



REGIONAL ANAESTHESIA

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- Local anaesthetics
- Regional anesthesia
 - Types
 - Uses and benefits
 - Video

Historie

- 1860 cocaine isolation – Niemann
- 1884 clinical use – Koller
- 1905 synthesis of procaine – Einhorn
- 1943 synthesis of lidocaine – Löfgren
- 50. léta – trimekaine (CSSR)
- 1950 bupivacaine synthesis – Ekenstam
- 1963 clinical use of bupivacaine - Widman



Local anaesthetics

- Block transmission of action potentials in nerve fibers
- LA blocks somatic sensory, autonomic and motor nerve conduction
- Weak bases





What does the block of nerves lead to?

- Somatic sensory - loss of cutaneous sensation (numbness), proprioception
- Motor nerve - loss of movement
 - (if it is a motor nerve) in the distribution of the peripheral nerve
- Autonomic nerves - vasodilation and warmth

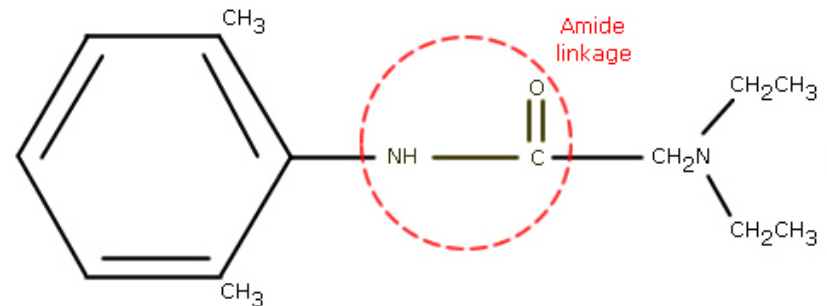
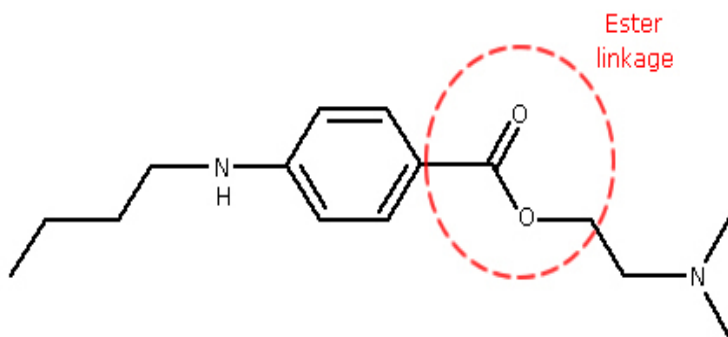
- Surgery can proceed without pain
- Postoperative analgesia dependent on the choice of LA and the anatomical location of the block
- Possible use of catheter – prolonged analgesia
- RA can be placed awake, with sedation or under general anaesthesia

Use of RA

- Analgesia, e.g. fractured femur, fractured ribs
- As the sole anaesthetic for surgery with or without sedation, e.g. hand surgery
- In combination with GA, e.g. total knee replacement
- For postoperative analgesia

LA - structure

Esters	Amides
procaine	lidocaine
chlorprocaine	bupivacaine
tetracaine	ropivacaine
amethocaine	trimecaine



Pharmacokinetics

Esters

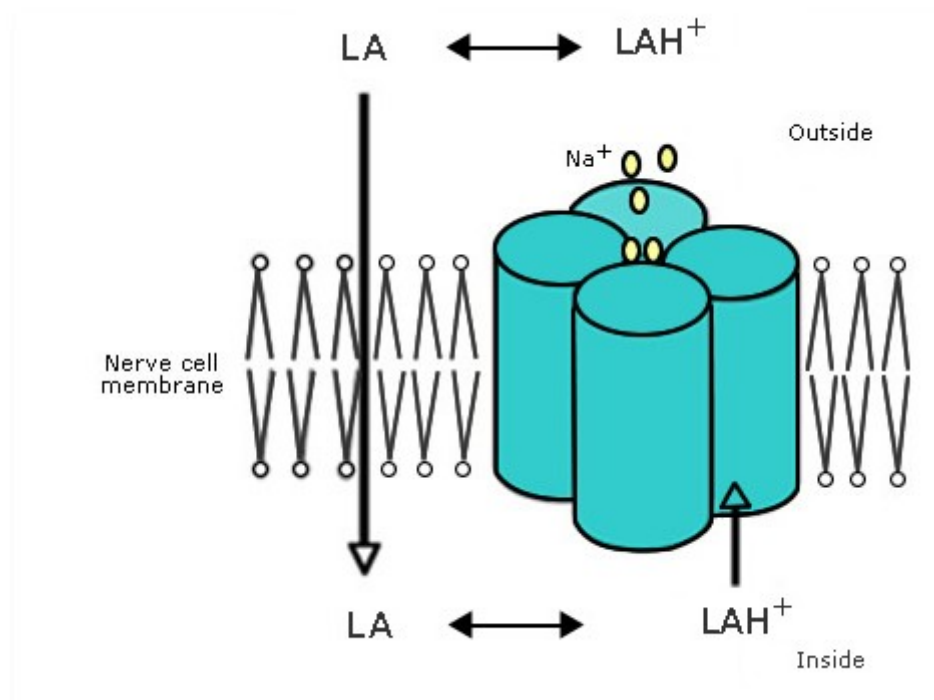
- Poorly protein bound – shorter duration of action
- Broken down by esterases
- Allergic reaction

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

	Lidocaine	Bupivacaine
Protein binding	70 %	95 %
Metabolism	liver	liver

Local anaesthetics - additives

- **Adrenaline** – decreased absorption, metabolism, toxicity
 - **CAVE** – terminal extremity
- **Bicarbonate** – faster onset of action
- **Clonidine** - α_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

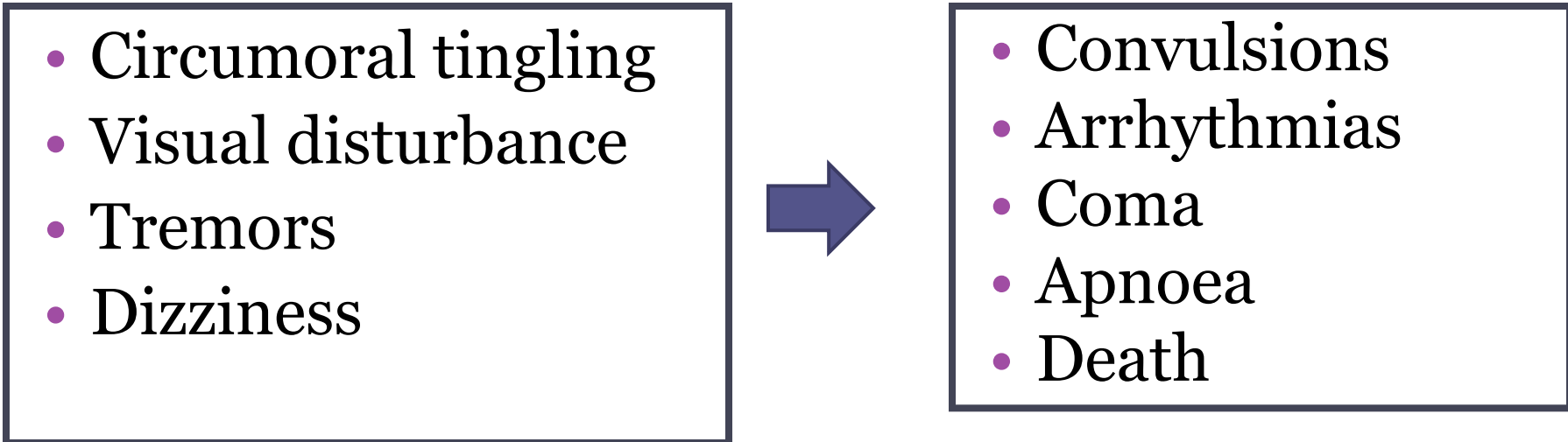
- Block of Na cardiac channels
- Direct myocardial depressant effect
- Tachycardia may enhance frequency – dependent blockade

- 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

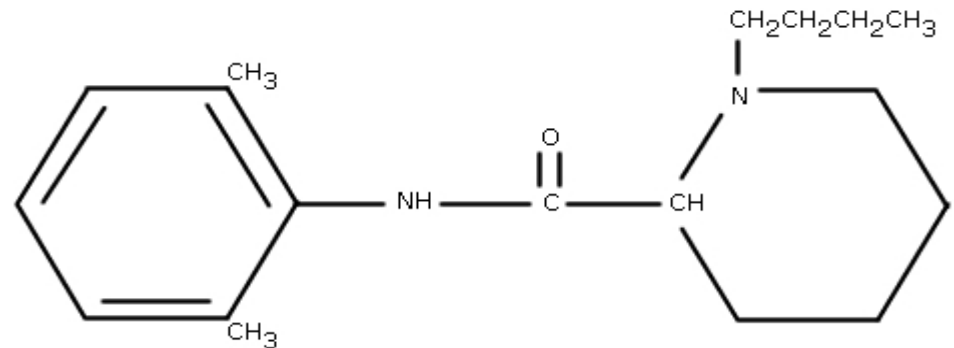
Lidocaine, Trimecaine

- 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%



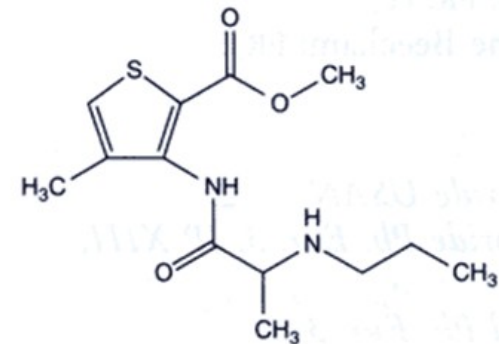
Bupivacaine

- 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

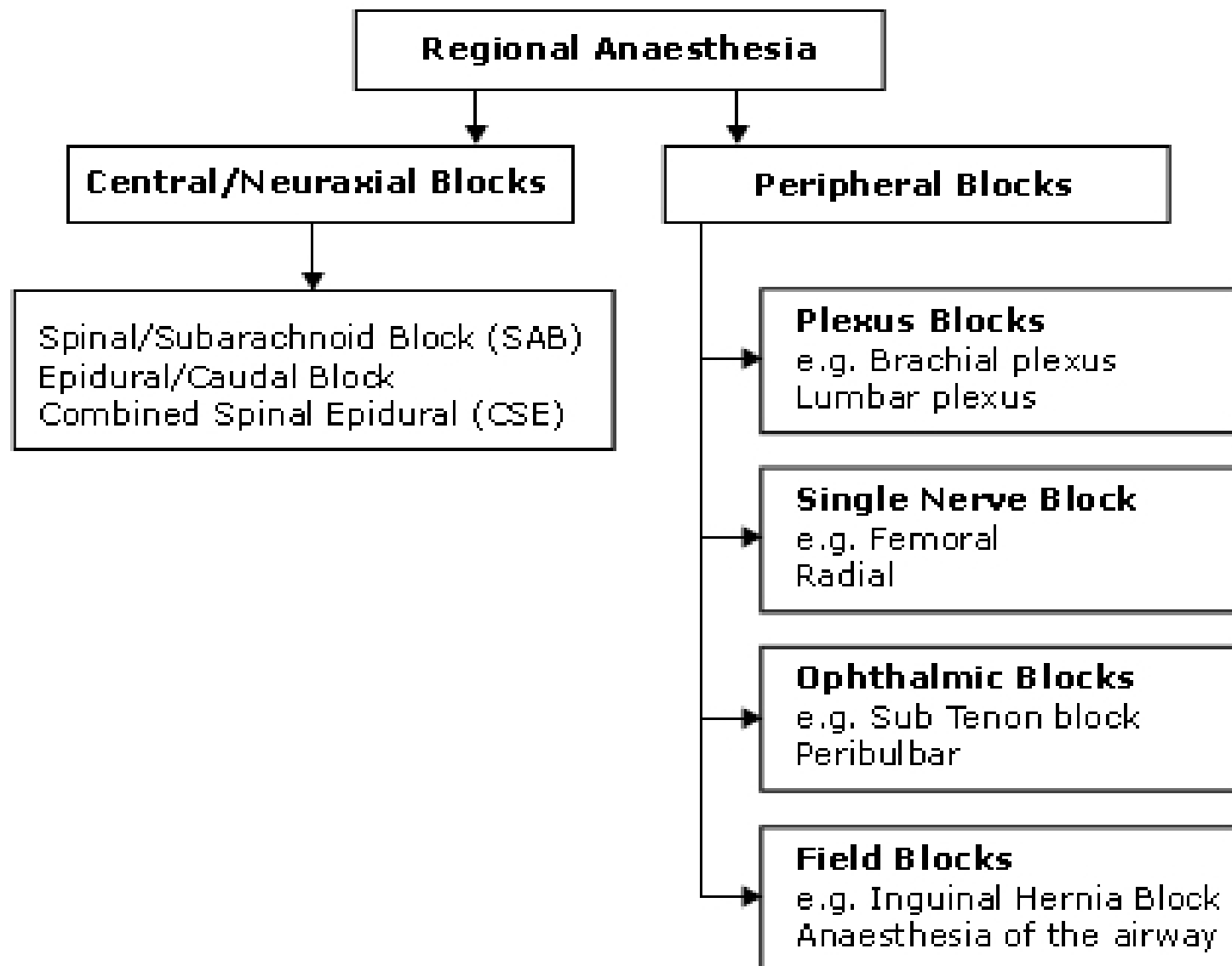


Local anaesthetics - summary

- 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)

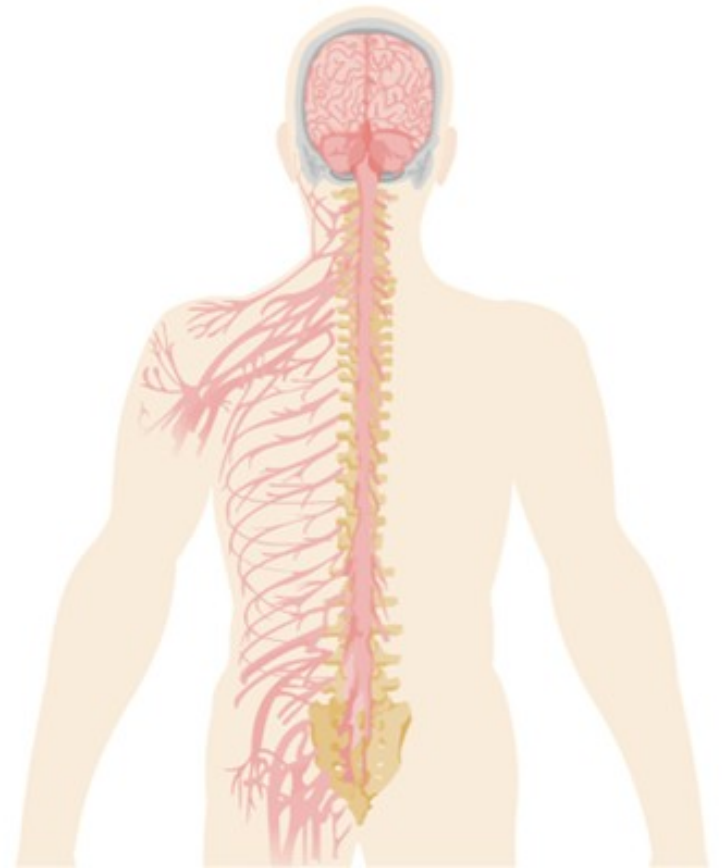
Use of Local Anaesthetic agent

- Topically: skin, mucous membranes, gel, cream, spray
- Infiltration: for field-blocks where superficial nerves are blocked locally
- Intravenously: for intravenous regional anaesthesia (IVRA) – Prilocaine only
- 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

- 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

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

Other benefits

- Suppression of stress response
 - Vasodilation
 - improved delivery of O₂
 - Better tissue perfusion
- Analgesia – low dose or no opioids
 - GA + use of opioids Suppression of immune response, progression of metastatic process?

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



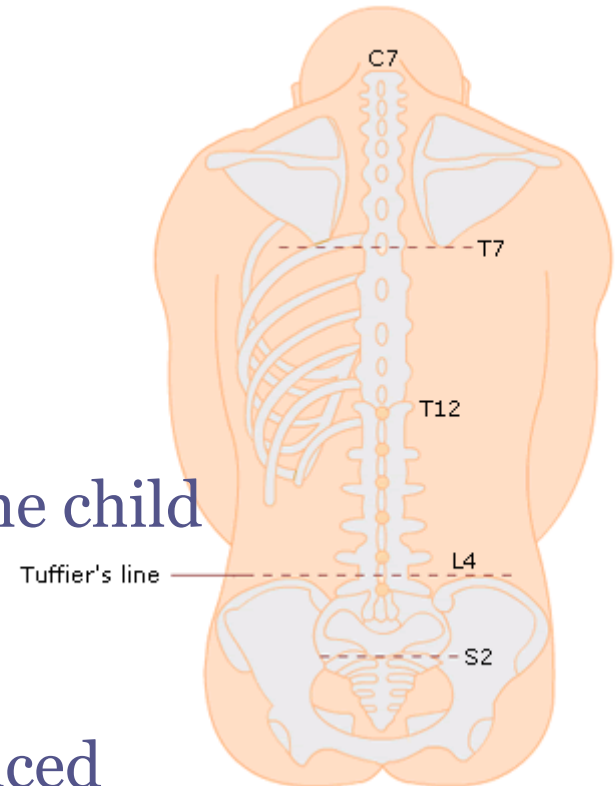
Alon Winnie

Regional anaesthesia is simply
an exercise in applied anatomy

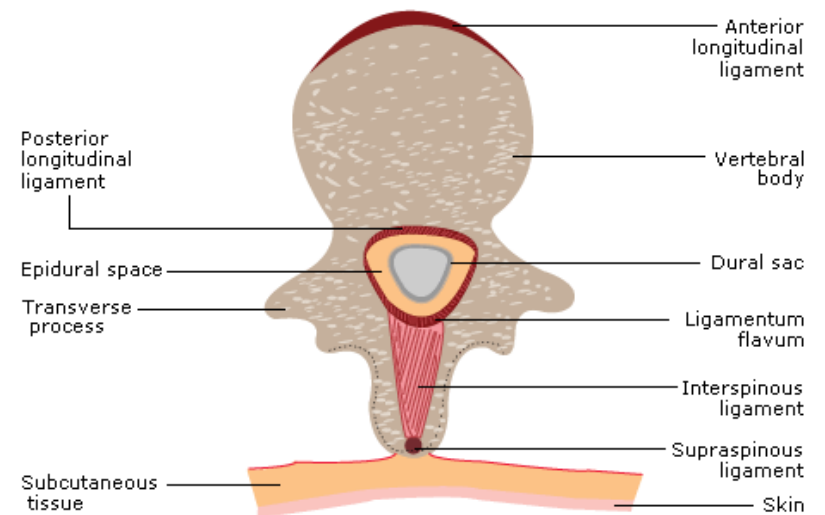
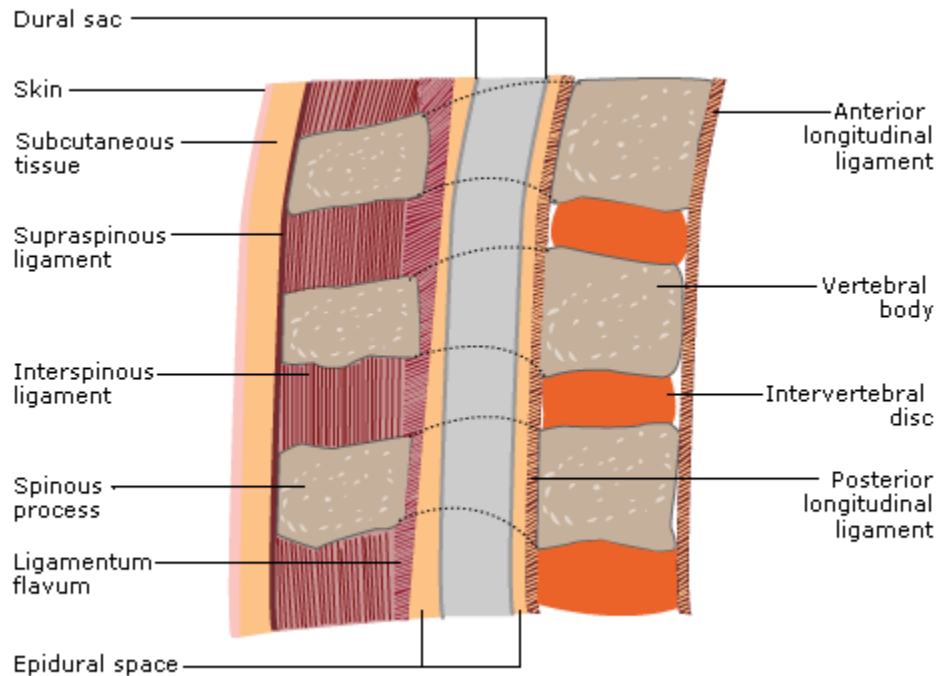
Most common regional anaesthesia

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 ?

