Regional Anaesthesia Dr Walid Zuabi MB BS MD FCA RCSI

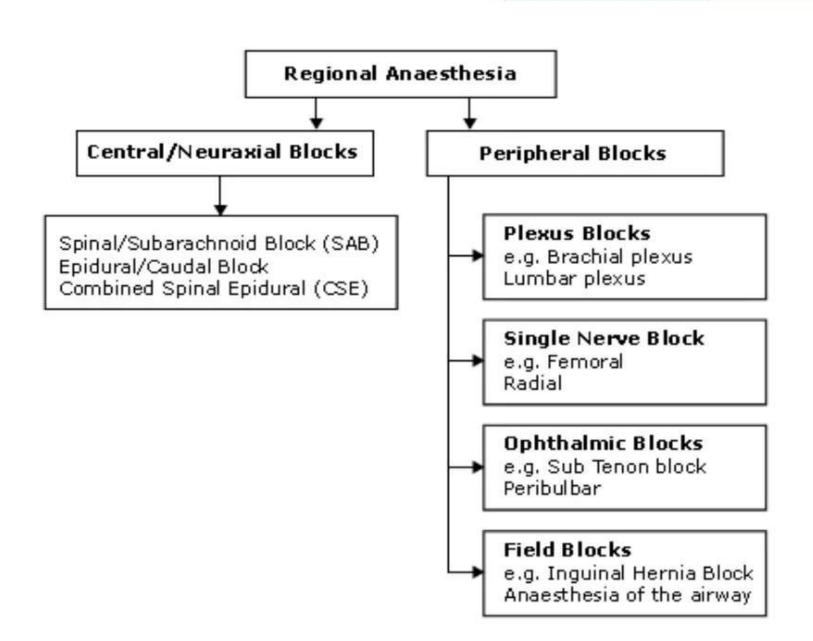
4th year MD Anaesthesia Tutorial

Concept

Regional anaesthesia affects one part of the body.

Types of Regional Anaesthesia

- Topical Application
- Infiltration
- Intravenous Regional Anaesthesia of the Arm (Bier's Block)
- Peripheral Nerve Block
- Central Nerve Block (Neuraxial Blockade)



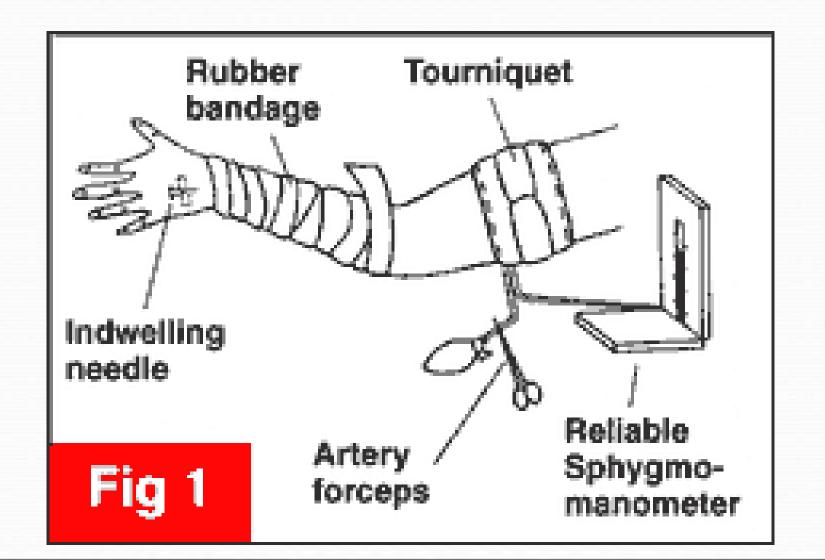
Topical

- Aerosolised
 - 2% lignocaine spray for vocal cords
- Cream: EMLA
- Direct Application
 - Drops

Infiltration

- Subcutaneously
- Intradermally

Bier's Block



Nerve location with Ultrasound



LA - structure

Esters	Amides
procaine	lidocaine
chlorprocaine	bupivacaine
tetracaine	ropivacaine
amethocaine	trimecaine

Pharmacokinetics

Esters

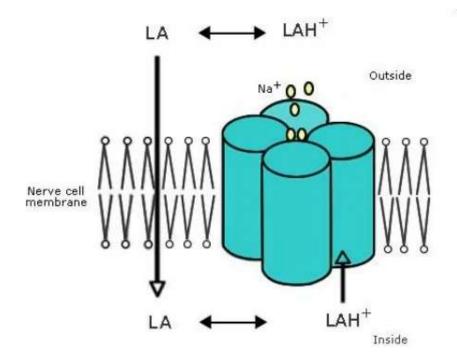
- Poorly protein bound shorter duration of action
- Broken down by esterases
- Allergic reaction

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

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.

Potency

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

Lidocaine	Bupivacaine
150	1000

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 ✓ 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

Neurotoxicity

- Biphasic effect
- Inhibitory neurons are blocked excitatory effects
- Central neurones are then depressed
- Circumoral tingling
- Visual disturbance
- Tremors
- Dizziness



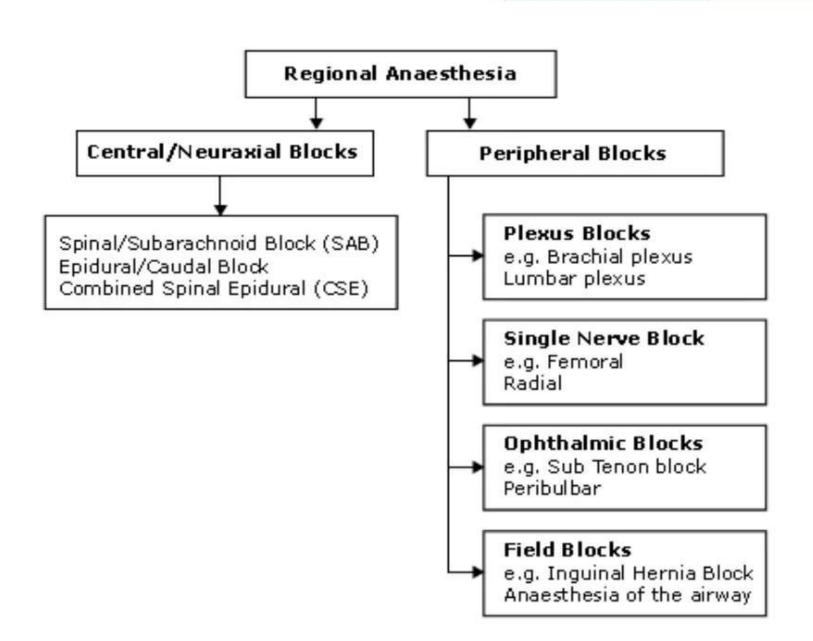
- Convulsions
- Arrhythmias
- Coma
- Apnoea
- Death

Management of LA toxicity

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

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, alllergic reaction (esters)



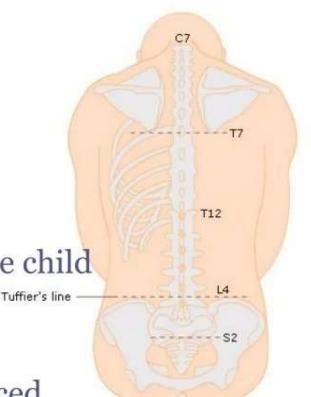
Is a central nerve block good enough for surgery?

- Yes
- Excellent operating conditions
 - Sensory block interrupts somatic and visceral painful stimuli
 - Motor block skeletal muscle relaxation

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



Patient Preparation

As for General Anaesthesia

Full history, examination and relevant special investigations

Starved

Decent IV Access

Theatre preparation

- Anaesthetic machine checked with ability to ventilate and give O₂
- Airway trolley
- Defibrillator
- Suction
- Anaesthetic drugs
- Emergency drugs

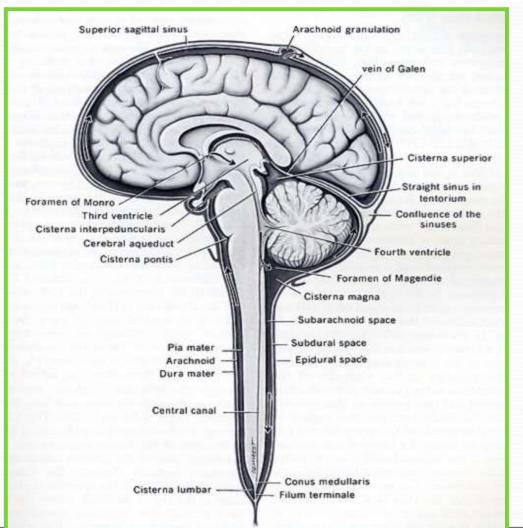


Applied Anatomy

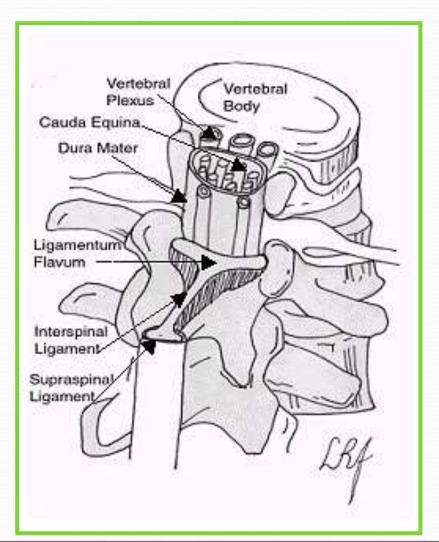
Spinal anaesthesia

- LA deposited into CSF
- Blockade of nerve roots as they pass through the SAS
- SAS is deep to the dura and arachnoid mater
- Spinal portion of SAS extends from foramen magnum superiorly to S2 inferiorly
- Spinal cord ends at L1/2

Subarachnoid Space (SAS)



Vertebral Column

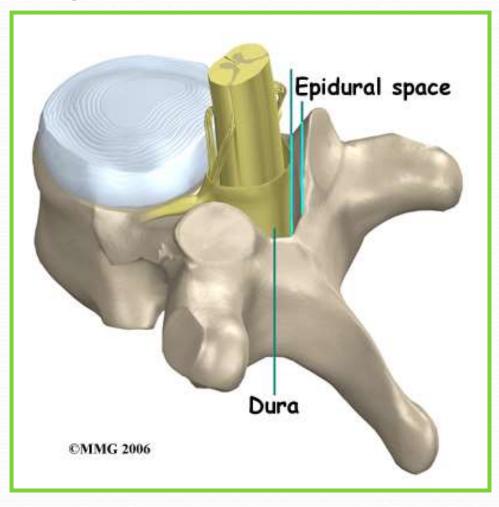


Applied Anatomy

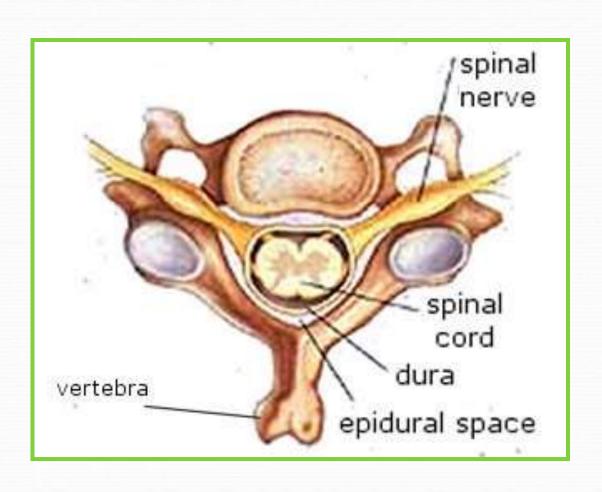
Epidural Anaesthesia:

- Epidural space lies outside dura
- "epi"- Greek for on, at, across or against
- The nerve roots pass through this space as they leave the spinal cord
- The epidural space is a potential space with a negative pressure
- Contains: fatty connective tissue, lymphatics and a venous plexus

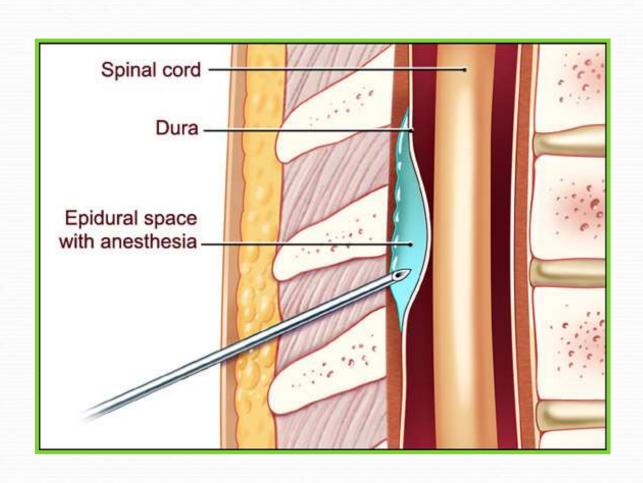
Epidural Space



Epidural space – cross-section



Epidural injection



Indications for Neuraxial Blocks

- Alone or with a GA
- Alone:
 - Lower abdominal
 - Inguinal
 - Urology
 - Gynaecology
 - Rectal
 - Lower extremity surgery

Contra-indications: ABSOLUTE

- Patient refusal
- Local infection at the site
- Coagulopathy
 - Platelets < 75
 - INR > 1.3
- Severe hypovolaemia
- TICP
- Fixed C.O. States: severe AS or MS and HOCM
- LA allergy

Contra-indications: RELATIVE

- Systemic sepsis
- Uncooperative patient
 - Psychiatric.. Blind / Deaf.. Mentally challenged
- Pre-existing neurological deficits
- Stenotic valvular heart lesions
- Severe spinal deformity
- Previous spinal surgery
- Complicated surgery where block would not last long enough.

Advantages

- Pre-emptive analgesia.
- Post-op analgesia.
- Usually *less* physiologic derangements.
- Rapid post-op recovery.
- No airway instrumentation and the complications.
- No GA and associated complications (aspiration, failed intubation, PONV.
- ↓DVT.

Complications

- Hypotension
- High spinal
- Post-dural puncture headache
- Meningitis and epidural abscess
- Epidural haematoma
- Neurological sequelae
- Urinary retention
- Pruritis
- Shivering
- Backache??? controversial

Hypotension

- Mechanism
 - Vasodilatation
 - Sympathetic blockade
 - Thoracolumbar T1-L2

• Treatment:

- Elevate legs
- IV fluids
- Vasopressors
 - Ephedrine: 5mg bolus
 - Phenylephrine: 50ug bolus
 - Adrenaline if unresponsive to the above measures

High spinal

- Presentation:
 - Severe hypotension
 - Bradycardia
 - Block the cardiac accelerator fibres
 - Difficulty breathing
 - Loss of consciousness

- Management:
 - IV Fluids
 - Vasopressors
 - Atropine
 - Intubation and ventilation
 - Adrenaline

Post-dural puncture headache

• Mechanism:

- CSF leak from a hole in the dura left by the needle
- Traction on dura
- Meningitis-like headache

• Incidence:

Higher with epidurals (1%)

• Prevention:

- Smaller gauge needles
- Pencil point needles
- Loss of resistance technique with spinals

Treatment:

- Conservative
 - Bed rest
 - IV Fluids
 - Simple analgesia
 - Opiates
 - Laxatives
- Epidural Blood Patch
 - 99% success

Neurological Sequelae

- Neuropraxias:
 - Transient
 - Nerve root damage from needle

- Paralysis:
 - Direct damage
 - Epidural haematoma
 - Monitor patient for return of motor function
 - Emergency
 - Urgent MRI
 - Must be released within 6 hours
 - laminectomy

Minor complications

- Shivering:
 - Treatment: iv Pethidine 10 25mg; 1mg propofol; clonidine
- Pruritis:
 - From opiate in spinal / epidural
 - Treatment: naloxone
- Urinary retention:
 - catheterise
- Backache:
 - Neuraxial anaesthesia will not make backache worse

Peri-operative Care

• Pre-op:

- Assessment same as for GA (must be suitable for GA, in the event that you need to convert to GA)
- Starved
- Premed
- Full theatre preparation

Intra-op:

- Monitors: ECG, NIBP, pulse oximeter, etCO2
- Supplemental oxygen
- Sedation
- Prevent hypothermia

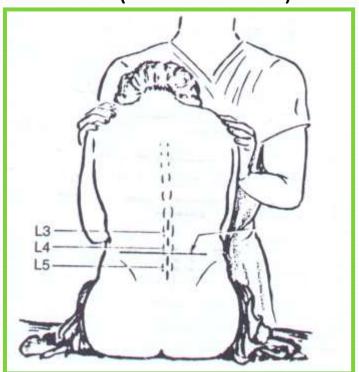
Post-op:

- Block should be receding
- If no return of motor function within 6 hours: be concerned re epidural haematoma
- Timing of anticoagulation

How to do a spinal ...

- Preparation: patient, theatre, consent
- IV line: 18G 0r 16G
- Monitors: ECG, NIBP, O2 Sat
- Positioning
- Strict asepsis
- Drugs

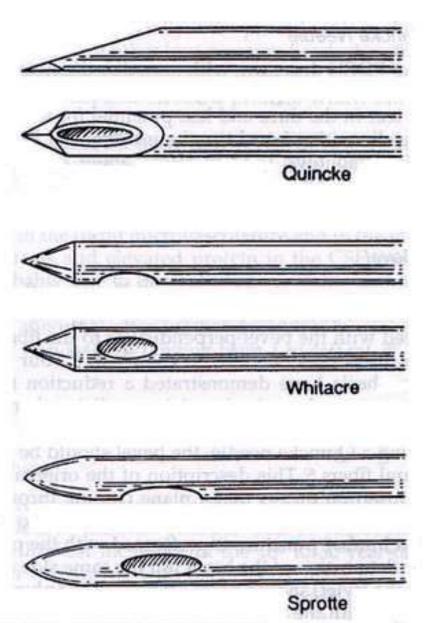
- Find landmarks
 - L4/5 level of the iliac crest (Tuffiers Line)





- LA infiltration
- Introducer at best space (L3/4 or L4/5) in midline
- Insert pp needle angle caudally
- Feel "gives" as pass through ligaments, then dura
- Remove stylet and confirm CSF flow in all directions
- Attach syringe, aspirate to confirm correct place
- Inject slowly over 10 sec

Spinal Needles



Quincke



Whitacre



Factors influencing the block height

- Patient position or posture
 - During and after the injection
- Specific gravity of solution
- Volume of drugs
- Volume of CSF
- Site (interspace)
- Force & rate of injection
- Barbotage
- Age, height, weight

Specific Gravity

- CSF has a SG of 1,004.
- Solutions with a higher SG (heavier) with sink in the SAS, they are gravity-dependent
 - Hyperbaric: "heavy" solutions bupivacaine with dextrose
 - Isobaric: plain bupivacaine or lignocaine

Opiates

Fentanyl or morphine

• Effect:

- Extends the duration of action
- Enhances analgesia
- Can be used alone, without LA, to give analgesia (block sensory nerves only)
- Side-effect: pruritis, can be severe

Epidurals

• Definition:

 LA placed into the epidural space at lumbar or thoracic level, via epidural catheter

• Advantages:

- Placement of epidural catheter allows for a constant infusion or top-up doses
- PCEA: Patient-controlled epidural anaesthesia
- Opiates enhance post-operative analgesia
- Graded block slow establishment of level avoids rapid haemodynamic changes

Uses:

- With GA
 - Thoracic epidural for thoracic surgery
 - Abdominal surgery
- Hip and leg surgery
- Labour epidural for analgesia
- Post-op analgesia
- Chronic Pain treatment

Epidural set







Epidural technique

"Loss of resistance"





Epidural strapped in place



Golden rules

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

Questions...

