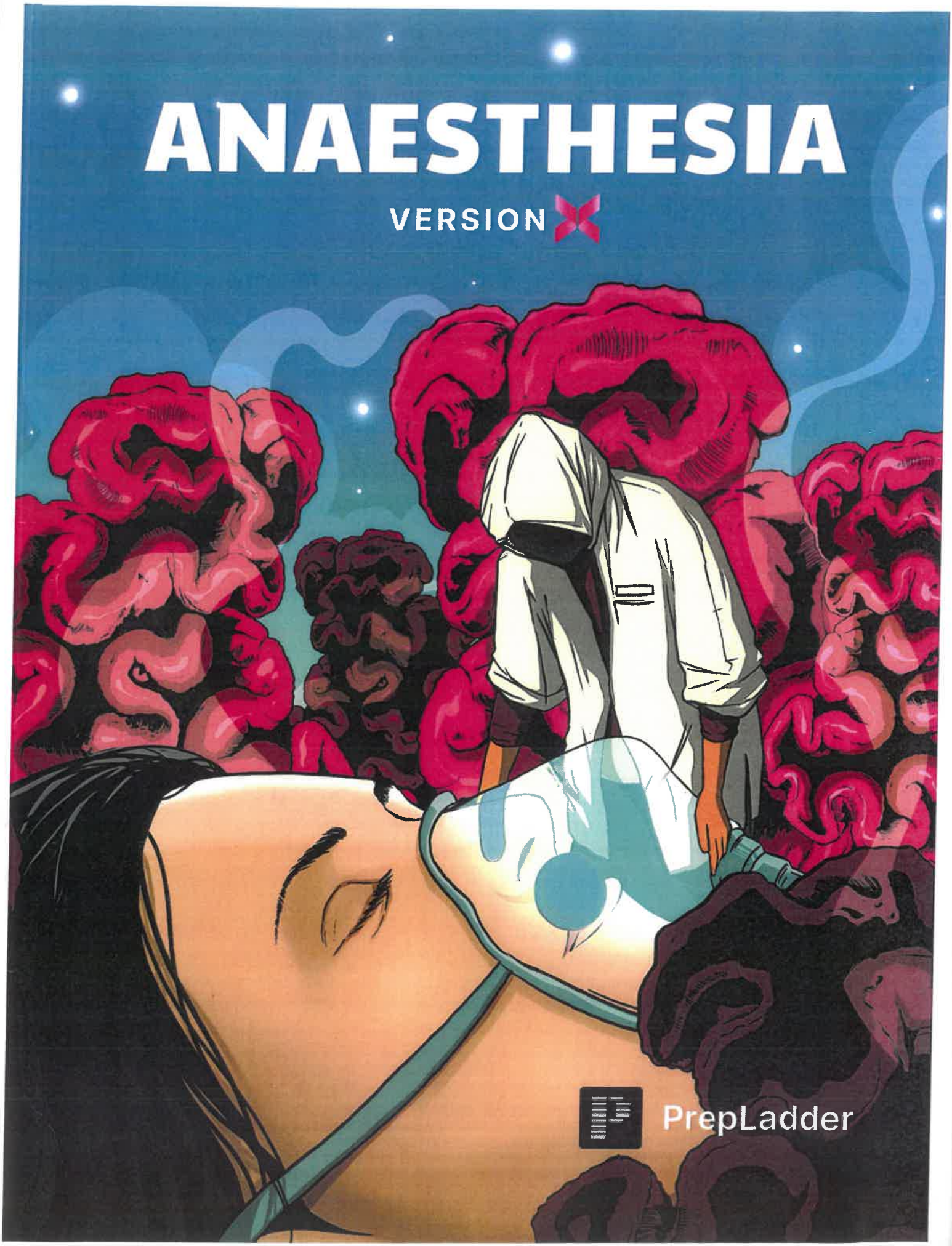
ANAESTHESIA

VERSION X



PrepLadder

Structured Notes According to

ANAESTHESIA

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

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

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CONTENTS

Anaesthesia

1. INTRODUCTION & PAC

HISTORY AND TYPES OF ANESTHESIA

00:00:19

- No / absence of sensation - Anesthesia
- It blocks pain before any procedure (Small cut injury to Open heart surgery)
- To maintain the vitals (BP, PR and RR) of the patient throughout the procedure

BEFORE PERFORMING ANY PAINFUL PROCEDURE

00:02:51

- Anesthesia is defined as loss of physiological response to the stimuli
- Reversible loss of pain

DIFFERENT TECHNIQUES OF ANESTHESIA

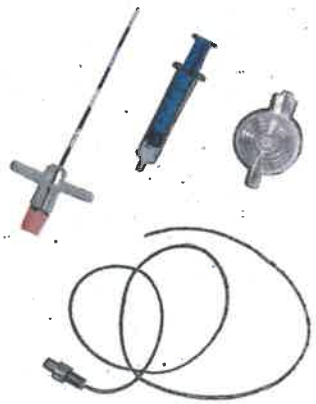
00:03:43

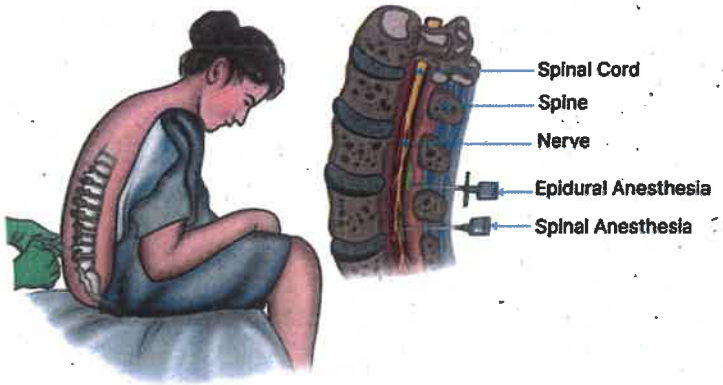
1. LOCAL ANESTHESIA

- Localised loss of pain sensation
- Easy to perform
- Dosing of the anesthesia is important
-

2. SPINAL ANESTHESIA

- Any surgery done below the level of umbilicus within 2-3 hours →
- Eg: Appendectomy,Hernia surgery
- Anesthesia is given below the level of spinal cord

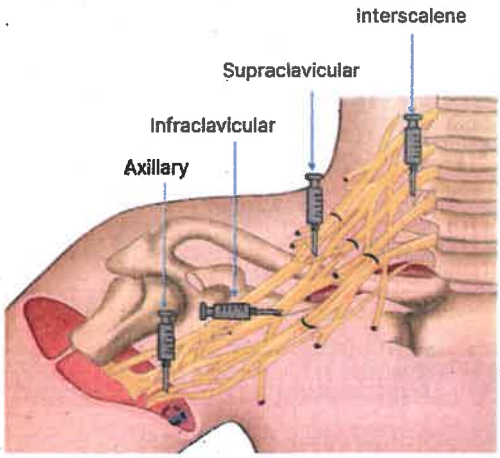




3. EPIDURAL ANESTHESIA

- It is also used for below umbilicus surgeries that requires > 3 hour duration
- Eg: Total knee replacement, Total hip replacement & ACL repair
- An epidural catheter is placed
  - One end of the catheter in the epidural space
  - Other end is outside

- Same local anesthetic is given in spinal and epidural anesthesia
  - In spinal - local anesthetic is given for 2-3 hours (single shot)
  - In epidural - It is given for > 3 hours (Top-up dose)



4. NERVE BLOCKS

- Brachial plexus block
- Stellate ganglion block
- Celiac plexus block
- Ankle block

THINGS COMMON IN LOCAL, SPINAL, EPIDURAL & NERVE BLOCK

00:17:09

- Patient is conscious
- Local anesthetics are given in all these techniques

5. GENERAL ANESTHESIA

- Patient is unconscious
- A mask is fit in the patient and asked to breathe in
- It does not depend upon the inhalational agents but
  - IV induction agents
  - Muscle relaxants
- Any surgery done above the level of umbilcus
  - Eg :Heart surgery, Brain and lung surgery requires general anesthesia

HISTORY OF ANESTHESIA

00:20:21

- Before 1840s - Surgeries were performed without anesthesia
  - Most of the interventions were emergency surgeries
- John Snow had used chloroform for anesthesia
  - Now chloroform is not used because of [redacted]
- Father of Anesthesia - John Snow
- Father of modern anesthesia - WTG Morton
  - Morton gave the 1st public demonstration of ether anesthesia on 16th October 1846
- World Anesthesia day - 16th October 1846
- August Bier has given the first spinal anesthesia in humans
  - Father of spinal anesthesia
- Clinical demonstration of N_2O was given by Horace Wells

PAC : PRE-ANESTHESTIC CHECK UP

00:26:44

- Airway assessment - Most important step
- History of comorbidities/allergies/personal history/surgery
- Investigations
- Fasting status
- Consent

AIRWAY ASSESSMENT

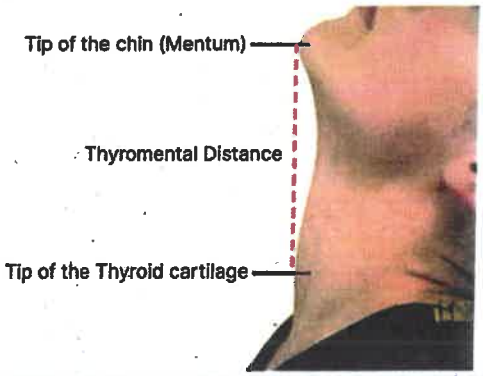
00:33:41

OPEN MOUTH

- Look for distance between upper and lower incisors - Interincisor distance
- Mallampati Classification

LIFT CHIN

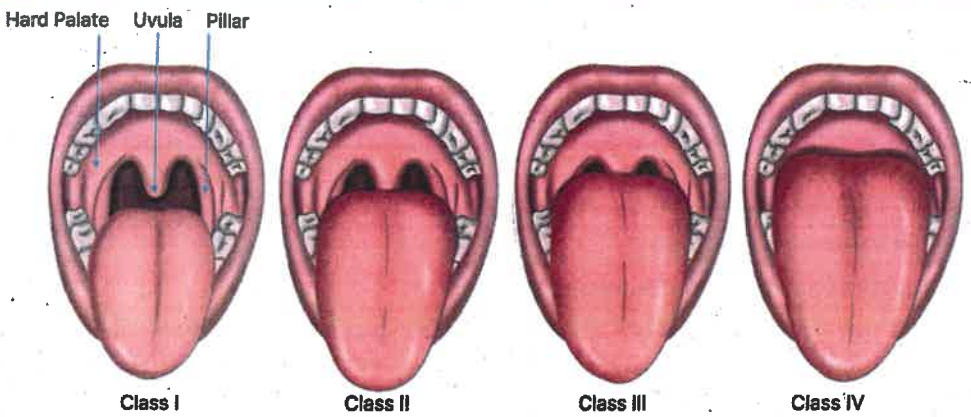
- Look for Thyromental distance
- Look for Sternomental distance



MALLAMPATI CLASSIFICATION

00:35:50

	CLASS I	CLASS II	CLASS III	CLASS IV
Hard palate	Visible	Visible	Visible	Visible
Soft palate	Visible	Visible	Visible	Not Visible
Uvula	Visible	Visible; Tip is not visible	Not visible, Tonsillar pillars are not visible	Not Visible



MODIFIED MALLAMPATI CLASSIFICATION

- To assess size of the tongue for Larygoscopy

CLASS I	CLASS II	CLASS III	CLASS IV	CLASS 0
Hard palate+Soft palate+Uvula+Tip of uvula+Tonsillar pillars	Hard palate +Soft palate +Uvula +Tonsillar pillars +Uvular tip is not visible	Hard palate & soft palate are visible	Only hard palate visible	Hard palate+Soft palate+Uvula+Tip of uvula+Tonsillar pillars+Tip of epiglottis

INTER-INCISOR DISTANCE

- It should be at least 4 cm or else difficult intubation
- Inter-incisor gap
  - Inter-incisor distance with maximal opening
  - Normal value > 5 cm/admits 3 fingers
  - Significance:
    - → < 3 cm : Difficult laryngoscopy
    - → < 2 cm : Difficult laryngeal mask airway (LMA) insertion
    - → Affected by TMJ & upper cervical spine mobility

LOWER INTERINCISOR DISTANCE

00:42:29

- It is seen in:
  - Tobacco chewers (submucous fibrosis)
  - Tetanus patients
  - Fracture mandible
  - Ankylosis of TMJ
- Best way to secure the airway of lower interincisor patients → Tracheostomy

THYROMENTAL DISTANCE

- Distance between mentum and thyroid cartilage is [redacted]

STERNOMENTAL DISTANCE

- Distance between the sternal notch and the mentum (It should be > 12.5 cm)

COEXISTING MEDICAL ILLNESS

00:46:03

1. History of disease - Diabetes mellitus, Hypertension,.CAD, Epilepsy, Thyroid disorders, Depression, Parkinson's disease

- Anti HTN's - should be continued in the same dose
  - Exception - ACE/ARB's are discontinued
  - In minor surgeries, optimize the BP before surgery
- In diabetics, Oral hypoglycemics should be discontinued as patient is fasting during surgery & before surgery → Risk of hypoglycemia
  - If required, switch to Insulin (major surgeries, 48 hours before surgery)
  - With reduced dose → [redacted]
  - Aim for blood glucose level is < 200 mg/dL
- Anti anginal/Antithyroid/Antiepileptics are continued
  - In epileptic patients, avoid usage of certain medication
  - Ketamine, Enflurane and Methohexitol should be used with caution as they precipitate seizures
- In thyroid disorders, aim is to make the patient euthyroid
  - Hypothyroidism reduces metabolism of patients leading to delayed recovery
  - Hyperthyroidism causes ventricular fibrillation & arrhythmias
- CAD

CONTINUED	STOPPED
• Aspirin – 75mg	• Clopidogrel - Stopped 8 days prior to the surgery
• Antianginal	• Warfarin - Stopped 3-5 days prior to surgery
• Anti cholesterol like statins	• Heparin -Stopped 6 hours prior to surgery
	• LMWH - Stopped 12 hours prior to surgery
	• Ticlopidine - Stopped 12-14 days prior to surgery

  - If a patient is taking Aspirin + Clopidogrel →Ask to stop Clopidogrel and continue with Aspirin
- OCPs :
  - Estrogen containing pills → ideally stop before 4 weeks (due to thromboembolism)
  - Progesterone containing pills : Safely continued
- Lithium
  - Prolongs the effect of muscle relaxants
  - Hence stopped 24-48 hours before surgery
  - If using newer muscle relaxants (Atracurium/Cisatracurium/Mivacurium)→ Lithium can be safely used
- **MAO inhibitors** - should be stopped 3 weeks before surgery
  - Reason : MAO inhibitor reacts with Pethidine to cause severe sympathetic reaction
  - Newer MAO inhibitor - Selegiline can be continued until the day of surgery
- **TCA**
  - It should be stopped 3 weeks prior to surgery
  - Preoperative use of antipsychotics and antidepressants →
- **Levodopa** should be continued
- **Smoking** ideally should be stopped 6-8 weeks prior to surgery
  - Smoking inhibits the mucociliary activity of the lung → Bronchospasm
  - If stopped for atleast 12 hours → reduces Carboxy-hemoglobin level
- **Steroids** - If used for > 1 week in the last year ,continue steroid medication before surgery
  - Sudden stopping of steroids can suppress endogenous cortisol
- **NSAIDS**
  - Avoid NSAIDs 24-48 hours before surgery as it can cause renal damage
- **Herbal medications** should be stopped 2-6 weeks before surgery
  - LFT should be done
- **Metallic stents**
  - Elective surgery should be deferred for 1 month
- **Drug-eluting stent**
  - Elective surgery should be deferred for 1 year

DRUGS THAT ARE CONTINUED	DRUGS THAT ARE STOPPED
All - Aspirin	How- Heparin/Herbal
Active - Antianginal	Can - Clopidogrel
Agents - Anti-cholesterol	The - TCA
Always - Antiepileptics	Medication - MAO inhibitors

Approved - Antithyroid	Let - Lithium Surgery - Smoking Occur - OHD (Oral Hypoglycemic Drugs)

- Personal history - Weight,age ,Smoker/Alcoholic
- History of allergies - Medicinal /Dust allergies
- History of surgery - Any complication related to Anaesthesia
  - Delayed recovery due to Pseudocholinesterase deficiency
  - Any history of halothane exposure
  - If history of halothane exposure is present, avoid halothane in the present surgery
- In emergency scenario
  - Followed by an RTA, the patient underwent craniotomy surgery under general anesthesia (CAD patient, smoking (+), on Clopidogrel)

↓

Anticipate bleeding, Arrange for blood transfuion

↓

Bronchodilators (due to the risk of bronchospasm in smokers)

INVESTIGATIONS

01:17:35

CBC	COAGULATION PROFILE	OTHER INVESTIGATIONS
• Hb - 10g/dL • Platelet	• PT, INR, BT, CT	• RFT • LFT - Antiepileptics, Anti TB • ECG - Add 2D-Echo • Chest x-ray - Smoker • UPT

FASTING BEFORE SURGERY

01:21:05

- Local anesthesia
- Spinal anesthesia
- Epidural anesthesia
- Nerve block
- General anesthesia
- Fasting should be done in all anesthesia to prevent aspiration
- Inguinal hernia → [redacted]

↓

Much bleeding (Need more time to complete the surgery)

↓

General anesthesia is given

↓

To prevent aspiration, fasting before surgery is manadatory

ADULT		CHILD	
Solid food	8 hours	Water	2 hours
Semisolid food (Fruits, juices with pulp, veggies)	6 hours	Mother's milk	4 hours
Liquid (Water,fruit juice without pulp)	2 hours	Formula feed	6 hours

CONSENT

01:26:22

- Very important thing
- Explain the anesthestic procedures
- Explain the complications associated with procedure
- Explain the risk of life threatening complication (very unlikely)
- Take consent from the patient or
- If minor, take consent from the guardian

ASA(AMERICAN SOCIETY OF ANESTHESIOLOGISTS) CLASSIFICATION

01:29:46

ASA CLASSIFICATION	DEFINITION
I	• Patient is free from comorbidities • Patient is free from systemic illness
II	• Patient has systemic illness which is well under control • Patient has systemic illness without any functional limitation
III	• Patient has systemic illness which is not under control • Patient has systemic illness with functional limitation • Severe systemic disease o Uncontrolled DM o Alcohol dependence o Moderate ↓ ejection fraction o BMI > 30
IV	• Patient with life threatening systemic illness o Recent MI o Stroke o ESRD
V	• Patient is morbid, not expected to survive without surgery o Intracranial bleed, Ruptured thoracic/Abdominal aneurysm
VI	• Brain dead patient

- Suffix 'E' represents an emergency procedure

Q) Case : A 30 year-old diabetci male diagnosed with tortion testis
  - His FBS → 94 mg/dl
  - PLBS →

Ans : ASA 2E

Q) A 40 year old patient was scheduled for mesh hernioplasty surgery. However, the surgery was postponed because the patient's preoperative blood pressure was 190/100 mmHg

- Ans :
  - In this case, BP is high due to Anxiety
  - In the pre-op room, 4 As are given

PRE-MEDICATIONS

01:39:14

- 4 As

1. ANTI-ANXIETY	• DOC - Lorazepam (Anterograde amnesia)
2. ANTIEMETICS	• DOC- Metoclopramide • Most potent - Hyoscine
3. ANTICHOLINERGIC	• Glycopyrrolate (DOC as PR is not increased as Atropine) • Atropine
4. ANTIBIOTICS	• Best time to given antibiotics is 30 min-60 min prior to surgery • All antibiotics are safely given before anesthesia except → Prolong the effect of muscle relaxants

MCQ's

Q)A 20 year old girl posted for appendectomy surgery comes to you for PAC while examining her airway you notic this,so which mallampatti classification this patient belongs to ?

a) Mp1
b) Mp2
c) Mp3
d) Mp4

Ans (b)

Q)A patient is on regular medications for co-existing medical problems.Which of the following drugs may be stopped safely with minimal risk of adverse effects before an abdominal surgery?
a) Statins
b) Beta blockers
c) ACE inhibitors/ACE receptor blockers
d) Steroids

Ans (c)

Q)What is the appropriate fasting recommendation for solid food in adults?
a) 4 hours for solids in adults
b) 6 hours for solids in adults
c) 8 hours for solid food in adults
d) 2 hours for soilds in adults

Ans (c)

Q)When should TCA be discontinued before laparoscopic cholecystectomy surgery in a 49 year old female?
Ans : 3 weeks prior to surgery

Q)As a junior resident in pediatric surgery department ,you re overseeing an infant scheduled for hypospadias repair surgery.What instructions would you provide to the mother concerning preoperative fasting for the infant on mother's milk?
a) 4 hour
b) 6 hour
c) 2 hour
d) 8 hour

Ans (a)

Q) Which of the following is the use of Mallampati classification?

a) Endotracheal intubation
b) To evaluate the risk of surgery
c) To evaluate the pros and cons of surgery
d) To evaluate the fitness of the patient

Ans (a)

Q) Which of the following comes under ASA grade 1?

a) Healthy patient
b) Mild disease
c) Moderate disease
d) Morbid patient

Ans (a)

2. LOCAL ANAESTHESIA

INTRODUCTION

- Local anaesthetics : Reversible loss of pain sensation
- These are given in
  - Local anaesthesia
  - Spinal anaesthesia
  - Epidural anaesthesia
  - Nerve blocks

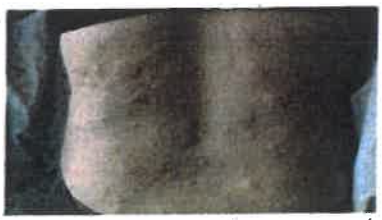
CLASSIFICATION

00:01:18

	AMINOESTERS (MNEMONIC : 1 I)	AMINOAMIDES (MNEMONIC : 2 I)
Drugs	• Cocaine • Procaine • Chloroprocaine • Benzocaine • Tetracaine • Proparacaine	• [redacted] • Bupivacaine • Mepivacaine • Prilocaine • Dibucaine
Metabolism	• Metabolized by Plasma esterase except cocaine • Cocaine is metabolized in liver	• Metabolized in the liver

Q. A patient after receiving a local anaesthetic started to complain of itching and rashes on his body, which LA could have caused this?

- Some amino esters are metabolized to para-aminobenzoic acid [redacted] causing allergic reactions
- Procaine and Benzocaine have the highest incidence of allergic reactions



MECHANISM OF ACTION

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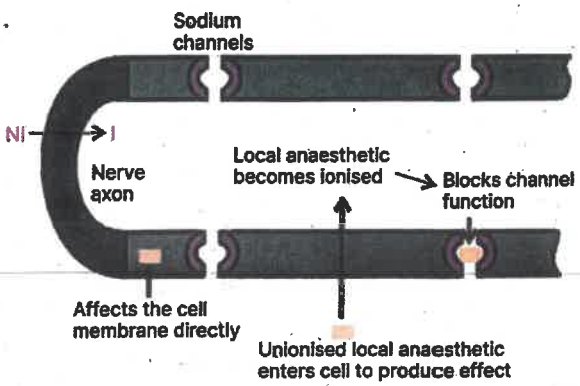


Non-ionized form of local anaesthetic enters the nerve terminal
↓
After entering the nerve, it becomes ionized
↓
Blocks the sodium channel
↓
Disrupts the depolarisation
↓
No action potential
↓
No pain sensation

- Mechanism of action : [redacted]
- Main mechanism
  - The non-ionized form of local anaesthetic enters the nerve
  - The ionized form of local anaesthetic blocks the sodium channel

NERVE FIBRE SENSITIVITY 00:11:10

- Autonomic > Sensory > Motor
- A fibres > B fibres > C fibres
  - A γ Fibres are more sensitive

ABSORPTION 00:12:38

- Easy absorption leads to toxicity
- Highest absorption : [redacted] > Tracheal > Intercostal > Brachial plexus > Epidural
- Duration depends on
  - ↑↑ dose : Long duration
  - ↓↓ dose : Short duration

ADDITIVES OF LOCAL ANAESTHETICS 00:15:00

- Additive is added to lignocaine to increase the duration
  - Adrenaline
  - Sodium bicarbonate
  - Opioids
  - Dextrose
- Addition of Vasopressors to LA causes
  - ↑ duration of LA
  - ↑ onset
  - ↓ absorption
  - ↓ toxicity
- M/c vasopressor : Adrenaline

ADRENALINE

- S/E
  - ↑ vascular resistance, → ↑ [redacted]
    → ↑ arrhythmias → hypertensive and CAD patients
  - Instead of adrenalin, we use a prodrug (less S/E) Felypressin → maintains BP and pulse rate

SODIUM BICARBONATE

- ↑ speed of onset
  - By ↑ pH of anaesthetic solution. (More alkaline)
  - ↑ non-ionized part of LA making it more permeable to the nerve fibre

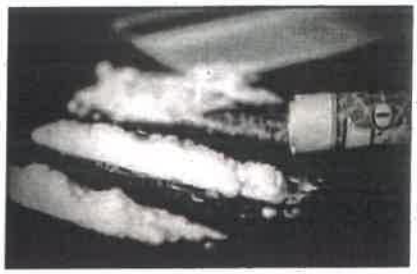
OPIOIDS

- All opioids are safely given : Fentanyl, Alfentanil, Sufentanil
- Exception : Ramifentynyl
  - Contains neurotoxic preservative
  - Avoided in spinal anesthesia
- S/E : Vomiting, Respiratory depression, Pruritus : M/c

DRUGS INCLUDED IN LOCAL ANAESTHETICS

00:23:36

COCAINE



- Belongs to Aminoester
- The first local anesthetic introduced by Carl Koller from the leaves of Erythroxylum coca
- 1st used for → Eye Surgery and Spinal Anaesthesia
- It is a vasoconstrictor LA and should never be administered IV
  - It causes potent vasoconstriction
- Most cocaine users usually end up with complications like HTN and stroke

CHLOROPROCAINE / PROCAINE

- Aminoester
- Short-acting LA
  - Chloroprocaine : shortest-acting LA
  - Procaine : [redacted]
- High dose + High concentration

LIGNOCAINE/XYLOCAINE/LIDOCAINE

- Aminoamide group
- Xylocard : preservative-free form of Xylocaine
- Only local anaesthetic given IV
- Duration of lignocaine is 45mins - 1 hour
- Mnemonic : LIG
  - L - M/c used LA worldwide, 2nd M/c used LA in spinal anaesthesia (M/c used LA in spinal anaesthesia is Bupivacaine)
  - I - M/c used in IV RA
  - G - Causes Malignant hyperthermia (Hot - Garam)

DOSE AND DURATION

- Plain Lignocaine
  - Dose : [redacted]
  - Duration : 45 mins - 1 hour
- Lignocaine + Adrenaline
  - Dose: 7 mg/kg (< 500mg)
    → Adding adrenaline ↓ absorption and toxicity of lignocaine
  - Duration: 2 hours

LIGNOCAINE TOXICITY

- Earliest manifestation of lignocaine toxicity : CNS manifestations
- Lignocaine primarily causes CNS toxicity

Lignocaine toxicity
↓
Perioral numbness (1st sign)
↓
Tremors (2nd sign)

↓

Seizures

↓

↓ SpO_2 → Respiratory depression

↓

Cardiac arrest

- T/t of lignocaine toxicity
  - Antiepileptic medication → Mask O_2 → Intubate and ventilate the patient
  - 20 % Intralipid solution : Commonly used for Bupivacaine toxicity

ADDITION OF LIGNOCAINE + ADRENALINE

- It causes
  - ↑ duration
  - ↑ onset
  - ↓ absorption/toxicity
- Addition of adrenaline should be avoided at end arterial areas
  - Fingers, toes, penis, pinna
  - End up in gangrene
- It is also avoided in patients having CAD/HTN

CONCENTRATION OF LIGNOCAINE IN VARIOUS TECHNIQUES OF ANAESTHESIA

- Calculation of concentration %
  - 2% = 2g/100ml = 2000mg/100ml
  - Each ml = 20mg
  - 2% = 20mg/ml

    → Simply multiply concentration with 10

TECHNIQUE (INETS)	CONCENTRATION
Intravenous regional anesthesia	0.5%
Nerve blocks	1-2%
Epidural	
Topical	2-4%
Spinal	5%

BUPIVACAINE

- Aminoamides group
-

DOSE AND DURATION

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

Important Information

- **LONGEST TO SHORTEST ACTING LA**
  - Delhi - Dibucaine (longest)
  - To - Tetracaine
  - Bombay - Bupivacaine (M/c LA in spinal anesthesia)
  - Loves - Lignocaine (M/c Worldwide)
  - P - Procaine
  - C - Chlorprocaine (Shortest)

BUPIVACAINE TOXICITY

- Bupivacaine is the most cardiotoxic LA. CNS : CVS = 1:3
  - It should never be administered IV, but safe in CSF
  - It causes cardiotoxicity by acting on Sodium channels
  - If given IV, it can cause arrhythmias
- Case

20 year old female posted for EM LSCS

↓

Was given spinal anesthesia by Junior residents

↓

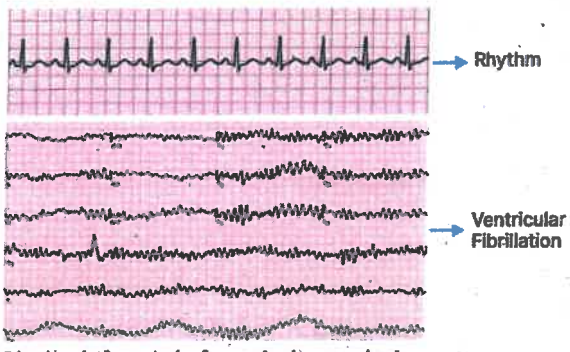
Immediately post spinal

↓

Patient developed initial symptoms as seizures, tinnitus, perioral numbness, mild HTN then slowly developed hypotension and arrhythmia

↓

Cause?



Rhythm before and after spinal anaesthesia

  - Normal sinus rhythm → ventricular fibrillation
  - Bupivacaine toxicity causes sudden cardiac arrest, unlike lignocaine toxicity
- T/t
  - Antiepileptics
  - If ventricular fibrillation, chemical cardioversion by
    → Bretylium, [redacted] procainamide
  - DOC : 20% intralipids → 1.5 ml/kg bolus followed by 0.5 ml/kg/hr infusion
  - 20% intralipids → [redacted]
  - Epinephrine (only when cardiac arrest occurs)

ROPIVACAINE

- Belongs to the
- It is the enantiomer of bupivacaine
- Structurally similar to bupivacaine
- Has less potency and cardiotoxicity

Important Information

- **POTENCY OF LA**
  - The potency of local anaesthetic is determined by lipid solubility
    → More the lipid solubility, the higher the potency
    → Less the lipid solubility, the lesser the potency

DIBUCAINE

- Belongs to the aminoamide group
- Longest acting LA
- The most toxic local anaesthetic
- Only used for dibucaine number test
  - Detects atypical pseudocholinesterase or pseudocholinesterase deficiency
    → Pseudocholinesterase is an enzyme responsible for the metabolism of drugs like Scoline
    → Patient with pseudocholinesterase deficiency : Prolong action of scoline → delayed recovery

SURFACE ANAESTHESIA

00:58:55

- When LA is used on mucous membranes (conjunctiva, skin)
  - E.g. Insertion of Ryles tube, Foley's catheter
  - Prilocaine, Benzocaine, Tetracaine, Hexycline, Dibucaine, Cocaine
- All LA that can be used as surface anaesthetics except
  - Procaine
  - Mepivacaine
  - Bupivacaine
- These drugs are avoided due to
  - Poor penetration into the mucous membrane
  - Systemic toxicity
  - Formulations

ANAESTHESIA FOR OCULAR SURGERY

01:01:03

- Commonly used is local anaesthesia
  - If the patient is not willing, then general anaesthesia is given.
- Local anaesthesia
  - Peribulbar
  - Retrobulbar
    → Contraindicated in bleeding disorders
  - Topical
    → Nowadays, Tetracaine drops are used topically by adding to the conjunctiva
    → The best topical LA for cataract surgery is Proparacaine