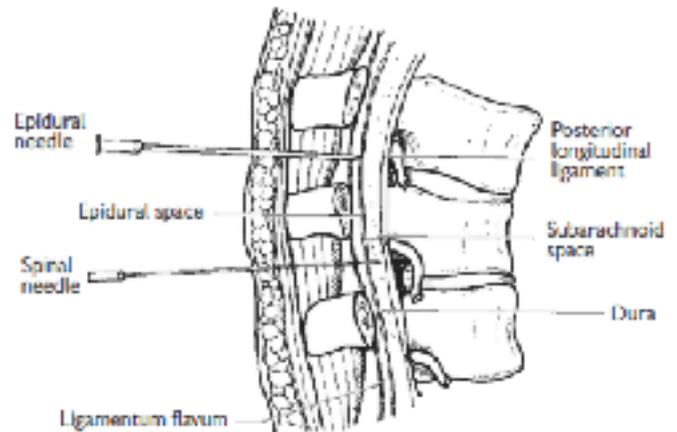


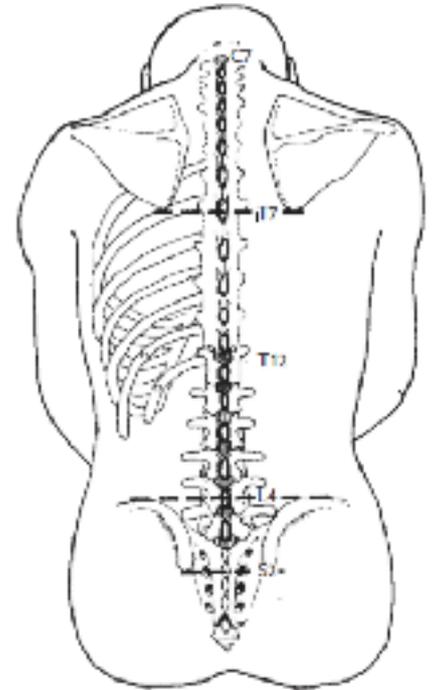
Spinal and epidural anatomy

- The spinal cord terminates at approximately L1 in adults and L3 in infants.
- The line joining the iliac crests (intercristine or Tuffler's line) is approximately at the L4 level.
- The subarachnoid space ends at approximately S2 in adults, lower in children (care with paediatric caudal block, use cannula rather than needle).
- The subarachnoid space extends laterally along the nerve roots to the dorsal root ganglia.
- There is a potential space between the dura and the arachnoid mater (the subdural space).
- The epidural (extradural) space lies between the walls of the vertebral canal and the spinal dura mater. It is a potential low-pressure space, occupied by areolar tissue, loose fat, and the internal vertebral venous plexus.
- The ligamentum flavum is thin in the cervical region, reaching maximal thickness in the lumbar region (2–5mm).



Spinal block

- Indications for spinal block are:
 - Lower abdominal surgery (Caesarean section, inguinal hernia).
 - Lower limb surgery.
 - Perineal surgery.
 - More extensive abdominal surgery is possible with experience.
- Landmarks : spinous processes of the lumbar vertebrae and the line joining the iliac crests (Tuffler's line).



Technique :

- The patient should be sitting or lying on their side.
- Mark a line joining the iliac crests.
- Identify the spinous process at the level of this line.
- The nearest interspace at this level is L3/4 (there is significant variation).
- Spinal blocks should always be carried out caudal to this space to avoid trauma to the tail end of the spinal cord (the conus).
- After subcutaneous infiltration with LA, insert a 24–29G needle of your choice:
 - **Midline** : at the level of the interspace, insert a needle in the midline (coronal plane). With 15° cephalad angulation, advance until a click or pop is felt, at an approximate depth of 4–6cm.
 - **Paramedian** : 1–2cm lateral to the upper border of the spinous process. Insert a needle perpendicular to the skin to contact the lamina of the vertebra. Withdraw slightly, reinserting the needle 15°medially and 30° cephalad to pass over the lamina through the interlaminar space. Advance until a click or pop is felt (the dura is pierced).
- After free flow of CSF, connect up the syringe containing the LA. Aspirate before and after injection to confirm correct placement in CSF throughout injection.

LA drugs and doses for spinal anaesthesia

- Dosing of LA in adults depends upon age and pregnancy: the older the patient, the less drug will be needed; pregnant patients need less than their non-pregnant counterparts.
- 2.5–3.0ml of a hyperbaric solution of LA will reach T6–T10 in most non-pregnant young adults placed in the recumbent position shortly after spinal injection.
- The dose of plain LA needed tends to be a little higher.
- There is no commercially marketed short-acting intrathecal preparation licensed for spinal anaesthesia within the UK. Manufacturers advise against the use of lidocaine due to risks of cauda equina syndrome and transient radicular irritation and transient neurological symptoms.
- Ropivacaine does not have a product licence for intrathecal use.
- Bupivacaine plain or heavy can be used (usually 0.5%). 'Heavy' is hyperbaric and contains 8% glucose. 'Plain' is isobaric at body temperature.
- Due to spread in the intrathecal space, hyperbaric solutions can be used to achieve a higher block. Plain solutions will usually produce a lower block height with consequently less hypotension, under normal conditions.

Clinical tips

- Ideally the injection should be at the L3/4 interspace; if there is difficulty, go down not up, as the level of termination of the conus is variable.
- Accurate surface identification of the L3/4 interspace is difficult—70% of clinicians mark it as a higher space.
- A sitting position increases CSF pressure and hence improves CSF flow with fine needles. It is also easier to find the midline in obese patients in this position.
- Lateral position offers familiarity of practice and possibility of sedation.
- Often problems are due to too short an introducer and a flexible needle. When difficulty is encountered in an elderly and osteophytic patient who would benefit from a spinal, consider a 22G Quincke-tip needle; post-dural puncture headache is rare in this patient group.
- When repeatedly hitting bone ask the patient to identify which side you are on. If they state 'middle' you are on a spinous process; if they can identify one side, you are out of the midline.

Contraindications

Relative contraindications:

- Peripheral neuropathy
- LVOT obstruction
- Uraemia
- Sepsis
- Stenosis of Mitral or Aortic valve
- Surgery to the back
- Demyelinating lesions

Absolute Contraindications

- Coagulopathy
- Refusal
- Hypovolaemia
- Severe aortic stenosis
- Infection at the site of injection
- Severe aortic stenosis

Complications

- Hypotension.
- Bradycardia (if block extends to the mid-thoracic region)—can progress to cardiac arrest.
- High block, compromising breathing, may extend to 'total spinal'.
- Urinary retention.
- Nerve damage.
- Post-dural puncture headache.
- Infection: abscess, meningitis.
- Bleeding: spinal canal haematoma—more likely in patients with disorders of coagulation. Can cause spinal cord compression and permanent paraplegia.
- The incidence of permanent injury due to neuraxial blocks was 1:25 000–1:50 000, with an incidence of death or paraplegia of 1:50 000–1:140 000. The incidence of complications in children, in obstetric patients, and in those undergoing chronic pain procedures was very low. There was an excess incidence of serious complications in elderly patients with epidurals used during and after surgery, and in patients undergoing combined spinal-epidurals (CSEs), a finding supported by other large studies. However, the overall incidence of major complications was reassuringly low. There were problems reported with the identification, treatment, and management of the serious complications of neuraxial anaesthesia.

Management of local anaesthetic toxicity

Local anaesthetic toxicity occurs when an excessive amount of local anaesthetic enters the circulation. Toxicity can be avoided by injecting slowly and in small boluses, interspersed with frequent gentle aspiration to exclude accidental intravascular needle placement, especially when single site large doses are administered.

Maximum dosages vary depending on the site to be anaesthetised, vascularity of the tissues, individual tolerance, and anaesthetic technique.

Levobupivacaine and ropivacaine are less toxic than bupivacaine. The higher toxicity of bupivacaine is related to the R-enantiomer which binds more firmly and is released more slowly from the myocardium.

Toxicity from prilocaine is less likely because of its rapid metabolism (primarily by the liver). Methaemoglobinaemia may occur with high doses (> 600 mg in an adult) and should be treated with methylnthioninium chloride (methylene blue 1–2 mg/kg).

Allergic reactions to local anaesthetics are extremely rare. The ester groups are more prone to exhibit allergic reactions than amides because they are metabolized to para-aminobenzoic acid (PABA) which acts as a hapten. There is also a cross-sensitivity of ester-type agents with sulphonamides. Allergic reactions range from simple local irritation with rash or urticaria, to laryngeal oedema or anaphylaxis.

Presentation

- Light headedness, dizziness, drowsiness. Tingling around lips, fingers, or generalized. Metallic taste, tinnitus, blurred vision.
- Confusion, restlessness, incoherent speech, tremors or twitching, leading to convulsions with loss of consciousness and coma.
- Bradycardia, hypotension, cardiovascular collapse, and respiratory arrest. ECG changes (prolongation of QRS and PR interval, AV block and/or changes in T-wave amplitude) Immediate management
- Discontinue injection
- ABC . . . 100 % O₂.
- Intubate and ventilate if required to prevent hypoxic cardiovascular collapse. Hyperventilation may help by increasing pH in the presence of metabolic acidosis.
- CPR if pulseless — commence ALS protocol.

- Treat convulsions with intravenous midazolam (3–10 mg), diazepam (5–15 mg), lorazepam (0.1 mg/kg), propofol (20–60 mg) or thiopental (50–150 mg). Titrate against patient response.

Lipid emulsion therapy

- Give an intravenous bolus injection of Intralipid . 20 % 1.5 ml/kg over 1 min (100 ml for a 70 kg patient).
- Start an intravenous infusion of Intralipid . 20 % at 0.25 ml/kg/min (400 ml over 20 min for a 70 kg patient).
- Repeat initial bolus twice at 5 min intervals if an adequate circulation has not been restored.
- After 5 min, double the infusion rate if an adequate circulation has not been restored.
- Continue CPR and infusion until a stable adequate circulation has been restored.

Propofol is NOT a suitable alternative to Intralipid . 20 % .

The mechanism of action is thought to be through extraction of lipophilic local anaesthetics from aqueous plasma and tissues, or by counteracting the local anaesthetic inhibition of myocardial fatty acid oxidation.

Anaesthetists should be familiar with guidelines for the treatment of local anaesthetic toxicity and should practise management drills. The AAGBI drill for management of severe local anaesthetic toxicity is available on the KHC Anaesthesia website under: Guidelines