Steve Hines case study: subacromial / subdeltoid bursa injection

Introduction

Shoulder complaints are the third most common reason for musculoskeletal GP appointments in the UK. Anywhere from 1.5% to 3% of adults present to their GP with shoulder pain at some point in their life. Women tend to report shoulder pain more than men with the peak age ranging from 45-64. Shoulder pain is an intransigent problem with almost half of all patients visiting their GP more than once. (Artus et al 2017, van der Windt et al 1995, Linsell et al 2005, Friedman et al 2017)

Referral and presentation

RT, an active 42-year-old male, self-referred to physiotherapy with acute onset left shoulder pain. RT is an active gym goer with no incident where he hurt his shoulder. There were no neurological symptoms, red flags and nothing of note in his past medical history. RT describes the shoulder being stiff first thing in the morning, aggravated by bench press, burpees and dumbbell flys and painful to sleep on the left side. RT was not taking any medication, herbs or supplements.

There was full glenohumeral joint range of movement with discomfort towards end of range flexion and abduction. All rotator cuff strength tests were strong and pain free. Hawkins-Kennedy test was pain free, however there was discomfort with Yocum and Neer's test. There was some pain with scarf test and some tenderness over the AC joint. The glenohumeral joint itself was anteriorly located with load and shift test and stiff to palpate with an AP glide.

Machine and settings

An ultrasound examination was undertaken using a General Electric (GE) Logiq e with a linear probe 8-12 MHz frequency range. The machine was in B mode using a pre-set for the

shoulder. This used a frequency of 12 MHz, a high enough frequency to get good spatial resolution without a great deal of attenuation of the sound waves for a structure of 2-3cm depth. Coded harmonics was selected which produces a sharper picture with less greyness. The gain was set at 50 and TGC was left center lined.

Images

Only pertinent images with pathology have been chosen.

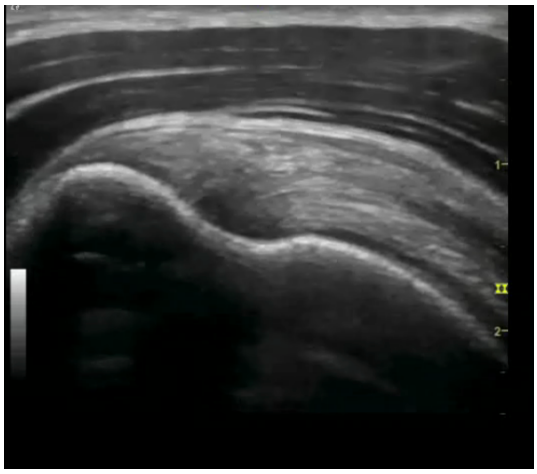

Figure 1

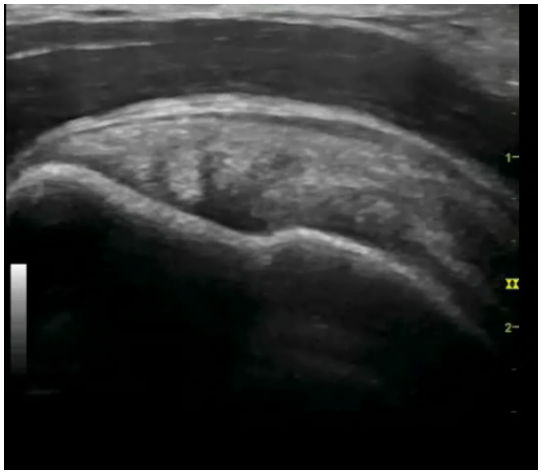

Figure 2

Figure 1 and 2: Supraspinatus in long axis. There is an accumulation of fluid in the sub-acromial / sub-deltoid bursa (SA/SD). There is a heterogenous appearance to the supraspinatus, and a small hypoechoic cleft in the substance of the supraspinatus suggestive of a partial thickness articular surface tear.

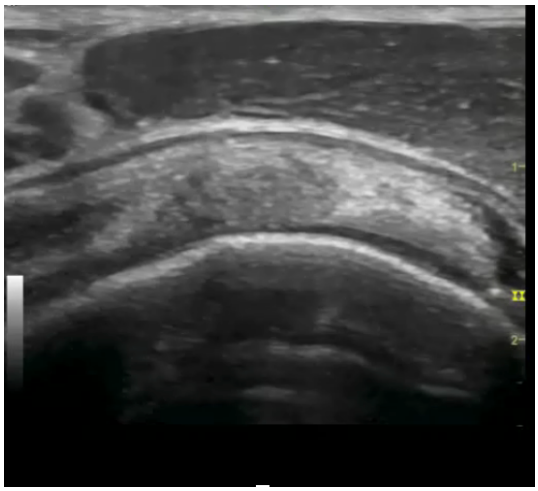

Figure 3

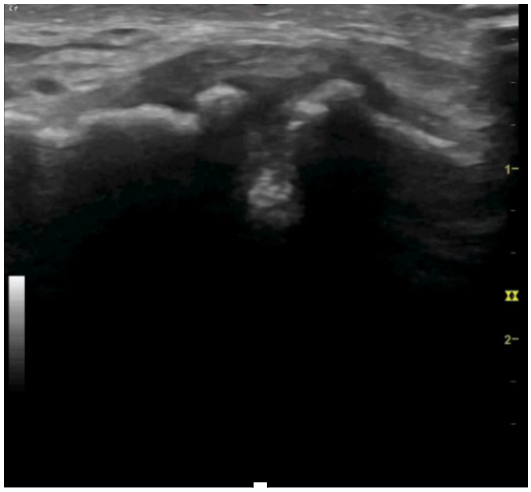

Figure 4

Figure 3 Supraspinatus in short axis displays heterogenicity and a possible small hypoechoic cleft in the tendon with a distended bursa. Figure 4: shows an ACJ with bony irregularity and a distended capsule.

Images using Doppler would have helped to identify any areas of hyperaemia in the supraspinatus tendon or ACJ.

Ultrasound report

The biceps tendon was intact and in the bicipital groove, there was some synovial thickening within the bicep tendon sheath. The subscapularis was intact, hyperechoic with some calcification at the footprint on the lesser tuberosity. The SA/SD bursa was distended with fluid. The supraspinatus tendon was hypoechoic at the greater tuberosity in short axis, there was a hypoechoic patch in the articular portion of the tendon in long axis, the remaining tendon was heterogenous in echotexture. The Infraspinatus and teres minor tendons were intact, homogenous and hyperechoic. The posterior GH joint was not distended with joint fluid. The AC joint capsule was enlarged with bony lipping around the joint with tenderness on sonopalpation.

Ultrasound imaging in MSK medicine

The development of ultrasound over the last decade has enabled it to be included as a primary imaging investigation method for musculoskeletal assessment and diagnosis (Gaitini 2012). However, as a physiotherapist it is important not to rely solely on what is seen on ultrasound and anything that is seen needs to be analysed in the context of the patient's story, the clinical examination, the clinician's experience, *and* imaging. A landmark paper by Girish et al (2011) nicely demonstrates this. Of 50 asymptomatic shoulders imaged (40–70 years), shoulder abnormalities were found in 96% of the subjects. US showed subacromial-subdeltoid bursal thickening in 78%, ACJ OA in 65%, supraspinatus tendinosis in 39%, subscapularis tendinosis in 25%, partial-thickness tear of the bursal side of the supraspinatus tendon in 22% and posterior glenoid labral abnormality in 14% of those examined.

Ultrasound has been shown to have a comparable accuracy to MRI for assessing rotator cuff tears (RCT's) (Prashanth et al 2017, Lanza et al 2013). Unfortunately, there remains a lack of clarity on the definition of the size and location of rotator cuff tears and whether a cuff tear seen on ultrasound is asymptomatic or not (Moosmayer et al 2009).

Asymptomatic tears increase with age. Moosmayer et al (2009) ultrasound scanned 420 subjects with asymptomatic shoulders. They found that asymptomatic tears were very uncommon in subjects younger than 60 years but increased in prevalence with age – with 2.1% of 50- to 59-year-olds, 5.7% of 60 to 69 year olds; and 15% 70 to 79 year olds having tears. The mean size of the tear was less than 3cm and tear localisation was limited to the supraspinatus tendon in most cases. Similarly, Tempelhof et al (1999) reported evidence of a RCT in 23% of the 411 patients they examined using ultrasound. They demonstrated 13% of the 50 to 59 year olds; 20% of the 60 to 69 years olds; 31% of the 70 to 79 year olds; and those over 80 years old 51% of the patients had tears. They suggested that which parameters convert an asymptomatic rotator cuff tear into a symptomatic tear remains unclear. A systematic review by Sayamanathan and Andrew (2017) demonstrated that the dominant hand had more than double the odds of sustaining a RCT, while an individual aged 60 or over had 5 times the risk of sustaining a RCT.

Mall et al (2010) report that asymptomatic tears can become symptomatic over time. They examined 195 subjects with a mean age of 63 that had an asymptomatic RCT. They found 44 subjects became symptomatic over 2 years and then compared them to 55 subjects who

remained asymptomatic over the same period. They found that the proportion of subjects that progressed from a partial thickness RCT to full thickness RCT was no different between the groups. However, the symptomatic group had larger tear width than the asymptomatic group. After 2 years 23% of symptomatic tears had increased in size. None of the asymptomatic group's partial thickness RCT tears had progressed and only 2 full thickness RCT tears had progressed. They also reported more full thickness RCT tears in the dominant shoulder. This suggests that tear size and tear progression over time may determine whether a tear becomes symptomatic or not.

A moderate sized bursitis was seen in the SA/SD bursa. The SA/SD bursa is a highly pain sensitive structure lined with synovium and innervated by the C5 dermatome. However, there is inconsistent terminology and lack of accepted diagnostic criteria to define a bursitis in the SA/SD bursa (Couanis et al 2015, Daghir et al 2011). What constitutes a bursitis, where we measure the bursa from, in which plane and whether we include the bursal fluid or peribursal fat in the measurement remain unanswered. In reality we "eyeball" the bursa and if there is a hypoechoic space between the layers of peribursal fat we term it a bursitis.

The normal size of the bursa has been reported to be 0.5mm (Schmidt et al 2003) to 0.7mm (White at al 2006), with a normal upper limit up to 2mm (Daghir et al 2011, Couanis et al 2015) in thickness. There is also inconsistent correlation between US findings and pain (Couanis et al 2015, Lo Goff et al 2010, Daghir et al 2011). An MRI study by White et al (2006) reported an abnormal bursa when it exceeded 3mm, however this study had a small cohort.

SA/SD bursal thickening is associated with pathological shoulders such as in RCT's, calcific tendinopathy as well as asymptomatic shoulders. Daghir et al (2011) showed that dynamic US with shoulder abduction results in gathering of bursal tissue to the same degree in symptomatic and asymptomatic shoulders. Lo Goff (2010) showed SA/SD thickened was linked to pain, however this was in relation to calcific tendinopathy and increased Doppler activity in deposit resorption – the bursitis may result from inflammation of the calcific deposit during its resorption. SA/SD bursal thickening may also be an adaptation to upper limb use and this has been shown to be the case in freestyle swimmers (Couanis et al 2015). RT had a clearly visible hypoechoic space where the SA/SD bursa lies, thus I determined this as a bursitis and clinical tests of impingement were painful.

Assessment conclusion and clinical reasoning

I focused on the SA/SD bursa being the primary pathology (Neer's and Yocum tests being positive, with impingement signs on AROM), with a concomitant supraspinatus tendinopathy and ACJ irritation (positive scarf test and tenderness to palpate the ACJ). I felt that the potential partial thickness articular surface tear of supraspinatus was asymptomatic as all rotator cuff strength tests were strong and pain free.

Injection technique

RT was emailed an information sheet about injection therapy and gave written and verbal consent for the procedure. The skin was cleaned using Choloprep and the probe and bed were cleaned with a 2% solution of Ecolab Chlorhexidine. An aseptic field was created around the

instruments for injection and sterile gloves were worn. RT was positioned in right side-lying with the left shoulder positioned in slight extension. The shoulder setting was selected on the GE Logiq e using a 12 MHz frequency. The supraspinatus was visualised in long axis and an injection of 4ml of leukocyte poor platelet rich plasma (LP-RPR) was performed in plane with a 23G 30mm needle. Needle visualisation is seen in Figure 5

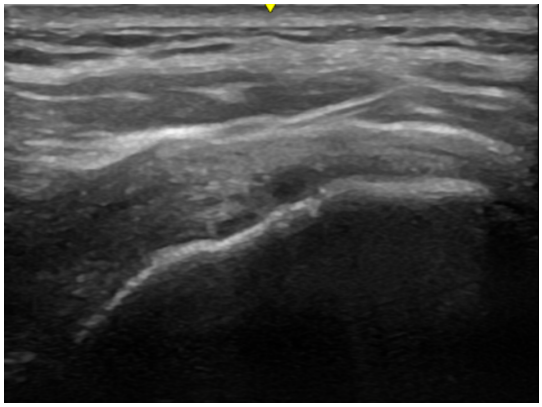

Figure 5: The needle is seen in the SA/SD bursa.

RT tolerated the injection well and was asked to wait an additional 20 minutes after the injection to make sure no adverse event took place, which they did not.

Are ultrasound guided injections accurate, effective and cost effective?

The findings of The American Medical Society for Sport Medicine position statement indicate there is strong evidence that ultrasound guided injections (USGIs) are more accurate than landmark guided injections (LMGI's), moderate evidence that they are more efficacious, and preliminary evidence that they are more cost-effective (Finnoff et al 2015).

When we consider USGI SA/SD injections there is less convincing evidence. With regards to SA/SD bursal injections (Finnoff et al 2015) in their position statement reported 10 level 1 or 2 studies that examined the accuracy of SA/SD bursal injections. Accuracy for landmark guided SA/SD bursal bursa injections ranged from 24% to 100% whilst ultrasound guided injections ranged from 65 to 100%. However, they state that due to the highly variable results, it is not clear that ultrasound guided SA/SD bursa injections a more accurate than landmark guided at this time and further research is required. A Cochrane review (Bloom et al 2012) found there was some evidence that ultra-sound guidance improved the accuracy but not clinical outcomes of subacromial steroid injections. Similarly, Daniels et al (2018) suggest current evidence indicates SA/SD USGI's may be superior to LMGI's, however most of the studies evaluated used small sample sizes and did not evaluate cost effectiveness. Orchard et al (2018) point out that regardless of the role US for guided injections, US it does have a role in diagnosis and decision making as to whether an injection is warranted as performing steroid injections into a SA/SD space in the presence of a rotator cuff tear may lead to worse outcomes longer term.

Studies on different body parts have shown USGI's to be effective. In an analysis of nine studies Porras and Boggess (2016) found that using only anatomical landmarks, the hip joint

was entered only a total of 52 to 80% of the time, whereas compared to fluoroscopic and CT guided injections ultrasound was 97% accurate and 25% cheaper.

Do subacromial steroid injections help?

Subacromial bursa injections are usually performed with corticosteroid and local anaesthetic to reduce local pain and inflammation. However, the literature remains inconclusive as to whether corticosteroid injections are effective for the long-term resolution of subacromial impingement syndrome. It has been reported that subacromial steroid injections are affective for up to 9 months and superior to oral non-steroidal anti-inflammatory drugs (Messina at al 2015). A meta-analysis by Arroll and Goodyear-Smith (2005) was the first to show a significant benefit for subacromial corticosteroid injection versus placebo for a painful shoulder. The numbers needed to treat range between 1.4 and 2.2 patients and were clinically significant. More recently and contrary to Arroll and Goodyear-Smith's findings a meta-analysis by Mohamadi et al (2017) found that corticosteroid injections provide minimal transient pain relief in a small number of patients with rotator cuff tendinitis at 4-8 weeks post injection. They found no differences three months after injection between steroid injection and placebo and for every five patients treated with a corticosteroid injection one would experience a slight, transient reduction of symptoms to mild pain. Mohamadi et al (2017) concluded SA/SD corticosteroid injections have limited appeal.

As a non-prescriber in private practice, I was unable to prescribe steroids or have them prescribed by a patient specific directive, so another solution was required.

Are there other effective subacromial injections?

Platelet-rich plasma (PRP) injections are now being used as an alternative to steroid injections as PRP contains more than 30 bioactive proteins such as growth factors within the platelets (Say et al 2016). Rotator cuff pathology (tendinopathy / tears) show reduced stem cell numbers, disorganised matrix and hypoperfusion (Phadke et al 2019). It is hypothesised that PRP injections improve these deficiencies. The evidence base for the use of ultrasound-guided PRP injection for rotator cuff tendinopathy and tears is still emerging, and due to heterogenicity of methodology it is still unclear as to its effectiveness. However, using PRP injections avoids the unwanted side effects of steroid injections such as steroid flare, fat atrophy or skin depigmentation.

There is a large body of research investigating the use of PRP in rotator cuff tendinopathy (Lin et al 2020). Say at et (2016) conducted a study on 60 subjects who were offered either a single dose injection of PRP or steroid for subacromial impingement. Both groups were also instructed to perform standard rotator cuff exercises for 6 weeks. Patients were evaluated before, and 6 weeks and 6 months after the injection. Patients that had the steroid injection fared better regarding self-reported pain at 6 weeks and 6 months compare to those who had the PRP injection. However, the study was not randomised, placebo controlled, and had a small cohort. Ibrahim at et (2019) also conducted a study to compare the efficacy of ultrasound guided PRP versus corticosteroid injection in the treatment of rotator cuff tendinopathy. 30 patients with RCT were randomly divided into two groups of 15 and received either ultrasound guided subacromial injection of 2ml of PRP or with a combination of 1ml

methylprednisolone and 1 ml of lidocaine. Patients also did an exercise program for 7 weeks including rotator cuff strengthening exercises. Two months post injection there was a significant improvement in pain and range of movement in each group with no significant difference between the groups. Ibrahim at et (2019) concluded that steroid injections may provide symptomatic relief but do not promote healing which makes PRP injection a good alternative for RCT. Niazi et al (2020) assessed the effect of ultrasound guided PRP on patient symptoms and supraspinatus tendon thickness in cases of rotator cuff tendinopathy. Thirty subjects received a single injection of 5-7ml PRP into the subacromial bursa. This study showed a decrease in pain and an increase in function at four, eight, 12- and 24-weeks post injection, however there was no difference in tendon thickness until 24 weeks where tendon thickness reduced.

Prodromos et al (2021) investigated the efficacy and safety of a dual PRP injection protocol in the treatment of patients with rotator cuff pathology who had failed conservative treatment. Injection one was an anterior lateral approach into the critical zone of the supraspinatus and subacromial bursa, injection two was a posterior glenohumeral approach, essentially the posterior arthroscopic portal. Results demonstrated there were statistically significant improvements in all groups that received dual injection procedure. The greatest improvement was seen in those with full thickness tears or greater than 50% partial thickness tears, followed by those with less than a 50% of full thickness, whilst those with tendinitis had the least statistically significant effect. This suggests PRP injection is more beneficial for those with greater structural damage. Hamid and Salzina (2021) conducted a systematic review to assess trials using PRP at reducing pain and improving function in the treatment of rotator cuff tendinopathy. Eight studies were included, with varied use of PRP technique and preparations. They found that PRP injection was effective for medium to long-term pain relief (6-12 months).

To date, studies demonstrate emerging evidence for the effectiveness of PRP for rotator cuff pathology, however, due to the heterogeneity in the study design (studies comparing PRP to placebo, steroid, physical therapy or dry needling) there is no consensus in the literature as to the number of injections, the site of injection (bursa or tendon), PRP preparation or the number of injections required.

Reflection

I was happy with my scanning clearly identifying SA/SD bursitis; however, I need to scan more shoulders to better clinically reason if I'm seeing tendinopathy or a tear. I was happy with the set up and delivery if this injection, recording needle visualisation in the SA/SD bursa (Figure 5), however I could have gotten better needle visualisation. RT was followed up by phone after 6 weeks and reported that symptoms were improving, no follow up ultrasound images were taken. It is important to remember that RT had been prescribed rotator cuff strengthening exercises to perform both before and after the injection, but on balance I would conclude this to be a successful short-term outcome from treatment and injection therapy.

Word count 3004.

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