Regional Anaesthesia

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FIBMS Anaesthesia

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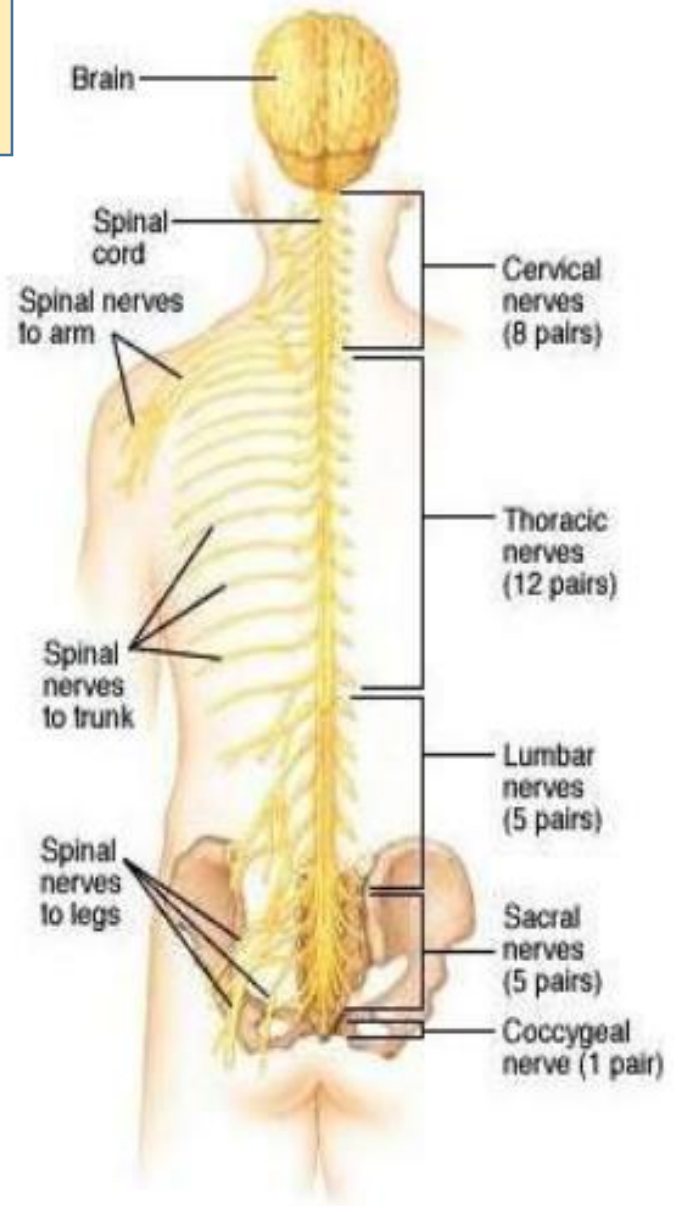
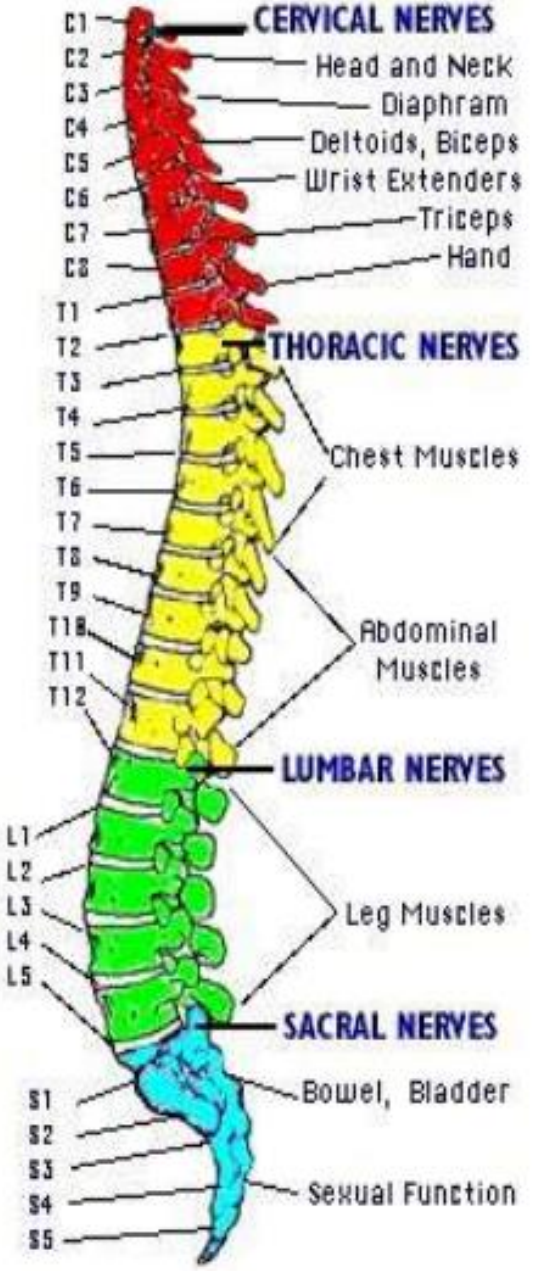
Spinal Anatomy :

33 Vertebrae :

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





Spinal Cord :

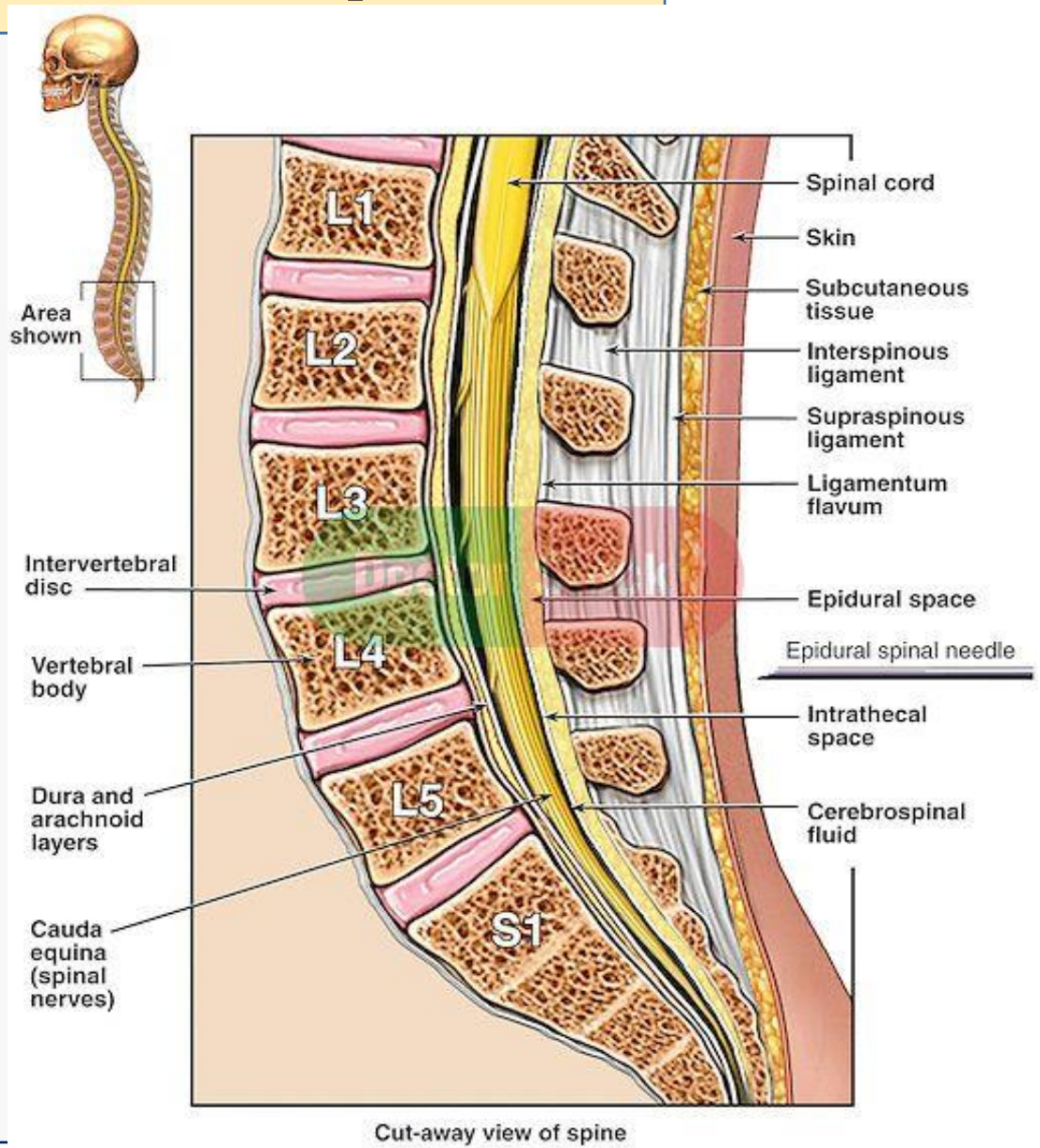
GENERAL CONSIDERATIONS

- Adult :
  - Begins: Foramen Magnum
  - Ends: L1
- Newborn :
  - Begins: Foramen Magnum
  - Ends: L3

- Terminal End: Conus Medullaris

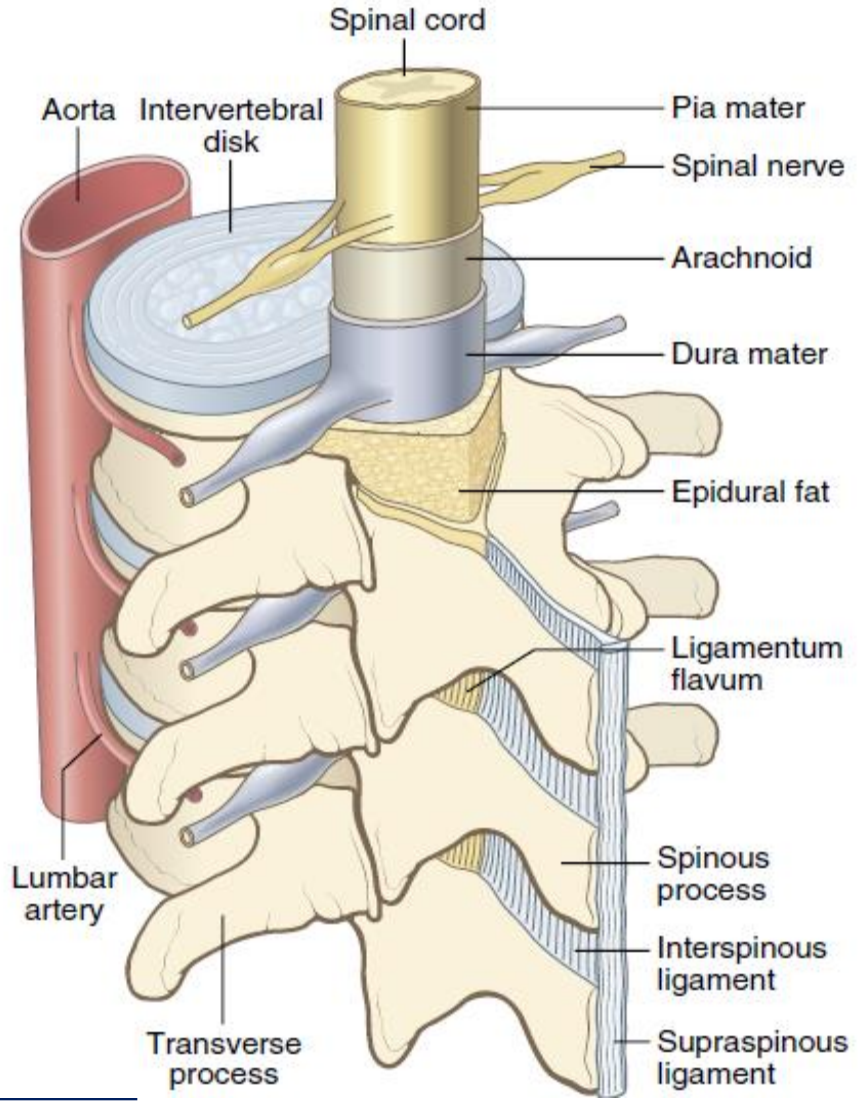
Sagittal Sections (ANATOMY CONTD) :

- 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 :

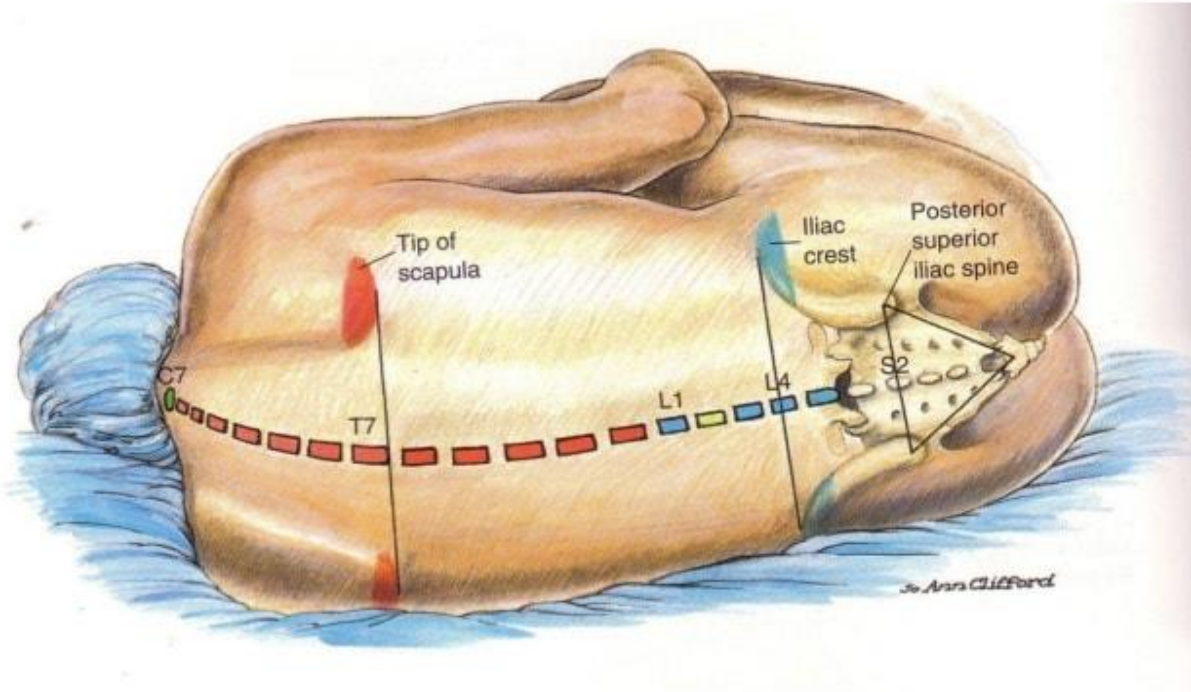
- Dura Mater
  - Outer most layer
  - Fibrous
- Arachnoid
  - Middle layer
  - Non-vascular
- Pia
  - Inner most layer
  - Highly vascular
- Sub Arachnoid Space
  - Lies between the arachnoid and piamater



Surface anatomy

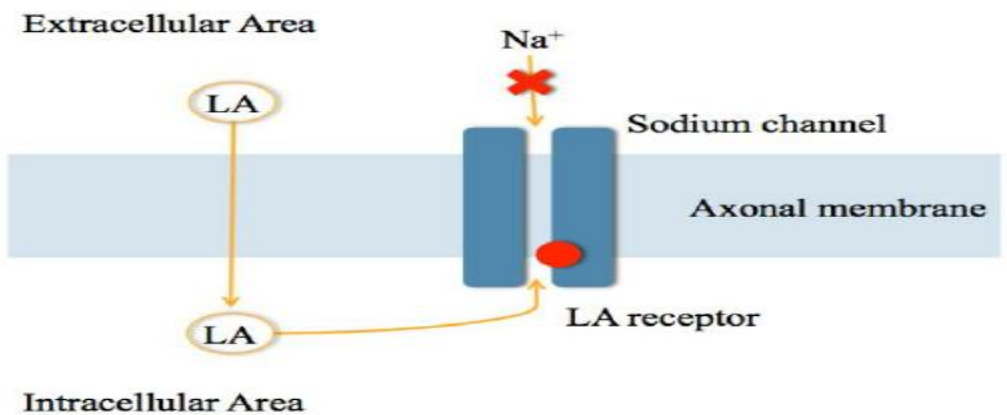
- Spinous process of T7 – inferior angle of scapula

- Tuffier's line – body of L4 or L4-L5 interspace



Mechanism of Action for Spinal Anesthetics

- Local anesthetic solutions block sensory, autonomic and motor impulses as the anterior and posterior nerve roots pass through the CSF. It is NOT the spinal cord!
- The site of action includes the spinal nerve roots and the dorsal root ganglion.



Levels of block

Sympathetic paralysis

Sensory block

Motor nerve blockade

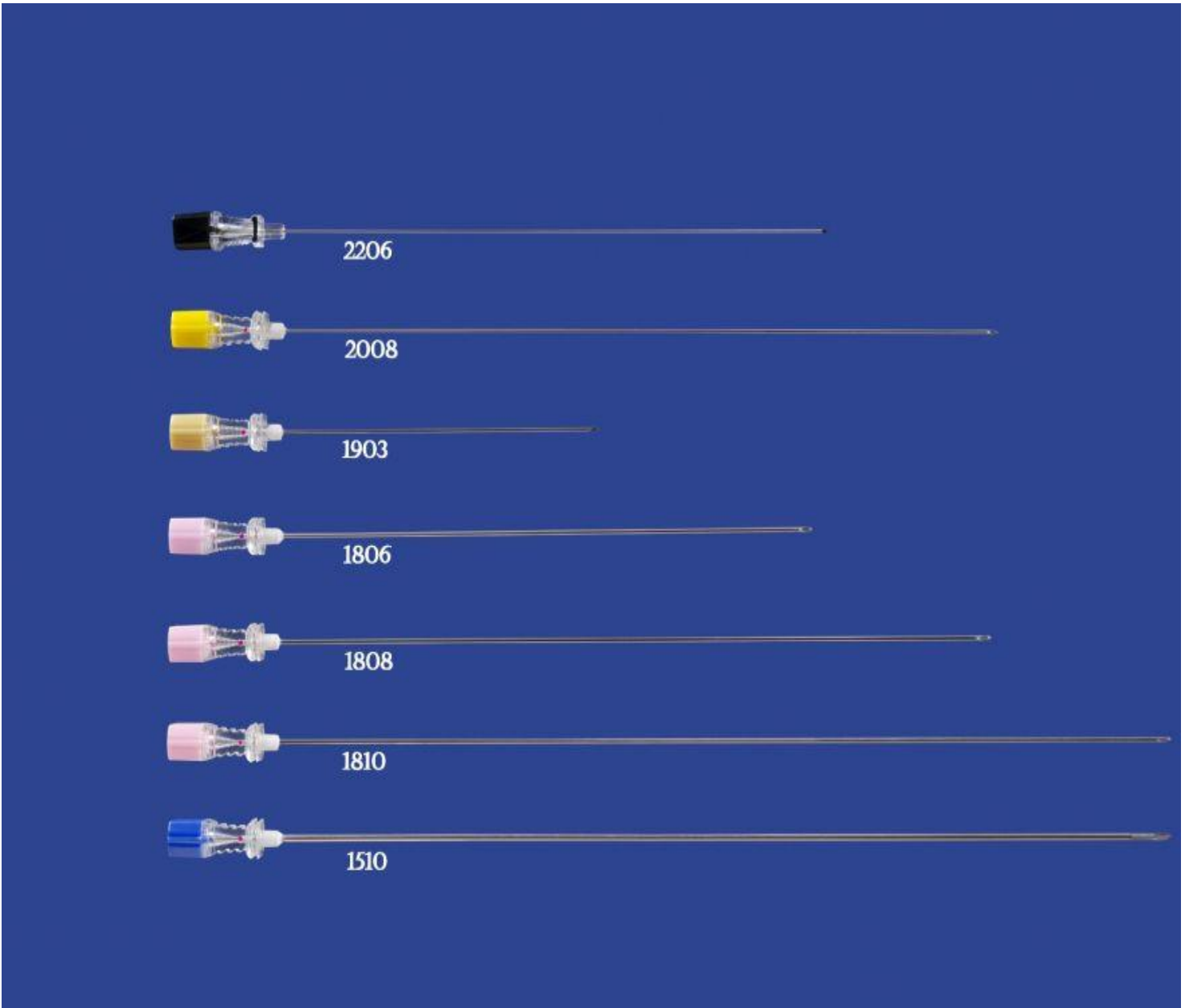
Indications & Advantages :

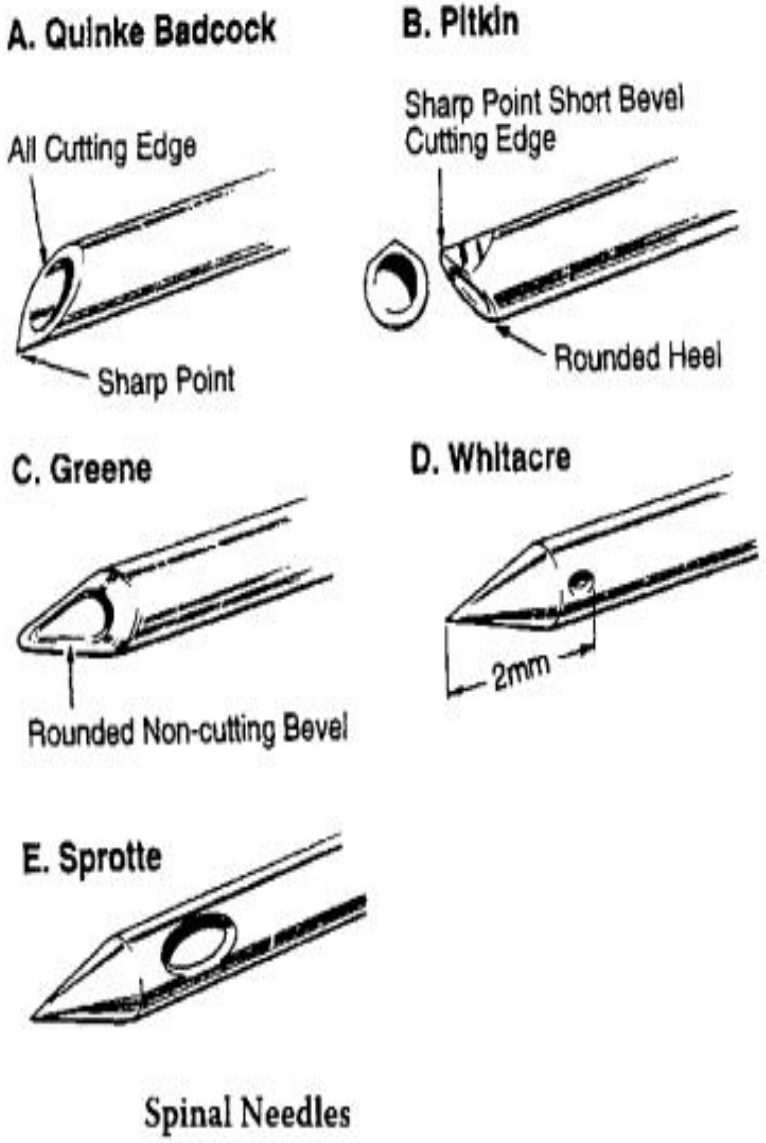
- Anatomic distortions of upper airway
- Lower abdominal surgeries
- Obstetrical surgery (T4 Level)
- Decreased post-operative pain

Contraindications :

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

Spinal Needles :





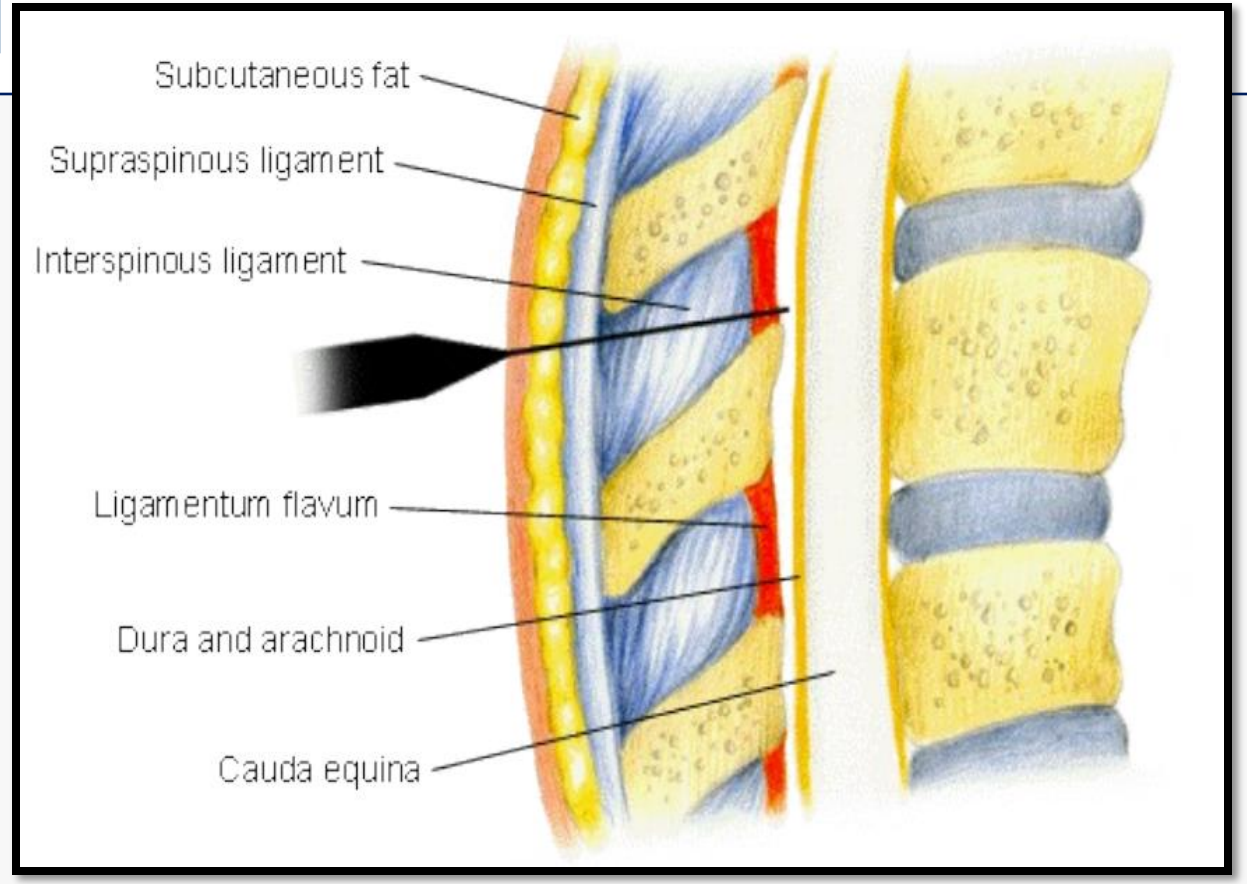
Spinal Needles

Spinal Technique :

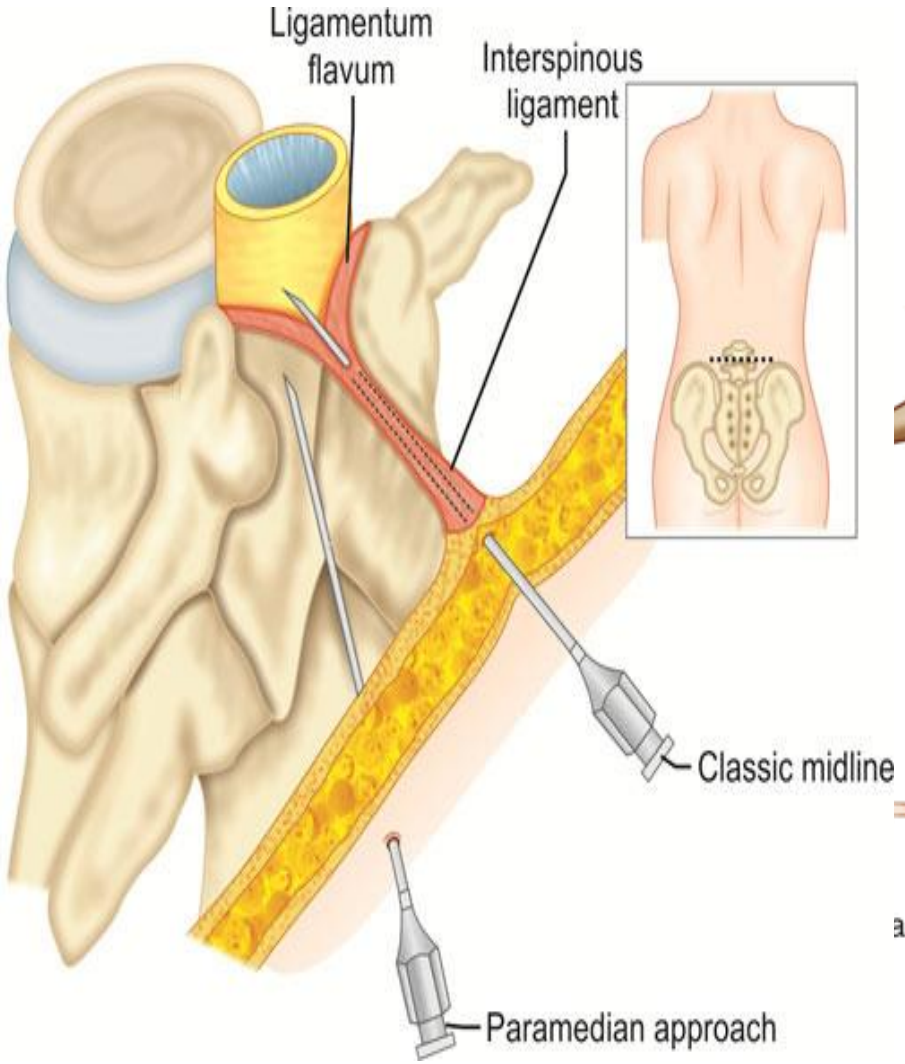
- Preparation & Monitoring
  - ECG
  - NBP
  - Pulse Oximeter
- Patient Positioning
  - Lateral decubitous
  - Sitting

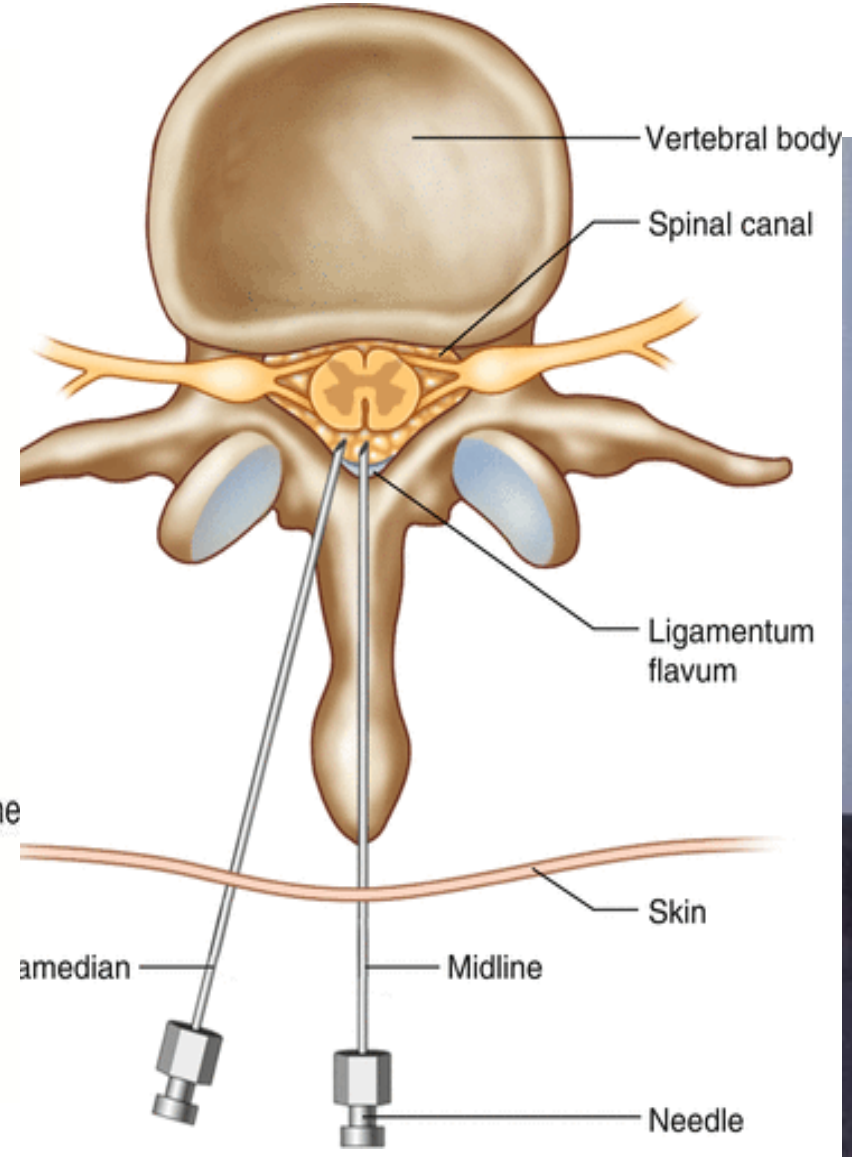
Spinal APPROACHES :

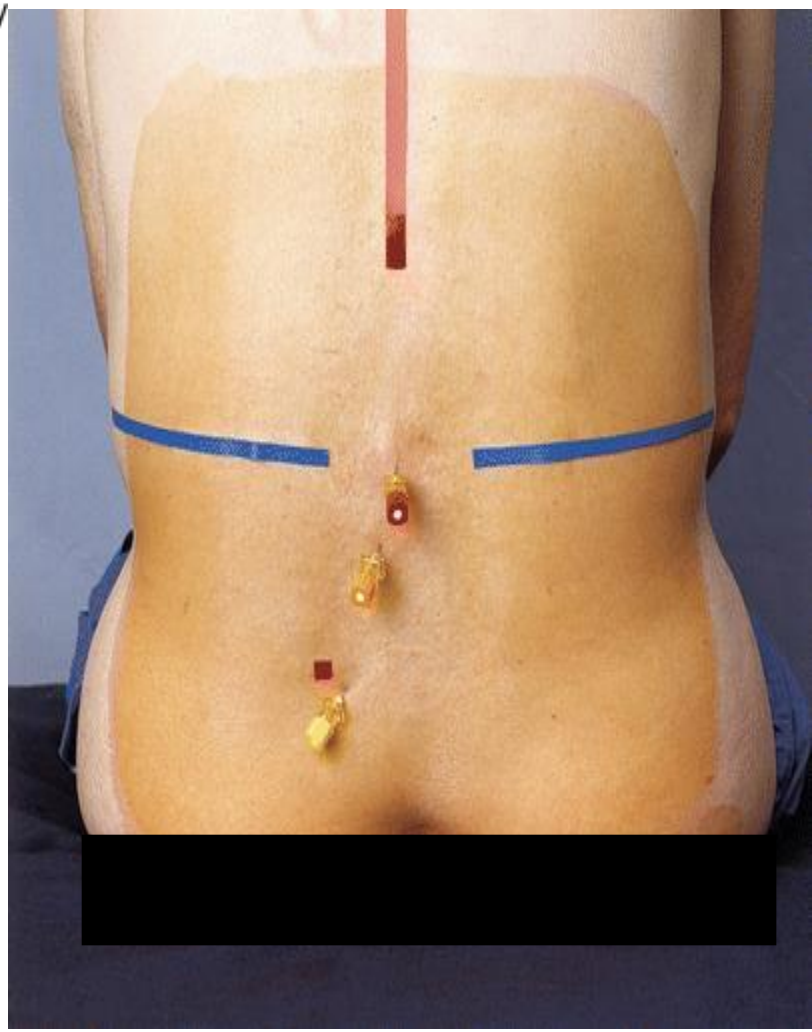
- **Midline Approach**
  - Skin.
  - Subcutaneous tissue.
  - Supraspinous ligament.
  - Interspinous ligament.
  - Ligamentum flavum.
  - Epidural space
  - Dura mater.
  - Arachnoid mater.



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


Ligamentum flavum
Interspinous ligament
Classic midline
Paramedian approach

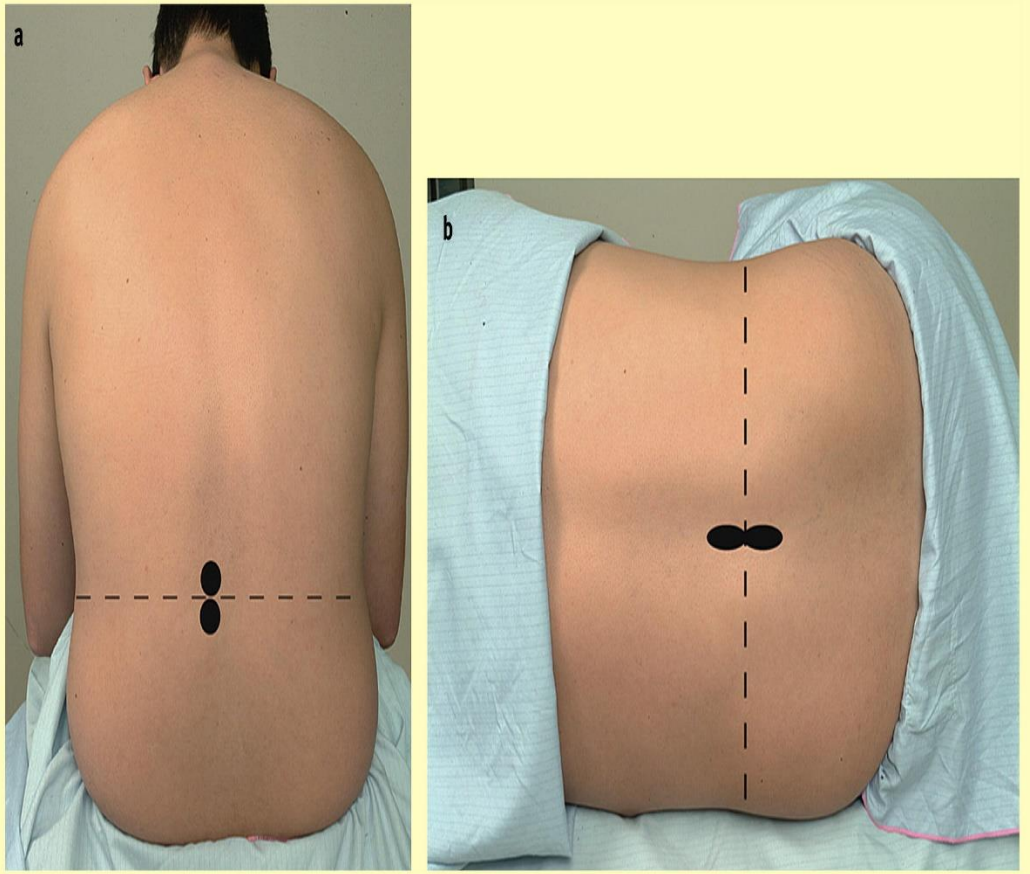

Vertebral body
Spinal canal
Ligamentum flavum
Skin
amedian
Midline
Needle



Technique :

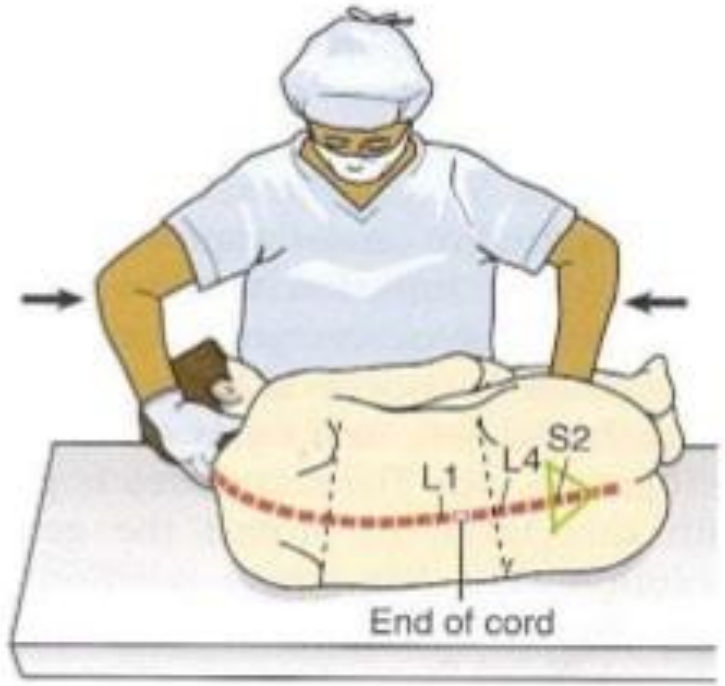
- Palpate the spinous process
- Identification of the spine level
    - L4- line joining iliac crest
- Loss of resistance and flow of CSF

Patient positions for spinal and epidural block

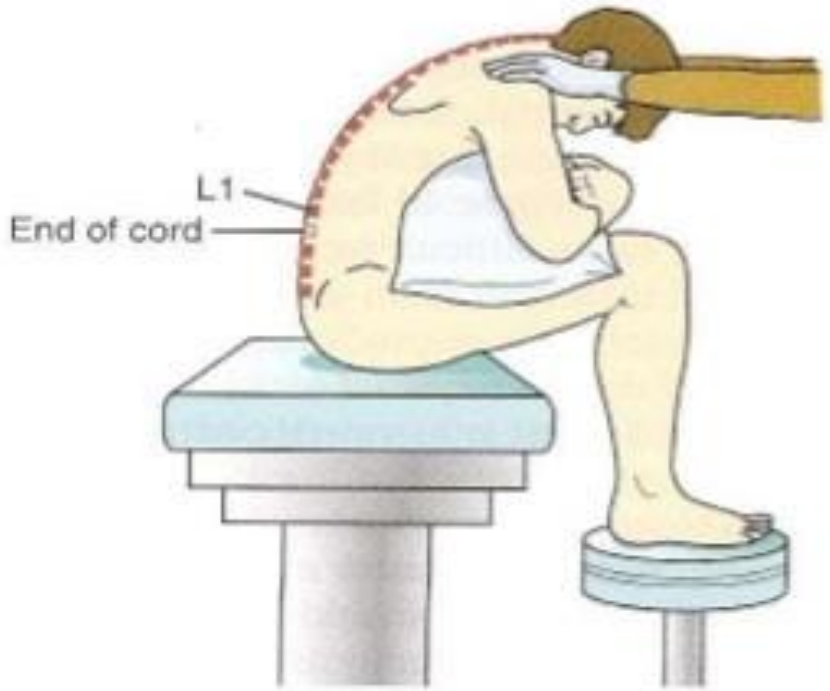


Surface markings for spinal and epidural block. Sitting **(a)** and lateral **(b)** positions for the spinal and epidural block. The dotted line represents Tuffier's line, which joins the two iliac crests and passes through the L3/L4 interspace or across the spinous process of L4.

Spinal Block - Position



Spinal block—lateral position.



Spinal block—sitting position.

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

Testing for levels of block

Sympathetic block

- Skin temperature sensation
- Changes in the skin temperature

Testing for levels of block

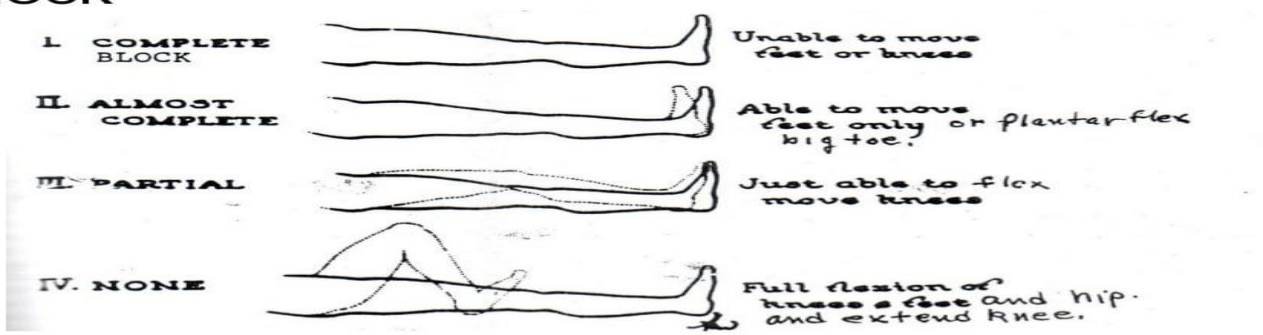
Sensory level

- Pin prick using sterile needle
- Loss of touch is two dermatomes lower than pin prick

Testing for levels of block

Motor block

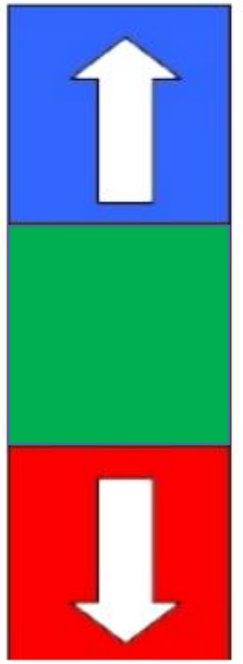
- Modified Bromage scale of onset of motor block



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

Spinal anaesthetic agents

Drug	preparation	Perineum, lower limbs (mg) dose	Lower abdomen (mg)dose	Upper abdomen (mg)dose	Duration (min)
procaine	10% solution	75	125	200	45
tetracaine	1% solution in 10% glucose	4-8	10-12	10-16	90-120
lidocaine	5% in 7.5% glucose	25-50	50-75	75-100	60-75
bupivacaine	0.75% in 8.25% dextrose	4-10	12-14	12-18	90-120
	0.5% in 8% dextrose	7.5 to 12.5	12.5-17.5	17.5-25	90-120
ropivacaine	0.2-1% solution	8-12	12-16	16-18	90-120

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

1. **Immediate complications**
   - **Hypotension**
   - **Bradycardia and Cardiac arrest.**
   - **High and Total spinal block leading to respiratory arrest.**
   - **Urinary retention.**
   - **Epidural hematoma, Bleeding.**

Complications

2. Late complications

- Post dural puncture headache (PDPH)
- Backache
- Nausea
- Focal neurological deficit
- Bacterial meningitis
- Sixth Cranial nerve palsy
- Urinary retention

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

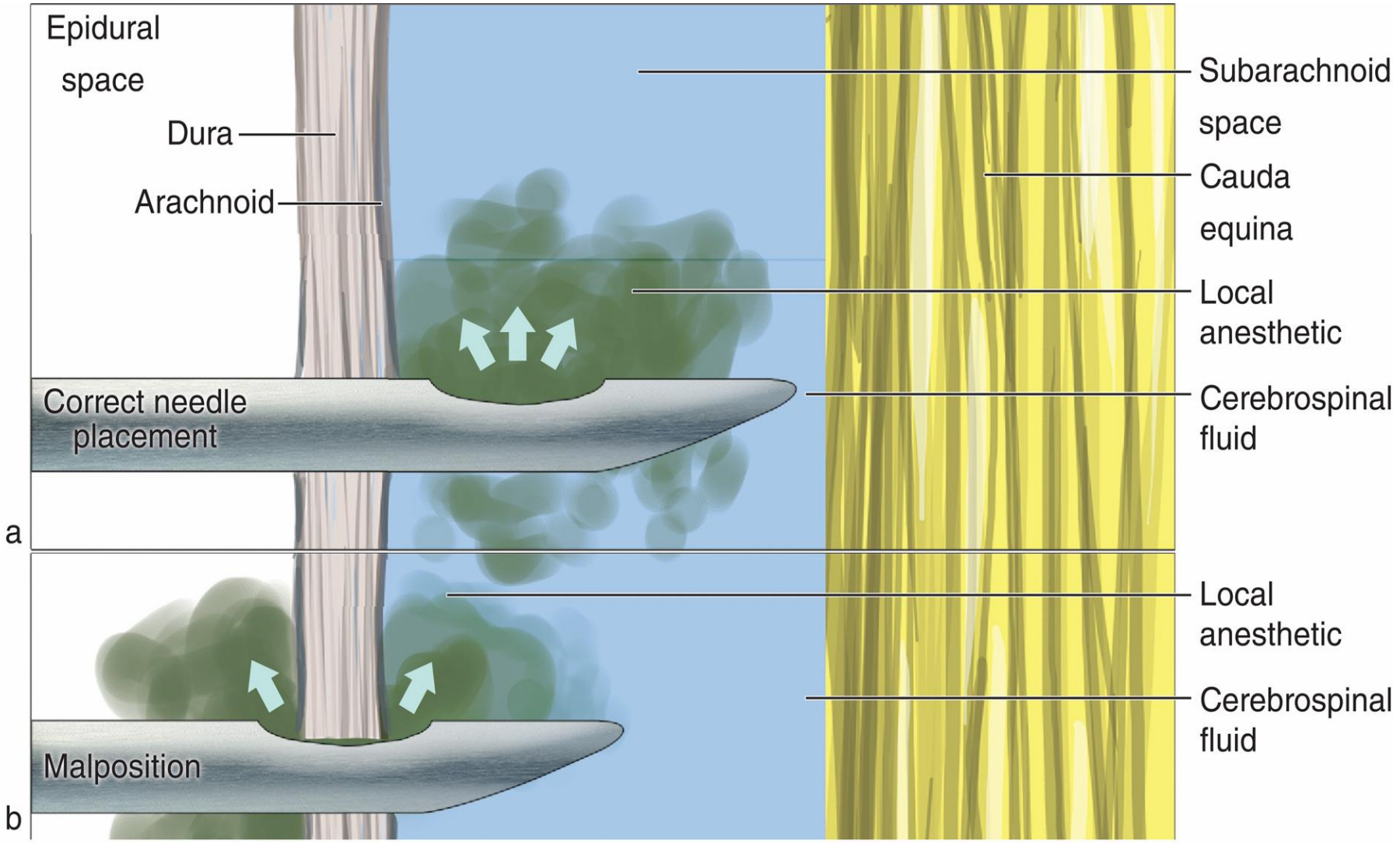
PDPH TREATMENT :

- 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.

Failed injection



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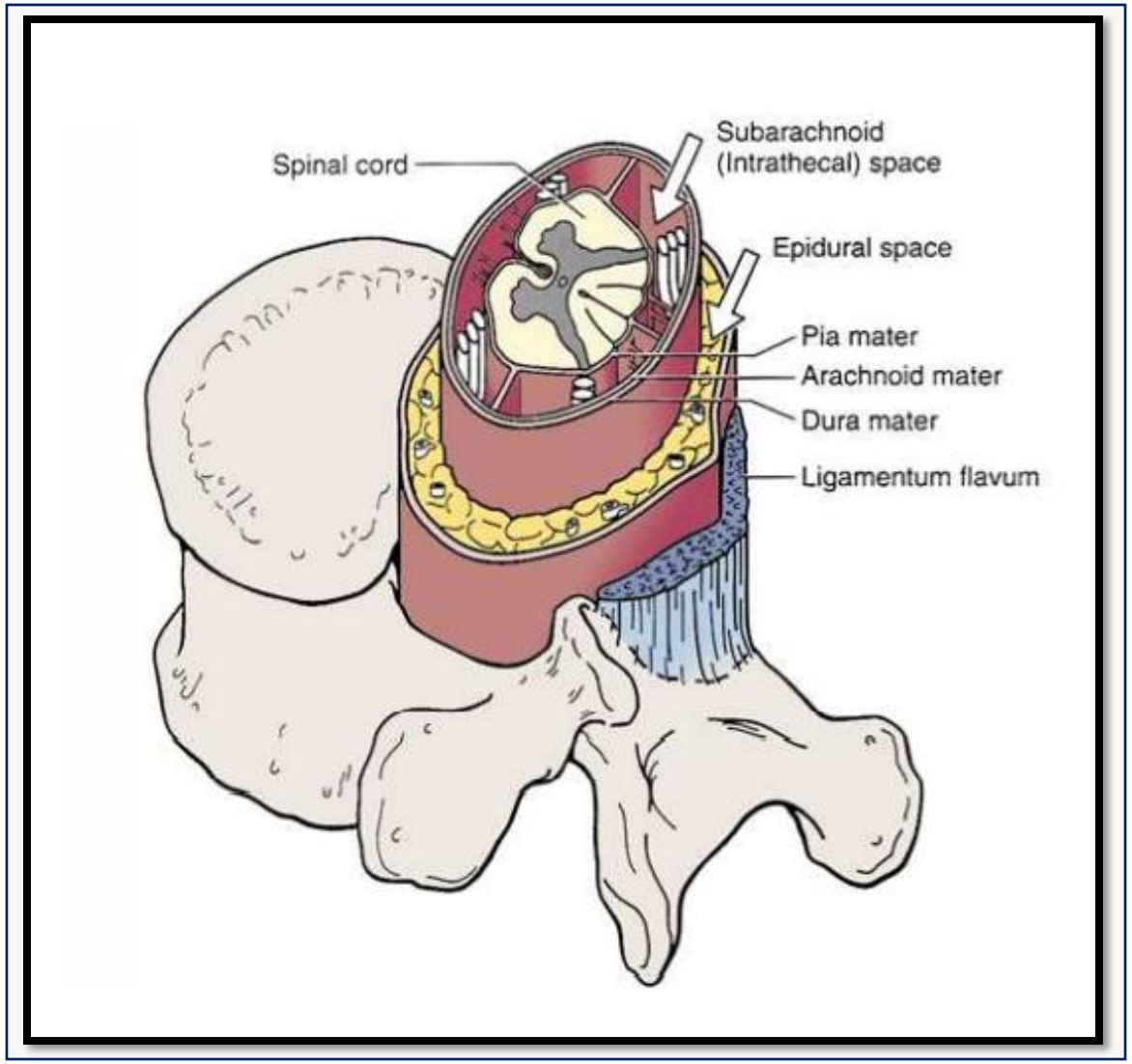
EPIDURAL ANESTHESIA :



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

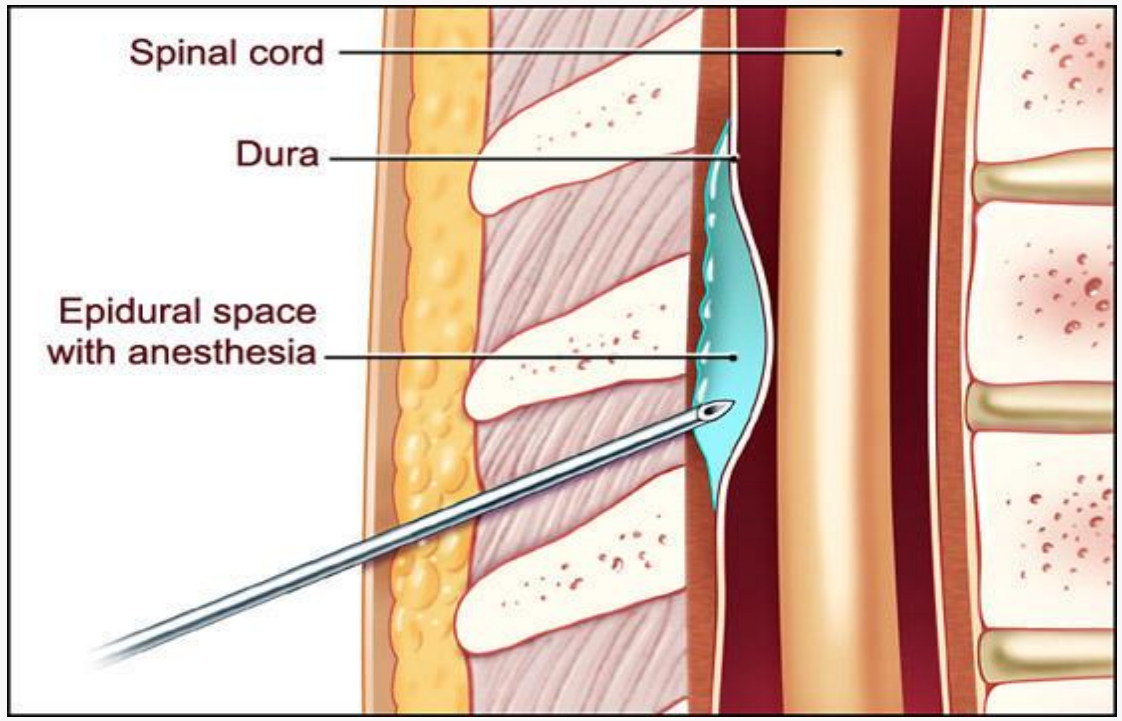
-Distance from skin to epidural space - 4-5 cm

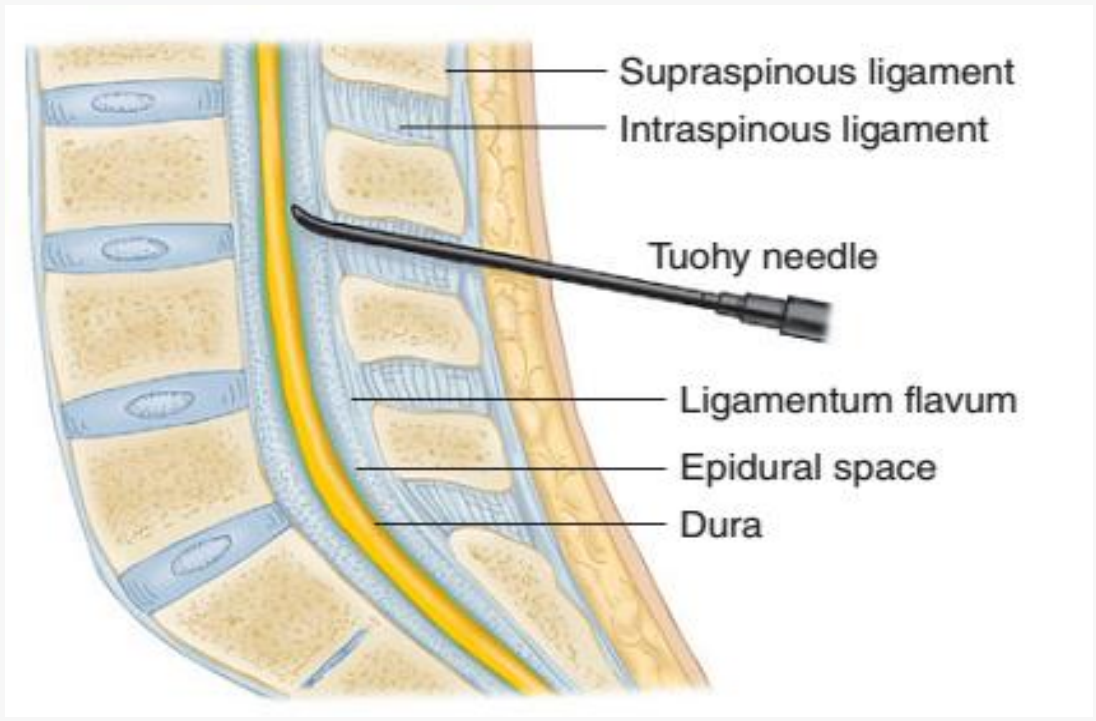
EPIDURAL ANESTHESIA :

- 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

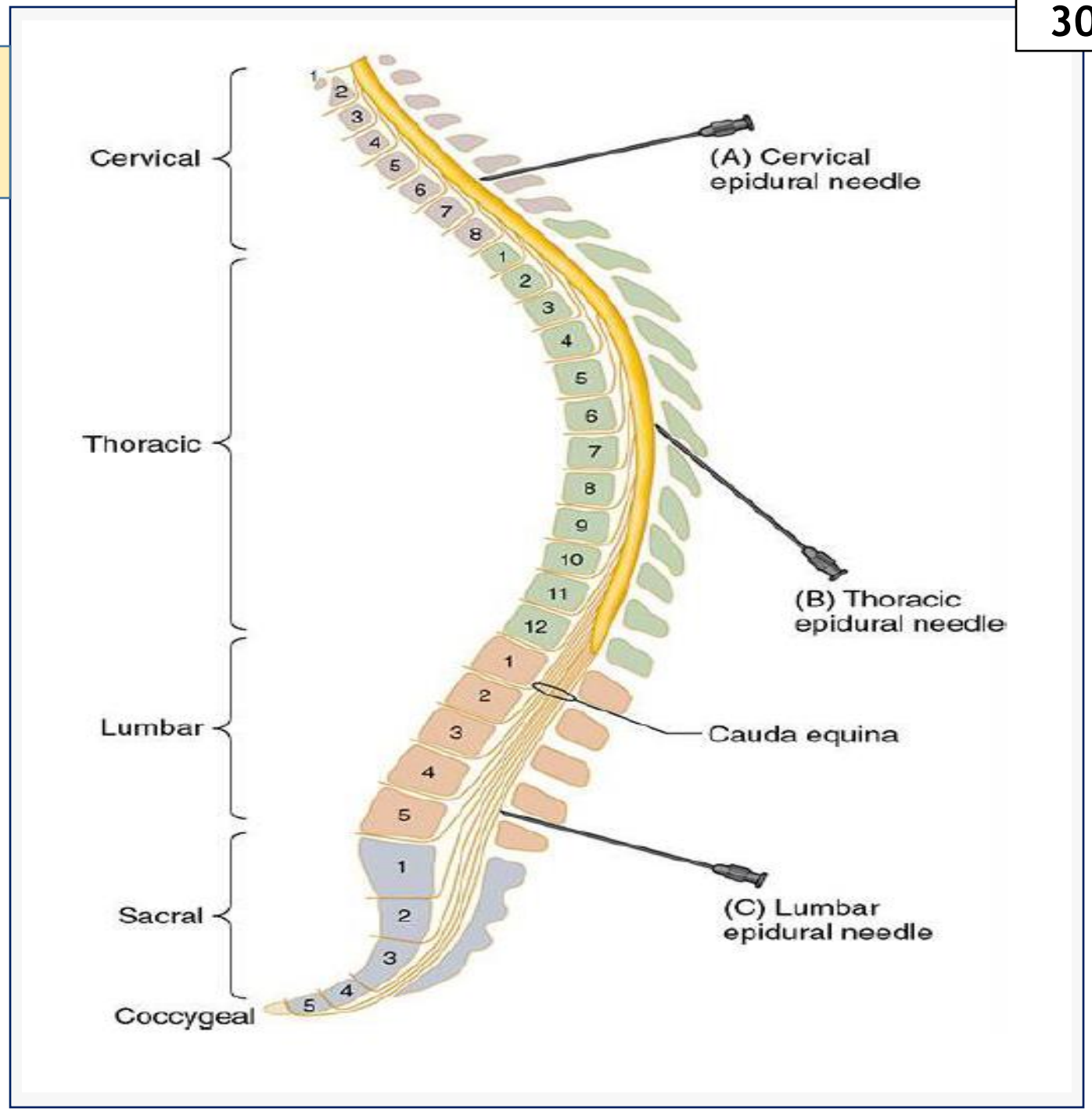
L4-L5 injection would require about 12 to 24 mL.

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

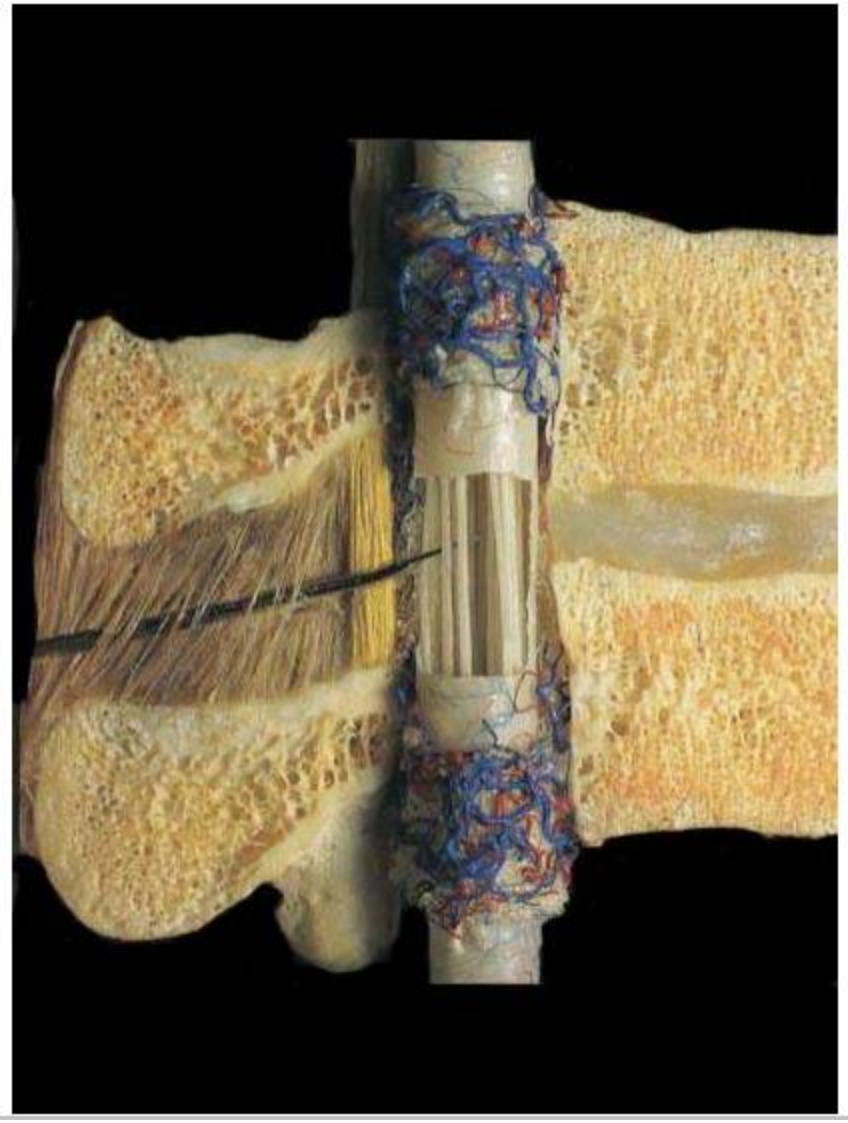
- Prolongs the effect of epidural Lidocaine > of bupivacaine
- Prolonging the duration and improving the quality of block

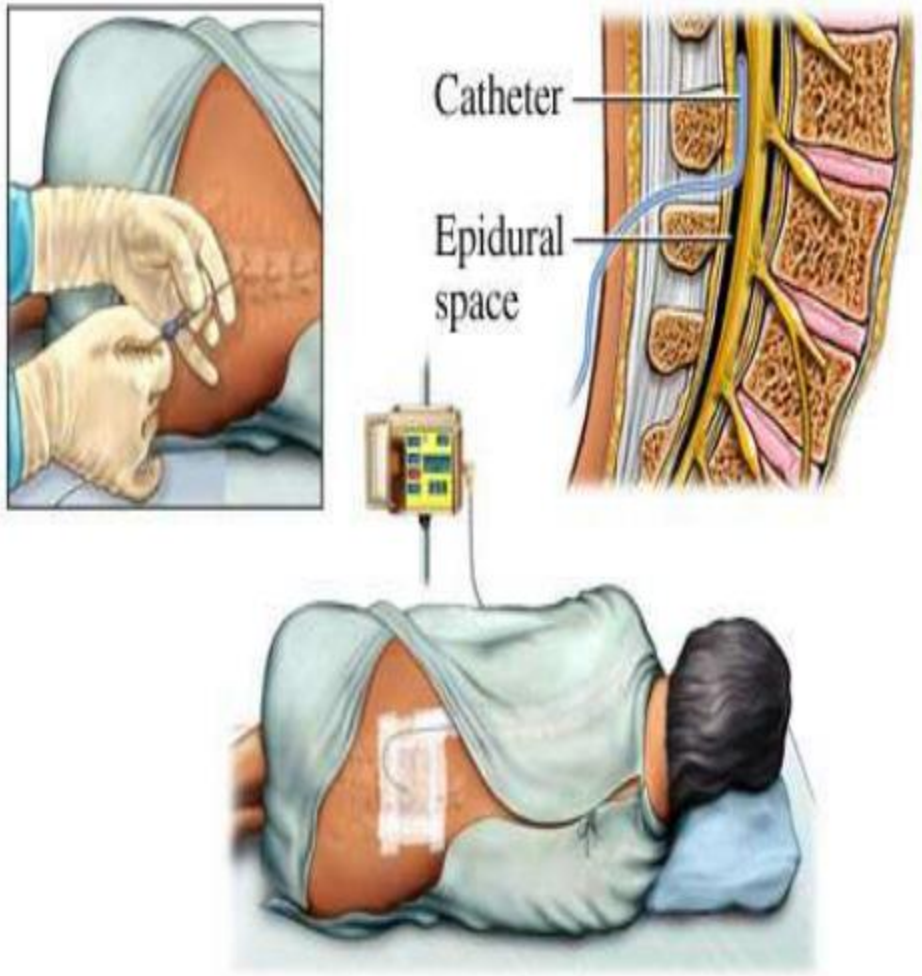
(epinephrine delays vascular absorption and reduces peak systemic blood levels of all epidurally administered local Anesthetics)

Epidural Anaesthetic Site And Needle Angle :



Epidural Anaesthetic Site And Needle Angle :





Epidural Anaesthetic Positioning :

A. Sitting Position

B. Lateral Decubitus

A

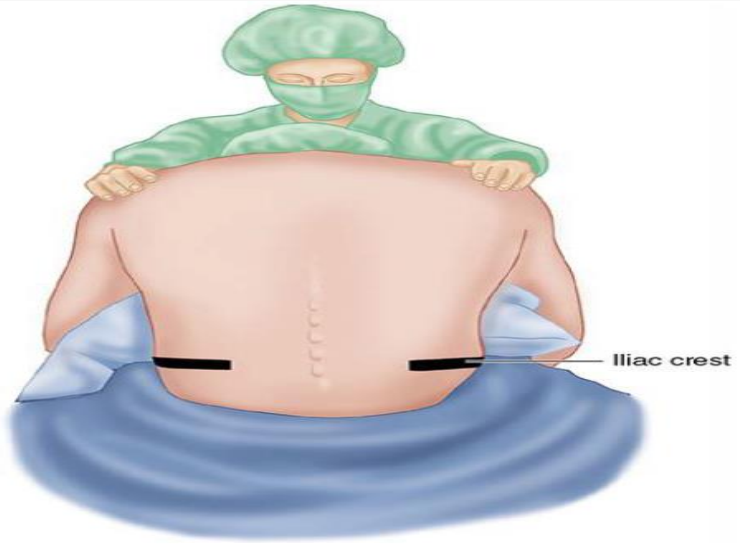


FIGURE 45–12 Sitting position for neuraxial blockade. Note an assistant helps in obtaining maximal spinal flexion.

B

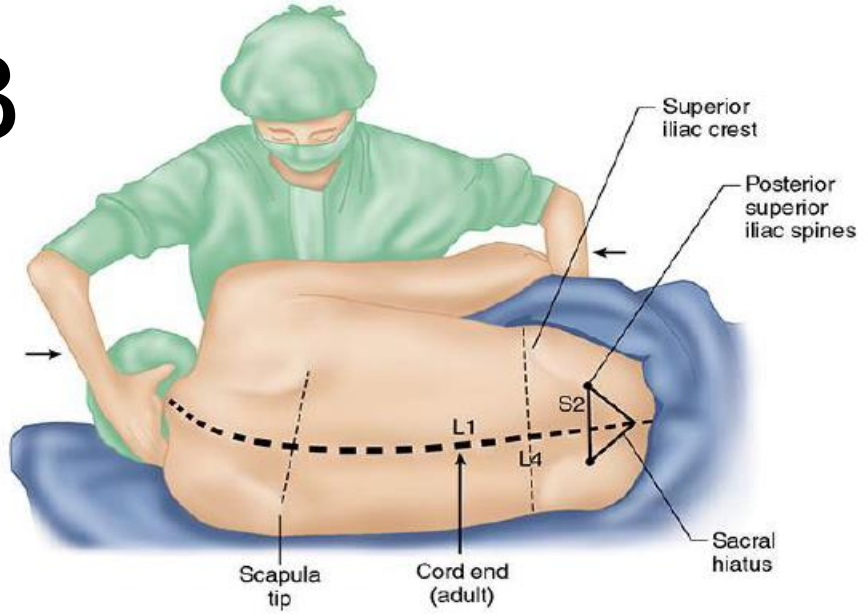


FIGURE 45–14 Lateral decubitus position for neuraxial blockade. Note again the assistant helping to provide maximal spine flexion.

Epidural set

1.Syrange10ml

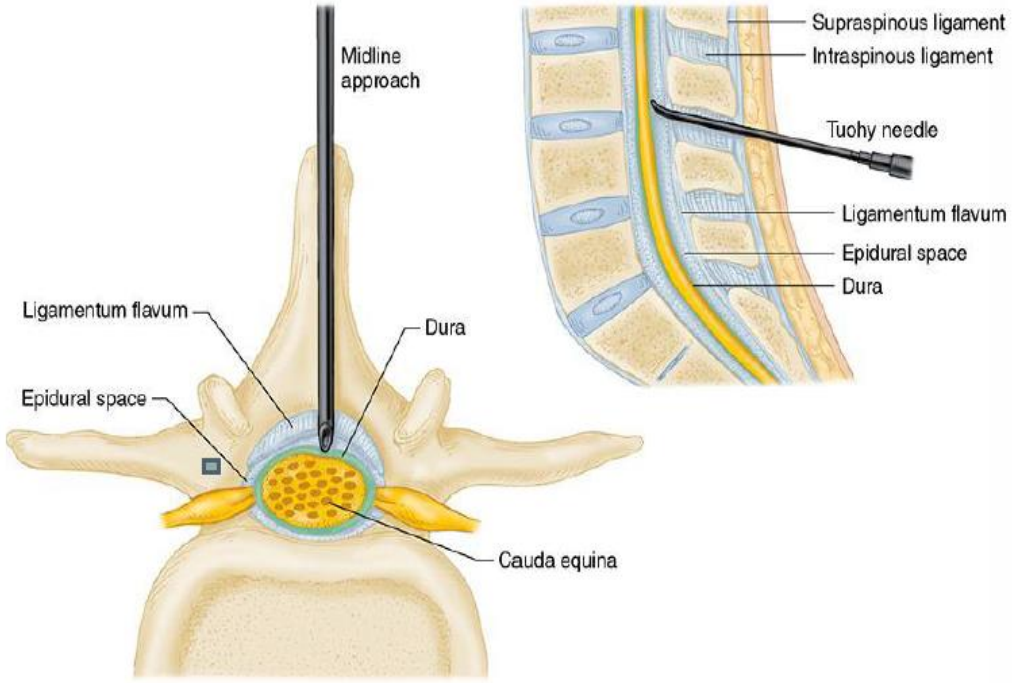
2.Tohy needle

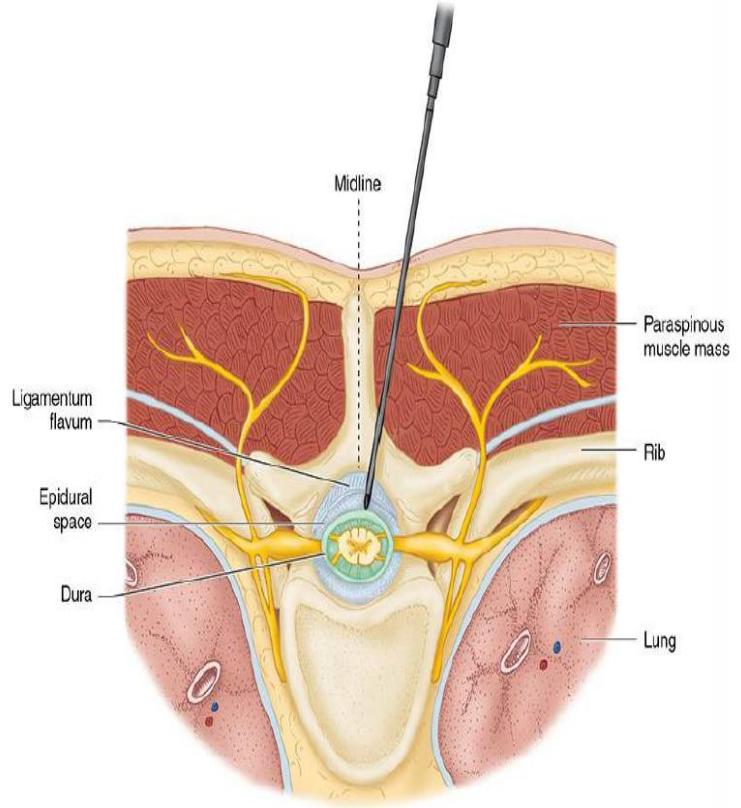
3.Epidural catheter.

4.Filter.

5.connector.

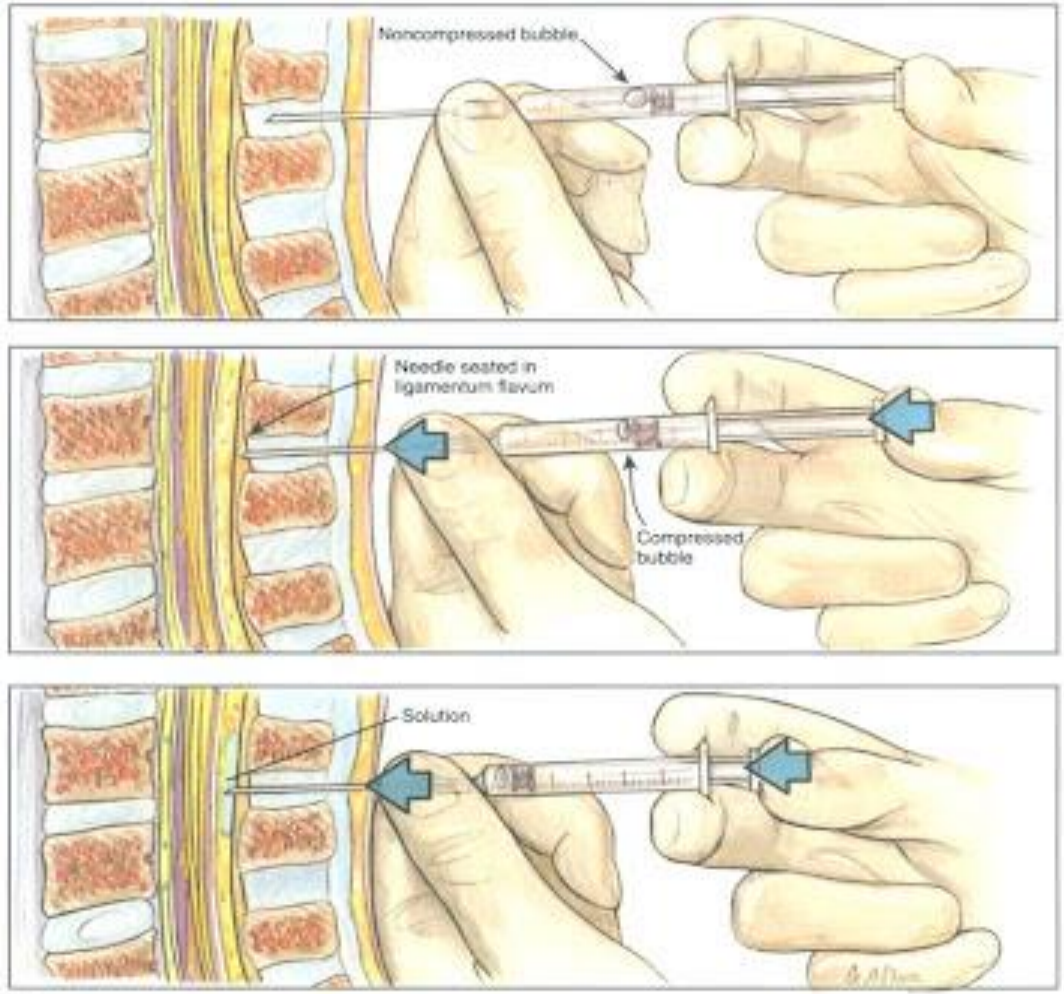
Anatomic Approach (Epidural Anaesthesia)

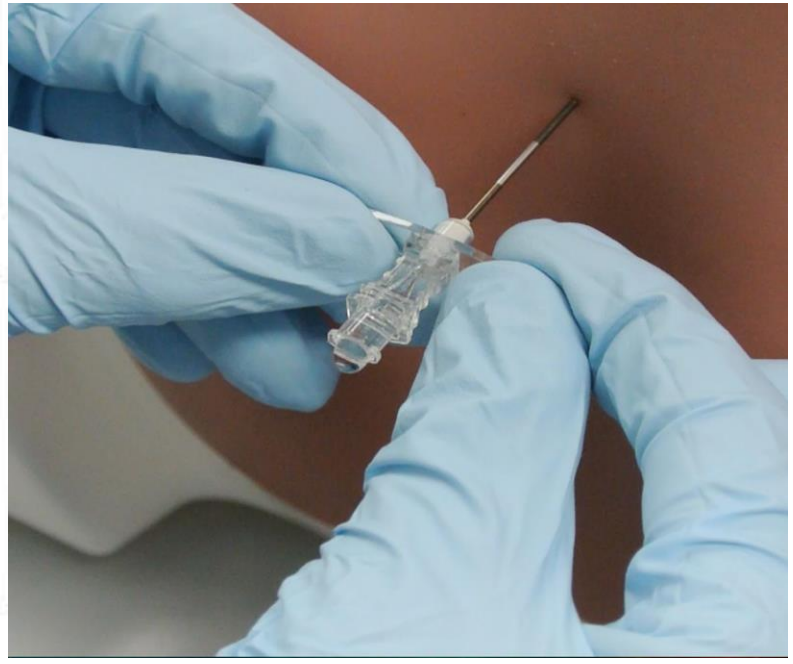




A. Midline Approach
Lumber Epidural Anaesthesia

B. Paramedian Approach
Lumber Epidural Anaesthesia


Noncompressed bubble
Needle seated in ligamentum flavum
Compressed bubble
Solution
A
Solution
Solution
B



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 β-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.

Volume

Can be variable

General rule: 1-2 ml of local anesthetic per dermatome

i.e. epidural placed at L4-L5; you want a T4 block for a C-sec. You have 4 lumbar dermatomes and 8 thoracic dermatomes. 12 dermatomes X 1-2 ml = 12-24 ml

Dose of local anesthetics administered in thoracic area should be decreased by 30-50% due to decrease in compliance and volume

Height

The shorter the patient the less local anesthetic required.

A 1 ml per dermatome while someone who is tall may require the full 2 ml per dermatome

Gravity

Position of patient does affect spread and height of local anesthetic BUT not to the point of spinal anesthesia.

i.e. lateral decubitus position will "concentrate" more local anesthetic to the dependent side will a weaker block will occur in the non-dependent area.

A sitting patient will have more local anesthetic delivered to the lower lumbar and sacral dermatomes

Adjuvant agent in neuraxial blockade anesthesia

Drug use to increase the effecacy or potancy or decrease the side effect of medication when given concurrently

Druge	*Epidural dose*
morphine	*2-5 mg*
diamorphine	*2-3 mg*
pethidine	*25-50 mg*
sufentanal	*10-50µg*
fentanyl	*50-100µg*
ketamine	*0.5-1.0mg/kg*
medazolam	*10-20µg/kg/hr*
Sodium bicarbonate	*1ml of 8.4% NaHCO3 per 10ml of lidocaine*
adrenaline	*5 µg/ml*
neostigmine	*postoperative pain: 50-100µg* *labour analgesia: 300-500µg*
clonidine	*75-150µg*

Differences between Spinal and Epidural Anesthesia

Spinal anaesthesia	Extradural Anaesthesia
Level: below L1/L2, where the spinal cord ends	Level: at any level of the vertebral column.
Injection: subarachnoid space i.e punture of the dura mater	Injection: epidural space (between Ligamentum flavum and dura mater) i.e without punture of the dura mater
Identification of the subarachnoid space: When CSF appears	Identification of the Peridural space: Using the Loss of Resistance technique.
Dosis: 2.5- 3.5 ml bupivacaine 0.5% heavy	Doses: 15- 20 ml bupivacaine 0.5%
Onset of action: rapid (2-5 min)	Onset of action: slow (15-20 min)
Density of block: more dense	Density of block: less dense
Hypotension: rapid	Hypotension: slow
Headache: is a probably complication	Headache: is **not** a probable.

Thank You

End of lecture