Regional Anaesthesia

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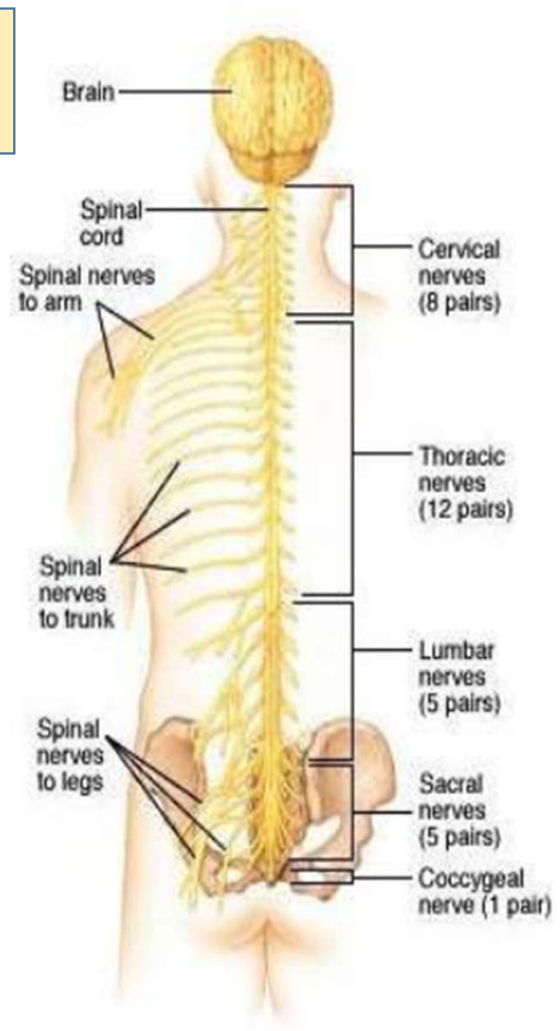
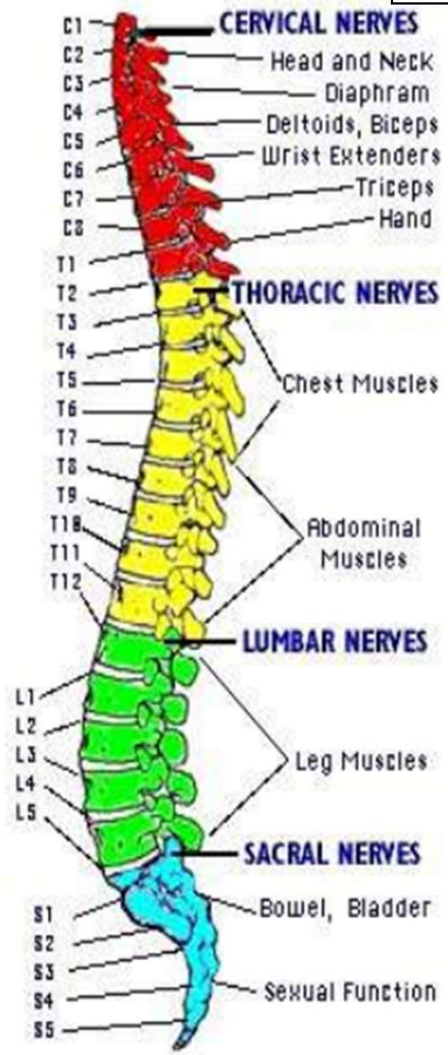
Spinal Anatomy :

33 Vertebrae :

- 7 Cervical
- 12 Thoracic
- 5 Lumbar
- 5 Sacral
- 4 Coccygeal





Spinal Cord :

GENERAL CONSIDERATIONS

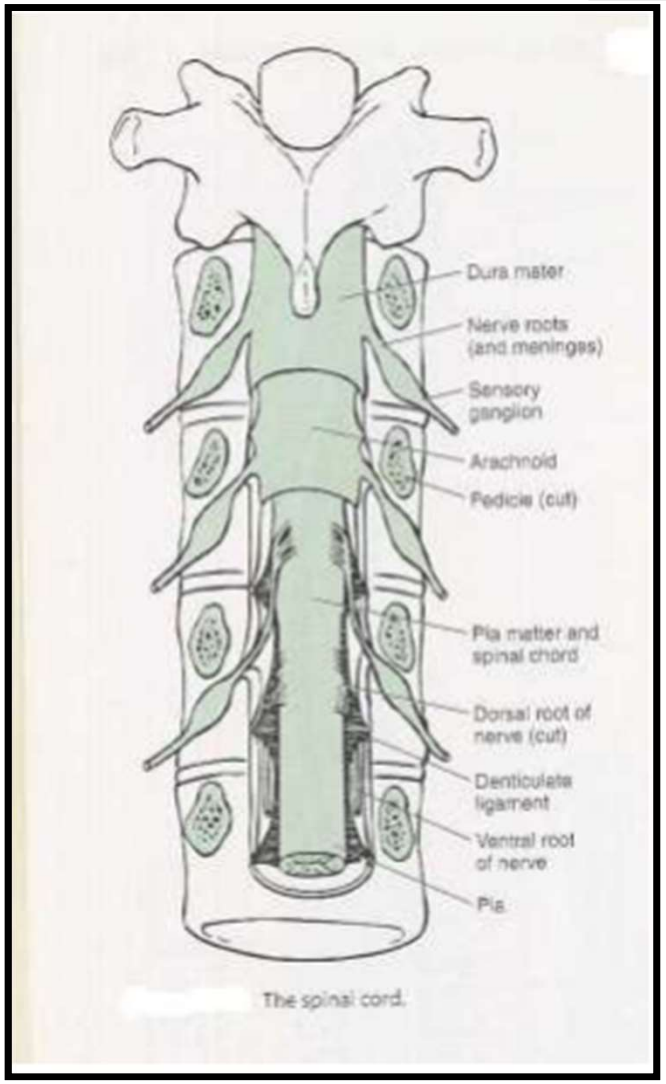
- Adult :
  - Begins: Foramen Magnum
  - Ends: L1
- Newborn :
  - Begins: Foramen Magnum
  - Ends: L3
- Terminal End: Conus Medullaris

Sagittal Sections (ANATOMY CONTD) :

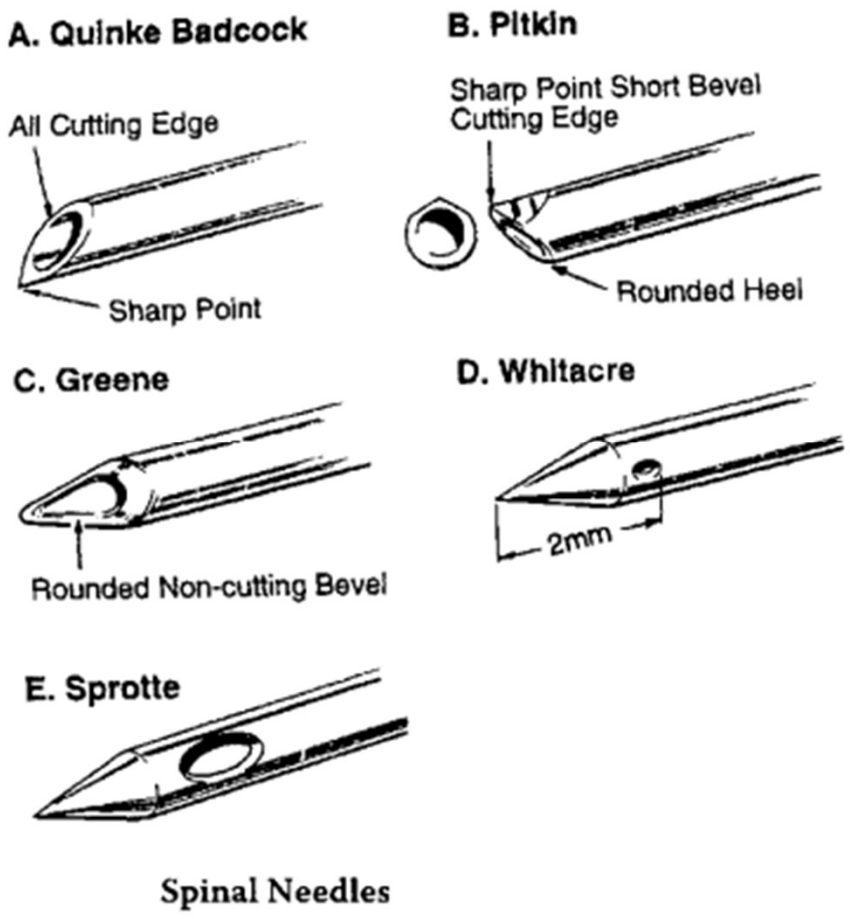
- Supraspinous Ligament
  - Outer most layer
- Interspinous Ligament
  - Middle layer
- Ligamentum Flavum
  - Inner most layer
- Space that surrounds the spinal meninges
  - Potential space(epidural)
- Widest at Level L2 (5-6mm)
- Narrowest at Level C5 (1-1.5mm)

Spinal Meninges :

- Dura Mater
  - Outer most layer
  - Fibrous
- Arachnoid
  - Middle layer
  - Non-vascular
- Pia
  - Inner most layer
  - Highly vascular
- Sub Arachnoid Space
  - Lies between the arachnoid and piamater



Spinal Needles :



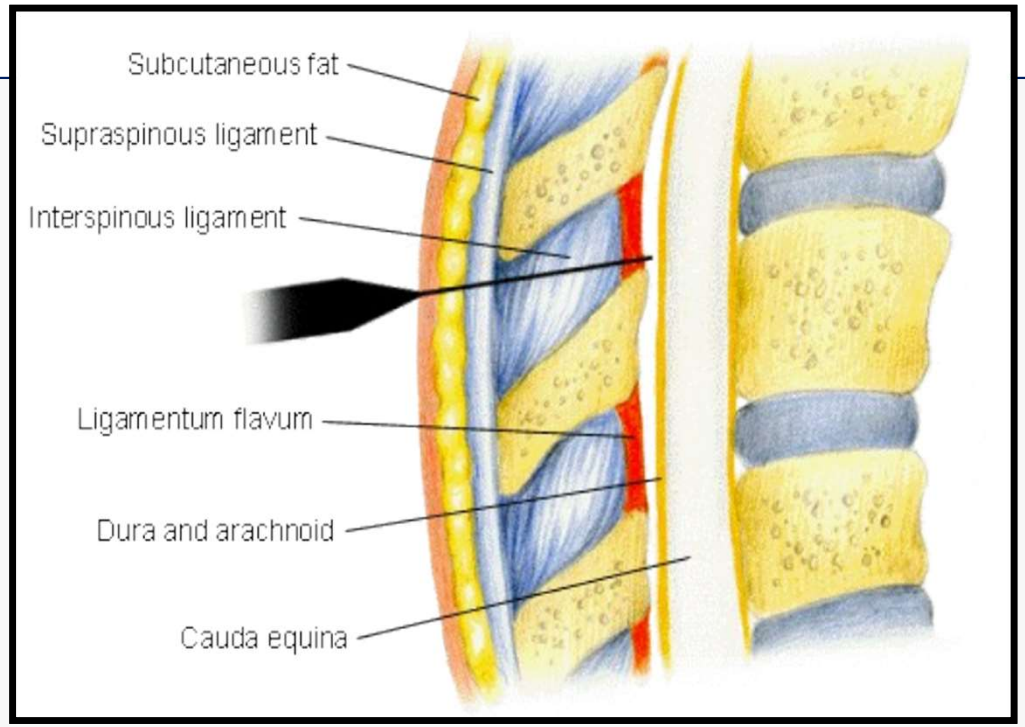
Spinal Needles

Spinal Technique :

- Preparation & Monitoring
  - ECG
  - NBP
  - Pulse Oximeter
- Patient Positioning
  - Lateral decubitous
  - Sitting

Spinal APPROACHES :

- **Midline Approach**
  - Skin.
  - Subcutaneous tissue.
  - Supraspinous ligament.
  - Interspinous ligament.
  - Ligamentum flavum.
  - Epidural space
  - Dura mater.
  - Arachnoid mater.



- **Paramedian or Lateral Approach**
  - Same as midline excluding supraspinous & interspinous ligaments .

Technique :

- Palpate the spinous process
- Identification of the spine level
    - L4- line joining iliac crest
- Loss of resistance and flow of CSF

Sequence of Loss of Nerve Function with Local Anesthetics (LA)

1. Sympathetic (vasomotor): dilation of skin and blood vessels including arteries and veins .
2. Temperature discrimination & pain recognition.
3. Touch and pressure sense.
4. Proprioception (awareness of body position).
5. Motor function.

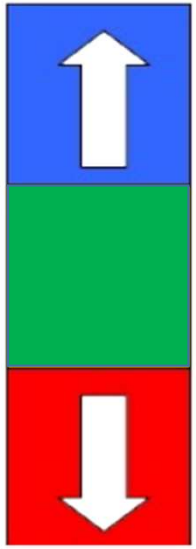
Sympathetic block is 2-6 dermatomes higher than sensory block

Motor block is 2 dermatomes lower than sensory block

Factors Effecting CSF Distribution :

- Site of injection
- Shape of spinal column
- Patient height
- Angulation of needle
- Characteristics of local anesthetic
    - Density
    - Specific gravity
    - Baricity
- Dose
- Volume
- Patient position (during & after)

Local Anesthetics & Baricity :



Hypobaric
(Dextrose)

Isobaric

Hyperbaric

- **Hypobaric**
  - Prepared by mixing local with sterile water
  - Flow is to highest part of CSF column
- **Isobaric**
  - Neutral flow that can be manipulated by positioning
  - Very predictable spread
  - Increased dose has more effect on duration than dermatomal spread
- **Hyperbaric**
  - Typically prepared by mixing local with dextrose
  - Flow is to most dependent area due to gravity

Factors Effecting Distribution :

- Most commonly used local anesthetic :
  - Bupivacaine 0.5% and 0.25%
  - Lignocaine 2% (transient neurological symptoms)
- Adjoints like opioids and adrenaline

Indications & Advantages :

- Anatomic distortions of upper airway
- Lower abdominal surgeries
- Obstetrical surgery (T4 Level)
- Decreased post-operative pain

Contraindications :

- **Absolute :**
  - Refusal
  - Infection
  - Coagulopathy
  - Severe hypovolemia
  - Increased intracranial pressure
  - Severe aortic or mitral stenosis
- **Relative :**
  - Doctor’s judgmen

SYSTEMIC EFFECTS :

Cardiovascular Effects :

- Blockade of Sympathetic Preganglionic Neurons
  - Send signals to both arteries and veins
  - Predominant action is vasodilation
- **Reduces :**
  - Venous return
  - Stroke volume
  - Cardiac output
  - Blood pressure
  - T1-T4 Blockade

SYSTEMIC EFFECTS :

Cardiovascular Effects :

- Causes unopposed vagal stimulation Bradycardia

» Decreased venous return to right atrium causes decreased Blood Pressure .

- Treatment

- Best way to treat is physiologic not pharmacologic

- Primary Treatment

- Increase the cardiac preload

- Large IV fluid bolus within 30 minutes prior to spinal placement, minimum 1 liter of crystalloids

- Secondary Treatment

- Pharmacologic

- Ephedrine is more effective than Phenylephrine

SYSTEMIC EFFECTS :

Respiratory System :

- Healthy Patients
  - Appropriate spinal blockade has little effect on ventilation
- High Spinal
  - Decrease functional residual capacity (FRC)
- Paralysis of abdominal muscles
- Intercostal muscle paralysis interferes with coughing and clearing secretions
- Apnea is due to hypoperfusion of respiratory center

High Neural Blockade
SYMPTOMS AND MANAGEMENT

- Dyspnea
- Numbness and tingling of the upper extremities (i.e. fingers)
- Nausea generally preceedes hypotension due to hypoperfusion of the chemoreceptor trigger zone
- Mild to moderate hypotension

- **TREATMENT :**

- Change position with hyperbaric technique(i.e. reverse Trendelenberg)
- Stop the administration of local anesthetics with an epidural technique
- Supplemental oxygen
- Use of IV fluids
- Treat hypotension with ephedrine or phenylephrine
- Treat bradycardia

Complications Associated with Needle Placement or Catheter Insertion :

- Inadequate anesthesia or analgesia .
- Intravascular injection .
- Total spinal .
- Subdural injection .
- Backache .
- Postdural puncture headache .
- Neurological injury .
- Spinal or epidural hematoma .
- Meningitis and arachnoiditis .
- Epidural abscess .
- Sheering off the tip of the epidural catheter .

Postdural Puncture Headache

- Headache occurs due to leakage of CSF through the dura
- Decrease in intracranial pressure occurs due to the leak
- Upright position in the patient leads to traction on the dura,tentorium, and blood vessels resulting in pain.
- Traction on the 6th cranial nerve can result in diplopia and tinnitus
- Headache may be bilateral, frontal , retroorbital and/or occipital with or without radiation to the neck

Postdural Puncture Headache

- Described as “throbbing” or constant
- May be associated with nausea and/or photophobia
- Onset is generally 12-72 hours; rarely is the onset immediate
- If untreated it may last for weeks
- Increased post dural puncture headache in younger patients, in female patients, and in pregnant patients

Postdural Puncture Headache / Associations :

- Increased incidence related to needle size, needle type .
- The larger the needle the higher the incidence .
- Cutting point needles have a higher incidence of post dural puncture headache than pencil points .
- When using cutting point needles orientate the bevel "sideways" so it will be parallel with the fibers.

This will act to "spread" the fibers as opposed to cutting them .

- A wet tap with a 17 g. epidural needle will yield a 50% incidence of pdph

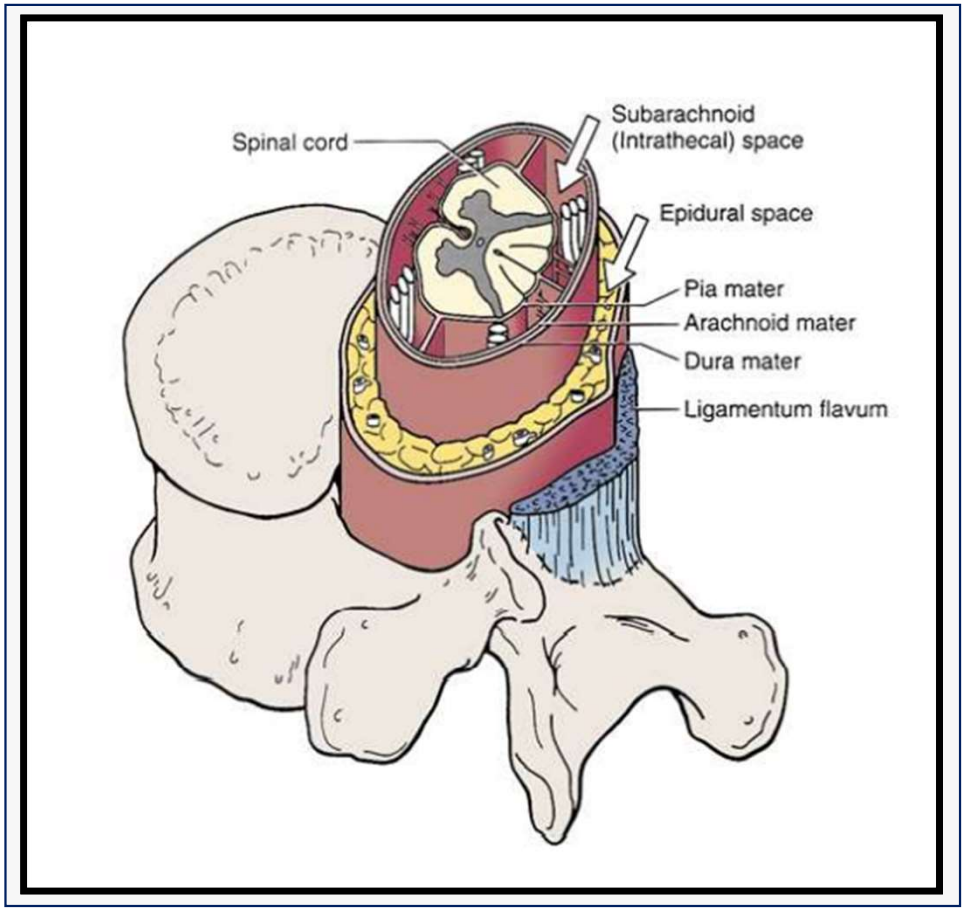
PDPH TREATMENT :

- Supine position .
- Hydration (IV / Oral).
- Caffeine (IV / Oral) .
- Paracetamol (IV / Oral) .
- NSAIDs (IV / Oral) .
- Hydrocortison Tab .
- Theophylline Tab .
- Pregabaline Tab .
- Stool softners .

PDPH TREATMENT :

- Blood patch works by mass effect and stops the leakage of CSF or alternatively by coagulating and “plugging” the hole .
- Should be administered one space below the dural puncture site .
- Place 15-20 ml of blood into the epidural space .
- Increased risk of meningitis or infection has to be explained to the patient.
- PDPH is 90% effective and not absolutely curative.

EPIDURAL ANESTHESIA :



EPIDURAL ANESTHESIA / Anatomy :

- Epidural space – base of skull (foramen magnum) to the coccyx (sacrococcygeal membrane)

- The epidural space surrounds the dura mater posteriorly, laterally, and anteriorly. Nerve roots travel in this space as they exit laterally through the foramen and course outward to become peripheral nerves

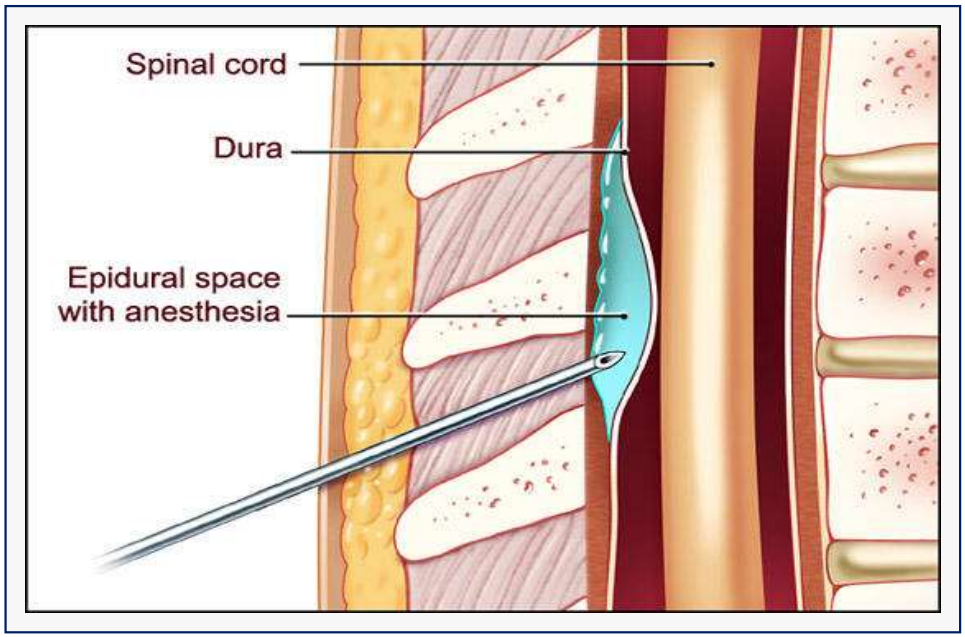
-Distance from skin to epidural space – 4-5 cm

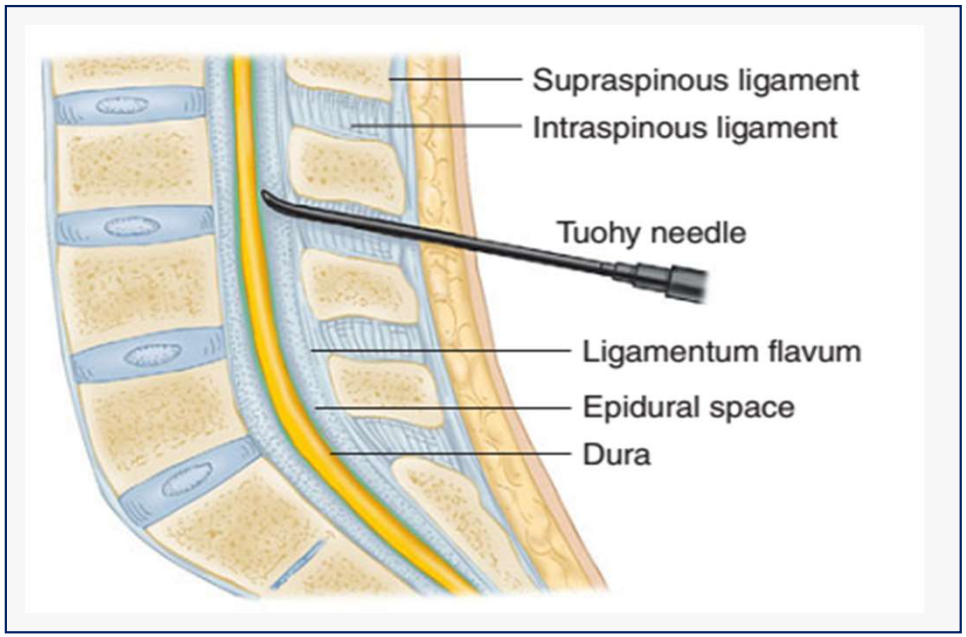
EPIDURAL ANESTHESIA :

• The epidural space is a potential space and is normally filled with blood vessels, lymphatic vessels, fatty tissue and spinal nerve roots.

• Single bolus, or the catheter is left in place for ideally 2 to 5 days with a continuous infusion, depending on the surgery.

EPIDURAL ANESTHESIA :





Factors Affecting Level of Block :

Age : The dose ↘ with age
Height : Shorter patients 1 mL of local anesthetic per segment to be blocked , Taller patients 2 mL per segment.
Gravity : According to the type of local anaesthesia .
Volume : In adults, 1 to 2 mL of local anesthetic per segment to be blocked , Eg , to achieve a T4 sensory level from an

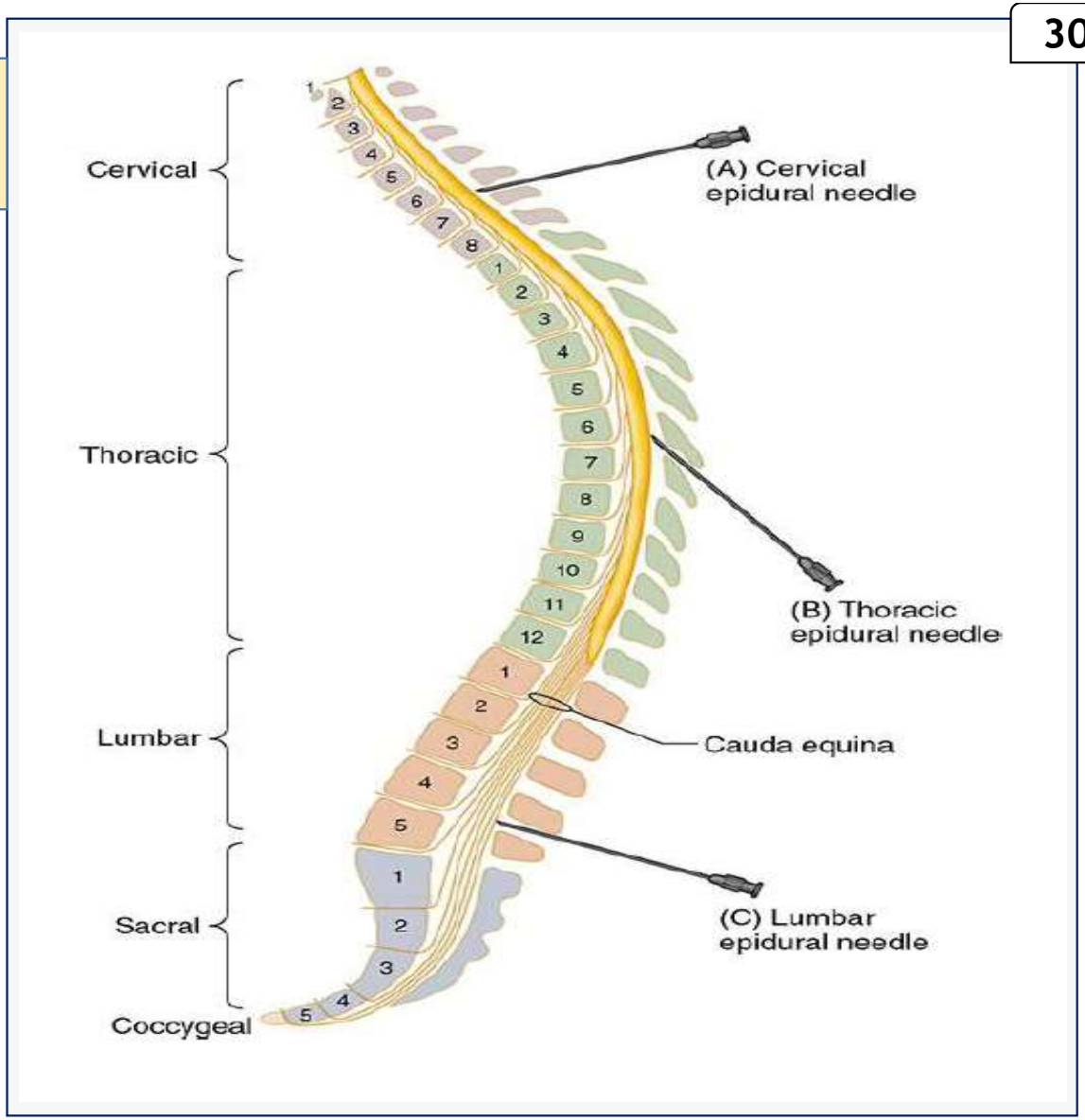
L4-L5 injection would require about 12 to 24 mL.

Drug Used : opioids ,
Epinephrine (Adrenaline) 5 mcg/mL

- Prolongs the effect of epidural Lidocaine > of bupivacaine
- Prolonging the duration and improving the quality of block

(epinephrine delays vascular absorption and reduces peak systemic blood levels of all epidurally administered local Anesthetics)

Epidural Anaesthetic Site And Needle Angle :



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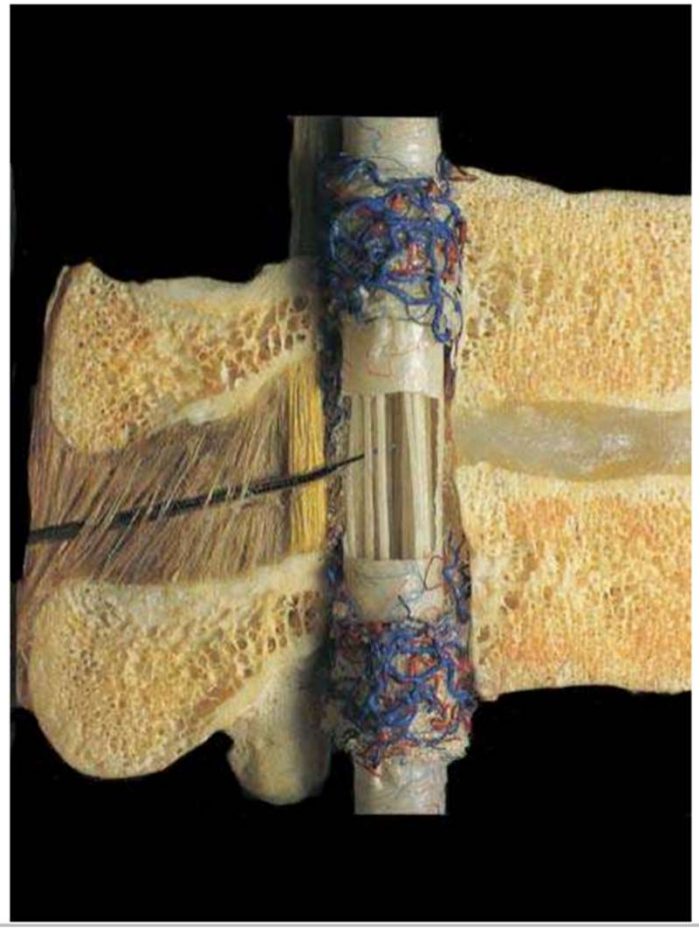
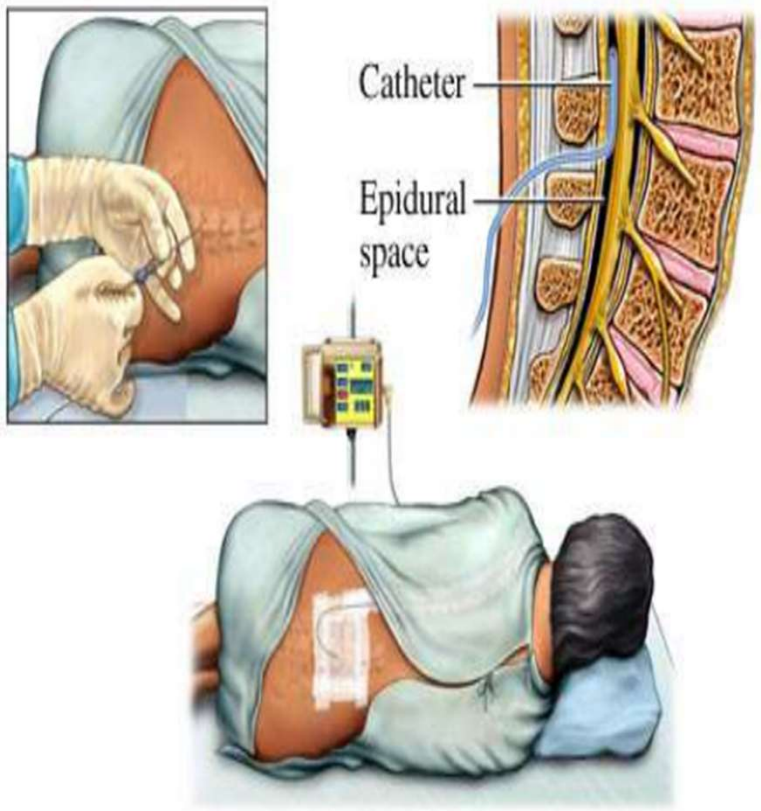




Epidural Anaesthetic Positioning :

A. Sitting Position

B. Lateral Decubitus

A

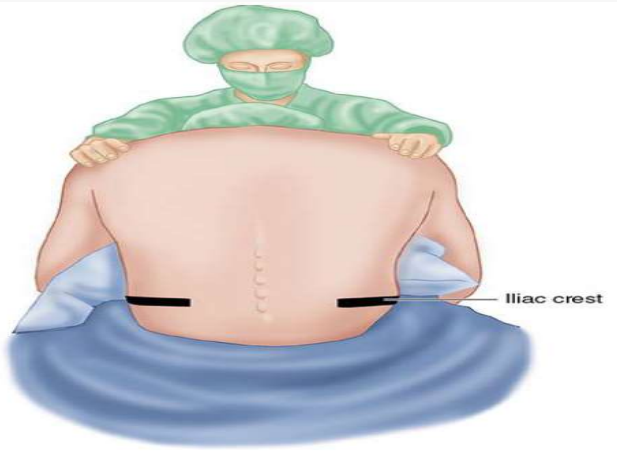


FIGURE 45–12 Sitting position for neuraxial blockade. Note an assistant helps in obtaining maximal spinal flexion.

B

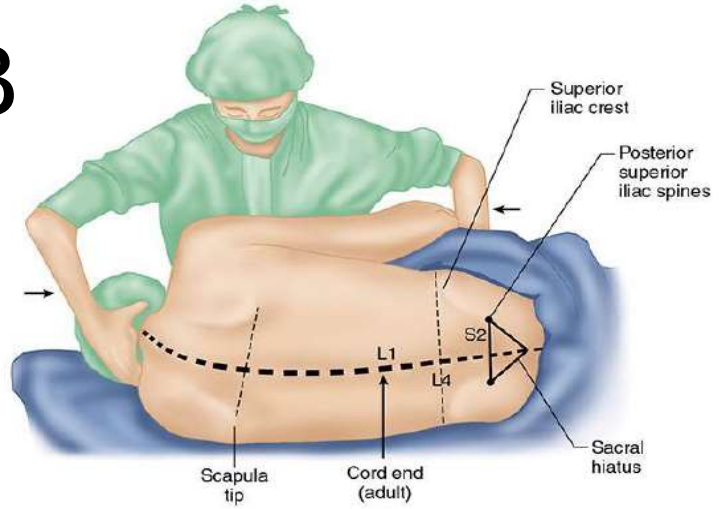
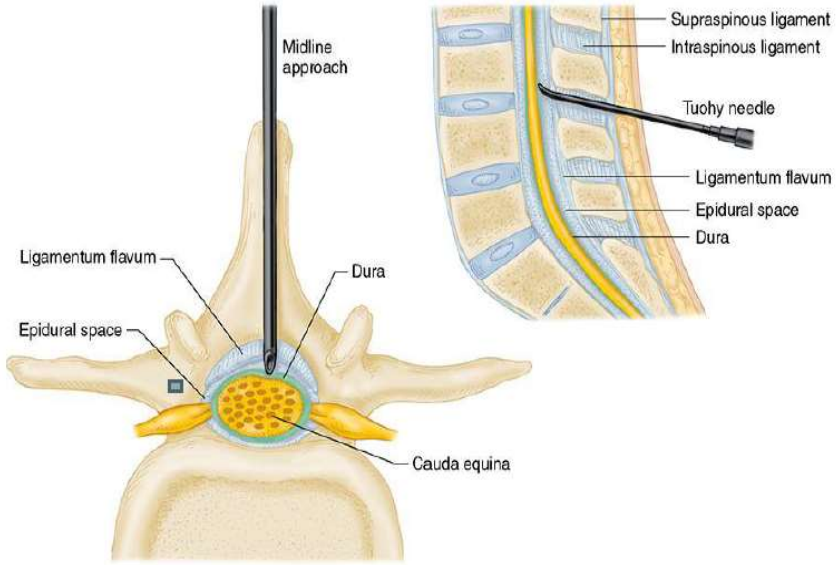
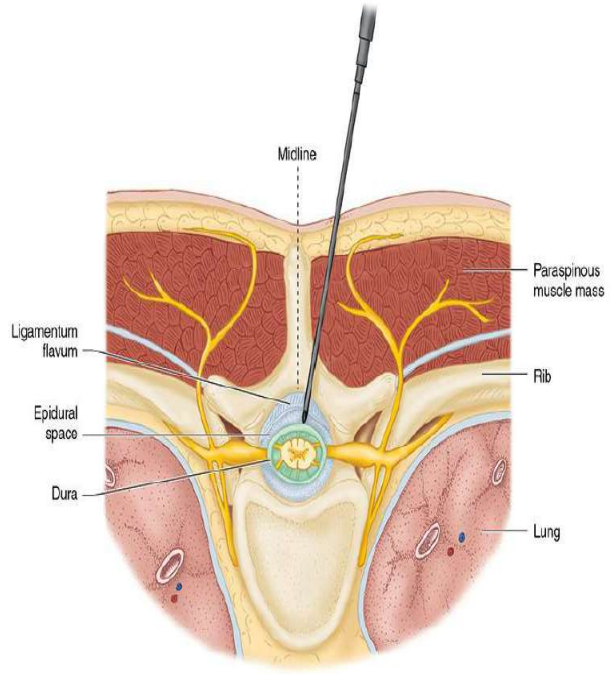


FIGURE 45–14 Lateral decubitus position for neuraxial blockade. Note again the assistant helping to provide maximal spine flexion.

Anatomic Approach (Epidural Anaesthesia)



A. Midline Approach
Lumber Epidural Anaesthesia



B. Paramedian Approach
Lumber Epidural Anaesthesia

EPIDURAL ANESTHESIA / Technique :

Test dose :

Is designed to detect both subarachnoid and intravascular injection. The classic test dose combines local anesthetic and epinephrine, Unfortunately, epinephrine as a marker of intravenous injection is not ideal.

False positives (a uterine contraction causing pain or an increase in heart rate coincident to test dosing) and false negatives (bradycardia and exaggerated hypertension in response to epinephrine in patients taking ß-blockers) can occur.

Simply aspirating prior to injection is insufficient to avoid inadvertent intravenous injection; most experienced practitioners have encountered fals enegative aspirations through both a needle and a catheter.

EPIDURAL ANESTHESIA / Technique :

Incremental dosing :

To avoid serious complications (“each dose is a test dose”).

If aspiration is negative, a fraction of the total intended local anesthetic dose is injected, typically 5 mL.

This dose should be large enough for mild symptoms (tinnitus or metallic taste) or signs (slurred speech, altered mentation) of intravascular injection to occur, but small enough to avoid seizure or cardiovascular compromise.

Thank You

End of lecture