

Techniques of epidural cannulation



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It is essential that the anaesthetist visits the patient preoperatively to exclude any contraindications to regional blockade, to explain the procedure and any common or important side-effects and to obtain informed consent. Measures to optimize the patient's condition may be required before the procedure takes place. For insertion of the block, the patient should be brought to a suitable place, such as an operating theatre, where appropriate monitoring is instituted and intravenous access secured. The patient is positioned and, using an aseptic technique, the epidural space can be cannulated using either local anaesthetic infiltration of the area or general anaesthesia (Figure 1).

Figure 1

Procedure for epidural blockade
Pre-procedure
• Visit the patient and exclude contraindications • Optimize any medical conditions • Obtain informed consent • Ensure the patient has an empty stomach • Take the patient to a suitable site • Institute monitoring • Draw up any drugs that may be needed • Obtain intravenous access
Procedure
• Position the patient, sitting or lateral with a flexed spine • Use an aseptic technique • Provide local anaesthetic infiltration or general anaesthesia • Use a midline, paramedian or caudal approach • Use a Tuohy needle for cannulation • Describe the direction to advance the needle • Describe the structures traversed by the needle • Identify the endpoint with a loss-of-resistance technique • Describe the volume, concentration and type of solution administered
Post procedure
• Monitor blood pressure, heart rate and respiration • Monitor the height and density of the block • Review the patient for late onset complications

Contraindications to epidural blockade

Absolute contraindications to epidural analgesia and anaesthesia include patient refusal, local anaesthetic allergy, moderate or severe bleeding diathesis or anticoagulation and local infection at the site of insertion.

Relative contraindications include raised intracranial pressure, hypovolaemic shock, some skeletal anomalies and following some types of back surgery.

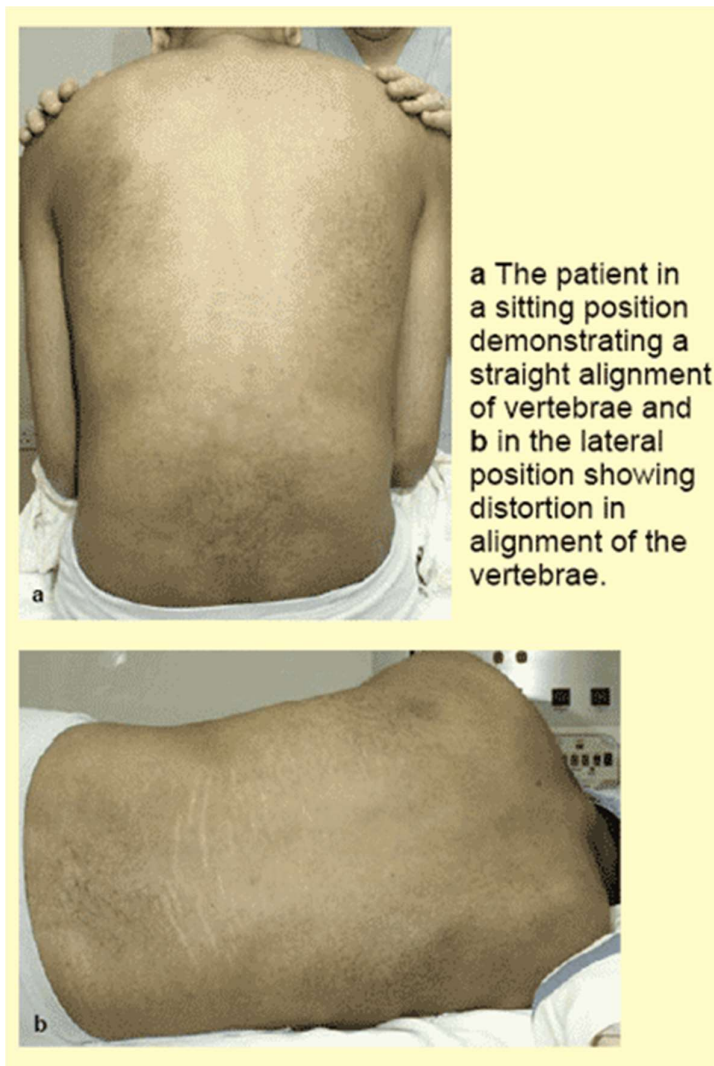
Cannulation techniques

To cannulate the epidural space successfully the spine must be held stable and flexed to open the space between the spinous processes of the adjacent vertebrae. This is usually achieved by positioning the patient in a sitting or lateral position and asking them to curl into a ball. The three common approaches for cannulation of the epidural space are the midline, the paramedian and the caudal.

Sitting and lateral positions

The lateral position (Figure 2) allows for optimal flexion of the spine and widening of the distance between the spinous processes, but commonly distorts the midline anatomy. The sitting position circumvents these problems, but substantially increases hydrostatic pressure in cerebrospinal fluid (CSF) and may increase the possibility of an inadvertent dural puncture.

Figure 2



Midline and paramedian approaches

With the midline technique, a Tuohy needle is introduced, directed slightly cephalad, through the skin in the midline between the two spinous processes at the level of the desired block. The needle passes through the supraspinous ligament, the interspinous ligament and the fused pair of ligamentum flavae before it enters the epidural space. A sudden 'give' may be felt as the needle tip exits the ligamentum flavum and enters the epidural space.

If a paramedian approach is chosen, the Tuohy needle is inserted through the skin at a point about 1.5 cm lateral to the mid point of the spinous process immediately below the level of the desired block. The needle is advanced perpendicular to the skin, through the underlying fat and muscle, until it strikes the vertebral lamina. It is then withdrawn slightly, redirected cephalad and medially, and walked off the lamina until it pierces the ligamentum flavum and enters the epidural space.

The dura mater is held against the posterior wall of the vertebral canal by the pressure of the CSF inside the dura. Regardless of approach, on cannulation of the epidural space the dura mater is indented by the tip of the Tuohy needle.

Identification of end point

For the midline and paramedian approaches the most common method for identification of the epidural space is 'the loss of resistance' technique. A low-resistance syringe containing air or normal saline is attached to the hub of the Tuohy needle after the tip has been inserted into a ligament. Pressure is applied to the plunger of the syringe as the Tuohy needle is advanced. While the tip of the Tuohy needle is in a ligament and its bevel is obstructed there is resistance to injection of its contents. When the epidural space is reached the resistance is lost and the contents of the syringe can be injected into the space, pushing the dura mater away from the tip of the Tuohy needle.

Caudal technique

For regional blockade of the caudal epidural space the patient is usually positioned in a lateral or prone position. The caudal space is approached through the tough sacrococcygeal ligament that covers the sacral hiatus. It is identified as a midline indentation in the sacrum at a point forming the apex of an equilateral triangle made with the posterior superior iliac spines. For the caudal epidural technique a 23 or 21 G needle is placed over the sacrococcygeal membrane at an angle of about 60° to the coronal plane and perpendicular to the other planes, with the bevel facing anteriorly to allow it to pass along the anterior sacral wall without piercing it. There is usually a loss of resistance as the membrane is pierced. The needle should then be lowered to an angle of about 20° and advanced a short distance. The dura is not approximated to the point of needle entry into the epidural space (as it is at other spinal levels), but is always at least 34 mm away in adults. Therefore a needle up to 25 mm long can be used safely without risk of dural puncture. In children, the dural sac is closer and the needle should be advanced only a short distance.

Local anaesthetic and other solutions

Local anaesthetic solutions may be administered by bolus or by continuous infusion through an indwelling catheter for a longer duration of action. The intensity of an epidural block is determined by the concentration and type of local anaesthetic solution given. Opioids administered with the local anaesthetic solution augment the sensory blockade, but spare motor blockade and are particularly useful for providing analgesia. Other drugs, including epinephrine and clonidine, have been used to prolong the block. The spread of local anaesthetic solution is related to the volume injected and occurs in cranial and caudal directions. The highest and lowest level of the block can be modified by changing the level of cannulation and by appropriate positioning of the patient as local anaesthetic spread is influenced by gravity.

Postoperative care

Monitoring

Following institution of an epidural blockade the height and spread of blockade should be monitored. This may include testing for motor block and loss of sensation to cold or light touch. Blood pressure should be measured and if hypotension occurs it should be treated with intravenous fluid and vasopressors. Heart rate should be monitored because bradycardia may occur due to unopposed vagal cardiac stimulation if the sympathetic outflow to the heart (T3/4/5) is blocked. If it occurs, it should be corrected with anticholinergic agents. Respiration may be depressed by epidural opioids and if the phrenic nerve outflow is blocked (C3/4/5) by local anaesthetic drugs, respiratory support is required.

Complications

Common complications of epidural blockade include incomplete blockade or failure of blockade; hypotension leading to nausea and vomiting; localized bruising at the site of injection resulting in short-term backache; dural tap headache and pruritus if opioids are used.

Uncommon complications include neurological damage due to direct trauma or epidural haematoma formation, resulting in obstruction of venous drainage and causing ischaemic damage to the cord; unplanned high block may result in cranial nerve lesions, Horner's syndrome and total spinal blockade.