Regional anesthesia techniques (neuraxial blockade)

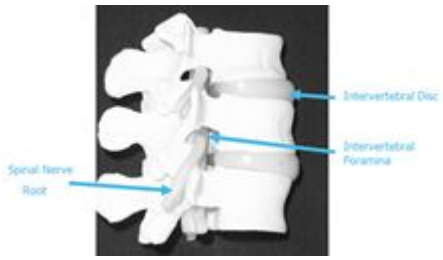
Objectives

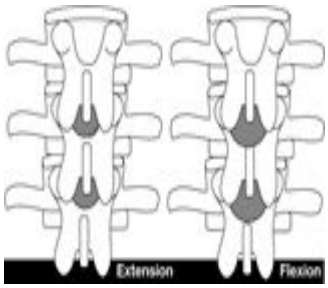
- Relevant anatomy and surface landmark for Neuraxial block.
- Differences between spinal and epidural.
- Equipment and local anesthetics.
- Indication and contraindication.
- Side effects, complications and treatment.
- LAST (local anesthesia toxicity)

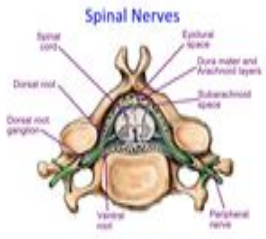
Important - Golden Note - Notes

Anatomy: knowledge of anatomy for neuraxial blockade is essential!

- 7 cervical vertebrae with 8 cervical nerves, 1 is between C1 and the occipital bone
- 12 thoracic vertebrae
- 5 lumbar vertebrae
- Sacrum
- Coccyx
- In the vertebral column we have cervical lordosis, thoracic kyphosis, and lumbar lordosis.
- To straighten the lumbar lordosis we ask the patient to flex (knee-chest position)"للمريض نقول يدنق مثل الركوع أو السجود" to wide the interspinous spaces and make it more superficial toward the skin.
- In pregnant women lumbar lordosis is exaggerated so it can be a challenge for us.
- Important: The 5th sacral vertebrae has no laminae so we can't feel it so it's difficult for us to use, But in pediatrics you can feel it that's why we do caudal block (low Epidural Anesthesia) for pediatrics.
- C1 and C2 are special because of odontoid process. The anterior-posterior diameter may be affected in rheumatoid patients (subluxation) and diabetics.







What level? Cervical ?
1- bifid (Y-shaped) spinous process.
2-bifid transverse process (through the transverse foramen the vertebral Arteries pass .

Individual Vertebral Anatomy:

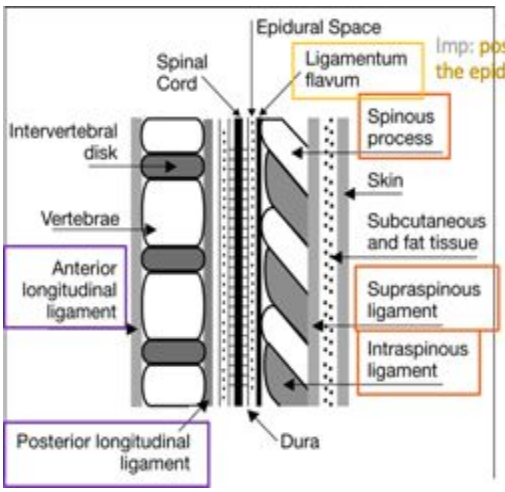
- Each vertebra consists of:
  - pedicle
  - transverse process
  - superior and inferior articular processes
  - spinous process.

Vertebral joints:

- Each vertebra is connected to the next by intervertebral discs.
- There are 2 superior and inferior articular processes (synovial joints) True joints on each vertebra that allows for articulation.
- Pedicles contain a notch superiorly and inferiorly (intervertebral Foramina) to allow the spinal nerve root to exit the vertebral column.
- Angle of transverse process will affect how the needle is orientated for epidural anesthesia or analgesia.
- With flexion the spinous process in the lumbar region is almost horizontal. In the thoracic region the spinous process is angled in a slight caudal angle.
- Interlaminar spaces are larger in the lower lumbar region.
- If an anesthesia provider finds it challenging at one level it is important to remember that moving down one space may provide a larger space

Ligaments that support the vertebral column

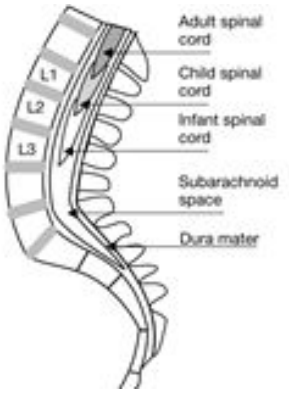
Important



- **Ventral side ligaments:**
  - Anterior and posterior longitudinal ligaments.
- **Dorsal side ligaments:**
  - Important since these are the structures your needle will pass through!
- **Ligaments are identified by tactile sensation (feel).**
  - Dorsal ligaments are transversed during neuraxial blockade.With experience the anesthesia provider will be able to identify anatomical structures by tactile sensation.

The needle pass through from post. to ant. : (OSCE)
Skin -> subcutaneous tissue ->supraspinous lig. -> intraspinous lig. ->ligamentum flavum -> epidural space ; if we go deeper we enter the arachnoid space (spinal anesthesia)

Termination of Spinal Cord:

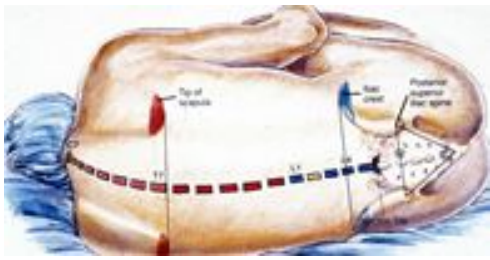


- **Adults:** usually ends at **L1**. *There are anatomical variations*.
  - For most adults it is generally safe to place a spinal needle below L2.
- **Children:** ends at **L2**
- **Infants: L3**
- So spinal cord ends at L2/L3 while dura end at S2... between L2 and S2 we find cauda equina
- We use bony landmarks because they are almost always accurate even if different body sizes
- Rule: NO spinal anesthesia above L2, you can do L3, L4, L5, but NEVER above L2.

Surface Anatomy and Landmarks: MCQs + OSCE

Locating prominent cervical and thoracic vertebrae:

- C2 is the first palpable vertebrae
- C7 is the most **prominent** cervical vertebrae (Spinous process)
- With the patient's arms at the side the tip of the scapula generally corresponds with T7
- Angle of scapula is T7, spine of scapula is T3.(most of thoracic EA between T3-7)
- Spinous process are generally palpable to help identify the midline.
  - If unable to palpate the spinous process? one can look at the upper crease of the buttocks and line up the midline if there is no scoliosis or other deformities of the spine
  - The 2 dimples we all have on our lower back is the posterior superior iliac spine on S2, which is the end of the epidural space.
  - Put your 2 fingers on each of the dimples and with the 3rd finger make an equilateral triangle and this is your caudal space on S5. so, two fingers on S2 and one finger on S5 for caudal block mostly in pediatrics (low EA).
- Tuffier's Line? (intercristal line)
  - A line drawn between the highest points of both iliac crests will yield either the body of L4 spinous process or the L4-L5 interspace.
  - Space above and below are excellent sites for both SA and EA.



Anatomical Considerations of the Spinal Cord and Neuraxial Blockade:

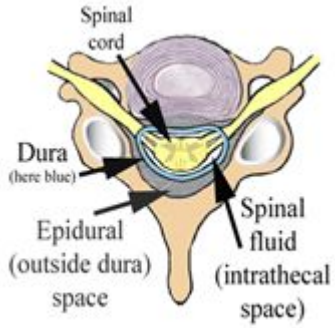
- **The Subarachnoid Space** is a continuous space that contains **CSF**, **Spinal cord** & **nerves.**
- **CSF:**
  - Clear fluid that fills the subarachnoid space
  - Total volume in adults is ~100-150 ml (2 ml/kg) 75kg -> 150 ml
  - Volume found in the subarachnoid space is ~35-45 ml. ½ in brain, ½ surrounding the spinal cord.
  - Continually produced at a rate of 450 ml per 24 hour period replacing itself 3-4 times
  - Reabsorbed into the bloodstream by arachnoid villi.
  - Specific gravity is between 1.003-1.007 (this will play a crucial role in the baricity "density" of local anesthetic that one chooses) . if <1.003 (hypobaric -> it will float "go up to brain"), >1.007 (hyperbaric-> it will sink "go down")
  - CSF plays a role in patient to patient variability, in relation to block height and sensory/motor regression (80% of the patient to patient variability)
  - Body wt is the only measurement that coincides with CSF volume (this becomes important in the obese and pregnant).

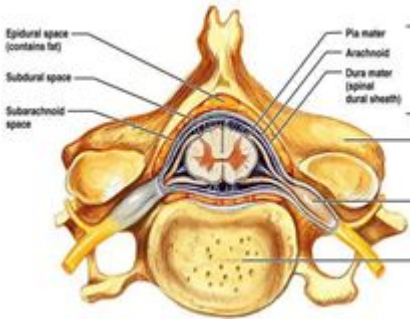
Membranes that surround the spinal cord (meninges):

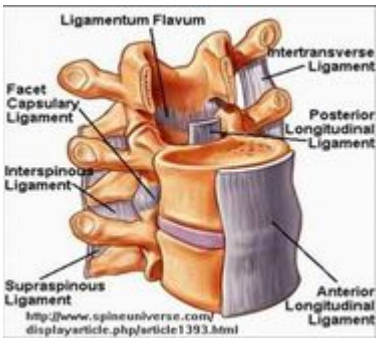
Pia mater	Arachnoid mater	Dura mater ("tough mother")
highly vascular	non vascular	- extension of the cranial dura mater. - extends from the foramen magnum to S2.
- covers the spinal cord and brain - Filum terminalis is an extension of the pia mater attaches to the periosteum of the coccyx.	- attached to the dura mater. - Principal barrier to the migration of medications in and out of the CSF.	

Epidural space anatomy: 'potential space'

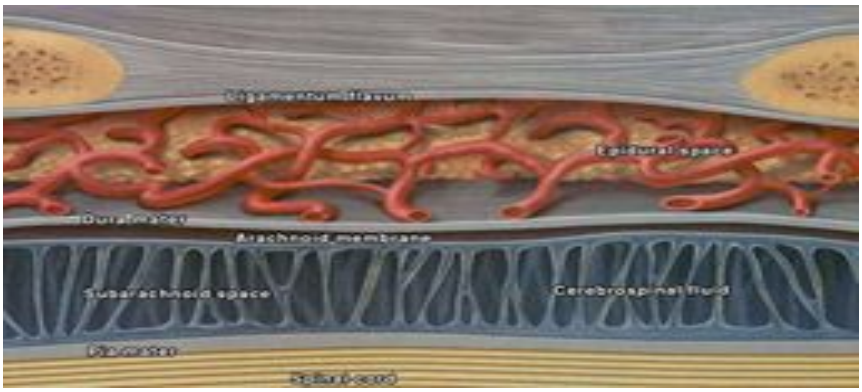
- Extends from the foramen magnum to the sacral hiatus . The epidural space surrounds the dura mater anteriorly, laterally, and most importantly to us posteriorly.
- **The Bounds of the Epidural Space are:**
  - **Anterior:** posterior longitudinal ligament connects the lamina from above and below, it's a very strong ligament, so most herniations happen laterally not anterior/posterior.
  - **Lateral:** pedicles and intervertebral ligaments
  - **Posterior:** ligamentum flavum: Most imp to us
    - Posterior to the epidural space
    - Extends from the foramen magnum to the sacral hiatus
    - Distance from skin to ligament varies from 3-8 cm in the lumbar area. It is 4 cm in 50% of the patients and 4-6 cm in 80% of the patients.
    - Thickness of the ligamentum flavum also varies. In the thoracic area it can range from 3-5 mm and in the lumbar it can range from 5-6 mm. And thickness on the same level varies (the part in midline is the thickest part of this ligament)
    - Function: to connect lamina up and down
- Contents of epidural space: 1- Fat 2- Areolar tissue 3- Lymphatics 4- Blood vessels including the Batson venous plexus (Valveless veins which are connected to the thoracic veins (which have a negative pressure). Because batson veins are valveless, this negative pressure is passed on the epidural space. We know we are in the epidural space when we come upon negative pressure (it is difficult to pass the needle).







Important picture:
Once penetrated ligamentum flavum only: epidural block. Penetrated The dura and arachnoid: Spinal Anesthesia.



Spinal anesthesia

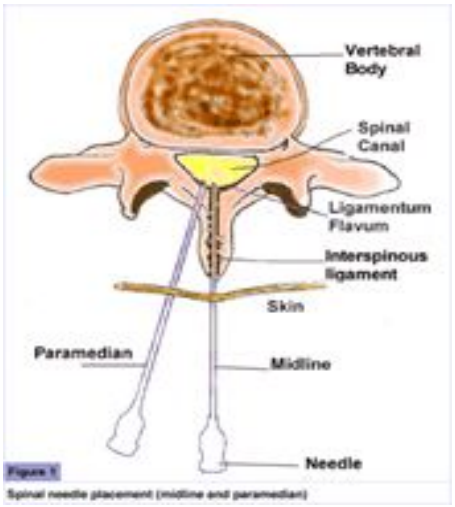
- Type of the central (neuraxial) blockade where injection of **small amounts 2-3 ml** of local anaesthetics into the CSF at the level **below L2** where the spinal cord ends, **anesthesia of the lower body part below the umbilicus (T10) is achieved.**

Indication	Contraindications	
Operations below the umbilicus:	**Absolute:**	**Relative:**
• Most commonly used in C-sections (decreased maternal death 20 times with it) • hernia repairs • gynaecological, urological operation pelvic operations • orthopedics Unilateral hip replacement (not bilateral because bilateral takes a long time). Knee, Femur • any operation on the perineum or genitalia. • Short operations, no longer than 2-3 hours (single shot)	• **Refusal** (most definitive contraindication) • Infection like bed sores or abscess around the site involved (to not carry infection into CSF) • **Coagulopathy & anticoagulated patient.** Patient is on warfarin, has a prosthetic valve, hemophiliac, because its a closed space, a small amount of blood will cause hematoma and cause compression. • Severe hypovolemia spinal anesthesia cause sensory and motor and sympathetic, causing vein dilation and low BP even more. • Increased ICP causes herniation • Severe aortic or mitral stenosis (they face difficulty dealing with the sympathetic effect)	Use your best judgment

Spinal technique

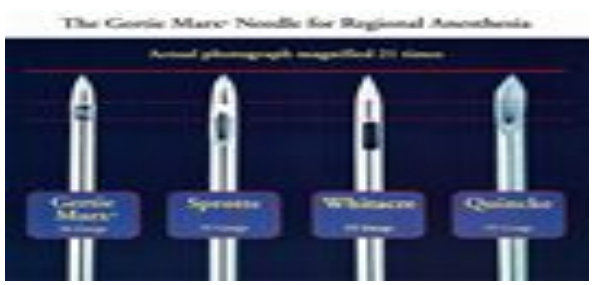
- **Sterility**
- I.V cannula for 1 liter of crystalloid preloading and for the possible need for fluid resuscitation in case of hypotension. Monitoring: 5 or 3 ECG, pulse oximetry, BP cuff.
- **Position: Sitting or Lateral decubitus.** In both cases their back must be curled forward in order to widen the intervertebral disc spaces. Example of who would benefit to be in lateral decubitus: Femur fracture patient.
- **Single shot technique** Assign Intercrestal Line

Midline Approach	Paramedian or Lateral Approach
1. Skin 2. Subcutaneous Tissue 3. SupraSpinous ligament 4. Interspinous ligament 5. Ligamentum flavum 6. Epidural space 7. Dura mater 8. Arachnoid mater 9. Intrathecal space	Same as midline excluding supraspinous & interspinous ligaments. 1 cm right or left of the midline, you'll bypass all these structures and go from skin directly to ligamentum flavum. Sometimes we use this when patient is not able enough to bend forward)



Needle types

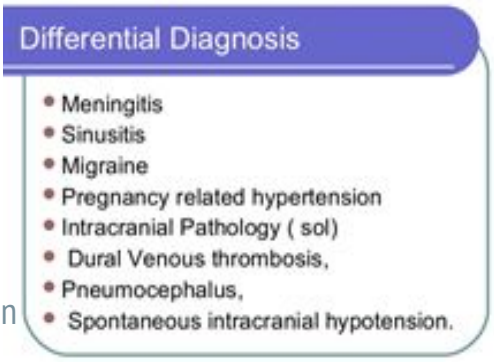
- Mainly two types: Quincke and pencil point (eg. Gertie marx, sprotte and whitacre are all called pencil point)
- **Pencil point needles are better in terms of post dural puncture headache** because when they penetrate the dura they only separate it rather than creating a hole behind that leaks CSF.
- You need to choose a large gauge(small diameter) needle to reduce the risk of post-dural puncture headache. We usually use 27 gauge pencil point needles.
- Young females are prone to Post-Dural Puncture Headache (PDPH) so it is quite common in obstetric procedures.



Post-dural puncture headache (PDPH) MCQs

- A side effect of spinal anesthesia.
- Develop 12-48 hours after **spinal** anesthesia
- Related to the puncture size.
- Headache improve when lying supine.
- Increases when standing upright. If not then it is not a PDPH.

PDPH occurs with spinal anesthesia because the dura is punctured, meanwhile in epidural the dura is not.



- **Mechanism:** Persistent **leakage of CSF** Leading to: the leak depends on : Gauge size and tip design
  - 1. **Decrease in CSF volume>** Shift of intracranial contents > stretching the meninges,
  - 2. **Decrease in CSF pressure>** Activating adenosine receptors > vasodilation of intracranial vessels.
- Monro law: the volume in the cranial cavity consists of fixed brain matter, CSF, blood.
- If the CSF decreases so the blood will increase, meaning we have vasodilation = headache. Giving caffeine will cause vasoconstriction and the patient will feel better.

- **Treatment:**
  - **Conservative**: by giving fluids, caffeine, abdominal strap, painkillers.
  - **Epidural blood patch:** if pt did not improve with conservative treatment.

Epidural Blood Patch: Taking the patient's own blood and closing the puncture site with it(go above the spinal level and inject (the fibrin and other blood products will close the defect and the relief happens almost immediately).

Factors affecting the level of spinal anesthesia:

Most important factors:

1. **Baricity** of anesthetic solution (relative to CSF) detailed in the table next slide
2. **Patient positioning**: During and immediately after injection
3. **Drug dosage**
4. **Site of injection.**

Other factors:

- Age
- Curvature of spine
- Intra-abdominal pressure
- Patient height
- CSF
- Drug volume
- Needle direction
- Pregnancy

Baricity (a concern only in spinal anesthesia)		
Hyperbaric >1.007 (Heavy)	**Hypobaric** <1.003	**Isobaric**
Typically prepared by mixing local with **dextrose**	Prepared by mixing local with **sterile water**	Neutral flow that can be manipulated by positioning Increased dose has more effect on duration than dermatomal spread. We don't use it in spinal. In epidural anesthesia the baricity doesn't matter so we use an isobaric solution.
Flow is to most dependent area due to gravity Very predictable spread The drug is liquid and CSF is also liquid. In case of spinal anesthesia we give hyperbaric drug because we want the drug to sink down by gravity. We don't want the drug to float upward toward the brain otherwise the patient might be paralysed.	Flow is to highest part of CSF column.	
Hyperbaric bupivacaine 0.5% (heavy) (commercial name: Marcaine) Q) is used in ? SA • Sterile, clear • **Preservative free** • **3 ml ampoules** • See the expiry date • Be sure it is **bupivacaine**??		**Isobaric bupivacaine** (20 ml) Slow onset (30 min), less dense block. Used for epidural anesthesia.

Note: Be cognizant of high & low regions of spinal column

Differential block of local anesthetic:

C. Classification of nerve fibers (in humans)

Fiber type	Function according to fiber type (Lloyd and Hunt types I–IV)	Diameter (μm)	Conduction rate (m/s)
Aα	Skeletal muscle efferent, afferents in muscle spindles (Ib) and tendon organs (Ib)	11–16	60–80
Aβ	Mechanoafferents of skin (II)	6–11	30–60
Aγ	Muscle spindle efferents	1–6	2–30
Aδ	Skin afferents (temperature and "fast" pain) (III)		
B	Sympathetic preganglionic; visceral afferents	3	3–15
C	Skin afferents ("slow" pain); sympathetic postganglionic afferents (IV)	0.5–1.5 (unmyelinated)	0.25–1.5

(After Erlanger and Gasser)

Table 3: Types of neurons blocked with local anesthetics

Important

Neuron type	Function	Myelination	Order of Blockade	Signs of Blockade
A alpha	Motor -skeletal muscle	Myelinated	Fifth	Loss of motor function
A beta	Sensory – touch, pressure	Myelinated	Fourth	Loss of sensation to touch and pressure
A gamma	Motor - muscle spindles proprioception	Myelinated	Third	Loss of proprioception
A delta	**Fast pain temperature**	**Myelinated**	**Second**	**Pain relief, loss of temperature sensation**
B	Autonomic, Pre-ganglionic sympathetic	Myelinated	First	Increased skin temperature
C	**Slow pain, autonomic, postganglionic sympathetic, polymodal nociceptors**	**Unmyelinated**	**Second**	**Pain relief, loss of temperature sensation**

- Spinal nerve is a combination of: sensory (different types) and motor and autonomic.
- Autonomic part is two types preganglionic B Fibers and postganglionic C fibers.
- Postganglionic autonomic nerve fibers in the sympathetic and parasympathetic nervous system are unmyelinated as are C-sensory nerve fibers that support temperature sensation and slow pain. Preganglionic autonomic fibers and sensory fibers involved in cold and pain sensation are small myelinated nerve fibers.
- A fibers are motor and are heavily myelinated.
- The different types of fibers in the table above have different sizes and myelination, thus, sensitivity to local anesthesia is different between them. This result in **"differential block"**
- **With local anesthesia, B fibers are affected first, then C and A delta together, then A beta, lastly myelinated motor A alpha fibers.**
- So the first thing we see is vasodilation and redness and warmth of lower limb because "B" affected first (below the injection) while the hands become cold to compensate
- Secondly, cold and pain sensation are lost together (because of C and A delta fibers are affected together).
- Lastly, A alpha motor function is affected.

To summarize:

- A delta (sensory): small, myelinated/ A alpha (motor): big, myelinated
- B fibers (sympathetic)/ C fibers: small, unmyelinated
- Note that Alpha is the last one to get blocked **but the first one that gets back**!
- B fiber is the first to be blocked and the last to get back (most sensitive)

Sympathetic, Sensory & Motor Blockade

Spinal Injection:

- **Sympathetic** block is 2 dermatomes **higher** than sensory block
- **Motor** block is 2 dermatomes **lower** than sensory block
- **Detect the sensory level by cold sensation test (Ice cubes).**

Block Order: B> C= A delta > A Beta > A alfa

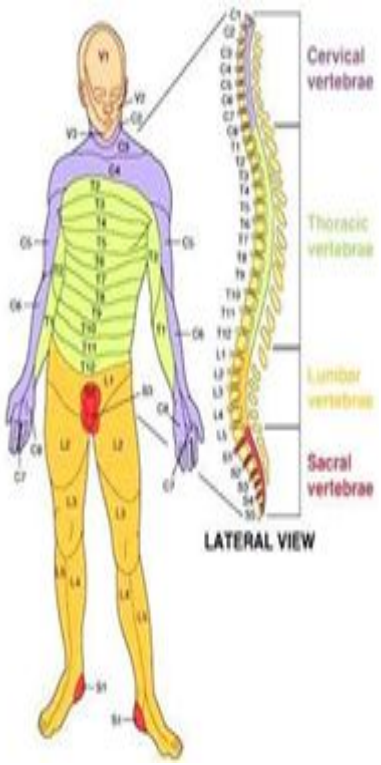
- if we want to check which level the block have reached then we asses cold sensation. So we take an ice cube and asses where the patient cannot feel it anymore.
- Assessing the level is possible for cold sensation while it is difficult to asses to which level motor and sympathetic function is preserved.
- We can estimate roughly the level of motor and sympathetic block. How?
  - Two segments above the last cold sensation felt is the sympathetic block.
  - Two segments below the last cold sensation felt is the motor block.

Example: if level of sensory block was found on T4(nipple) then sympathetic block is estimated to be at T2. this is a problem because that area may affect cardiac acceleration nerves and cause bradycardia and profound hypertension.

Another example: If he couldn't feel it at T8 then sympathetic block is at T6 and motor block is at T10.

Spinal Anesthesia Levels (*You must know dermatomes*)

Dermatome	Application
C_4 (clavicle)	Chest surgery
T_4 - T_5 (nipples)	upper abdominal surgery
T_6 - T_8 (xiphoid)	intestinal surgery, appendectomy, gynecologic pelvic surgery, and ureter and renal pelvic surgery
T_8 (lower border of ribcage)	Abdominal surgery
T_{10} (umbilicus)	transurethral resection, obstetric vaginal delivery, and hip surgery
L_1 (inguinal ligament)	transurethral resection, if no bladder distension, thigh surgery, lower limb amputation
L_2 - L_3 (knee and below)	foot surgery
S_2 - S_5 (perineal)	perineal surgery, hemorrhoidectomy, anal dilation



T12, L1 = Pubic Area

Complications

The most common side effect of spinal anesthesia is hypotension not PDPH.

- Failed block
- Back pain
- 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, Fluids, Caffeine, Blood patch
- Epidural hematoma if patient is on anticoagulants.
- Epidural abscess in immunocompromised or with improper aseptic technique.
- Meningitis
- Cauda equina
- Neurological deficit
- TNS. Transient neural stimulus, pain in buttocks, then analgesia, then nothing.
- Bradycardia--- Cardiac arrest
- **Hypotension (MOST COMMON COMPLICATION** almost must happen if the anesthesia is working! That's why they put predosing IV line before starting)
- **Best way to treat hypotension is physiologic not pharmacologic**
    - **Primary Treatment:** Increase the cardiac preload using large **IV fluid (Ringer's Lactate) bolus** within 30 minutes prior to spinal placement, minimum 1 liter of crystalloids
    - **Secondary Treatment:** Pharmacologic **vasopressor** agents (5-10 mg **Ephedrine** or phenylephrine). Pharmacological treatment is incase i can't give crystalloid preloading like in cardiac patients or if physiologic treatment fails.

The mechanism is similar to inferior vena cava syndrome in pregnant women, but because we already have venodilatation from the anesthesia the hypotensio is very severe. So we always do Left Uterine Displacement by either putting a wedge or make the table raised on the left side so it is higher

Epidural anesthesia

- Administered with patient in C-shaped position
- **Loss of resistance technique** to saline or air. For precision, while advancing the needle we support the needle by putting 3 fingers on patient back preventing accidental unwanted extra push of needle… we stop advancing the needle one loss of resistance noticed.
- **Catheter technique:** Continious shot , stays for days. The catheter should stay 5 cm inside the epidural space, so if we get to the epidural space (by loss of resistance) at 5.5 cm then we insert the catheter in 10.5 cm. If more than 5 cm it could migrate, if less it could get dislodged.
- **Isobaric bupivacaine** (20 ml), **Slow onset (30 min) ,Less dense block** unlike spinal which has immediate response, more dense
- **Touhy needle.** Has a wing, large facet tip needle (tip faces up), 18 gauge. In spinal : Quinke or pencil Tip

Epidural Test dose: (IMP in OSCE)

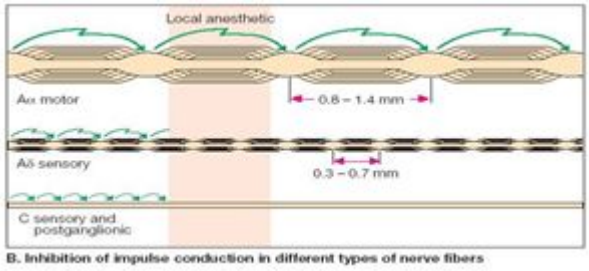
- After checking the catheter > Careful aspiration, NO blood or CSF
- 3 ml Lidocaine 1.5% mixed with epinephrine 5 micg/ml (they are the markers)
- With careful monitoring, give the epidural injection 15-20 ml bupivacaine in allequete.

20 ml is a large quantity if it gets inside the vessels it will cause local anesthesia systemic toxicity (LAST) so we need a test dose "ذواقة"
Mention in OSCE that ECG, BP cuff, pulse oximeter and IV line preloading are attached before beginning and coagulation profile and immunology tested. Then We inject the preparation (3+5 mentioned above) and look for tachycardia, if it happens then I am inside a vessel (Intravascular Injection). If no tachycardia and no increase in BP (20 above systolic) so I am safe. Then I ask the patient to move his legs, if he cannot then I am in the intrathecal space (if I didn't test and injected all amount then total spinal anesthesia happens!).(Intrathecal Injection)
If no change in BP and limb is moving then continue injecting 5, 5, 5... etc until 20 ml reached.
Test dose only used for epidural.

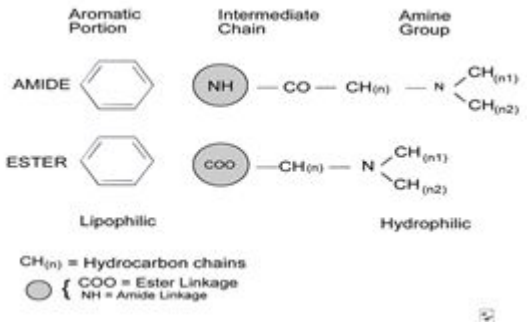
Local anesthetics

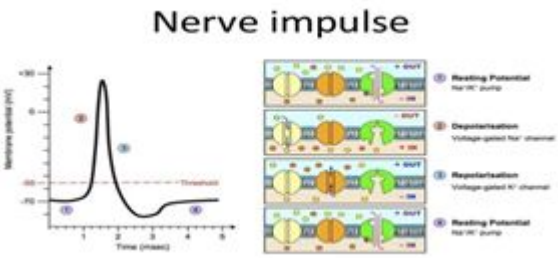
TABLE 2. Local anesthetics

AMIDE GROUP	ESTER GROUP
Lidocaine	Cocaine
Mepivacaine	Procaine
Bupivacaine	Chloroprocaine
Etidocaine	Tetracaine
Prilocaine	



B. Inhibition of impulse conduction in different types of nerve fibers





Mechanism of action:
Un-ionized local anesthetic diffuses into nerve axon > ionized form > binds the receptors of the Na channel in the inactivated state.
It blocks voltage gated sodium channels from **inside cell** (by the amine group in the anesthetic agent).

1. Duration of action:

- The degree of protein binding is the most important factor
- Lipid solubility is the second leading determining factor
- Greater protein bound + increase lipid solubility = longer duration of action

2. Toxicity & Allergies

- **Esters:** Increase risk for allergic reaction due to para-aminobenzoic acid produced through ester-hydralysis not used anymore
- **Amides:** Greater risk of plasma toxicity due to slower metabolism in liver. We use it with caution. DON'T exceed the dose

Local Anesthetic Systemic Toxicity (LAST)

1. **Can be due to:**
   - **Exceeding the maximum safe dose**:
     - Bupivacaine (2mg/kg), instead we give 4mg
     - Lidocaine (5mg/kg).
     - Lidocaine + adrenaline (7mg/kg).
   - **Intravascular injection**

     More dangerous, regardless of the dose and happens within seconds. Related to CMAX (acceleration, or rate of rising of local anesthesia level in plasma)

     ممكن أحد من تركيز 15 يجيه LAST بينما شخص ثاني وصل 20 وما تأثر. السبب هنا هو الأول يصير عنده بسرعة بينما الثاني ببطء . فهو بسبب CMAX وليس مقدار المادة. بالتالي CMAX أخطر شيء

2. **Manifestations:**

- CNS: activation phase first (as tingling, agitation…) then depression phase (as loss of consciousness…)

  First the patient will experience oral numbness then blurred vision then becomes unresponsive, then convulsions then coma.
- CVS: activation 1st then depression
  - Tachycardia and hypertension.
  - Hypotension
  - Wide QRS
  - VF
  - Cardiac arrest

Tachycardia ⟶ supraventricular tachycardia

⟶ wide QRS ⟶ ventricular fibrillation

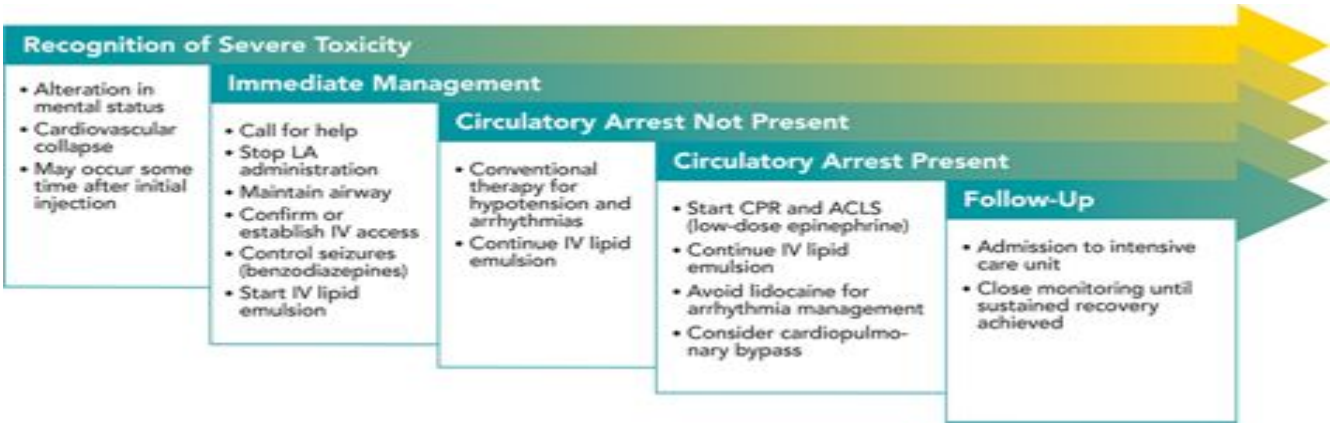
⟶ arrest

BOX 1 *Manifestations of Systemic Toxicity*

Minor (Associated With Low Plasma Levels)	Major (Associated With High Plasma Levels)
■ Perioral numbness	■ Sudden loss of consciousness
■ Facial tingling	■ Tonic-clonic seizures
■ Restlessness	■ Cardiovascular collapse
■ Tinnitus	■ Cardiac arrest
■ Metallic taste	
■ Vertigo	
■ Slurred speech	

LAST Management

- ABC (maintain airway, CVS support)
- Control Seizures (midazolam/ benzodiazepines)
- Give Lipid emulsion (20% so 200 mg) effusion then start CPR.
- How does lipid emulsion work? It builds up lipid phase in plasma, thus it will pull the drug from the receptors to plasma.



How to calculate the maximum dose of local anesthesia?

Q1: A patient is 50 kg. How much is the maximum dose of (bupivacaine 0.5%)?
A: maximum dose of bupivacaine is 2mg/kg.
Multiply it by patient's weight: 2(mg/kg) **x** *50kg* =100 mg
convert drug concentration in percentage to mg/ml by multiplying x10 (0.5%x10=5mg/ml)
Now divide 100mg ÷ (5mg/ml)=20 ml

Q2: *A patient is* 50 kg. *How much is the maximum dose of (Lidocaine 2%)?*
A: maximum dose of Lidocaine is 5mg/kg. Multiply it by patient's weight: 5(mg/kg) **x** 50kg =250 mg
convert drug concentration in percentage to mg/ml by multiplying x10 (2%x10=20mg/ml)
Now divide 250mg ÷ (20mg/ml) = 12.5 ml

Comparison between spinal and epidural anesthesia

Spinal anesthesia	Epidural anesthesia
Hyperbaric anesthetic	Isobaric anesthetic
Spinal cord not isolated from agent so: - Small amount of drug injected (2-3ml) - Gives rapid action after injection	The anesthetic agent has to distribute within dural cuffs in different levels so: - Bigger amount of drug needed (around 20) - Takes around 30 minutes to give action
Must be injected below L2	No limit
Single shot (effect may last 2-3 h)	Catheter (effect may stay longer as desired)

Questions

Q1: Which one of the following is suitable local anesthesia for spinal block?
A. Procaine
B. Cocaine
C. Bupivacaine
D. Tetracaine

Q2: A known case of coagulopathy for emergency cesarean section due to placental abruption. What is your anesthesia plan for this patient?
A. Spinal Anesthesia
B. General Anesthesia With Inhalational Induction
C. Combined Spinal And Epidural
D. General Anesthesia With Rapid Sequence Induction

Q3: which is the most vascular layer during passage of a spinal needle ?
A. Epidural Space
B. Ligamentum Flavum
C. Intrathecal Space
D. Subdural Space

Q4: which of the following is true regarding to the epidural space?
A- 3-6 mm potential space
B- extend from foramen magnum to lower border L1 C- surrounded by the meninges
D- laterally is bounded by the ligamentum-flavum

Q5: what is the factor affecting local anaesthesia drug duration ?
A- aka of the drug
B- protein binding
C-lipid solubility
D- rate of diffuse across the dura

Q6: A 29 y/o patient booked for elective low segment CS , which one of the following is the best anaesthesia technique ?
A- caudal anesthesia
B- general anesthesia
C- spinal anesthesia
D- thoracic epidural anesthesia

Q1:A, Q2:D, Q3:A, Q4:A, Q5:B, Q6:C

Thank You

Lamis Alsuwailem

Ghada Alqarni

Hadeel Awartani

Sarah Alkathiri

Revised by : Rotana Khateeb

Special thank you to
436 team