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Hand book of

Basic Medical Procedure

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Preface

The “Hand book of basic medical procedure “book is intended to produce for medical professionals including medical and nursing students. I started to prepare this book five years back, however the time was ripened to publish in 2018. When I start my academic carrier, I realized that most of the medical students passed the final hurdle without knowing simple medical procedure. It is unacceptable and made a bad impact on our society. I hope this portable hand book will give fundamental knowledge regarding medical procedure to students.

It covers basic procedure which are performing routinely in the medical and surgical ward. It was written in a methodological way, which give more user-friendly for students, and within a short period they able to grasp the contents without any difficult.

I would like to thank Dr. for his valuable Contribution for this book

Thanks

Dr. M. Umakanth

Contents

1. Venepuncture
2. Intravenous Cannulation
3. Blood pressure measurement
4. Arterial blood gas sampling
5. Peak flow measurement
6. Inhaler technique
7. Oxygen administration
8. Nasogastric(NG) tube Insertion
9. Male urethral catheterization
10. Female urethral catheterization
11. Suprapubic catheterization
12. Endotracheal (ET) intubation
13. Lumbar puncture
14. Pericardial aspiration
15. Ascitic tap
16. Knee joint aspiration.
17. Injections
18. Blood cultures from Peripheral and Central sites
19. Central vein Cannulation
20. Chest drain insertion
21. Abdominal paracentesis(drainage)
22. Tracheostomy management
23. Aspiration of Pleural fluid
24. Basic Airway Management
25. Non-invasive ventilation

01. Venepuncture

Equipment Required

- Gloves
- Alcohol swabs
- Tourniquet
- Needle
- Syringe/Vacutainer
- Cotton wool/Gauze
- Sticky tape(plaster)
- Appropriate blood bottles

Indication

- Diagnostic testing of Blood
- Monitoring of Physiological or Pharmacological parameters

Contraindication/Inappropriate sites for venepuncture

- Limbs post local/regional lymph node dissection
- Cellulitic areas
- Haematomas
- Oedematous areas
- Scarred areas
- Phlebitis or thrombophlebitis
- Arm in which there is a transfusion or infusion
- Arm on the side of previous mastectomy
- Arms with AV fistulae or vascular Grafts

Procedure

- Introduce yourself, confirm patient's identity, explain the procedure, obtain verbal consent.
- The patient should be lying or sitting comfortably with the arm resting on a pillow.
- An aseptic non-touch technique should be used
- Apply tourniquet and identify suitable vein
- Put on gloves and ask the patient to clench their fist for few times.
- Prepare skin with alcohol swab, clean in spirals-inside to out.
- Fix vein using a spare finger
- Warn patients of a sharp scratch and not move their arm
- Insert the needle at a 30-45° angle into vein (bevel upwards), always pointing away from yourself.
- Blood will visibly enter the hub (plastic portion) of the needle('flashback').
- Take sample
 - holding the needle in position with syringe in the nondominant hand
 - pull back on the plunger with dominant hand
- When enough blood is taken,release the tourniquet first before removing the needle from vein(reduce bruising)
- Apply a clean cotton wool/gauze to puncture site with pressure.
- Apply a plaster to the site,thank the patient.
- Dispose of any sharps in the sharps bin

- Label blood bottles immediately as per trust guidelines.
- Document in the notes

Post Procedure management

Check site for bleeding, infection risk and excessive bruising.

Complication

- Bleeding, bruising, haematoma
- Inadvertent arterial puncture (if this occurs be prepared to apply prolonged pressure over the site)
- Damage to local structures, including nerves

02.Intravenous Cannulation

Equipment Required

- Gloves
- Alcohol swabs
- Tourniquet
- A Cannula of Appropriate size
- 5ml syringe
- Saline for injection
- Sticky Tape
- Gauze/Cotton wool

Indication

- Administration of intravenous(IV)Fluids, medications and blood products

Contraindication

- Localized skin infection
- Limbs post local/regional lymph node dissection

Procedure

- Introduce yourself, confirm patient's identity, explain the procedure, and obtain verbal consent.
- The Patient should be lying or sitting comfortably with the arm resting on a pillow.
- An aseptic non-touch technique should be used
- Apply tourniquet and identify suitable vein

- Put on gloves and ask the patient to clench their fist for few times.
- Prepare skin with alcohol swab, clean in spirals-inside to out.
- Remove the cannula from its packaging and ensure that the cannula is functioning properly by withdrawing the needle and replacing it. Fold down the wings and open the port on the top.
- Warn patients of a sharp scratch and not move their arm
- Insert cannula at a 10-15° angle into vein (bevel upwards), always pointing away from yourself.
- When flashback is observed flatten the cannula
- Advance cannula further into vein, whilst slowly withdrawing needle
- Remove Tourniquet
- Depress vein at tip of the cannula, remove the needle, and dispose of its safely in a sharps bin.
- Place cap on to end of cannula and fix it in place with the sticky dressing.
- Flush with 5-10ml normal saline through the cannula using the port on the top.
 (if the cannula is misplaced, the saline will enter the subcutaneous tissues causing swelling)
- Label date of insertion on cannula dressing
- Document the procedure in patient's medical notes

Complication

- Bleeding, bruising, haematoma
- Infection-Cellulitis, bacteraemia and septicaemia
- Damage to local structures, including nerves

03.Blood pressure measurement

Equipment Required

- A (Functioning) sphygmomanometer
- An appropriately sized cuff
- Stethoscope

Procedure

- Introduce yourself, confirm patient's identity, explain the procedure, and obtain verbal consent
- Check the sphygmomanometer Functioning and the dial reads '0'.
- The Patient should be sitting, relaxed for 5 minutes beforehand.
- Apply the cuff to the upper arm with the air bladder anteriorly (over the brachial artery)
- Using your left arm, support the patient's arm
- Close the valve (may be a screw/lever), monitor the patient's radial artery, and inflate the cuff until the radial pulse is no longer palpable.
- Listen over the brachial artery at the antecubital fossa- using the diaphragm or bell of the stethoscope-whilst deflating the cuff at a rate of 2-3mmHg/sec
- Note the point at which the pulsation is audible (Korotkoff phase I-the systolic BP)
- And the point at which the sounds disappear (Korotkoff phase V -the diastolic BP)

- In some normal people, the sounds may not disappear completely.in this case, a distinct muffling of the noise (Korotkoff phase IV) should be used to indicate the diastolic BP.
- Record the BP as 'systolic/diastolic' to the nearest 2mmHg.
- Document the BP in patient's medical notes.

04.Arterial blood gas sampling

Equipment Required

- Sterile Gloves
- Alcohol swabs
- ABG kit (Specialized heparinized ABG syringe, needle, vented cap)
- Gauze/cotton wool
- Tape(plaster)

Indication

- To assess respiratory or/and metabolic status, in particular pH, PaO_2 , PaCO_2 , HCO_3^- , base excess(BE), and lactate
- It may also be used to gain rapid electrolyte information including glucose.

Contraindication

- History of severe artery spasm following previous puncture.
- Risk of, or actual limb ischemia
- Infection at site of puncture
- Known Aneurysm or Pseudoaneurysm of artery
- Coagulopathy/Bleeding disorder
- No collateral circulation through ulnar artery, as determined by Allen's test (lack of spontaneous return of circulation to hand on release of ulnar artery when radial and ulnar arteries have been occluded with digital pressure).

Procedure

- Introduce yourself, Confirm Patients Identity, explain the procedure, obtain verbal consent.
- Wash hands and put on gloves.
- Note patient's temperature and oxygen support.
- Choose site for arterial puncture (Locate artery and identify area of maximum pulsation).

Radial

- Commonly used site (no adjacent nerves or vessels)
- Assess Ulnar arterial circulation by occluding radial artery with finger-tip pressure.
- Take the blood gas syringe, ensuring that the heparin has coated
- Attach the needle and expel the excess heparin.
- Position the wrist in extension.
- Palpate the radial arterial pulse.
- Clean skin with alcohol swab
- Insert the needle bevel facing upwards at an angle of 45°.
- Advance the needle until arterial pressure fills the syringe.
- Obtain sample of 1-3ml and withdraw the needle.
- Remove needle and dispose in sharp bin
- Apply pressure to the puncture site using gauze
- Take sample rapidly for analysis
- Document results and procedure in the notes.

Femoral

- Position the patient with the hip extended and slightly internally rotated.
- Note that the femoral nerve is just lateral to the artery so maintain a medial approach.
- Procedure as above but use a 21-gauge needle, aiming at the pulsation positioned between your index and middle finger.
- Angle for needle insertion - 90°

Brachial

- Position the elbow in extension.
- Watch for adjacent nerves
- Angle for needle insertion - 60°

Complication

- Bleeding, bruising, hematoma
- False aneurysm
- Prolonged arterial spasm
- Arterial occlusion
- Damage to local structures, including nerves

05.Pea^k flow measurement

- ‘Peak expiratory flow rate’ is a measure of maximum speed of expiration.
- Normal values are based on gender, age, and height

Equipment Required

- A Peak flow meter
- A clean disposable mouth-piece.

Indication

Test performed before and after the administration of a bronchodilator to assess reversible airway obstruction.

Procedure

- Introduce yourself, Confirm Patients Identity, Explain the Procedure, Obtain Verbal consent.
- The patient should be standing or sitting upright.
- Ensure that the meter is set to 0°.
- Ask the patient to take a deep breath in, hold the mouthpiece in the mouth, and seal their lips tightly around it.
- The patient should blow out as hard and as fast as possible.

- PEFR-Short maximal blow out, does not need to blow out completely.
- Make a note of the reading.
- The procedure should be repeated and the best of 3 efforts recorded. High value should be taken.
- Compared to the normal value on the Nunn-Greggs Nomogram.

06.Inhaler technique

Variety of inhalers are in market, but typical inhaler is Metered dose inhaler(MDI).

Metered dose inhaler(MDI)

Indication

- Patients with known COPD or asthma with acute exacerbations.
- Patients without known respiratory disease who exhibit expiratory wheezing.
- Patients with known respiratory disease with evidence of airflow obstruction who require endotracheal intubation in order to control the degree of respiratory failure.

Contraindication

- Patient whose airflow obstruction is due to an inhaled foreign body.
- Patient with airflow obstruction and an acute myocardial infarction.
- Congestive Heart failure.

Instruction for use

- Remove the cap and shake the inhaler several times.
- Sit upright, hold head up and breathe out.

- Place inhaler in mouth and seal lips around mouthpiece.
- Breath in, press the canister down to release the drug and continue to take a deep breath in. Take one dose at a time.
- Remove inhaler and hold breath for as long as possible up to 10 seconds.
- Recover before taking the next dose, replace cap.

07.Oxygen administration

Oxygen is a drug with a correct dosage
When administered correctly may be life saving.

Aim is to achieve adequate tissue oxygenation

(without causing a significant decrease in ventilation and consequent hypercapnia or oxygen toxicity)

Need to treat

- Tissue hypoxia is difficult to recognize as clinical features are nonspecific—include dyspnoea cyanosis, tachypnoea, arrhythmias, altered mental state, coma.
- Treatment of tissue hypoxia should correct any arterial hypoxemia (Cardiopulmonary defect/shunt e.g.-asthma, pneumonia, PE), any transport deficit (anaemia, low cardiac output), and underlying causes.
- SaO₂/PaO₂ can be normal when tissue hypoxia is caused by low cardiac output states.

Oxygen administration Equipment

The method of delivery will depend on the type and severity of respiratory failure, breathing pattern, respiratory rate, risk of CO₂ retention, need for humidification and patient compliance.

Each oxygen delivery device comprises

- An oxygen supply(>4L/min)
- Flow rate

- Tubing
- Interface + humidification

1) Nasal cannula

These direct oxygen via 2 short prongs up the nasal passage
They:

- Can be used for long periods of time.
- Prevent rebreathing.
- Can be used during eating and talking.

2) Low flow oxygen masks

These deliver oxygen concentrations that vary depending on the patient's minute volume. Some rebreathing of exhaled gases.

3) Fixed performance masks

These deliver constant concentration of oxygen independent of the patient's minute volume.

The masks contain 'venturi' barrels where relatively low rates of oxygen are forced through a narrow orifice producing a greater flow rate.

4) Partial and non-rebreath masks

This mask have a 'reservoir' bag that is filled with pure oxygen and depend on a system of valves which prevent mixing of exhaled gases with the incoming oxygen.

5) High flow Oxygen

Masks or nasal prongs that generate flows of 50-120ml/min using a high flow regulator to entrain air and oxygen at specific concentrations.

It should always be used with humidification.

Procedure

- Introduce yourself, confirm patient's identity, explain the condition, Obtain Verbal consent.
- Choose an appropriate oxygen delivery device
- Choose an initial dose...
 - Cardiac or respiratory arrest:100%.
 - Hypoxaemia with $\text{PaCO}_2 < 5.3 \text{ kPa}$:40-60%.
 - Hypoxaemia with $\text{PaCO}_2 > 5.3 \text{ kPa}$:24% initially.
- Decide on the acceptable level of SaO_2 or PaO_2 and titrate oxygen accordingly.
- If possible, try to measure a PaO_2 in room air prior to giving supplementary oxygen.
- Liaise with nursing staff, physiotherapist or outreach for support in setting up equipment.
- Apply the oxygen and monitor via oxymetry(SaO_2) and/or repeat ABG(PaO_2) in 30 minutes.
- If hypoxemia continue, then the patient may require respiratory support either invasively or non-invasively- liaise with your seniors and/or the respiratory doctors.
- Stop supplementary oxygen when tissue hypoxia or arterial hypoxaemia has resolved.

08.Nasogastric(NG) tube Insertion

Equipment Required

- NG tube
- Disposable gloves
- Lubricant gel
- Cup of water
- 50ml Syringe
- Drainage bag (If necessary)
- Adhesive tape
- Paper towel
- Plastic apron.

Indication

- Feeding (Ryle's tube)
- Patients who have an increased risk of aspiration
- Decompression of stomach during bowel obstruction
- Gastric lavage

Contraindication

- Severe Facial trauma
- Basal skull fracture
- Suspected oesophageal perforation
- Grossly abnormal nasal anatomy

Procedure

- Introduce yourself, confirm patient's identity, explain the procedure, and obtain verbal consent
- Wash hands thoroughly, put on gloves and plastic apron.

- Sit the patient up, slightly extending the neck.
- Examine patient's nose for deformity.
- Use the tube to measure the length from the nares to the stomach, (Xiphisternum-earlobe-tip of nose) and note the distance.
- Lubricate the tip(4-8cm) of the tube, avoiding blocking the lumen.
- Insert into the nostril and advance directly posteriorly
- Whilst advancing, ask the patient to take sip of water and hold it in their mouth.
- Request the patient to swallow and, as the patient swallows, advance the tube down oesophagus.
- Continue to advance the tube until 10-20cm beyond pre-measured distance to stomach (60-70cm total).
- **To confirm correct placement**
 - Aspirate some gastric contents with syringe and check fluid's acidic pH(with litmus paper) confirmatory
 - If unsure, obtain a chest X-ray(CXR) with a view of the stomach.
 - Although commonly done on wards, injecting 5-10ml air into the tube whilst auscultating for babbling with stethoscope placed over stomach.
- Remove guidewire if present
- Either Place cap into the end of NG tube or attach a drainage bag.
- Secure the tube in place by taping to nose.

Complication

- Discomfort, pain, gagging
- Bleeding (at any site, but particularly nose)
- Failure to correctly place tube e.g. Placement in trachea or bronchi
- Perforation of esophagus and stomach
- Electrolyte imbalance if rapid decompression of stomach.
- Esophagitis
- Nasal or retropharyngeal necrosis.

09.Male urethral catheterization

Equipment Required

- A Catheter pack (kidney dish, a small pot with cotton balls, a sterile towel, sterile gauze, sterile gloves-02)
- Antiseptic solution or sachet of saline
- 10ml 1% lignocaine/lubricant gel in pre-filled syringe
- 10ml water-filled syringe.
- A Catheter bag
- A male catheter (12F or 14F)
 - Catheter types
 - Short term catheter-latex with or without Polytetrafluoroethylene (PTFE)-should be changed after 2weeks.
 - Long term catheter-should be changed after 12weeks
 - Other types-Caude catheter (angled tip)
 - ◊ Teeman catheter (tapered end)-useful for enlarge prostates.

Indication

- To relieve urinary retention
- To accurately monitor urine output

Contraindication

- Established or suspected urethral trauma

Procedure

- Introduce yourself, confirm patient's identity, explain the procedure, obtain verbal consent, Wash hands thoroughly.
- Prepare equipment on clean trolley
- Expose the patient
- Put on two pairs of sterile gloves
- Place drape over the area
- Place gauze around shaft of the penis
- Use non-dominant hand to hold the penis with some gauze.
- Retract foreskin, clean glans with normal saline starting centrally and working around
- Lift penis to a vertical position, insert local anesthetic gel into the external urethral meatus.
- Position the kidney bowl between the patient's thighs to catch spillages later.
- Remove one pair of gloves, take sterile catheter and insert into urethra and advance slowly but firmly by feeding it out of the remaining wrapper.
- On passing through the prostate, some resistance may be felt, holding the penis taut, perpendicular to the body.
- Once inserted urine should start to drain from the catheter, advance the catheter fully to ensure the balloon is beyond the urethra.
- Inflate balloon with 10ml sterile water, whilst observing patients face for evidence of pain

- Withdraw catheter until resistance felt
- Attach draining tube and catheter bag
- Replace the foreskin, clean and redress the patients.
- Document the procedure in patient's note

Complication

- Infection-urethritis, cystitis, pyelonephritis, bacteremia
- Bleeding
- Urethral perforation
- Urethral stricture-with long term use
- Paraphimosis
- Creation of a false passage

10.Female urethral catheterization

Equipment Required

- A Catheter pack (kidney dish, a small pot with cotton balls, a sterile towel, sterile gauze, sterile gloves-02)
- Saline solution
- 5ml 1% lignocaine/lubricant gel in pre-filled syringe
- 10ml water-filled syringe.
- A Catheter bag
- A female catheter (12F or 14F)

Indication

- To relieve urinary retention
- To accurately monitor urine output

Contraindication

- Established or suspected urethral trauma

Procedure

- Introduce yourself, Confirm Patients Identity, Explain the Procedure, Obtain Verbal consent, Wash hands thoroughly.
- Prepare equipment on clean trolley
- Expose the patient (supine with knees flexed and hips abducted with heels together)
- Put on two pairs of sterile gloves
- Place drape over the area with genitalia exposed.

- Use non-dominant hand to hold the labia apart, approaching the patient from right hand side.
- Clean the genitalia with normal saline soaked cotton balls, pubis – anus direction.
- Position the nozzle of the local anesthetic gel inside the meatus and instilling most of the 5ml.
- Position the kidney bowl between the patient's thighs to catch spillages later.
- Remove one pair of gloves, take sterile catheter and apply a little lidocaine gel to catheter tip and insert into urethra and advance slowly but firmly by feeding it out of the remaining wrapper.
- Once inserted urine should start to drain from the catheter, advance the catheter fully to ensure the balloon is beyond the urethra.
- Inflate balloon with 10ml sterile water, whilst observing patients face for evidence of pain
- Withdraw catheter until resistance felt
- Attach draining tube and catheter bag
- Clean and redress the patients.
- Document the procedure in patient's note and residual urinary volume.

Complication

- Infection-Urethritis, cystitis, pyelonephritis, bacteremia
- Bleeding
- Urethral perforation
- Urethral stricture-with long term use

11. Suprapubic catheterization

Equipment Required

- Trolley
- Suprapubic catheter pack-'Bananno'(puncture needle, catheter with sleeve and adaptor clamp)
- 1 drainage bag.
- Iodine or antiseptic solution
- Green needle-01
- Orange needle-01
- 10ml syringe-02
- 1% lidocaine 5-10ml
- Sterile pack(gloves, swabs, container)
- Fine non-absorbable suture.

Indication

- Urethral injuries
- Urethral obstruction
- Bladder neck masses
- Benign prostatic hypertrophy(BPH)
- Prostate cancer

Contraindication

- Absence of an easily palpable or ultrasonographically localized distended urinary bladder.
- Coagulopathy (until the abnormality corrected)
- Prior lower abdominal or pelvic surgery (potential bowel adherence to bladder)

- Pelvic cancer with or without pelvic radiation (increased risk of adhesions)

Procedure

- Introduce yourself, confirm patient's identity, explain the procedure, Obtain Verbal consent, Wash hands thoroughly.
- Prepare equipment on clean trolley
- Expose the patient (supine with genitalia exposed)
- Make sure that the patient has palpable bladder. (if not, distend with 500-700ml of saline via a urethral catheter if urethral route available)
- Put on gloves, prepare the suprapubic area with antiseptic solution, (Shave the area if patient is hirsute)
- The point of insertion is in midline, 2finger-breadths (4-5cm) above the pubic symphysis.
- Ultrasonography to verify the bladder location and to ensure that no loops of bowel are present between the abdominal wall and the bladder.
- Apply sterile drapes and verify the insertion site by palpating the anatomic landmarks.
- Advance the catheter sleeve along the radio-opaque catheter from a proximal position adjacent to the suture disc to the distal end of catheter to allow to straightening of the coiled catheter.
- Infiltrate the insertion area with the lidocaine.
- Insert 18G puncture needle into the catheter so needle bevel is directed along inside the curve of the catheter and move in a clockwise direction-until bevel extend beyond the catheter tip.

- Slide the straightener sleeve off the distal end of the catheter.
- Grasp the catheter needle above the distal end, and push the needle through the abdominal wall-heading in a caudal direction-until you feel resistance disappear.
- Check the position of the catheter in the bladder by removing the black vent plug and aspirate urine using a 10ml syringe.
- Disengage needle from the catheter hub and advance catheter until the suture disc is flat against the skin.
- Withdraw needle and connect adaptor-clamp to the catheter hub and attach with standard drainage catheter bag.
- Suture the catheter into the abdominal wall.
- Undrape the patient and apply drain dressing around the catheter at the insertion site.
- Document the procedure in patient's note.
- Do not change a newly inserted catheter for 4 weeks to establishd catheter tract,it should be changed at least once a month to decrease infections.

Complication

- Gross hematuria is typically transient condition
- Infection: cellulitis and abscess formation
- Bowel perforation and intra-abdominal visceral injuries.
- Post obstruction diuresis is also possible

12.Endotracheal (ET) intubation

Equipment Required

- ET tube (size 7 in most women and size 8 in most men)
- Laryngoscope (check bulb)-usually size 3
- Sterile lubricant.
- 20ml syringe for cuff inflation
- Tape to tie tube in place
- Gum-elastic bougie, or rigid stiletto.
- Self –inflating bag and oxygen supply
- Suction apparatus with wide bore suction tube
- Gloves
- Stethoscope

Indication

- Relieving airway obstruction
- Protecting the airway from aspiration
- Facilitating artificial ventilation of the lungs

Contraindication

- Total upper airway obstruction, which requires a surgical air way
- Total loss of facial /oropharyngeal landmarks, which requires a surgical air way

Procedure

- In the awake patient, introduce yourself, confirm patient's identity, explain the procedure, obtain verbal consent, wash hands thoroughly and put on a pair of gloves.
- Pre-oxygenate the patient with a high concentration of oxygen for minimum of 15 seconds.
- Position the neck such that it is distally extended and proximally slightly flexed position with a small pillow underneath the head—an exaggeration of the normal cervical lordosis.
- Stand at the head of the bed and open the mouth.
- Inspect for loose dentures or foreign material-remove if any
- Hold the laryngoscope in the left hand and look down its length as you insert.
- Slide the scope into the right side of the mouth then move the blade to left so that tongue is pushed into a midline position.
- Advance, following the posterior edge of the soft palate until uvula comes into view, and advance the blade over the base of the tongue and the epiglottis should pop into sight.
- Apply traction in the line of the handle of the laryngoscope, this should lift the epiglottis and expose the v-shaped glottis behind.
- Once the triangular-shaped laryngeal inlet is in view, position the ET between the vocal cords, use the mark on the tube above the cuff to indicate the correct position.

- If difficulty is experienced passing the ET tube into the larynx, pass a gum elastic bougie first and then try passing a lubricated ET tube over this.
- Once the ET tube is in position, inflate the cuff while ventilating through the ET with a self-inflating bag.
- **Confirm correct tube placement by**
 - Direct visualization-the tube is seen to pass between the vocal cords.
 - Auscultation over the epigastrium and thorax bilaterally.
 - Portable CXR-to confirm where the tip of the tube lies and exclude complications such as pneumothorax.
 - Measurement of expired carbon dioxide by capnography.

Complication

- Trauma-to teeth, airway, larynx, or trachea.
- Tube misplacement.
- Aspiration.
- Airway obstruction.
- Hypoxia from prolonged attempts.
- Tracheal stenosis (late complication).

13.Lumbar puncture

Equipment Required

- Sterile gloves and surgical mask
- Sterile drapes
- Sterile gauze swabs
- Antiseptic solution for skin preparation
- Small wound dressing
- 5ml Syringe,25G and 21G needles,1% lidocaine
- Spinal needle (20 or 22G)
- Manometer and three-way tap
- Sample pots (label 1,2,3) ,Fluoride oxalate(grey)sample tube-for glucose

Indication

- A diagnostic test for pathology affecting the central nervous system e.g. meningitis and multiple sclerosis-if bacterial meningitis take blood cultures and start antibiotics, before lumbar puncture.
- Suspected Encephalitis-if viral start acyclovir immediately, before lumbar puncture.
- Suspected Subarachnoid hemorrhage-wait 12hr from onset of headache before performing lumbar puncture.
- Suspected idiopathic intracranial hypertension, other causes of raised CSF pressure must be excluded first.
- Suspected Guillain-Barre syndrome

Contraindication

- Raised CSF pressure associated with 'brain shift' e.g.
-secondary to focal lesion. (Focal neurological signs)
- Reduced level of consciousness
- Papilledema
- Recent seizure
- Bleeding disorder (including platelet count $<50\times10^9/l$, INR >1.5 , receiving anticoagulant)
- Local skin infection.
- Anatomical abnormality, previous spinal surgery.

Procedure

- Introduce yourself, confirm patient's identity, explain the procedure, and obtain verbal consent.
- Position the patient in a lateral position with hips and knees flexed in the fetal position.
- Ensure that the patient can hold this position comfortably.
- Identify Iliac crest-the disc space vertically below this will be L3-L4.
- Mark the space between the vertebral spines with a pen.
- Wash hands and put on sterile gloves.
- Clean the skin with antiseptic solution.
- Inject 1% lidocaine initially subcutaneously with orange needle, then deeper with green needle. Take care to aspirate before injecting to ensure blood vessels are avoided.
- Wait for 1min for anaesthetic to take effect.
- Insert lumbar puncture needle into interspinous space at 90° to skin, aiming towards umbilicus.

- Advance needle until it gives once is passes through the ligamentum flavum, further push of the needle should produce as the needle enters the subarachnoid space.
- Remove stylet and observe for CSF drainage.
- Attach manometer and wait for CSF to reach a steady level.
- Then fill 3 sample bottles about 5-6drops per bottle, bottles should have labeled 1,2,3, in order of collection. Fill more drops into special bottle for glucose measurement.
- Replace the stylet and remove the needle and apply dressing.
- Send samples for analysis.
 - Cell count (bottle 1,3)
 - Microscopy, culture and sensitivities (bottles 1,3)
 - Protein(bottle 2)Glucose(special bottle- Fluoride oxalate (grey) sample tube)
- Advise the patient to lie flat for 1hr and ask nursing staff to check CNS observations at least twice during that time.

Complication

1. Post lumbar puncture headache (occur 1/3 of all patients with in 48hrs after procedure)
 - Advice to lie on their back for few hours
 - Keep well hydrated
 - Caffeine may be of benefit
 - Blood patch can be performed by anaesthetist for severe cases

- Exclude other causes of headache also
- 2. Bleeding-local, epidural haematoma
- 3. Infection-epidural abscess
- 4. Pain-local, referred
- 5. Damage to local structures-e.g. nerves, cauda equina, spinal cord
- 6. Cerebral herniation
- 7. Subarachnoid epidermal cysts because of introducing a skin plug.

Interpretation

Parameters	Normal	Bacterial	Viral	TB
Appearance	Clear	Cloudy/ Purulent	Clear	Clear/turbid
Opening pressure	7-20cm	High	-	-
Protein	<0.4g/L	> 1.0g/L	0.5-0.9g/L	> 1.0g/L(often much higher)
Glucose	> 70% of plasma glucose	Very low	> 70% of plasma glucose	< 50% of plasma glucose
White cells	< 4x10 ⁹ /L	5-2000x10 ⁹ Neutrophils	5-1000x10 ⁹ Lymphocytes	5-500x10 ⁹ Lymphocytes
Other useful tests	-	Gram stain/ culture	Viral PCR	AFB staining/culture/PCR

14. Pericardial aspiration

Equipment Required

- Sterile gown and gloves
- Antiseptic solution
- Sterile towels.
- 10ml syringe.
- 50ml syringe.
- Three-way tap.
- Local anaesthetic.
- Needles
- 18G Cannula
- ECG Monitoring, defibrillator, and resuscitation equipment.

Indication

- Cardiac tamponade (Echocardiography must be done first to confirm the presence of a pericardial effusion unless there is cardiac arrest from presumed tamponade)
- Pericardial effusion due to suspected bacterial Pericarditis.

Contraindication

- Pericardial effusion of less than 2cm thickness without haemodynamic compromise
- Bleeding disorder/coagulopathy (including platelet count $<50 \times 10^9/l$, INR >1.5 , receiving anticoagulant)
- Associated aortic dissection or myocardial rupture.

Procedure

- If conscious, introduce yourself, confirm patient's identity, explain the procedure, and obtain verbal consent.
- Position the patient in a semi-recumbent position at a 30 - to 45degree angle. This position brings the heart closer to the anterior wall.
- Established IV access and connect ECG monitor with full resuscitation equipment to hand.
- Provide adequate sedation if necessary.
- Put sterile gloves and gown.
- Identify anatomic landmarks (xiphoid process, 5th 6th ribs).
- Clean the sub-xiphoid area with antiseptic solution.
- If time permits infiltrate local anaesthetic solution ai the insertion site.
- Attach the 18G cannula with 50ml syringe.
- Introduce needle at 450 to the skin immediately below and to the left of the Xiphisternum to a depth of 6-8cm, in a direction aiming for the tip of the scapula.
- Aspirate continuously and watch the ECG
 - If the needle touches the ventricle an injury pattern (depressed ST segment) or arrhythmia may be seen-withdrawing the needle slightly.
- Aspirate pericardial fluid through the syringe and 3-way tap.
- Aspiration should produce immediate hemodynamic improvement.

- You can check if the fluid you are aspirating is pure blood if it clots quickly. Heavily blood stained pericardial fluid does not.
- Perform a CXR and ECHO after the procedure.
- You may wish to insert a pericardial drain.
- Document the details of the procedure in the patient's notes.

Complication

- Penetration of a cardiac chamber (usually right ventricle)
- Laceration of an artery (coronary, left internal thoracic, intercostal, intra-abdominal)
- Arrhythmia
- Pneumothorax
- Perforation of stomach or colon
- Vasovagal reaction
- Failure of the procedure.
- Infection.

15.Ascitic tap

A needle is inserted through the abdominal wall and withdraw a small amount of fluid for diagnostic purposes.

Equipment Required

- Sterile pack (gloves, cotton, container)
- 10ml syringe
- 20ml syringe
- Green needle
- Orange needle
- 5-10ml 1% lidocaine solution.
- Antiseptic solution
- Microbiology culture bottles
- 2 sterile collection bottles
- Biochemistry tube(glucose).
- Hematology tub.

Indication

- **Diagnostic tap**
 - New onset ascites
 - Suspected spontaneous or secondary bacterial peritonitis
 - Refractory ascites
- **Therapeutic tap**
 - Respiratory compromise secondary to ascites
 - Abdominal pain or pressure secondary to ascites (abdominal compartment syndrome)

Contraindication

- An acute abdomen that require surgery
- Severe thrombocytopenia or coagulopathy

Relative Contraindications

- Pregnancy
- Distended Urinary bladder
- Abdominal wall cellulitis
- Distended bowel
- Intra-abdominal adhesions

Procedure

- Introduce yourself, confirm patient's identity, explain the procedure, obtain verbal consent.
- Ensure that the patient has emptied their bladder.
- Position the patient lying supine or in the lateral decubitus position leaving the right side available- undress exposing the abdomen.
- Percuss the abdomen for ascetic dullness.
- Mark a suitable site of the right iliac fossa with in the area of dullness.
- Clean the area with antiseptic solution and put on sterile gloves.
- Inject local anaesthetic, to skin and subcutaneous tissue via orange needle and 10ml syringe and wait for 1min for it to take effect.
- Attach the Green needle to 20ml syringe and insert into the abdomen, perpendicular to skin. Advance the needle until fluid is withdrawn.

- Aspirate as much as possible
- Remove the needle and apply a suitable sterile dressing.
- Put 4ml of fluid in each bottle and send to Lab for:
 - Biochemistry-standard collection bottle (albumin, LDH, amylase)
 - Biochemistry-accurate glucose collection tube (glucose).
 - Cytology.
 - Haematology (total and differential white cell count)
 - Microbiology (MC &S)

Complication

- Perforation of intra-abdominal organs (bowel, bladder, liver, spleen)
- Bleeding
- Infection(peritonitis)
- Persistent leak of ascitic fluid from puncture site.
- Failure to obtain ascitic fluid sample.

16.Knee joint aspiration

Equipment Required

- Sterile drapes
- Sterile gloves.
- Sterile gallipot
- Antiseptic solution
- Sterile universal sample bottles
- 1% lidocaine-5-10ml
- 20ml syringe
- 5ml syringe
- 21G Green needle
- 25G Orange needle

Indication

- Suspected Septic arthritis
- Unexplained joint effusion
- Suspected gout and hemarthrosis
- Aspirating large joint effusions to relieve symptoms from tense effusion

Contraindication

- Cellulitis of overlying skin
- Bleeding disorder (platelet count $<50\times 10^9/L$,INR >2)
- Prosthetic joint
- Bacteraemia
- Liaise with hematologist as indicated

Procedure

- Introduce yourself, confirm patient's identity, explain the procedure, and obtain verbal consent.
- Prepare all equipment on clean trolley.
- Position the patient supine with rolled towel placed below the knee to hold the joint in a slightly flexed position.
- Identify the anatomical landmarks and palpate the patella to determine the site of insertion (aspiration easier on the medial side).
- Put on sterile gloves, clean the site with antiseptic solution.
- Use sterile drapes to create sterile field around needle insertion site.
- Infiltrate local anaesthetic with 5ml syringe and 25G orange needle.
- Attach 21G green needle with 20ml syringe and insert the needle at an angle of around 45° in the gap between the lower border of the patella and the medial joint line.
- If the needle is in joint space, you can freely aspirate synovial fluid.it can be aided by pressing on the opposite side of the joint with your free hand.
- Remove 20ml of fluid full in syringe and transfer the fluid into sterile specimen bottles.
- Apply a sterile dressing
- Document the procedure in patient's note.
- Send sample for Analysis
 - Microbiology
 - Polarized light microscopy (asses for negatively

- bi-refrangent monosodium urate crystals)
- Biochemistry (glucose, protein, and LDH)

Complication

- Introducing of infection causing septic arthritis
- Cartilage injury
- Hemarthrosis
- Failure to obtain synovial fluid.

Cause of joint effusion	Appearance	Cells(cells/ μ l) Protein(g/dL)Glucose(mg/dL)	Other
Normal	Straw-coloured, clear	WBC: < 200 Neutrophils: < 25% Protein: 1-2 Glucose: Serum glucose	-
Non-inflammatory	Clear or slightly turbulent	WBC: 0-2000 Neutrophils: < 30% Protein: 2-3 Glucose: Serum glucose	-
Inflammatory joint disease eg-RA,SLE	Cloudy	WBC: 2000-100,000 Neutrophils: > 50% Protein: > 3-4 Glucose: < 25	-
Septic arthritis	Purulent	WBC: 50,000-200,000 Neutrophils: > 90% Protein: > 3-4 Glucose: < 25	Gram stain may reveal organisms in fluid.
Crystal arthropathy	Cloudy	WBC: 500-100,000 Neutrophils: > 90%	Polarised light microscopy reveals crystals

17.Injections

I. Intra-Muscular (IM) Injections.

Equipment Required

- Gloves
- Syringe
- Needle(21-23G)
- Alcohol swab
- Extra 21G needle for drawing up dose.
- Cotton
- Sharps bin
- Appropriate medication.

Indication

- Allows rapid bolus of medication without the need for IV access.
- Where IV access is difficult or would pose unnecessary trauma to the patient.

Contraindication

- Thrombocytopenia
- Coagulation disorder.

Procedure

- Introduce yourself, confirm patient's identity, explain the procedure, and obtain Verbal consent.

- Wash your hands and put on a pair of gloves
- Draw up the medication using 21G needle and double check the medication, dose, and expiry date.
- Select the needle long enough to reach the muscle(25G), and expel any air in the syringe
- Clean the injection site with alcohol swab.
- Slide the skin and subcutaneous 2-3cm in any direction and hold taut.
- IM injection should be given at a 90⁰ angle to ensure needle reaches the muscle, and to decrease pain.
- Aspirate for blood, alter position of needle if blood aspirated.
- Inject medication (<1ml/10seconds)
- Release the skin, remove needle and dispose of sharps in the sharps bin.
- Ensure documentation of the site, time and drug injected is done.

Complication

- Pain
- Haematoma
- Damage to local structures (arterial puncture, nerve damage, tissue necrosis, fibrosis)

Post procedure management

Check for signs of localized redness, swelling, bleeding, and inflammation at the injection site.

II. Subcutaneous (SC) Injections.

Equipment Required

- Gloves
- Syringe
- Needle(21-23G)
- Alcohol swab
- Extra 21G needle for drawing up dose.
- Cotton
- Sharps bin
- Appropriate medication.

Indication

- Where IV access is difficult or would pose unnecessary trauma to the patient.

Contraindication

- Surgical emphysema
- Cellulitis
- Obesity(this would greatly reduce the bioavailability of the drug due to poor absorption)

Procedure

- Introduce yourself, confirm patient's identity, explain the procedure, and obtain verbal consent.
- Wash your hands and put on a pair of gloves
- Draw up the medication using 21G needle and double check the medication, dose, and expiry date.
- Select the needle long enough to reach the muscle(25G), and expel any air in the syringe

- Clean the injection site with alcohol swab.
- Pinch a fold of skin so as to lift the adipose tissue away from the underlying muscle.
- Insert the needle horizontally into the fold and aspirate for blood, alter position of needle if blood aspirated.
- Inject medication (<1ml/10seconds)
- Release the skin, remove needle and dispose of sharps in the sharps bin.
- Ensure documentation of the site, time and drug injected is done.

Complication

- Long term use of the subcutaneous route, E.g.-in diabetics, can result in lipodystrophy, therefore rotation of the injection site is important.
- Skin irritation

III. Intra-Dermal (ID) Injections.

Equipment Required

- Gloves
- Syringe
- Needle(25,27G)
- Alcohol swab
- Extra 21G needle for drawing up dose.
- Cotton
- Sharps bin
- Appropriate medication.

Indication

- Where IV access is not necessary and will provide least infection risk for diagnostic testing.eg-Mantoux test

Contraindication

- Cellulitis
- Surgical emphysema
- Obesity.

Procedure

- Introduce yourself, confirm patient's identity, explain the procedure, and obtain Verbal consent.
- Wash your hands and put on a pair of gloves
- Draw up the medication using 21G needle and double check the medication, dose, and expiry date.
- Select the needle(25-27G), and expel any air in the syringe
- Clean the injection site with alcohol swab.
- Inject using 25-27G needle advancing it parallel to the skin, into the epidermal dermal junction.
- Injection will result in slight separation of different layers of the skin, aspirate for blood, alter position of needle if blood aspirated.
- Inject medication.
- Remove needle and dispose of sharps in the sharps bin.
- Ensure documentation of the site, time and drug injected is done.

Complication

Localized infection.

18.Blood cultures from Peripheral and Central sites

Equipment Required

- Gloves
- Tourniquet
- 20ml Syringe
- Needle
- Alcohol swab
- Cotton
- Tape
- Aerobic and anaerobic blood culture sets.

Indication

- Patients with features of suspected infection.
- Blood cultures should ideally be taken before administration of antibiotics.

Contraindication

- Limbs post local/regional lymph node dissection

Procedure for peripheral blood cultures

- Introduce yourself, confirm patient's identity, explain the procedure, and obtain verbal consent
- Blood cultures should be taken from a fresh venepuncture and not from IV cannula
- Blood cultures should be taken in the same way as one

- would take blood during venipuncture
- If possible avoid Femoral puncture due to increased risk of contamination
- Clean skin with alcohol swab for 30seconds and allow to dry by evaporation. Do not retouch the skin over the skin over the vein as this will contaminate the site
- Remove the tops from the culture bottles and clean with alcohol swab for 30seconds and allow to dry by evaporation
- Take blood cultures, filling the aerobic bottle first
- Dispose of any sharps in the sharps bin
- Once taken blood cultures should be stored in an incubator or sent to microbiology quickly
- Documents in the Patient's notes.

Procedure for peripheral blood cultures

- Introduce yourself, confirm patient's identity, explain the procedure, and obtain verbal consent.
- Remove the tops from the culture bottles and clean with alcohol swab for 30seconds and allow to dry by evaporation
- Put on sterile gloves
- Remove the cap of the central line port
- Wipe with alcohol swab
- Connect 10ml syringe and aspirate 5-10mls, discard this syringe
- Connect another new syringe and aspirate a further 5-10mls

- Empty it into the culture bottles (anaerobic first), which should be sent to microbiology quickly or stored in an incubator
- Dispose of any sharps in the sharps bin
- Flush the line with 10ml normal saline and replace the cap
- Documents in patient's notes (always consider paired peripheral samples)

Complication

- Damage to local structures(nerves)
- Bleeding, bruising, haematoma
- Inadvertent arterial puncture

19.Central vein Cannulation

Equipment Required

- Sterile gloves and gown.
- Sterile pack including sterile drapes
- Sterile dressing.
- Trolley
- Antiseptic solution
- Local anesthetic 1% lidocaine-5ml
- Suture material 2.0 silk on a curved needle
- Seldinger central vein line kit
- 21G(green),25G(orange) needles.
- Saline or heparinized saline to prime and flush the line prior to and post insertion.
- Ultrasound machine.

Indication

- Measurement of Central venous pressure(CVP).
 - Transfusion of large volumes of fluid required(the fluids itself can be given faster via a large bore peripheral IV cannula)
 - Fluids challenge in patients with oliguria or hypotension.
 - To exclude hypovolemia when clinical evidence is equivocal.
- Monitoring venous oxyhemoglobin saturation
- Urgent haemodialysis.

- Insertion of a temporary pacing lead or pulmonary artery catheter
- IVC filter placement
- Administration of certain drugs (inotropes, potassium chloride, TPN)

Contraindication

- Bleeding disorder/Coagulopathy (including platelet count $<50 \times 10^9/l$, INR >1.5 , receiving anticoagulant)
- Local skin infection
- Uncooperative patients
- Prohibitive anatomic distortion.

Procedure-Internal jugular vein

- Introduce yourself, confirm patient's identity, explain the procedure, and obtain verbal consent.
- Prepare all equipment on a clean trolley
- Put on a sterile gown and gloves.
- Check that wire passes through the needle freely. Flush all the lumens with heparinized saline.
- Position the patient lying flat with the bed tilted head down and patient's head turned to the left
- Clean the skin with antiseptic solution and drape the area.
- Stand at the head of the bed.
- Locate the cricoid cartilage and palpate the carotid artery lateral to it.
- The site of insertion is 1/3 of the way up the sternocleidomastoid, just between its 2 heads.
- Use ultrasound probe to confirm position of the Internal Jugular vein in the neck.

- Infiltrate the skin around the proposed site of the line insertion with local anaesthetic, using a 25G orange needle.
- Use the ultrasound probe with a sterile sheath to confirm position of the Internal jugular vein in the neck.
- Attach the Seldinger needle to 5ml syringe and advance needle, bevel up, through subcutaneous tissues into Internal jugular vein under direct ultrasound guidance, pulling back on the plunger at all times.
- Stop advancing the needle when venous blood is aspirated into syringe.
- Stabilize the needle with one hand, remove the syringe and pass the guide-wire through the needle(looking at cardiac monitor as the wire is advanced, as arrhythmias may occur at this stage).
- Hold the guidewire all the times, to prevent it being lost inside the patient and remove the needle.
- Use the scalpel to make a small skin incision immediately adjacent to the guide-wire.
- Pass the dilator along the guide-wire and advance through the skin into the vein, Remove the dilator, leaving the guide-wire in place
- Pass the Central line over the guide-wire and advance it through the skin into the vein to a suitable depth, and remove the guide-wire.
- Check lumen placement by aspirating through the pigtails and flush with saline. Lock off the 3-way taps.
- Secure the catheter in place with a suture and cover with an adhesive sterile dressing.

- Dispose of all sharps in the sharps bin.
- Document all the details of the procedure in patient's notes.

Complication

- Arterial puncture or laceration
- Pneumothorax
- Haemothorax
- Chylothorax
- Injury to adjacent nerves
- Air embolism
- Arrhythmias
- Infection
- Thrombosis of vessel
- AV fistula
- Cardiac tamponade.

Post procedure management

- Request CXR to confirm correct position of the line.
- Rule out complications eg-pneumothorax.

Procedure-Subclavian vein

- Introduce yourself, Confirm Patients Identity, Explain the Procedure, Obtain Verbal consent.
- Prepare all equipment on a clean trolley
- Put on a sterile gown and gloves.
- Check that wire passes through the needle freely. Flush all the lumens with heparinized saline.

- Position the patients lying flat with the bed tiled head down and patient's head turned to the left
- Clean the skin with antiseptic solution and drape the area.
- The Operator should be positioned on the right-hand site of the patients.
- Skin is punctured just below the junction between the medial and middle thirds of the clavicle.
- Direct the needle medially, slightly upward and posteriorly behind the clavicle toward the suprasternal notch.
- Slowly advance the needle while gently withdrawing the plunger.
- When a free flow of blood appears, follow the Seldinger approach (explained earlier)
- Ultrasound can be used to guide puncture of the vein using a more lateral approach.
- The catheter tip should lie in the SVC above the pericardial reflection.
- Perform a CXR to confirm the position and exclude a Pneumothorax.

Procedure-Femoral Vein

- Introduce yourself, Confirm Patients Identity, Explain the Procedure, Obtain Verbal consent.
- Prepare all equipment on a clean trolley
- Put on a sterile gown and gloves.
- Check that wire passes through the needle freely. Flush all the lumens with heparinized saline.
- Lie the patient flat. The leg should be slightly abducted and externally rotated.

- Identify the femoral artery below the inguinal ligament (the femoral vein usually lies medially).
- Shave the groin and Clean the skin with antiseptic solution and drape the area.
- After infiltrate the skin and subcutaneous tissue with 1% lidocaine slowly advance the needle upward and posteriorly whilst gently withdrawing the plunger.
- When a free flow of blood appears, follow the Seldinger approach (explained earlier)
- Ultrasound can be used to identify the vessels.

Removing Internal jugular vein catheters

Remove all dressing and suture material.

Ensure all drugs and infusions have been stopped.

Lie the patient down to reduce the risk of air embolism.

Ask the patient to take a deep breath and fully exhale.

Remove the line smoothly, while the patient is breath holding and apply firm pressure to the puncture site for at least 5 minutes to stop bleeding.

Ask the patient to sit up.

If infection is suspected, send the tip of the line in a dry specimen pot for culture.

20.Chest drain insertion

Equipment Required

- Sterile gloves and gown.
- Sterile pack including sterile drapes
- Sterile dressing.
- Trolley
- Antiseptic solution
- Local anesthetic 1% lidocaine-10ml
- 10ml syringe
- 21G(green),25G(orange) needles.
- Suture material 2.0 silk on a curved needle
- Seldinger chest drain kit(chest drain introducer, chest drain needle,syringe,scalpel,3-way tap, guide wire)
- Chest drain tubing.
- Chest drainage bottle.
- 500ml sterile water.

Indication

- Pneumothorax
 - Pneumothorax in any ventilated patient
 - Tension pneumothorax
 - Large symptomatic spontaneous secondary pneumothorax
 - Large symptomatic recurrent or persistent pneumothorax

Consider thoracentesis:-

- Symptomatic spontaneous primary pneumothorax of any size.
- Small symptomatic spontaneous secondary pneumothorax in patients under 50 years.
- Pleural effusion
 - Pleural infection, that is, complicated parapneumonic effusion or empyema
 - Symptomatic malignant pleural effusion
 - Traumatic Haemothorax

Consider thoracentesis: -

- Pleural effusion of unknown cause, for diagnostic purposes
- Large symptomatic pleural effusion for therapeutic purposes

Contraindication

- Uncertain diagnosis (bulous diseaseVs pneumothorax, elevated hemidiaphragm,lung collapse or consolidation misdiagnosed as pleural effusion)
- Localized skin infection
- Coagulopathy($INR > 1.5$, $PLT < 50 \times 10^9$ /anticoagulant therapy)

Procedure

- Introduce yourself, confirm patient's identity, explain the procedure, and obtain verbal consent
- Prepare all the equipment on a clean trolley.
- Confirm the indication for the procedure (history, percussion, CXR to be sure of which SIDE needs the drain)
- Position the patient

- Semi-reclined with hand behind head
 - Sitting up leaning over a table with padding.
 - Lateral decubitus position
- Consider pre-medication with either an opioid analgesic (morphine 2.5mg iv), or an anxiolytic(midazolam 1-2mg iv)
- Ensure the patient is comfortable and in a position that allows access to the site where chest drain is to be inserted. (Safe triangle formed by the diaphragm, the latissimus dorsi and the pectoralis major)
- Wash your hands and put on a pair of gloves
- Clean the insertion site skin area with antiseptic solution and drape the area
- Infiltrate the skin and subcutaneous tissue with 1% lidocaine using orange needle(25G),then down to parietal pleura using green needle(21G).
- Attach the Seldinger needle to a 10ml syringe insert needle into intercostal space and advance through the anaesthetized skin,pulling back on plunger all the time.
- Stop advancing the needle when the pleural fluid or air is aspirated into the syringe,whilst keeping the needle still,remove the syringe and pass the guide-wire through the needle(always keep hold of the guide-wire)
- When half the guide-wire has been inseted into the pleural space,remove needle.
- Use the scalpel to make a small cut in the skin adjacent to the guide-wire.
- Pass the dilator along the guide-wire and advance through the skin into pleural space, Remove the dilator, leaving the guide-wire in place in the end.

- Pass the chest drain over the guide-wire and advance through the skin into pleural space, Remove the guide-wire.
- Attach the 3-way tap and make sure all the ports are closed.
- Suture the drain to the skin.
- Connect the bottle with under water seal to the 3-way tap, and open the 3-way tap.
- Confirm functioning of the chest drain by observing water in the bottle to be swinging/bubbling+/- fluid draining.
- Secure the chest drain insertion site with sterile dressing.
- Document all the procedure in patient's notes.

Post procedure management

Confirm correct positioning of chest drain:

- Observe water in bottle for swinging/bubbling
- Determine whether the fluid or air is draining from the pleural space
- Obtain post-procedure CXR

Complication

- Pain
- Malposition of the ICD
- Damage to Viscera
- Bleeding –intercostal vessels
- Infection following ICD insertion
- Drain dislodgement or blockage
- Re-expansion pulmonary oedema
- Damage to local structures (liver, spleen, visceral puncture)

Procedure for the removal of a chest drain

- Introduce yourself, confirm patient's identity, explain the procedure, and obtain verbal consent
- Prepare all the equipment on a clean trolley.
- Wash your hands and put on a pair of gloves remove the dressings around the drain
- Cut the suture and whilst asking the patient to exhale firmly pull the chest drain out.
- With your other hand, apply sterile gauze to the wound and secure in place with sterile dressing.
- Arrange a follow-up CXR to rule out pneumothorax or surgical emphysema.
- If the wound is large or there is considerable bleeding, consider the need for sutures
- Document the procedure in patient's notes

21. Abdominal paracentesis (drainage)

A drain is inserted into the abdominal cavity allowing drainage of large amounts of ascitic fluid for therapeutic purposes.

Equipment Required

- Sterile pack (gloves, cotton, container)
- 10ml syringe x 2
- Green needle
- Orange needle
- 5-10ml 1% lidocaine solution.
- Antiseptic solution
- Banano abdominal catheter pack (catheter, sleeve, puncture needle, adaptor clamp)
- Catheter bag.
- Catheter bag stand.
- Scalpel.

Indication

- Respiratory compromise secondary to ascites
- Abdominal pain or pressure secondary to ascites (abdominal compartment syndrome)

Contraindication

- An acute abdomen that require surgery
- Severe thrombocytopenia or coagulopathy

Relative Contraindications

- Pregnancy
- Distended Urinary bladder
- Abdominal wall cellulitis
- Distended bowel
- Intra-abdominal adhesions

Procedure

- Introduce yourself, confirm patient's identity, explain the procedure, and obtain verbal consent.
- Ensure that the patient has emptied their bladder.
- Position the patient lying supine or in the lateral decubitus position leaving the right side available- undress exposing the abdomen.
- Percuss the abdomen for ascetic dullness.
- Mark a suitable site of the right iliac fossa with in the area of dullness.
- Clean the area with antiseptic solution and put on sterile gloves.
- Inject local anaesthetic ,to skin and subcutaneous tissue via orange needle and 10ml syringe and wait for 1min for it to take effect.
- Attach the Green needle to 20ml syringe and insert into the abdomen, perpendicular to skin. Advance the needle until fluid is withdrawn.
- Prepare the catheter kit- straighten the catheter using the plastic covering sheath provided.
- Take the needle in the pack and pass through the sheath until the needle protrudes from the catheter tip.

- Close off the rubber bung at the end of the catheter.
- Make a small incision in the skin using the scalpel.
- Grasp the catheter needle 4' above the distal end and, with a firm thrust, push the needle through the abdominal wall to 3cm deep.
- Withdraw needle from the catheter hub and advance catheter until the suture disc reaches the skin.
- Remove the needle, connect adaptor-clamp to the catheter hub and securely attach the rubber portion of the clamp into a standard drainage catheter bag.
- Suture the catheter into the abdominal wall carefully and tape to ensure the catheter won't fall out.
- Ensure the clamp is open to allow fluid to drain
 - In cirrhotic patients-every 3L of ascitic fluid drain need to be replaced by infusing human albumin solution(HAS)
 - Usually catheters are not left in place for >24hrs.
- Document all the procedure in patient's note

Complication

- Perforation of intra-abdominal viscera(bowel, bladder, liver, spleen)
- Bleeding
- Infection(peritonitis)
- Persistent leak of ascitic fluid from puncture site.
- Failure to obtain ascitic fluid sample.

22.Tracheostomy management

Tracheostomy indications

- Prolonged mechanical ventilation in patients with respiratory failure
- Ventilation in the presence of any obstruction of the upper airways is an emergency case
- Severe trauma and/or burns around the head and neck area
- Subcutaneous emphysema

Tracheostomy care

It includes

- Care of stoma site and changing tracheostomy dressings
- Monitoring cuff pressures
- Suctioning
- Changing a tracheostomy tube

Tracheostomy tube type

Tracheostomy tube type	Description
Cuffed	<ul style="list-style-type: none">• Allows positive pressure mechanical ventilation and protects against aspiration of gastric contents.• Cuff pressures should be monitored and cuffed deflated regularly to reduce risk of tracheal stenosis.

Uncuffed	<ul style="list-style-type: none"> Should be used in preference to cuffed tubes if the cuff is not necessary. Allows movement of air around tracheostomy tube to facilitate speaking and weaning.
Fenestrated	<ul style="list-style-type: none"> Additional opening in body of tube to allow air to pass through tube when external opening is plugged (for speaking and weaning) Fenestrations are often not in the correct place and can cause irritation and granulation of the trachea mucosa.
Double-cannula tube	<ul style="list-style-type: none"> This consists of an outer(permanent)tube and an inner tube which can be removed for short periods of time to be cleaned or replaced. It maintains patency of tracheostomy lumen for longer.
Single-cannula tube	<ul style="list-style-type: none"> Single-lumen tube without an inner cannula. They need to be changed more frequently to maintain patency of airway.

Care of stoma site and changing tracheostomy dressings

- Introduce yourself, confirm patient's identity, explain the Procedure.
- Wash hands and wear gloves
- Remove the old dressing and examine the site carefully for any skin irritation and infection.
- Carefully clean the skin around the tracheostomy with sterile saline and gauze.
- Dry the skin and replace with a new tracheostomy dressing.
(The stoma site should be cleaned daily to prevent build-up of secretions and debris)

Monitoring cuff pressures

- Patients with **cuffed tracheostomies** often require careful monitoring of their cuff pressures and regular cuff deflation is required, so as to reduce the risk of tracheal stenosis.
- Cuff pressure should be checked twice daily using manometer.
- Cuff pressure should be kept within the range 15-20mmHg.
- Daily cuff deflation also allows for the removal of secretions that may accumulate above the cuff.

Suction of Tracheostomy tube

- Wash your hands and wear gloves
- Attach a sterile catheter to suction equipment ensuring a good seal and leave most of the packaging in place.
- Insert suction catheter gently into tracheostomy tube to approximately one-third of the catheter length.
- Start suctioning as catheter is removed by placing thumb over suction port.
- Suction should not be applied for longer than 15seconds to avoid hypoxia.
- If further suctioning is required, a fresh suction catheter should be used.
- Repeat suctioning until airway is clear
- Observe and document the amount of secretions, colour and consistency and document this in the notes.

Tube occlusion

- Call for help.
- Reassure the patient.
- Ask the patients to cough or attempt to clear secretions via suction.
- Remove inner cannula and replace with new one.
- If no inner cannula, deflate cuff and administer oxygen facially, instill 2-5ml of 0.9% saline and suction to try to clear blockage.
- If unable to clear blockage, a total tube change may be required.
- If tube insertion fails then consider mask to stoma ventilation (consider suction via stoma).
- If respiration stops all together, put out a ‘crash call’, for anesthetist, inflate the cuff and manually ventilate using catheter mount and rebreathe or ambu-bag.

Changing a tracheostomy tube

- Wash hands and wear gloves
- Prepare trolley with new tracheostomy tubes (tube, lubricant gel, sterile saline, gauze, tracheal dilators, suction equipment)
- Lubricate the new tube with plenty of gel.
- Position the patient in upright or semi-recumbent position with neck slightly extended (place rolled towel under shoulders if necessary)
- Remove old tracheostomy tube while asking patient to breathe out
- Insert new, clean the tracheostomy tube using ‘up and over ‘action

- Remove introducer from the tracheostomy tube (to allow the patients to breathe).
- Replacing a tracheostomy tube will cause patient to cough which may dislodge the tube-do not let go of tube until secured in place
- If replacing a double-cannula tracheostomy, place an inner tube in position once an outer tube has been inserted
- Secure the tracheostomy tube in place with tapes
- Administer suction through tracheostomy tube if required.
- If replacing the cuffed tube, inflate the cuff to pressure of 15-20 mmHg (check with manometer)
- Always clean around the tracheostomy site with normal saline and gauze and apply the tracheostomy dressing if required.

Complications

Mucus plugging may cause acute respiratory distress.

23.Aspiration of Pleural fluid

Equipment Required

- Sterile pack(gloves,cotton,sterile drape)
- Green needle(21G)
- Orange needle(25G)
- 1% lidocaine solution.
- Syringe(10ml,20ml)
- Antiseptic solution
- Universal sample pots
- Floride oxalate(grey)sample tube
- Heparinised(ABG) syringe
- Dressing

Indication

- Diagnostic testing
- Therapeutic removal of fluid

Contraindication

- Localized skin infection
- Development of pneumothorax /tension pneumothorax

Procedure

- Introduce yourself, confirm patient's identity, explain the procedure, and obtain verbal consent
- Prepare the equipment on a clean trolley.

- Position the patient comfortably sitting upright on the edge of the bed, leaning forward with arm raised.
- Percuss the upper border of the effusion posteriorly and choose a site 1 or 2 intercostal spaces below that.
- Mark a suitable site at the upper edge of a rib with a pen.
- Clean the area with antiseptic solution and put on sterile gloves.
- Inject local anaesthetic ,to skin and subcutaneous tissue via orange needle and syringe and wait for 1min for it to take effect.
- Attach the Green needle(21G) onto the 20ml syringe, then advance the needle through the anaesthetised skin, always pulling back on plunger whilst advancing.
- Stop advancing the needle when pleural fluid is aspirated into the syringe.
- Aspirate 20ml of pleural fluid into the syringe.
- Remove the needle and syringe and dispose of them in the sharps bin.
- apply a suitable sterile dressing.
- Put 4ml of fluid in each bottle and send to Lab for:
 - Biochemistry-standard collection bottle (Protein, LDH)
 - Biochemistry-Fluoride oxalate sample tube (glucose).
 - Cytology.
 - pH (in heparinized (ABG)syringe) if empyema suspected
 - Microbiology (MC &S and AAFB)

Interpretation

Exudate vs Transudate

- Pleural fluid protein > 35g/L = Exudate
- Pleural fluid protein < 25g/L = Transudate

If pleural fluid protein is between 25-35g/L, Light's criteria should be applied

A pleural fluid is an exudate if 1 of the following 3 criteria are met:

- Pleural fluid:serum total protein ratio > 0.5
- Pleural fluid:serum LDH ratio > 0.6
- Pleural fluid LDH > two thirds upper limit normal for serum LDH

Complication

- Pneumothorax
- Haemothorax
- Damage to local structures
- Infection e.g.-empyema
- Removal of large volumes of pleural fluid can result in large fluid shifts, causing hemodynamic instability or pulmonary edema. (to reduce this remove 1.5L at any one time)

24.Basic Airway Management

Airway compromise is a medical emergency. An inadequate airway leads rapidly to hypoxemia and, if uncorrected brain damage and death.

Indication

- Reduced Conscious level (of any cause) due to obstruction by tongue and other soft tissues(GCS<9/15)
- Intraluminal obstruction e.g. Vomit, blood, foreign body
- Swelling of airway e.g.-Anaphylaxis, angio-edema, epiglottitis
- Laryngospasm e.g.-epiglottitis
- Exogenous compression e.g. tumor
- Trauma

Recognizing a compromised airway

Simple positioning and the recovery position of the patient for airway protection alone

Asses for airway obstruction

- LOOK:

For chest wall movements,cyanosis, signs of respiratory distress

- LISTEN:

For breath sounds,stridor,choking,gurgling,snoring,inability to speak in sentences

- FEEL:

For air movement(expired air)

The airway should be assumed to be compromised, or potentially compromised in patients with a GCS<8.

Make sure that you have

1. Suction equipment
2. Oxygen tubing
3. Ambu-bag
4. Rebreath bag

Simple Airway manoeuvre

Open mouth;

Look for any obstructions .If any obstructions are found they should be removed under direct vision

McGill's forceps can be used to remove defined objects

A wide bore, rigid(Yankauer)sucker is useful in removing liquids eg-blood and vomit

Narrow bore, flexible suction tubes can also be used in some circumstances

If found carefully remove obstruction if it can be seen at all times.

Head tilt

Place hands around patient's forehead and tilt backwards so as to achieve upper cervical extension.

Chin lift

Place the tips of the index and middle fingers of your right hand under the front of the patient's mandible.

Lift upwards, pulling the mandible anteriorly.

Jaw thrust

Use this if there is suspicion of an injury to the cervical spine.
A two handed technique.

Holding the patient from behind, place the fingers of both hands behind the angle of the mandible.

Lift the mandible with these fingers whilst using your thumbs to displace the chin downwards, opening the mouth

Airway devices

I. Face masks

Use the smallest fitting mask to fit over mouth and nose.

One hand technique

- Place your thumb and index finger on the mask in a "C" shape
- Grasp the jaw with remaining fingers pulling the face into the mask.

Two hand technique

- Place your thumbs either side of the mouth.
- Use your index fingers can be used to lift the jaw and extend the neck.

oropharyngeal(Guedel) airway

Use when the patient is semi-conscious

Indication

- Unconscious patients in protecting them from posterior displacement of the tongue

Contra indication

- Patients with an gag reflex, may lead to vomiting or laryngospasm
- Maxillofacial injuries

Procedure

- Estimate the size of the guedel required by holding different sizes parallel to head.the correct size should reach from the incisors to the angle of the jaw(size 2,3,4 used in adults)
- Open the mouth and remove any foreign material as above
- Initially insert the guedel upside down. As it hits the palate rotate it 180° so that the curve is lying over the curve of the tongue
- Reassess the patient

iii. Nasopharyngeal airway

Tolerated better than the oropharyngeal airway in alert patients

This is a flexible tube that is inserted through the nose to the oropharynx.

Indication

- In patients with reduced levels of consciousness but with intact gag reflexes.

Contra indication

- Known or suspected base of skull fractures
- Grossly abnormal nasal anatomy
- Severe maxillofacial injuries

Procedure

- Estimate the size required by holding different sized nasopharyngeal airways parallel to head. The diameter estimated by using a size correlating to the size of the patient's little finger.(6-8mm commonly used in adults)
- Lubricate the end of the tube, without obstructing the lumen.
- Examine both nares to look for obstruction (e.g.-septal deviation, polyps) and insert on the right for preference and insert into the larger one
- Advance directly posteriorly, (not superiorly) until the flange lies against the nares

iv.Laryngeal mask airway(LMA)

Equipment Required

- Laryngeal mask airway(LMA)
- Appropriately sized syringe for cuff inflation
- Water-soluble lubricant
- Bag-valve mask
- Oxygen source
- Yankauer suction device
- Intubation equipment

Indication

- After failed intubation (used as rescue device)
- Cardiac arrest (alternative to intubation for airway management)
- Conduit for intubation (when direct laryngoscopy is unsuccessful)
- Prehospital airway management

Contraindication

- Cannot open mouth
- Complete upper airway obstruction

Procedure

- Preoxygenate the patient with 100% oxygen via bag and mask.
- Choose the appropriate size LMA.
- Check the LMA cuff for leaks and deflate the cuff.
- Lubricate the outer cuff with aqueous gel.
- The patient should be in a supine position with the head and neck in alignment.
- Stand behind the patient or if this is not possible, from the front.
- Hold the tube like a pen and pass into the mouth with the distal aperture facing the feet of the patient
- Push back over the tongue while applying the tip to the surface of the palate until it reaches the posterior pharyngeal wall.
- The mask is then pressed backwards and downwards until it reaches the back of the hypopharynx and resistance is felt.
- The black line of the tube should be aligned with the nasal septum.
- Inflate the cuff with usually 20-30ml of air.
- The tube should lift out of the mouth slightly and the larynx is pushed forward if it is in the correct position.

- Attach a breathing circuit and gently ventilate the patient with 100% oxygen.
- Confirm the correct placement by auscultating the chest in the axillary regions and observe for bilateral chest movement.
- Insert a bite block and secure the airway with the bandage or tie provided.

25. Non-invasive ventilation(NIV)

Non-invasive ventilation(NIV) which support gas exchange between the atmosphere and the lungs without the need for endotracheal intubation or tracheostomy.

Indication

- Management of acute type 2 respiratory failure(T2RF) complicating an exacerbation of chronic obstructive pulmonary disease(COPD)
- Management of patients with chronic T2RF maintained on home NIV presenting with worsening respiratory failure.

Contra indication

Absolute Contra indication	Relative Contra indication
Upper airway obstruction	Diagnosis of pneumonia
Impending respiratory arrest	Confusion or agitation
Glasgow Coma Scale score < 8	Severe hypoxaemia
Respiratory rate < 8 breaths/min	Bowel obstruction
Undrained pneumothorax	Copious respiratory secretions
Asthma	Vomiting
	Haemodynamic instability
	Facial burns or trauma
	Upper airway or upper GI surgery
	Arterial pH < 7.25

Patients receiving NIV outside HDU/ICU should have continuous ECG and pulse oximetry monitoring for the first 12hr, and physiological observations recorded every 15min for the first 2hr.

CPAP(Continuous Positive Airways Pressure)

It uses a single pressure continuously throughout both inspiratory and expiratory phases.

It is used in the treatment of type 1 respiratory failure (obstructive sleep apnoea, cardio-pulmonary oedema and pulmonary embolus, pneumonia, weaning from ventilation)

Equipment Required

- Mask,head strap,PEEP valves(5-7.5-10cmH₂O)
- Circuit,safety ‘blow-off’ valve.
- High flow generator for oxygen and air.
- Heated humidification.

Procedure

- Explain the Procedure,Obtain Verbal consent.
- Use measuring templates to assess appropriate size interface and minimize air leaks.
- Set oxygen and flow rate and ensure the PEEP valve opens a small distance only and never fully closes.
- Start with a low pressure and slowly increase for patient comfort and to gain compliance.
- Aim to reduce the work of breathing.
- Continuously monitor ABG/SaO₂, heart rate, and BP. Watch for abdominal distension.

BiPAP(Bilevel Positive Airways Pressure)

- It uses different pressure on expiration(EPAP) and on inspiration(IPAP).
- Used in the treatment of type 2 respiratory failure (hypoventilation, chronic neuromuscular conditions, exacerbations of COPD)

Equipment Required

- Mask(facial/nasal), prongs, full face mask, head strap.
- Circuit, exhalation port.
- Entrained oxygen if required.
- Ventilator (NIPPV1/2/3, BiPAP vision).
- Heated humidification.

Procedure

- Explain the Procedure,Obtain Verbal consent.
- Use measuring templates to assess appropriate size interface and minimize air leaks.
- Start with a low pressure and slowly increase for patient comfort and to gain compliance.
- Setting inspiratory and expiratory times will need to be continuously reassessed as respiratory rate will change over time.
- Initially aim to match the patient's own ventilatory pattern but eventually aim to decrease respiratory rate and increase tidal volume/flow using the minimal pressure possible.
- Monitor ABG/SaO₂, heart rate and BP at 1 and 4 hours. Watch for abdominal distension.

Weaning of non-invasive ventilation

- In general, patients require NIV for 48-72hr after presentation:
 - Day 1 continual NIV with breaks for meals, drinks, administration of medications by mouth or nebulizer
 - Day 2 NIV for 16hr
 - Day 3 NIV for 12hr including 6-8hr overnight
 - Discontinue NIV day 4 unless continuing therapy indicated
- Some patients will self-wean earlier, and others may need longer. Weaning should be guided by clinical impression and blood gases.
- Failure to wean or recurrent admission with decompensated T2RF are indications for consideration of long term home NIV.

Complications

- Pressure ulcers/necrosis
- Facial or ocular abrasions
- Claustrophobia/anxiety
- Agitation
- Air swallowing with gastric/abdominal distension, leading to vomiting and aspiration
- Oro-nasal mucosal dryness
- Raised ICP
- Breathing asynchrony

