

Structured Notes According to **ANAESTHESIA**

Revision friendly **Fully Colored Book/Structured Notes**

For Best results, watch the video lectures along with reading note



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SYNOPSIS



PRE-ANAESTHETIC EVALUATION

Introduction and PAC

1. Types of Anaesthesia
2. History of Anaesthesia

3. PAC: Preanesthetic checkup

Must Know

- 3.1 Hb Required
- 3.2 Fasting Status
- 3.3 Co-existing Medical Illness

4. ASA

4.1 ASA classification

Good to Know

1 INTRODUCTION AND PAC



Types of Anaesthesia

00:01:25

Local Anaesthesia (Ax)

- Localized loss of pain sensation
- Used in minor procedures, E.g. Root canal treatment, cut injury

Spinal Ax

- Given below the level of spinal cord.
- Surgeries done below the level of umbilicus within 2-3 hours of duration.
- E.g. Surgeries for appendicitis, hernia, hydrocele, varicocele

Epidural Ax

- Given for the surgeries done below the level of the umbilicus for a longer duration (~6-8 hours)
- E.g. Total hip replacement, Total knee replacement
- In the epidural Ax, a continuous catheter is placed through which top – up doses are administered, whereas in the spinal Ax only a single dose is administered.

Patient is conscious

Nerve block

- A selected plexus of nerves is blocked
- E.g. U/L = Brachial plexus block, L/L = Femoral / Popliteal, to lower sympathetic activity = Stellate block

General Ax

- Full body anaesthesia
- Indicated for the above umbilicus surgeries
- E.g. Heart surgery, lung surgery, laparoscopic surgery (Few can be done by spinal Anaesthesia – To avoid complications associated with CO₂ used in GA as it irritates the diaphragm)

Patient is unconscious

History of Anaesthesia

00:13:10

1840

- Surgeries were performed without anaesthesia leading to PTSD.

John Snow

- In 1844, he used Chloroform on patients to perform surgeries. It was even used on the Queen during delivery.
- **Regarded as the Father of Anaesthesia and published the 1st literature on anaesthesia**
- Since Chloroform is a cardiotoxic compound it is now not in use.

WTG Morton

- He used Ether to make the patient unconscious as it had no cardiotoxicity
- Performed a public demonstration on 16th October 1846 to prove Ether can be used safely to make the patient unconscious
- He is regarded as the Father of modern anaesthesia

World Anaesthesia Day

- 16th October 1846 (1st public demonstration of Ether) is celebrated as World anaesthesia Day.

Oliver Wendell Holmes

- Coined the term “anaesthesia”

August Bier

- Gave the first spinal anaesthesia in humans
- Regarded as the Father of spinal anaesthesia

Priestley

- Synthesized Oxygen and nitrous

Horace Wells

- Gave a clinical demonstration of nitrous anaesthesia
- 1st inhalation anesthetic used was nitrous oxide in 1844



Public demonstration of Ether use in
16th October 1846 in Ether dome

PAC: Preanesthetic checkup

00:24:05

- PAC is an important tool for an anaesthetist where the patient is screened for the parameters
 - Airway assessment
 - Haemoglobin concentration
 - Fasting status
 - H/O of comorbidities

Clinical scenario

A 20-year old female admitted for tonsillectomy surgery on Monday. Sunday, a PAC call was given to an anaesthetist, but the call was not attended. Despite this patient was taken up for surgery and was given general anaesthesia.



3 aims of GA

- Make the patient unconscious
- Make muscle relax
- Intubate and ventilate the patient

While performing intubation due to lack of visibility of vocal cord was not being able to intubated, the saturation drops and ultimately leading to cardiorespiratory arrest.


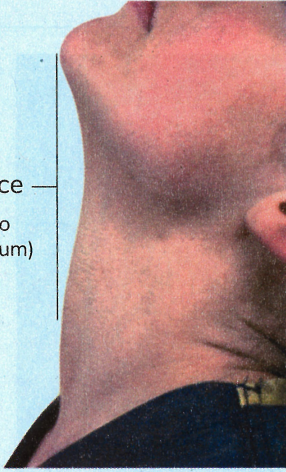


- This situation could be prevented by PAC. Assessment of airways would have prepared anaesthetist for Bag and mask ventilation/Tracheostomy/Cricothyrotomy when the patient's saturation was dropping.

legal implications

Airway Assessment

00:36:10

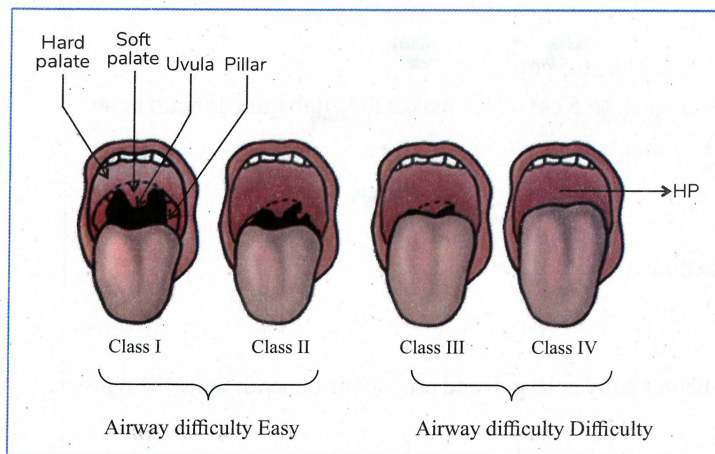
Ask the patient to open their mouth	Ask the patient to lift the chin
<ul style="list-style-type: none"> • Mallampati classification and inter-incisor distance are assessed 	<ul style="list-style-type: none"> • Sternomental distance and Thyromental distance are calculated
	 <p>Thyromental distance Tip of thyroid cartilage to the tip of the chin (mentum)</p>

Mallampati Classification

- Done to know the difficulty of the airways during intubation.
- The structures seen in the mouth
 - Hard palate
 - Soft palate
 - Uvula
 - Tonsillar pillar

PYQ: NEET PG 2018

PYQ: FMGE 2018, 2021, 2023



- Class 1**
 - Hard palate, soft palate, uvula, tip of uvula and tonsil pillars are visible
- Class 2**
 - Hard palate, soft palate, uvula, and tonsil pillars are visible
 - The tip of the uvula is not visible
- Class 3**
 - Hard palate, soft palate, base of the uvula are visible
- Class 4**
 - Only hard palate is visible
 - For minor surgeries, noninvasive methods of giving oxygenation
 - For emergencies, tracho-thyroidectomy or tracheostomy
- Class 0**
 - Hard palate, soft palate, uvula, tip, tonsillar pillars along with the tip of the epiglottis is visible
 - Seen only when a previous airway surgery was performed on a patient

- **Modified Mallampati classification: To assess the size of the tongue for Laryngoscopy**
- The initial version of the Mallampati classification was till Class 3 which was further modified by Sampson and Young who added Class 4.

Inter-incisor distance



- Inter-incisor distance with maximal mouth opening with a normal value of **>5cm/admits 3 fingers**.
- IID <4 cm is an indication for difficult intubation.
- **Low IID (<4 cm)** is seen in
 - Tetanus
 - Tobacco chewers developing submucous fibrosis (SMF)
 - Mandible fractures
 - Fracture in TMJ
- The best way to intubate patients with low IID is by Tracheostomy.

Thyromental Distance

- Distance between mentum and thyroid (should be ≥ 6.5 cm).
- In webbed neck patients, thyromental distance is < 6.5 cm which makes the intubation difficult as an extension of the neck in these patients is minimal.

Sternomental Distance

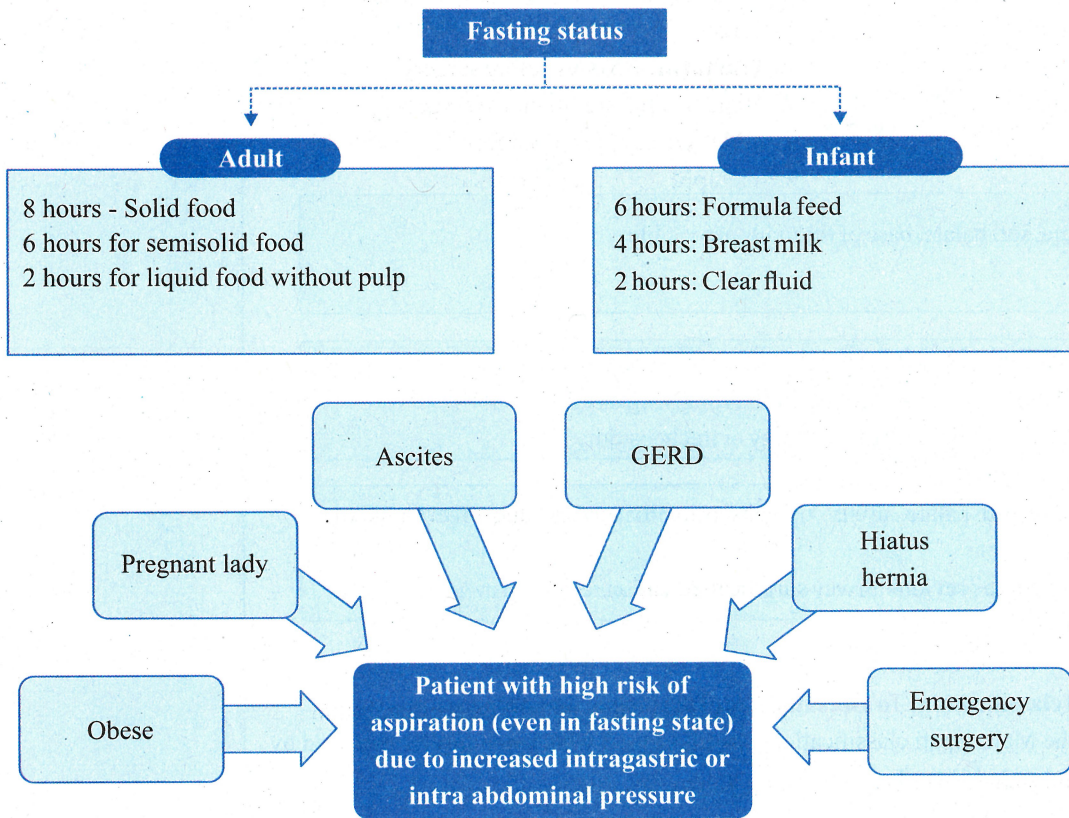
- Distance between the sternum and the mentum (it should be > 12.5 cm)

Hb Required

- The minimal requirement for surgeries theoretically is **10 g/dl** and practically depends upon the type of surgery.

Fasting Status

- Fasting status before surgeries reduces the risk of aspiration.



Co-existing Medical Illness

- H/o comorbidities and drug history indicate which medications need to be continued before the surgery and which to be stopped.

Hypertensive patients

- **Anti HTN:** Should be continued in the same dose
 - ACEi/ARBs are discontinued (causes refractory hypotension)

Diabetic patients

- **Oral hypoglycemics**
 - Should be discontinued
- **Insulin**
 - Can be continued
 - **Reason:** Insulin dose can be titrated, but OHD are fixed dosage form
 - If required, switch to insulin from ODH (Major surgeries, 48 hrs before surgery)

CAD patients

Medications can be continued

- **Aspirin:** 75 mg
 - Exception: CNS, retinal surgeries, as the micro blood vessels might bleed.
- Atorvastatin or rosuvastatin
- Antianginal drugs

Medications need to be stopped

- **Aspirin:** >75 mg, before 3-5 days of surgery
- **Clopidogrel:** Stop it 8 days before the surgery
- **Warfarin:** 3-5 days before surgery
- **Heparin:** Before 6 hours of surgery
- **LMWH:** 12 hours of surgery
- **Ticlopidine:** 14 days prior surgery

In young patients

Antiepileptic / antithyroid drugs

- Continue the medication

Oral contraceptives

- Oestrogen containing pills: Stop using 4 weeks prior to surgery due to the risk of thromboembolism
- Progesterone only or combined pill → Continue the medication

TCA (nortriptyline or amitriptyline) / MAO inhibitors

- Stop 3 weeks before surgery TCA's stopped due to risk of developing postoperative delirium
- MAO inhibitors stopped as it causes severe sympathetic reaction with pethidine
- Selegiline (MAO inhibitor) can be continued until the day of surgery

Lithium

- Discontinued 24 to 48 hrs before the surgery
- Prolong the effect of muscle relaxants.
- Can be given with new generation muscle relaxants (atracurium, mivacurium, and cisatracurium)

Anticonvulsant

- Should be continued
- Levodopa should be continued

Smoking

- **Should be stopped** 6-8 weeks prior to surgery as smoking inhibits the mucociliary activity and nicotine increases chances of bronchospasm
- Stopping at least for 12 hours reduces Carboxyhemoglobin

Steroids

- If taken for >1 week last year, it is continued, as sudden stopping of steroids can suppress endogenous cortisol

NSAIDS

- Stop 24-48 hours before surgery since it aggravates renal damage

Herbal medications

- Stopped 6 weeks before any surgery, as they may pose problems on the kidney or liver

Summary

All A's can be safely given

- Aspirin 75
- Antihypertensives, except ACE inhibitors
- Antiepileptic drugs
- Antithyroid
- Steroids

HOT MLC – Women are to be stopped

- Heparin: 6 hours before surgery
- OCP: 4 weeks before surgery
- OHD: The day of surgery
- TCA: 3 weeks before surgery
- M- MAO inhibitors
- L- Lithium
- C- Clopidogrel
- W- Warfarin

If the patient is having metallic stent (E.g. CAD)

- Elective surgery: The surgery has to be deferred for at least 1 month
- Drug eluting stent: The surgery has to be deferred for at least 1 year

ASA

01:26:55

- Gives the guidelines if the patient is fit to undergo anaesthesia.
- Defines only the anaesthesia-related risk and not surgical.
- ASA depends on the systemic illness the patient suffers (DM/HTN/CAD/Stroke/MI)

ASA classification

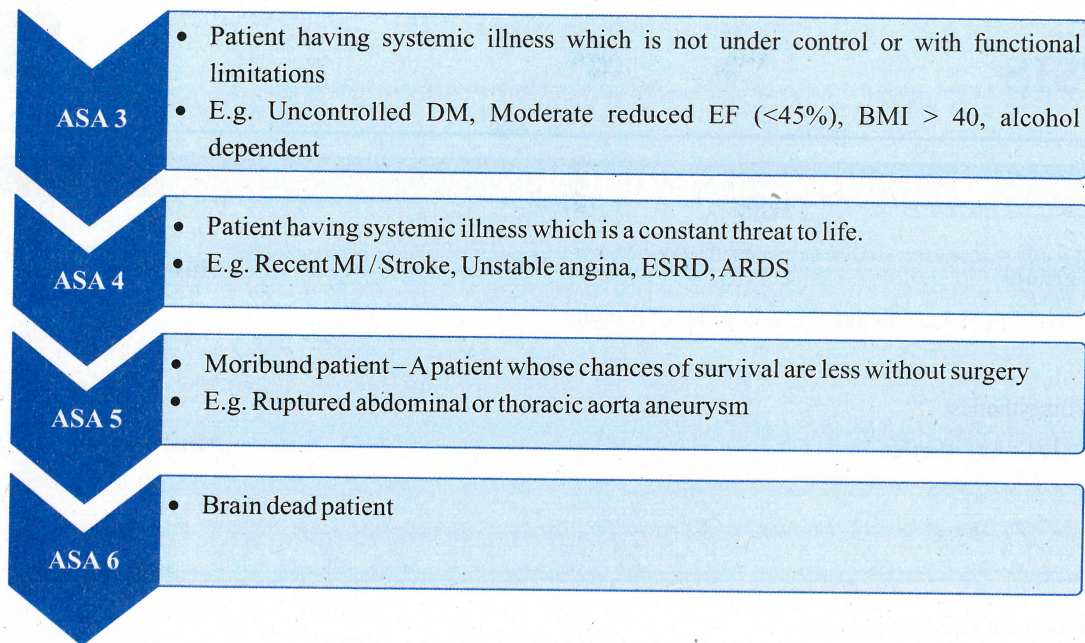
PYQ: INICET 2021

ASA 1

- Free from systemic illness
- E.g. 20 year old female posted for tonsillectomy with no comorbidities

ASA 2

- Patient having systemic illness which is under control or without any functional limitations
- E.g. Diabetic patient with FBS: 90 mg / dl, PLBS: 120 mg / dl → Well controlled or Patient is a social smoker or a social alcoholic



Note

- Suffix 'E' represents emergency surgery.
 - Example: 20-year-old diabetic female with ruptured ectopic posted for surgery. Also, her FBS is 94 and her PLBS is 118 mg/dl → ASA 2'E'

MCQs

Q1. A 62-year-old patient with uncontrolled hypertension presents in the emergency department with a complaint of sharp, sudden pain in the upper back and difficulty breathing for the last 10 minutes. On examination, the patient has a GCS of 11/15, blood pressure of 80/40 mmHg, pulse rate of 99 beats/minute with low volume, and SpO₂ of 86% at room air. The CT scan shows a ruptured aortic aneurysm, and his hemoglobin level is 3g/dL. He is immediately taken to the operation theatre for operative intervention. This patient belongs to the ASA class _____

Ans. ASA-5.

Q2. As a junior resident in the pediatric surgery department, you are overseeing an infant scheduled for hypospadias repair surgery. What instructions would you provide to the mother concerning preoperative fasting for the infant on the mother's milk?

- A. 4hr
- B. 6hr
- C. 2hr
- D. 8 hr

Q3. When should nortriptyline be discontinued before laparoscopic hernia repair surgery in a 49-year-old female with a paraumbilical hernia with a defect of 3cm and a history of neuropathic pain?

Ans. TCA → Stop 3 weeks before surgery (Risk of developing postoperative delirium).

Q4. A 30-year-old female is brought to the emergency with a series of seizures for more than 30 minutes without returning to normal consciousness. The seizures last for more than 5 minutes. The patient has a severe tongue bite during these seizures causing a swollen tongue. The tongue is blocking the airway showing a soft, hard palate and base of uvula. The ETT is indicated but isn't easy because of the traumatised tongue. What grade of MPC is given in this case?

Ans. The patient belongs to Mallampati Class III



LOCAL ANAESTHETICS

Local anesthetics

1. Classified into two groups

Must Know

2. Mechanism of Action of Local Anesthetics: Acts on nodes of Ranvier
3. Absorption
4. Additives of Local Anaesthetics

5. Drugs included in local Anaesthetics

Must Know

6. Surface Anesthesia
7. Ocular anesthesia
8. Emla Cream
9. IVRA: Intravenous regional anesthesia

2 LOCAL ANESTHETICS

- Local anesthetics are the drugs given in local anesthesia, spinal, epidural, and nerve blocks except general anesthesia.
- Local anesthetics cause reversible loss of pain sensation.

PYQ: FMGE 2020

PYQ: INICET 2021

Classified into two groups

Pharmacology

00:01:50

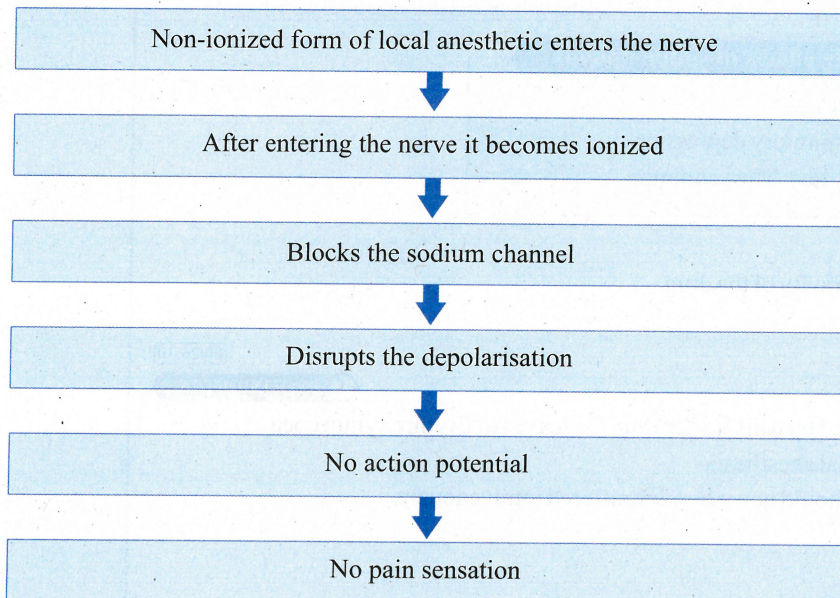
PYQ: INICET 2019

PYQ: FMGE 2018

	Aminoesters	Aminoamides
Drugs	<ul style="list-style-type: none"> Cocaine Procaine Chloroprocaine Benzocaine Tetracaine 	<ul style="list-style-type: none"> Lignocaine/ Lidocaine/ Xylocaine: Most commonly used worldwide Bupivacaine: Most commonly used in spinal anesthesia Mepivacaine Prilocaine Dibucaine
Metabolism	<ul style="list-style-type: none"> Metabolized by Plasma esterase except for cocaine (metabolized in the liver) Some amino esters are metabolized to para-aminobenzoic acid causing allergic reactions in patients Procaine and Benzocaine have the highest incidence of allergic reactions 	<ul style="list-style-type: none"> Metabolized in the liver

Mechanism of Action of Local anesthetics: Acts on nodes of Ranvier

00:09:36



Absorption

- Highest absorption: **IV route** > Tracheal > Intercostal > Brachial plexus > Epidural
- High dose: Long duration
- Low dose: Short duration

Additives of Local Anaesthetics

- **Drugs added to increase the duration of action of the local anaesthetics:**
 - Adrenaline
 - Sodium bicarbonate
 - Opioid
 - Dextrose

Adrenaline

Advantages <ul style="list-style-type: none">• The most commonly used• Increases the duration of lignocaine• Decreased the toxicity of lignocaine• Decrease in blood loss	Disadvantage <ul style="list-style-type: none">• Increases the risk of arrhythmia by increasing the peripheral resistance leading to increased heart rate and BP
Contraindication <ul style="list-style-type: none">• HTN• Ischemic heart disease	Felypressin <ul style="list-style-type: none">• Synthetic vasopressor• No increase in BP and pulse rate

Sodium bicarbonate: Increases the speed of onset

Opioids

Exception <ul style="list-style-type: none">• All opioids are safely given• Exception: Ramifentanyl<ul style="list-style-type: none">○ Contains neurotoxic preservative so avoided in spinal anesthesia	Drugs commonly used <ul style="list-style-type: none">• Fentanyl• Alfentanil• Sufentanil
Side effects of spinal opioids <ul style="list-style-type: none">• Nausea• Respiratory depression• Pruritus: Most common	

- **Dextrose:** Increases the specific gravity of the drug

Drugs included in local Anaesthetics

Cocaine

00:26:10

PYQ: INICET 2022

- The first local anesthetic introduced by **Karl Koller** from the leaves of **Erythroxylum coca**
- 1st used for eye surgery and as spinal anesthesia
- It is a potent vasoconstrictor and should never be administered intravenously.

Chlorprocaine or procaine

- These are short-acting local anesthetics
 - **Chlorprocaine** is the shortest-acting local anesthetic
 - Procaine: Safest local anesthetic in malignant hyperthermia
- Used in high dose + High concentration

Lignocaine

PYQ: FMGE 2023

Other names

- Lidocaine, xylocaine

Category

- Belongs to the aminoamide group

Facts

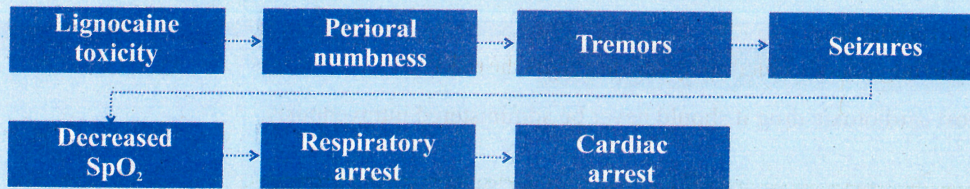
- The most commonly used local anesthetic worldwide
- The most commonly used local anesthetic in intravenous regional anesthesia
- The most common local anesthetic to cause malignant hyperthermia

Dose and duration

- Plain Lignocaine: 4.5 mg/kg acting for 45 mins - 1 hour
- Lignocaine + Adrenaline: 7 mg/kg acting for 2 hours

Toxicity

- 1st sign of lignocaine toxicity: CNS manifestations



Treatment of lignocaine toxicity

- Antiepileptic medication: Midazolam, diazepam
- Intubate and ventilate the patient
- Intralipid 20% solution

Addition of lignocaine + Adrenaline

- Concentration: 1:2,00,000

Concentration of lignocaine in various anesthesia techniques

Technique	Concentration
Intravenous regional anesthesia	0.5%
Nerve blocks	1-2%
Epidural	
Topical	2-4%
Spinal	5%

Bupivacaine

PYQ: INICET 2022

PYQ: NEET PG 2021

Category

- Belongs to aminoamides group
- **Most commonly used local anesthetic in spinal anesthesia**

Duration

- Longer (2-3 hrs)

Dose

- Plain Bupivacaine: 2-2.5 mg/kg
- Bupivacaine + Adrenaline: 3 mg/kg

Longest to shortest acting local anesthetics

- Dibucaine (Longest) > Tetracaine > Bupivacaine > Lignocaine > Procaine > Chlorprocaine (Shortest)
- Dibucaine, Tetracaine: Most toxic local anesthetics

Route of administration

- Not given in IV route

Bupivacaine toxicity

- Since Bupivacaine is the **most cardiotoxic drug it should never be administered intravenously, but the drug is safe in CSF.**
- Administration of Bupivacaine should be stopped if blood is noticed in CSF is noticed - can lead to increased BP, sudden fluctuations in heart rate, and arrhythmia on ECG leading to sudden cardiac arrest.

Treatment of Bupivacaine toxicity

- CPR is started in cardiac arrest
- If no cardiac arrest but arrhythmia is present
 - Antiarrhythmic drugs (bretylium, amiodarone, procainamide)
 - 20% intralipid solution: 1.5 ml/kg bolus followed by 0.5 ml/kg infusion

Ropivacaine

- Belongs to the **aminoamide group**
- It is the enantiomer of bupivacaine
- Structurally similar to bupivacaine
- Has less potency and cardiotoxicity
- The potency of local anesthetic is determined by **lipid solubility**: More the lipid solubility, higher the potency

Dibucaine

- Belongs to the aminoamide group
- The most potent and most toxic local anesthetic
- Has the longest duration of action
- Only used for **dibucaine number test**

Clinical scenario

- A 30 years old male posted for tonsillectomy under general anesthesia was given scoline and after surgery, in the reversal phase of anesthesia, the patient didn't recover on time.

Explanation

- Case of delayed recovery
- Scoline: Muscle relaxant
 - Action: 3-8 mins during metabolism by **plasma pseudocholinesterase**.
- Patient with pseudocholinesterase deficiency: Prolong action of scoline
 - Duration: 4 hrs
- Dibucaine number test: Detects atypical pseudocholinesterase or pseudocholinesterase deficiency

Drugs metabolized by pseudocholinesterase

- Scoline
- Aminoesters
- Mivacurium

Surface Anesthesia

01:10:00

- Any anesthetics agents applied on skin or mucous membranes are called surface anesthetics. E.g. Insertion of Ryles tube, Foley's catheter.
- All local anesthetics that can be used as surface anesthetics except
 - Procaine
 - Mepivacaine
 - Bupivacaine

Ocular anesthesia

01:12:50

Route administration

- Peribulbar
- Retrobulbar: An invasive procedure and contraindicated in bleeding disorders
- Topical: Used for cooperative patients and Tetracaine eye drops is most commonly used

Drugs

- Bupivacaine+Lignocaine=Used in Peribulbar and Retrobulbar routes
- Bupivacaine is the best ocular local anesthetic

Emla Cream

01:15:40

- EMLA: Equal Mixture of Local Anesthetics
- Used as an emulsion for better absorption

Composition

- 2.5% Lignocaine + 2.5% prilocaine
- Onset: 1.5 - 2 hours

Indications

- Children with needle phobia
- Adults: Skin grafting
- Atopic dermatitis

Contraindications

- Cut injuries
- Neonates
- Prilocaine absorbed through the neonatal skin leads to methemoglobinemia (also caused by benzocaine)

Clinical features of Methemoglobinemia

- Nausea
- Drowsiness
- SpO₂: Falsely low
- Jerky movements
- DOC: IV methylene blue

IVRA: Intravenous regional anesthesia

01:23:45

- Other Name: **Bier's block**
- Introduced by **August Biers** (Father of spinal anesthesia)

Clinical scenario

Q. An 88-year-old male patient was admitted with Colles fracture underlined comorbidities including HTN, CAD, COPD, EF 25%. Which anesthesia is recommended?

- A. Local anesthesia
- B. Spinal anesthesia
- C. Epidural
- D. Nerve block**
- E. General anesthesia

Explanation

- Nerve block: Brachial plexus block
 - Complication: **Pneumothorax - As we cannot afford to have this complication of pneumothorax hence we proceed towards IVRA.**

Technique

1. Raise the limb for 8-10 minutes
2. Apply tourniquet: Pressure while applying tourniquet
 - Upper limb: 50 + systolic BP
 - Lower limb: 100 + systolic BP
3. Place an IV cannula and inject local anesthetics

Indications

- Surgeries of upper and lower limb which are done within 1 hour of duration

Contraindications

- Raynaud's disease patient with **Colles fracture**
- Sick cell anemia
- Scleroderma

Local anesthetics used in IVRA

- Lignocaine 0.5% (most commonly used)
- Prilocaine 0.5%
- Bupivacaine contraindication (cardiotoxic)

MCQs

Q. Which drug can be administered to a 45-year-old male with alcoholic liver disease, undergoing open reduction and internal fixation, under a brachial plexus block using local anesthetics, without requiring dose adjustment?

Explanation

- Amino esters are recommended
- Amino Amides are not recommended as they are metabolized in the liver

Q. A 24-year-old boy presents to the surgical outdoor patient department with a complaint of Swelling on his forehead, which is about 2 x 5 cm in size. On examination, it was a sebaceous cyst. The patient wants to remove that for which he was admitted, and the patient is told that it will be removed under local anesthesia. Alkalinization of local anesthetic solutions by the addition of sodium bicarbonate has what benefit?