Ultrasound Guided Therapeutic Injections in the Treatment of Shoulder Pain: A Multimedia Review

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Learning objectives

To describe and review the indications and techniques for therapeutic procedures commonly performed under ultrasound guidance in the treatment of shoulder pain.

We describe our suggested approach for each of the techniques and illustrate these using multimedia ultrasound clips which demonstrate the anatomy and ideal needle position for each technique.
Background

Shoulder pain is an extremely common presenting complaint to general practitioners and can be the result of a degenerative process or following trauma. Approximately 1% of adults will consult their general practitioner each year with a new onset of shoulder pain (1).

Treatments for shoulder pain can be both operative and non-operative. Conservative treatments include physiotherapy supplemented by oral analgesics or steroid injections.

The injection of corticosteroids has shown to be an effective treatment for shoulder pain. The use of high frequency ultrasound to ensure accurate needle placement is a safe and readily available tool. Studies have shown that injections performed under ultrasound guidance are more accurately delivered than blind injections which have a variable accuracy in actually reaching the targeted site (2). Furthermore, we believe that ultrasound guided injection of steroid mixed with a long acting local anaesthetic has the added benefit that the local anaesthetic component also allows assessment of the site of origin of pain and thus refining diagnosis.
Subacromial-subdeltoid Bursal Injection

The subacromial-subdeltoid bursa is a synovial lined space located deep to the deltoid muscle and coraco-acromial arch and superficial to the rotator cuff. It plays a part in reducing friction which in turn allows the rotator cuff tendons to move separately from the deltoid muscle. Pain can occur when the bursa becomes thickened and inflamed. The term impingement is commonly used to describe painful restricted movements of the glenohumeral joint and bursal thickening is commonly seen in patients with impingement. Bursal injection can provide a diagnostic benefit if patients are asked to assess the effect on their symptoms during the 24 hour period after the procedure and the fluid injection can help to break down bursal adhesions providing a therapeutic effect.

We suggest a lateral approach with the arm internally rotated and slightly extended. Under ultrasound guidance, a mixture of 6ml of 0.5% bupivacaine and 40mg (1ml) of triamcinolone acetonide is injected into the bursa. Successful placement of the needle within the bursa (figure 1) sees fluid flow away from the needle tip with resultant distension of the bursa (figure 2). It is frequently helpful to insert the needle with the bevel initially superficial to aid penetration of the bursa by the needle point. Once inserted, the needle can be rotated through a half turn so the bevel is directed deep, towards the tendon, reducing the likelihood of injectate flowing into the overlying deltoid muscle.

Long Head of Biceps Tendon Sheath Injection

Inflammation or tendinopathy of the long head of biceps can occur in people who play sports involving overhead motion (e.g. swimming and tennis); or simply as part of the degenerative/ageing process. When injecting into the tendon sheath, ideal needle position is within the bicipital groove, but avoid injecting the tendon itself.

We suggest either taking a lateral approach transversely (figure 3) or a superior approach longitudinally, injecting a mixture of up to 5ml of 0.5% bupivacaine and 40mg (1ml) of triamcinolone acetonide.

When taking a lateral approach transversely, the elbow is flexed to 90 degrees and the arm is slightly externally rotated. A small amount of fluid is injected slowly to begin with in order to confirm that the needle tip is safely within the biceps tendon sheath.

Acromioclavicular Joint (ACJ) Injection
Acromioclavicular joint pain can occur due to primary osteoarthritis or less commonly as a result of distal clavicle fractures or ACJ dislocation (secondary osteoarthritis).

We suggest initial imaging of the ACJ with the probe orientated in the coronal plane to identify the joint as the gap between the superficial cortical surfaces of the acromion and clavicle. For the injection, we then rotate the probe into a sagittal position to lie entirely over the joint itself with the lateral clavicle and acromion identifiable if the probe is moved medially and laterally respectively.

With the probe positioned transversely over the joint, either an anterior or a posterior approach can be taken and both of these allow visualization of the needle shaft and the tip entering the joint (figure 4). A mixture of 1 ml of 0.5% bupivacaine and 40 mg (1 ml) of triamcinolone acetonide is injected.

**Glenohumeral Joint Injection**

Arthritis of the glenohumeral joint may be primary or secondary to previous injury, either to bones, cartilage or rotator cuff tendons around the shoulder. Glenohumeral joint osteoarthritis more commonly affects the glenoid side of the joint (3). Injection into the glenohumeral joint may also be used to treat frozen shoulder (acute or chronic capsulitis), although hydrodilatation is now used more commonly (see below).

A postero-lateral approach allows more direct access to the joint without having to negotiate the coracoid process and is therefore our favoured approach. It also has the secondary benefit of avoiding the patient from seeing the needle. The tip of the needle is sited on the medial surface of the humeral head, close to the labrum and with the bevel directed towards the humerus, reducing the likelihood of injectate flowing outside the capsule. Once careful injection of a small amount of fluid confirms successful intra-articular placement, the full injection of 9 ml of 0.5% bupivacaine and 40 mg (1 ml) of triamcinolone acetonide is delivered. This ultrasound guided approach can also be used to instill intra-articular contrast prior to MR arthrography as an alternative to fluoroscopic guidance.

**Hydrodilatation**

Hydrodilatation or hydrodistension is a relatively new therapy, used in the treatment of frozen shoulder (adhesive capsulitis). While patients with chronic frozen shoulder may get some benefit, it is most successful when undertaken in the early stages. It is important to perform an initial diagnostic ultrasound (or MRI) to ensure that the rotator cuff is intact.
We suggest a postero-lateral approach which allows more direct access to the joint and avoids having to negotiate the coracoid process. The procedure involves phasic distention of the joint with relatively large volumes of fluid, generally 40-80ml of fluid, sometimes resulting in capsular rupture (figure 6). The injected fluid contains local anaesthetic and steroid as well as saline as the procedure is often painful. Following the procedure, intense physiotherapy is undertaken for 6 weeks.

While the procedure can also be done under fluoroscopic guidance, we favour ultrasound as it allows assessment of the rotator cuff before the hydrodilatation is undertaken and also saves the patient exposure to ionizing radiation.

**Shoulder Barbotage**

Calcific tendonitis of the rotator cuff most commonly affects the supraspinatus tendon. Symptoms include severe pain and restricted movement and may occur both when the calcium is relatively immature and when more mature calcium leaks out into the bursa causing local inflammation. The calcific focus is seen on ultrasound as a linear or curvilinear focus of increased reflectivity with posterior acoustic shadowing. Differentiating calcification from cortical irregularity and fracture is important and radiographic correlation may be required.

During the barbotage procedure, repeated injection and aspiration of the calcified focus with local anaesthetic is performed (figure 7). Once the focus has been broken down as much as possible, the resultant fragments are aspirated away and are frequently identified in the syringe (figure 8). Rapid symptom relief generally occurs following this, however the procedure often provokes a painful attack of inflammatory subacromial-subdeltoid bursitis and therefore a subacromial-subdeltoid bursal injection is also performed during the procedure. Patients often experience intense pain 16-24 hours following the procedure and should be warned accordingly, but rapid improvement subsequently occurs.

**Contra-indications to Shoulder Injections**

While injection therapies are relatively safe procedures, there are certain situations when an injection may be contra-indicated:

- Infection around a joint
- A tear of the rotator cuff tendons
- Allergy to any of the proposed injection agents
Complications of Shoulder Injections

In general, injections of local anaesthetic and steroid into the sites described above are relatively safe with minimal risk. Side effects are more commonly related to the use of steroid and include tendon weakening or rupture, fat atrophy and muscle wasting. Passage of a needle though the soft tissues and into the joint also includes a low risk of introducing infection and causing septic arthritis or causing damage to neurovascular structures. Evidence shows that these complications are extremely rare, however it is still important to mention these to the patient during the consent process. These risks can be minimised by good injection technique with appropriate aseptic precautions, and by avoiding frequent injections. In general, injections should not be performed at less than 3 month intervals to minimise steroid related side effects.
Fig. 1: Needle within the subacromial-subdeltoid bursa (SASBD) superficial to the supraspinatus tendon (SST)

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Fig. 2: Subacromial-subdeltoid bursal injection

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Fig. 3: Biceps tendon sheath injection

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Fig. 4: Acromioclavicular joint injection

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Fig. 5: Posterior view of the glenohumeral joint (GHJ)

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Fig. 6: Hydrodilatation of the glenohumeral joint

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Fig. 7: Shoulder barbotage demonstrating needling of the calcific focus

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Fig. 8: Syringe containing foci of calcification (arrow) within a cloudy fluid following barbotage

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Conclusion

Steroid and local anaesthetic injections are useful conservative management options for selected patients who present with shoulder pain. These procedures can be performed safely and effectively under ultrasound guidance. A sound technique is required when injecting under ultrasound guidance and we have illustrated our favoured techniques here. The use of ultrasound allows more accurate needle placement resulting in a greater improvement in symptom control when compared to blind injections.
References

