

A guide to joint and soft tissue corticosteroid injection.

Part 1: general principles and the knee

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Joint and soft tissue injection techniques are useful additions to the general practitioner’s repertoire of procedures.

Musculoskeletal complaints account for a large and growing proportion of GP consultations. A small proportion of patients with these complaints will be referred to musculoskeletal specialists but most will be managed by general practitioners. Joint aspiration and injection are remarkably useful tools in the daily repertoire of specialist rheumatologists, and can have equal utility in general practice. Aspiration is fundamental in the diagnosis of conditions such as gout, pseudogout and joint sepsis, and a well placed corticosteroid and local anaesthetic injection can provide prolonged symptom relief in patients with established soft tissue or articular pathology.

Traditional undergraduate courses and early hospital training give scant attention to musculoskeletal complaints. As a result, aspiration and injection techniques are not routinely taught, even though they are generally not difficult to learn, are low risk if the appropriate precautions are taken, and are of great use in any medical practice that often deals with musculoskeletal complaints.¹

This article, in two parts, provides a concise, step by step guide to aspiration and injection of some of the more common articular and soft tissue problems, with evidence from the literature where available. This first part discusses general considerations using the knee as an example, chosen because it is the joint most commonly aspirated and injected. The second part, to be published in a forthcoming issue of *Medicine Today*,

will consider other commonly performed and useful joint and soft tissue injections.

Indications for joint aspiration

The two principal indications for joint aspiration are for diagnosis and to relieve the discomfort associated with a large effusion. The most urgent diagnostic use is to identify infection. An effusion might also be caused by crystalline arthritis, inflammatory arthritis (such as rheumatoid arthritis) or haemarthrosis, or it might be noninflammatory (that is, osteoarthritis).

At the first presentation of a monoarthritis with effusion, sepsis should be suspected and aspiration is mandatory. Prompt diagnosis of bacterial septic arthritis should lead to early treatment, which is strongly related to better outcomes. Overlying erythema typically occurs with either infection or crystalline arthritis. Be aware that overlying cellulitis can look similar, and is a contraindication to aspiration. Erythema tends to be absent with other causes of inflammatory arthritis.

Draining synovial fluid before a corticosteroid injection improves comfort and also may hasten and prolong symptomatic benefit – for example, reducing relapse in rheumatoid arthritis.²

Synovial fluid – an aid to diagnosis

Appearance of synovial fluid

The macroscopic appearance of aspirated synovial fluid can provide valuable and

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Table 1. Synovial fluid: diagnostically useful features

Colour	Clarity	Viscosity	White cell count (mm ³)	Likely cause
Clear	Clear	High to moderate	<200	Normal
Straw	Clear	Moderate	200 to 10,000	Osteoarthritis
Off-white	Opaque to turbid	Low	5000 to 75,000	Inflammation
Variable	Turbid to purulent	Low	>50,000	Sepsis

immediate diagnostic information (Table 1). Dripping fluid from the syringe into a specimen jar gives a reasonable guide to viscosity. Appearance can distinguish an inflammatory from a noninflammatory effusion. The latter is likely to be associated with mechanical disease such as osteoarthritis or trauma and has the appearance of normal synovial fluid, which is clear to straw coloured, fully translucent and moderately viscous. Inflammatory effusions are increasingly turbid and become less viscous with an increasing concentration of inflammatory cells.

The finding of blood in a joint, particularly after recalled trauma, indicates an intra-articular injury such as a ruptured ligament, meniscus or fracture. Fat globules may be seen if a fracture extends into the joint space.

Synovial fluid laboratory tests

Basic laboratory tests performed on synovial fluid should include urgent Gram stain if infection is suspected, microscopy for crystals, quantitative cell count, culture and antimicrobial sensitivity testing. If the effusion is chronic and undiagnosed, mycobacterial and fungal cultures may be useful.

Crystalline arthritis, most commonly gout or pseudogout, is only definitively diagnosed if crystals are seen on microscopy of synovial fluid or tophi. Although the sensitivity for gout (monosodium urate) crystals is usually greater than 95%, it is relatively poor for pseudogout (calcium pyrophosphate dihydrate) crystals, which are smaller and less intensely birefringent. Infection can coexist with crystalline arthritis, so it is still important to obtain a Gram stain and culture even when crystals are detected.

Indications for corticosteroid injection

There is no doubt that injecting a joint affected by an inflammatory process such as rheumatoid arthritis, a seronegative

arthropathy or crystalline arthritis is often an effective means of providing symptomatic relief. These conditions usually respond within 48 hours to the corticosteroid component of the injection, with the local anaesthetic component providing immediate but transient analgesia. Importantly, injection can also be useful in non-inflammatory arthritis. Meta-analysis of randomised controlled trials investigating corticosteroid injection for knee osteoarthritis showed sustained (four to six months) symptom benefit in some patients, with a number needed to treat of 4.4.³

Some common soft tissue problems also respond to injection, although the evidence varies for each. The most frequently performed include carpal tunnel syndrome, tennis elbow, rotator cuff syndromes, trochanteric bursitis/gluteus medius enthesitis and plantar fasciitis. These, and some other joint injections, will be discussed in Part 2 of this article.

Frequency of injections

With all articular and soft tissue conditions, the duration of benefit from injection is variable, and probably depends on the nature and severity of the underlying pathology. To be considered useful, symptomatic relief should last for months rather than weeks.

Generally, in any given joint or soft tissue region including the knee, no more than one injection should be administered every three months, with a maximum of three or four injections each year. A maximum of two or three areas injected at any single session helps to minimise the risk of acute systemic effects.

Contraindications for aspiration and injection

Definite contraindications to joint injection are bacteraemia and overlying cellulitis, because of the risk of introducing infection into the joint space. Injecting through psoriatic skin also risks

infection. Fracture is considered a contraindication.

Orthopaedic surgeons discourage injection if there is a plan for an elective joint replacement within three months. Prosthetic joints should never be injected, again because the consequences of infection are catastrophic.

Anticoagulation and a bleeding diathesis are considered relative contraindications. However, in experienced hands it is probably reasonable to aspirate or inject joints in patients with an INR less than 3.0 provided the operator is confident that the procedure will be atraumatic.

Lastly, uncertainty of the diagnosis and repeated failure of injections to provide significant benefit should be considered relative contraindications.

Aspiration and injection procedure

Site preparation

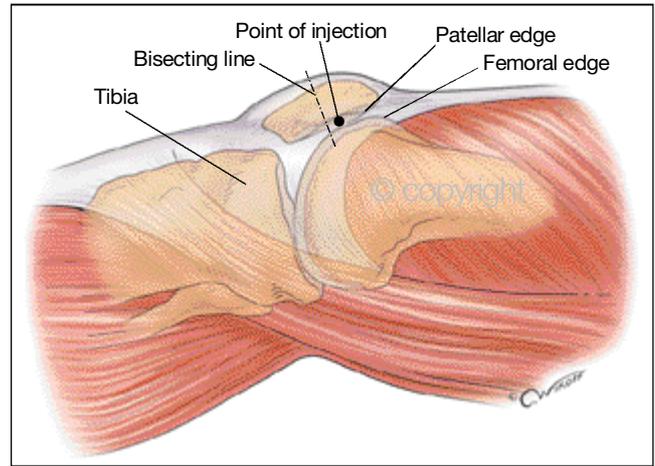
Two major issues apply to all aspirates and injections: accurate placement and aseptic technique. The patient's consent to the procedure should be obtained, with a thorough explanation of the risks and benefits.

Positioning the patient

For a knee aspiration or injection, the patient should lie on his or her back with the leg relaxed (tightening the quadriceps reduces the target zone), and rest the knee on a folded towel or small pillow so that it is slightly flexed to around 5°.

Marking the injection site

It is useful to draw onto the skin the surface anatomy for at least the first few times the procedure is done. Draw in the underside edge of the patella, and a horizontal line bisecting it (shown dotted in Figures 1a and 2a). The knee joint space is continuous between the suprapatellar pouch, patellofemoral space and tibiofemoral space, and also the popliteal fossa if a Baker's cyst is present. The joint is most safely and



Figures 1a and b. Knee injection, medial approach. a (left). Surface anatomy drawn on the skin. b (right). Site of needle entry into the patellofemoral space from the medial side.

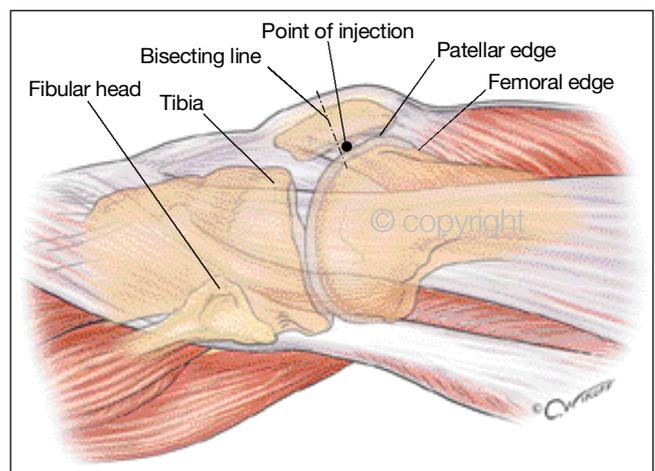
conveniently entered through the patellofemoral space with either a medial or lateral approach (Figures 1a and b, and 2a and b).

Both medially and laterally, a point 1 to 2 cm superior to the bisecting line and underneath the patella outline is usually appropriate for needle placement. Practitioners usually develop a preference for either the medial or lateral approach, and for the distance between the bisecting line and superior pole of the patella. Traditional teaching is that medially the knee is entered at the bisecting

line, and laterally at the junction between the top and middle thirds. Medially it is usually easy to feel the patella but harder to feel the medial femoral condyle, whereas the space between the lateral femoral condyle and patella usually feels more distinct but is narrower. Mark the point of injection with the firm indentation of a retracted ballpoint pen or the end of a needle sheath. This will not wash off when sterilising the area, and gives a feeling of depth that helps with accurate needle placement.

It is highly recommended that sterile

technique with a wide field is used for joint aspiration and injection. Sterile technique has the advantage of allowing palpation and reassessment of the approach if there is any difficulty. The 'no touch technique' is suitable for experienced practitioners; in this technique no further palpation is done after marking the injection site and sterilising the skin surface, and the needle itself is never touched. Both techniques should be aseptic, and there is no evidence that the rates of infection complications differ between them.⁴



Figures 2a and b. Knee injection, lateral approach. a (left). Surface anatomy drawn on the skin. b (right). Site of needle entry into the patellofemoral space from the lateral side.

Table 2. Equipment and materials for knee aspiration and injection

Sterile technique

- Dressing pack
- Topical antiseptic agent – such as chlorhexidine and alcohol (Microshield Tincture) or iodine and alcohol (Betadine Alcoholic Skin Prep, Iodine in Alcohol)
- Sterile disposable gloves

No touch technique

- Three alcohol swabs or antiseptic soaked sterile gauzes
- Disposable gloves

Aspiration materials

- Two 10 mL syringes or one 10 mL and one 20 mL syringe if there is a large effusion
- One drawing-up needle
- One 21 gauge needle (a 23 gauge may be gentler if the effusion is small and corticosteroid injection is the primary objective), and a second small gauge needle for infiltration of local anaesthetic if desired
- 5 mL 1 or 2% lignocaine (Lignocaine Hydrochloride Injection, Lignocaine Injection, Xylocaine Ampoules [Plain] Injection)
- Sterile specimen jar
- EDTA/FBC tube for cell count if needed
- Culture bottles if infection is suspected
- Dressing (Band-Aid)

Additional materials for injection

- One of the following:
 - 1 to 2 mL betamethasone acetate 5.7 mg/mL (Celestone Chronodose), or
 - 1 to 2 mL methylprednisolone acetate 40 mg/mL (Depo-Medrol, Depo-Nisolone), or
 - 1 to 2 mL triamcinolone acetonide 40 mg/mL (Kenacort-A 40)
- 3 to 5 mL 1% lignocaine and/or 0.5% bupivacaine (Bupivacaine Injection BP, Marcain 0.5% Injection) to mix with the corticosteroid
- One 5 or 10 mL syringe

Equipment needed

The equipment and materials required to perform sterile and no touch technique aspirations and injections are given in Table 2. All equipment should be single use.

Procedure

There are many procedural options for injecting joints and soft tissue. One sterile method is detailed below.

1. Mark the surface anatomy and needle

- placement point.
2. If injecting, open the vial of corticosteroid preparation and a vial of local anaesthetic for sterile drawing up.
3. Set out the equipment on the sterile field.
4. Put on gloves and prepare the field.
5. Draw up 1 or 2 mL of lignocaine in a 10 mL syringe, then switch the drawing-up needle to a second syringe and draw up the remaining local anaesthetic and the corticosteroid.

Invert a couple of times to mix. Expel air and return the syringes to the sterile field.

6. Either use a separate fine gauge needle to infiltrate the area with local anaesthetic, or use the 23 or 21 gauge needle and the 10 mL syringe charged with local anaesthetic to infiltrate as you proceed. Make sure that you can easily take the needle off the syringe, especially with the Luer lock type, if injecting through the same needle later. With experience, local anaesthetic is often not required.
7. The patellofemoral space is ‘V’ shaped in an axial cut. This and the rotation of the leg (note the lie of the foot) need to be taken into account. The needle is advanced at about 20° to the flat anterior surface of the patella for the lateral approach, and closer to parallel for the medial, ensuring that the leg is not externally or internally rotated. The needle will often advance more than 3 cm to its hilt, but aspirating as you go can reveal when the synovial space is reached and there is no reason to advance it any further.
8. The 10 or 20 mL syringe can be used to aspirate as many times as required by changing syringe barrels with the needle left in the joint space. Manual pressure on the suprapatellar pouch and the opposite side of the patellofemoral space will sometimes allow more fluid to be drained.
9. If injection is required, leave the needle in place and connect the syringe with the local anaesthetic and corticosteroid mixture. A flashback of synovial fluid on aspiration can confirm accurate placement. Injecting into joint spaces should be quite easy, and it is recommended that clinicians familiarise themselves with the amount of pressure required to inject with their most often used equipment. Never inject under pressure as the point of the needle may be buried in cartilage or other tissue.

Precautions and complications

The most serious complication of joint injection is sepsis, and there have been cases in the literature where this has resulted in fatal septicaemia. However, the risk of joint infection is low – an estimated one case in 10,000 joint injections.⁵ The risk of sepsis can be minimised by taking aseptic precautions, and morbidity can be reduced by educating the patient to re-present early if there is any increase in pain, swelling, redness or fever after 48 hours.

Local bruising may occur. A relatively common but expected and self-limiting problem is inflammation 24 to 48 hours after the injection. This is the so-called 'post steroid flare', and relates to the crystalline nature of the corticosteroid preparation causing short-lived inflammation.

Rarely, leakage or sinus formation can complicate aspiration or injection. This is more likely when a large, tense effusion is inadequately drained, or when aspirating a bursa that has little overlying soft tissue to seal the puncture, such as the olecranon.

Certain injections have been associated with tendon rupture. Injecting into any tendon should be avoided, reinforcing the principle of never injecting under pressure. In particular, avoid injecting around the extensor tendons of the fingers and the Achilles tendon, which are particularly prone to this complication.

Local depigmentation and atrophy of subcutaneous fat can result from corticosteroid injections, particularly when they are superficially placed (for example, in tennis elbow). It is important to warn the patient of this potential cosmetic complication. Anecdotally, this problem may be minimised by piercing the skin with a needle that has not been in contact with the corticosteroid. This can be achieved by using a drawing-up needle to prepare the corticosteroid and local anaesthetic mixture, and changing to this syringe only when the needle is accurately placed.

The last category of adverse effects relates to the systemic absorption of the corticosteroid load. Diabetic patients should be warned that their blood sugar levels may increase, and reassured that this is usually for no more than 48 hours. Some patients may have acute psychological disturbances, usually restricted to

sleeplessness and increased appetite, although agitation or mania can occur. Avoid giving more than one or two ampoules of the corticosteroid preparations at any one time. The long term side effects of oral corticosteroid use such as osteoporosis and avascular necrosis are not usually seen unless frequent injections are performed over a long period of time.

Follow up and after care

A diagnostic aspirate needs urgent and immediate follow up if infection is found. An 'unsuccessful' aspirate in the setting of suspected infection should be repeated under radiological (usually ultrasound) guidance.

If an injection is performed into a weight-bearing joint, ask the patient to walk as little as possible for at least the following 24 hours. This helps to retain

the corticosteroid within the joint space. Warn the patient that they might experience some ache from the post steroid flare the day after the injection, but that any worsening of symptoms after that may represent infection, and they should then seek immediate medical attention.

The maximum benefit from an injection is usually apparent after about a week but, as discussed above, the duration is variable. It may be prudent to see the patient after a week to judge efficacy and to make sure that there have been no problems.

Conclusion

Joint injection and aspiration techniques are useful additions to the general practice repertoire of procedures. These procedures can be performed using simple equipment combined with a sound knowledge of local anatomy, and are low risk if routine aseptic precautions are taken. The knee is the most common joint requiring aspiration or injection. **MT**

References

1. Kumar N, Newman RJ. Complications of intra- and peri-articular steroid injections. *Br J Gen Pract* 1999; 49: 465-466.
2. Weitof T, Uddenfeldt P. Importance of synovial fluid aspiration when injecting intra-articular corticosteroids. *Ann Rheum Dis* 2000; 59: 233-235.
3. Arroll B, Goodyear-Smith F. Corticosteroid injections for osteoarthritis of the knee: meta-analysis. *BMJ* 2004; 328: 869.
4. Charalambous CP, Tryfonidis M, Sadiq S, Hirst P, Paul A. Septic arthritis following intra-articular steroid injection of the knee – a survey of current practice regarding antiseptic technique used during intra-articular steroid injection of the knee. *Clin Rheumatol* 2003; 22: 386-390.
5. Hunter JA, Blyth TH. A risk-benefit assessment of intra-articular corticosteroids in rheumatic disorders. *Drug Saf* 1999; 21: 353-365.

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