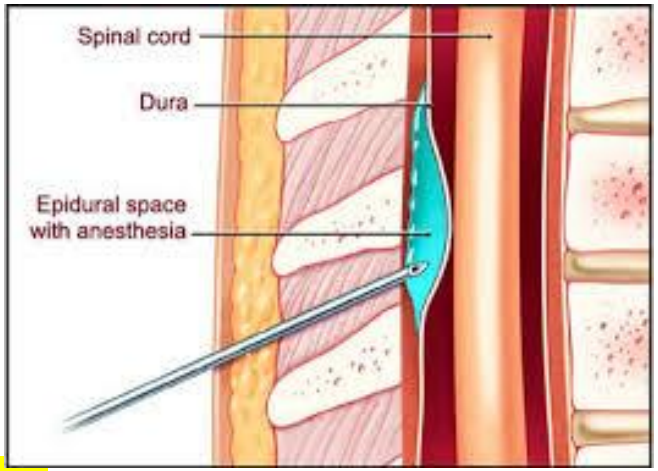
Regional anesthesia



DR HUSSAM KAREEM

- Regional anesthesia is the use of local anesthetics to block sensations of pain from a large area of the body, such as an arm or leg or the abdomen.
- Regional anesthesia allows a procedure to be done on a region of the body without the patient being unconscious.
- Regional anesthesia and analgesia, either alone or in combination with general anesthesia, has the potential to provide excellent operating conditions and prolonged postoperative pan relief.

Relative indications of regional anesthesia:

- To avoid some of the dangers of general anesthesia, such as difficult tracheal intubation, severe respiratory failure, and when problems due to the use of muscle relaxant or general anesthetics are expected.
- Patients who specifically request regional anesthesia.
- To provide high - quality postoperative pain relief.
- As part of a postoperative rehabilitation programme to enable early return to function.

Relative contraindications for regional anesthesia:

- Uncooperative or restless patients.
- Some psychiatric patients.

Preparation before local anesthetic is injected:

Before any local anesthetic is administrated **the following should be available:**

1) An indwelling intravenous cannula.
2) A tilting table or trolley.
3) Facilities of intermittent IPPV with oxygen.
4) Patient monitoring, including ECG, noninvasive blood pressure, pulse oximetry and end - tidal carbon dioxide (in case of need for general anesthesia).
5) Suction equipment and catheters.
6) Syringes or ampoules of tranquilizers (eg. midazolam), induction agents (e.g., Propofol), muscle relaxants (e.g., Suxamethonium), atropine, and pressor agents such as ephedrine.
7) Crystalloid and colloid solutions for infusion.
8) Full resuscitation equipment and drugs, including a defibrillator.

Major types of regional anesthesia include:

A) **Peripheral nerve blocks:**

- A local anesthetic is injected near a specific nerve or bundle of nerves to block sensations of pain from the area of the body supplied by the nerve.
- Nerve blocks are most commonly used for surgery on the arms and hands, the legs and feet, the groin, or the face.

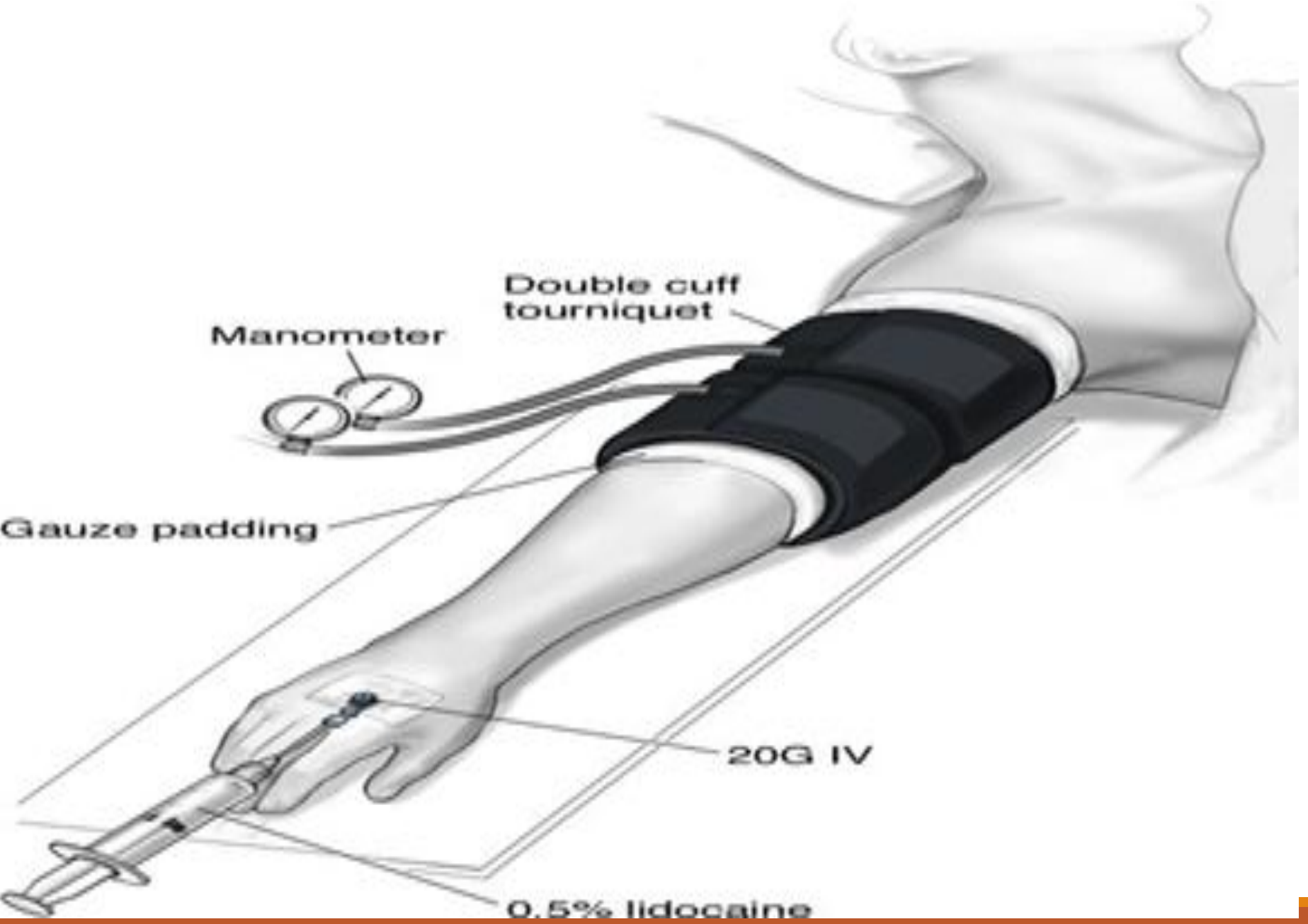
- **Intravenous regional anesthesia – Bier's block:**

Bier's block is one of the peripheral nerve block techniques performed on the body extremities, It is ideally suited to operations of the distal arm or leg (i.e. below the elbow or knee), such as reduction of a radial or ulna fracture.

- **IVRA is useful for only short surgical procedures; performed in 40 minutes or less** (the length of operating time is limited by tourniquet pain)

- First of all, the target region exsanguinated to force blood out of the extremity followed by the application of pneumatic single or double tourniquet inflated 100mmHg above the patient's systolic blood pressure to safely stop blood flow.

- The anesthetic agent is intravenously introduced into the limb and allowed to diffuse into the surrounding tissue while tourniquets retain the agent within the desired area.


Double cuff
tourniquet
Manometer
Gauze padding
20G IV
0.5% lidocaine

- **Two intravenous cannulae should be placed, one for venous cannulation distal to the tourniquet and one for cannulation in a non targeted arm to allow access to the circulation if required in the event of complications.**

- **The dose required in Bier's block is about 3 – 4 mg/ kg of 0.5% plain solution (without adrenaline) of lidocaine or prilocaine, while bupivacaine should never be used due to its cardiotoxicity (leading to ventricular arrhythmias and death).**

Contraindications:

- Crush injury to the limb, IVRA may provoke further tissue damage secondary to hypoxia
- Raynold's disease (intermittent arteriolar vasospasm of the distal limbs).
- Sickle cell anemia.
- Scleroderma.

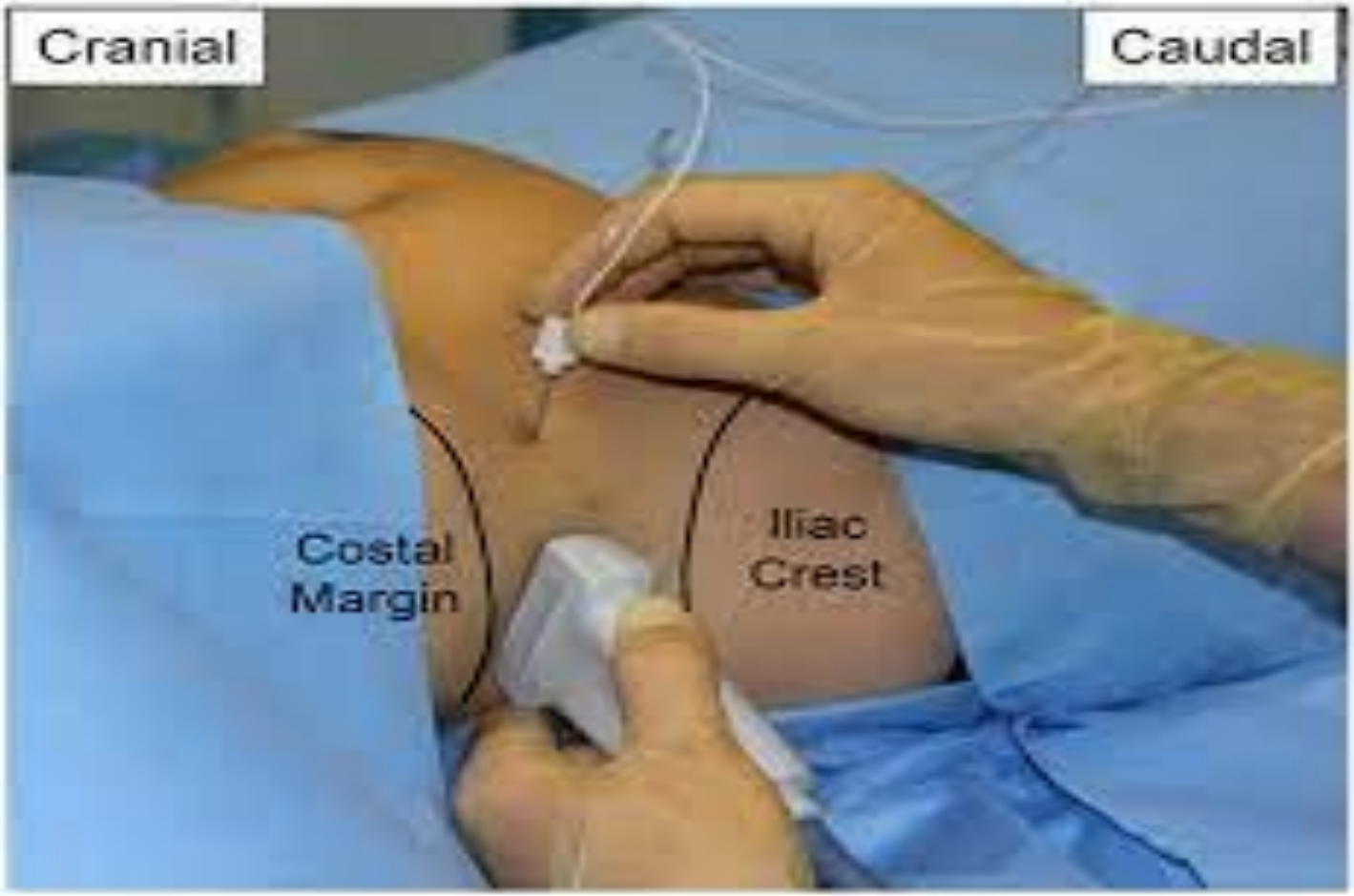
Ultrasound guided regional anesthesia(USGRA)

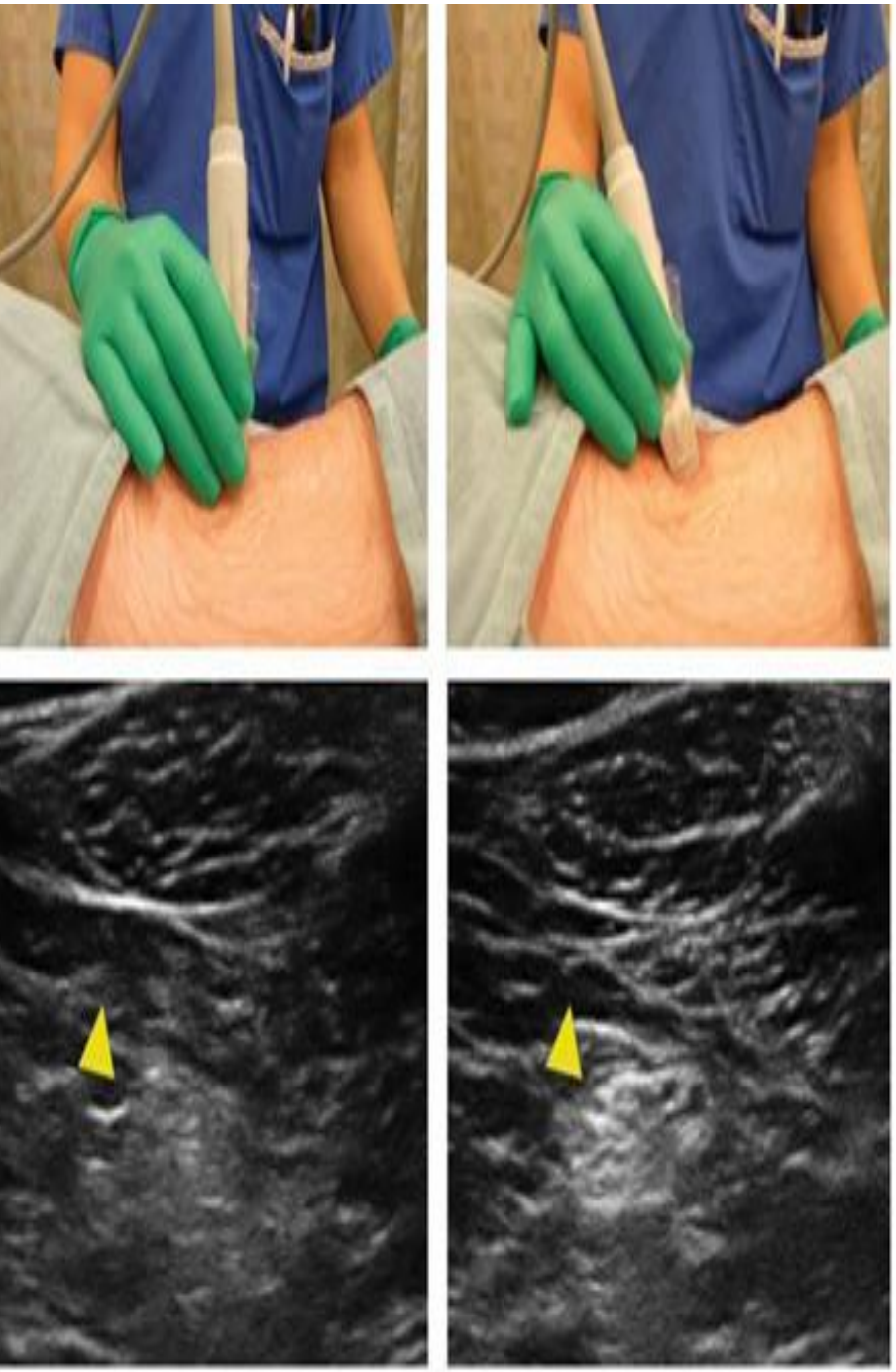
- **Ultrasonography (US) as a means to guide peripheral nerve blockade (PNB) was first explored by anesthesiologists at the University of Vienna in the mid-1990s..**
- **The utility of ultrasound to facilitate a range regional anesthesia techniques including brachial plexus and femoral blocks was demonstrated.**
- A decade later, colleagues from the University of Toronto, Canada, embrace this technology, further demonstrating its utility and describing in detail the sonoanatomy of the brachial plexus.

The Transversus Abdominis Plane (TAP) Block

- is a local anaesthetic block used to provide analgesia to the anterior and lateral abdominal wall.
- It described an anatomical landmark technique and provided evidence of blockade to the mid/lower thoracic and upper lumbar spinal nerves as they travelled in the fascial plane between the transversus abdominis and internal oblique muscles.
- Later on an ultrasound-guided approach to the TAP block.


Regional Anesthesia
TAP block
(Transversus abdominis plane block)

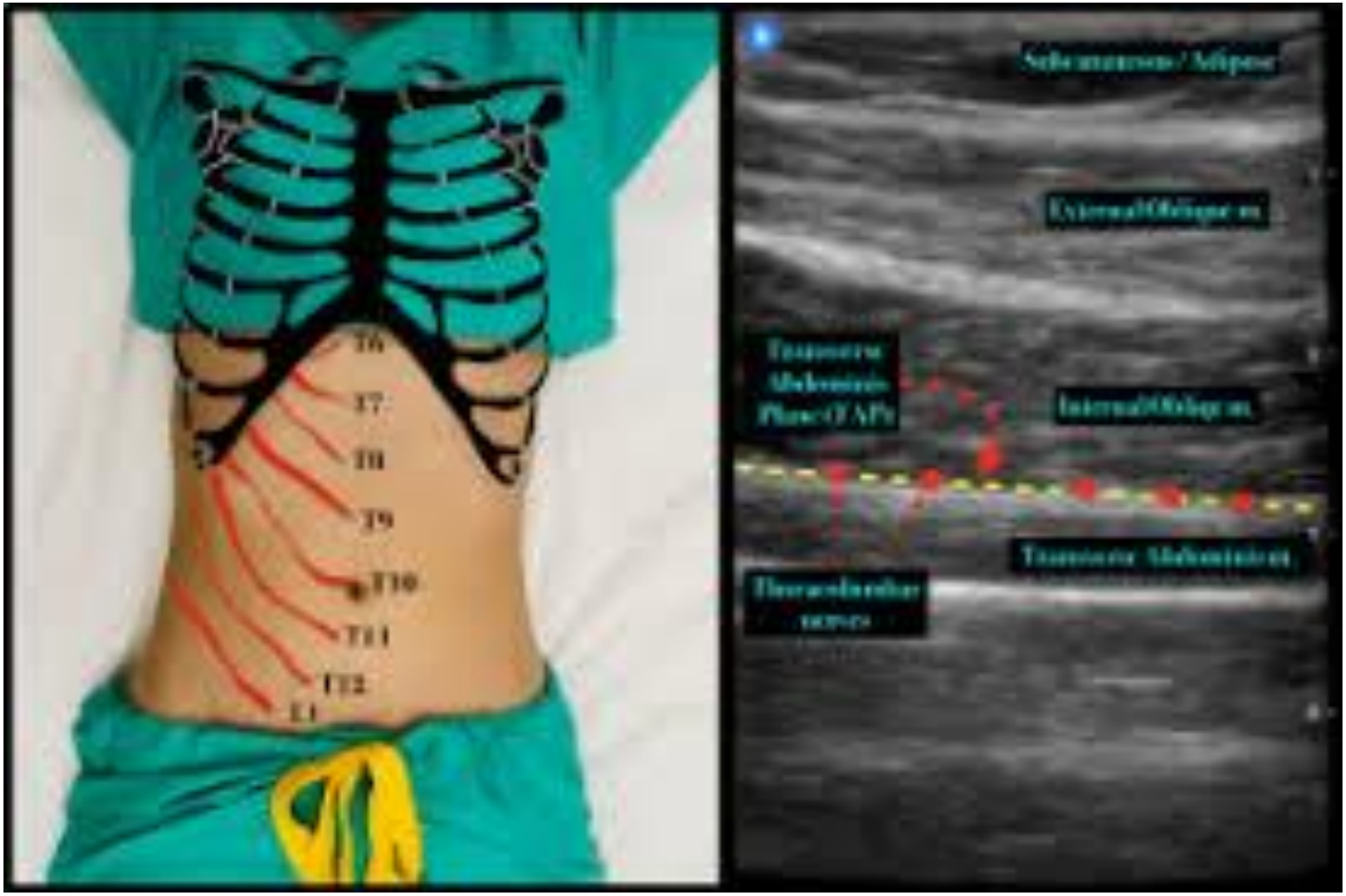

Cranial
Caudal
Costal Margin
Iliac Crest




Sciatic nerve at
popliteal fossa

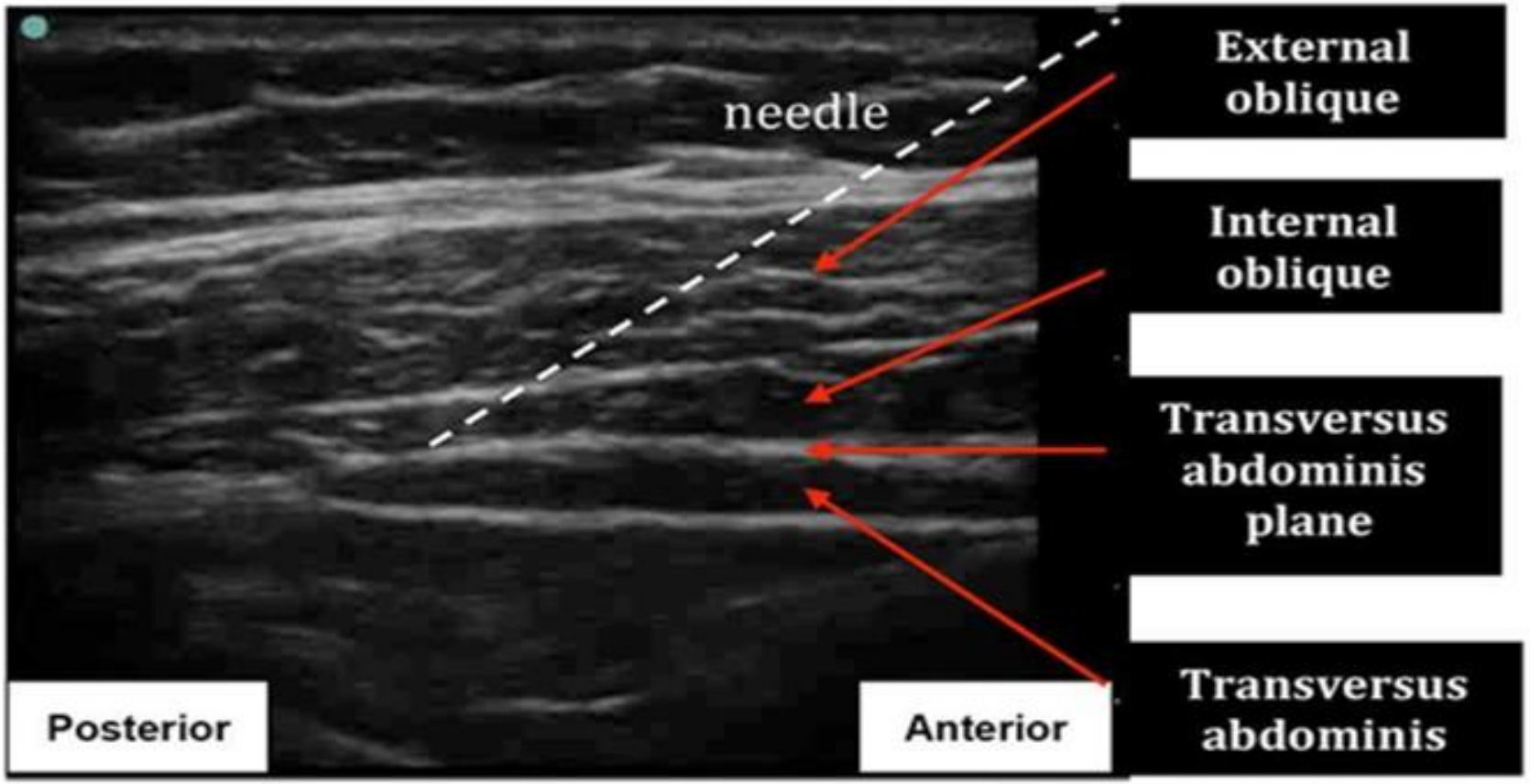
The TAP block can be used as part of an analgesic regimen for abdominal surgery.

- Initial studies were able to demonstrate blocks extending from T7-L1 using bilateral injections .
- Subsequent studies have been unable to reproduce these findings with most studies achieving uppermost sensory levels around T9/10.
- This lower block is supported by findings in a cadaveric study, looking at spread of local anaesthetic after a single posterior TAP injection.


T7
T8
T9
T10
T11
T12
L1

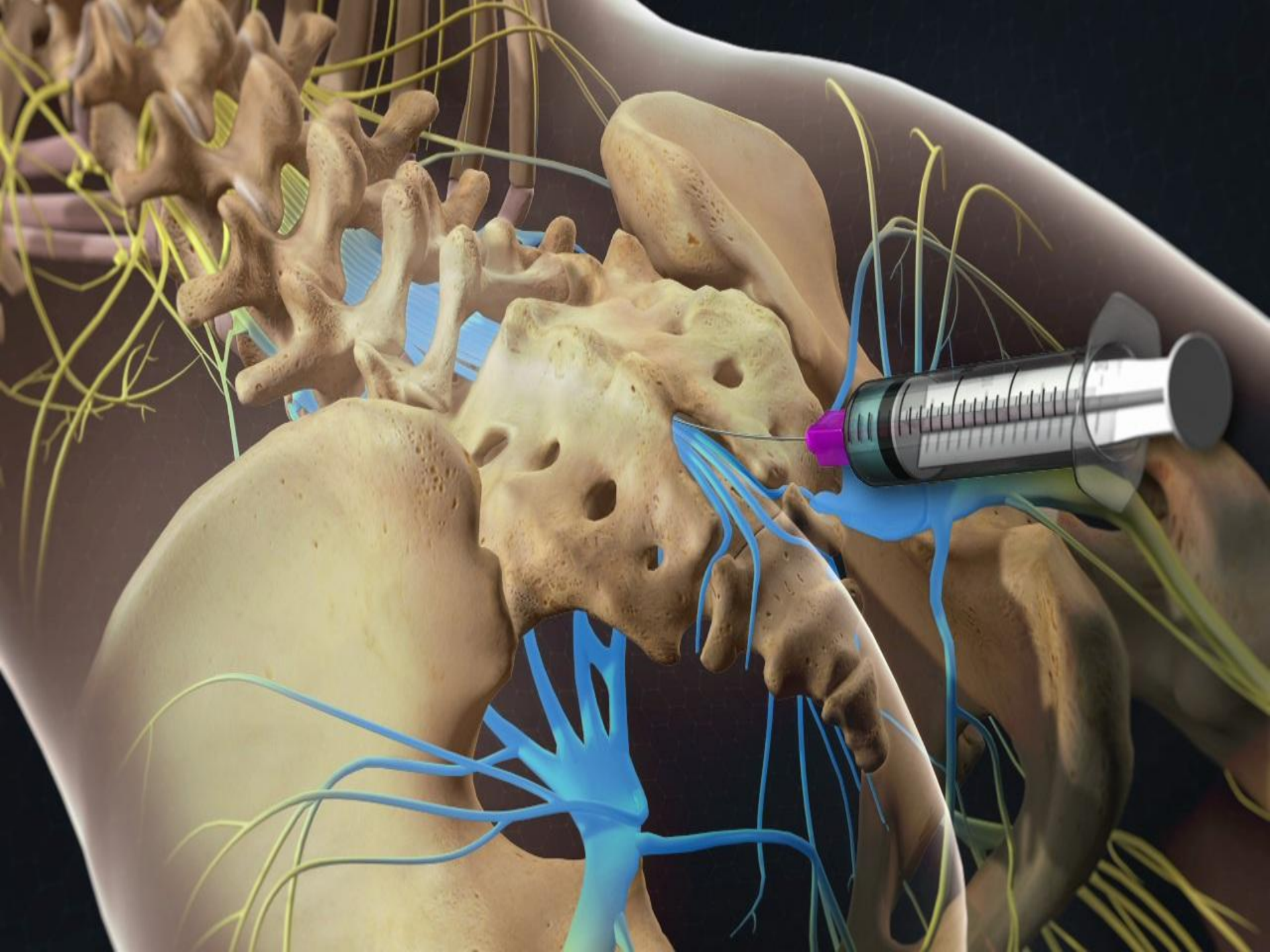
INDICATIONS FOR TAP BLOCK

- used as part of an analgesic regimen for abdominal surgery.
- It therefore sensible to recommend that the TAP block can only reliably be used for analgesia in surgery on the lower abdomen, for example:
- • Hernia repair
- • Open appendicectomy
- • Caesarian section
- • Total abdominal hysterectomy
- • Radical prostatectomy


needle
External oblique
Internal oblique
Transversus abdominis plane
Transversus abdominis
Posterior
Anterior

Caudal block:

- It involves injection of local anesthetic into the epidural space through the sacral hiatus to obtain anesthesia of sacral and coccygeal nerve roots.
- It indicated for superficial operations such as skin grafting, perineal procedure, and lower limb surgery.



Spinal (intradural) anesthesia:

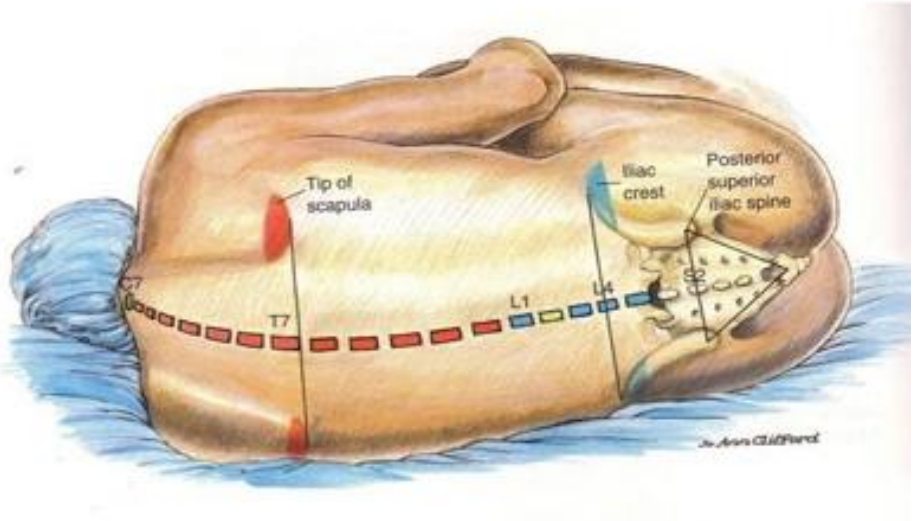
anatomy:

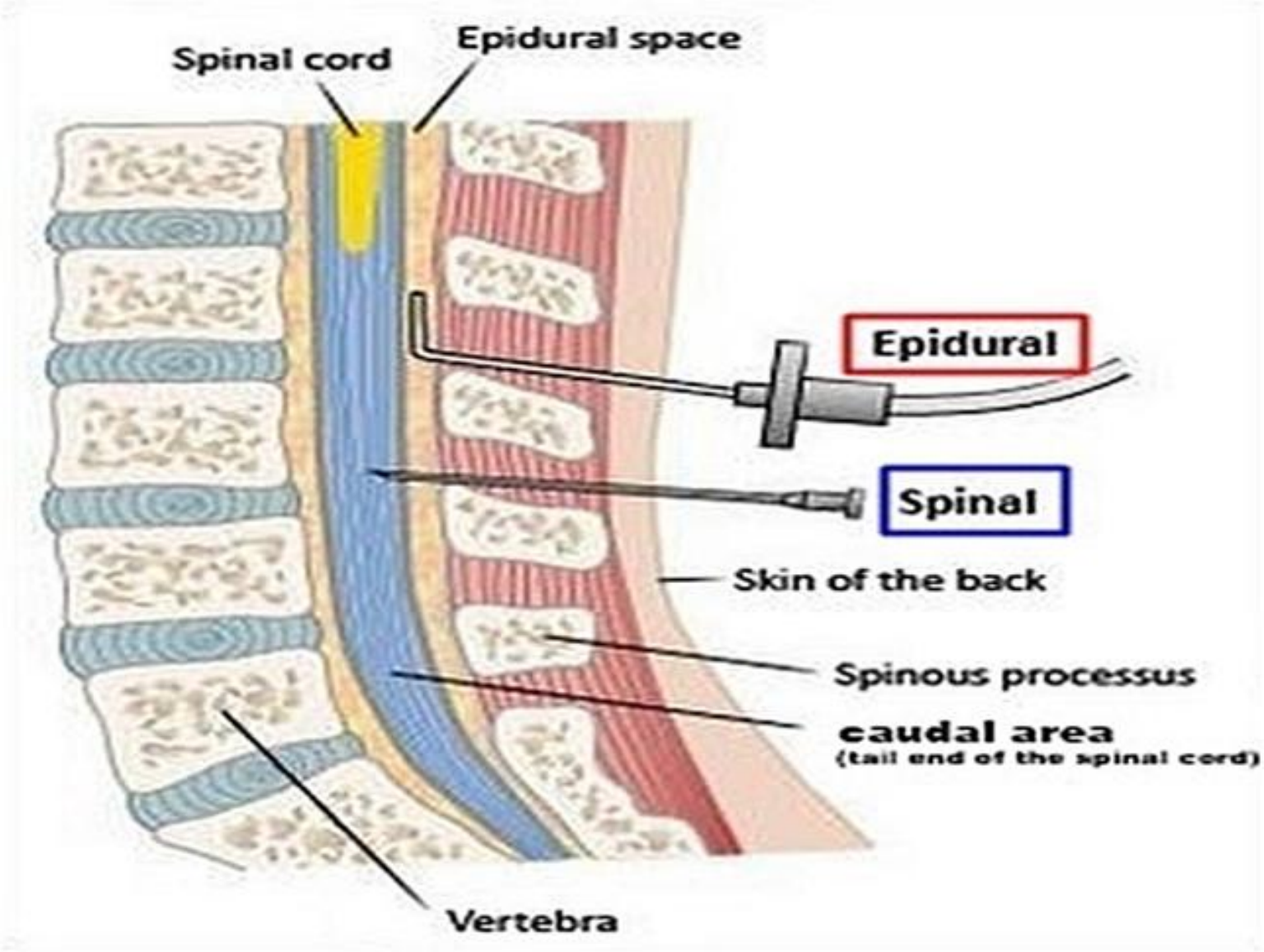
- The spinal cord usually ends at the level of L1 in adults and L3 in children.
- Dural puncture above these levels is associated with a slight risk of damaging the spinal cord and is best avoided.
- An important landmark to remember is that a line joining the top of the iliac crests is at L4 to L4/5.

Surface anatomy

- Spinous process of T7 – inferior angle of scapula

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




Spinal cord
Epidural space
Epidural
Spinal
Skin of the back
Spinous processus
caudal area
(tail end of the spinal cord)
Vertebra

Indications & Advantages

- Surgeries of lower limbs, perineum, pelvis, abdomen It is ideal in Renal failure greater by two or three segments,
- duration is shorter
- Cardiac disease
- Liver disease
- Obstetric anaesthesia
- Full stomach
- Anatomic distortions of upper airway
- TURP surgery

Levels of block

- Sympathetic paralysis Sensory block Motor nerve blockade

TECHNIQUE

- It is done in a similar way. But the local anesthetic is injected using a much smaller needle, directly into the cerebrospinal fluid that surrounds the spinal cord.
- The site in which the needle should be inserted in is between the third and fourth lumbar vertebrae.
- The area numbed first with a local anesthetic.
- Then the needle is guided into the spinal canal, and the anesthetic is injected.
- This is usually done without the use of a catheter.
- Spinal anesthesia numbs the body below and sometimes above the site of the injection. The person may not be able to move his or her legs until the anesthetic wears off.

Factors Effecting Distribution

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

Volume

Cardiovascular Effects:

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

- **T1-T4 Blockade Causes**
- unopposed vagal stimulation
- Bradycardia
- Associated with decrease venous return & cardioaccelerator fibers blockade
- Decreased venous return to right atrium causes decreased stretch receptor response

Hypotension:

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

Respiratory System:

- 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 hypo perfusion of respiratory center

Complications:

1. Immediate complications –

- Hypotension –
- Bradycardia and Cardiac arrest.
- High and Total spinal block leading to respiratory arrest.
- Urinary retention.
- Epidural hematoma
- Bleeding.
- 2. Late complications –
- Post dural puncture headache (PDPH)
- Backache - Nausea - Focal neurological deficit - Bacterial meningitis - Sixth Cranial nerve palsy - Urinary retention

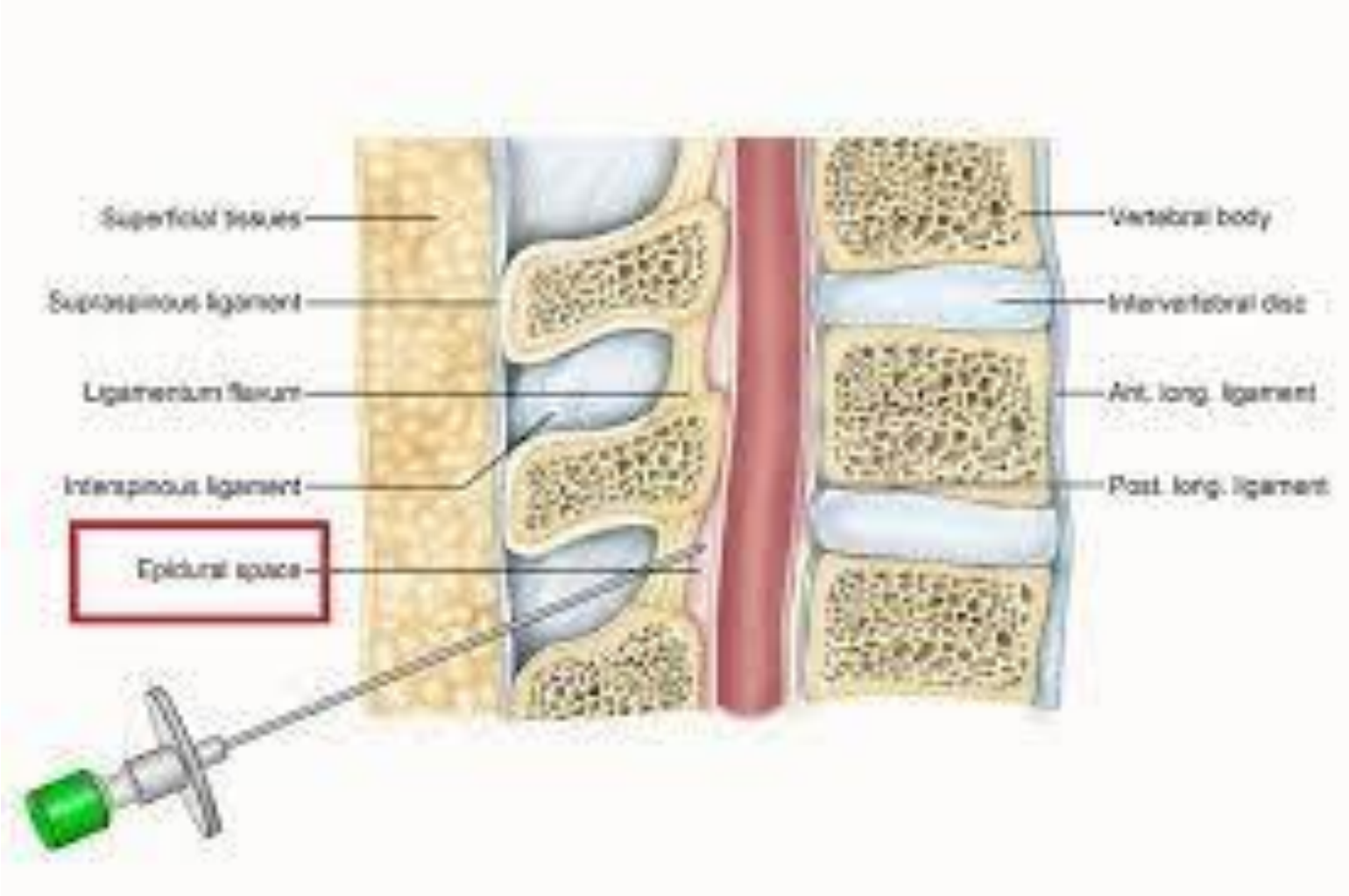
Spinal headache:

- ❑ More common in women ages 13-40
- ❑ Larger needle size increase severity
- ❑ Onset typically occurs first- or second-day post-op
- ❑ Treatment:

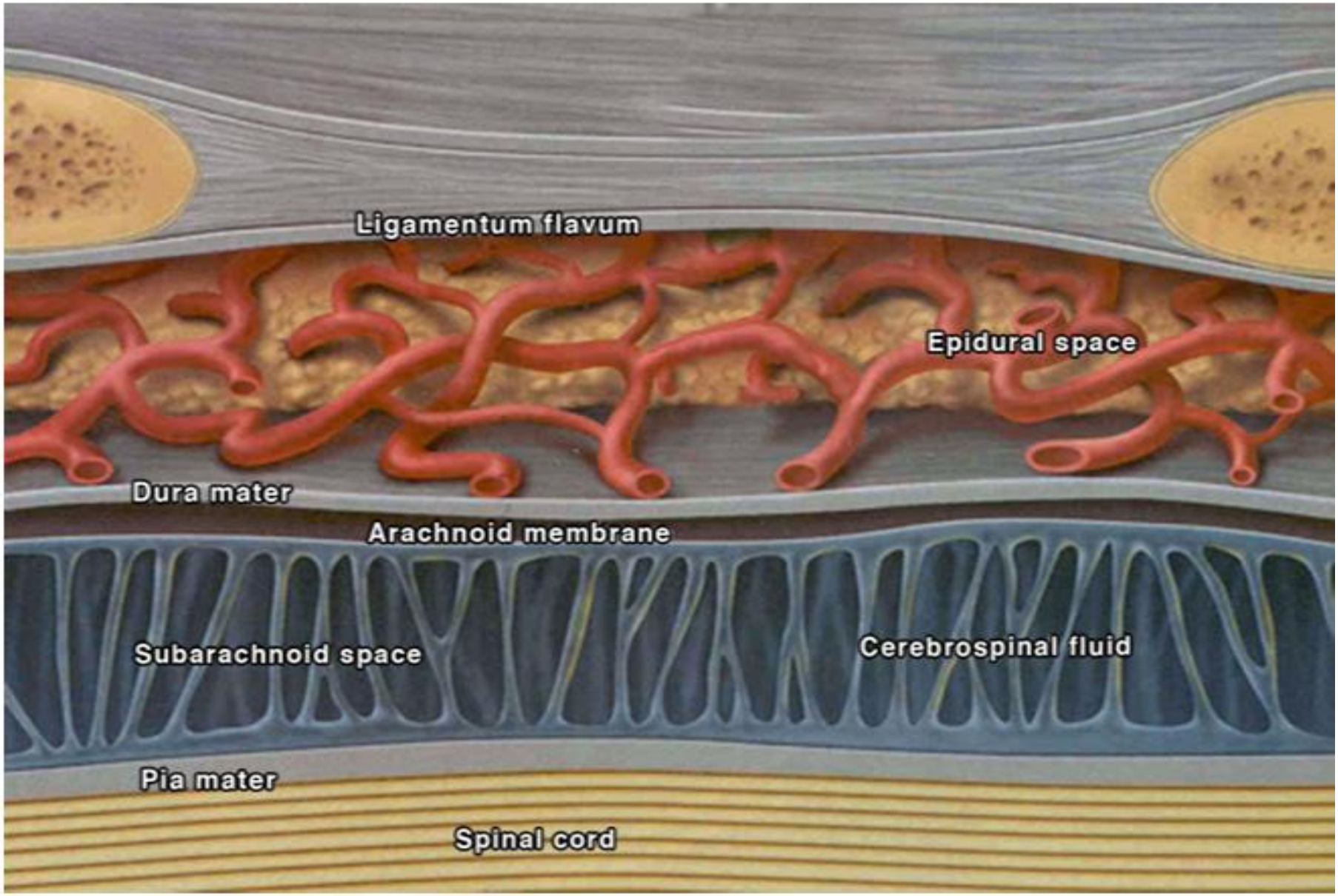
- Bed rest (remain lying flat in bed as this relieves pain)
- Fluids (drink freely or IV fluid to maintain hydration)
- Simple analgesia such as paracetamol, or aspirin or codeine may be helpful. Caffeine containing drink
- **Blood Patch**: Increase pressure of CSF by placing blood in epidural space
- May do no more than two
- 95% success with first patch
- Second patch may be done 24 hours after first

Epidural space:

- Potential space between the dura mater and ligament flavum
- Made up of vasculature, nerves, fat and lymphatic
- Extends from foramen magnum to the sacrococcygeal ligament.
- Is segmented and not uniform in distribution
- The Bounds of the Epidural Space
- Anterior- posterior longitudinal ligament, Lateral- pedicles and intervertebral ligaments, Posterior- ligamentum flavum


Superficial tissues
Supraspinous ligament
Ligamentum flavum
Interspinous ligament
Epidural space
Vertebral body
Intervertebral disc
Ant. long. ligament
Post. long. ligament

- Epidural level (cervical ,thoracic, lumber, Caudal)
- Widest at Level L2 (5-6mm)
- Narrowest at Level C5 (1-1.5mm
- Distances from Skin to Epidural Space
- Average adult: 4-6cm (80%)
- Obese adult: up to 8cm
- Thin adult: 3cm
- Volume : 118ml



Local anaesthetic solutions are deposited in the peridural space between the dura mater

- Local anaesthetic solutions are deposited in the peridural space between the dura mater and the periosteum lining the vertebral canal.
- The injected local anaesthetic solution produces analgesia by blocking conduction at the intradural spinal nerve roots.
- TECHNIQUE: It involves the insertion of a hollow needle and a small, flexible catheter into the space between the spinal column and outer membrane of the spinal cord (epidural space) in the middle or lower back.
- The area where the needle will be inserted is numbed with a local anesthetic.

- The catheter remains in place.
- The anesthetic medicine is injected into the catheter to numb the body above and below the point of injection as needed.
- The catheter is secured on the back so it can be used again if more medicine is needed.

- **Test Dose: 1.5% Lido with Epi 1:200,000**
- 1.Tachycardia (increase >30bpm over resting HR)
- 2.High blood pressure
- 3.Light headedness
- 4.Metallic taste in mouth
- 5.Ring in ears
- 6.Facial numbness
- Note: if beta blocked will only see increase in BP not HR

Testing for level of block

If **Sympathetic block occurs**?

- Skin temperature sensation

Changes in the skin temperature

Sensory level:

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

Motor block

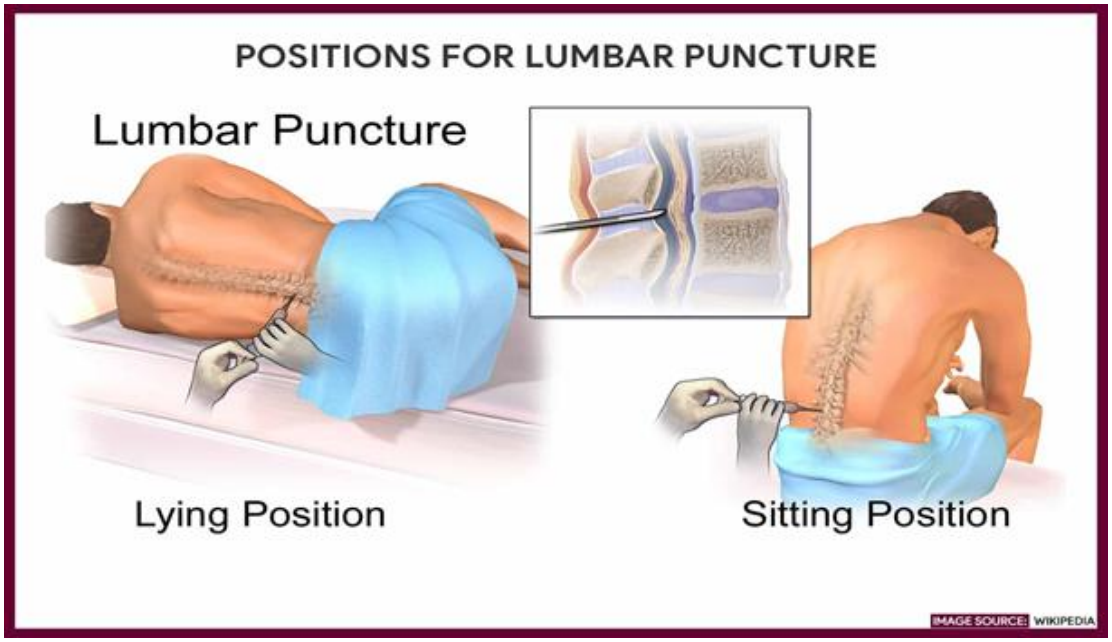
Modified Bromage scale of onset of motor Block Central Neuraxial Block

Bromage 3 (complete)
Unable to move feet or knees

Bromage 2 (almost complete)
Able to move feet only

Bromage 1 (partial)
Just able to move knees

Bromage 0 (none)
Full flexion of knees and feet


POSITIONS FOR LUMBAR PUNCTURE
Lumbar Puncture
Lying Position
Sitting Position
IMAGE SOURCE: WIKIPEDIA

Contraindications to central neuraxial blockade:

Absolute:

1)Raised intracranial pressure.

2)Coagulopathy, blood dyscrasias or full anticoagulant therapy.

3)Skin sepsis.

4)Marked spinal deformity.

5)Hypovolaemia.

6)Patient refusal.

Relative:

- **Mildly impaired coagulation, the risk of spinal hematoma should be weighed against the benefits of avoiding general anesthesia in patients with patients with platelets less than 80 000/ ml.**
- **If coagulation is impaired, spinal anesthesia is should be preferred over epidural anesthesia because of the reduced risk of hematoma formation.**

Comparison between spinal anesthesia and epidural anesthesia

Spinal anesthesia	Epidural anesthesia
1) Drug delivered to the subarachnoid space and into the CSF	1) Drug delivered outside the dura (outside CSF)
2) Injected only below the 3rd lumber vertebra to avoid piercing the spinal cord	2) May be given at cervical, thoracic, lumber or sacral sites
3) smaller dose injected	3) larger dose injected
4) onset: 2 – 5 minutes for initial effect, 20 minutes for maximum effect	4) onset: 5 – 15 minutes for initial effect, 30 – 45 minutes for maximum effect
5) cause a significant neuromuscular block (muscle relaxation)	5) Doesn't cause a significant neuromuscular block
6) Gives profound block of all motor and sensory function below the level of injection	6) Blocks a 'band' of nerve roots around the site of injection, with close-to normal function below the levels blocked.
7) almost always a one-shot only	7) an indwelling catheter may be placed that allows for repeated doses

Local anesthetics:

- There are many anesthetic drugs used for neuraxial block; lidocaine, bupivacaine, levobupivacaine, and ropivacaine.
- Doses are associated with the amount of the local anesthetic and the concentration of the solution, depends on **age, body height and weight, type and duration of the surgery**,

as example; **bupivacaine dosage** that required for spinal (intradural) anesthesia ranges between 0.5 – 2 ml of 0.75% solution (approximately 4 – 15 mg), epidural dosage for adults ranged between 10 – 20 ml of 0.25%, 0.50%, 0.75% (25 – 150mg)