than non-image guided intra-articular corticosteroid injections and therefore the decision about which approach to proceed with should be made after an informed discussion between the clinician and the individual person about the risks and benefits of each procedure.
6. The Committee recommends that image guided intra-articular corticosteroid injections should be promoted as the treatment of choice because there is sufficient evidence to suggest that it is associated with more injection accuracy which is likely to lead to better clinical outcomes and fewer complications and some evidence to suggest a greater reduction in pain/disability.

Summary

Background

- Osteoarthritis is a chronic musculoskeletal disorder characterised by involvement of all joint structures including the synovial membrane, cartilage and bone.

- Osteoarthritis can affect most joints. The most commonly affected joints are the knees, hips and small joints of the hand.
- People with OA often have joint pain, stiffness, reduced participation in daily activities and poor quality of life.
- OA is a major source of disability owing to pain and loss of function. It is the most common form of joint disease and among the top 10 causes of disability worldwide.
- A range of lifestyle, pharmacological, non-pharmacological, and surgical interventions are used for controlling symptoms and improving function.
- Conventional therapies include the use of analgesics, non-steroidal anti-inflammatory drugs, physical therapy and intra-articular (IA) corticosteroid administration.

Clinical effectiveness

- We identified three studies of image guided intra-articular (IA) corticosteroid injections compared to non-image guided IA corticosteroid injections; one retrospective comparative study and two randomised single-blinded studies.
- Park et al (2015) retrospectively reviewed the medical charts of patients with acromioclavicular[a] (AC) joint degenerative OA who had been treated with ultrasound-guided (US) (n=50) or palpation-guided (n=50) AC joint IA corticosteroid injections between January 2012 and December 2013 at their outpatient clinic.
- The authors reported that the Shoulder Pain and Disability Index (SPADI)[b], Verbal Numeric pain Scale (VNS)[c] at rest (VNSar) and under local pressure (VNSlp), and the arm adduction test (VNSaat) all improved at one, three and six months after the injections in both groups ($p<0.05$).
- They also reported a statistically significantly greater improvement in the VNSlp score and SPDAI at six months and in the VNSaat score at three months and six months for the US-guided group compared with the palpation group ($p<0.05$).
- Given that the study was retrospective and conducted in one centre by a single physician (also one of the assessors), the potential for bias is substantial and therefore the results should be interpreted with caution.
- Nam et al (2013) carried out a randomised, prospective single-blinded clinical study (n=60) on the mid-term benefits and accuracy rate of US-guided versus palpation-guided IA injections for the treatment of distal radioulnar joint[d] (DRUJ) disorder.
- The authors reported that US-guided IA injections showed significantly higher accuracy (100%) than palpation-guided IA injections (75.8%) [$p<0.05$] in DRUJ disorder.
- They found that VNS, Disability of the Arm, Shoulder, and Hand questionnaire (DASH), Modified Mayo Wrist Score (MMWS), and range of movement (ROM) were improved at one, three and six months in both groups ($p<0.05$) but reported no significant difference in clinical outcome measures between the group receiving US-

[a] The acromioclavicular joint, or AC joint, is a joint at the top of the shoulder. It is the junction between the acromion (part of the scapula that forms the highest point of the shoulder) and the clavicle.

[b] The Shoulder Pain and Disability Index (SPADI) was developed to measure current shoulder pain and disability in an outpatient setting. The SPADI contains 13 items that assess two domains; a 5-item subscale that measures pain and an 8-item subscale that measures disability.

[c] Successful treatment (significant pain relief) was defined as > 50% improvement in the VNS score, *a five-point Likert scale of 3 (good) or 4 (excellent)* and 20 point improvement in the SPADI) at one, 3 and 6 months after the injections [14].

[d] The distal radioulnar joint is a joint between the two bones in the forearm; the radius and ulna, at the wrist.

guided injections and that receiving palpation-guided injections. However, they reported a positive correlation between pain/disability improvements and accuracy of IA injections at one, three and six months follow-up.

- These findings may not be generalisable because the palpation-guided IA injection was given by an experienced physician (seven years) which may not always be the case in clinical settings. This may have affected the accuracy rate. In addition, the relatively small number of inaccurate injections means that the study may not have been sufficiently powered to show any difference in results between US-guided and palpation-guided injections.
- Both studies only included patients with BMI of less than 30kg/m^2; this does not necessarily represent the general OA population. The larger amounts of subcutaneous fat – the increased distance between the skin and bone in obese patients – are likely to have an effect on the accuracy of the injection, particularly for palpation-guided injections.
- Sibbitt et al (2011) reported the results from a single-blinded RCT (n=92) which addressed how sonographic needle guidance affects clinical outcomes of IA injection in patients with OA of the knee. Patients' pain was measured using the visual analogue scale (VAS) where 0cm signifies no pain and 10cm unbearable pain.
- The authors reported a significant reduction in pain mean scores (from a mean of 7.5 (±2.0) to 1.4 ±2.1 versus 7.8 ±1.8 to 2.4 ±2.1 with sonographic guidance relative to palpation guidance at two weeks (p=0.025) but this was not sustained at six months follow-up (p=1.0). They also reported superior duration of therapeutic effect in months [4.2± 1.9 versus 3.1± 2.1 (p=0.01)] and lower reinjection rates within 12 months [52% (24/46) versus 74% (34/46) (p=0.03)] with sonographic guidance. The authors also reported a significantly higher responder[e] rate with sonographic guidance of 67% (31/46) versus 33% (15/46) with palpation guidance, p=0.0004.
- These results should be interpreted with caution as participants were not blinded to their treatment and the details on the randomisation methods and concealment were not provided.

Safety

- Two of the three studies identified reported almost identical adverse effect profiles. They report that two and three patients in the US-guided group respectively and one patient (in each study) in the palpation-guided group complained of pain due to steroid-induced synovitis. In both studies skin atrophy and depigmentation were observed in two patients in the palpation group and in none in the US-guided group. There were no severe complications, such as septic arthritis, allergic reactions or ruptured tendons.
- The third study did not report adverse effects.

Cost-effectiveness

- We found one cost-effectiveness study of the use of image guided intra-articular corticosteroid injections compared to non-image guided intra-articular corticosteroid injections conducted in the USA.

[e] Responders were defined as those who had VAS <2cm

- Sibbitt et al (2011) aimed to assess the cost effectiveness of IA injection in patients with OA of the knee based on the results from a single-blinded RCT (n=92) which addressed whether sonographic needle guidance affects clinical outcomes.
- The authors reported a number of data on costs based on the USA Medicare system: cost per year if patient was treated at the physician's office as $173 ± $81 for palpation-guided IA injection compared with $460 ± $207 for sonographic guidance (p=0.0001); cost per year for patients treated in hospital outpatient clinic as $126 ± $58 for palpation-guided IA injection compared with $109 ± $49 for sonographic guidance (p=0.13).
- Cost per responder per year in a physician's office was reported as $531 ± $248 for palpation-guided IA injection compared with $1129 ± $307 for sonographic guidance (p=0.0001) and cost per responder per year in hospital outpatient clinic as $386 ± $180 versus $162 ± $73 respectively (p=0.0001). The authors concluded that the use of sonographic guidance in hospital outpatient clinics modestly reduced the cost per patient per year and cost per responder per year relative to palpation guided injections.
- However it should be noted that the sonographic needle guidance procedure in hospital outpatients is not reimbursed by Medicare so the authors only included $2 per procedure for each mechanical syringe and hence the true costs were missing. The relevance of these results outside of the USA is therefore questionable.

Equity issues

- It is not known whether there is variation in access to image guided intra-articular corticosteroid injections compared to non-image guided intra-articular corticosteroid injections across providers in the NHS Birmingham and Solihull CCG, Sandwell and West Birmingham CCG, and Walsall, Wolverhampton and Dudley CCGs areas, or how access compares to the rest of England.

1 Context

1.1 Introduction

Osteoarthritis (OA) refers to a clinical syndrome of joint pain accompanied by varying degrees of functional limitation and reduced quality of life. It is the most common form of arthritis, and one of the leading causes of pain and disability worldwide. It is a chronic musculoskeletal disorder characterised by involvement of all joint structures including the synovial membrane, cartilage and bone. People with osteoarthritis often have joint pain, reduced mobility, reduced participation in daily activities and poor quality of life [1].

The joints most commonly affected by OA are the knees, hips and small joints of the hand, although most joints can be affected. Pain, reduced function and effects on a person's ability to carry out their day-to-day activities can be important consequences of osteoarthritis. Pain in itself is also a complex biopsychosocial issue, related in part to a person's expectations and self-efficacy (that is, their belief in their ability to complete tasks and reach goals), and is associated with changes in mood, sleep and coping abilities. There is often a poor link between changes visible on an X-ray and symptoms of osteoarthritis: minimal changes can be associated with a lot of pain, or modest structural changes to joints can occur with minimal accompanying symptoms [2].

Contrary to popular belief, OA is not just caused by ageing and does not necessarily deteriorate. It is believed that a variety of traumas may trigger the need for a joint to repair itself which may result in a structurally altered but symptom-free joint. However, in some people, because of either overwhelming trauma or compromised repair, the process cannot fully compensate, resulting in eventual presentation with symptomatic osteoarthritis; this might be thought of as 'joint failure'. This in part explains the extreme variability in clinical presentation and outcome that can be observed between people, and also at different joints in the same person [2].

A range of lifestyle, pharmacological, non-pharmacological, surgical and rehabilitation interventions are effective for controlling symptoms and improving function (NICE 2012). Conventional therapies include the use of simple analgesics, non-steroidal anti-inflammatory drugs, physical therapy and intra-articular (IA) corticosteroid administration [3].

1.2 Existing national policies and guidance

There is no relevant NICE Technology Appraisal Guidance (with statutory requirement for NHS organisations to make funding available), clinical guidelines or quality standards specifically for the use of image guided intra-articular corticosteroid injections compared to non-image guided intra-articular corticosteroid injections. However, NICE published Clinical Guideline (CG177) - Osteoarthritis: care and management in February 2014 [2]. The guidelines made the following recommendations regarding intra-articular injections;

- Intra-articular corticosteroid injections should be considered as an adjunct to core treatments for the relief of moderate to severe pain in people with osteoarthritis.
- Do not offer intra-articular hyaluronan injections for the management of osteoarthritis.

2 Epidemiology

OA is a major source of disability owing to pain and loss of function. It is the most common form of joint disease and among the top 10 causes of disability worldwide [4]. With aging of the population and increasing obesity, OA arises as a major public health problem and an important financial burden for the global economy [5].

In the UK, approximately 8.75 million people aged 45 years and over (33%) have sought treatment for OA. OA is more common in women (60% female, 40% male), and this difference is most apparent for hand and knee OA and among people over 50 years of age [6]. The risk of developing OA increases with age; one third of women and almost a quarter of men between 45 and 64 have sought treatment for OA, this rises to almost half of people aged 75 and over [7]. X-ray studies show that at least 50% of people older than 65 have evidence of OA [1].

The risk of developing OA throughout life increases with rising BMI [8]. People who are overweight or obese are respectively approximately 2.5 and 4.6 times more likely to develop knee OA than those of normal body weight [9]. This, along with the aging population, is contributing to the increasing number of people with OA.

Knee OA is more frequently observed in people with occupations that require squatting and kneeling, hip OA is associated with prolonged lifting and standing. Hand OA is more frequent in people with occupations requiring increased manual dexterity [10]. Genetic factors are thought to account for 60% of hand and hip OA and 40% of knee OA [11].

The total cost of OA to the UK economy is estimated at 1% of annual gross national product. In 1999/2000, 36 million working days were lost because of OA, costing the economy nearly £3.2 billion in lost production [1].

3 The interventions

Intra-articular injections of corticosteroids have been used for several decades in the management of inflammatory and degenerative joint conditions including OA when first-line conservative therapies fail to provide adequate symptom relief [12].

Although osteoarthritis is generally thought to be of degenerative rather than inflammatory origin, there is evidence that an inflammatory component may be prese nt in at least some phases of the disease. Corticosteroids are known as potent anti-inflammatory agents that act through a variety of mechanisms [13].

Traditionally, intra-articular injections have been performed using anatomical landmarks to identify the correct trajectory for needle placement. However, different anatomical-guided injection techniques have yielded inconsistent intra-articular needle positioning due, in large part, to the fact that the physician cannot directly visualize the area of interest, and variations in anatomy are common. Incorrect needle placement has been partially associated with variable clinical outcomes. Furthermore, inaccurate corticosteroid injections may result in complications such as post-injection pain, crystal synovitis,

haemarthrosis, joint sepsis, necrosis, and steroid articular cartilage atrophy, as well as systemic effects, including fluid retention or exacerbation of hypertension or diabetes mellitus. Therefore, identification of methods and proper training to aid in correct needle placement during these procedures is warranted [12, 15]. However, it is controversial whether accuracy of needle placement has a significant impact on clinical outcome [12, 13].

The purpose of guidance during corticosteroid joint injections is to allow visualization, typically in real time, of the target anatomy so that the operator can achieve a more accurate and potentially safer and more effective injection [12, 13].

4 Findings

We searched Medline, Embase and Cochrane Library on the 14th September 2018 using the search strategy detailed in section 7 below. We also ran a search of TRIP database and NICE Evidence search with similar limits and restricting to Evidence Reviews.

The search was limited to 2008 onwards and English language only and we excluded letters, commentary, case reports and conference papers.

4.1 Evidence of effectiveness

We did not find any systematic reviews of the clinical effectiveness of image guided intra-articular corticosteroid injections compared to non-image guided intra-articular corticosteroid injections for patients with osteoarthritis. However we identified three studies; one retrospective comparative study and two randomised single-blinded studies [14, 15, 16] that met the PICO criteria for inclusion. Only comparative studies were included in this review.

> *We also identified one cost-effectiveness study of image guided intra-articular corticosteroid injections compared to non-image guided intra-articular corticosteroid injections conducted in the USA [16].*

4.1.1 Clinical effectiveness

We identified three studies of image guided intra-articular corticosteroid injections compared to non-image guided intra-articular corticosteroid injections; one retrospective comparative study [14] and two randomised single-blinded studies [15, 16].

Park et al [14] retrospectively reviewed the medical charts of patients (n=100) with acromioclavicular (AC) joint degenerative OA who had undergone ultrasound (US) guided or palpation-guided AC joint IA corticosteroid injection between January 2012 and December 2013 at their outpatient clinic. Fifty patients had US guided IA corticosteroid injection and the other 50 had palpation-guided IA corticosteroid injection.

The authors reported that the Shoulder Pain and Disability Index (SPADI), Verbal Numeric pain Scale (VNS)[f] at rest (VNSar) and under local pressure (VNSlp), and the arm adduction test (VNSaat) improved at one, three and six months after the injections compared to before injection in both groups (p<0.05). They also reported a statistically significantly greater improvement in the VNSlp score at six months [baseline scores 6.10 ± 0.93 vs 6.02 ± 0.89; at 6 months: 2.29 ± 1.06 vs 2.83 ± 0.64 (p<0.05)] and SPADI at six months [baseline scores 51.50 ± 6.64 vs 52.88 ± 7.96; at 6 months: 27.44 ± 6.07 vs 30.63 ± 5.59 (p<0.05)] and in the VNSaat score at three months and six months [baseline scores 5.68 ± 0.99 vs 5.64 ± 0.92; at 3 months:2.50 ± 0.71 vs 2.85 ± 0.78 (p<0.05); at 6 months: 2.20 ± 0.98 vs 2.79 ± 1.06 (p<0.05)] for the US-guided group compared with the palpation-guided group. Please refer to table 1 for details.

The authors concluded that US-guided AC joint IA injection for the treatment of symptomatic AC joint OA resulted in better pain and functional status improvement than palpation-guided IA injection at the 6-month follow-up. However, these results need to be interpreted with caution as the treatment was carried out by a single physician in one centre and therefore may not be generalisable. As this is a retrospective chart review, the participants' information and recorded results may not have been accurate. The participants were not randomised, they chose their preferred intervention, and both the participants and the assessors (one of whom was the physician) were not blinded (they were aware of which intervention was used). In addition all the participants had BMIs of less than 30kg/m^2. All of these are likely to have introduced bias to the study.

Nam et al [15] conducted a randomised, prospective single-blinded clinical study (n=60) on the mid-term benefits and accuracy rate of US guided versus palpation guided intra-articular (IA) injections for the treatment of distal radioulnar joint (DRUJ) disorder. Participants were randomly assigned to undergo US-guided or palpation-guided IA injection.

The authors reported that US-guided IA injections showed significantly higher accuracy (100%) than palpation-guided IA injections (75.8%) into the DRUJ (p<0.05). They found that the primary outcome (Disability of the Arm, Shoulder, and Hand questionnaire (DASH)) and the secondary outcomes (VNS[g], Modified Mayo Wrist Score (MMWS), and range of movement (ROM)) all improved at one, three and six months in both groups but observed no significant difference in clinical outcome measures between the group receiving US-guided injections and the group receiving palpation-guided injections. However they observed a positive correlation between pain improvements and accuracy of IA injections at follow-up. DASH scores at baseline were 44.0 ± 8.5 vs 46.3 ± 10.2 for accurate vs inaccurate injections respectively; and scores at 6 months were 15.3 ± 4.1 vs 19.9 ± 2.3 (p<0.05) in favour of accurate injections. This is in contrast to DASH scores for US-guided versus palpation-guided injections with baseline scores of 44.3 ± 8.6 vs

[f] Successful treatment (significant pain relief) was defined as > 50% improvement in the VNS score and 20 point improvement in the SPADI) at one, 3, and 6 months after the injections.
[g] A successful outcome required a five-point Likert scale of 3 (good) or 4 (excellent) and a reduction on the VNS of >50 % and DASH of >15 points at 1, 3, and 6 months after the injection.

44.1 ± 8.9 and six months scores of 16.3 ± 4.1 vs 15.5 ± 4.4 (p=NS[h]). Please refer to table 1 for details.

These results need to be interpreted with caution for a number of reasons. The study was not double-blinded (only the assessors were blinded) and lack of blinding could have resulted in bias, particularly if a difference had been anticipated by patients. The palpation-guided IA injection was given by an experienced physician (seven years) which may not always be the case in clinical settings. This may have affected the accuracy rate. The relatively small number of inaccurate injections means that the study may not have been sufficiently powered to show a difference between the two groups. All the participants had BMIs of less than 30kg/m^2; this is not necessarily representative of the general OA population. The larger amounts of subcutaneous fat in obese patients are likely to have an effect on the accuracy of the injection.

Sibbitt et al (2011) reported the results from a single-blinded RCT (n=92) which addressed how sonographic needle guidance affects clinical outcomes of IA injection in patients with OA of the knee. Patients' pain was measured using the visual analogue scale (VAS) where 0cm signifies no pain and 10cm, unbearable pain.

The authors reported a significant reduction in pain mean scores with sonographic guidance relative to palpation guidance at two weeks (p=0.025) but this was not sustained at six months follow-up (p=1.0) (baseline pain mean scores were 7.5±2.0 versus 7.8±1.8 for the sonographic guidance versus palpation guidance groups respectively; scores at two weeks were 1.4± 2.1 versus 2.4±2.1). They also reported superior duration of therapeutic effect in months [4.2± 1.9 versus 3.1± 2.1 (p=0.01)], lower reinjection rates within 12 months [52% (24/46) versus 74% (34/46) (p=0.03)] and longer time to next procedure (reinjection or referral to surgery) [7.1± 3.2 versus 6.0± 2.8 (p=0.08, not significant)] with sonographic guidance. The authors also reported a significantly higher responder[i] rate with sonographic guidance of 67% (31/46) versus 33% (15/46) with palpation guidance (p=0.0004).

These results should be interpreted with caution as participants were not blinded to their treatment and no details of the randomisation methods used or concealment were provided.

Trials in progress
A search of clinicaltrials.gov identified two trials both of which have been discontinued.

- NCT01032720 – This was a randomised trial to determine if ultrasound-guided knee steroid injections are more effective than sham ultrasound knee steroid injections for the treatment of osteoarthritis. This study, which recruited 33 participants, was terminated in February 2012; no further details are available [17].
- NCT02104726 – This was an open label study to compare relative efficacy of intraarticular steroid injection using anatomic landmarks versus a fluoroscopy guided technique in decreasing knee osteoarthritis pain one month after the procedure. The

[h] NS = not statistically significant
[i] Responders were defined as those who had VAS <2cm

trial, which did not recruit any participants, was withdrawn in July 2016; no further details are available [18].

4.1.2 Cost-effectiveness

We found one cost-effectiveness study of the use of image guided intra-articular corticosteroid injections compared to non-image guided intra-articular corticosteroid injections conducted in the USA.

Sibbitt et al [16] reported the results from an RCT which addressed whether sonographic needle guidance affects clinical outcomes and used these to determine the cost effectiveness of IA injection in patients with OA of the knee.

The authors reported a number of data on costs: cost per year if patient was treated in the physician's office as $173 ± $81 for palpation-guided IA injection compared with $460 ± $207 for sonographic guidance (p=0.0001); cost per year for patients treated in hospital outpatient clinic as $126 ± $58 for palpation-guided IA injection compared with $109 ± $49 for sonographic guidance (p=0.13).

> *Cost per responder per year in a physician's office was reported as $531 ± $248 for palpation-guided IA injection compared with $1129 ± $307 for sonographic guidance (p=0.0001) and cost per responder per year in hospital outpatient clinic as $386 ± $180 for palpation guidance versus $162 ± $73 for sonographic guidance (p=0.0001). The authors concluded that the use of sonographic guidance in hospital outpatient clinics modestly reduced the cost per patient per year and cost per responder per year relative to palpation guided injections.*

These results should be interpreted with caution for the following reasons: very little information was provided and there was no information on the method of randomisation or concealment. The study was conducted in the USA and costings were based on the Medicare reimbursement system which is not universally applicable. The costs not supported by the system were omitted from the costings e.g. sonographic guidance provided in hospital outpatients were not reimbursed and hence the potential cost for this was not reflected in the calculations. This certainly would have skewed the cost difference between the two study arms. It is unclear how relevant these resources and costs are to the NHS in England.

Table 1: Summary of studies of image guided intra-articular corticosteroid injections compared to non-image guided intra-articular corticosteroid injections for patients with osteoarthritis

Study	Patients	Intervention	Comparator	Outcomes
Park et al 2015 [14] Seoul, Republic of Korea Retrospective comparative study (chart review)	Patients with OA of AC joint who had palpation or US guided IA corticosteroid between January 2012 & December 2013 n=100	US guided AC joint IA steroid injection (n=50) mixture of 0.5% lidocaine (1ml) + triamcinolone 20 mg/mL (0.5 ml) + radiographic contrast material (0.5 ml) Men: 11 (22%) Women: 39 (78%) Age: 57.8 ± 8.4 years BMI(kg/m^2): 22.9 ± 1.9 FU: 6.5 ± 2.3 months (Mean±SD)	Palpation (P) guided AC joint IA steroid injection (n=50) mixture of 0.5% lidocaine (1ml) + triamcinolone 20 mg/mL (0.5 ml) + radiographic contrast material (0.5 ml) Men: 12 (24%) Women: 38 (76%) Age: 59.1 ± 8.5 years BMI(kg/m^2): 22.8 ± 2.1 FU: 6.6 ± 2.2 months (Mean±SD)	**Successful (accurate) Injection as determined by the presence of contrast dye in the joint cavity by radiography (US vs P)** 96% (48/50) vs 60.5% (31/50) (p<0.05) **SPADI (US vs P)(Mean±SD)** Baseline 51.50 ± 6.64 vs 52.88 ± 7.96 At one month: 23.88 ± 4.57 vs 25.30 ± 7.56 (p=NS) At 3 months: 25.71 ± 5.01 vs 28.12 ± 6.75 (p=NS) At 6 months: 27.44 ± 6.07 vs 30.63 ± 5.59 (p<0.05) **VNSar (US vs P)** Baseline 5.16 ± 0.79 vs 5.02 ± 0.80 At one month: 2.16 ± 0.96 vs 2.18 ± 0.80 (p=NS) At 3 months: 2.45 ± 0.83 vs 2.56 ± 0.56 (p=NS) At 6 months: 2.47 ± 0.90 vs 2.29 ± 0.75 (p=NS) **VNSlp (US vs P)** Baseline 6.10 ± 0.93 vs 6.02 ± 0.89 At one month: 2.82 ± 0.69 vs 2.94 ± 0.89 (p=NS) At 3 months: 2.52 ± 0.86 vs 2.94 ± 0.89 (p=NS) At 6 months: 2.29 ± 1.06 vs 2.83 ± 0.64 (p<0.05) **VNSaat (US vs P)** Baseline 5.68 ± 0.99 vs 5.64 ± 0.92 At one month: 2.64 ± 0.78 vs 2.94 ± 0.89 (p=NS) At 3 months:2.50 ± 0.71 vs 2.85 ± 0.78 (p<0.05) At 6 months:2.20 ± 0.98 vs 2.79 ± 1.06 (p<0.05) **All (at rest, under local pressure, and the arm adduction test) of the VNS and SPADI after the injection improved significantly from baseline at one, 3, and 6 months in both groups (p<0.05 for each before vs after injection comparison).** Successful treatment (significant pain relief) was defined as > 50% improvement in the VNS score and 20 point improvement in the SPADI) at one, 3 and 6 months after the injections. **Safety – US vs P** Steroid-induced synovitis – 3 vs 1 Skin atrophy and depigmentation – 0 vs 2 No p values reported

Study	Patients	Intervention	Comparator	Outcomes
Nam et al 2013 [15] Seoul, South Korea Randomised, prospective, single-blinded study	Patients with DRUJ disorder n=60 (57 analysed)	US guided IA injection of 0.5ml Omnipaque + 1% lidocaine (0.25ml) + triamcinolone 20mg (0.5ml) into the DRUJ n=28 Mean age: 52.9 years Male: 10 Female: 18	Palpation guided IA injection of 0.5ml Omnipaque + 1% lidocaine (0.25ml) + triamcinolone 20mg (0.5ml) into the DRUJ n=29 Mean age: 54.1 years Male: 11 Female: 18	**Clinical outcome by method of injection guidance** **Primary outcome (US vs P)** **DASH** Baseline 44.3 ± 8.6 vs 44.1 ± 8.9 Score at one month: 21.1 ± 4.5 vs 22.8 ± 4.8 (p=NS) Score at 3 months: 12.8 ± 2.3 vs 14.17 ± 3.5 (p=NS) Score at 6 months: 16.3 ± 4.1 vs 15.5 ± 4.4 (p=NS) **Secondary outcome (US vs P)** **VNS** Baseline 6.5 ± 1.0 vs 6.4 ± 0.9 Score at one month: 2.6 ± 0.8 vs 3.0 ± 0.9 (p=NS) Score at 3 months: 2.7 ± 1.0 vs 3.1 ± 0.8 (p=NS) Score at 6 months: 3.3 ± 1.1 vs 3.5 ± 0.7 (p=NS) **MMWS** Baseline 56.5 ± 6.4 vs 55.3 ± 5.1 Score at one month: 73.6 ± 3.1 vs 72.6 ± 4.1 (p=NS) Score at 3 months: 83.9 ± 3.2 vs 82.2 ± 3.4 (p=NS) Score at 6 months: 80.1 ± 5.0 vs 81.0 ± 4.1 (p=NS) **ROM** Pronation Baseline 63.4 ± 4.5 vs 63.6 ± 5.2 Score at one month: 83.5 ± 3.7 vs 82.1 ± 3.8 (p=NS) Score at 3 months: 82.7 ± 5.7 vs 80.1 ± 4.3 (p=NS) Score at 6 months: 80.3 ± 4.5 vs 79.4 ± 3.8 (p=NS) Supination Baseline 63.5 ± 4.5 vs 63.4 ± 5.9 Score at one month: 82.0 ± 3.4 vs 81.4 ± 3.5 (p=NS) Score at 3 months: 84.7 ± 5.4 vs 83.2 ± 4.3 (p=NS) Score at 6 months: 85.4 ± 5.6 vs 83.7± 4.5 (p=NS) **All outcomes after the injection improved significantly from baseline at one, 3 and 6 months in both groups but there were no significant differences in clinical outcome between the US guided and the palpation guided groups.** A successful outcome required a five-point Likert scale of 3 (good) or 4 (excellent) and a reduction on the VNS of >50 % and DASH of >15 points at 1, 3, and 6 months after the injection.

Study	Patients	Intervention	Comparator	Outcomes
				Successful (accurate) injection as determined by the presence of contrast dye (Omnipaque) in the joint cavity by radiography (US vs P) 100% (28/28) vs 75.8% (22/29) (p<0.05) **Clinical outcome by accuracy of injection** **Primary outcome (Accurate vs Inaccurate)** **DASH** Baseline 44.0 ± 8.5 vs 46.3 ± 10.2 Score at one month: 21.3 ± 4.3 vs 26.6 ± 5.6 (p<0.05) Score at 3 months: 12.8 ± 2.5 vs 18.6 ± 1.4 (p<0.05) Score at 6 months: 15.3 ± 4.1 vs 19.9 ± 2.3 (p<0.05) **Secondary outcome (Accurate vs Inaccurate)** **VNS** Baseline 6.4 ± 1.0 vs 6.6 ± 0.5 Score at one month: 2.6 ± 0.7 vs 4.1 ± 0.4 (p<0.05)) Score at 3 months: 2.8 ± 0.9 vs 3.3 ± 0.9 ((p<0.05) Score at 6 months: 3.3 ± 0.9 vs 4.0 ± 0.0 (p<0.05) **MMWS** Baseline 56.0 ± 6.0 vs 55.3 ± 3.9 Score at one month: 73.4 ± 3.7 vs 70.7 ± 1.5 (p<0.05) Score at 3 months: 83.6 ± 3.2 vs 79.0 ± 1.6 (p<0.05) Score at 6 months: 80.8 ± 4.7 vs 78.4 ± 2.0 (p=NS) **ROM** <u>Pronation</u> Baseline 63.7 ± 4.6 vs 62.1 ± 6.5 Score at one month: 83.3 ± 3.7 vs 78.9 ± 1.3 (p<0.05) Score at 3 months: 86.7 ± 5.7 vs 81.1 ± 1.7 (p<0.05) Score at 6 months: 84.3 ± 4.8 vs 77.4 ± 2.1 (p<0.05)) <u>Supination</u> Baseline 63.6 ± 5.1 vs 62.1 ± 6.5 Score at one month: 82.2 ± 3.4 vs78.4 ± 1.4 (p<0.05) Score at 3 months: 85.9 ± 5.2 vs 80.8 ± 1.3 (p<0.05) Score at 6 months: 83.2 ± 4.6 vs 76.7± 2.5 (p<0.05) **All outcomes after the injection improved significantly from baseline at one, 3, and 6 months in both groups. There was a statistically significant improvement in the VNS, DASH and ROM in the accurate injection group compared with the inaccurate injection group at one, 3 and 6 months but not the MMWS at 6 months.**

Study	Patients	Intervention	Comparator	Outcomes
				Safety – US vs P Steroid-induced synovitis – 2 vs 1 Skin atrophy and depigmentation – 0 vs 2 No p values reported
Sibbitt et al 2011 [16] New York, USA Single-blinded RCT and cost-effectiveness study	Non-effusive knees with OA n=92	Sonographic image guided injection (80mg triamcinolone) enhanced with one-handed mechanical syringe. n=46	Palpation guided anatomic landmark injection (80mg triamcinolone). n=46	**Pre-procedure baseline pain on VAS scores – mean (SD) (P vs US)** 7.8 (1.8) vs 7.5 (2.0) (p=0.45) **Pain at 2 weeks using VAS scores (P vs US)** 2.4 ± 2.1 vs 1.4 ± 2.1 (p=0.025) – 42% difference **Pain at 6 months using VAS scores (P vs US)** 6.3± 2.9 vs 6.3± 2.6 (p=1.0) **Duration of therapeutic effect (months) (P vs US)** 3.1± 2.1 vs 4.2± 1.9 (p=0.01) **Time to next procedure (reinjection or referral to surgery) (P vs US)** 6.0± 2.8 vs 7.1± 3.2 (p=0.08) **Reinjection within 12 months (P vs US)** 74% (34/46) vs 52% (24/46) (p=0.03) **Referral to surgery within 12 months (P vs US)** 7% (3/46) vs 4% (2/46) (p=0.7) **Responders at 2 weeks (P vs US)** 33% (15/46) vs 67% (31/46) p=0.0004 **Cost per year - physician's office (P vs US)** $173 ± $81 vs $460 ± $207 (p=0.0001) **Cost per year – hospital outpatient (P vs US)** $126 ± $58 vs $109 ± $49 (p=0.13) **Cost per responder per year - physician's office (P vs US)** $531 ± $248 vs $1129 ± $307 (p=0.0001) **Cost per responder per year – hospital outpatient (P vs US)** $386 ± $180 vs $162 ± $73 (p=0.0001) Responders were defined as those who had VAS <2cm VAS goes from 0- to 10cm; where 0cm is no pain and 10cm unbearable pain. VAS<2cm is regarded as asymptomatic and significant pain is defined as >5cm

Study	Patients	Intervention	Comparator	Outcomes
				Details of data on those treated in the physicians' office and in hospital outpatients were not provided. Ultrasound guided procedure in hospital outpatients is not reimbursed by Medicare so the authors only included $2 per procedure for each mechanical syringe and hence the true costs were missing.

Abbreviations: AC joint - acromioclavicular joint; BMI – body mass index; DASH - Disability of the Arm, Shoulder and Hand questionnaire; DRUJ - distal radioulnar joint; FU - follow-up; IA - intra-articular; MMWS - Modified Mayo Wrist Score; NS – not significant; OA - osteoarthritis; P – palpation; ROM - range of motion; SD – standard deviation; SPADI - Shoulder Pain and Disability Index; US - ultrasound; VAS - visual analogue scale; VNS - Verbal Numeric pain Scale; VNSar - Verbal Numeric pain Scale at rest; VNSlp - Verbal Numeric pain Scale under local pressure; VNSaat - Verbal Numeric pain Scale arm adduction test

4.2 Safety

The study by Park et al [14] reported that three patients in the US-guided group and one patient in the palpation group complained of pain due to steroid-induced synovitis. Skin atrophy and depigmentation were observed in two patients in the palpation group and none in the US-guided group. There were no severe complications, such as septic arthritis or allergic reactions.

Due to the retrospective nature of the study, it is possible that some of the adverse effects experienced by the patients were not documented.

Nam et al [15] also reported almost identical safety issues “two patients in US-guided group and one patient in the palpation group complained of pain due to steroid-induced synovitis. Skin atrophy and depigmentation were observed in two patients in the palpation group, none in the US-guided group. There were no severe complications, such as septic arthritis, allergic reactions and tendon ruptures”.

4.3 Summary of findings

We did not find any systematic reviews. However, we identified three clinical effectiveness studies, one of which assessed the cost-effectiveness of image guided intra-articular corticosteroid injections compared to non-image guided intra-articular corticosteroid injections in patients with osteoarthritis. The cost-effectiveness study was conducted in the USA.

The retrospective study by Park et al [14] reported statistically significant improvements in patients with OA of the AC joint in all outcome measures at one, three and six months after the injections in both the US and the palpation-guided groups. They also reported a statistically significantly greater improvement in two of the four outcome measures (VNSlp score and SPDAI) at six months and in one of the four measures (VNSaat score) at three months and six months for the US-guided group compared with the palpation group. However, it is unclear what the clinical relevance of the differences observed in these outcome measures is. In addition, given that the participants chose their preferred intervention, the study was retrospective and conducted in one centre by a single physician (also one of the assessors), the potential for bias is substantial and therefore the results should be interpreted with caution.

The randomised prospective single-blinded clinical study by Nam et al [15] reported significantly higher accuracy (100%) with US-guided than with palpation-guided IA injections (75.8%) in patients with DRUJ disorder. They found that all clinical outcome measures were improved at one, three and six months in both the groups receiving US-guided injections and those receiving palpation-guided injections but found no significant difference between the groups. However, they reported a positive correlation between pain improvements and accuracy of IA injections at six months follow-up. These findings may not be generalisable because the palpation-guided IA injection was given by an experienced physician (seven years) which may not always be the case in clinical settings. This may have affected the accuracy rate. In addition, the relatively small number of inaccurate injections means that the study may not have been sufficiently powered to show any difference between the two types of injection guidance.

Both studies only included patients with BMI of less than 30kg/m^2; this does not necessarily represent the general OA population. The distance between the skin and bone in obese patients is likely to have an effect on the accuracy of the injection.

Sibbitt et al [16] reported the results from an RCT as well as the cost effectiveness of IA injection in patients with OA of the knee. The authors reported significant pain reduction with sonographic guidance relative to palpation guidance at two weeks which was not sustained at six months follow-up. They also reported superior duration of therapeutic effect with sonographic guidance compared to palpation guidance and a lower rate of reinjection within 12 months with sonographic guidance. However, there is potential for bias in the results reported because participants were not blinded to the treatment they received.

The authors reported a number of data on costs based on the USA Medicare system: for patients treated in the physician's office they reported a significantly lower cost per patient per year and cost per responder per year for palpation-guided IA injection compared with sonographic guidance. In contrast, for patients treated in hospital outpatient clinic, they reported a significantly lower cost per responder per year with sonographic guidance compared with palpation guidance, but no difference in cost per patient per year for the two groups.

The authors concluded that the use of sonographic guidance in hospital outpatient clinics modestly reduced the cost per patient per year and cost per responder per year relative to palpation guided injections. However it should be noted that the sonographic needle guidance procedure in hospital outpatients is not reimbursed by Medicare so the authors only included $2 per procedure for each mechanical syringe and hence the true costs were missing. The relevance of these results outside of the Medicare system is therefore questionable.

5 Equity issues

It is not known whether there is variation in access to image guided intra-articular corticosteroid injections compared to non-image guided intra-articular corticosteroid injections for patients with osteoarthritis across providers in the NHS Birmingham and Solihull CCG, Sandwell and West Birmingham CCG, and Walsall, Wolverhampton and Dudley CCGs areas, or how access compares to the rest of England.

6 Discussion and conclusions

Question 1

In adults with a painful joint due to osteoarthritis, is image guided intra-articular corticosteroid injection clinically effective compared to non-image guided intra-articular corticosteroid injection?

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We did not find any high quality evidence to support the clinical effectiveness of image guided intra-articular corticosteroid injections compared to non-image guided intra-articular corticosteroid injections, although some lower quality evidence was found.

Evidence from a low quality study (retrospective chart review) [14] suggests that US guided intra-articular corticosteroid injections for osteoarthritis of the AC joint significantly improves some clinical outcome measures (VNSlp score and SPADI score at six months and VNSaat score at three months and six months)[j] compared to palpation guided intra-articular corticosteroid injections. The clinical relevance of the difference seen in these outcome measures is uncertain. In addition, a moderate quality study (single-blinded RCT) [16] also suggests that sonographic guided intra-articular corticosteroid injections significantly improves pain relative to palpation guided injections in patients with osteoarthritis of the knee after two weeks (although this was not sustained at six months follow-up), reduces reinjection rates within 12 months and increases the time to the next procedure. However, the lack of blinding of the participants to the treatments they received means that there was potential for bias in the results.

These findings conflict with those from a moderate quality prospective single-blinded randomised controlled study [15] which reported no difference in the clinical outcomes measured between US guided and palpation guided IA corticosteroid injections for patients with DRUJ disorder.

Evidence from this study of DRUJ injections [15] suggests that US guided IA corticosteroid injections into the DRUJ have a higher accuracy rate relative to palpation guided IA corticosteroid injections (100% versus 75%; $p<0.05$). The authors also suggest a positive correlation between accuracy and improvement in clinical outcomes measured ($p<0.05$). However, the study may not have been sufficiently powered to show any differences between outcomes for US guided compared to palpation guided injections due to the relatively small number of inaccurate injections in the latter group.

Question 2
In adults with a painful joint due to osteoarthritis, is image guided intra-articular corticosteroid injection cost effectiveness compared to non-image guided intra-articular corticosteroid injection?

We did not find any high or moderate quality evidence to support the cost-effectiveness of image guided intra-articular corticosteroid injections compared to non-image guided intra-articular corticosteroid injections.

> *We found one cost-effectiveness study of sonographic guided versus palpation guided IA corticosteroid injections in patients with osteoarthritis of the knee based on an RCT conducted in the USA. The study based its costs on the Medicare reimbursement system which is unique to the USA. It is therefore unclear how these results relate to the NHS in England.*

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[j] SPADI - Shoulder Pain and Disability Index; VNSlp - Verbal Numeric pain Scale under local pressure; VNSaat - Verbal Numeric pain Scale arm adduction test

7 Search Strategy

Search date: 14th September 2018

We searched Medline, Embase and Cochrane Library, limited to 2008 onwards and English only. We also ran a search of TRIP database and NICE Evidence search with similar limits and restricting to Evidence Reviews. We excluded letters, commentary, case reports and conference papers.

Search terms
Medline:

1 exp Adrenal Cortex Hormones/
2 Injections, Intra-Articular/
3 1 and 2
4 ((intraarticular or intra-articular or inject*) adj5 (steroid* or corticosteroid* or glucocorticoid*)).ti,ab.
5 ((intraarticular or intra-articular or injection*) adj5 (triamcinolone or methylprednisolone or prednisolone)).ti,ab.
6 3 or 4 or 5
7 (imag* adj5 guid*).ti,ab.
8 (ultraso* or ultra-so* or sonogra* or doppler or fluoroscop*).ti,ab.
9 exp Ultrasonography/
10 7 or 8 or 9
11 6 and 10
12 (imag* adj3 guid* adj5 (steroid* or corticosteroid* or glucocorticoid*)).ti,ab.
13 ((steroid* or corticosteroid* or glucocorticoid*) adj5 imag* adj3 guid*).ti,ab.
14 (imag* adj3 guid* adj5 (triamcinolone or methylprednisolone or prednisolone)).ti,ab.
15 ((triamcinolone or methylprednisolone or prednisolone) adj5 imag* adj3 guid*).ti,ab.
16 11 or 12 or 13 or 14 or 15
17 (comment or editorial or letter or news or "review").pt. or case report.ti.
18 16 not 17
19 limit 18 to (english language and yr="2008 -Current")
20 limit 11 to "reviews (maximizes specificity)"
21 limit 20 to (english language and yr="2008 -Current")
22 19 or 21

Embase

1 exp corticosteroid/ar
2 ((intraarticular or intra-articular or inject*) adj5 (steroid* or corticosteroid* or glucocorticoid*)).ti,ab.
3 ((intraarticular or intra-articular or injection*) adj5 (triamcinolone or methylprednisolone or prednisolone)).ti,ab.
4 1 or 2 or 3
5 (imag* adj5 guid*).ti,ab.
6 (ultraso* or ultra-so* or sonogra* or doppler or fluoroscop*).ti,ab.
7 *exp echography/

8 5 or 6 or 7
9 4 and 8
10 (imag* adj3 guid* adj5 (steroid* or corticosteroid* or glucocorticoid*)).ti,ab.
11 ((steroid* or corticosteroid* or glucocorticoid*) adj5 imag* adj3 guid*).ti,ab.
12 (imag* adj3 guid* adj5 (triamcinolone or methylprednisolone or prednisolone)).ti,ab.
13 ((triamcinolone or methylprednisolone or prednisolone) adj5 imag* adj3 guid*).ti,ab.
14 9 or 10 or 11 or 12 or 13
15 (conference* or comment or editorial or letter or news or "review").pt. or case report.ti.
16 14 not 15
17 limit 16 to (english language and yr="2008 -Current")
18 limit 9 to "reviews (maximizes specificity)"
19 limit 18 to (english language and yr="2008 -Current")
20 17 or 18

Table 2: Inclusion criteria for identification of relevant studies

Question	Population	Indication	Intervention	Comparator	Outcomes	Studies
In adults with a painful joint, what is the clinical and cost effectiveness of image guided intra-articular corticosteroid injections compared to non-image guided intra-articular corticosteroid injections?	Adults with a painful joint (exclude : inflammatory joint conditions - RA, gout, psoriatic arthritis)	Pain management in degenerative joints due to osteoarthritis	Image guided therapeutic intra-articular joint injections with corticosteroids with/without local anaesthetic Exclude: arthrocentesis for any reason	Non image-guided intra-articular joint injections with corticosteroids	Clinical effectiveness including Pain Function/mobility QoL AE Cost effectiveness Subsequent arthroplasty	Standard evidence review in order to be robust enough to influence/change clinical practice. SRMA SR of RCTS RCT SR Prospective cohort studies Retrospective cohort studies Cost effectiveness studies

Inclusion Criteria
Peer reviewed publications
English language

Exclusion Criteria
Abstracts
Letters
Commentaries
Conference papers
Case reports
Papers published more than 10 years ago
Papers published online subsequent to the search date

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9 Clinician comments after 3 week consultation of the draft evidence review

Date	Clinician	Comments	SPH response
	Jamie Arbuthnot Consultant Trauma & Orthopaedics Good Hope & Solihull Hospital	Can you confirm that this is image guided injections as a treatment rather than as a diagnostic measure please?	Yes, we can confirm that the rapid evidence review relates to image guided injections as a treatment. We will clarify this in the title of the document.
28/11/2018	Mr Andrew M Pearson Executive Medical Director & Consultant Orthopaedic Surgeon The Royal Orthopaedic Hospital NHS Trust	Thank you for sending me the details of this consultation. I have listed some of my personal observations below which you and your team may or may not find helpful in arriving at a decision. 1. Patients should always be managed with pharmacological and lifestyle modifications before referral to secondary care for any type of injection 2. Injections can be used for diagnostic or therapeutic purposes. Particularly in the case of patients with lower back and hip joint pain a hip injection can be useful in differentiating pain arising from the hip and back. 3. Whether image-guidance is required when undertaking a joint injection depends very much on which joint if being injected. For example the knee joint never requires the use of image guidance to be sure that the injection is performed intra-articularly. But in the hip joint it always requires the use of image-guidance to be sure that the injection is in the right place. 4. I see far too many patients in secondary care who have allegedly had joint injections conducted in primary care where the outcome is questionable, but where I have little confidence that the injection actually entered the joint as intended.	Thank you very much for these helpful comments. We will include them in section 9 of the report so that they are available for discussion with the rest of the rapid evidence review. We have clarified in the title that the review relates to injections for treatment rather than diagnostic purposes. We found no studies of the comparative effectiveness of image guided versus palpation guided intra-

		5. I areas where there are important structures nearby, such as the hand, it is important that intra-articular injections are supported by image-guidance. I would be very happy to be involved in any way that I can in order to help further with this consultation	articular injections in the hand.
04/12/2018	Mr. Samir Massoud Consultant Trauma & Orthopaedics - University Hospitals Birmingham NHS Foundation Trust Queen Elizabeth Hospital, Queen Elizabeth Medical Centre, Birmingham	Thanks, The review of injections for arthritis is difficult to comment on because of lack of evidence. As far as I know, ultrasound guided injection of the subacromial space for impingement is much more common than these injections and may be worth investigating as these are fairly simple to do without ultrasound guidance. This would be a more likely source of savings. In my practice, more than 90% of shoulder injections are done in my clinic at the ROH with no ultrasound guidance.	Thank you very much for these helpful comments. This was a review of intra-articular joint injections, and hence injections into the subacromial space were not within scope of this review. We will include your comments in section 9 of the report so that they are available for discussion with the rest of the rapid evidence review.
06/12/2018	Geoff Naylor Clinical Director Planned Care BSOL	Bsol CCG have data suggesting quite a lot of these injections are done by a select few of orthopaedic surgeons mainly in the independent sector on the NHS ECN contract. Not just for the shoulder, but also CMC joint injection injections	Thank you very much for your comment. We will include it in section 9 of the report so that it is available for discussion with the rest of the rapid evidence review.
06/12/2018	William Goude Walsall Healthcare NHS Trust	I agree that making decisions based on 3 low power studies, none of which look at sub acromial or CMCJ injections is not	Thank you very much for these helpful comments and clinical opinion. We will

		possible. My personal practice is to perform the majority of sub acromial injections in the clinic, but if it is an important diagnostic test (e.g if the patient has symptoms from the cervical spine etc as well) I will get the injection ultrasound guided. As upper limb surgeons we are probably confident to perform these injections ourselves in the clinic, but this may not be the case for our juniors or some of our colleagues.	include them in section 9 of the report so that they are available for discussion with the rest of the rapid evidence review. This was a review of intra-articular joint injections, and hence injections into the sub acromial space were not within scope of this review. We found no studies of the comparative effectiveness of image guided versus palpation guided intra-articular injections in the hand/CMCJ.
06/12/2018	Mike Craigen Consultant Orthopaedic and Hand surgeon Trauma & Orthopaedics - University Hospitals Birmingham NHS Foundation Trust	Thank you for your request. I am a hand surgeon managing problems in the elbow wrist and hand and therefore have no experience of high volume intraarticular injections as these would be inappropriate in these areas. As to image guided joint injections this has been my standard practice for all my consultant career, normally using x ray but occasionally using ultrasound. You seem to have found the few studies that are published. The rationale is that if the injection fails to resolve the symptoms one possible explanation is failure to inject into the joint (easy to do in the hand and wrist), a problem avoided if image guidance is used. In addition you don't seem to have made any comment on the complications of injecting steroid outside the joint, including fat necrosis and tendon injury, again a higher risk in the hand due to the number of tendons in close proximity. I would support a recommendation that injections in the hand	Thank you very much for these helpful comments and clinical opinion. We found no studies of the comparative effectiveness of image guided versus palpation guided intra-articular injections in the hand. We will include your comments in section 9 of the report so that they are available for discussion with the rest of the rapid evidence review.

		and wrist should be performed under image guidance although I would prefer under x ray by an specialist in that area would be my preferred choice. I would be happy to provide further input.	
06/12/2018	*Richard Dias* *Clinical Director, Trauma & Orthopaedics* *Consultant Orthopaedic Hand & Upper Limb Surgeon* *Honorary Senior Lecturer, University of Birmingham*	I agree with Samir that subacromial space injections for impingement are easy to do without ultrasound guidance. I suspect it is the physiotherapists that use ultrasound for these injections. I totally agree with Mike Craigen that all injections into the hand and wrist should be done under image guidance. In clinical practice we often see patients who have had blind injections to the small joints of the hand with no benefit at all and the lack of confidence in further injections.	Thank you very much for these helpful comments and clinical opinion. We will include them in section 9 of the report so that they are available for discussion with the rest of the rapid evidence review. This was a review of intra-articular joint injections, and hence injections into the subacromial space were not within scope of this review. We found no studies of the comparative effectiveness of image guided versus palpation guided intra-articular injections in the hand.
06/12/2018	Mr. Rajive Jose Consultant, Hand Surgery Burns & Plastics - University Hospitals Birmingham NHS Foundation Trust Queen Elizabeth Hospital Birmingham,	My practice is the same as Mike Craigen and I echo his comments regarding injections in the hand.	Thank you for your comment. Please see comments above.

06/12/2018	Mr. Mark Brewster Hand Surgery - Consultant Trauma & Orthopaedics - University Hospitals Birmingham NHS Foundation Trust Queen Elizabeth Hospital Birmingham	I must admit that I perform almost all injections without USS or XR I do use XR for CMCJ and STT but all soft tissue injections, wrist joint/TFCC and MCPJs injection I do in the clinic with anatomical guidance only.	Thank you very much for these helpful comments. We will include them in section 9 of the report so that they are available for discussion with the rest of the rapid evidence review.
06/12/2018	Mr. Alastair Marsh Consultant Orthopaedic Trauma Surgeon Clinical Lead Major Trauma Service Trauma & Orthopaedics - University Hospitals Birmingham NHS Foundation Trust Queen Elizabeth Hospital Birmingham	You have done a few though Mike! The important thing is that the joints that are difficult to get into, you do with guidance. Most common reasons for joint injections to not work are wrong joint or not in joint to start with. As a foot and ankle Surgeon I use xray guidance almost always so that I have the confidence that I have placed it where I want it. It also reduced the risk of fat necrosis in the foot and plantar plate rupture around the toes. It allows me to see the joint as well to confirm stability as well.	Thank you very much for these helpful comments and clinical opinion. We will include them in section 9 of the report so that they are available for discussion with the rest of the rapid evidence review. We found no studies of the comparative effectiveness of image guided versus palpation guided intra-articular injections in the ankle or foot.
06/12/2018	Paul Parker University Hospitals Birmingham NHS Foundation Trust	I just guess where the hip is..... Or not.....	
06/12/2018	Seyed A Ali Trauma & Orthopaedic Consultant University Hospitals Birmingham NHS Foundation Trust Selly Oak Hospital	I completely agree with Alastair Marsh. Being a Foot & Ankle Surgeon, I always use X-ray guidance to inject small joints of the foot for reasons mentioned by Alastair. Thank you.	Thank you very much for your helpful comment and clinical opinion. We will include it in section 9 of the report so it is available for discussion with the rest of the rapid evidence review.

			We found no studies of the comparative effectiveness of image guided versus palpation guided intra-articular injections in the ankle or foot.
10/12/2018	Paresh Jobanputra (Rheumatology) University Hospitals Birmingham NHS Foundation Trust	Evidence review: The focus of the review is rather narrow but I suspect the search strategy is sufficiently accurate in terms of the literature for osteoarthritis. However since a large number of injections are done for shoulder pain, and one might argue that much rotator cuff disease is due to AC joint OA, a broader perspective should have been taken to allow the commissioners to make a more informed decision. There are more studies for shoulder pain and several systematic reviews. We should also bear in mind that injections for OA, however they are delivered, have limited efficacy so evidence from systematic reviews of these should have been described to give commissioners a broader perspective. Current clinical practice: I suspect there is considerable practice variation both in primary care and in secondary care. We do not have a local protocol for this but I believe that many hard pressed clinicians are asking for radiology-based injections because of time pressures and also a prevalent belief that the latter are more effective. It would seem appropriate to commission a clear physiotherapy based triage pathway for patients with isolated joint pains such as knee pain, shoulder pain and hand osteoarthritis. Clinical opinion: I suspect that all injections for OA have a large placebo element so a pragmatic approach whereby clinical landmark-based injections done by an experienced practitioner in an appropriate setting, as a first step, is	Thank you very much for these helpful comments and clinical opinion. We will include them in section 9 of the report so that they are available for discussion with the rest of the rapid evidence review. Regarding shoulder pain, separate rapid evidence reviews were carried out on the effectiveness of high volume joint injections and on the effectiveness of subacromial decompression.

		sensible. It seems reasonable to consider an US guided injection in resistant cases especially if these could avoid more invasive therapy. The definition of 'resistant' needs care bearing in mind that, for established OA, injections have limited efficacy. I can only speculate about the number of patients but, given the prevalence of shoulder pain (including AC OA), knee pain (including all grades of OA) and hand pain (DIP and CMC joint disease), I suspect the population burden and consultations in primary care and secondary care are substantial.	
12/12/2018	Michael Waldram SOH Trauma Consultant SOH Trauma Trauma - University Hospitals Birmingham NHS Foundation Trust Queen Elizabeth Hospital, Queen Elizabeth Medical Centre	I have been in Consultant Hand surgery practice for 35 yrs I entirely echo the comments of Mike Craigen	Thank you for your comment. Please see comments above.
12/12/2018	Munawar Shah Walsall Healthcare NHS Trust	I am upper limb consultant for nearly 17 years have been injecting 90% without xray or US however I do have US available to me in clinic and hence use it when required but agree with rest	Thank you very much for these helpful comments. We will include them in section 9 of the report so that they are available for discussion with the rest of the rapid evidence review.

Competing Interest

All SPH authors have completed the ICMJE uniform disclosure form (www.icmje.org/coi_disclosure.pdf) and declare: grants from Solihull CCG, Birmingham CrossCity CCG and Birmingham South Central CCG to SPH to undertake the submitted work, no financial relationships with any organisations that might have an interest in the submitted work in the previous three years and no other relationships or activities that could appear to have influenced the submitted work.

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