NHS England South West

Severn Foundation School F2 Regional Teaching
PRACTICAL PROCEDURES & ULTRASOUND SKILLS


"Whoa! That was a good one! Try it, Hobbs — just poke his brain right where my finger is."

Course Handbook and Pre-Reading Material
August 2023

Introduction

This is a practical course designed to cover some of the practical skills desirable as per the Foundation Year 2 curriculum.

This handbook provides an outline of topics and associated theory with some useful facts, tips, and references. Try to familiarise yourself with this handbook prior to the course to gain the most out of the course; we hope this will improve your confidence in practical procedures in your workplace.

The aim of the day is to 'have a go' in a safe environment with support from the Faculty on equipment representative to real life as much as possible. We hope you find the day useful and enjoyable.

For all procedures, it is good practice to obtain adequate consent and document procedure in the patient's notes.

At the end of the day please complete the feedback form via MaxCourse to ensure we continue to run a course of the highest standard. If you would like to test your knowledge there is an optional MCQ via:
http://www.ruh.nhs.uk/For_Clinicians/education/foundation/f2_clinical_skills_post_course.asp

Outline of the Day

There are 6 stations covering the following clinical skills:

1. Pleural Aspiration & Chest Drain (Seldinger) insertion and management
2. Lumbar Puncture
3. Suturing
4. Therapeutic paracentesis
5. Joint aspiration
6. USS guided cannulation

Please ensure you arrive early so we start promptly and you get adequate exposure at each station.

Pleural Aspiration (Thoracocentesis)

A procedure whereby pleural fluid or air is aspirated via a system inserted temporarily into the pleural space.

Indications	Contraindications
Pneumothorax ○ Primary spontaneous pneumothorax >2cm ○ Secondary spontaneous pneumothorax	Tension pneumothorax
Effusions ○ Small volumes for diagnostics especially empyema ○ Large volumes for symptom control	Coagulopathy
	Bullae

Complications

- Pneumothorax
- Visceral injury
- Procedure failure
- Pain
- Haemorrhage

Equipment

- An aseptic technique is required using sterile gloves, field, skin sterilising fluid and dressing.
- 21G (green) needle/cannula, 3-way tap, tubing and 20-50 ml syringe
- Lidocaine up to 3 mg/kg (5-10 ml 1% Lignocaine is usually sufficient)

Patient position and site of insertion

- upright leaning forward with arms elevated but resting onto a table
- lying on a bed with their arm behind their head

In most cases the site of needle insertion is in the **triangle of safety** (bordered by the lateral edge of pectoralis major, laterally by the lateral edge of latissimus dorsi, inferiorly by the line of the 5th intercostal space and superiorly by the base of the axilla)

Technique

- Visualise pleural effusion via USS
- Cleaning of skin and apply local anaesthetic to skin and pleura
- Advance needle above rib (avoid neurovascular bundle)
- Once fluid aspirated, remove needle and leave cannula in situ
- Attach 3-way tap system
- Aspirate until
  - No more fluid aspirated
  - 1500 ml aspirated due to risk of re-expansion oedema
  - Patient develops cough or pain
- Record the volume of fluid and appearance.

If diagnostic aspiration, fluid should be sent to:

- **Microbiology**
  - MCS
  - AAFB
  - TB Culture
- **Biochemistry – pleural and serous fluid**
  - Protein
  - Lactate dehydrogenase
- **Cytology**
- **pH** - A pH of < 7.2 indicates an empyema and is an indication for a chest drain.

Light's criteria

The pleural effusion is an exudate if:

- Pleural fluid protein divided by serum protein >0.5
- Pleural fluid LDH divided by serum LDH >0.6
- Pleural fluid LDH >2/3 the upper limits of normal serum LDH

Post-Procedure

- Routine observations
- CXR (check for resolution of pathology and any evidence of pneumothorax)

Simple analgesia may be required.

Chest Drain (Seldinger) insertion and management

A tube placed in the pleural space to drain its contents (fluid or air) and remaining in place until drainage is complete. This course focusses on Seldinger drains.

Indications	Complications
Pneumothorax ○ In any ventilated patient; ○ Tension pneumothorax after initial needle relief; ○ Persistent or recurrent pneumothorax after simple aspiration; ○ Large secondary pneumothoraces	Pain
Malignant pleural effusions	Wound & Intra-pleural infection
Empyema	Visceral injury and serious bleeding
	Drain blockage & dislodgement

Equipment

- Sterile gloves, gown, drapes and swabs
- Skin antiseptic solution
- A selection of syringes and needles (21-25 gauge)
- Local anaesthetic e.g., Lignocaine 1% or 2%
- Seldinger drain pack
- Suture material 1.0 or 2.0 silk
- Dressing
- Underwater drainage system with sterile water

Local anaesthesia

Lignocaine (up to 3 mg/kg) is infiltrated to the skin, periosteum and pleura.

Insertion technique

- Insertion of pleural needle to appropriate depth (note measurement)
- Guidewire passed down needle (always hold onto wire at all times)
- Needle withdrawn
- Small skin incision
- Dilator passed over wire using a slight twisting action.
- Insert drain over the wire; aim apically for air and basally for fluid
- Connect drain via 3-way tap to tubing and underwater drainage system.
- The drain is secured to the skin with a suture
- An omental tag of tape reduces tube kinking and tension.
- If repositioning only withdraw as insertion risks infection.

Chest drain management

DO	DON'T
Perform a CXR after insertion	Allow more than 1.5 l to be drained in the first hour – may lead to re-expansion pulmonary oedema
Manage the patient in a specialist ward with experienced nurses	Ever clamp a bubbling chest tube
Seek senior advice if a patient with a clamped tube suddenly becomes breathless or develops subcut. emphysema	Clamp a chest tube sited for pneumothorax
Make sure that the drain swings on breathing, indicating correct site and tube patency	Allow the underwater seal to be raised above the level of insertion
Remove if stops bubbling or condition resolved on CXR	Remove if draining > 200 ml/day
Remove a chest drain in expiration or with the patient performing a Valsalva	Remove if drain still bubbling
Perform a CXR after removal	
Ensure that documentation occurs at *all* stages – some Trusts have pre-printed stickers to fill out	

Lumbar Puncture

Indications	Contraindications
Diagnostic: ○ Bacterial/Viral/Carcinomatous/TB meningitis ○ Subarachnoid haemorrhage ○ Demyelination Disease ○ Benign Intracranial Hypertension	Patient refusal
Therapeutic: ○ Spinal anaesthesia ○ Benign Intracranial Hypertension ○ Intrathecal chemotherapy	Signs of raised ICP
	Infected skin over needle entry site
	Coagulopathy (INR>1.4) or thrombocytopenia (Plts < 50x109 /L)

Complications

1. **Post LP headache**
   - Uncommon ~1% with blunt tipped needles
   - Improves on lying down, hydration, simple analgesia, caffeine
   - May need rarely epidural blood patch to completely resolve
2. **Haemorrhage**
   - epidural, subdural or subarachnoid
3. **Infection**
   - bacterial meningitis, discitis, epidural abscess
4. **Neurological Injury**
   - spinal cord or nerve damage
5. **Post LP uncal herniation**

Equipment

- Procedure pack, spinal needle, manometer, syringe and needles
- Sterile gloves
- Chlorhexidine solution
- 5-10 ml 1% lignocaine
- 3 / 4 sample bottles (label 1-4) & fluoride tube (grey top) for glucose
- Plaster

Position + insertion site

Left lateral – place patient on left side, back exactly aligned with the edge of the bed. Hips, knees + chin flexed to the chest.
Sitting – Sit patient up, feet on stool, leaning over pillow on lap.

Aim for interspace between L4/L5 (Spinal cord ends L1).

Technique

- Aseptic technique, clean skin and prepare equipment
- Apply local anaesthetic aspirating before injecting.
- Insert LP needle in interspinous space towards umbilicus bevel upwards.
- Feel resistance from the spinal ligaments + dura then a ‘give’.
- Remove stylet and check for CSF at needle hub.
- Connect manometer to needle with 3 way tap.
- Measure CSF pressure (normal pressure 5-20 cmH20, up to 25 cm obesity)
- Collect 5-10 drops of CSF in each of the sample bottles
- Reinsert the stylet and remove the needle (reduces risk of PDPH).
- Apply plaster.

Send fluid for: Cell count, paired glucose and protein, Gram stain + MC+S, cytology, viral PCR, oligoclonal bands and xanthochromia depending on clinical situation.

Suturing

Learning Objectives

1. To appreciate the range of wound closure options.
2. To become aware of potential suturing pitfalls.
3. To choose appropriate type and size of suture.
4. To learn to apply simple sutures during your skills station.

Wounds can be closed using a number of techniques including steristrips and glue for superficial wounds, staples and sutures for deeper wounds.

Indications

Closure of lacerations & surgical wounds

Contraindications	Complications
Contaminated wound	Bleeding
Delayed presentation	Wound infection
Retained foreign bodies	Dehiscence
Injury to underlying structure	Scarring

Preparation

Full history & examination, including mechanism of injury, PMH, DH, tetanus, allergies and assessment of deeper structures e.g., Neurovascular bundle, tendons.

Tips for Simple Interrupted Skin Sutures

1. Infiltrate with local anaesthesia. Oppose the skin aiming for slight eversion of wound edges.
2. Use the finest non-absorbable suture adequate for the wound (see table below) and a cutting needle.
3. Ensure knots lie to one side of the wound to reduce risk of infection.
4. Tie sutures just tightly enough for wound edges to meet. Excessive tension increases the risk of inflammation and infection.
5. Handle the skin edges with tooth forceps only to minimise skin trauma.
6. Use strategic initial suture to match up obvious points in irregular wounds.
7. Deep wounds may require an absorbable deep stitch or a mattress suture to bring gaping wound edges together.
8. If the suture does not look right, take it out and start again.
9. Other techniques include continuous, mattress & subcuticular sutures.

Part of body	Suture & size	Time to removal
Scalp	3/0 non-absorbable, glue or staples	7 days
Trunk	3/0 non-absorbable	10 days
Limbs	4/0 non-absorbable	10 days
Hands	5/0 non-absorbable	10 days
Face	5/0 non-absorbable or glue	5 days
Lips, tongue, mouth	Absorbable	

Further Reading

NHS Clinical Knowledge Summaries:
www.cks.nhs.uk/lacerations

McGregor AD, McGregor IA. Fundamental techniques of plastic surgery and their surgical applications. 10th ed. London: Churchill Livingstone; 2000; 40.

Therapeutic Paracentesis

Indications	Contraindications
Diuretic resistant/intractable ascites in liver disease	Local infection
Malignant ascites	

Cautions	Complications
Coagulopathy, pregnancy, organomegaly, adhesions, obstruction	Sepsis, perforation, volume depletion and hepatic encephalopathy

Equipment

- Sterile filed, gloves and skin cleaning fluid
- Syringes, needles, scalpel and lidocaine 1%
- Paracentesis catheter
- Urine catheter bag or similar
- Sample bottles including blood culture bottles
- 20% human albumin solution

Technique

- Position patient in bed supine
- Select appropriate point in left or right lower quadrant
- Clean skin and prepare equipment.
- Anaesthetise skin and underlying tissues until able to aspirate ascetic fluid and note depth
- Insert catheter gradually to same depth then advance catheter over needle to hilt and remove needle
- Fix catheter to abdominal wall and connect to drainage bag
- For liver ascites give 100 ml of 20% HAS for every 2 litres of ascites
- Send samples for:
    - Paired samples of protein, albumin, LDH and glucose
    - White cell count
    - MC+S with paired blood cultures
    - If clinically indicated cytology, amylase, bilirubin and triglycerides
- Observations
    - Monitor pulse BP and Respiratory Rate (every 15 minutes for 1 hour; 30 minutes for 1 hour then hourly for 4 hours)
- Aim to remove drain within 6 hours to reduce chance of SB

Joint Aspiration and Injection

Indications

Aspiration

- Suspected septic arthritis
  - Classical picture: hot, swollen, tender joint with painful reduced ROM and effusion, systemically unwell/septic, raised CRP & WBC
  - Only aspirate, do not inject steroids!
- Therapeutic relief and diagnosis

Injection

- Reduction of inflammation, providing pain relief
- Entrapment neuropathies (e.g., carpal tunnel syndrome, ulnar nerve entrapment at the elbow, etc.) – technically not joint injections, but follow similar principles
- Diagnostic: if the injection works even for a short period of time, then that joint/nerve tunnel is likely to be the source of the pain, so surgery in that particular area may be beneficial ("try before you buy" principle)

Contraindications of Joint Aspirations

- Infected/damaged overlying skin without features of septic arthritis
- Pre-patellar bursitis – not necessary, as treatment is with empirical antibiotics; also, you might actually cause septic arthritis by transferring the germs from the bursa inside the knee joint

Contraindications of Joint Injections

- Infected/damaged overlying skin
- Hypersensitivity/allergy to steroid or local anaesthetic
- Significant systemic illness
- Previous lack of improvement

Cautions

- Infected or damaged overlying skin – discuss with on call T&O Registrar: may still need aspiration if you strongly suspect septic arthritis – if so and if possible, avoid infected/damaged skin
- Prosthetic joints – always refer to the on call T&O Registrar because aspiration needs to be done in theatre to reduce risk of superimposed iatrogenic infection
- Recent trauma – aspiration may convert a closed fracture to an open fracture, so exclude fracture first (e.g., X-ray)
- Anticoagulant therapy
- Bleeding disorders
- Poorly controlled diabetes
- Warn patient that if they wish to undergo joint replacement surgery in the near future, this can be done safely only after at least 6 months post-injection, to reduce the risk of prosthetic joint infection due to the local reduction of defense mechanisms caused by the steroids
- Covid-19 – theoretical risk of developing more severe disease due to the systemic effects of the locally injected steroids which may enter the systemic circulation in small amounts, especially in immune-compromised patients – however, no clear evidence, merely a theoretical risk, so steroid injections still generally accepted to be safe despite the pandemic context, but prior to the injection you should warn the patient of this potential risk

Glucocorticoids

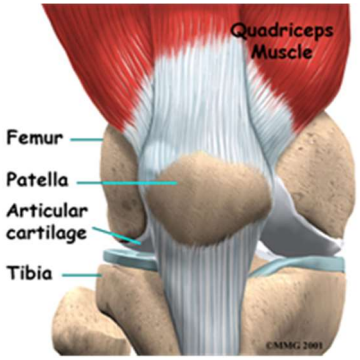
Steroids used for intra-articular injections in clinical practice have anti-inflammatory but little mineralocorticoid or systemic effect. Commonly used in practice:

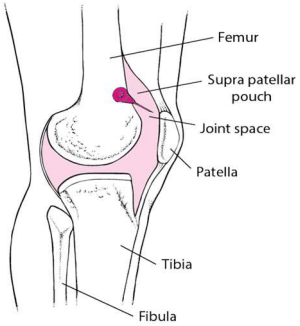
- Methyl-prednisolone (Depo-Medrone®)
- Triamcinolone (Kenalog®)
- Triamcinolone hexacetonide – in children with juvenile idiopathic arthritis
- Dexamethasone

Complications

- Infection
- Post injection flare: treat with RICE (rest, ice, compression, elevation) or NICER (NSAIDs, ice, compression, elevation, rest) ☺
- Bruising
- Soft tissue atrophy/Skin thinning and discoloration
- Progressively less anti-inflammatory effect after a joint had multiple injections
- Facial flushing 24 hours later
- Allergy/anaphylaxis
- Steroid arthropathy/cartilage damage
- Tendon rupture

Aspirating/Injecting the Knee





Before the procedure:

- History and clinical examination
- X-ray: effusion, OA, chondrocalcinosis (pseudogout), lipohaemarthrosis (fracture)
- Baseline bloods: FBC, U&E, CRP, uric acid
- Bear in mind that an already damaged/arthritic/gouty joint is more prone to infection, so do not dismiss the diagnosis of infection just because the patient already has known chronic degenerative disease! On the contrary!

Patient position

- Supine on the examination couch with the knee in a relaxed extended or slightly flexed (15-20 degrees) position

Palpate for effusion

- Secure patella holding medial and lateral borders between thumb and index finger.
- With the index finger from the other hand press the patella against the distal femur.
- If effusion is present, the patella will bounce back when releasing the finger pressure.
- In large effusions, you might be unable to feel this movement due to increased tension of the soft tissues, but the knee will look very swollen.
- Differentiate from pre-patellar bursitis: swelling/fluctuance located only in the pre-patellar region.

Equipment

- Chlorhexidine or Betadine
- Local anaesthetic for skin: Normally not necessary, as it's just an extra needle prick for the patient. Usually well tolerated procedure without the use of local anaesthetic. However you can use 5 ml of 1% Lidocaine to the skin if the patient would prefer.
- Syringe
- Needle: for suspected septic arthritis, ideally use a larger bore needle (white), as the pus is a thick fluid and you might not be able to aspirate with a thinner needle.
- For sampling:
  - White top sterile bottle (the ones used for urine samples)
  - Blood cultures bottles for aerobes/anaerobes – optional, may help cultures
- Bowl to discard extra fluid not sent to the lab
- Steroid +/- short & long-acting local anaesthetics (Lidocaine + Chirocaine) if performing injection
- Small plaster

Technique

- Obtain informed consent from the patient and document in the notes
- Sterilize skin with Chlorhexidine or Betadine – wait for it to dry
- Use aseptic non-touch technique (ANTT) and sterile gloves
- Use medial or lateral approach
- Locate the medial or lateral margin of the patella
- At the junction between the proximal 1/3rd and the distal 2/3^{rds} of the medial or lateral patellar margin, find a space deep to the patella, which feels like a soft spot.
- Insert the needle deep directing it at about 45 degrees, following the natural direction of the articular facets located on the posterior aspect of the patella
- If fluid is present, aspirate to dryness if possible. Increased efficiency using the "milking" technique – with your non-dominant hand press against the suprapatellar pouch and swipe the effusion in a distal direction and with your thumb glide the patella medially or laterally respectively, depending on your approach, to increase the space while you aspirate at the same time using your dominant hand.
- If indicated, inject the steroid/anaesthetic mixture as a bolus
- Withdraw the needle, obtain haemostasis and cover with a small plaster
- Video available here:

Post aspiration

- If septic arthritis is suspected, send samples to the microbiology lab for urgent Gram stain and crystals – ring the on call microbiology technician to get sample processed ASAP. Sample should also be processed for Cultures and Sensitivities even if the initial Gram stain is negative.

Possible results

- Organisms – urgent referral to the on call T&O team, keep the patient nil by mouth, as they will likely need urgent surgery (joint washout). Also, discuss with on call Microbiology consultant to guide the antibiotherapy.
- Uric acid crystals (gout) – medical treatment with analgesics/NSAIDs and lifestyle/dietary advice; consider Colchicine and Allopurinol

- Calcium pyrophosphate crystals (pseudogout) – medical treatment with analgesics/NSAIDs
- No organisms, no crystals – analgesia, refer to rheumatology, who may consider further diagnostic tests (?rheumatoid, ?psoriatic, etc.) +/- steroid injection
- WBC – non-specific, but +++WBC result with no organisms on Gram stain does not fully exclude septic arthritis in a patient with a strong clinical suspicion of septic arthritis – for these patients, you should check the cultures and sensitivities in 24-48 hours. For the ones who are unwell, surgical treatment (open or arthroscopic joint washout) may be indicated even before identifying an organism

Post injection advice

- Mobilise fully weight bearing, full range of movement. Excess activity may reduce local efficacy, so avoid for the first 24-48 hours post-injection
- Analgesia as required
- Warn the patient that in the first few days and up to a week, the steroid may actually increase the pain which will gradually settle, with a full analgesic benefit at around 6 weeks post-injection
- Ask patient to keep pain diary and show it to you at 6-8 weeks; follow up in clinic to assess efficacy

References and further reading

- https://www.msdmanuals.com/en-gb/professional/musculoskeletal-and-connective-tissue-disorders/how-to-do-arthrocentesis/how-to-do-knee-arthrocentesis
- https://www.webmd.com/pain-management/knee-pain/knee-pain-joint-aspiration
- https://www.ncbi.nlm.nih.gov/books/NBK470229/
- https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8294711/
- https://online.boneandjoint.org.uk/doi/full/10.1302/2633-1462.19.BJO-2020-0130.R1

USS guided cannulation

Indications	Relative Contraindications
Challenging insertion e.g., oedematous skins or obesity	Previous lymphedema
Severe dehydration	AV fistula
Multiple previous cannulation	Local injury/burns/infection

Complications

- Injury to nerve, artery or vein
- Failure

Equipment

- USS machine with appropriate probe, cover and ultrasound gel
- Normal equipment for cannulation

Procedure

- Start in antecubital fossa
- Identify vessel
  - Easily compressible
  - Non-pulsatile
  - Colour Doppler if available
- Insert cannula in normal way under direct visualisation

Confirmation of cannulation

- Visualisation of cannula in vessel
- Flashback into cannula
- Saline flush 10 ml; flushing cannula with direct visualization of ‘bubbles’ in vessel using USS