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2022

Ultrasound guided corticosteroid injection for adhesive capsulitis

A case study

Society Of Musculoskeletal Medicine
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Introduction

Adhesive capsulitis (AC) affects 2-5% of the general population and is a painful and debilitating condition resulting in progressive restricted active and passive glenohumeral movement (Fields et al., 2019). Boyle-Walker et al., (1997) early demographic studies show most patients with AC (84%) fall between the ages of 40-60 and it affects women and the non-dominant side in 70% of cases (Fields et al., 2019; Boyle-Walker et at., 1997). Patients with diabetes mellitus are five times more likely to develop AC compared to the general population (Fields et al.,2019). In some cases patients may present with bilateral AC. This may suggest an underlying systemic cause (Ryans et al., 2005). The condition is usually classified as primary (idiopathic) or secondary due to trauma, surgery or associated with conditions such as diabetes mellitus and cardiovascular disease (Page et al,. 2010).

The exact molecular mechanism and pathophysiology is still unclear, however the condition is associated with an capsular inflammation coupled with dysregulated fibrosis, contraction and synovial thickening (Challoumas et al, 2020). There is no definitive consensus on the exact limitation of range of motion in this condition (Robinson et al,. 2012). However, commonly patients will present with a capsular pattern *i.e.* loss of external rotation followed by abduction, internal rotation and flexion (Manske et al,. 2008). AC is characterised through three overlapping stages, *(Stage 1 - Pain)* lasting 2-9 months, *(Stage 2 - Stiffness)* lasting 4-12 months and *(Stage 3 - Recovery)* lasting 5-24 months (Challoumas et al, 2020). However, this characteristic is only an estimated time frame. Many patients can also experience symptoms at five and six years (Hand et al, 2008).

The intentions of this case study is to describe and analyse the outcomes of ultrasound-guided corticosteroid injection on a patient with adhesive capsulitis.

History and Examination

Case description

A 41-year-old female hairdresser with diffuse acute left shoulder pain that had gradually worsened the last 4 months. She was having more difficulty with activities of daily living (ADL), sleeping on the painful side and having increasingly sharper and more long lasting pain with certain shoulder movements. She struggles to

identify the exact cause of the pain, but felt the pain was worse during and after activity. On the visual analog scale (VAS) she reported 9-10/10 at its worst, and varying between 3-7/10 constantly during the day in general. She also reported the pain becoming sharper and noted more pain around the deltoid area and her elbow the last two weeks. There were no reported recent or old trauma during the history taking.

Medical history: No known comorbidities, autoimmune diseases or allergies. Recent blood test revealed low B- and D-vitamins 2 months prior. The GP advised supplements and exercise. The patient had not taken x-ray, MRI or ultrasound and was not on any other medications and had not undergone any surgery in her lifetime.

Medications: Completed non-steroidal anti-inflammatory medications (10 days) with limited effect. Takes B- and D-vitamin supplements and omega-3 tablets.

Social: Married, two children 8 and 10 years old. Hairdresser for 20 years working full time.

Examination and Diagnosis

Observation and Pain: Upon observation, the patient had an antalgic and guarded posture which most likely was due to compensatory mechanism and fear of pain. She presented with left antero-lateral shoulder pain, guarding/antalgic posture and limited range of motion. Affected arm was braced against the body and there was a lack of willingness to use the affected side. There were no visible edema or skin changes around the shoulder region. She had also noticed an increased stiffness in her cervical region. She did not report any headaches.

Palpation: Palpation around the coracoid process, bicipital groove and antero-lateral deltoid were notably tender and hypersensitive compared to the contralateral side. The patient's cervical region was cleared with full ROM and negative spurlings, kemp and compression/distraction tests. However, she was tender around the middle and upper trapezius area.

Neurological screen: Upper extremity deep tendon reflexes and dermatome testing were cleared. Strength tests of fingers, elbow and wrist were also cleared. However, isometric strength testing of the shoulder in all directions revealed weakness and pain on the affected side (3/5) compared to (5/5) on the contralateral side.

Range of motion (ROM): Restricted and painful active ROM with hiking of the shoulder during abduction, internal- and external rotation and flexion. Passive ROM revealed loss of passive external rotation, abduction, flexion and internal rotation. All movements were painful towards the end-range. Flexion was the least painful direction during the examination, external and internal rotation was the most painful. The range of motion was visually compared with the contralateral side which revealed pain free and normal end-range flexion, abduction, flexion and abduction.

Joint integrity/mobility: End-feel during ROM testing was empty and painful. No sign of hypermobility/instability when assessing the normal and affected side.

Orthopaedic special tests: Coracoid pain test, Empty-full can, Neers, Hawkin-kennedy and Speeds tests were all painful and positive on left side. Drop arm test, crossarm test and apprehension test were negative but also difficult to interpret due to the patient's pain during the special tests.

Sonographic findings: Normal rotator cuff, subacromial and subcoracoid bursa and suprascapular notch were noted. However, ultrasound revealed synovial sheath effusion and hyperemia around the long head of biceps brachii tendon (LHBBT) with no sign of disruption of tendon fibers. Increased coracohumeral ligament (CHL) thickness at 1.1mm. The cut-off value of CHL is 0,7mm for diagnosis of AC (Tandon et al., 2017). On dynamic examination, abduction and external rotation revealed lack of isolated muscular movement during testing and axillary recess capsule thickness measured at 3.6mm on affected side and 1,9mm on non-affected side. Axillary capsule recess measured >2mm is indicative of AC with good sensitivity and specificity (Sernik et al., 2019). An axillary capsule recess measured at >4mm alone was 95% specific and 70% sensitive for the diagnosis of AC (Park et al.,2016). ***Fig.1.*** from Park et al. (2016) illustrates the probe position (A) and measurement of the axillary recess (B). At this stage additional x-ray was not needed since there was no sign of sinister pathology, instability or fractures. In patients with AC, plain x-ray are usually unremarkable (Zappia et al., 2016). However, x-ray can also be used to rule out underlying pathology, loose bodies and periarticular calcifications when ultrasound is not readily available (Zappia et al., 2016).

Diagnose

The diagnosis of adhesive capsulitis was determined by the patient's acute and progressive shoulder pain, impaired activities of daily living, decreased active/passive ROM coupled with clear capsular pattern, muscle weakness and supporting sonographic findings.

Treatment Plan

The main goal of treatment is to educate the patient about the condition, significantly reduce pain and regain normal shoulder function. Indications for use of intra articular cortisone injections for this patient was the combination of progressive acute shoulder pain associated with decreased shoulder strength and AROM/PROM, impaired activities of daily living and function with supporting sonographic findings for adhesive capsulitis . The patient was cleared for contraindications and educated about side-effects, complications and benefits. The patient gave written and verbal consent after acquiring information about the possible complications and side effects. *Table 1* includes contraindications and complications with corticosteroid injections in musculoskeletal medicine. Complications from corticosteroid injections are rare. However, the patient should be counselled and informed about the possible risks pertaining to each specific injection therapy (Stehepns et al., 2008).

Kim Hwee Koh (2016) conducted a systematic review to assess the efficacy and safety of IA cortisone injections for AC and to evaluate the optimum dose. Doses of 20 mg and 40 mg triamcinolone glenohumeral injections showed identical outcomes and up to 3 injections were noted beneficial at 6-16 weeks from first injection (Shah & Lewis 2006; Kim Hwee Koh 2016). Also, there was limited evidence that 4-6 injections were beneficial. There was no evidence supporting the use of > 6 corticosteroid injections for treatment of AC (Shah & Lewis 2006).

Table 1: Musculoskeletal corticosteroid injection: Adverse effects and cautions.

Complications	Caution/Monitor	Contraindications
• Post-injection flare • Flushing • Infection • Vasovagal reaction • Tendon weakening • Allergic or anaphylactic reaction • Subcutaneous atrophy • Increase in blood sugar • Skin pigmentation • Arthropathy • Pericapsular calsification • Menstrual disturbance • Sterile abscess • Mood change	• Diabetes mellitus • Heart failure • Poorly controlled hypertension • Osteoporosis • Cataract or glaucoma • Peptic ulcer • Anxious or psychiatric illness • Recent trauma • Bleeding disorder/anticoagulant therapy • Pregnancy	• Infection • Hypersensitivity to steroid • Not acquired patient consent • Prosthetic joint • Haemarthrosis • Live attenuated virus vaccination • Idiopathic thrombocytopenic purpura • INR > 2.5 • Due to have surgery at injection area

Table 1: (Yasir et al., 2021; Hazlewood et al., 2007; NHS East Kent Hospitals University 2021; Stephens et al., 2008)

Clinical and sonografic findings concluded with AC. Current evidence display good discharge results when patients are treated with 20-40mg triamcinolone acetonide (TA) and/or triamcinolone hexacetonide (TH). TH is shown to be more effective and have a longer duration of action when using the same dose as TA with intra-articular injections (Zulian et al., 2003; Eberhard et al., 2004). However, TA is more soluble and releases the steroid faster than TH and therefore seems to give a more rapid anti-inflammatory response (Eberhard et al., 2004; Derendorf et al., 1986). However, both TA and TH are effective treatments for intra-articular injections (Eberhard et al., 2004).

Injection Technique

To help decrease the risk of infection the use of *no touch* technique is recommended. In general, the site of injection is usually done 1cm below the posterior angle of acromion with the direction of the needle towards the coracoid process. However, both anterior and posterior injection techniques can be used (Rijs et al., 2021). In this case study we used a posterior approach seen in *Figure 2.*

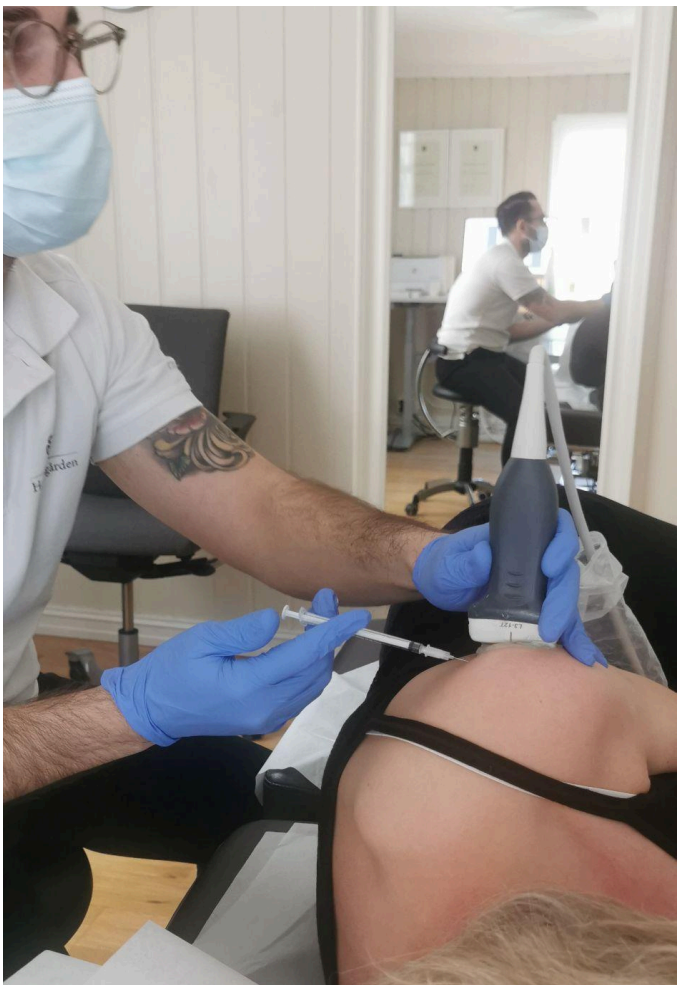

Figure 2: Posterior approach - Illustrating needle, patient and practitioner position.

Equipment used during the procedure was a 1ml syringe, 27Gx40mm needle and 40mg/ml kenalog. Hands were washed for 30 seconds with soapy water and application of nitrile gloves. The injection site was marked and sterilised with chlorhexidine antiseptic solution three times and left to dry for 30 seconds. Introduction of needle was done at 30-40 degree angle into the intra-articular area and the injection was delivered as a bolus (*see figure 3)*. Safety aspiration is advised. Needle was withdrawn under compression with firm pressure on the injection site and covered with a sterile plaster. After injection the patient was observed for 15 minutes and had to wait another 15 minutes in the waiting area before she could leave. There were no reported adverse events other than local post-injection pain 2 hours after the treatment lasting less than 12 hours. The patient started to notice substantial symptom relief day 4 after the injection. *Figure 3-4* illustrates the injection site, technique and patient position during the patients first treatment. *Table 2* summarises the treatment progression and objective and

subjective outcomes after each treatment. Local anaesthetics were not used for any of the treatments due to the fact that these injections are relatively pain free and decrease the risk of potential adverse events i.e. hypersensitivity reactions or anaphylaxis.

Table 2: Summary of treatment: Progression and outcomes

Progression	**Objective and subjective outcome**
First treatment: Day 1 20 mg triamcinolone acetonide (Kenalog/Kenacort-T) Posterior approach: Intra-articular injection. **Advice:** Relative rest two weeks. Try to maintain normal activities at home and work. Heavy lifting or repetitive shouler activity was not advised. - Patient received two weeks sick-leave from work.	● VAS 8-10 with special tests ○ Empty can, Neers, Hawkin-kennedy and Speeds test, coracoid pain test ● Severe pain whilst sleeping on the affected shoulder at night. ● Severe difficulty with ADL and work. ● Decreased and painful ROM in all directions. ● 3/5 Isometric abduction, flexion, external and internal rotation.
Second treatment: Day 14 20 mg triamcinolone acetonide (Kenalog/Kenacort-T) Posterior approach: Intra-articular injection. Total volume 0,5ml **Advice:** Start with low grade and pain free ROM exercises, isometric shoulder exercise and stretches. - Patient acquired an additional two week sick-leave.	● VAS 5-6 with special tests ● Less pain at night and whilst working. ● Easier to do ADL. ● Decreased ROM in all directions but less pain during AROM/PROM tests. ● 4/5 Isometric abduction, flexion, external and internal rotation.
Third treatment: Day 22 20 mg triamcinolone acetonide (Kenalog/Kenacort-T) Posterior approach: Intra-articular injection. Total volume 0,5ml **Advice:** Start with moderate grade strength exercise and ROM mobilizations for shoulder and upper back and slowly advance to more heavy weights within pain free ROM. Additional soft tissue massage and manual therapy was also advised for neck and back muscles. -Patient wanted to return to work and end her sick-leave.	● VAS 1-2 with special tests ○ Hawkin-kennedy and Speeds test. ● No pain whilst sleeping at night. ● ADL pain free. Can work pain free. ● Shoulder limited by stiffness, not pain. ● Increased AROM/PROM and no pain during tests. ● 5/5 isometric abduction, flexion, external and internal rotation.

This patient received in total three intra-articular injections with two week intervals. Upon the fourth consultation she reported no pain (VAS 0/10) during ADL, work or with special tests. She only noticed limited shoulder movement and tightness around her upper back and neck musculature. She was given home exercises and instructed to begin physiotherapy to regain strength and shoulder function. A combination of clinical reasoning, ultrasound diagnostics and intra-articular cortisone injection resulted in an excellent outcome. The patient achieved increased AROM/PROM, complete resolution of pain, strength and ability to work.

Intra-articular corticosteroid injections have been shown to improve ROM in both short and long term which is indicative that injection therapy can be beneficial for the patient's functional and symptomatic recovery in AC (Wang et al., 2017).

Figure 3: Illustrating shoulder anatomy and needle placement during intra-articular injection with guidance. Yellow arrow points to the needle inserted at 35-40 degree angle. H, humeral head.

Discussion and evaluation

Challoumas et al., (2020) conducted a systematic review and meta-analysis to assess and compare the effectiveness of multiple treatment options available for adhesive capsulitis. The study included 65 randomised studies with 4097 participants and suggested early intra-articular (IA) cortisone injections to be associated with earlier benefits lasting up to 6 months compared to placebo, physiotherapy, home exercise, electrotherapy and mobilizations. Therefore IA cortisone injections should be offered at first contact as long as there are no contraindications. However, accompanying home exercise with stretching and ROM-exercises, physiotherapy and mobilizations could add midd-term benefits (Challoumas et al., 2020). The described treatment plan and injection technique combined with home exercises led to substantial reduction in pain and increased functionality. This case study is consistent with current literature and shows intra-articular corticosteroid injections combined with patient education, relative rest, home exercise and physiotherapy as an applicable combination of interventions for patients with AC (Challomas et al. 2002; Manske et al. 2008; Hand et al. 2008; Fields et al. 2019; Shah et al. 2007; Ryans et al. 2005; Yasir et al. 2021).

Conclusion

Current literature strongly supports intra-articular corticosteroid injections as first line treatment for adhesive capsulitis. The use of 20-40mg TA or TH is viewed as an effective dosage per treatment session. However, there was no evidence supporting the use of more than six injections. Additionally, combining strength and ROM-exercises must be considered when the patient shows good progression in symptoms and shoulder function. Further studies should focus on long-term follow up studies and most effective dosage and treatment intervals.

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