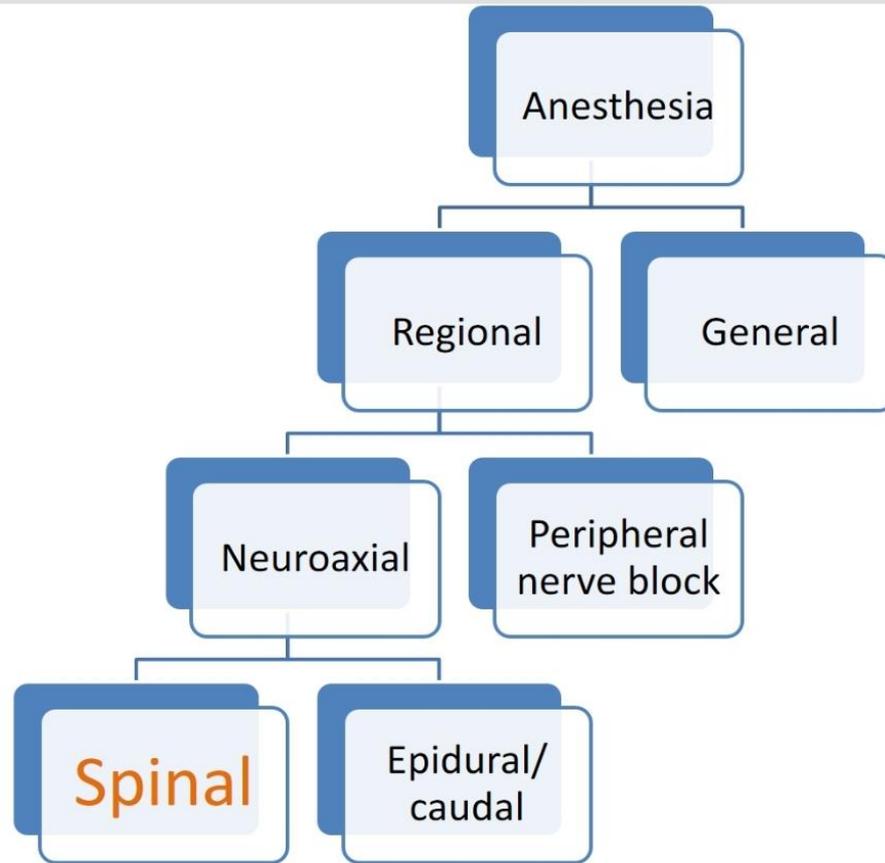


Spinal, Epidural and Caudal Anesthesia

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Spinal Anesthesia

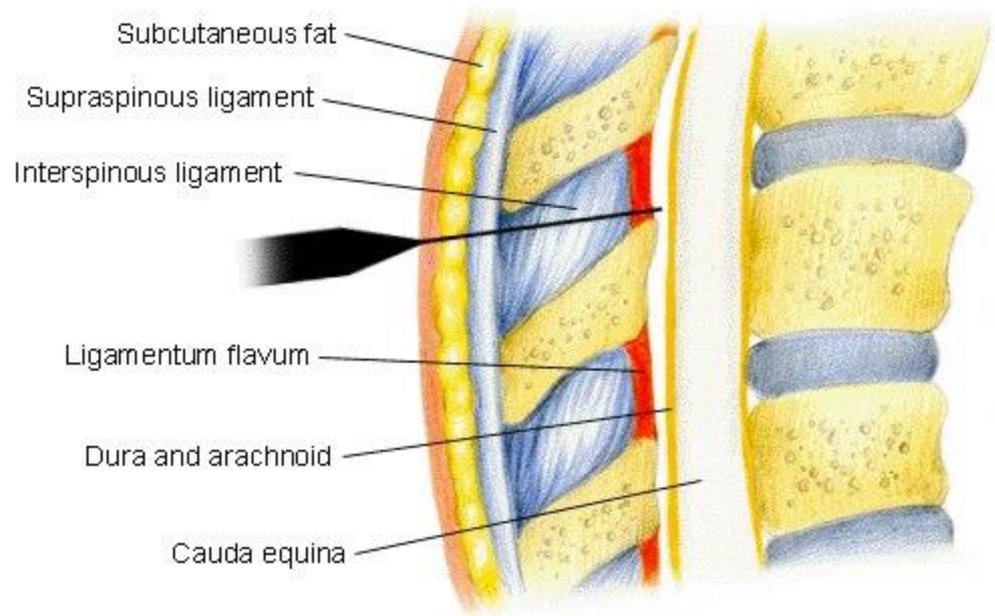
Form of neuraxial regional anesthesia involving the injection of local anesthesia or opioid into CSF; subarachnoid space, generally through a fine needle.

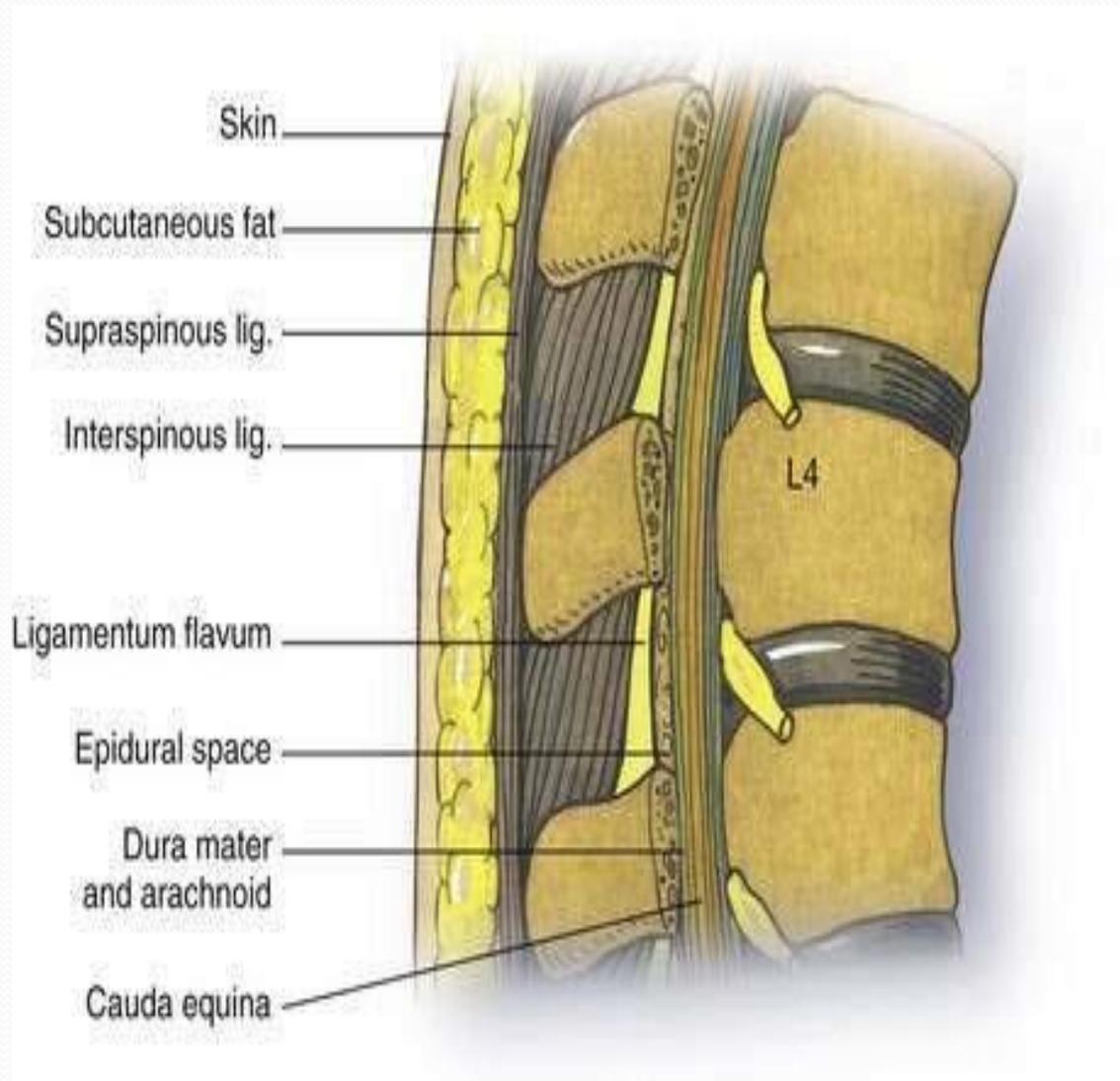
Subarachnoid or intrathecal anesthesia is commonly referred to as spinal anesthesia.

Anatomy

Our target is the CSF which is contained in the subarachnoid space

The brain and the spinal cord are covered with meninges and surrounded by CSF





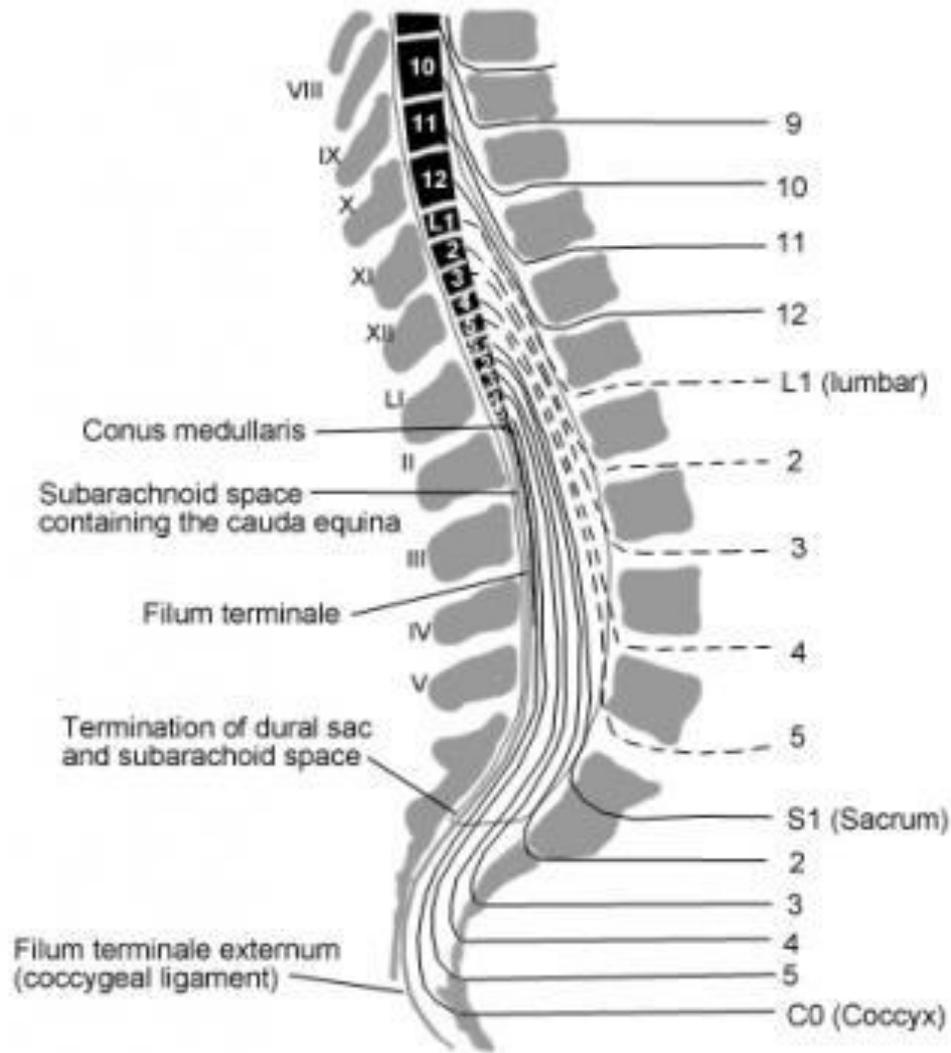
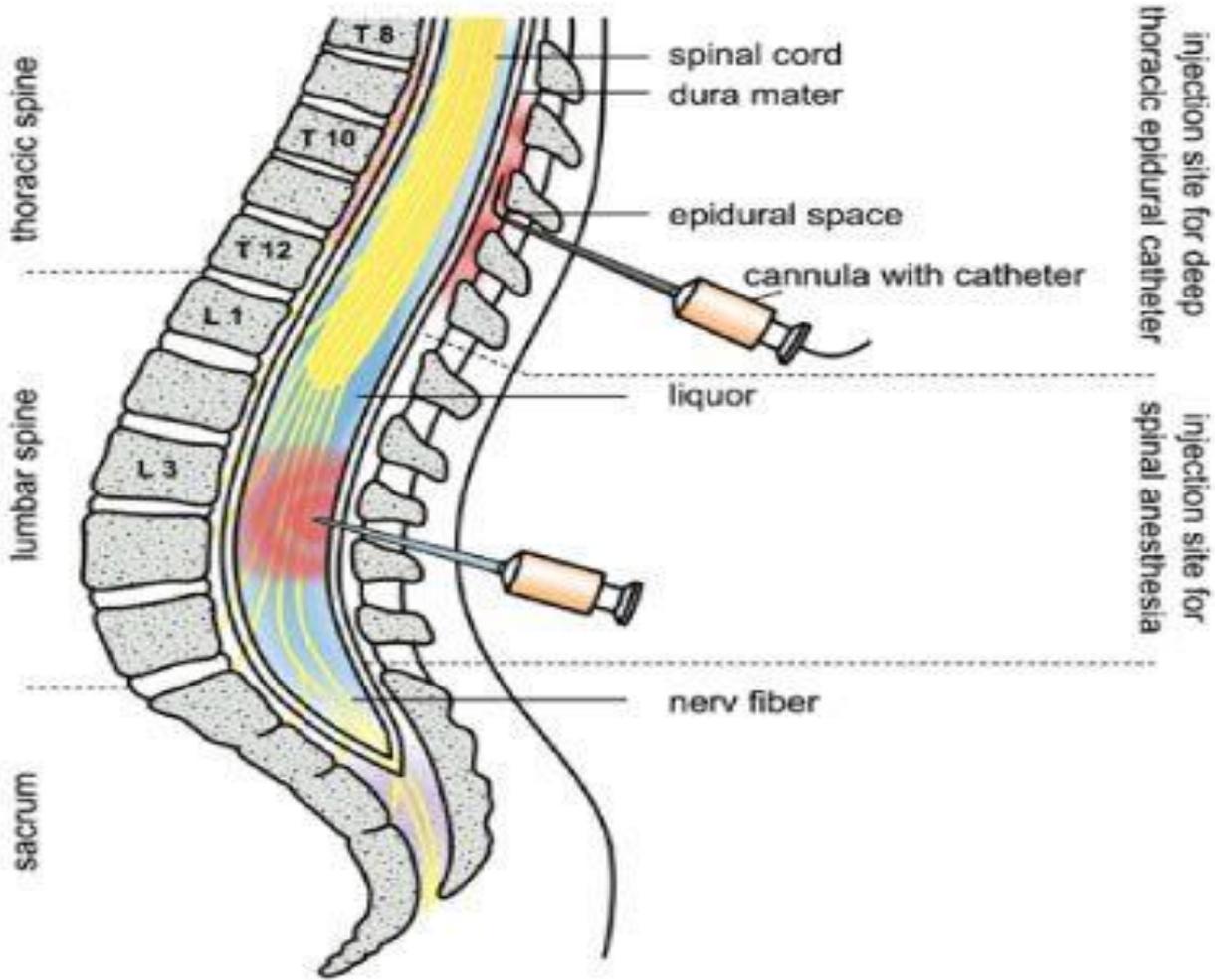
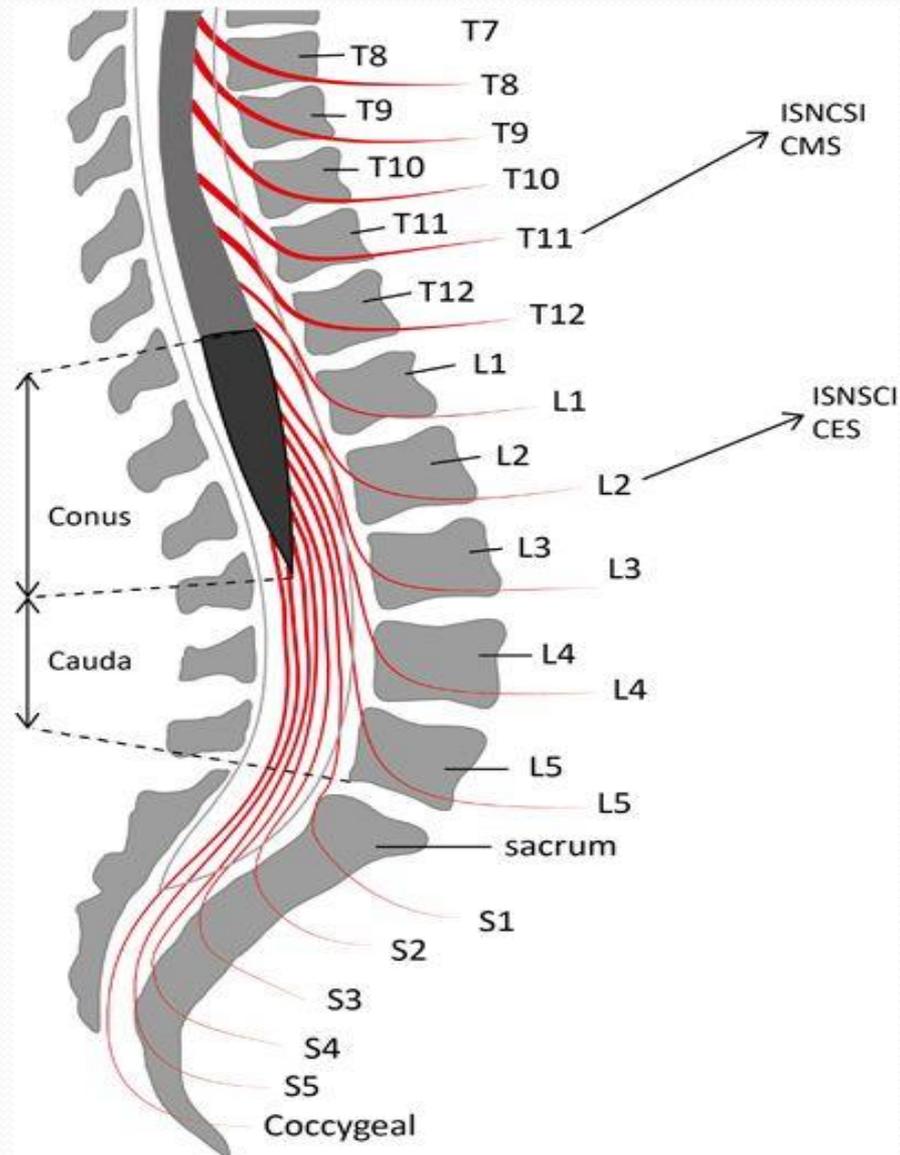


Figure 1 - Method of CSTEА.





Spinal cord and ligaments

In adults, the spinal cord typically ends at the level of L₁. Therefore, performing spinal below L₁ in an adult usually avoids potential needle trauma to spinal cord. Damage to the cauda equina is unlikely, as there nerve roots float in the dural sac below L₂ and tend to be pushed away rather than pierced by an advancing needle.

There are 2 anterior and 3 posterior ligaments stabilizing the vertebral bodies

Anterior : anterior and posterior longitudinal ligaments

Posterior : supraspinous and interspinous ligament and ligamentum flavum (thickest)

Meninges

Dura matter is the outermost and thickest .

The inner edge is vascular which is important for drug clearance from both epidural and subarachnoid space.

The subarachnoid space exist between dura and arachnoid matter .

Arachnoid matter is Avascular that serve as barrier for drugs moving between epidural space and the subarachnoid space with low permeability keeping CSF in subarachnoid space.

Spinal nerve roots run in the subarachnoid space .

Technique and Patient position

Preparation , consent , patient education

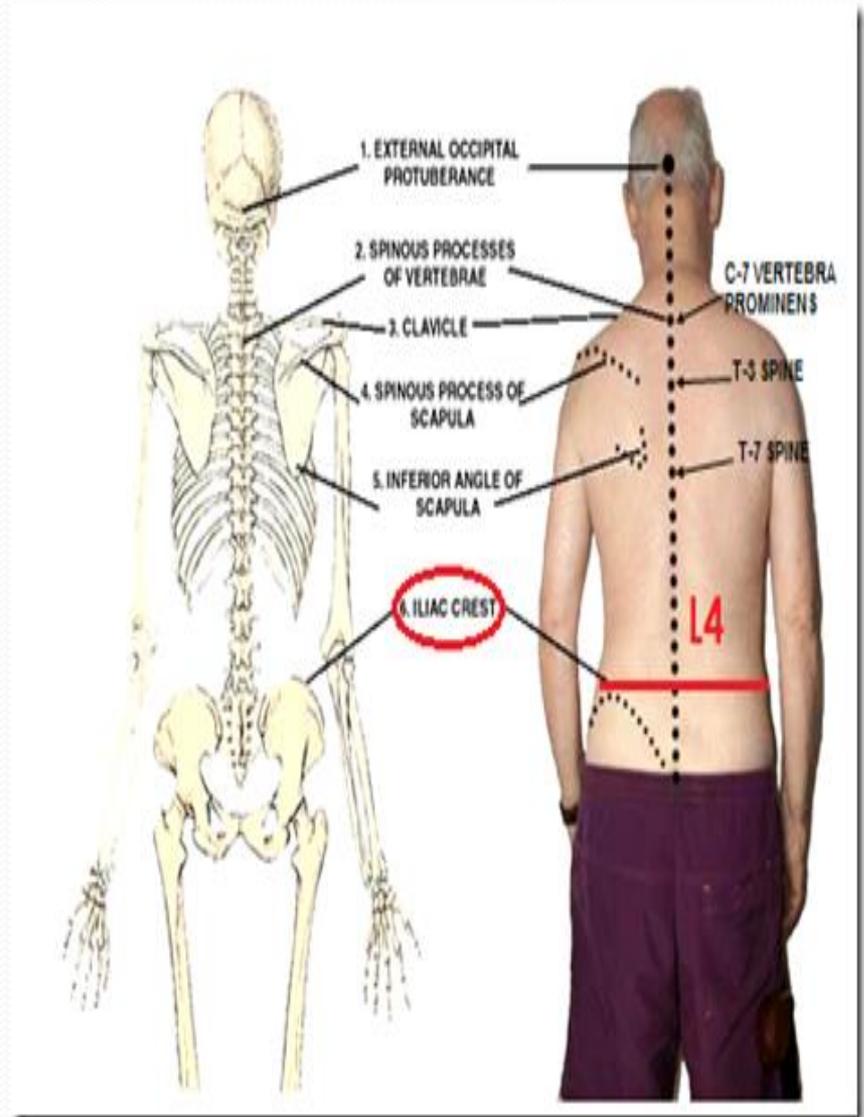
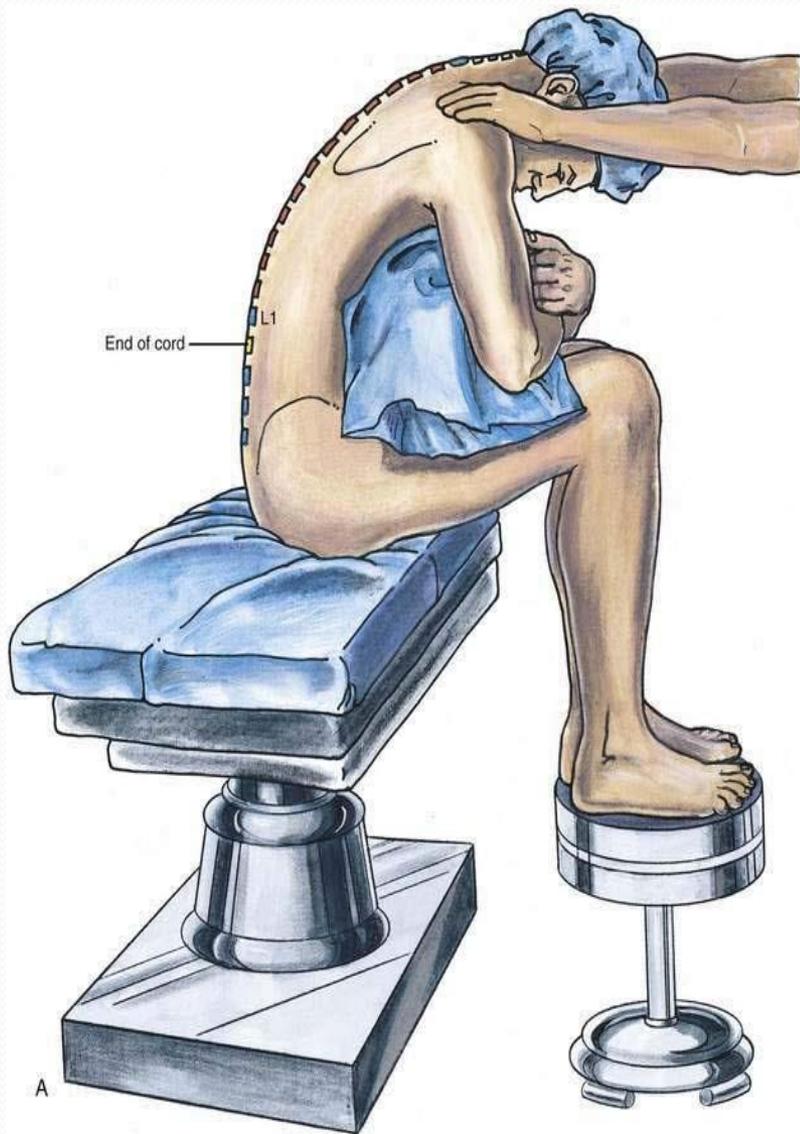
Full monitor and adequate IV access

Emergency drugs and airway management devices and
Oxygen source and skilled assistant

Full sterile technique with thorough hand washing and
surgical scrub solution , wear a cap, mask, sterile gown
and gloves and large sterile drape with sterile needles

Proper positioning is essential for successful blockage
with explanation to the patient and your assistant .

Sitting or lateral

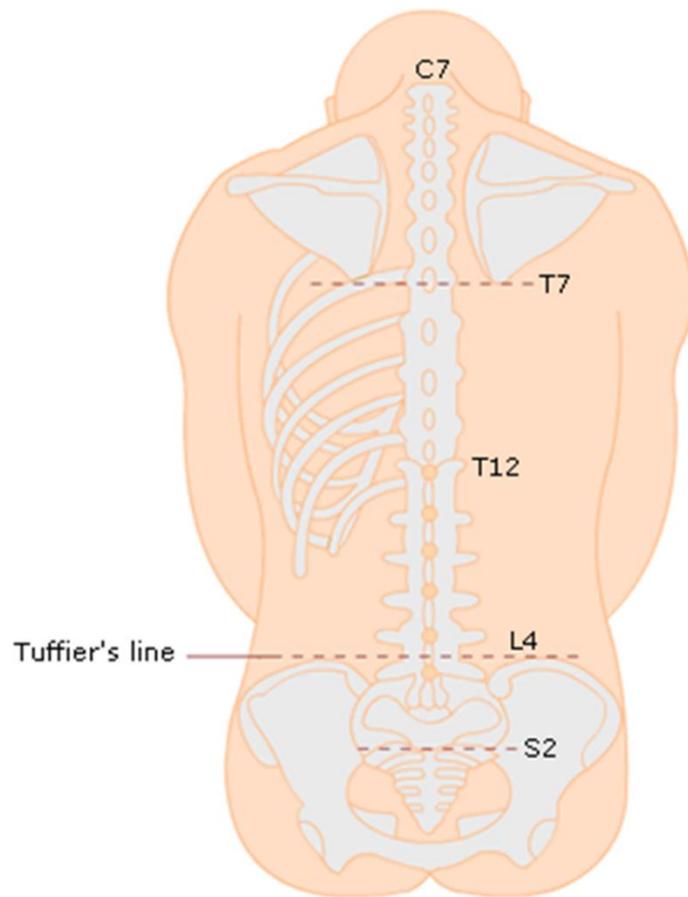


Anatomical structures that will be traversed is skin, SC fat, supraspinous ligament , interspinous ligament, ligamentum flavum, epidural space, dura , arachnoid and finally into subarachnoid space .

Being off midline is one of the most common reasons that CSF does not com back.

If the patient complains of a sharp pain in the hips or legs while inserting the needle, immediately remove the needle and reassess the approach .

Once CSF returns, hold the needle against the patient back then attach the syringe containing local



needles

- ← Since the discovery of spinal anesthesia in 1885 by J Leonard Corning, spinal needles have been modified to simplify their use and minimize complications.
- ← Needle design variables, such as **diameter**, **tip design** and **orifice location**, have been altered to enable **rapid flow** of cerebral spinal fluid (CSF) and injected medications, yet simultaneously **limit dural trauma** and **loss of CSF**.

- ← Spinal needles are classified according to their tips
 - ← 1 – Beveled (cutting)
 - ← 2 – Pencil point (non-cutting)
- 

Actual photograph magnified 21 times



Gertie Marx[®]
26 Gauge



Sprotte
25 Gauge



Whitacre
25 Gauge



Quincke
25 Gauge



facil point



GREENE



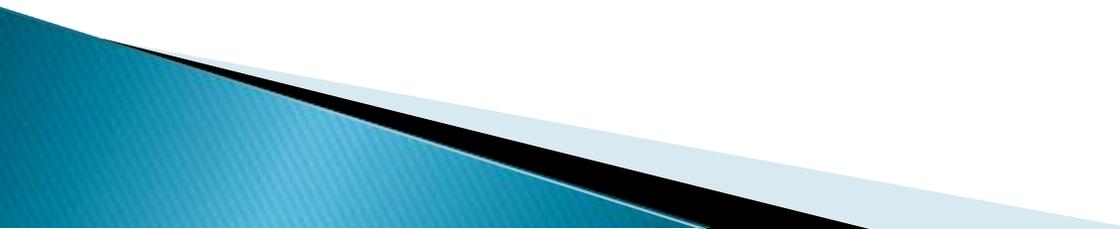
Atraucan

Pharmacology

- ← Many drugs are used world wide intrathecally with various effects and side effects
- ← Never use drugs that are not preservatives free



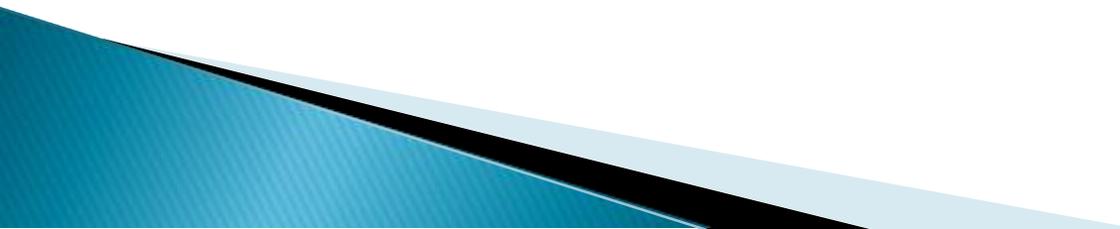
1 – local anesthetics

- ◀ Many local anesthetics are used with different onset, duration, uptake, elimination properties
 - ◀ Some of them cause permanent nerve injury and transient neurologic symptoms.
 - ◀ They target the spinal nerve roots and dorsal root ganglia, and the spinal cord (superficial and deep portions).
- 

Baricity

- ← Baricity = relative densities between two substances (drug and CSF).
 - ← Density = ratio between mass and volume of a substance
 - ← Drug's baricity affects block height.
 - ← Hyperbaric solutions will preferentially spread to the dependent regions of the spinal canal
 - ← Hypobaric solutions will spread to nondependent regions.
 - ← Isobaric solutions tend not to be influenced by gravitational forces.
 - ← increasing temperature decreases density of a solution and warming of local anesthetic solution to body temperature, therefore making it more hypobaric.
- 

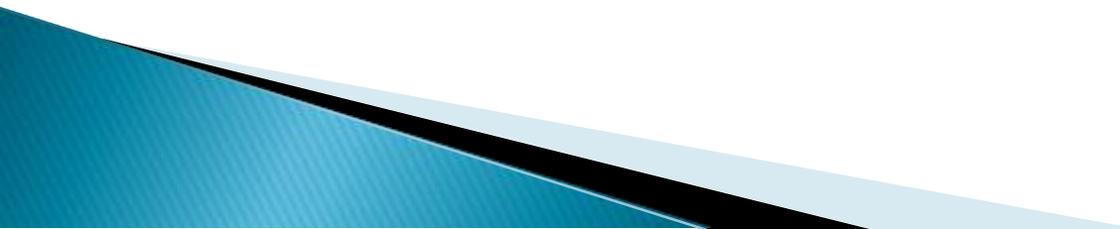
Bupivacaine

- ← has slow onset: 4–8 minutes
 - ← long duration of action = 130–230 minutes
 - ← suitable for 2–3 hours surgeries.
 - ← low-doses are suitable for short surgeries.
 - ← rarely associated with TNS.
 - ← 10–15mg reaches for T10
 - ← 12–20 mg reaches for T4
- 

2- Opioids

- ← They exert direct analgesic effect.
- ← prolong the duration of sensory and motor blockade, and increase mean spread of blockade.
- ← allow for a reduction in the required dose of local anesthetic.
- ← Promote motor block sparing and faster recovery while still producing the same degree of analgesia.
- ← the relative intrathecal to intravenous potency depends on the agents hydrophilicity.
- ← Side effects: respiratory depression, nausea and vomiting, pruritus, and urinary retention.

Block height

- ← Dermatomal level required for various surgical procedures:
 - ← Upper abdominal surgery T4
 - ← Cesarean delivery T4 (uterus = T10 though)
 - ← Transurethral resection of prostate T10
 - ← Hip surgery T10
 - ← Foot and ankle surgery
- 

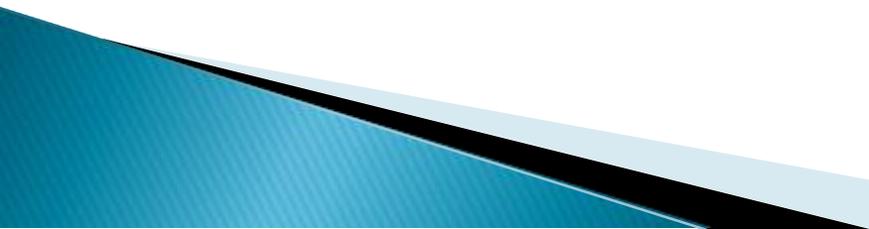
BLOCK MONITORING

- ← Best method is by assessing temperature sensation by alcohol.
- ← After that assess by using painful stimuli.
- ← Analgesia (pinprick) extends two or more segments more cephalad than anesthesia (touch).
- ← Sympathetic block (temperature) may extend as many as six spinal segments higher than the upper limit of sensory block.
- ← Because smaller fibers are more sensitive for block

Indications

- ← Surgeries below the umbilicus
- ← Spinal anaesthesia is especially indicated for older patients and those with systemic disease such as chronic respiratory disease, hepatic, renal and endocrine disorders such as diabetes.
- ← Most patients with mild cardiac disease benefit from the vasodilation that accompanies spinal anaesthesia except those with stenotic valvular disease or uncontrolled hypertension.

Contraindications

- ← patient refusal.
 - ← unstable patients (sepsis, hypovolemia)
 - ← Inadequate resuscitative drugs and equipment.
 - ← Uncooperative patients. (psychiatry, pediatrics).
 - ← Anatomical deformities, spine surgeries
 - ← Neurological disease: Any worsening of the disease postoperatively may be blamed erroneously on the spinal anaesthetic.
 - ← Raised intracranial pressure.
 - ← Severe aortic stenosis.
 - ← Clotting disorders.
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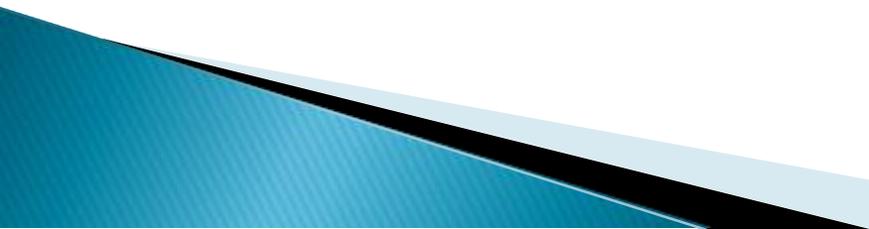
Anticoagulation stopping for neuroaxial block guidelines

- ← NSAIDs and Aspirin: no need to be stopped.
- ← Clopidogrel (Plavix) = 7 days
- ← Warfarin: INR < 1.4
- ← Unfractionated IV heparin = 1 hr
- ← Heparin 5000 SQ twice daily = 12 hrs
- ← Heparin >5000 SQ or >twice daily = 24 hrs
- ← Prophylactic LMWH = 12 hrs
- ← Therapeutic LMWH = 24 hrs
- ← Fondaparinux = 42 hrs
- ← Factor X inhibitors = >3–6 days.

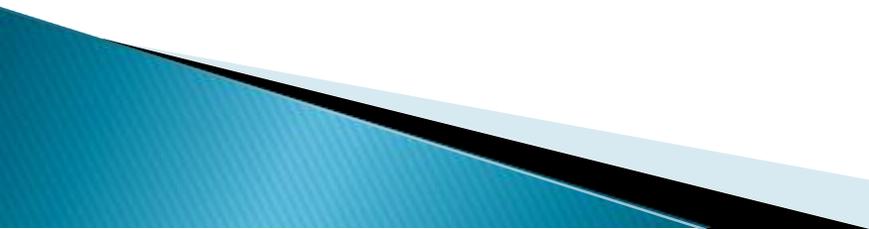
Physiological effects

- ← **1 – cardiovascular:** mimics alpha1 and beta1 blockade due to sympathectomy
BP = decreases
HR = decreases due to T5 blockade or empty atrium
although it might increase as a reflex.
- ← All patients should be preloaded with IV fluids prior to spinal induction
- ← Treat with generous IV fluids + vasopressors

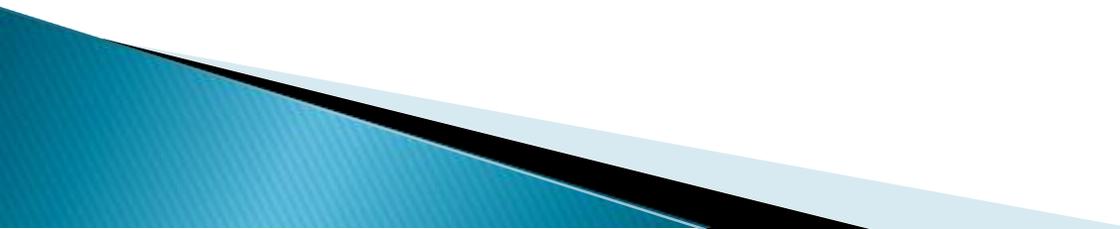
2- nerve block

- ← Depends on size, surface area, myelination of the nerve fiber
 - ← First to be affected are sympathetic fibers, then pain and temperature, the tactile nerves, then motor nerves.
 - ← Recovery occurs in reverse order
 - ← = last to be affected is the first to recover.
- 

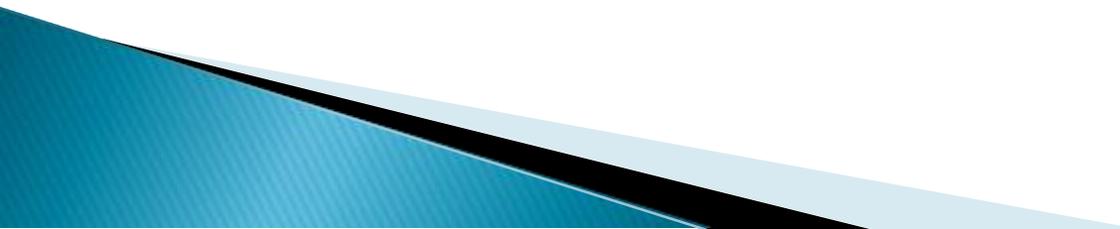
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- 

3 – respiratory

- ← changes usually are of little clinical consequence even in elderly.
 - ← decrease in vital capacity follows a reduction in expiratory reserve volume related to paralysis of the abdominal muscles necessary for forced exhalation.
 - ← Respiratory arrest might occur due to brainstem hypoperfusion.
- 

4- GI system

- ← Sympathectomy and unopposed parasympathetic activity result in a contracted gut and hyperperistalsis.
 - ← Nausea and vomiting may be associated with neuraxial block in as much as 20% of patients
- 

complications

- ←1 – PDPH
- ←2 – epidural hematoma
- ←3 – epidural abscess
- ←4 – paraplegia (direct injury, neurotoxicity)
- ←5 – cauda equina
- ←6 – backache
- ←7 – total spinal
- ←8 – bradycardia and hypotension
- ←9 – nausea and vomiting
- ←10 – urinary retention
- ←11 – pruritis (zofran, naloxone)

Epidural analgesia

Local anaesthetic solutions are deposited in the peridural space between the dura mater and the periosteum lining the vertebral canal. The peridural space contains adipose tissue, lymphatics and blood vessels. The injected local anaesthetic solution produces analgesia by blocking conduction at the intradural spinal nerve roots.

Technique: ▶

Loss of resistance technique to identify the epidural space.

0.5% Bupivacaine (mainly) or lidocaine ▶ (2.0%) is usually used to produce epidural anaesthesia.

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 puncture of the dura mater	Injection: epidural space (between Ligamentum flavum and dura mater) i.e without puncture 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	Dosis: 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.

Caudal anesthesia

Caudal epidural anesthesia is a common regional technique in pediatric patients.

Used also in anorectal surgery in adult .

The caudal space is the sacral portion of the epidural space.

Caudal anesthesia involves needle penetration of the sacrococcygeal ligament covering the sacral hiatus that is created by the unfused S4 and S5 laminae .

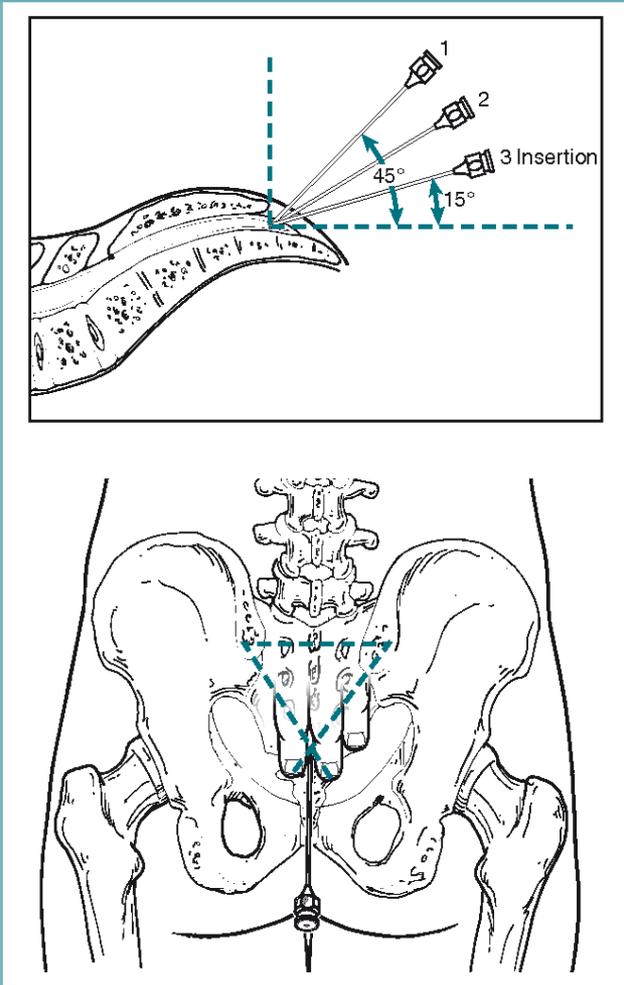
The hiatus felt may be felt as a groove or notch above the coccyx and between two bony prominences, the sacral cornua

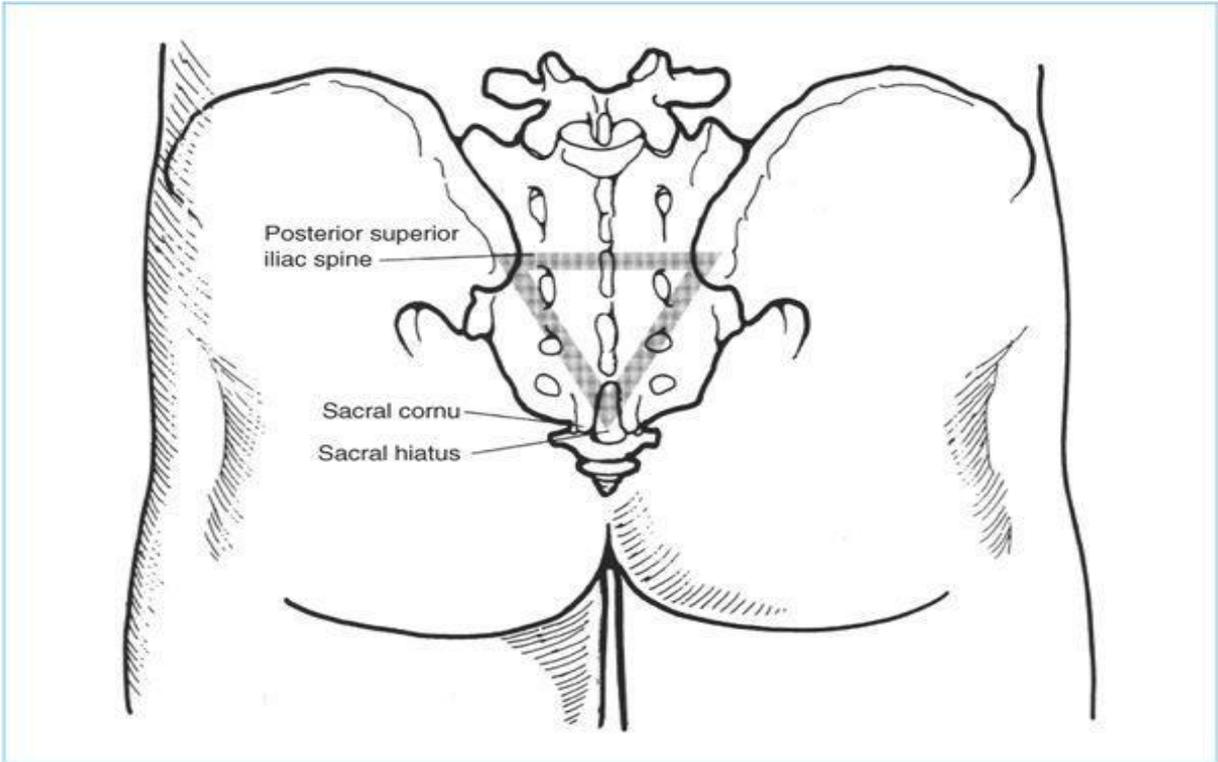
Calcification of the sacrococcygeal ligament may make caudal difficult or impossible in older adults.

Within the sacral canal, the dural sac extends to the 1st sacral vertebra in adults and to about the 3rd sacral in infants, making inadvertent intrathecal injection more common in infant .

Combination with general in pediatric .







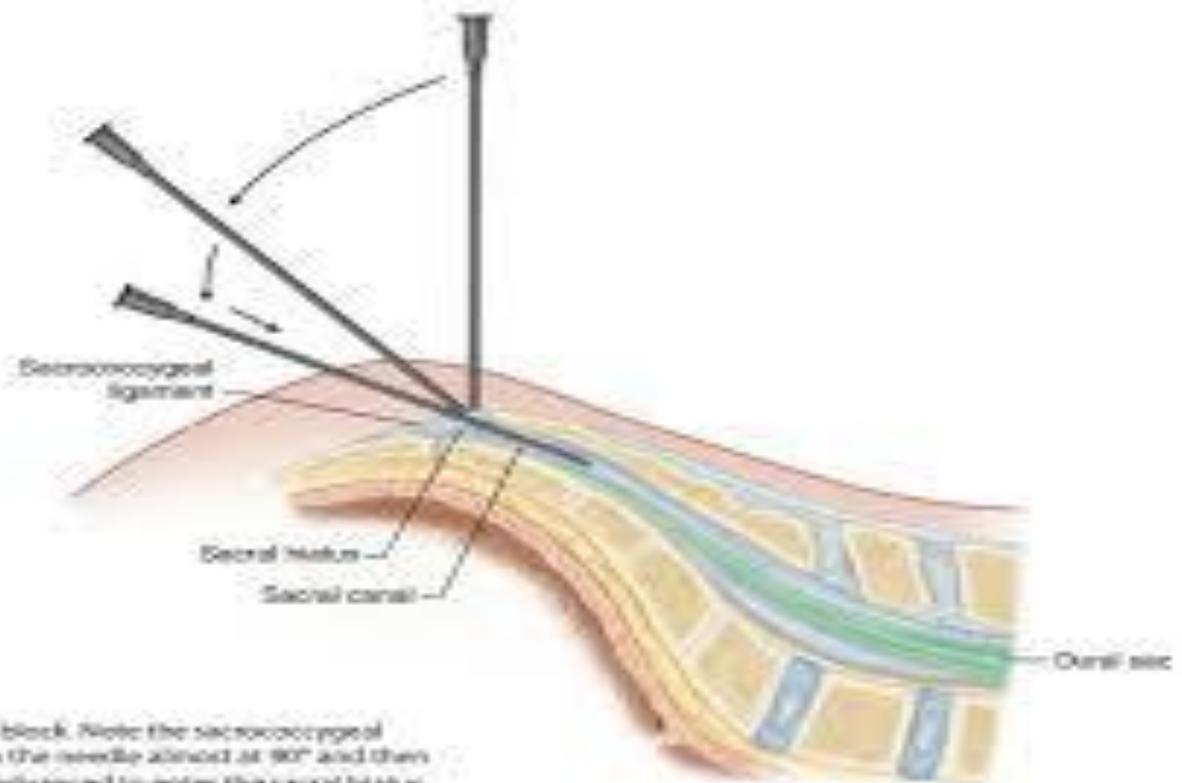


FIGURE 45-21 Caudal block. Note the sacrospinous ligament is penetrated with the needle almost at 90° and then must be angled down and advanced to enter the sacral hiatus.