Learning objectives

This poster aims to provide education and instruction for commonly performed image guided musculoskeletal procedures for the general and trainee radiologist.

1. Improve understanding of commonly performed interventional procedures.
2. Improve confidence and efficiency in performing image guided musculoskeletal procedures.
Background

There has been an increase in the case load of musculoskeletal, image guided procedures in recent years. As a result, there has been increasing pressure on the general radiologist to perform an increasing number of these procedures on a regular basis. Most medical imaging trainees obtain little experience in musculoskeletal intervention during their training and, as such, have varying levels of confidence in performing these procedures. There is a growing need for further teaching and education in this expanding area of clinical practice to ensure the provision of quality health care.
Imaging findings OR Procedure details

General Tips

1. Wherever possible the radiologist should hold the ultrasound probe in order to utilise one’s own proprioception (i.e. left hand knows what the right hand is doing). This makes needle visualisation easier.

2. Ergonomics are important. Wherever possible there should be a straight line between the radiologist, patient and ultrasound screen (Fig. 1 on page 10).

3. Wherever possible use a fine gauge needle (25 gauge needle).

4. Only non-particulate steroids and short acting local anaesthetic should be used for procedures above the level of the clavicle and for spinal procedures [1,2].

5. Patient comfort should be a priority. Local anaesthetic should be used for procedures involving larger bore needles (greater than 22 gauge). Injecting local first, prior to drawing up other medications, allows time for the local anaesthetic to work.

6. Aseptic, no touch technique is adequate for most procedures. Chlorhexidine preparations are more effective than betadine based preparations [3,4]. Regular gloves from boxes, as opposed to sterile gloves, are adequate for most procedures [5,6].

7. Procedures in the hand and procedures in patients who are predisposed to vasovagal attacks are best done with the patient lying down.

8. Procedures in the hand and foot are best performed with the use of a hockey stick ultrasound probe.

9. The bevel of a needle can be used to steer the needle to target area. The needle will move in the opposite direction to the bevel.

10. A short history from the patient regarding allergies, propensity to vasovagal attacks, along with informed consent, is essential.

11. Micro-bubbles, formed by shaking the syringe with an air bubble in situ, create a contrast agent.

TIPS FOR SPECIFIC PROCEDURES THAT YOU MAY HAVE NFI OF:

Unless otherwise specified all procedures performed under ultrasound guidance.

Barbotage:

• Liberally inject bursa with 10-15ml of Xylocaine for anaesthesia and to break up adhesions.
• Flush with saline using two 18 gauge needles or single 18 gauge needle technique and 20ml syringes (Fig. 2 on page 10, Fig. 3 on page 11).
• Always inject steroid into the bursa at the end of the procedure to prevent associated bursitis.
• Avoid mistaking linear dystrophic calcification at the enthesis /insertion as calcific tendonitis. Calcific tendonitis is round, oval or dumbbell shaped.

Bone Biopsy

• Use a hammer or drill to get through hard bone, rather than force, to avoid accidental giving way if you reach softer bone.

Cervical Nerve Root Injection - CT Guided

• Safety is paramount. There have been catastrophic events, including death related to this procedure.
• Use smallest gauge needle possible.
• Aim for inferior aspect of foramen to avoid the artery.
• Inject a small test dose of Xylocaine and assess clinically for posterior circulation symptoms prior to injecting non-particulate steroid (dexamethasone). Do not use particulate steroid due to risk of microvessel infarction [1].
• Confirm position with contrast and aspirate prior to injection.

Facet Joint Cyst Rupture - CT Guided

• Perform an epidural steroid and anaesthetic injection first for analgesia.
• Jam the 22 gauge needle deep into the degenerate facet and inject until rupture of contrast into the epidural space (Fig. 4 on page 12, Fig. 5 on page 13, Fig. 6 on page 14)
• Use air as contrast in the initial epidural injection, this will allow you to confirm cyst rupture by contrast extravasation from the facet joint into the epidural space.

Ganglion Cyst Aspiration

• Loosen cyst contents with 3-5ml Xylocaine and a 25 gauge needle. Inject some Xylocaine under the skin with the same needle. Allow anaesthetic time to work (Fig. 7 on page 15).
• Use an 18 gauge needle and 10ml syringe to perforate and aspirate the ganglion.
• Inject 1ml Celestone at the end of the procedure.
**Hip Joint Injection**

- Always use a 9cm 22 gauge or longer spinal needle to prevent falling short on length.
- Internally rotating the foot moves the femoral vessels medially, out of the path of the needle.
- In contradistinction to fluoroscopic guided injection, do not aim for femoral neck as this puts the needle more perpendicular to the probe, reducing needle visualisation. On ultrasound, position is confirmed by needle tip beneath labrum and micro-bubbles in joint (Fig. 8 on page 16, Fig. 9 on page 17).
- Inferior capsule is thicker and harder to penetrate as opposed to thinner superior capsule - another benefit of aiming deep to labrum.
- Turning the needle 180 degrees in clockwise and anticlockwise will help the bevel bore through a tented capsule
- Micro bubbles are helpful to confirm position

**Intermetatarsal Bursa Injection**

- A dorsal needle approach with the ultrasound probe on the plantar aspect of the foot is beneficial as it is less painful and there is potentially less skin flora on dorsal aspect of foot compared to plantar aspect (Fig. 10 on page 18).
- Massaging jelly into skin at plantar aspect of foot improves contact and visualisation, particularly in patients with thick, dry skin [7].

**Knee Joint Injection**

- In the absence of suprapatellar pouch fluid, aim for the trochlea with lateral approach with the knee in flexion. In a small number of patients the suprapatellar pouch does not freely communicate with the remainder of the joint, therefore this technique is preferable in any case (Fig. 11 on page 19).

**Lateral Cutaneous Nerve of Thigh Injection**

- Palpate the anterior superior iliac spine.
- Locate the origin of sartorius and follow it 1cm distally until the muscle belly begins to form.
- Identify the lateral femoral cutaneous nerve on the surface of sartorius.
- Track it proximally back inside the pelvic brim under the inguinal ligament. Target the nerve at this site.

**Mechanical Hydro Release of Sciatic Nerve**
• Under ultrasound guidance, use a 22 gauge needle with local anaesthetic and cold saline to strip away adhesions from the sciatic nerve, which form secondary to chronic hamstring injury (Fig 12).
• Use liquid pressure ahead of the needle to mechanically open tissue planes.

Greater Occipital Nerve (GON) Block

• Best performed at the inferior obliquus capitus muscle level. The alternative location at the external occipital protuberance is rendered difficult due to the patient's hair [8, 9] (Fig. 13 on page 21).
• Use dexamethasone/non-particulate steroid as injecting above the clavicle.
• To locate it sonographically position the probe transversely onto base of occiput to find the posterior arch of C1, identified by single spinous process. Move inferior until the bifid C2 spinous process is in view, then move the probe laterally and obliquely to find obliquus capitus muscle (Fig. 13). The location of the GON is between Inferior Obliqius Capitus and Semispinalis Capitus/Splenius Capitus muscles Fig. 14 on page 22.

Paratenon Stripping (Brisement) of Non-insertional Achilles Tendinosis

• Medial or lateral approach, placing 22 gauge needle deep to paratenon but not into tendon substance (Fig. 15 on page 23).
• High volume injection starting with 10mls Xylocaine, followed by 1ml Celestone and cold saline to a volume of 40-60mls total (Fig. 16 on page 24, Fig. 17 on page 25).
• Smaller volume of 20-40ml can be used on the patella tendon.

Plantar Fascia Injection with Nerve Block

• Blocking tibial nerve at the level just above medial malleolus with Xylocaine 5-10ml makes this procedure much more tolerable (Fig. 18 on page 27).
• If you inject the nerve too inferior you may miss the take-off of the branch to the plantar fascia (lateral plantar nerve).
• Inject steroid deep to plantar fascia (not superficial) to prevent fat pad necrosis.
• Dry needling can be performed at the same time

Platelet Rich Plasma (PRP) Injection

• Draw 1-3, 8.5ml, vacuette of blood from antecubital vein. The vacuette contains an anticoagulant to prevent platelet activation.
• Spin blood in centrifuge at high speed for 10 minutes. Each 8.5 ml vacuette will yield 1.5ml of PRP.
• Draw buffy coat and deepest component of plasma (Fig. 19 on page 26).
• Inject 5ml Xylocaine with a 22 gauge needle at the superficial surface of the tendon. Leave needle in place and use same needle to inject PRP.
• Target areas of reduced echogenicity/myxoid degeneration with tendon.

Pulley Release:
• Best reserved for fingers due to the challenging anatomy of the thumb.
• Full sterile technique.
• Mark the tendon path as a guide of the neurovascular bundle location.
• First inject local anaesthetic with a 25 gauge needle.
• A rolled up towel under the patient's hand creates MCPJ hyperextension, which is helpful in allowing the needle to enter the target area unimpeded.
• Bend an 18G needle, using its cap, at the needle hub and mid-point to use as a cutting device [10]. The bevel should be in a sagittal plane. Attach 3ml syringe as a handle (Fig. 20 on page 28).
• Position the needle tip deep to pulley and apply force down and back (Fig. 21 on page 29, Fig. 22 on page 30).
• Concurrent steroid injection at the time of release will treat any co-existent tenosynovitis.
• A hand therapist opinion is recommended post release.

Shoulder Hydrodilatation
• Lay the patient down for comfort - decubitus position ( ).
• Use a medial or lateral approach at the posterior shoulder joint to aid positioning the needle deep to the teres minor or labrum respectively (Fig. 24 on page 32, Fig. 25 on page 33).
• Low volume (capsule preserving) hydrodilatation, using a maximum of 5-10ml, is effective [11].
• Rupturing the capsule is not necessary and allows steroid to escape the joint, potentially reducing the effectiveness of the hydrodilatation.

Soft Tissue Tumour Biopsy:
• Perform only in consultation with surgical team to prevent potential seeding of unwanted path.
• Aim for the enhancing, non-necrotic, region to get the best result.

Subacromial Bursa Injection
• Asking the patient to watch the ultrasound screen creates distraction.
• Posterior approach avoids anterior supraspinatus tears (the most common site).
• Relaxed arm positioning allows relaxation of deltoid muscle reducing pain and discomfort (Fig. 26 on page 34).

Subtalar Joint Injection

• Anterior and mid subtalar joints communicate with the talonavicular joint, therefore the mid and anterior joint can be accessed by injecting into the dorsal aspect talonavicular joint - which is easily accessible with ultrasound.
• Posterior subtalar joint is more difficult to access under ultrasound guidance and is best accessed with computed tomography. If ultrasound is used, it is best to target the subtalar joint just anterior to the calcaneofibular ligament with an off-plane approach.

Suprascapular Nerve Block

• Consider this procedure for older patients with cuff tearing and arthropathy.
• Medial approach (Fig. 27 on page 34).
• Inject into suprascapular notch.

Tendon Injection- Common Flexor and Common extensor Origin

• Laying the patient supine with the arm abducted and resting above the head (flexed abducted, supinated) allows easy access to the common flexor origin (Fig. 28 on page 35).
• Injecting the steroid and anaesthetic along the tendon surface can help to strip neovessels and reduce pain related to tendinopathy (Fig. 29 on page 36).

Wrist Joint Injection and Arthrogram

• Lay the patient prone in neutral wrist position with volar flexion over a pillow (Fig. 30 on page 37).
• Use a dorsal/distal approach of the needle onto the scaphoid (Fig. 31 on page 38).
Images for this section:

Fig. 1: Ergonomic position for ultrasound guided procedures

© Benson Radiology, SA/AU
Fig. 2: Barbotage single needle technique. Note calcific deposit in syringe.

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Fig. 3: Barbotage double needle technique.

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Fig. 4: Facet joint cyst compressing nerve root (red arrow).

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Fig. 5: 22 gauge needle and contrast in facet joint.

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Fig. 6: Cyst rupture confirmed with contrast spilling into epidural space.

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Fig. 7: Loosening contents of ganglion with local anaesthetic prior to aspiration/perforation.

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Fig. 8: Probe positioning for anterior hip joint injection

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Fig. 9: Anterior Hip Joint Injection Needle tip directed deep to the labrum (red arrow)

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Fig. 10: Position for intermetatarsal injection - dorsal approach.

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**Fig. 11:** Knee injection at the lateral trochlea level.

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Fig. 12: 22 gauge needle injecting around sciatic nerve.

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**Fig. 13:** Obliquus capitus level greater occipital nerve block

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**Fig. 14:** Note location of GON between IOC and SSPC/SPC. Greater Occipital Nerve (GON), Inferior Obliquus Capitus (IOC), Semispinalis Capitus (SSPC), Splenius Capitus (SPC).

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Fig. 15: Approach for paratenon stripping for non-insertional Achilles tendonitis.

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Fig. 16: Needle positioned at deep paratenon for stripping.

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Fig. 17: Needle positioned at superficial paratenon

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Fig. 19: Left: Centrifuge Right: Buffy coat (red arrow) is aspirated for PRP injection.

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Fig. 18: Tibial nerve block prior to plantar fascia injection.

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Fig. 20: Modified 18 gauge needle releasing pulley.

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**Fig. 21:** Withdraw needle (blue arrow) whilst applying downward force on the syringe (orange arrow), which forces the needle tip in a palmar direction to cut the A1 pulley.

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Fig. 22: 18 gauge needle deep to the A1 pulley (red arrow) prior to release.

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**Fig. 23:** Lateral decubitus position for shoulder injection.

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Fig. 24: Shoulder injection with medial approach - needle passes deep to teres minor.

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**Fig. 25:** Shoulder injection with lateral approach - needle passes deep to labrum (authors prefer this approach).

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**Fig. 26:** Ergonomic alignment for posterior approach subacromial bursa injection

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Fig. 27: Suprascapular nerve block positioning

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Fig. 28: Positioning for common flexor tendon injection. (Screen at head of bed)

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Fig. 29: Needle positioned at superficial tendon surface to strip neovessels

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Fig. 30: Position for wrist joint injection

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**Fig. 31:** Needle inserted from distal approach (red arrow) to pass below the dorsal radius.

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Conclusion

A better understanding of image guided musculoskeletal interventions will help the general radiologist provide more effective patient care. This poster provides a valuable, easy to use reference for the general and trainee radiologist to assist in teaching and performing image guided musculoskeletal procedures.
Personal information

Dr. Michael Croft
Radiology Registrar (Year 1)
Flinders Medical Centre

Mr Stephen Bird
Senior Sonographer
Benson Radiology

Dr. Matthew Sampson
Consultant Radiologist
Benson Radiology and Repat Radiology
References


