

# 8. Regional Analgesia and Anesthesia

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## Anesthesiology



■ From slides ■ Doctor's Notes ■ Team's Notes ■ From the book ■ Important

**REGIONAL/NEURAXIAL ANESTHESIA:**

Reversible loss of sensation in a specific area of the body.

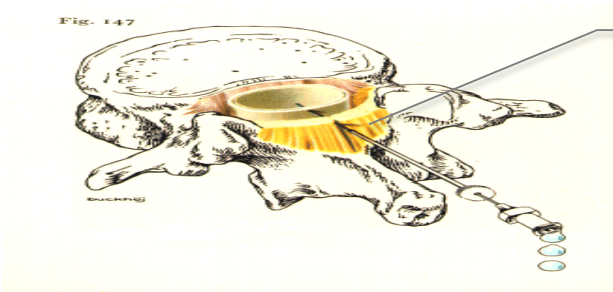
- Bier block
- Ultrasound guide peripheral nerve block , Ankle block
- Neuroaxial block :Spinal, Epidural, Caudal

It is not use now... For more information  
<http://www.nvsora.com/techniques/3071-bier-block.html>

**DEFINITIONS:**

- **SPINAL ANESTHESIA (INTRATHECAL):**

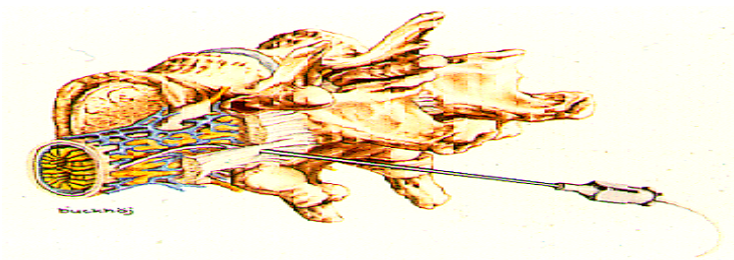
Administration of medication into subarachnoid space ( intrathecal space )



Ligament of flava or  
 ligamentum Flavum

- **EPIDURAL ANESTHESIA:**

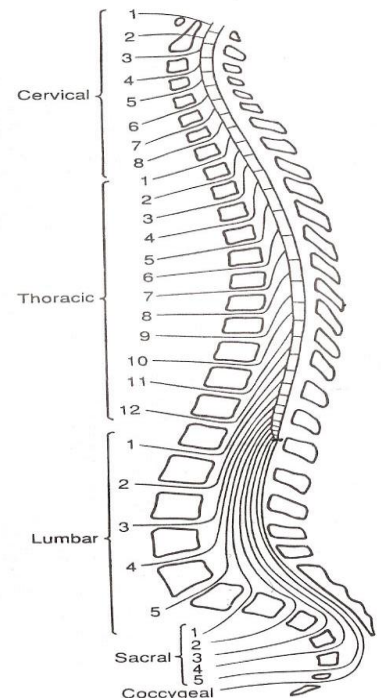
Administration of medication in epidural space



**OVERVIEW OF THE SPINAL ANATOMY**

The vertebrae are 33 number, divided by structural into five region:

Cervical 7	Use for thoracic and higher abdomen surgery
Thoracic 12	
Lumber5	Spine end in L1-2. To locate use iliac crest, at its level the L4 located
Sacral 5	
Coccygeal3-4.	At S5 the sacral hiatus site of caudal, which is use most commonly in pediatric



## SPINAL CORD

Located and protected within vertebral column extends from the foramen magnum to lower border 1<sup>st</sup> L1 (adult). Spinal Cord tapers to a fibrous band - conus medullaris. Nerve roots continue beyond the conus- "cauda equine", Surrounded by the meninges, (dura, arachnoid & pia mater). The spinal cord becomes the cauda equina at the level of L2 in an adult and the cerebrospinal fluid stops at the level of S2.

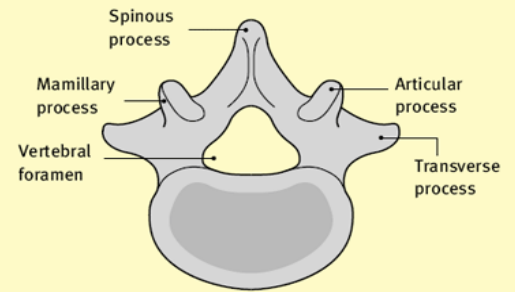
The epidural space is 3–6 mm wide

### The contents of the epidural space are:

- Nerve roots
- Venous plexus
- Fat
- Lymphatic

The spinal anesthesia work in 1 – 2 min because it act on naked nerve root unlike the epidural takes longer "20 – 30" because it act on covered nerves.

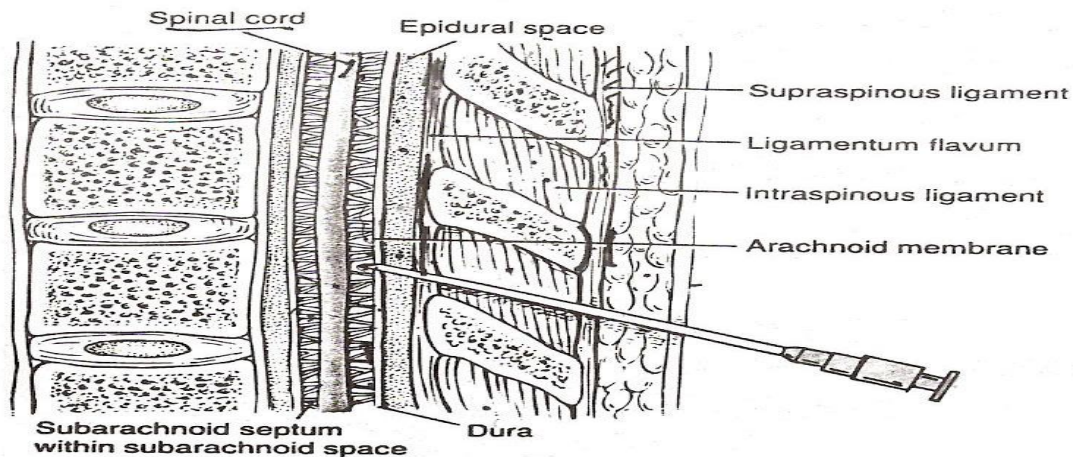
A typical lumbar vertebra: superior aspect



The veins contain no valves and communicate directly with the intracranial, thoracic and abdominal venous systems.

## EPIDURAL ANESTHESIA:

### ANATOMY:



## INDICATIONS

- The objective of epidural analgesia is to relieve pain in :
  - intraoperative & postoperative Major surgery
  - Trauma (# ribs)
  - Palliative care (intractable cancer pain)
  - Labor pain analgesia

## CONTRAINDICATIONS

### **Absolute:**

- Patient refusal
- Infection at insertion side, septicemia
- **Abnormal co-agulation** profile
- Allergy to local anesthetic drug

### **Relative:**

- Raised intracranial pressure
- Chronic spinal disorders
- Used **anticoagulant drugs**
- Hypovolemia
- Central nervous system disease

### **Requirements before starting regional anesthesia:**

1. Informed consent
2. Vascular access
3. Resuscitation drugs and equipment
4. Sterility of anesthetists
5. Sterility of operative site
6. No contraindications to procedure
7. Correct dosage of local anesthetic drug

- LMWH can be given before and after 8 h surgery and the dose is 40mg.
- Warfarin stopped 3 days before surgery and monitored PT, INR.
- Heparin monitored by PTT.
- Aspirin is relative.

We preload the pt with 1L of fluid because of sympathetic block.

One of the side effect of epidural is hypotension and vasodilatation for that we use Fedrin or Phenylephrine

### **The equipment used for the insertion of an epidural catheter is:**

- Tuohy needle is either 16 or 18 gauge.

It is 10 cm long: 8 cm of needle and 2 cm of hub. It is marked in centimeters and has a curved 'Huber' tip.

- The epidural catheter has three holes , 2 cm from the end of the catheter. The catheter is marked in centimeter gradations up to 20 cm.
- The filter has a 0.2  $\mu\text{m}$  mesh that stops the injection of particulate matter, such as glass, and bacteria into the epidural space.



## Technique of insertion of an epidural catheter:

- An intravenous infusion of 500 ml of crystalloid
- Atropine and a vasopressor should be drawn up before starting the block.
- Can be done in either the lateral or sitting position spine should be flexed.
- local infiltration
- Slow controlled advance of the Tuohy needle using a syringe with loss of resistance technique by air or saline.
- The needle passes through skin, subcutaneous tissue, supraspinous ligament, interspinous ligament, ligamentum flavum, and finally enters the epidural space.
- The ligaments resist the injection of air or saline, but when the needle enters the epidural space the resistance is lost.

Patient assume a sitting or side-lying position with the back arched toward the physician. Help to spread the vertebrae apart

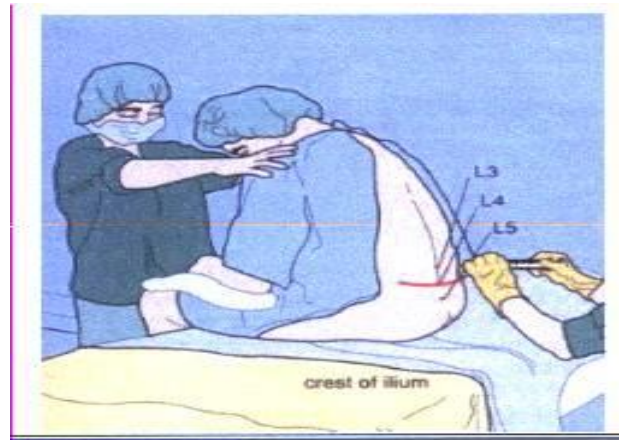
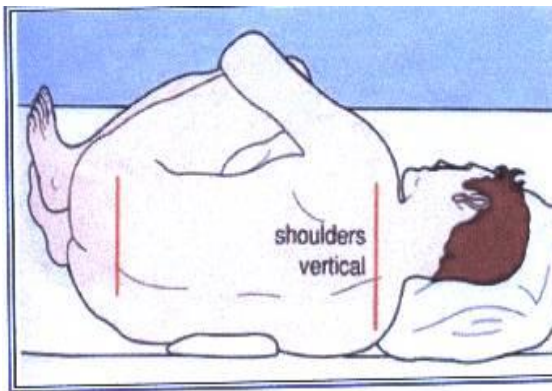
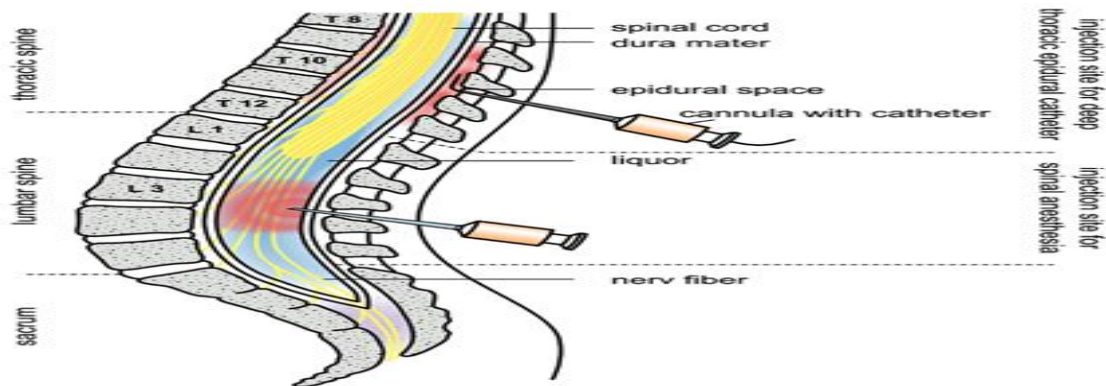


Figure 1 - method of catheter.



## INSERTION OF EPIDURAL CATHETER

Positioning of patient

The site is dependent upon the area of pain

Fixing the catheter

The epidural catheter is suitable for long surgery because of catheter that allows us to maintain anesthesia unlike the spinal last for an hour to hour and half

<u>Incision</u>	<u>Level</u>
Thoracic	T4-T6
Upper abdo	T6-T8
Lower abdo	T8-T10
Pelvic	T8-T10
Lower extremity	L1-L4

- Ideal Placement 3-5 cm catheter

### **CATHETER MIGRATION:**

A change in depth of the catheter indicates migration either into or out of the epidural space.

- Catheter migration into a blood vessel in the epidural space or subarachnoid space
  - rapid onset of neuroaxial block
  - Decrease loss of sensory or motor loss (marcain)
  - Profound hypotension
  - Toxicity
- Out of the epidural space
  - ineffective analgesia
  - no analgesia
  - drugs deposited into soft tissue.

### **COMPLICATIONS OF EPIDURAL ANALGESIA:**

Severe hypotension	Accidental intravenous injection
Dural puncture: – massive spinal anesthetic	– headache
Leg weakness	Shivering
Atonic bladder	Contraction of the small bowel
Backache	Epidural haematoma
Isolated, reversible nerve damage from catheter/needle trauma	
Epidural abscess	Meningitis

How to manage Post Dural puncture Headache?

First conservative if last more than 24h then by injection of 25 ml of blood 1 space above previous one.

Atonic bladder => put catheter if long surgery

## MEDICATION COMMONLY USED

OPIOIDS-Fentanyl +Morphine (affect the pain transmission at the opioid receptors)

L.A.-Bupivacaine(marcaine)

(inhibits the pain impulse transmission in the nerves with which it comes in contact)

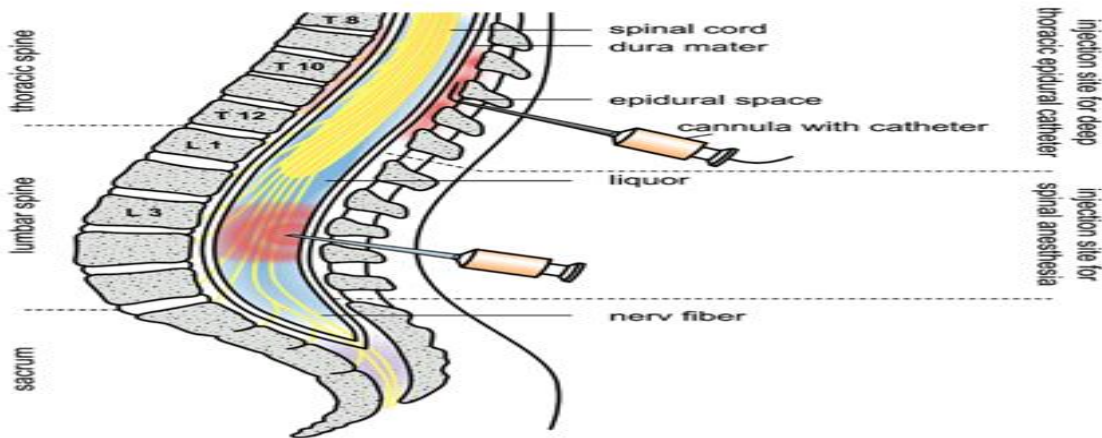
## METHODS OF ADMINISTRATION

- BOLUS (FENTANYL, DURAMORPH)
- CONTINUOUS INFUSION( bupvacaine + fentanyl )
- All drugs administered epidural should be preservative free.
- All epidural opioids should be diluted with normal saline prior to intermittent bolus administration.

In epidural, we have to do Test dose, which is 2% lidocaine with 5 microgram/ml epinephrine. If pt. have tachycardia after injection that is means, I am in vessel.

## SPINAL ANESTHESIA:

**Figure 1 - Method of CSTE A.**



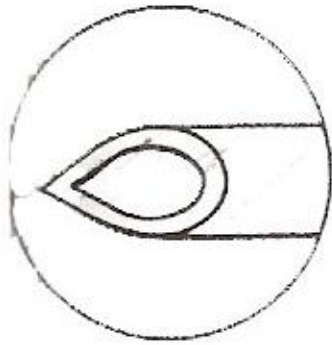
How you can know the level of anesthesia?

The nipple is T4, The umbilicus is T10, and shoulder blade is T7 and so on.

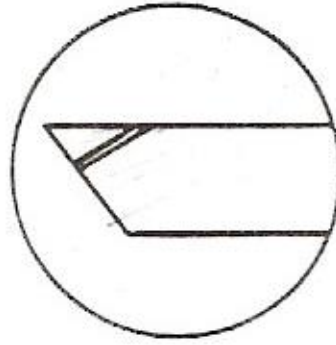
Then with Ice Bag check the level of sensation of temperature.

Note that the motor block level is 2 segments below sensory block!

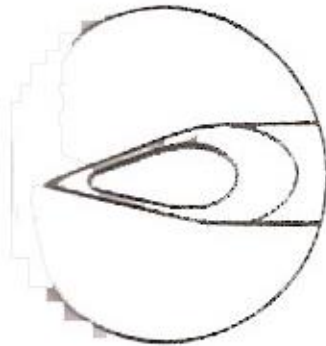
## NEEDLES:



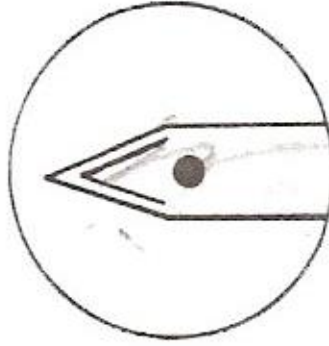
A. Quincke-Babcock



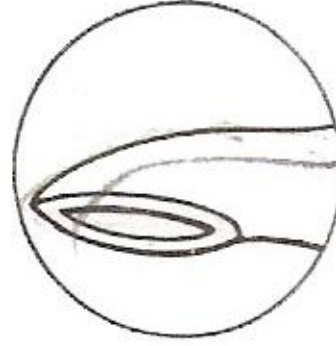
B. Pitkin



C. Greene



D. Whitacre



E. Tuohy

Note:

The needle tip and gage play the major role in post dural puncture headache

## SPINAL ANESTHESIA

Injection of local anaesthetic into the cerebrospinal fluid (CSF) by means of a lumbar puncture. It is normally given as a single injection, but can be used in conjunction with epidural anesthesia (combined spinal epidural anesthesia) for longer procedures.

Local anesthetic solutions for spinal anesthesia are isobaric or hyperbaric with respect to the CSF. Isobaric solutions are claimed to have a more predictable spread in the CSF, independent of the position of the patient. Hyperbaric solutions are produced by the addition of glucose and their spread is partially influenced by gravity.

- If we use hypobaric it will go up to the brain causing convulsions then coma.

Many factors determine the distribution of local anesthetic solutions in the CSF; this makes prediction of the level of blockade difficult ( Local anaesthetic drug , Baricity ,Dose of drug , Volume of drug ,Increased abdominal pressure ,Spinal curvatures , Position of patient, Speed of injection)

How you can know if the fluid is CSF or not?

By Glucose! CSF had glucose



## **COMPLICATIONS:**

Pain on Injection.

Backache.

Headache.

Urinary Retention.

Meningitis.

Vascular Injury.

Nerve Injury.

High Spinal Anaesthesia.

## **CAUDAL ANESTHESIA:**

The caudal space is a continuation of the epidural space in the sacral region.

The signet-shaped, formed by the failure of fusion of the laminae of the fifth sacral vertebra. The hiatus is bounded laterally by the sacral cornua and is covered by the posterior sacrococcygeal ligament, subcutaneous tissue and skin.

The epidural space is located by passing a needle through the sacral hiatus. The caudal canal contains veins, fat and the sacral nerves.

The cerebrospinal fluid finishes at the level of S2.

Caudal anaesthesia is used for operations in areas supplied by the sacral nerves, such as anal surgery and circumcision.

The precautions are the same as those described for epidural anaesthesia .

The needle must be aspirated after insertion to exclude blood and cerebrospinal fluid.

The complications are the same as for epidural anaesthesia .

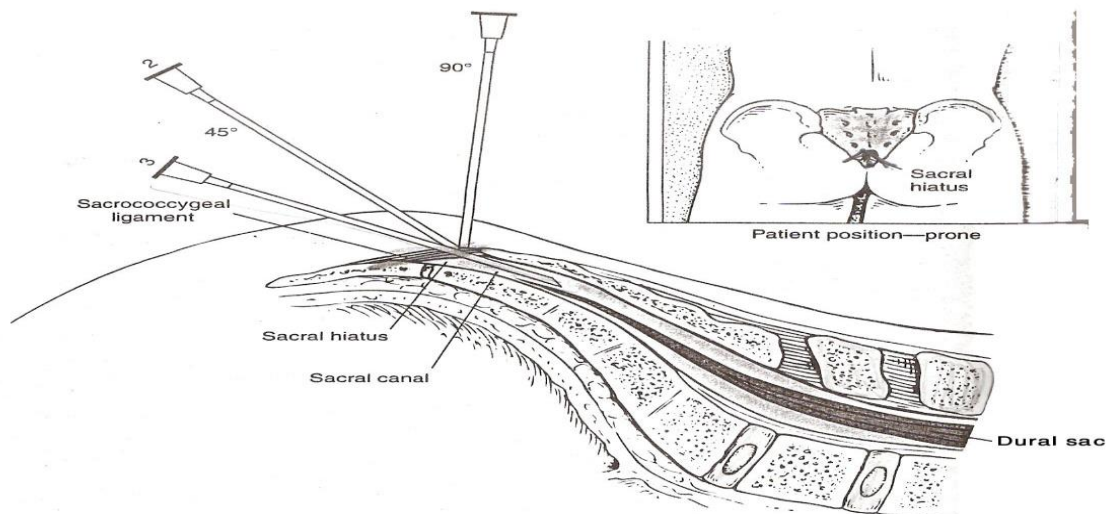


Figure 16-21. Caudal block.

## INTRAVENOUS REGIONAL ANALGESIA

A limb can be anaesthetized by the administration of local anesthetic intravenously distal to a tourniquet placed high on the limb.

This technique is used on the arm only, because the leg needs toxic doses of local anesthetics.

It is used commonly for manipulation of fractures and brief operations on the hand .

An intravenous cannula is inserted into a vein on the dorsum of the hand.

A single or double cuff is placed around the humerus. If a double cuff is used, the higher cuff is compressed first

Local anesthetic injected usually lidocaine 0.5 % 40 ml

wait until the arms anaesthetized, then the lower cuff is inflated over the numb skin to make it more comfortable for the patient.

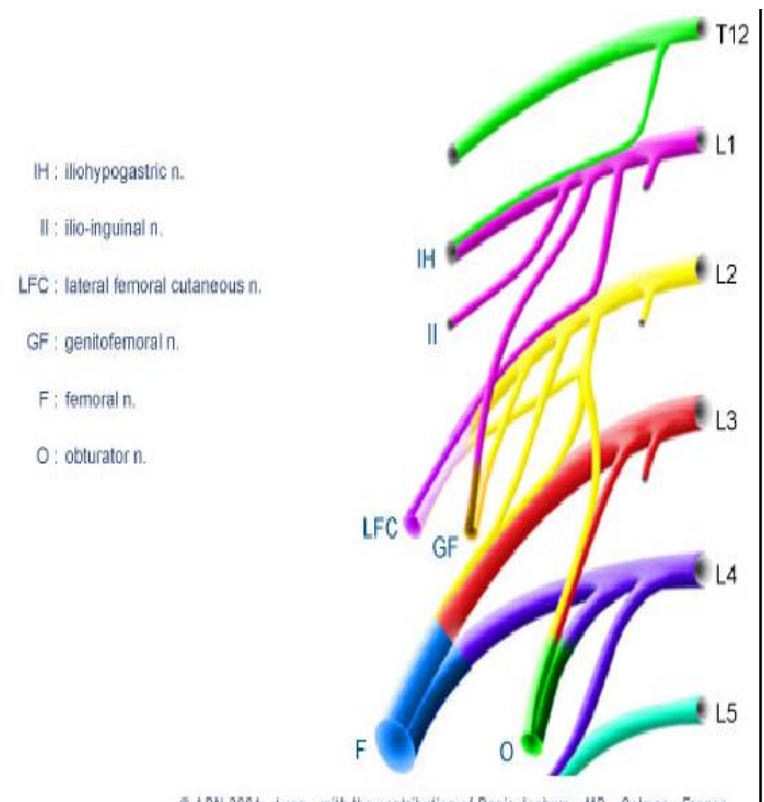
patient will often only tolerate the cuff for 45–60 min because of pain.

The cuff must remain inflated for at least 20 minutes, otherwise systemic toxicity may occur from rapid uptake of the drug when the tourniquet is released.

The main problem with this block is the tourniquet. It must not deflate accidentally.

## ULTRA-SOUND GUIDED PERIPHERAL NERVE BLOCK OR NERVE STIMULATION

### ANATOMY OF LUMBAR AND SACRAL PLEXUS:





## SELECTION OF LA

Choice of LA depends on:

Onset of action – influenced by pKa (lower the pKa, the higher the concentration of the base form of the LA and the faster the onset of action)

Duration of effects – influenced by protein binding (long duration of action when the protein binding of LA is strong)

Potency – influenced by lipid solubility (agents with high lipid solubility will penetrate the nerve membrane more easily)

## LOCAL ANESTHETICS

<u>AMIDES</u>	<u>MAX / DOSE</u>
BUPIVACAINE	2 MG/KG
LIDOCAINE	7 MG/KG
ROPIVACAINE	4 MG/KG
MEPIVACAINE	7 MG/KG
PRILOCAINE	6MG/KG

### **NOTE:**

Any fat-soluble drug it will be slower in onset and longer in duration!

## LOCAL ANESTHETICS

<u>ESTERS</u>	<u>MAX /DOSE</u>
CHLOROPROCAINE	20 MG/KG
COCAINE	3 MG/KG
NOVOCAINE	12 MG/KG
TETRACAINE	3 MG/KG

## Mechanism of Action

- Bupivacaine (marcaine)
  - local anaesthetic works as an analgesic (subanesthetic dose)
  - inhibiting impulse transmission in the nerve fibers
  - sensory nerves are blocked first before the motor fibers
  - sensory fibers carrying the pain is blocked before those carrying heat cold touch and pressure.

## **PROGRESSION OF LOCAL ANESTHESIA**

Loss of:

1. Pain
2. Cold
3. Warmth
4. Touch
5. Deep pressure
6. Motor function

## **OPIOIDS**

### **Mechanism of action-distribution**

- **Vascular uptake by blood vessels in the epidural space**
- **Diffusion through dura into CSF to spinal cord to the site of action.**
- **Uptake by the fat in the epidural space.**

### **Morphine (Duramorph/Astramorph)**

Hydrophilic(water soluble)

Slow to diffuse across the dura on to the spinal cord

Can cause late respiratory depression

Monitor respiratory status for 12 hrs after the last dose of duramorph

Duration 6 hrs+, Broad spread

### **Fentanyl (preservativefree)**

Lipophilic(fat soluble)

Crosses the dura rapidly

Rapid onset of action(segmental)

Decreased risk of late respiratory depression

Onset 5-20 mins ,Duration 2-4hrs

Excellent for breakthrough pain

### **Adverse Effects -Opioids**

- Sedation and resp.depression- IV narcans
- N/V-Opioids stimulate the chemoreceptor trigger zone promperan
- Pruritus- diphenhydramine or narcans (low dose)
- Urinary retention- low dose narcans and /or catheterization
- Slowing of GI motility
- Hypotension

## Adverse Effects L.A

- Hypotension:
  - assess intravascular volume status
  - no trendelenberg positioning
- Temporary lower-extremity motor or sensory deficits.  
Tx: lower the rate or concentration.
- Urine retention  
Tx: catheter
- Local anesthetic toxicity (neurotoxicity)  
Tx: stop infusion.
- Resp. insufficiency  
Tx: stop infusion                      ABC(100% o2, call for help)

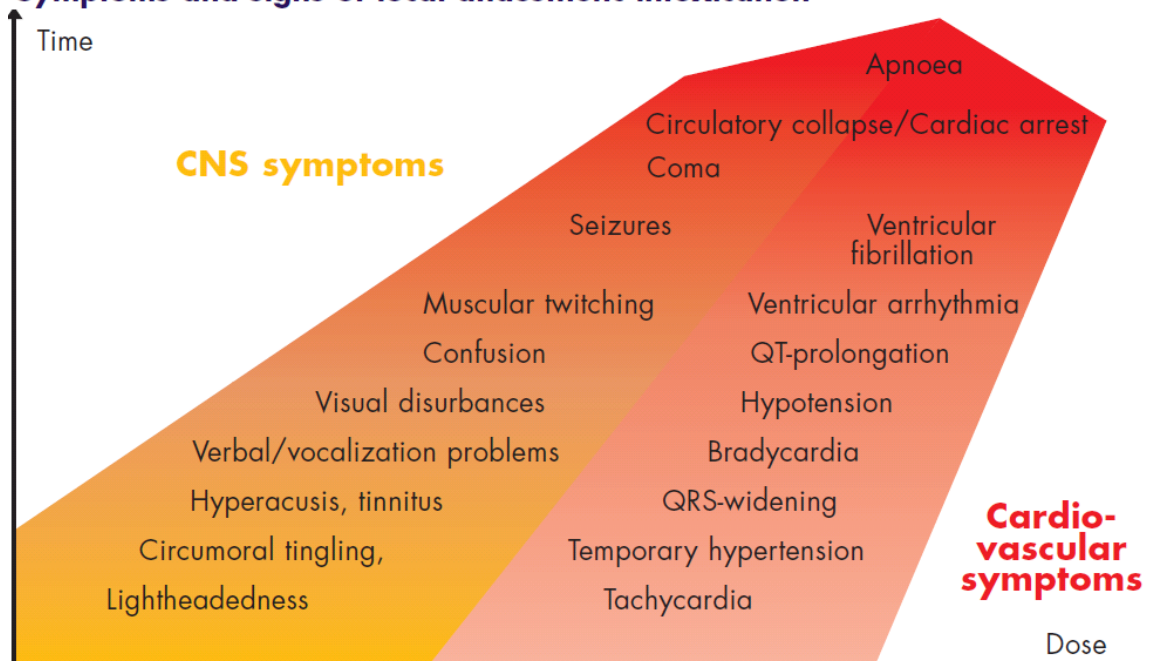
Treatment  
fluids

## LOCAL/REGIONAL ANESTHESIA TOXICITY

### Systemic Toxicity

- Occurs by accidental intravascular injection, LA overdose, or unexpectedly rapid absorption
- Manifests mainly at CNS first and then CVS

### Symptoms and signs of local anaesthetic intoxication



## PREVENTION AND TREATMENT OF LOCAL/REGIONAL ANESTHESIA TOXICITY

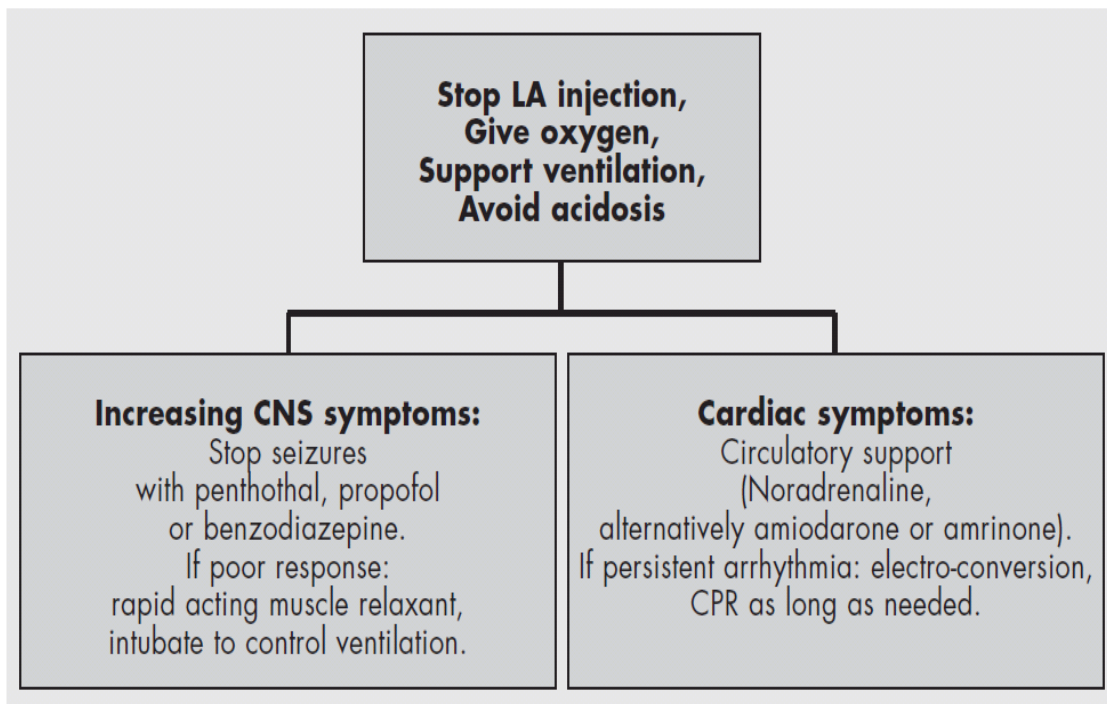
### Prevention

- Always use the recommended dose
- Aspirate through the needle or catheter before injecting the local anesthetic.
- If a large quantity of a drug is required, use a drug of low cardiac toxicity and divide the dose into small increments, increasing the total injection time
- Slow injection and communicate with the pt.

### Treatment

- Early recognition of signs
- 100% O<sub>2</sub>, manage ABCs
- Diazepam may be used to increase seizure threshold
- If the seizures are not controlled by diazepam, consider using: Thiopental, Possible endotracheal intubation .

### Treatment of local anaesthetic intoxication



Used lipid emulsion with CPR with refractory cardiac arrest with vasopressor

### NOTE:

The Idea behind using lipid emulsion is the bupivacaine is lipid soluble so that help to bring it from the heart to lipid and decrease the toxicity.