



Round : Anesthesia - Lecture 1

Group no : B 8

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LOCAL ANESTHETIC TECHNIQUES

CSF volume $\rightarrow$ 150 ml
production $\rightarrow$ 450 ml
in pediatrics $\rightarrow$ 2ml/kg



Anesthesia is the process of administering chemical compounds in non-toxic concentrations to cause a reversible loss of perception of different stimuli, as well as the ability to respond to them. It's a reversible process so once the patient recovers from it, the perception of different sensations as well as the level of consciousness that have been altered return back to normal.

We have two types as we know, local and general anesthesia. General anesthesia is performed in cases of major surgeries, and it results in a loss of sensory, motor, autonomic and cognitive functions since it blocks the transmission of nerve impulses throughout the entire body. So patients require supportive devices to maintain vital functions like mechanical ventilation.

However, local anesthesia on the other hand is limited to a desired location. So it doesn't result in loss of consciousness and doesn't affect vital functions elsewhere in the body.

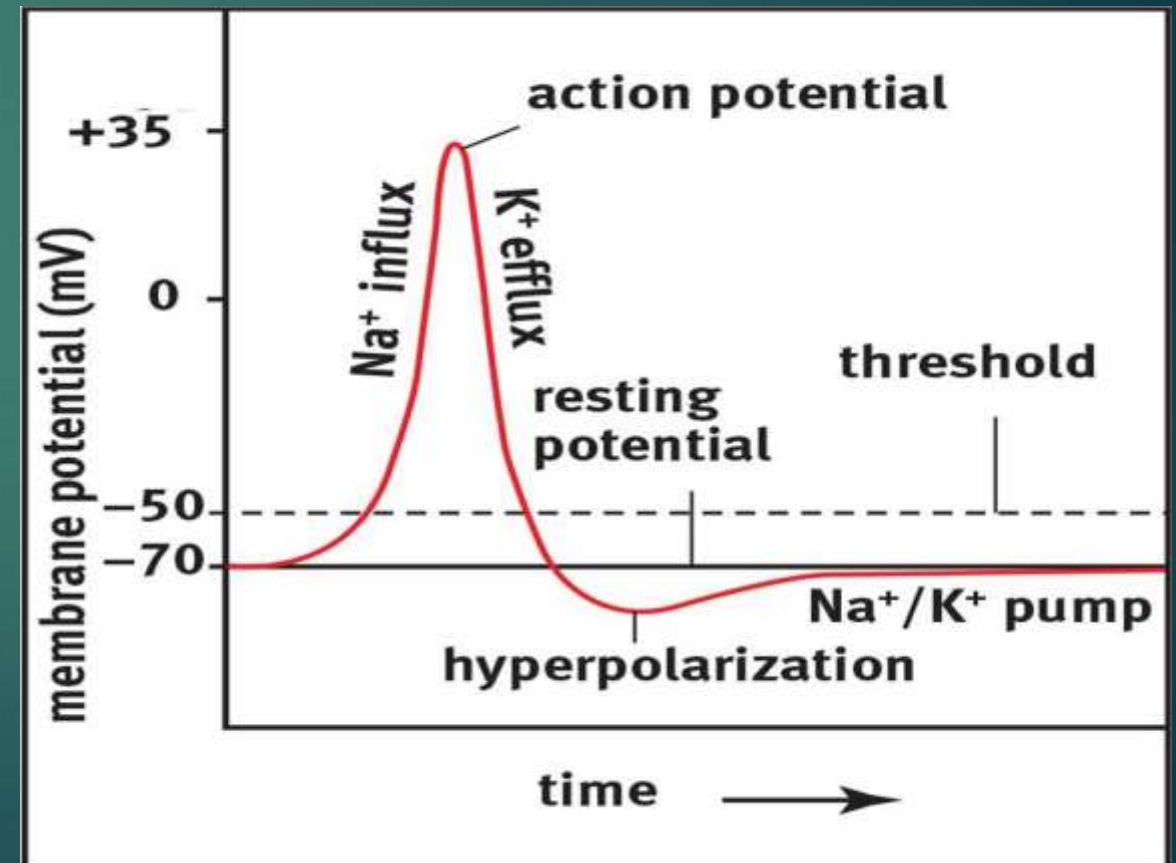
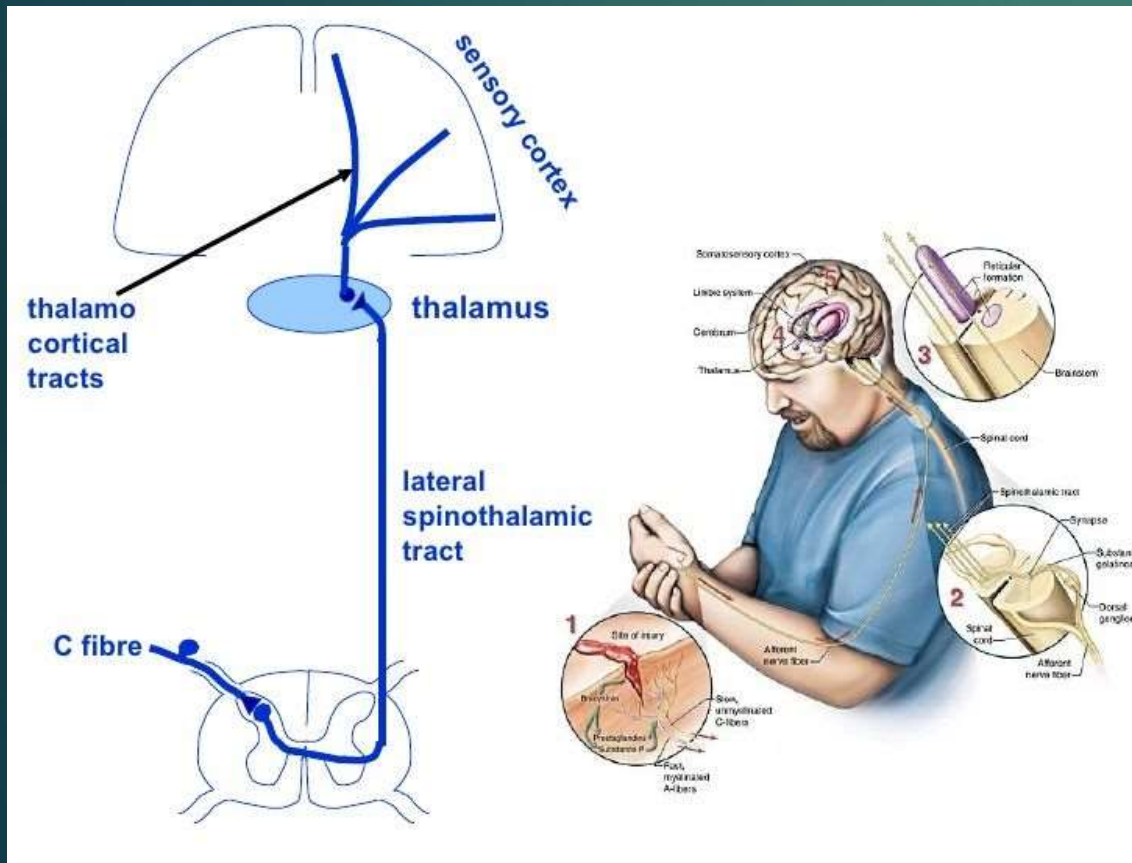
Pain is sensed by free nerve endings, which we can refer to as 1st order neurons in the pain pathway.

These nerve endings

are stimulated by multiple triggers. could be mechanical like a bump or thermal like heat and cold or it could be chemical stimulators like bradykinin and histamine. These triggers then result in opening of transient receptor potential channels which allows cations to enter the cell leading to depolarization that's enough to result in the opening of voltage-gated sodium channels causing rapid depolarization, reaching the threshold and subsequent generation of action potentials. Then these neurons synapse with second order neurons in the spinal cord carrying these sensations to the brain where they're processed. Local anesthetic agents work to block this transmission exactly where they're administered.

Local Anesthetics – Definition

- A substance which applied topically in non-toxic concentration to induce reversible regional loss of sensation by blocking nerve transmission of sensation .



How local anesthesia works ?

This theory suggests that local anesthetics diffuse to the hydrophobic regions of the cell membrane, inserting themselves into the lipid bilayer of the membrane, causing the membrane to expand and sodium channels to become narrow, preventing depolarization (indirect)

- Two theories explained the mechanism :
- A- **membrane expansion theory** : postulates that the local anesthetic is absorbed into the cell membrane, expanding the membrane and leading to narrowing of the sodium channels
- B- **specific receptor theory**: This theory proposes that the local anesthetic diffuses across the cell membrane and binds to a specific receptor at the opening of the voltage-gated sodium channel , so block them . *Direct blocking effect, more accepted*

Mechanism of Action of Local Anesthetics

- 1) Displacement of calcium ions from the sodium channel receptor site
Calcium increases the affinity to sodium ions so its displacement decreases depolarization
- 2) Binding of the local anesthetic molecule to this receptor site
- 3) Blockade of the sodium channel
- 4) Decrease in sodium conductance
- 5) Depression of the rate of electrical depolarization
- 6) Failure to achieve the threshold potential level (firing level)
- 7) Lack of development of propagated action potentials
- 8) Conduction blockade

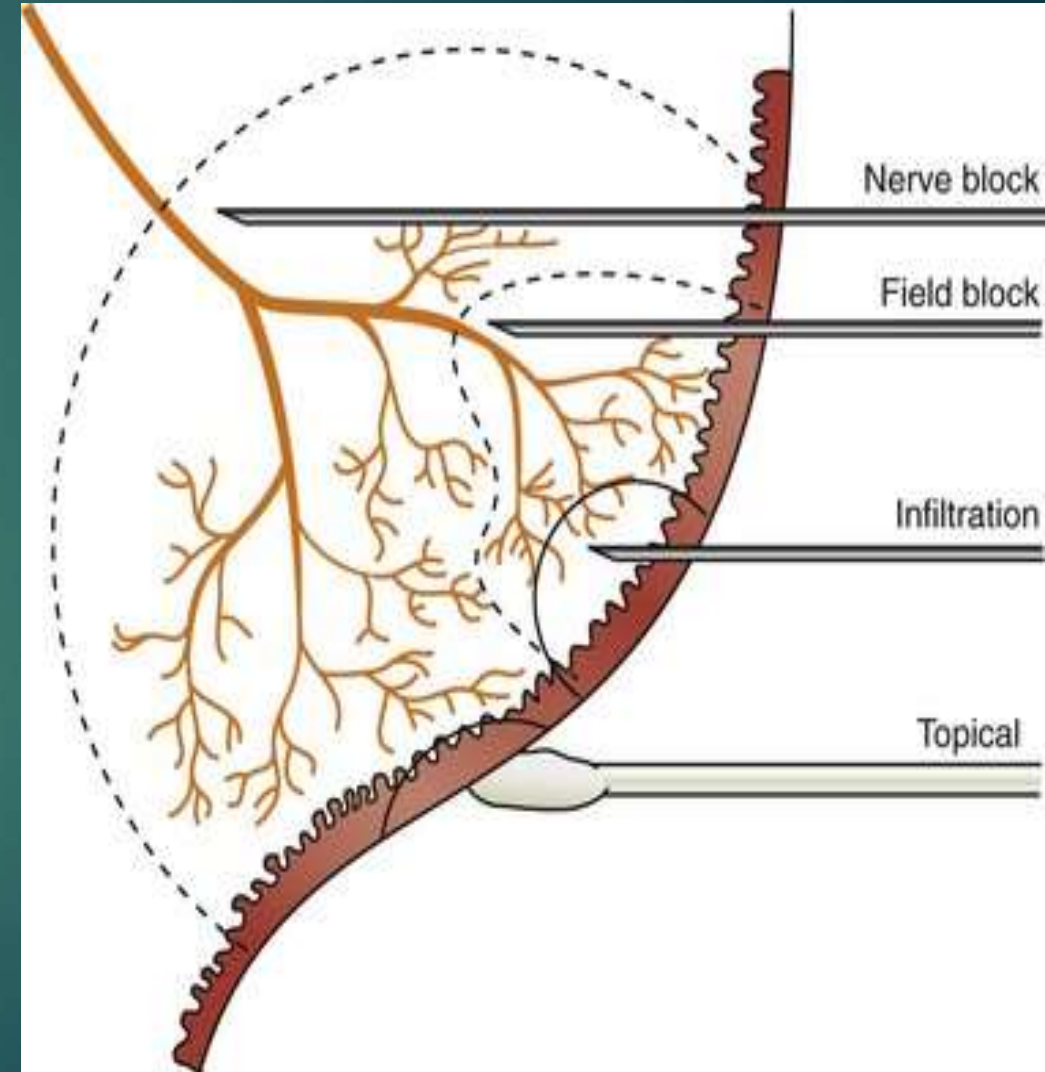
Local Vs General Anaesthesia

What indicates which drug is faster is their solubility. Desoflurane is faster because it is less soluble.

	General Involves the brain and depresses centers	Local
Site of action	CNS	Peripheral nerves
Area	Whole body	Restricted areas
Consciousness	Lost	Unaltered
Preferential use	Major surgery	Minor surgery
Use in non-cooperative patients	Possible Could be used in pediatric patients	Not possible
Poor health patient	Risky Cardiac diseases	Safer
Care for vital functions	Essential	Not needed

Sites of Local Anesthesia ...

- Surface (topical) anaesthesia
- Infiltration anaesthesia
- Nerve and plexus block
- Epidural blocks
- Spinal (or subarachnoid) block



1-Surface anaesthesia

Applied to the skin/mucosa

- A surface (**topical anesthetic**) is a local anesthetic that is used to numb the surface of a body part. They can be used to numb any area of the skin as well as the front of the eyeball, the inside of the nose, ear or throat, and anus and urinary tract...
- Has a limited effect on free nerve endings
- Surface (Topical) anesthetics are available in creams, ointments, aerosols, sprays, lotions, and jellies
- Used in ophthalmology, dentistry before applying nerve blockers or to relieve pain from minor cuts or scratches.

EMLA cream is great for this



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2-infiltration anesthesia

Injections into tissues

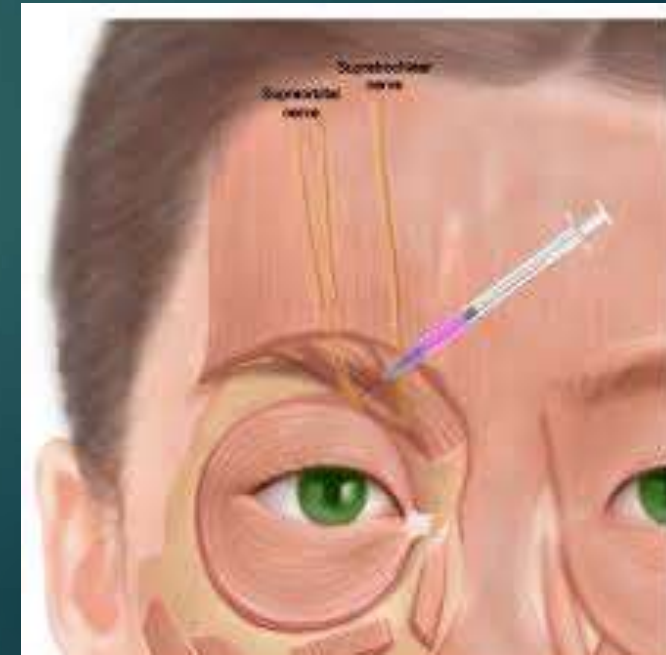
- Administration of the local anesthetic solution subcutaneously.
- It is produced when the terminal nerve endings is flooded by local anesthetic solution by injection



3- Nerve block

Deeper and we can include the whole plexus

- Induced when the nerve trunk flooded by the local anesthetic solution
- can be used to block any nerve
- Numbs the area of the body that is innervated by that nerve.



4-EPIDURAL ANESTHESIA

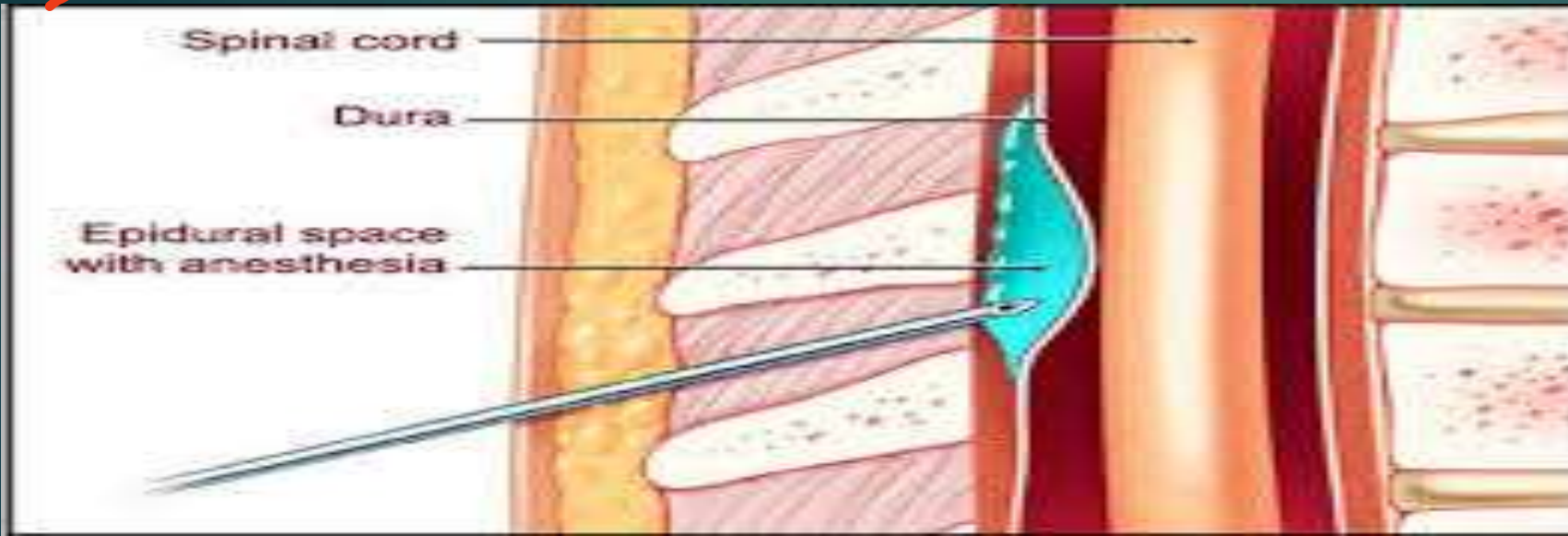
- is a medical route of administration in which a drug is injected into the epidural space (btw ligamentum flavum and dura matter)of the spinal cord.
- Injection of local anesthetic into the epidural space at any level of spinal column (cervical, thoracic, lumbar, sacral region)

Not regarded as central as it does NOT reach the brain

Landmark is the lower border of the scapula T7

Landmark is C7 which can be felt by us

Iliac crest (L3-L4)



You will cross :

skin > subcutaneous
tissue > deep fascia >
supraspinus ligament >
intraspinous ligament >
ligamentum flavum >
epidural space

Indications

- Sole epidural anesthetic
 - Orthopedics - Surgeries of lower limbs, including hip, knee, and pelvic areas
 - Vascular surgery - Lower limbs, amputations
 - Obstetrics - Cesarean delivery
 - Gynecology - Surgeries of female pelvic organs
 - Urology - Prostate and bladder surgeries Transurethral prostatic resection, the most common complication is TRB syndrome
 - General surgery - Lower abdominal surgeries, including appendectomy, bowel surgeries, hernia repair
 - Pediatric surgery - Penile procedures, inguinal hernia repair, lower limb orthopedic procedures
- Epidural anesthesia may be combined with spinal anesthetic We use combination when we want rapid anesthesia since epidural takes 30mins.
 - This combination is referred to as combined spinal epidural (CSE).
 - All of the indications noted above for sole epidural anesthetic may also be performed with CSE.
- Prolonged postoperative analgesia Administrations of substances that could reduce pain for some time
 - obtained by continuous or patient-controlled infusions of local anesthetics, opioids ...etc
 - Labor epidural analgesia

➡ Contraindications

- Absolute -

- ➡ **Patient refusal** We need the consent of the patient
- ➡ **Coagulopathy or Therapeutic anticoagulation** may cause traumatic bleeding into the epidural space. Clotting abnormalities may lead to the development of a large hematoma leading to spinal cord compression.
- ➡ **Skin infection at injection site**: Leads to neurological problems. may introduce pathogenic bacteria into the epidural space, leading to serious complications such as meningitis or epidural abscess.
- ➡ **Raised intracranial pressure.** Accidental Dural puncture in a patient with raised ICP may lead to brainstem herniation. Could compress the respiratory center and results in death
- ➡ **Uncontrolled Hypovolemia**: The sympathetic blockade produced by epidurals, in combination with uncorrected hypovolemia, may cause profound circulatory collapse (Ex : aortic stenosis , HOCM)
- **allergy to local anesthetics** Hypertrophic obstructive cardiomyopathy (genetic condition causing thickening of cardiac muscle) if these conditions are severe then it is absolutely contraindicated.

Relative

- ➡ **Uncooperative patients** : Could cause trauma. may be impossible to position correctly, and be unable to remain still enough to safely insert an epidural.
- ➡ **Pre-existing neurological disorders** : such as multiple sclerosis, may be a contraindication, because any new neurological symptoms may be ascribed to the epidural.
- ➡ **Anatomical abnormalities of vertebral column** : may make the placement of an epidural technically impossible.

↪ relative risk يكون mild or moderate اذا كان

ANATOMY

****The spinal cord usually ends at the level of L1-L2 in adults and L3 in children.**

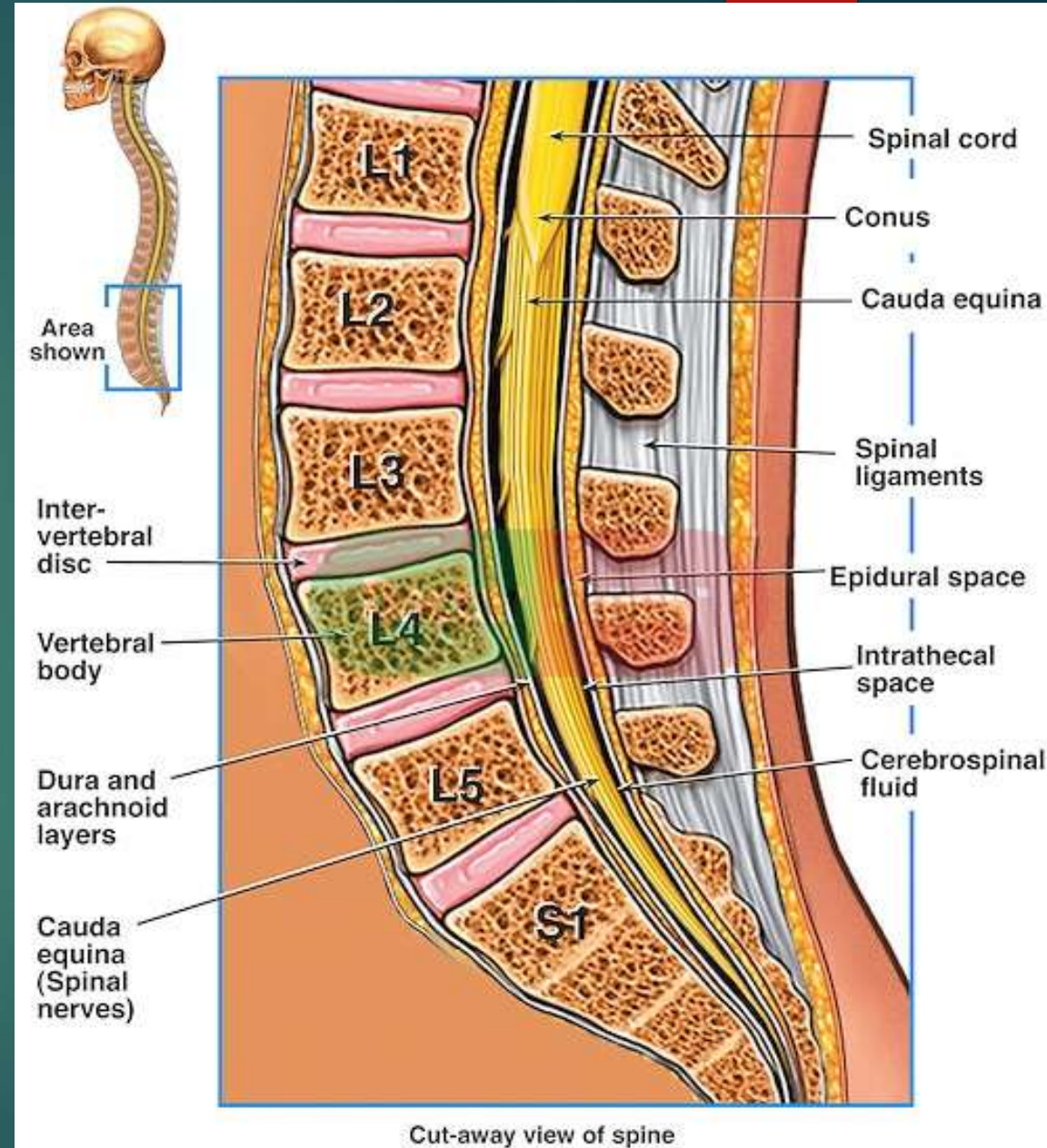
☆ Dural sac and the subarachnoid space both end at level s2 in adults, and s3 in pediatric patients

****Dural puncture above these levels is associated with a slight risk of damaging the spinal cord and is best avoided.**

The spinal cord ends with cauda equina which is non-traumatic and keeps floating in the CSF

**** An important landmark to remember is that a line joining the top of the iliac crests is at L4 to L5. Tuffier's line**

☆ The principle site of action in epidural anesthesia is nerve roots



Technique of Epidural Anesthesia



▶ 1- Preoperative Visit.

- ▶ Patients should be told about their anesthetic during the preoperative visit.
- ▶ It is important to explain that although spinal anesthesia abolishes pain, they may be aware of some sensation in the relevant area, but it will not be uncomfortable.
- ▶ It should also be explained that their legs will become weak or feel as if they don't belong to them any more. They must be reassured that these sensations are perfectly normal and that if, by any chance, they feel pain they will be given a general Anesthetic. Should tell the patient that there is a possibility it wont work or could be partially done..etc

- ▶ obtain informed consent prior to performing an epidural.
- ▶ The patient should be informed of the possible risks and complications associated with epidurals .
- ▶ A formal preanesthetic assessment should be carried out, and this should be no less rigorous than one carried out prior to general anesthesia.
- ▶ special attention should be given to the patient's cardiovascular status, with the emphasis on valvular lesions or other conditions that might impair the ability to increase cardiac output in response to the vasodilatation that inevitably follows sympathetic blockade. Neuromuscular like MS is contraindicated
- ▶ The back should be examined and any lesions or abnormalities noted.
- ▶ Laboratory assessment of the patient's coagulation status is necessary where there is any doubt regarding coagulopathy or anticoagulation therapy. INR (or prothrombin time), PTT and absolute platelet count should be within the normal range. Where there is doubt about platelet function in the presence of a normal platelet count, a hematologist's advice should be sought. International normalized ratio (INR) is the preferred test of choice for patients taking vitamin K antagonists (VKA). It can also be used to assess the risk of bleeding or the coagulation status of patients 1.1 normal, 2-3 warfarin therapy

► **N.B**

- **Premedication is often unnecessary, but if a patient is **apprehensive**, a Anxious and fearful benzodiazepine such as 5-10 mg of diazepam may be given 1 hour before the operation. Other sedative or narcotic agents may also be used. Anticholinergics such as atropine or scopolamine are not routinely required.

2-Intravenous Preloading

☆ We give pre-loading to patients in order to insure the presence of a circulation. If no circulation is available then the drugs administrated wont be effective

☆ When we perform spinal, we often give ephedrine

- ▶ All patients having epidural or spinal anesthesia must have a large intravenous cannula inserted and be given intravenous fluids immediately before the procedure.
- ▶ This helps prevent hypotension following the vasodilation which is produced.
- ▶ The volume of fluid given will vary with the age of the patient and the extent of the proposed block, e.g: If a high block is planned, at least a 1000 mls should be given to all patients. Caesarean section patients need at least 1500 ml
- ▶ Crystalloids such as 0.9 % Normal Saline or Hartmans are most commonly used. Dextrose 5 % should be avoided as it is not effective for maintaining the blood volume.

Maintenance depends on the nature of the surger if it was major or minor

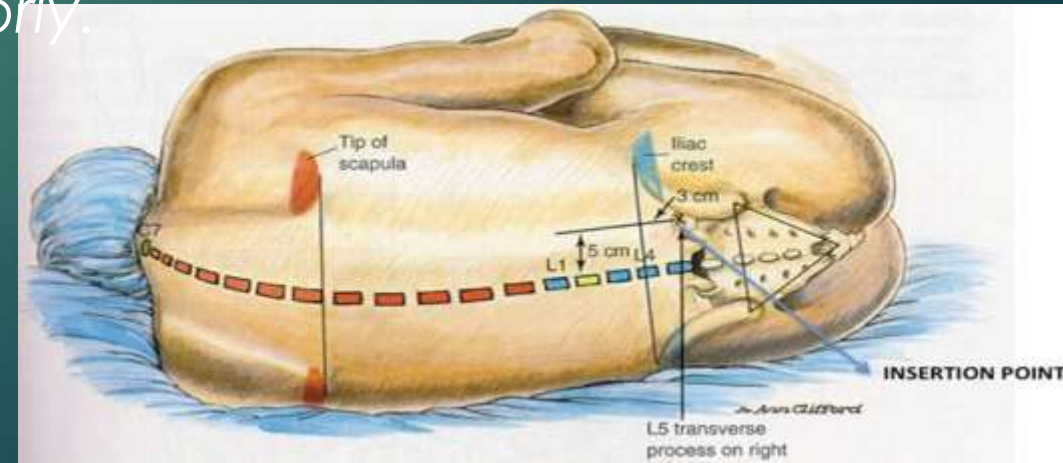
Colloids

3-Positioning the patient

Mostly used

► 1- Lateral Decubitus Position

- The **most commonly used position** for placing an epidural or spinal anesthetic is the lateral decubitus position.
- Ideal positioning consists of having the back of the patient parallel to the edge of the bed closest to the anesthesiologist, knees flexed to the abdomen, and neck flexed to maximize the distance between the spinous processes while pulling the spinal cord superiorly.

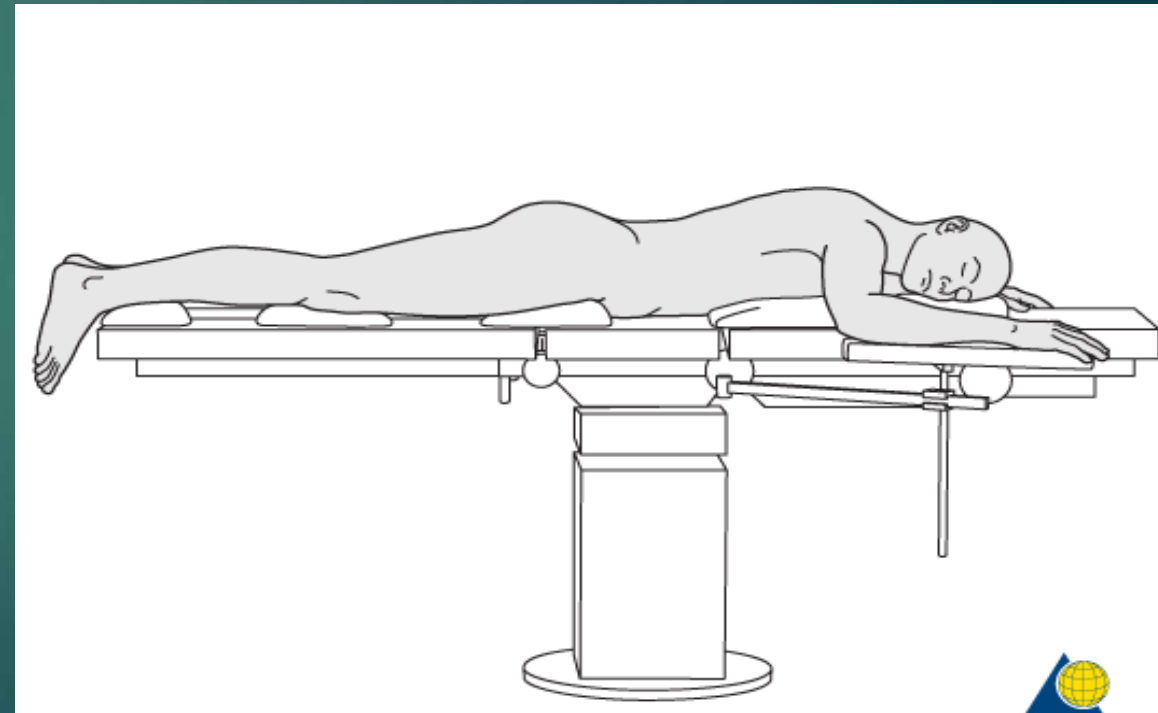


- ▶ **2-sitting Position & “ Saddle Block ”**
- ▶ The sitting position is utilized for low lumbar or sacral anesthesia and in instances when the patient is obese and there is difficulty in finding the midline in the lateral position.
- ▶ When performing a saddle block, **the patient should remain in the sitting position for at least 5 min** after a hyperbaric spinal anesthetic is placed to allow the spinal to settle into that region.



3-Prone Position

- ▶ The prone position is utilized for spinal anesthesia if the patient needs to be in this position for the surgery, such as for rectal, perineal, or lumbar procedures.



Equipment

- ▶ Prior to performing the block ,all equipment should be checked :
- ▶ Intravenous access, preferably with a large bore cannula (e.g. 16 G). is mandatory before the block is sited.
- ▶ The skin should be prepared with alcohol or iodine containing sterilizing solution.
- ▶ The back should be draped in a sterile fashion, the operator should take full sterile precautions, including gown, mask and gloves.

eg

Equipment(cont'd)

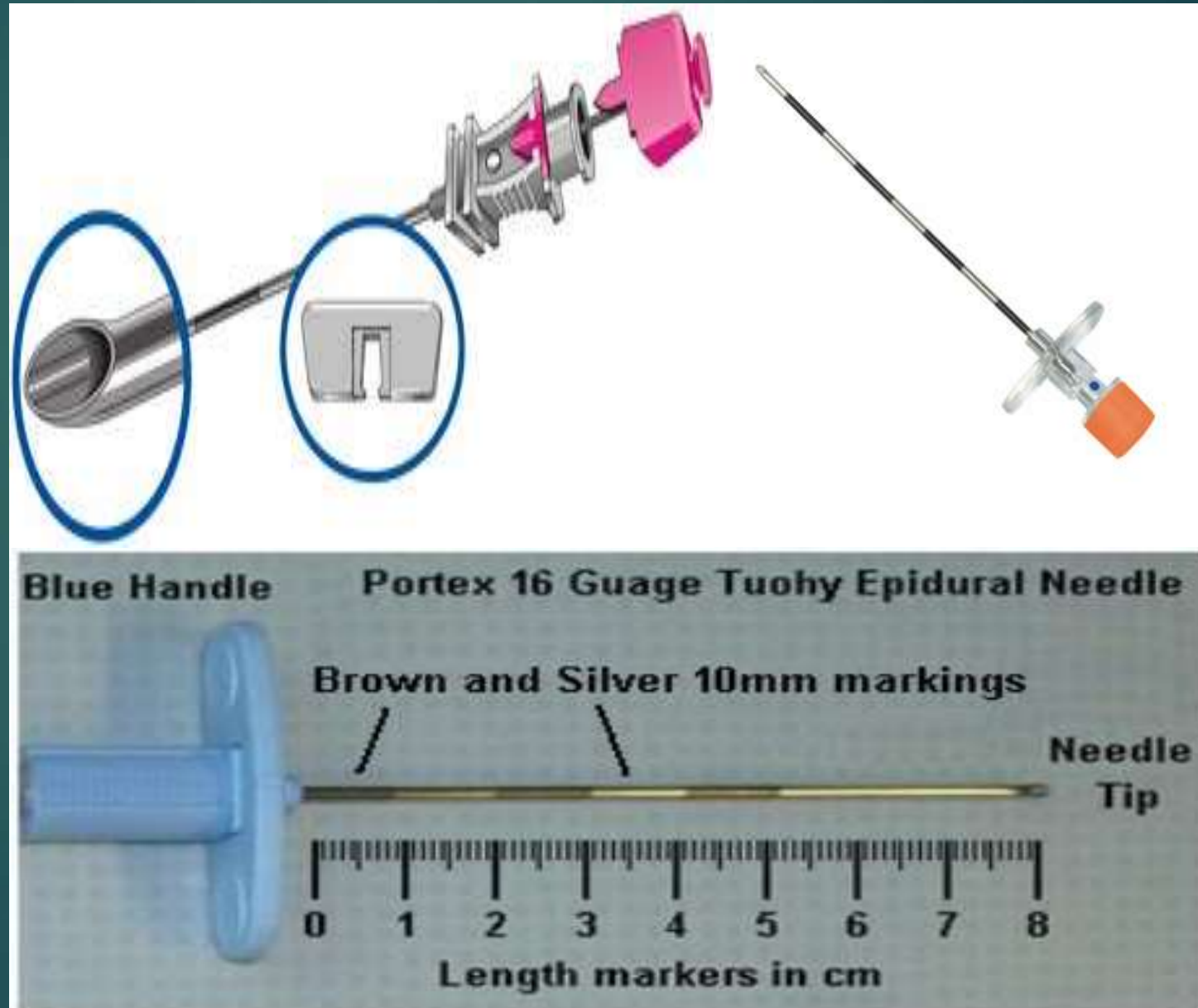
- ▶ The epidural needle:
- ▶ is typically 16-18 G! 8 cm long with surface markings at 1 cm intervals, , and has a blunt bevel with a 15-30 degree curve at the tip. The most commonly used version of this needle is **Tuohy needle** , and the tip is referred to as Huber tip the Most commercially available needles have the Tuohy/ Huber configuration and have wings attached at the junction of the needle shaft with the hub, which allow better control of the needle as it is advanced. needle was called the Weiss needle .



Needles are classified depending on their gauge, the larger the gauge, the longer the needle and the smaller the diameter.

☆the smaller the diameter the less likely for it to cause post punctural headache (less CSF dropping)

☆ Normally the distance between the skin and the dura is 4cm. In obese patients it could reach 5-6 cm and in thin patients it reaches 3cm.



Equipment(cont'd)

- ▶ Epidural appropriate catheter
- ▶ needles and syringes
- ▶ Preservative free normal saline 10 mL, Why ?!
1- For loss resistance method
2-To expand Epidural space to place the catheter

When we feel a resistance ,the first one indicates the ligamentum flavum. The second one indicates passing the subarachnoid layer.

Either saline or air. If it has air then there is a risk of air embolism.

If saline then we might mistake CSF with it. (We can differentiate between them according to their characteristics. CSF has a crystal color, temperature of 37c, and contains sugars. Unlike saline which has the room temperature and devoided of any sugars



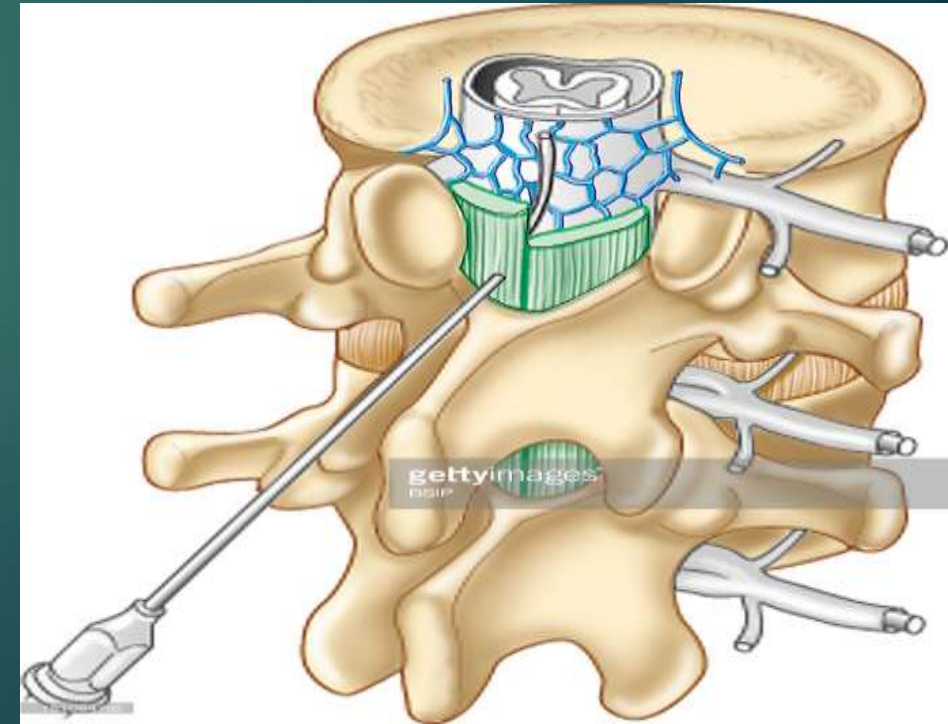
How to begin ?



- ▶ *Prepare the site of epidural anesthesia*
- ▶ *Mark the site*
- ▶ *Use fully aseptic technique (perfect sterilization)*
- ▶ *Local anesthesia at the site of injection (lidocaine 2-3 cc)
we introduce the needle of syringe then we shaft the
ejector back to avoid the entrance of blood vessel then
we draw back the syringe at the same time we push
lidocaine to avoid muscle contraction*

Locating epidural space

- ▶ A particular type of needle known as a Tuohy needle.
- ▶ The Tuohy needle is inserted and slowly advanced between two spinous processes. (The loss of resistance to injection technique is used to identify the epidural space.)

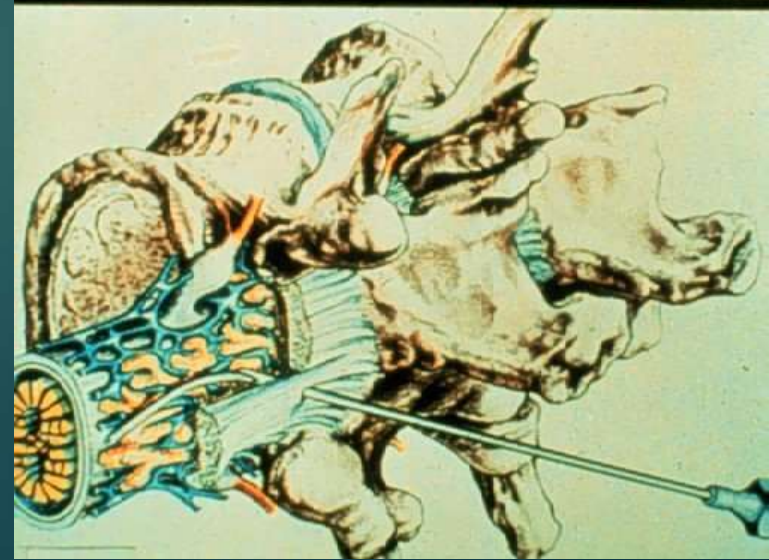
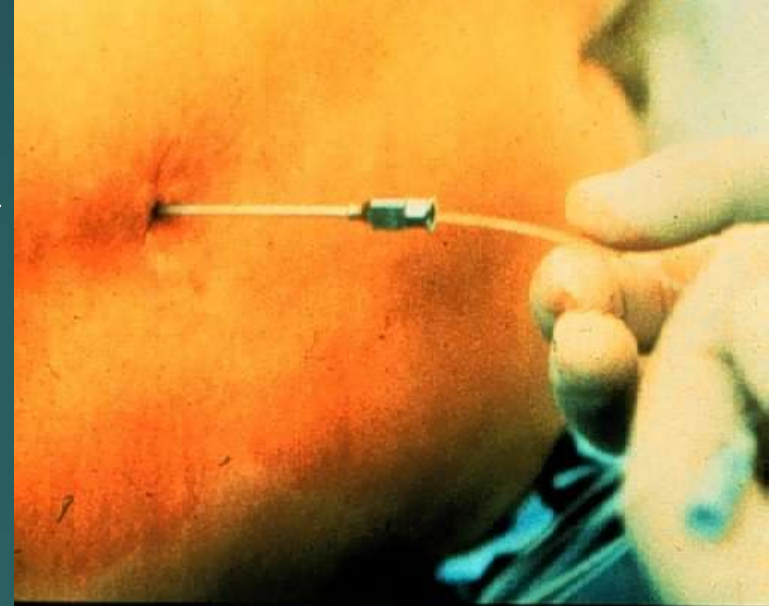


WHAT WE DO AFTER?!

→ If the needle went in 4 cm until it reached the epidural, the length of the catheter inside should be 4 plus the fixed 6 = 10 cm

- ▶ Once the position is verified, a very small catheter(tube) is placed via the needle. The needle is then removed and the catheter remains in the Epidural space. The catheter needs to be 6cm in fixed. The rest is the distance from the skin to the epidural space.
- ▶ The catheter is then taped to the patients back. Local anesthetics and narcotics given epidurally via this catheter. We often give opioids. i can give morphine etc. opioids makes the onset of action faster. But i can NOT give ephedrine
- ▶ The procedure usually takes 10-25 minutes.

Ephedrine is only used to increase blood pressure



When we Remove the catheter?!

- ▶ *The catheter is usually removed when the patient is able to take oral pain medications. Catheters can safely remain in place for several days with little risk of bacterial infection.*
- ▶ *Before removing the catheter, the anticoagulation status of the patient must be checked. If the patient is on anticoagulation therapy, it must be stopped for at least 12 hours before the catheter is removed. After removing the catheter, anticoagulation may be resumed after a wait of 2 hours.*

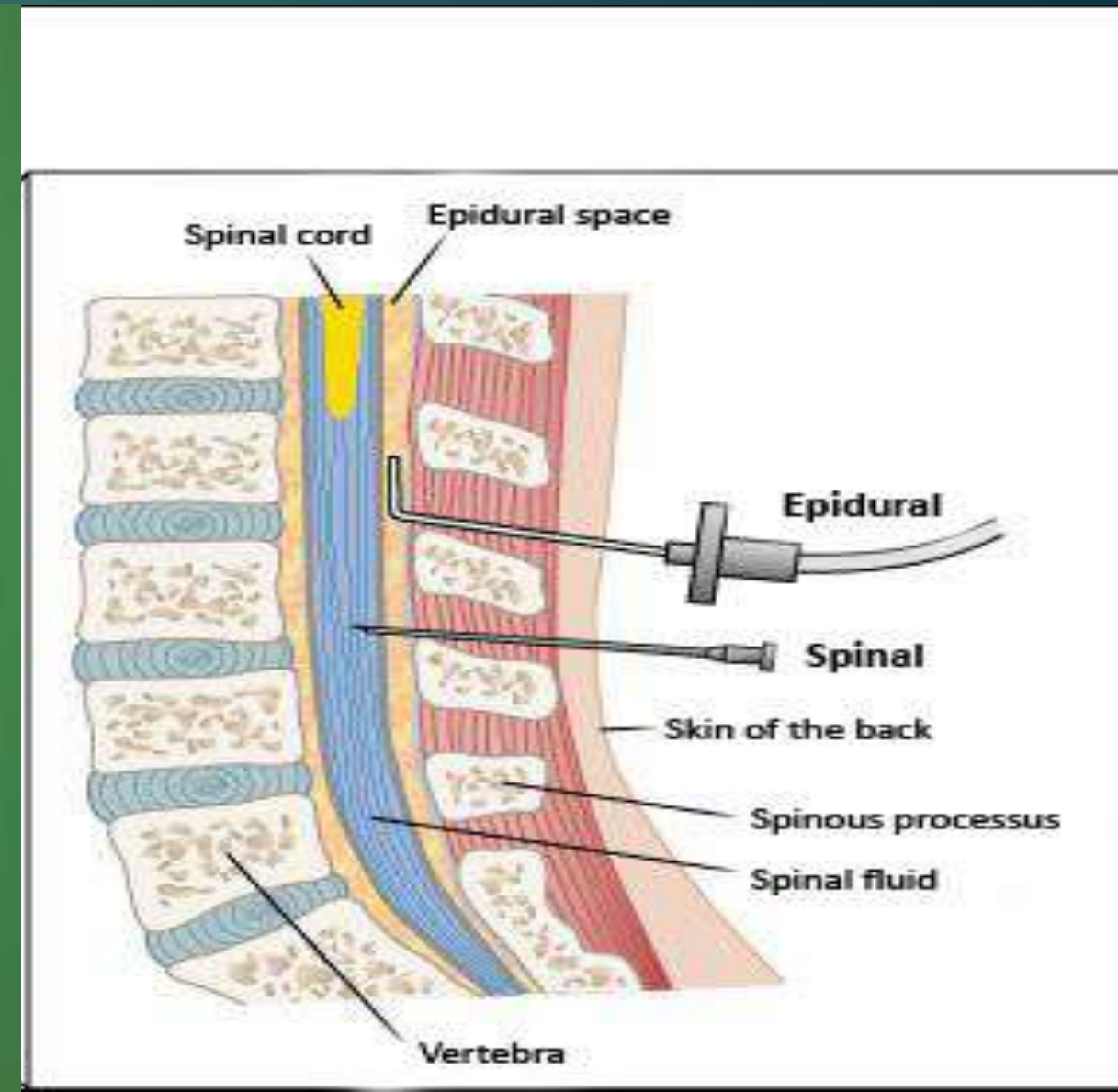
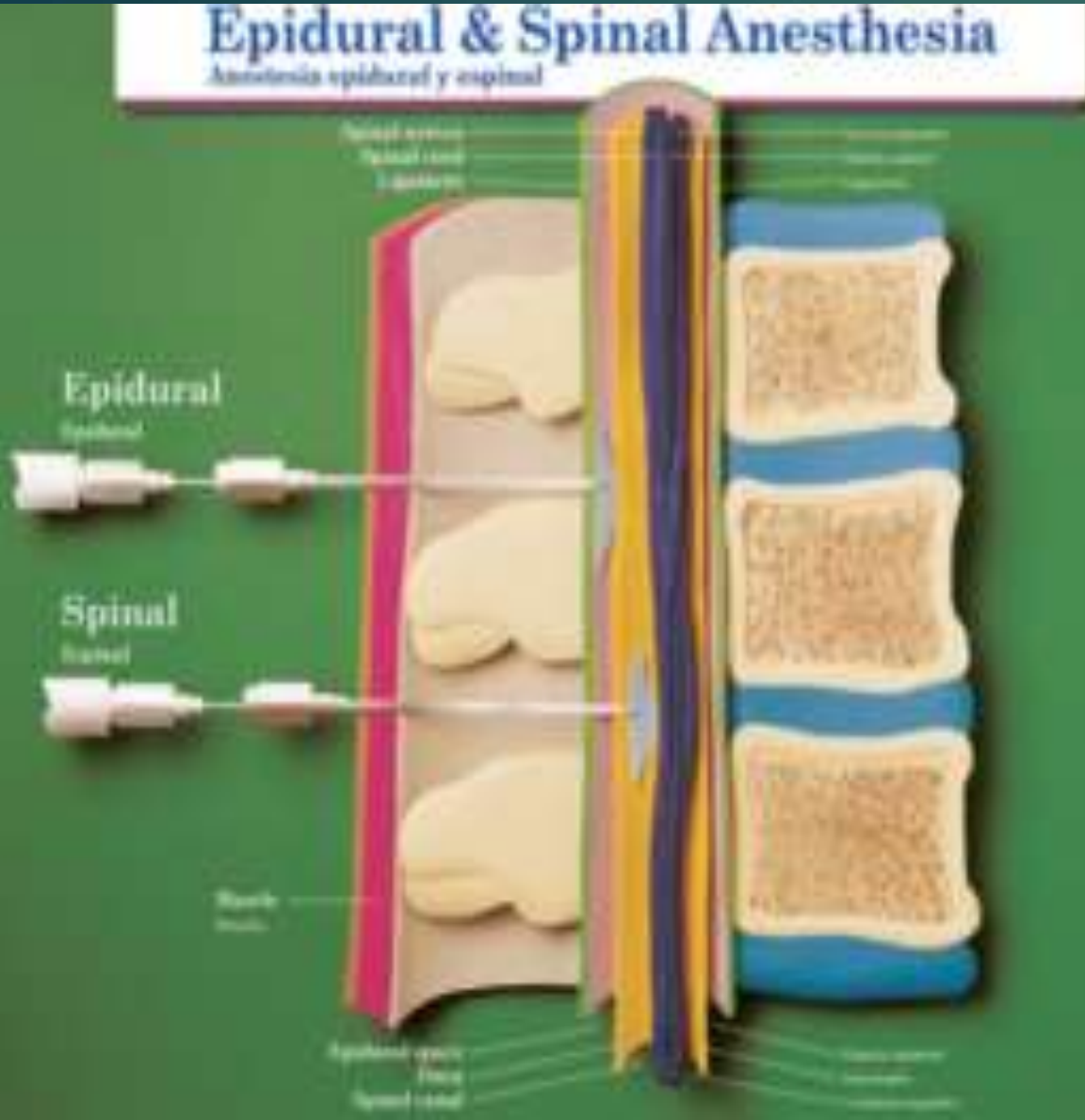
COMPLICATIONS

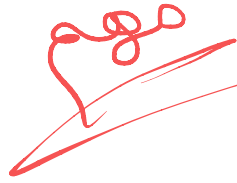
- ▶ **Cardiovascular system:** Vasodilatation of resistance and capacitance vessels occurs, causing relative hypovolemia and tachycardia, with a resultant drop in blood pressure. This is exacerbated by blockade of the sympathetic nerve supply to the adrenal gland preventing the release of catecholamines. If blockade is as high as T2 sympathetic supply to the heart (T2-5) is also interrupted and may lead to bradycardia.
- ▶ **Respiratory system:** Usually unaffected unless blockage is high enough to affect intercostal muscle nerve supply (thoracic nerve roots) leading to reliance on diaphragmatic breathing alone. This is likely to cause distress to pt as may feel unable to breathe adequately.
- ▶ **Gastrointestinal system:** they Blockade of sympathetic outflow (T5-L1) to the GI tract leads to predominance of parasympathetic (vagus and sacral parasympathetic 5 outflow), leading to active peristalsis and relaxed sphincters, a small contracted gut, which enhances surgical access. Splenic enlargement (2-3 fold) occurs. ★Does NOT cause constipation
- ▶ **Genitourinary tract:** Urinary retention is a common problem with epidural anesthesia.

COMPLICATIONS

- ▶ **spinal epidural hematoma:** leading to temporary or permanent disability have been attributed to central neuroaxial blocks, damage to neural structure ,epidural abscess.
- ▶ **Accidental dural puncture**
- ▶ **Headache** (Occipito-frontal headache, triggered by standing up and relieved when supine. Its associated with tinnitus and blurred vision.) -The patient isn't allowed to move until 6-7 hours after the procedure, stay hydrated and drink caffeine and give pain killers. Not treated then perform a spinal patch
- ▶ **Infections**
- ▶ **Pain at the injection site** ☆ Most common adverse effect of epidural anesthesia
- ▶ **Cauda equina syndrome :** defined as low back pain, unilateral or usually bilateral symptoms in the distribution of sciatic nerve, saddle sensory disturbances, bladder and bowel dysfunction, and variable lower extremity motor and sensory loss. This may occur with neurotoxicity from local anesthesia).
Known as transient neurological symptoms. It goes alone, it has the same symptoms as cauda equina syndrome except that it does not cause urinary and bowel incontinence
- ▶ **Neurotoxicity :** associated with lower back pain that radiates to the buttocks and posterior thighs is likely due to transient lumbosacral nerve root irritation.

4-SPINAL ANESTHESIA





Epidural vs Spinal

Epidural	Spinal
Dose is high (10-20 ml) <i>Volume dependent</i>	Dose is low (1.5-2 ml) <i>Concentration dependent</i>
Onset is slow (25-30 min)	Onset is fast (5 min)
does not cause as significant neuromuscular block	Does cause as significant neuromuscular block <i>We should always administrate a foley catheter</i>
Multiple dosing possible	Single dose only
Can be given at various point along the Backbone <i>Catheter</i>	Can only be given at specific point along the Backbone to avoid damaging the spinal cord <i>Decrease the dose in pregnant women</i>

★ Spinal is affected by the position, the age, pregnant or not, height etc.
EXCEPT WEIGHT AND GENDER dont affect spinal.

★ Before administrating local anesthetics when introducing the needle in epidural procedure, we administrate testing dose (lidocaine and epinephrine) to check we are at a correct location, IF motor block occurs rapidly, then we are at the subarachnoid space doing (spinal, intrathecal or subarachnoid.) (they're all the same) But not epidural space as motor block occurs lastly during epidural.