Regional Anaesthesia

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Introduction:

- **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.

The provision of pain relief that enables postoperative mobilization and early feeding may accelerate rehabilitation and return of normal function.

Relative indications of regional anesthesia:

1) 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.

2) Patients who specifically request regional anesthesia.

3) To provide high - quality postoperative pain relief.

4) As part of a postoperative rehabilitation program to enable early return to function.

Relative contraindications for regional anesthesia:

1) Uncooperative or restless patients.

2) 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).

Preparation before local anesthetic is injected:

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 :

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.

Major types of regional anesthesia :

A) Peripheral nerve blocks :

➢ 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, which usually develops after 40 to 60 minutes

Major types of regional anesthesia :

A) Peripheral nerve blocks :

➢ Intravenous regional anesthesia – Bier's block :

- 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.

Major types of regional anesthesia :

A) Peripheral nerve blocks :

➢ Intravenous regional anesthesia – Bier's block :

- Two intravenous cannulas 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).

Major types of regional anesthesia :

A) Peripheral nerve blocks :

Contraindications :

Intravenous regional anesthesia – Bier's block :

1) Crush injury to the limb, IVRA may provoke further tissue damage secondary to hypoxia

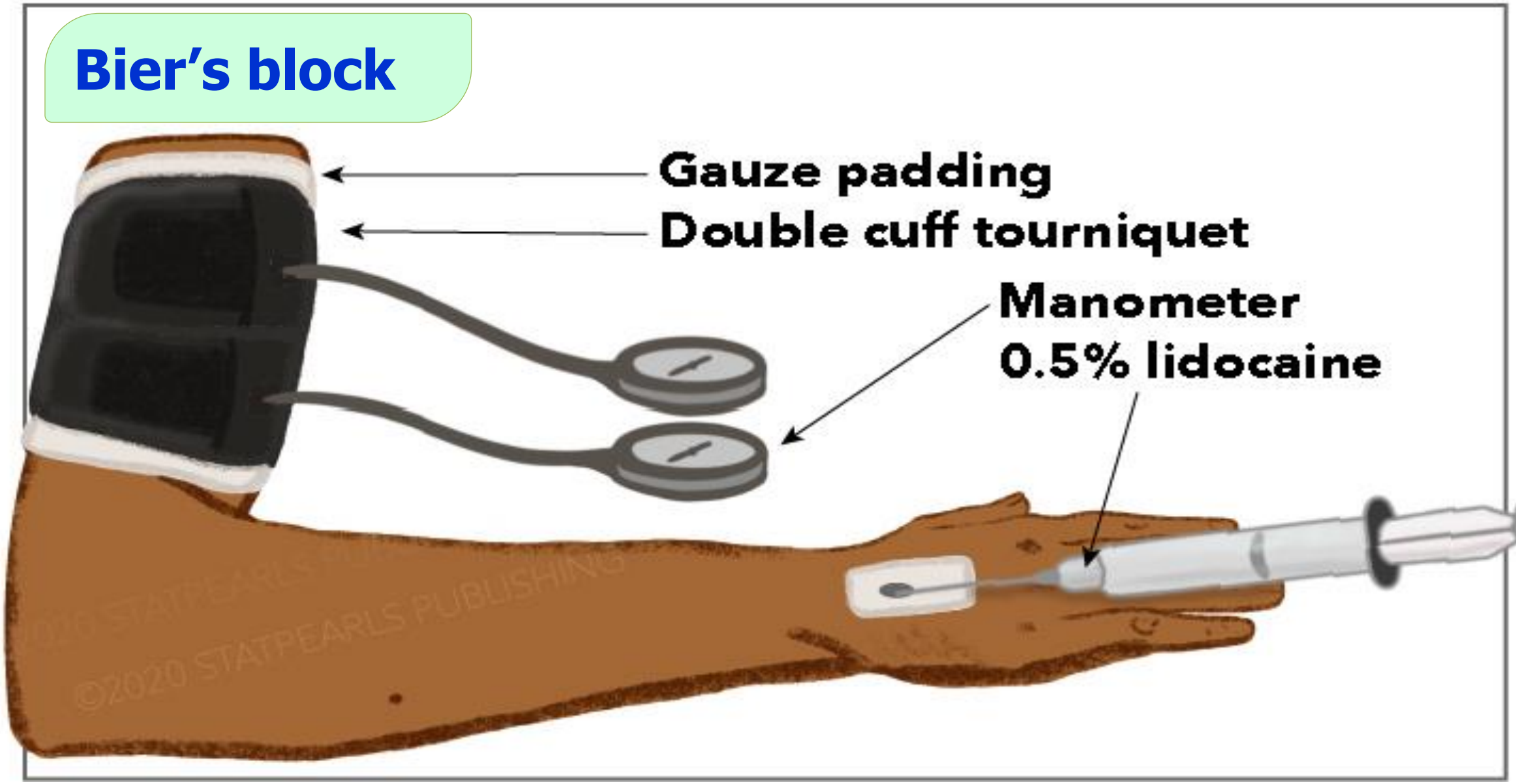
2) Reynold's disease (intermittent arteriolar vasospasm of the distal limbs).

3) Sickle cell anemia.

4) Scleroderma.

Major types of regional anesthesia :

Bier's block



Major types of regional anesthesia :

A) Peripheral nerve blocks :

➢ 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. Although radiologists had made use of ultrasound technology to guide needles for biopsy, the application of this imaging modality for PNB was novel at that time. The utility of ultrasound to facilitate a range regional anesthesia technique including brachial plexus and femoral blocks was demonstrated.

Major types of regional anesthesia :

A) Peripheral nerve blocks :

➢ Ultrasound guided regional anesthesia (USGRA) :

A decade later, colleagues from the University of Toronto, Canada, began to 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.

Major types of regional anesthesia :

A) Peripheral nerve blocks :

➢ Ultrasound guided regional anesthesia (USGRA) :

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.

Major types of regional anesthesia :

A) Peripheral nerve blocks :

INDICATIONS FOR TAP BLOCK :

Ultrasound guided regional anesthesia (USGRA) :

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.

Major types of regional anesthesia :

A) Peripheral nerve blocks :

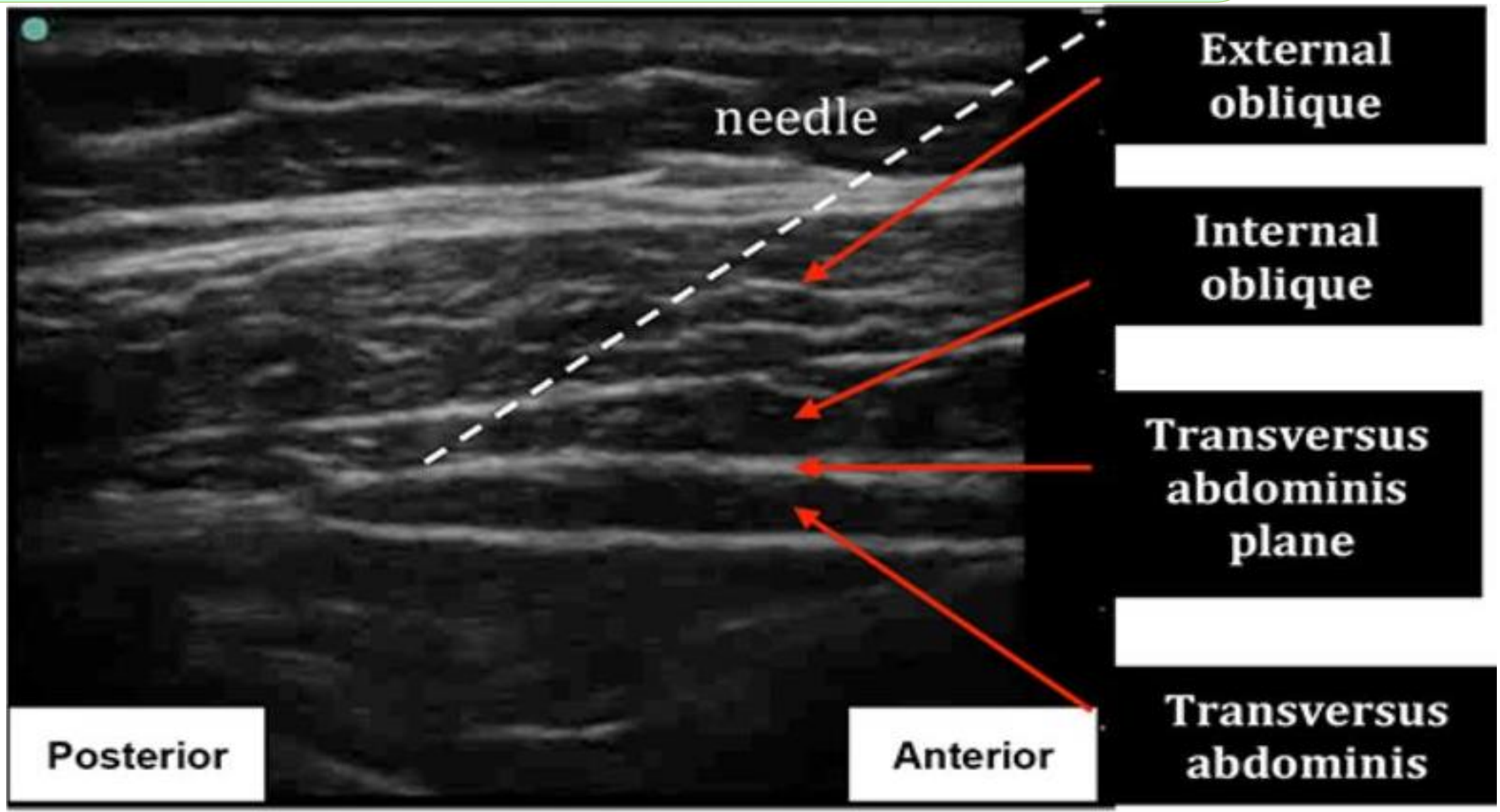
INDICATIONS FOR TAP BLOCK :

Ultrasound guided regional anesthesia (USGRA) :

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

Ultrasound guided regional anesthesia (USGRA) :



Major types of regional anesthesia :

B) Central neuraxial blockade :

- A local anesthetic is injected near the spinal cord and major nerves that enter the spinal cord to block sensations of pain from an entire region of the body, such as the lower abdomen, the hips, or the legs.

Major types of regional anesthesia :

B) Central neuraxial blockade :

➢ 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.

Major types of regional anesthesia :

B) Central neuraxial blockade :

➢ Spinal (intradural) anesthesia / 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.

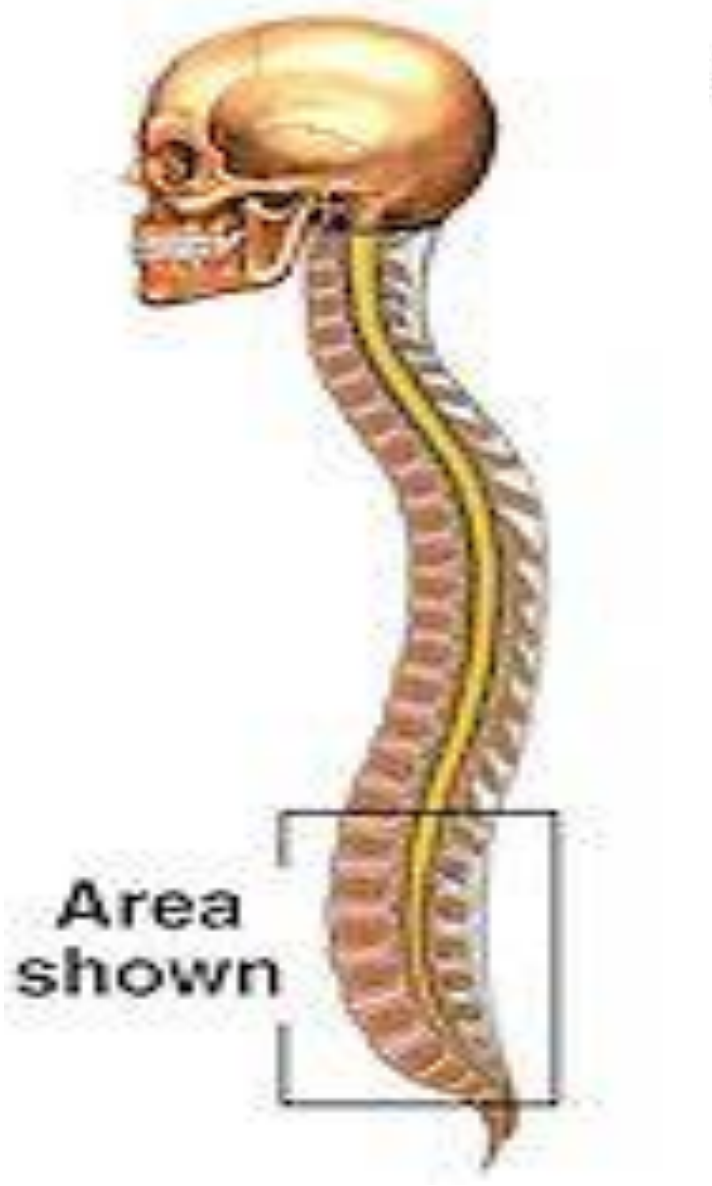
Major types of regional anesthesia :

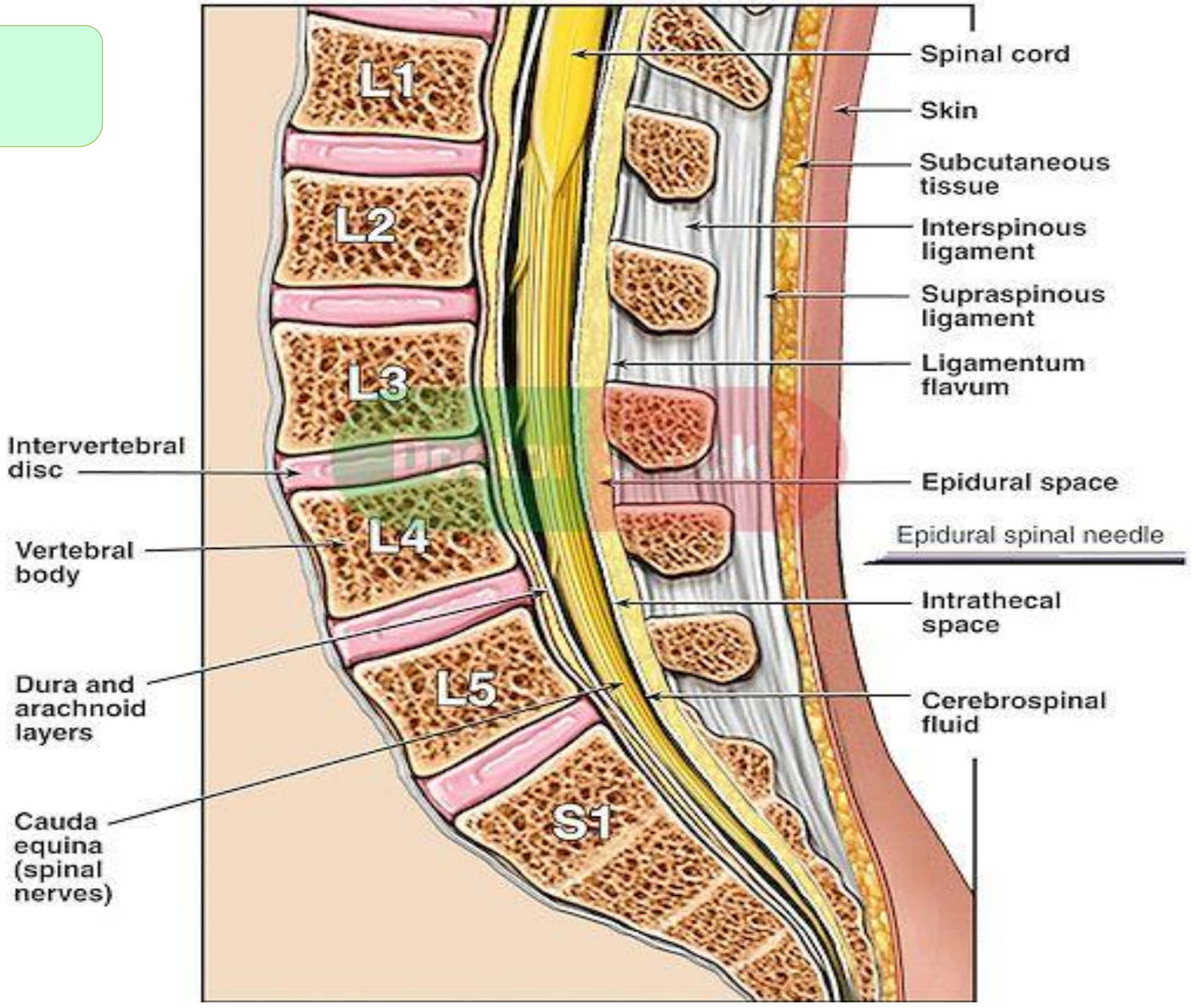
B) Central neuraxial blockade :

➢ 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.

Anatomy

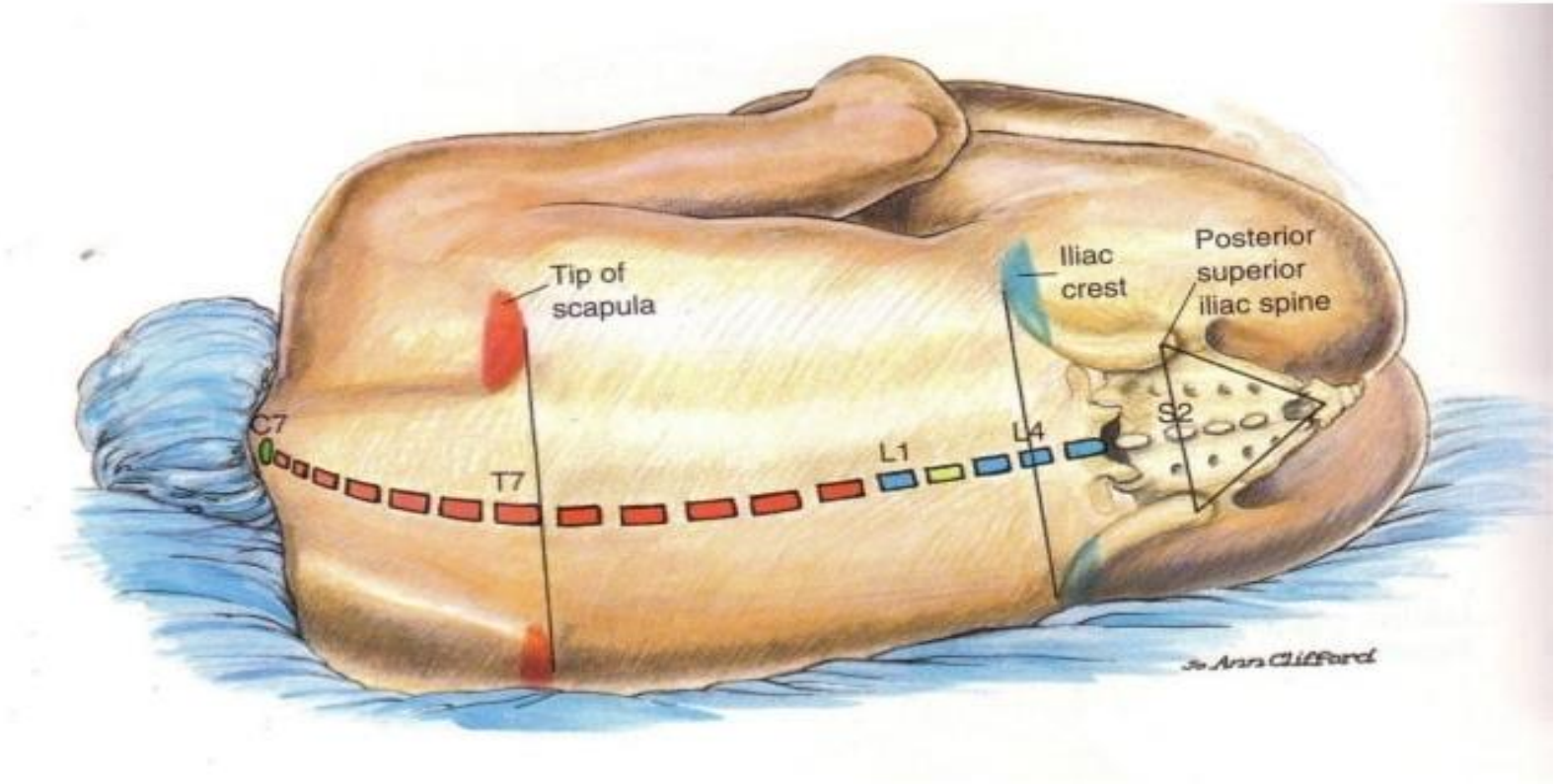

Area
shown

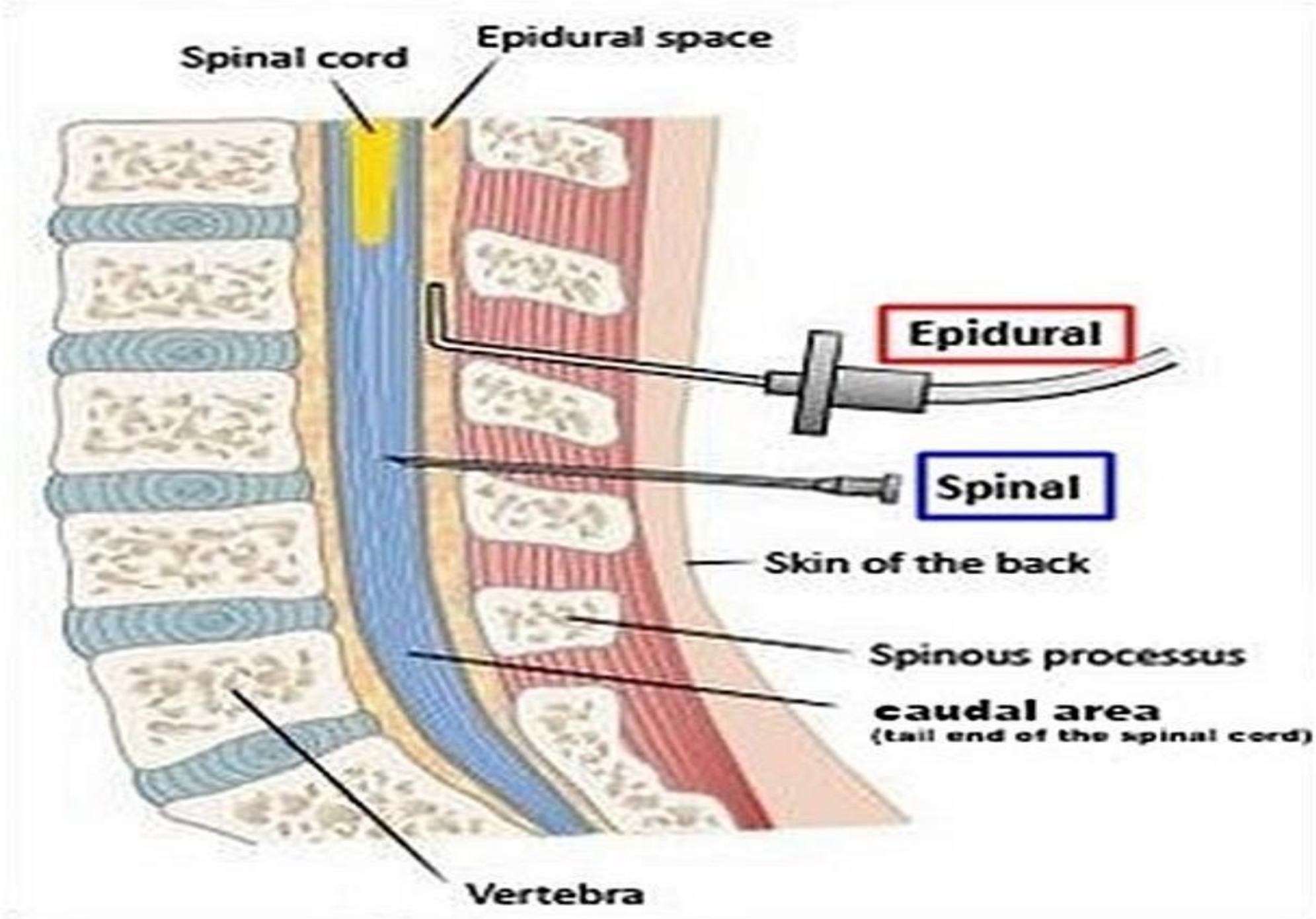

L1
L2
L3
L4
L5
S1
Spinal cord
Skin
Subcutaneous tissue
Interspinous ligament
Supraspinous ligament
Ligamentum flavum
Epidural space
Epidural spinal needle
Intrathecal space
Cerebrospinal fluid
Intervertebral disc
Vertebral body
Dura and arachnoid layers
Cauda equina (spinal nerves)

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

Major types of regional anesthesia :

B) Central neuraxial blockade :

➢ Spinal (intradural) anesthesia / 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 .

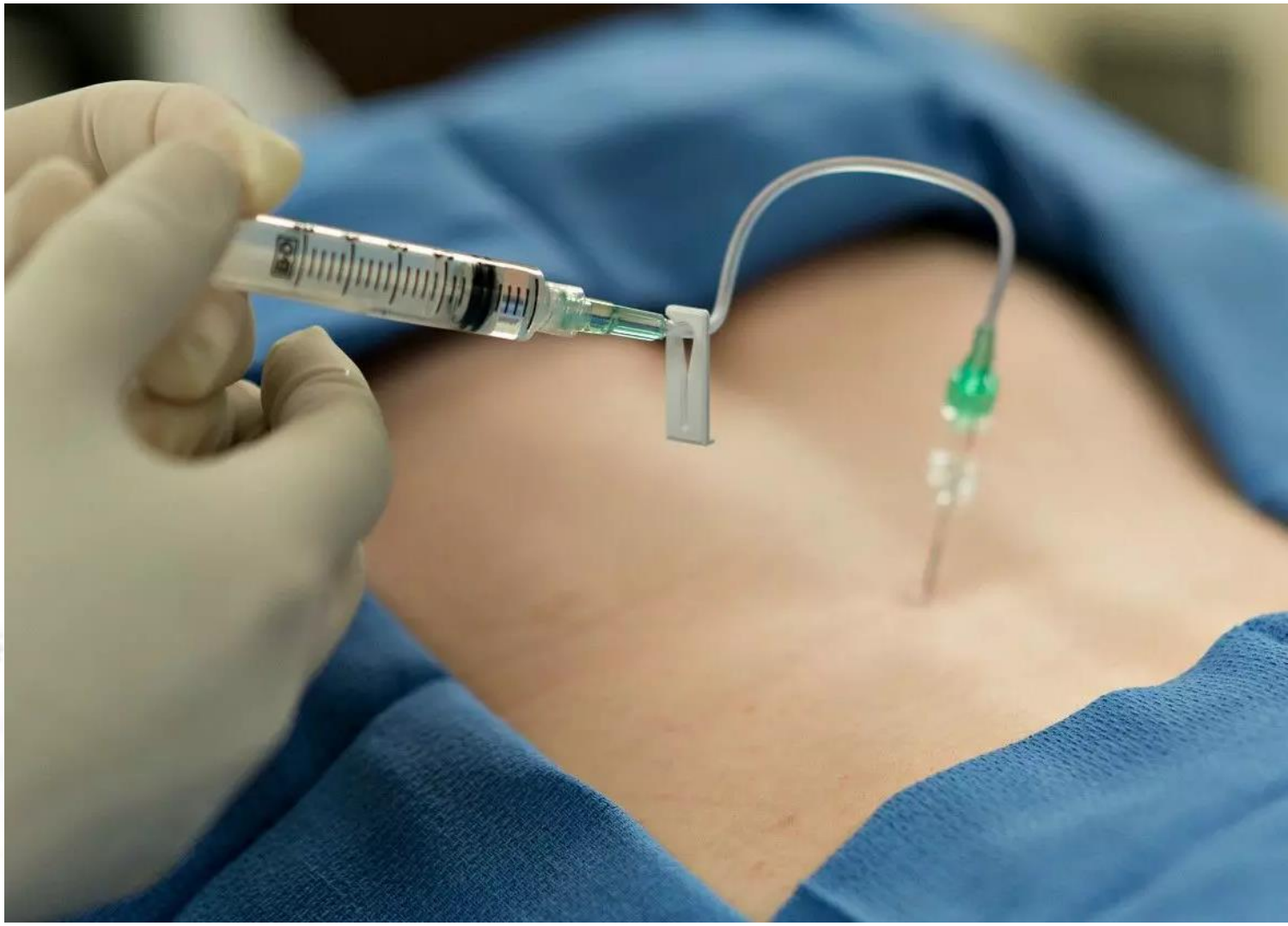
Major types of regional anesthesia :

B) Central neuraxial blockade :

➢ Spinal (intradural) anesthesia :

Levels of block :

Sympathetic paralysis ⟶ Sensory block ⟶ Motor nerve blockade



Major types of regional anesthesia :

B) Central neuraxial blockade : ➢ Spinal (intradural) anesthesia

Factors Effecting Distribution :

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

Major types of regional anesthesia :

B) Central neuraxial blockade : ➢ Spinal (intradural) anesthesia

Cardiovascular Effects:

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

Major types of regional anesthesia :

B) Central neuraxial blockade : ➢ Spinal (intradural) anesthesia

Cardiovascular Effects:

- 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

Major types of regional anesthesia :

B) Central neuraxial blockade : ➢ Spinal (intradural) anesthesia

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

Major types of regional anesthesia :

B) Central neuraxial blockade : ➢ Spinal (intradural) anesthesia

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

Major types of regional anesthesia :

B) Central neuraxial blockade : ➢ Spinal (intradural) anesthesia

Complications :

1. Immediate complications

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

Major types of regional anesthesia :

B) Central neuraxial blockade : ➢ Spinal (intradural) anesthesia

Complications :

2. Late complications :

-Post dural puncture headache (PDPH)

-Backache

- Nausea

- Focal neurological deficit

- Bacterial meningitis

- Sixth Cranial nerve palsy

- Urinary retention

Major types of regional anesthesia :

B) Central neuraxial blockade : ➢ Spinal (intradural) anesthesia

Spinal head ache :

- 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

Major types of regional anesthesia :

B) Central neuraxial blockade : ➢ Spinal (intradural) anesthesia

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

Major types of regional anesthesia :

Epidural (extradural) anesthesia:

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

Major types of regional anesthesia :

Epidural (extradural) anesthesia:

Epidural space :

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

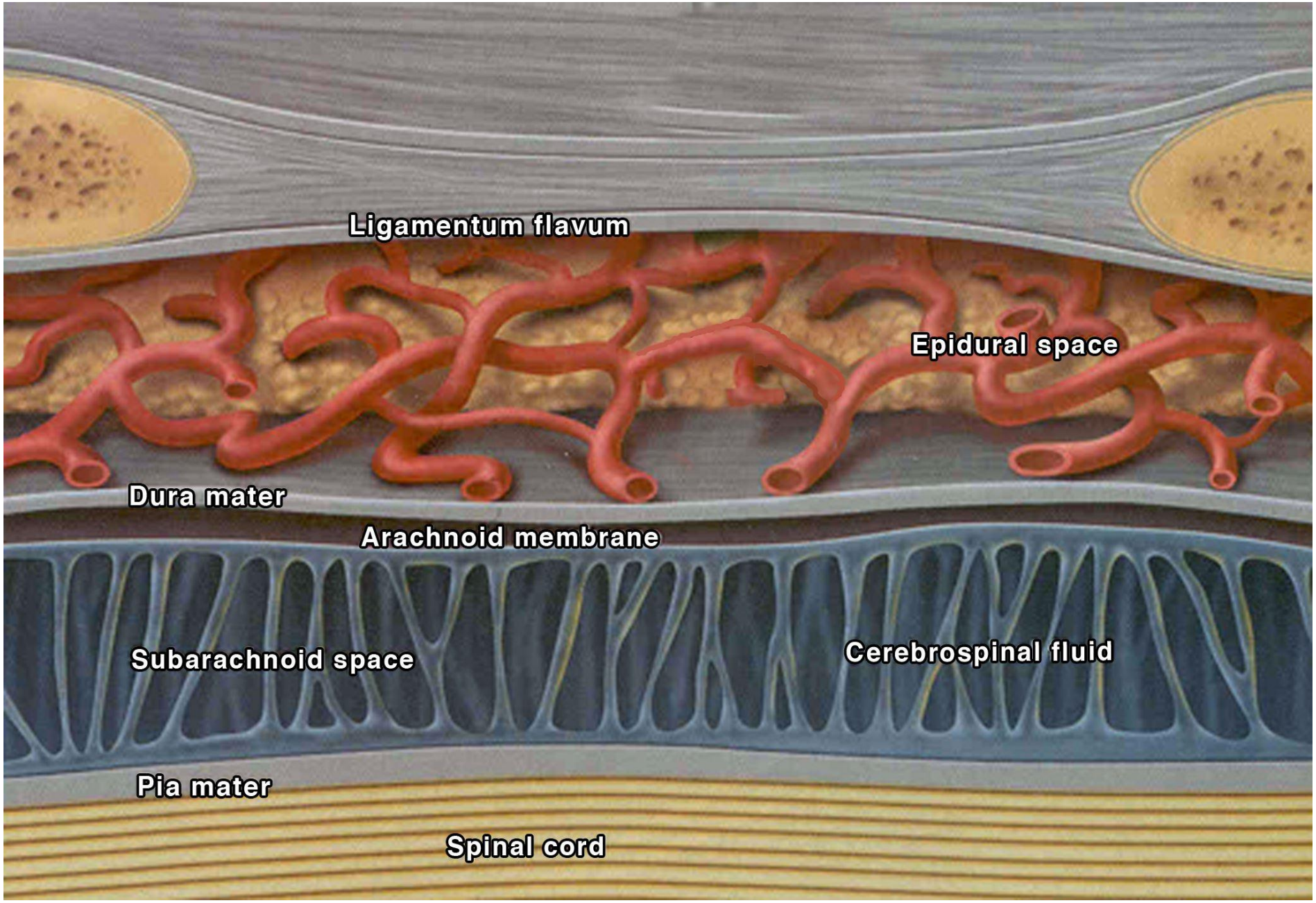
Major types of regional anesthesia :

Epidural (extradural) anesthesia:

Epidural space :

Local anaesthetic solutions are deposited in the peridural space betwee the dnura mater and the periosteum lining the vertebral canal. The injected local anaesthetic solution produces analgesia by blocking conduction at the intradural spinal nerve roots.

Epidural (extradural) anesthesia:



Major types of regional anesthesia :

Epidural (extradural) anesthesia:

Spread of Local Anesthetic in the Epidural Space:

- Local anesthetic injected into the epidural space moves in a horizontal and longitudinal manner.
- Theoretically the longitudinal spread could reach the foramen magnum and sacral foramina if enough volume was injected

Major types of regional anesthesia :

Epidural (extradural) anesthesia:

Spread of Local Anesthetic in the Epidural Space:

- Horizontally the local anesthetic spreads through the intervertebral foramina to the Dural cuff.
- Local anesthetics spread through the Dural cuff via the arachnoid villa and into the CSF.
- Blockade occurs at the mixed spinal nerves, dorsal root ganglia, and to a small extent the spinal cord

Major types of regional anesthesia :

Epidural (extradural) anesthesia:

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

Major types of regional anesthesia :

Epidural (extradural) anesthesia:

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

Major types of regional anesthesia :

Epidural (extradural) anesthesia:

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

Major types of regional anesthesia :

Epidural (extradural) anesthesia:

technique :

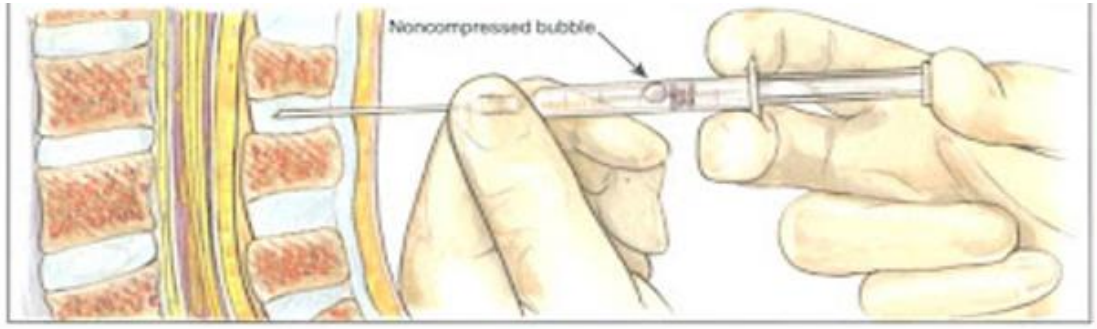
- It involves the insertion of a hollow needle and a small, flexible catheter into the space between the spinal column and outer membrane of the spinal cord (epidural space) in the middle or lower back. The area where the needle will be inserted is numbed with a local anesthetic. Then the needle is inserted and removed after the catheter has passed through it.

Major types of regional anesthesia :

Epidural (extradural) anesthesia:

technique :

- 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.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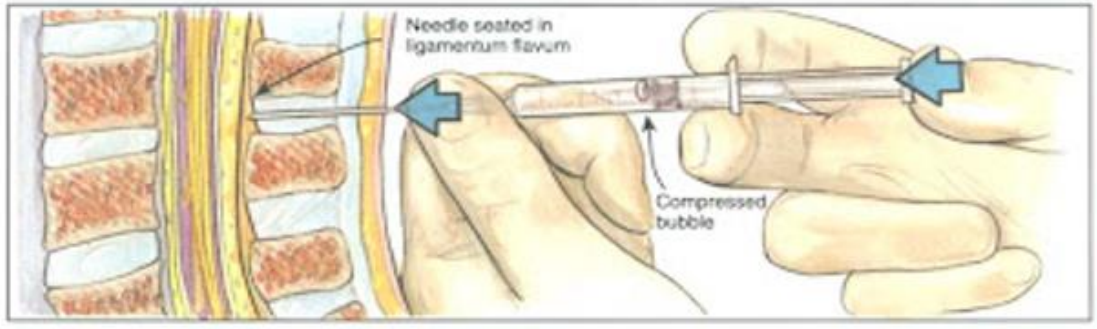
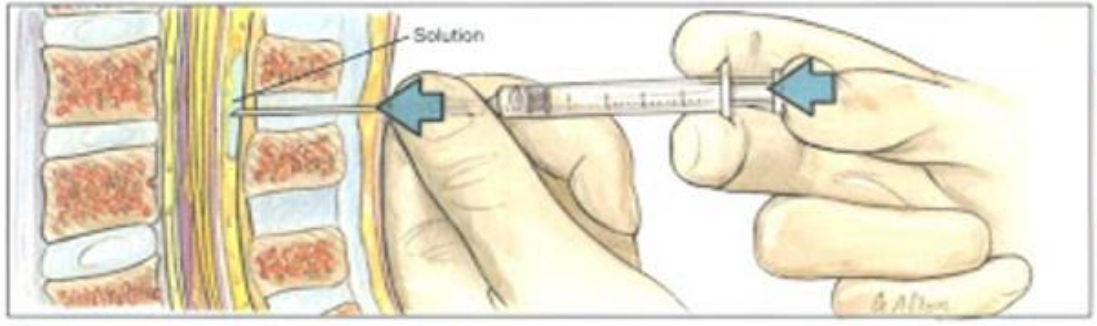

Needle seated in ligamentum flavum
Compressed bubble


Solution

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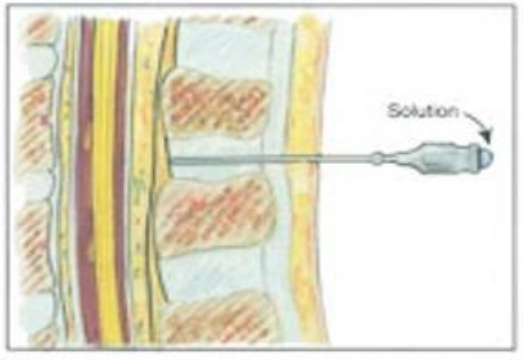
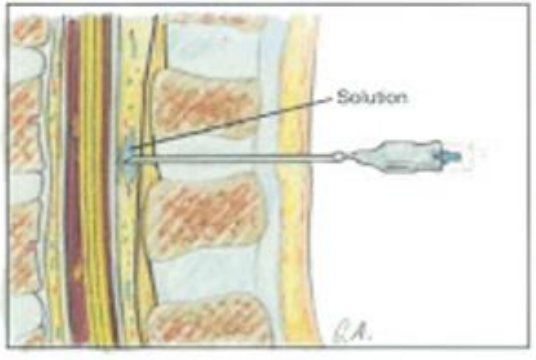

Solution


Solution

Major types of regional anesthesia :

Epidural (extradural) anesthesia:

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

Major types of regional anesthesia :

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

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

Major types of regional anesthesia :

Preparation for central neuraxial blockade :

1) All equipment, drugs, I.V fluids and facilities that mentioned in the preparation to local anesthetic injection should be available.

2) Assessment, explanation, consent and examination of the patient.

3) Full asepsis and "no – touch" technique is essential; surgical scrub, gown, mask, gloves, hat, and a sterile field. Equipment should be prepared in advance and in a sterile manner.

Major types of regional anesthesia :

Preparation for central neuraxial blockade :

4) A sedative benzodiazepine should often help the patient to tolerate the procedure.

5) Ketamine 0.1 – 0.25 mg/ kg has been given when positioning causes pain (such as fractured hip).

6) If the patient heavily sedated or ill, he/ she should be positioned in the lateral position with his/ her back parallel to the edge of the table and knees and head fixed.

Major types of regional anesthesia :

Preparation for central neuraxial blockade :

7) Many anesthetists find the sitting position easier than the lateral position, the patient is placed across the table or bed with their feet resting comfortably on a stool – the spine should be flexed with the chin pressed on to the sternum, and pillow on the knees gives helpful support on the arms.

POSITIONS FOR LUMBAR PUNCTURE

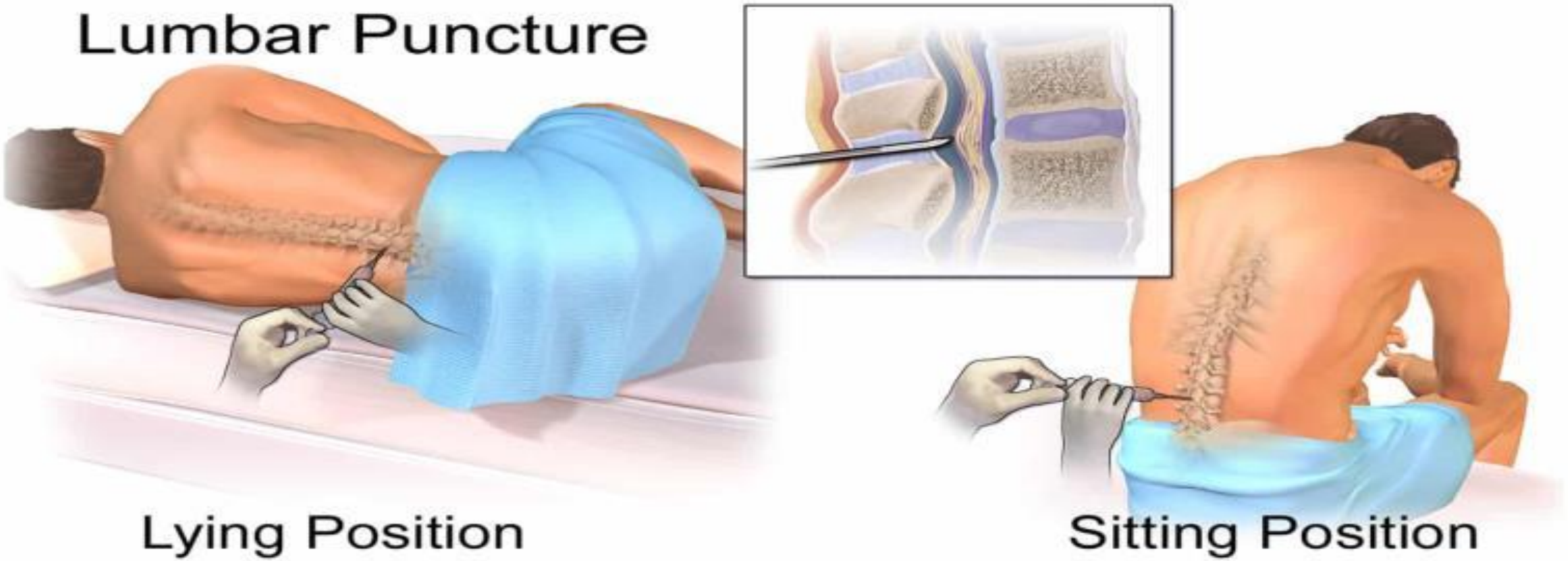


IMAGE SOURCE: WIKIPEDIA

Major types of regional anesthesia :

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.

Major types of regional anesthesia :

Contraindications to central neuraxial blockade :

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

Major types of regional anesthesia :

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)