

# REGIONAL ANAESTHESIA

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- **Local anaesthetics**
  - Mode of action
  - Use
  - Toxicity
- **Regional anesthesia**
  - Types
  - Uses and benefits
  - Video

# Local anaesthetics

- Block transmission of action potentials in nerve fibers
- Sensory and motor block
- Weak bases

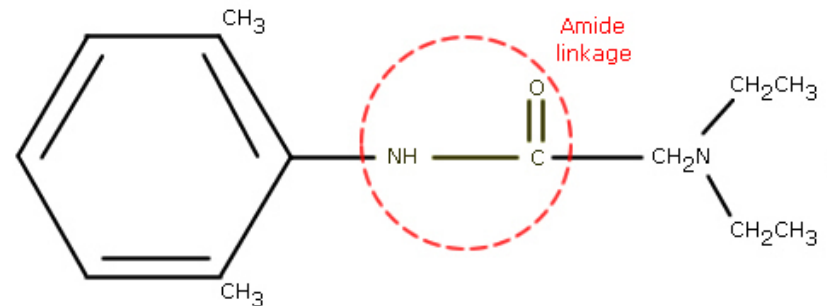
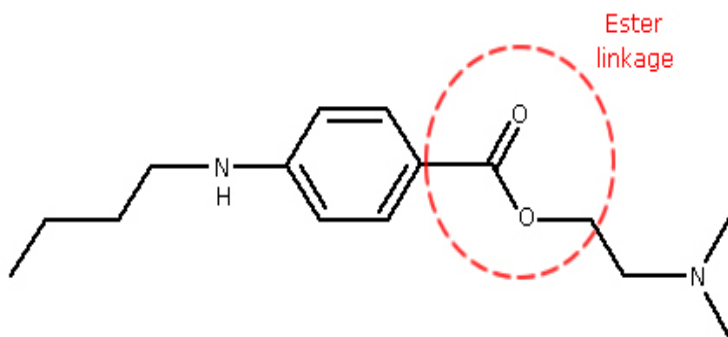


Which nerve fibres transmit pain ?



# LA - structure

Esters	Amides
procaine	lidocaine
chlorprocaine	bupivacaine
tetracaine	ropivacaine
amethocaine	trimecaine



# Pharmacokinetics

## **Esters**

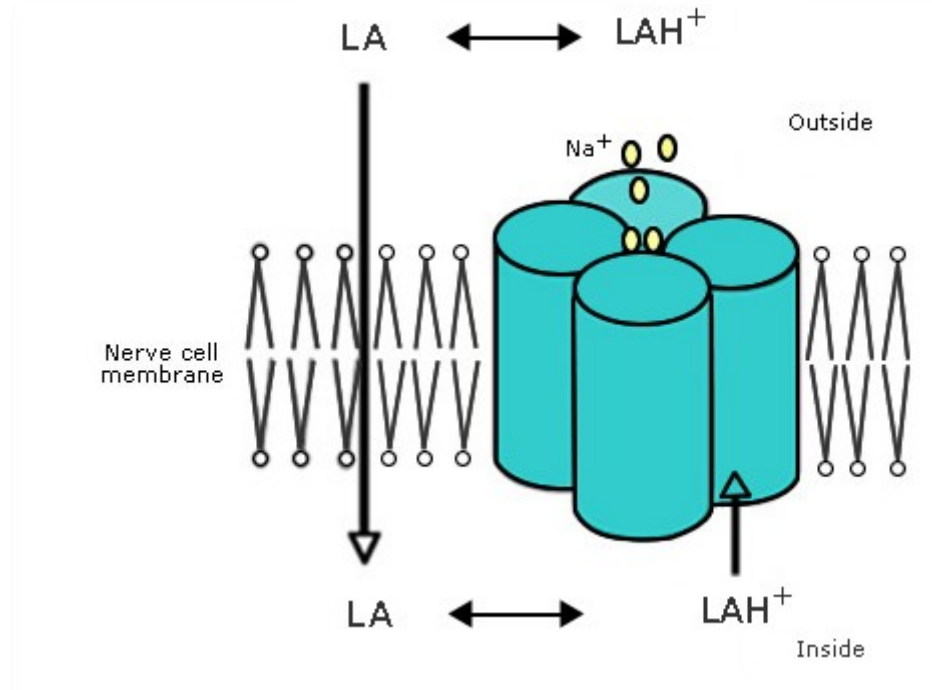
- Poorly protein bound – shorter duration of action
- Broken down by esterases
- Allergic reaction

## **Amides**

- Highly protein bound – longer duration of action
- Metabolised by amidases in the liver
- Rarely allergic reactions

# Mechanism of action

- Reversible blockade of Na channels



# Choice of LA

- Potency
- Speed of onset
- Duration of action
- Toxicity

# Potency

- Lipid solubility
  - bupivacaine is more lipid soluble than lidocaine by a factor of about nine

Lidocaine	Bupivacaine
150	1000



# Speed of onset



What determines the proportion of any drug in the ionized form compared with the unionized form?

Three factors:

- Whether the drug is a weak acid or a weak base.
- The pKa of the drug: the pKa is the pH at which the ionized and unionized forms are present in equal amounts.
- The pH of the environment.

# Speed of onset - pKa

- The higher the proportion of unionized drug, the more rapid the passage across the membrane and the faster the onset of block.

Lidocaine	Bupivacaine
7.7	8.1



**Question:** What could be done to increase the proportion of drug in the unionized form?

**Question:** Can you think of a situation when tissue pH is low and local anaesthesia may be indicated?

# Duration of action

- Protein binding
- Rate of removal from the site and subsequent metabolism
- Drug's inherent vasodilator property
- Additives - adrenaline

	<b>Lidocaine</b>	<b>Bupivacaine</b>
Protein binding	70 %	95 %
Metabolism	liver	liver

# Local anaesthetics - additives

- **Adrenaline** – decreased absorption, metabolism, toxicity
  - **CAVE** – terminal extremity
- **Bicarbonate** – faster onset of action
- **Clonidine** -  $\alpha_2$  adrenergic agonist, prolongs duration of sensory and motor block
- **Opiates** – spinal/peripheral opiates receptors
- **Ketamine** – NMDA receptor agonist, weak LA properties

# LA - complications

- Toxicity – cardiac and neuro
- Autonomic blockade
- Gangrene – with additives
- Allergic reactions – anaphylaxis
  
- Technique related

# Toxicity of LA

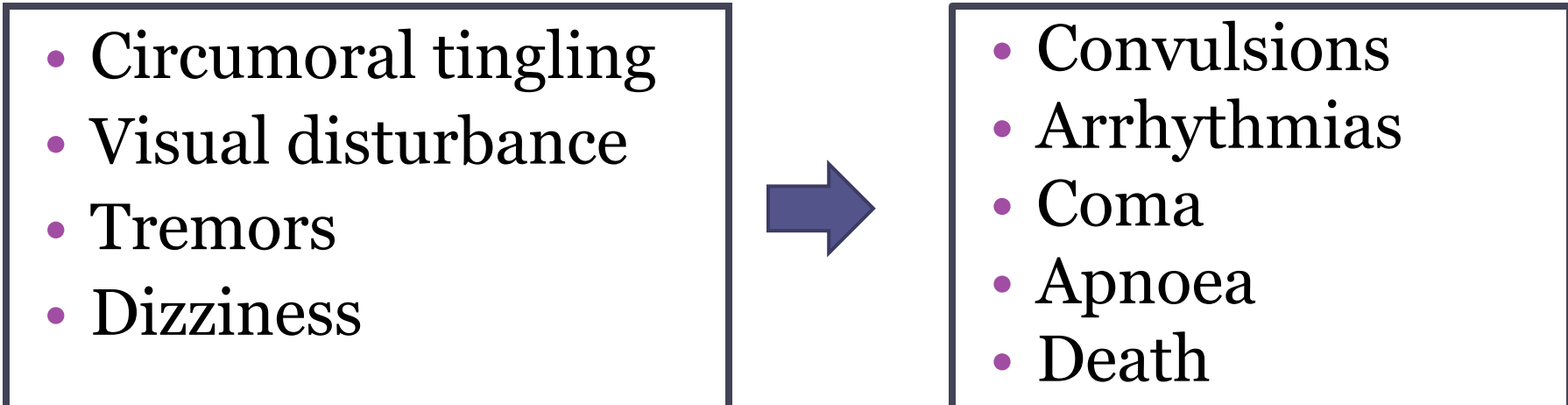
## **Cardiotoxicity**

- Block of Na cardiac channels
- Direct myocardial depressant effect
- Tachycardia may enhance frequency – dependent blockade
  
- Bupivacaine > ropivacaine > lidocaine

# Toxicity of LA

## **Neurotoxicity**

- Biphasic effect
- Inhibitory neurons are blocked – excitatory effects
- Central neurones are then depressed

- 
- Circumoral tingling
  - Visual disturbance
  - Tremors
  - Dizziness

- Convulsions
- Arrhythmias
- Coma
- Apnoea
- Death

# Management of LA toxicity

- ABC approach
- Oxygen
- Treat convulsions – diazepam, thiopentone
- Treat arrhythmias - amiodarone
- If cardiovascular collapse – start CPR
  
- Lipid emulsion



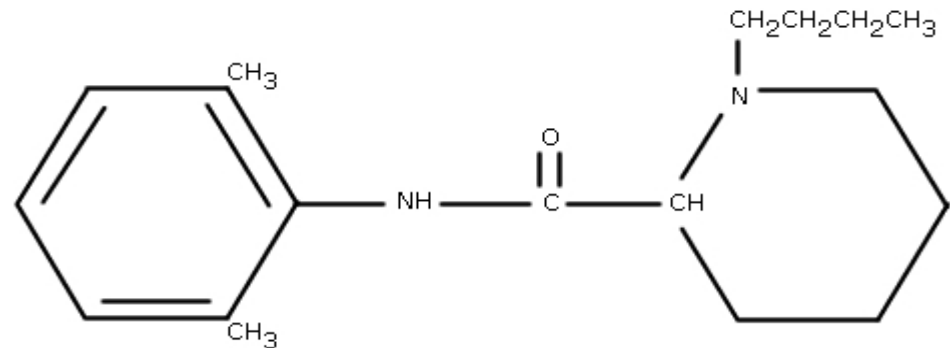
# Lidocaine, Trimecaine

- Low level of toxicity
- Lidocaine – class Ib anti-arrhythmic
- Max doses lidocaine
  - 3mg/kg without adrenaline
  - 7 mg /kg with adrenaline
- Concentrations
  - Topical 10%, 2%
  - Nerve blockade 0.5 – 1%



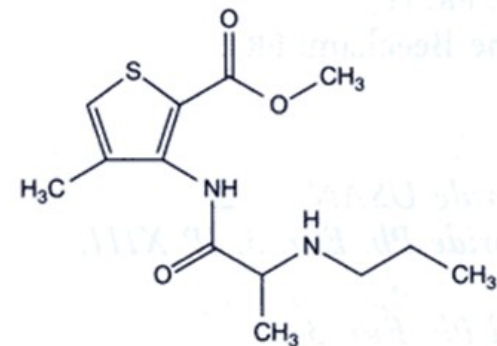
# Bupivacaine

- Slower onset
- Longer duration of action
- More toxic
- Racemic mixture
- 0.25 % and 0.5 % concentrations
- Also in combination with glucose 80 mg/ml
- Max dose 2mg/kg



# Articaine

- Fast onset
- Moderate duration of action
- Used in dentistry with adrenaline
- Concentrations - 1 - 2 %



# EMLA cream

- Eutectic mixture of local anaesthetic in cream
- 2.5 % lidocaine + 2.5 % prilocaine
- Topical anaesthesia prior cannulation

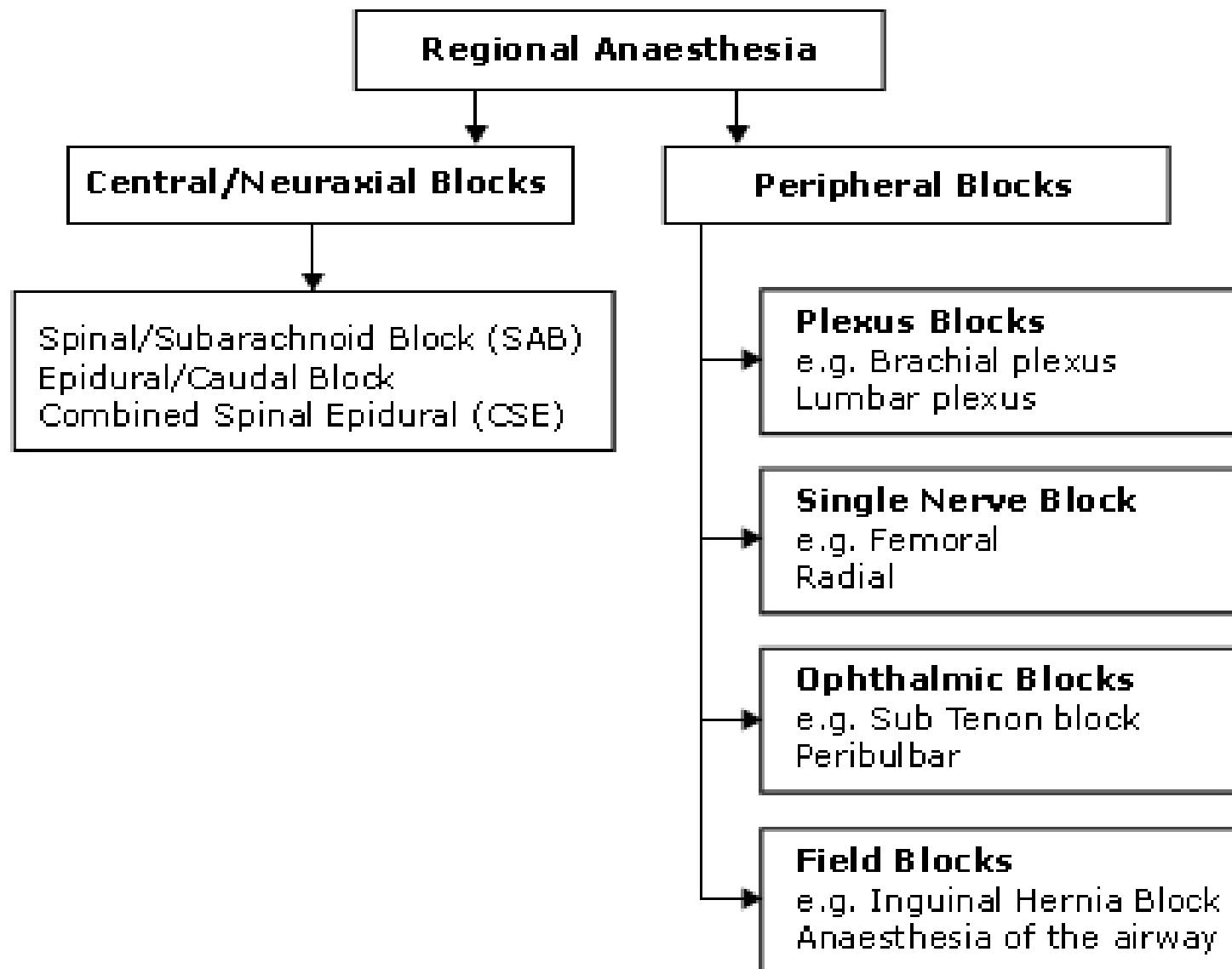


# Local anaesthetics - summary

- Esters and amides
- Onset of action – pH and pKa
- Duration of action – protein binding, vascularity
- Potency – lipid solubility
- Used with additives
- Side effects – neuro and cardiac toxicity, allergic reaction (esters)

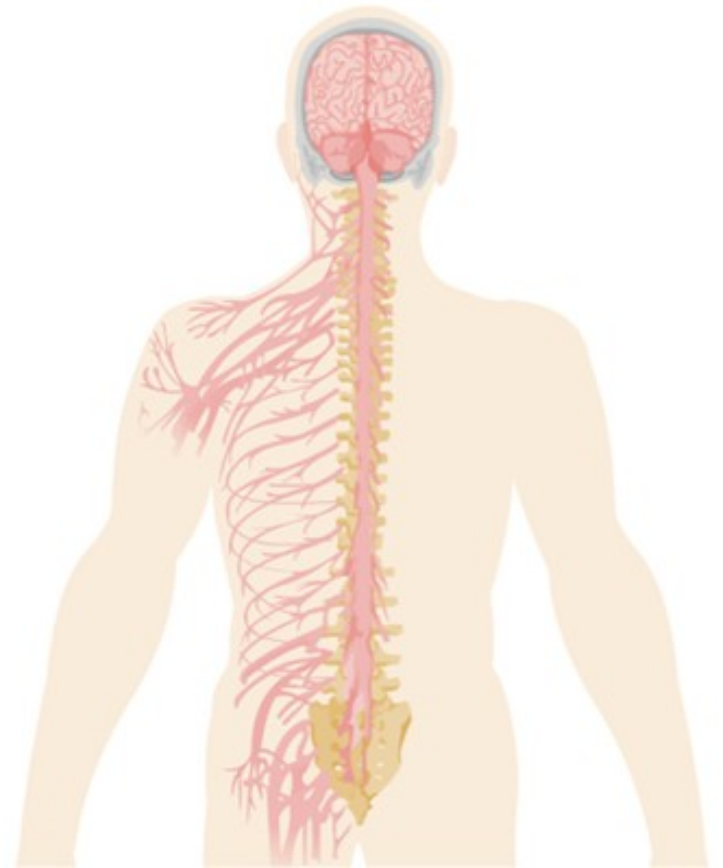
# Use of Local Anaesthetic agent

- Topically: skin, mucous membranes, gel, cream, spray
- Infiltration: for field-blocks where superficial nerves are blocked locally
- Intravenously: for intravenous regional anaesthesia (IVRA)
- Epidural or subarachnoid: for regional anaesthesia blocking spinal nerves



# When to use regional techniques

1. Patient safety
2. Patient satisfaction
3. Surgical outcome





# 1. Patient safety

- A frail elderly diabetic patient with severe COPD, requires an amputation of the fifth toe.
- Ring block
- Ankle block
- Popliteal block
- Sciatic block
- Spinal or epidural

# 1. Patient safety

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- Ring block
- **Ankle block**
- Popliteal block
- Sciatic block
- Spinal or epidural

## 2. Patient satisfaction

- Very low incidence of postoperative nausea or vomiting (PONV)
- Rapid resumption of oral intake
- No sore throat
- Good initial post operative analgesia
- Early ambulation/discharge
- Increased 'control'



# 3. Surgical outcome

- Any measure that improves safety will improve surgical outcome.
- 'awake' **carotid endarterectomy**
- 'awake' **craniotomy**
  - assess the patient's neurological status during surgery

# Preequisites for the block

- Informed patient consent incl. risks/benefits
- Discussion with the operating surgeon
- Check no contraindications to block
- Skilled assistance available
- Intravenous access
- Full patient monitoring
- Immediate access to emergency drugs/defibrillator
- Fasted patient

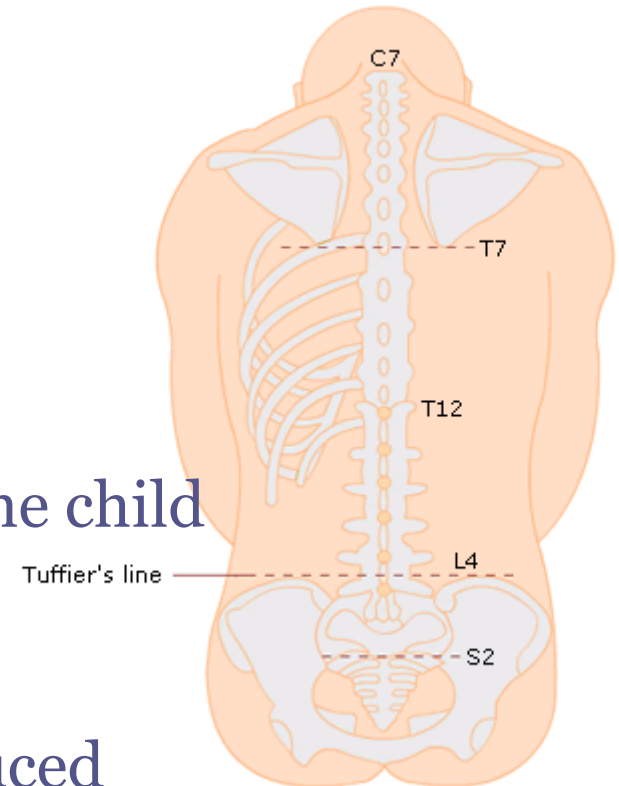
# Golden rules

- 1. Know the anatomy, the technique and the possible complications
- 2. Be prepared to fail – have a back up plan

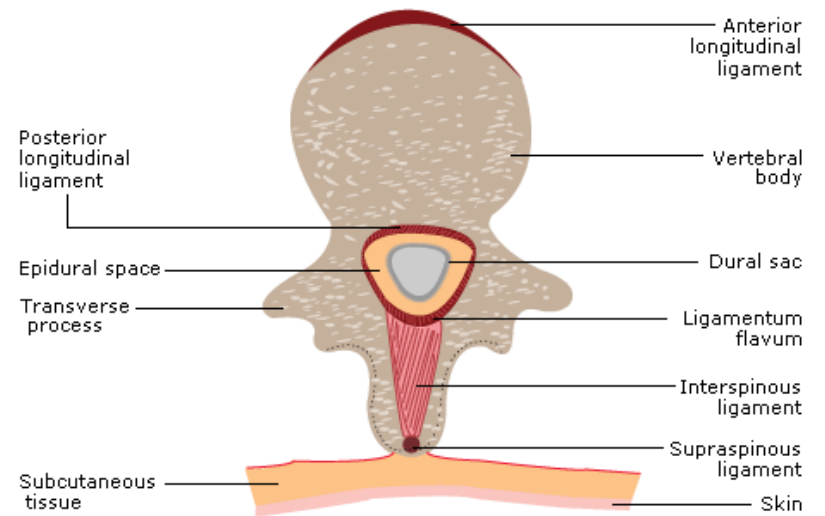
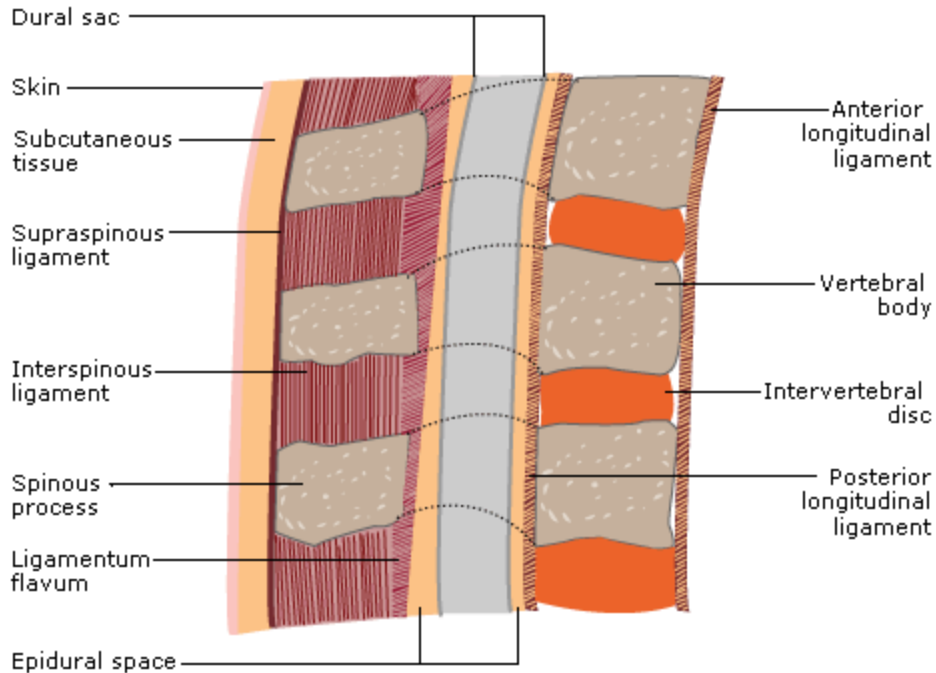
# Most common regional anaesthesia

## Caesarian section

- Patient safety
  - Control of airway
- Patient satisfaction
  - Awake during the delivery of the child
  - Presence of partner
- Surgical outcome
  - Intraoperative bleeding is reduced
  - Reduced stress response



# Neuroaxial blocks





# RA combined with GA

## **Before GA**

- Typically, blocks are performed in the awake or sedated patient **before** inducing anaesthesia.
  - Able to respond to severe pain and paraesthesia
  - Verbal contact – LA toxicity signs, side effects related to blocks – intrathecal injection

# RA combined with GA

## **After induction**

- Paediatric population
- Non compliant adult population
- Difficult position, e.g. placement of an epidural for a fractured pelvis
- If the patient refuses to have the technique performed awake

# Regional anaesthesia - summary

- RA can be used alone or in combination with general anaesthesia
- RA can improve patient safety and satisfaction or surgical outcome
- RA is a serious and potentially dangerous procedure
- All the appropriate consent, monitoring and safeguards need to be in place before block performance
- The subset of neuraxial blocks are very common and have clear contraindications and complications



# Questions ?

