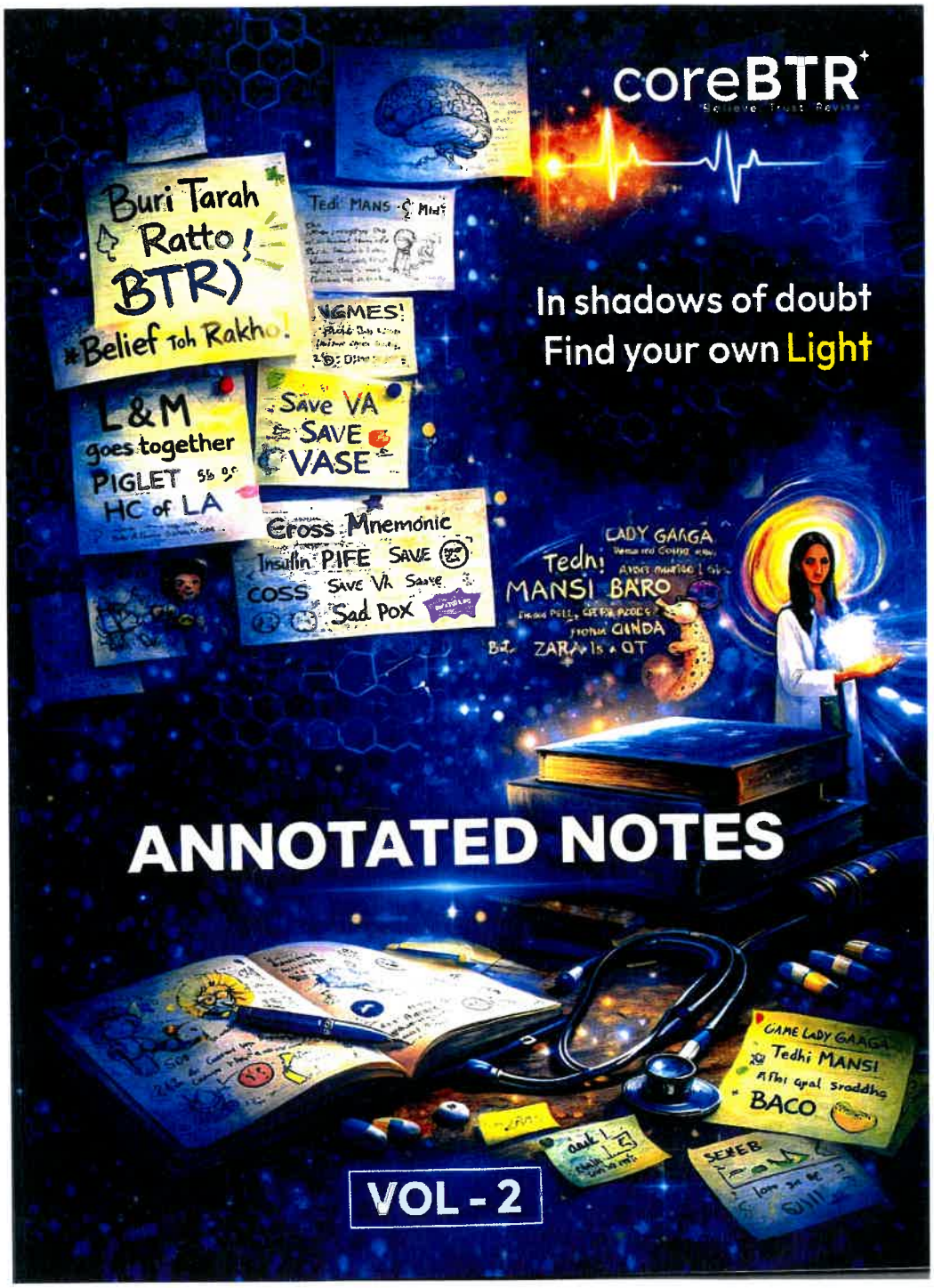

coreBTR
Buri Tarah Ratto! BTR)
*Belief Toh Rakho!
In shadows of doubt
Find your own Light
L&M goes together
PIGLET
HC of LA
Save VA
SAVE
VASE
Cross Mnemonic
Insulin PIFE SAVE
COSS Save VA Saave
Sad POX
LADY GAGA
Tedhi MANSI BARO
ANNOTATED NOTES
VOL - 2

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9 CHAPTER

ANAESTHESIA

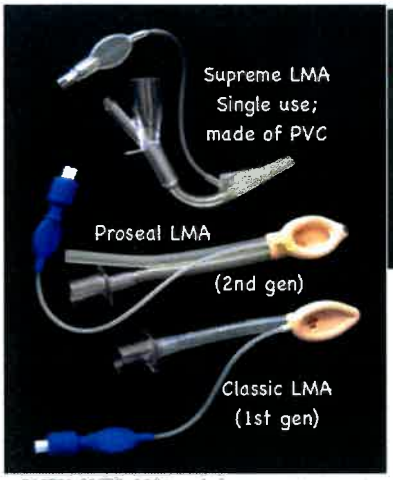
INSTRUMENTS

Guedel's oro-pharyngeal airway



Nasopharyngeal airway

Tip of nose to ear lobule
C/I in base of skull injuries & coagulopathies



AMBU AURA LMA - 1st generation LMA

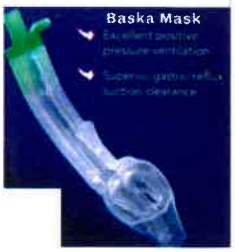


Streamlined Liner of the Pharynx Airway (SLIPA)



iGel LMA (3rd gen LMA)





SIZE OF LMA
Child: 3
Female: 4
Male: 5

Intubation & Instruments Needed

Macintosh-Adults



McCoy- Levered blade



Intubation Blades

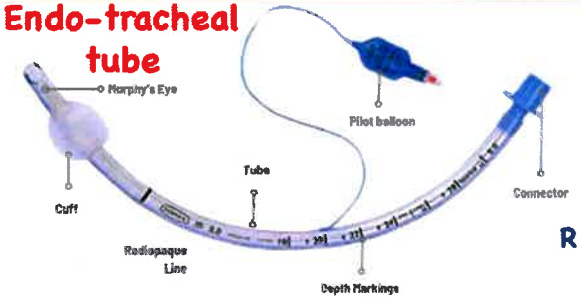
Miller's- Child





C-Mac Video laryngoscope

Endo-tracheal tube



$R \alpha \frac{1}{r^4}$

ET tube placement:

- CXR
- Best: EtCO2 = 35-45mmHg

- Preterm- 0
- Term- 1
- Children- 2
- Female- 3
- Male- 4

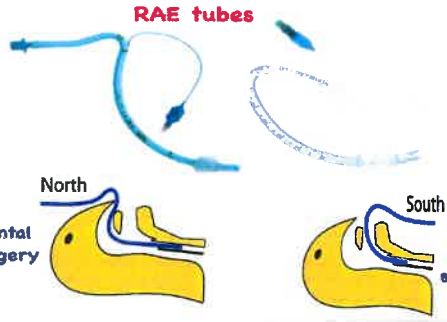
- Hand: Left sided
- Insert: Right side of mouth
- Pressure: Forwards & upwards
- MC injury: Upper central incisions
- BURP: Backward-Upward-Rightward

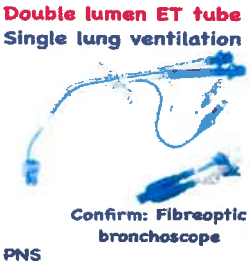
Internal diameter: Resistance
Cuff- Low pressure, High volume
Children: Microcuffed > Uncuffed
Size of ETT-

- <1200g (<28wk): 2.5
- 1200-2200g (29-34wk): 3
- >2200g (>34wk): 3.5
- Child: 3-4
- Female:7
- Male: 8

Instruments	Formula
ETT(mm) (Uncuffed)	4 + (Age /4)
ETT depth (cm)	3 x ETT
NG Tube/ Foley's (Fr)	2 x ETT
Chest Tube (Fr)	4 x ETT

coreBIR by Dr. Zainab Vora

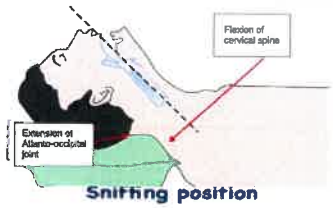




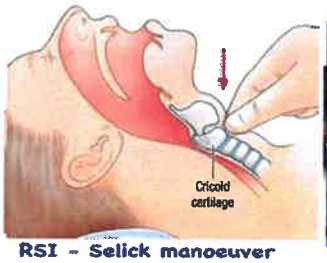






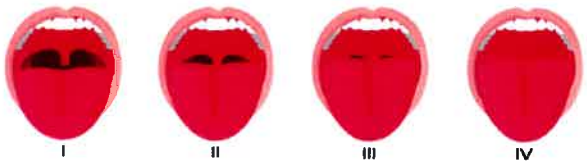








Difficult Intubation



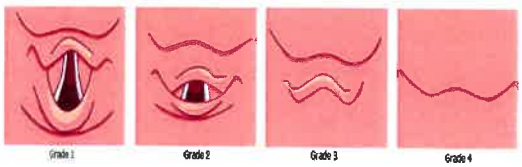
Mallampati score

R/F:

- Obese
- Bearded
- Edentulous
- Snorer
- Elderly
- Neck circumference >40 cm
- Finger breadth:TMJ >3 fingers
- Thyro-mental distance- >6.5cm
- Sterno-mental distance- >13cm
- Lip bite test

Fibreoptic intubation

Cormack-Lehanne Laryngoscopic grading



Difficult Intubation

Plan A:
- Face-mask ventilation & Tracheal intubation
- Direct/ video Laryngoscopy (max. 3 + 1 attempts)

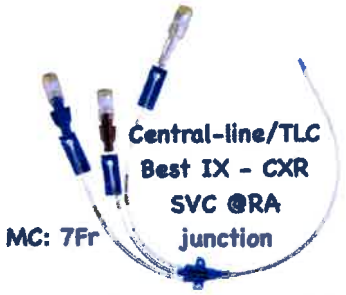
Pre-oxygenation - 3min 100%

Plan B:
- 2nd generation SAD insertion
- Max- 3 attempts

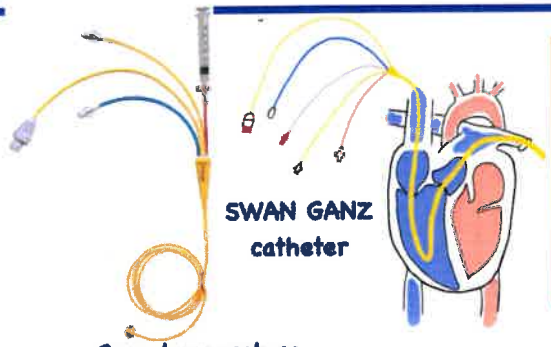
Plan C: Face-mask ventilation

Plan D (CICO): Restricted mouth opening
- Front Of Neck Access (FONA)
- Scalpel Cricothyrodotomy

Instruments



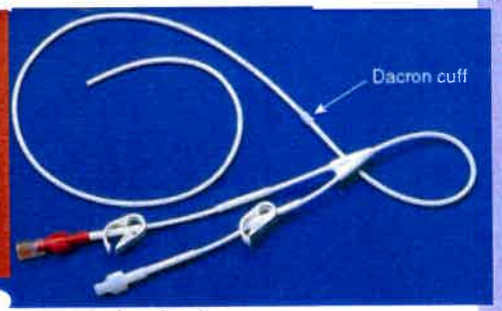
CLAI: S.epidermidis/CoNS



Core temperature
- ideal site: PA
- MC: lower end of esophagus



Chemoport/Portcath
For chemotherapy



Tunnelled catheter
-Permacath
-Hickmann's catheter
Dialysis, TPN, Chemotherapy

- MC vein for central line: Internal Jugular Vein
- MC vein for TPN: Subclavian vein
- Max risk of pneumothorax: Subclavian vein
- Max risk of infection: Femoral vein
- Max risk of thrombosis: Femoral vein

Total Parenteral Nutrition (TPN):

- 20:30:50 Protein:Fat:Carbs
- >1kg/day weight gain: Fluid overload
- Weight gain after: >6days
- Refeeding syndrome: Hypo-K/Mg/P
- Zn, B12 deficiency
- MC metabolic complication: Insulin resistance

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Instruments



18G needle
Minimum G in ATLS(Trauma)



18Fr Foley's catheter



14Fr NG tube

CI: Skull base #
Esophageal stricture

Length of NG tube:
NEX (Nose-Ear-Xiphoid) - Adults
NEMU (Nose-Ear-Midpt. b/w Xiphoid & Umbilicus) - children

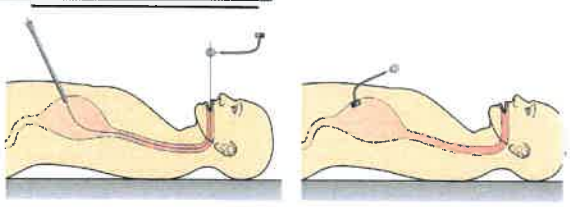
Colour Code	Size	Flow rate
Orange	14G	270
Gray	16G	210
White	17G	130
Green	18G	80
Pink	20G	50
Blue	22G	30
Yellow	24G	20
Violet	26G	10

GORY from PunjaB

Color Code	French 1Fr = 0.3mm
Green	14
Orange	16
Red	18
Yellow	20
Purple	22
Blue	24



PEG tube (Percutaneous Endoscopic Gastrotomy)



Day Care Anesthesia

Criteria

- Surgery < 2hrs
- Low risk of significant immediate postoperative complications
- Patient able to eat, drink postoperatively
- Post-op pain managed by oral painkillers in conjunction with LA/ Peripheral block
- Patient able to mobilise postoperatively
- BMI (to avoid respiratory distress) <38

Contra-Indications

- Unstable ASA 3
- ASA 4, 5
- Any poorly controlled comorbidity

Preferred anesthesia: TIVA → Propofol
Preferred opioid: Remifentanyl [shortest acting] → Pseudocholinestrase
Preferred MR: SCh/Rocuronium > Mivacurium
Leading cause of re-admission: PONV; Hemorrhage

discharge
Aldrete score: Activity/ BP/ Consciousness / Respiration/ o2 saturation

Monitoring during Anesthesia









Pulse oximetry
Beer lambert law
OxyHb: IR light
DeOxyHb: Red light
False low(~85%) = Meth-Hb
False high(~100%) = CO-Hb
Detect via Co-oximetry

No drug	Nondepolarizing block	Depolarizing block	
		Phase I	Phase II
Train-of-four	Fade	Constant but diminished	Fade
TOF-R = 1.0	TOF-R = 0.4	TOF-R = 1.0	TOF-R = 0.4

>5mg/kg

Level of consciousness
- frontal processed EEG
- Depth of anaesthesia

0 - 40-60 - 100 Fully awake
Coma Anaesthesia

- MC nerve: Ulnar nerve - adductor pollicis
- 2nd MC nerve: Facial nerve - orbicularis oculi
- MC stimulus: ToF[2Hz]
- Tetanic stimulation: 50Hz
- Extubation TOF: >0.9 - clinical sign → lifts head > 5s

Oxygen Delivery Devices















High flow





- fixed O2 %
- COPD
- O2 toxicity





↓NP dead space
Humidification, PEEP+
May delay intubation



Prerequisites for NIV
- Conscious
- Empty stomach

Device	Nasal Cannula	Hudson mask	Venturi device	NRBM	HFNC	NIV[CPAP]
Max Flow Rate (L/min)	5	10	15	15	60	No limit
Max Saturation (%)	40	60	60	85-90	100	100

Inhalational anesthetics

	MAC α 1/potency	BLOOD GAS SOLUBILITY α 1/speed
Methoxyflurane	0.2	12
Halothane	0.75	2.5
Isoflurane	1	1
Sevoflurane	2	0.65
Desflurane	6	0.45 (Xenon min)
N20	104	0.47



Sevoflurane

Compound A
Fruity odour
Best for Asthma
Day care Sx
Liver D

Compound A: Nephrotoxic

Isoflurane

Best for cardiac Sx

Halothane

Min MAC
Max bronchdil
AI hepatitis
Max ICP rise
Sensitises heart to epiN

arrhythmia

Desflurane

Tec-6 vaporizer
Irritant X induction
CO with dessicated soda lime
Maintenance agent of choice
Best for Renal D, Obese

N2O

Concentration effect
Second gas effect
Diffusion hypoxia
B12 deficiency

C/I: Intestinal obstructn; Middle ear sx

ALL Inhalational agents:
-Cerebral metabolic O2↓
-CBF/ ICP↑
-CVS, HR↓
-Respiratory drive↓

ALL IV agents:
-Cerebral metabolic O2↓
-CBF/ ICP↓ Except KETAMINE
-CVS,HR↓
-Respiratory drive↓

IV anesthetics

(TIVA)

DOC for Day care/ Liver/ Kidney/ NeuroSx/ TIVA/ Malignant Hyperthermia/ Porphyria/Antiemetic : PROPOFOL

Infusion syndrome (acidosis, green urine), Painful injection- Soyabean oil, Egg lecithin : PROPOFOL

NMDA antagonist, Dissociative anesthesia, DOC in Asthma/ COPD, Cyanotic HD, Shock : KETAMINE

C/I in Hypertension / Epilepsy/ Glaucoma : KETAMINE

DOC in Cardiac surgery, S/E- Adrenal suppressant (11β-hydroxylase) : ETOMIDATE

DOC in Hyperthyroidism, Seizures, Narcoanalysis, Redistribution S/E- Intra-arterial vasospasm: THIOPENTONE

Rx: Paperverine injection

Muscle relaxants

Depolarising MR: Sch
Best for RSI, Shortest acting
S/e: Myalgia (MC), Hyperkalemia, Bradycardia, Intragastric pressure high

Non-depolarising MR:
Aminosteroid compounds: Rocuronium, Vecuronium, Pancuronium
Longer duration, metabolized in liver & kidneys

Benzylisoquinolinium compounds: Atracurium, Mivacurium
Shorter duration of action
Hofmann elimination & ester hydrolysis- safe in RF/ LF/ pediatrics Atracurium
May cause more histamine release
By-product of Atracurium: Laudonosine- seizure (cis-atracurium preferred)

- Most cardiostable, neuroSx (Biliary excretion) : Vecuronium
- Shortest acting NDMR: Gantacurium(X FDA approved) > Mivacurium

•Dibucaine No. <30: Atypical psuedocholinesterase
Prolonged paralysis after giving Succinylcholine & Mivacurium

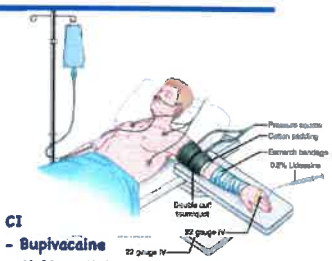
- Reversal : NDMR —> Neostigmine + Atropine
- Sugammadex : Cyclodextrin —> for Ve/Rocuronium [C/I in Liver ds.]

Local anesthetics

Amides	Esters
Bupivacaine, Lidocaine, Ropivacaine, Prilocaine	Cocaine, Procaine, Benzocaine
Liver – cytochrome P450	Plasma – pseudocholinesterases
Longer action	Shorter action
Less allergy	PABA metabolite- More allergy



Eutectic Mixture of Lignocaine + Prilocaine

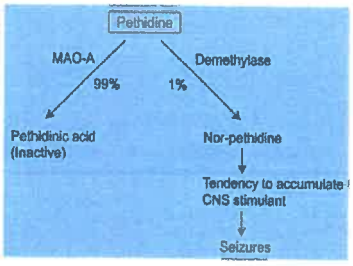

CI
- Bupivacaine
- Sickle cell A

- MOA- unionised form –> Na+ (inactivated voltage gated) inhibition
- Autonomic > Sensory > Motor
- Causing Hypertension: Cocaine
- S/E- MethHb: PRILOCAINE, BENZOCAINE
- Most cardiotoxic: Bupivacaine Dose: 2mg/kg
- Max dose of Lignocaine: 5mg/kg [w/ epinephrine: 7mg/kg]
- Proparacaine duration: topical - 10-20 min
- Safest in MH: Procaine
- LAST: CNS/CVS toxicity DOC: 20% intralipid
- Route: iv > intra-tracheal > intercostal > caudal/epidural > brachial

Opioids

- Full agonist: Morphine, Pethidine, Heroin, Meperidine, Methadone, Codeine, Fentanyl
- Partial agonist: Buprenorphine
- Mixed agonist/antagonist: Nalbuphine, Pentazocine, Butorphanol
- Antagonist: Naloxone, Naltrexone

- Avoid Opioids in- Head injury, Biliary obstruction - SOD dysfunction, asthma
- Mydriasis: Meperidine
- Pruritus: Histamine release- vasodilation, hypotension
- No tolerance to: Constipation, Miosis
- Serotonin syndrome: TRAMADOL(μ Rc action + Serotonin Rc)
- Wooden chest syndrome: Fentanyl
- Prolonged QTc: Methadone
- Shortest acting (Day care): Remifentanyl



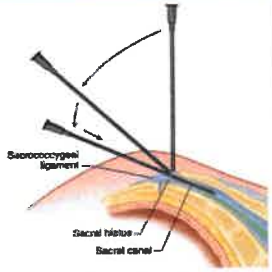
Regional Anesthesia



Anterior ethmoidal nerve



Nasociliary n. block

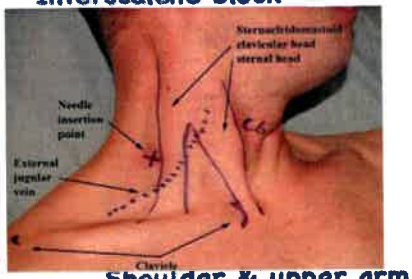


Caudal anasthesia (<8yrs)
Sacral hiatus open
S3-S4 lvl

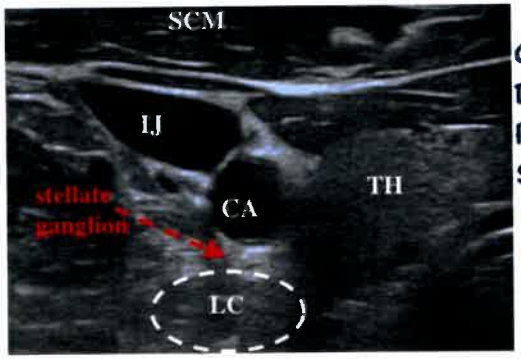


Upper arm surgery; R/o Pneumothorax, Phrenic n. #

Interscalene block

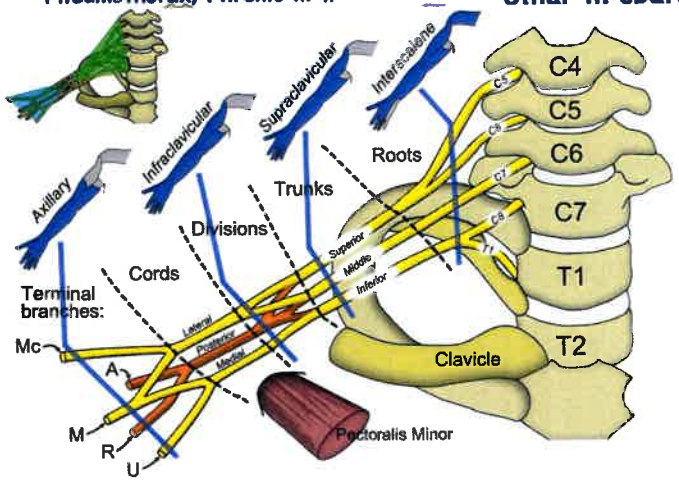


Shoulder & upper arm
Ulnar n. sbared



C6 - Stellate ganglion block
Done for: Raynaud's; Vasospasm; PTSD
Signs:

- Horner's - Ptosis[1st]
- Guttman sign - nasal mucosal congestion



coreBTR by Dr. Zainab Vora

Neuraxial block autonomic/motor/sensory

Epidural Anesthesia (EA)	Spinal Anesthesia (SA)
Larger dose of drug	Smaller dose of drug
Anywhere	L3-L4 MC Tuffier's line ~ iliac crest[L4-5]
Not as good as SA	Better quality of anesthesia
Adjustable, prolonged action via a catheter	Single-shot injection; action for ~3hrs Umbilicus

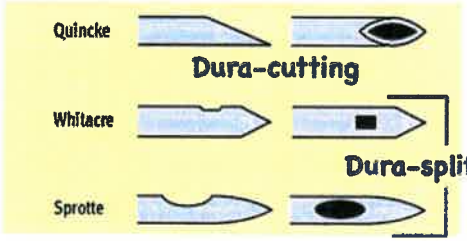
CI: Raised ICP; Papilledema; Coagulopathy; Shock; Local infection

Layers punctured for LP:

Skin → subcutaneous fat → supraspinous lig → interspinous lig → Ligamentum flavum → Dura → Arachnoid







Post-dural puncture headache:
- TOC: iv fluids + bed rest -x-> Autologous blood patch

MC Intra-op complication: Hypotension
DOC: Phenylephrine
MC post-op complication: Urinary retention

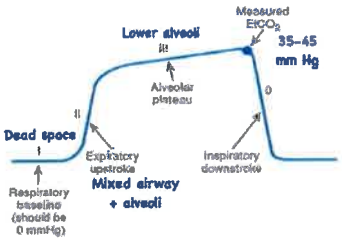
PDPH: increases in pregnancy & on ambulation; reduces on supine position

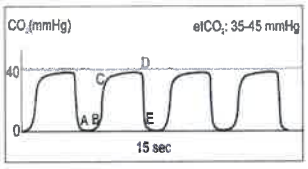
1. Adult spinal cord-Lower border of L1
2. Spinal cords in infants-Upper border of L3
3. A/D/Subarachnoid space-Lower border of S2

PIH, Heart ds in pregnancy: Epidural / GA
Except CoA/ Eisenmenger/ Uncorrected TOF: GA

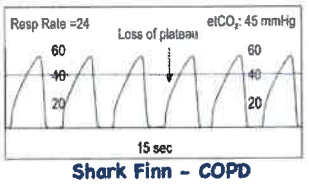
coreBTR by Dr. Zainab Vora
Anaesthesia

Capnography

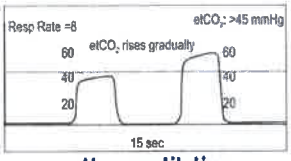




Normal

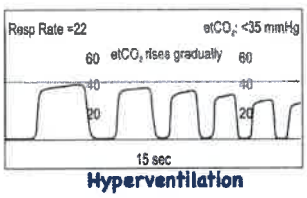


Shark Finn - COPD airway obstruction

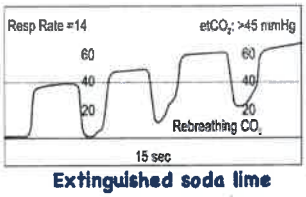


Hypoventilation

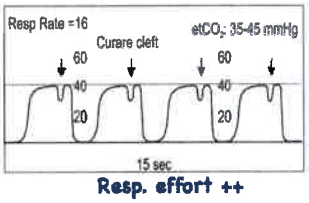
Infrared spectroscopy



Hyperventilation



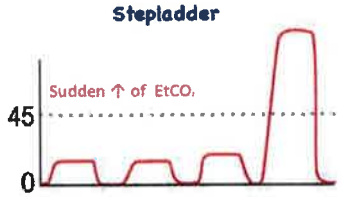
Extinguished soda lime



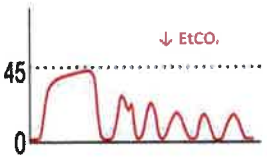
Resp. effort ++

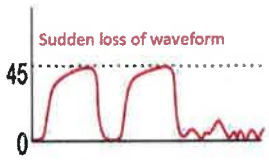
80% Ca(OH)2 + NaOH + KOH +15% H20 Soda lime
Ca(OH)2 + NaOH + CaCl2 Amsorb
Ba(OH)2 + CaSO4 Barylime

Stepladder



Esophageal intubation

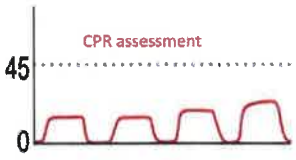




- Circuit disconnect
- Cardiac arrest
- Venous air embolism

R/F: Neurosurgery/ Laparoscopy/ Sitting posture/ Fowler's position/ Neck surgery

Next: DURANT position [Lt.lateral decubitus + Trendelenberg] —> Aspirate



EtCO2 > 10-20mm
↓
Adequate Chest compression
↑
Intra-arterial DBP >20mm

Malignant hyperthermia

- Sch, Lignocaine, Inhalational agents
- Tachycardia + Rigidity
- Earliest sign- EtCO2 ↑
- Late sign- Hyperthermia
- RyR/DHPR (Chr 19)-AD
- DOC- Dantrolene sodium

Pre-Op Assessment

Pre-op drug DOC to reduce anxiety: Midazolam
Pre-op drug DOC to reduce secretions: Glycopyrrolate
Pre-op Antibiotic time: 30min - 1hr prior to incision - Cefazolin
MC nerve injured intra-op- Ulnar nerve
MC intra-ophthalmic complication- Corneal abrasions
PONV DOC: Ondansetron
POVL MCC: Ischemic optic N
MCC of intra-op anaphylaxis: Antibiotics > MR
Min acceptable Hb: 8mg/dL(elective)
Min acceptable platelet: 1 lakh

Mendelson syndrome Aspirin + pregnancy
NPO heavy meal: 8hr
Light/semi-solid meal/ Formula: 6hr
Breastmilk: 4hr
Clear liquids: 2hr

Goldman Grading system
♥ risk assessment

Stop Drugs before surgery

Clopidogrel: 7d Warfarin: 5d LMWH: 24h UFH: 4-6h Li: 48hr SGLT2-: 24hr (r/o Euglycaemic ketoacidosis)
ACEi/ ARB/ OHG/ Insulin/ Diuretic (except thiazide): omit morning dose
OCP: r/o DVT (immobilisation/obese) - 4-6wks
Smoking: 4-6wks

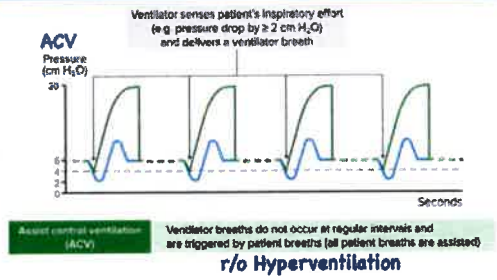
ASA classification

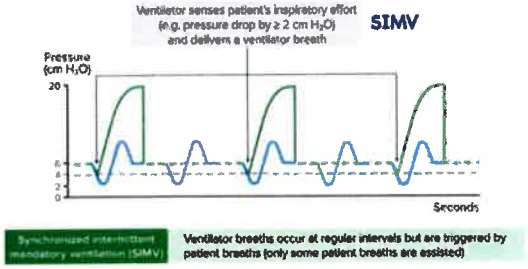
ASA PS	Definition	Examples (including, but not limited to):
ASA I	A normal healthy patient	Healthy, non-smoking, no or minimal alcohol use
ASA II	A patient with mild systemic disease	Current smoker, social alcohol drinker, pregnancy, obesity (BMI 30–40), well-controlled DM/HTN, mild lung disease
ASA III	A patient with severe systemic disease	Poorly controlled DM or HTN, COPD, morbid obesity (BMI ≥40), active hepatitis, alcohol dependence or abuse, implanted pacemaker, moderate reduction of ejection fraction, ESRD undergoing regularly scheduled dialysis, premature infant PCA < 60 weeks History (>3 months) of MI, CVA, TIA, or CAD/stents
ASA IV	A patient with severe systemic disease that is a constant threat to life	Recent (<3 months) MI, CVA, TIA, or CAD/stents, ongoing cardiac ischemia or severe valve dysfunction, severe reduction of ejection fraction, sepsis, DIC, ARD, or ESRD not undergoing regularly scheduled dialysis
ASA V	A moribund patient who is not expected to survive without the operation	Ruptured abdominal/thoracic aneurysm, massive trauma, intracranial bleed with mass effect, ischemic bowel in the face of significant cardiac pathology, or multiple organ/system dysfunction
ASA VI	A declared brain-dead patient whose organs are being removed for donor purposes	Organ donor (brain-dead patient)

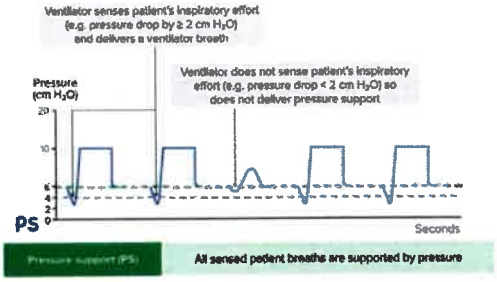
Mechanical ventilation modes

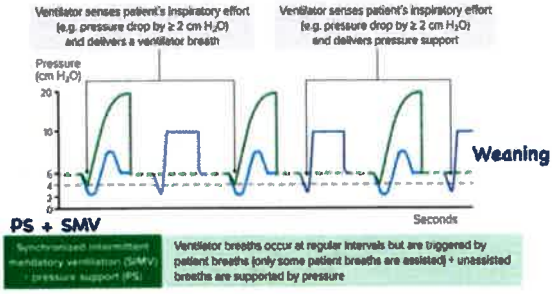
Volume-controlled	• Controlled mechanical ventilation (CMV): Breaths all triggered by ventilator, predefined rate and volume set • Assist-controlled ventilation (ACV): Breath triggered by patient's effort, if no patient breath per unit time, ventilator triggered; predefined tidal volume set • Synchronized intermittent mandatory ventilation (SIMV): Spontaneous breathing permitted with no ventilator assist; predefined tidal volume set.
Pressure-controlled	• Pressure support ventilation (PSV): Triggered by patients inspiration only; assist with pressure limitation provided.
Mixed	• PS/SIMV: Ensures spontaneous breaths permitted in SIMV receive pressure assist

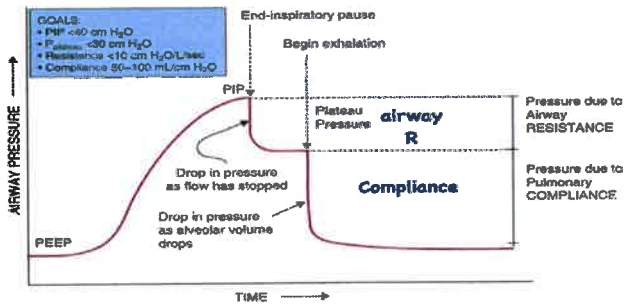
Modes of Mechanical Ventilation











Not for weaning: CMV
Best for weaning: SIMV/PS
Rapid shallow breathing index: Predict weaning(RR/TV)
<105: Weaning

PEEP: Positive end-expiratory pressure
-Prevents collapse, Increase recruitment
-Reduce work of breathing
-Barotrauma, Low CO, Raised ICP

GOALS of mechanical ventilation:
Tidal volume: 6-8ml/kg ARDS : 4-6ml/kg
RR: 12-18bpm
FiO2: 21-100% — ABG paO2/paCO2
PEEP: >5cm H2O (5-8cm) ARDS : >8cm H2O
Plateau pressure: <30cm H2O

Basics of CPR

PUSH HARD-PUSH FAST

1/3 AP dia: 5-6cm (2-2.5in) 100-120/min

allow complete recoil

Adequate CPR

Rate of breathing in CPR

Adults: 10 bpm

Children: 20-30 bpm

Neonates: 30-60 bpm[NRP Update]

POST CARDIAC ARREST CARE

1. **Optimization of circulation** (MAP > 65 mmHg)
2. **Optimization of ventilation** (SpO_2 > 94%)
3. **Targeted temperature management**
   32–36°C for 24 hours for comatose patients
4. **Moderate glycemic control**
   (Blood sugar 144–180 mg/dL)
5. **Coronary intervention (PCI)**
   If cause is MI (preferably within 90 minutes)
6. **Early prognostication of neurologic outcome**
   (To be assessed after 72 hours)

Adrenaline Doses

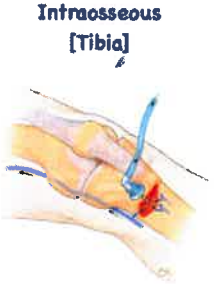
- Anaphylactic shock / Status Asthmaticus: 1mg 1:1000 im/sc
- Cardiac Arrest: 1:10000 IV > Intraosseous > Intratracheal
- Vasoconstriction: 1 : 1 lakh
- With LA for VC: 1 : 2 lakh
- Labour Epidural: 1 : 4 lakh

Amiodarone Dose: 300mg –> 150mg

Lignocaine Dose: 1-1.5mg/kg –> 1/2

Shock energy for defibrillator:

- Monophasic: 360J
- Biphasic: 120-200J

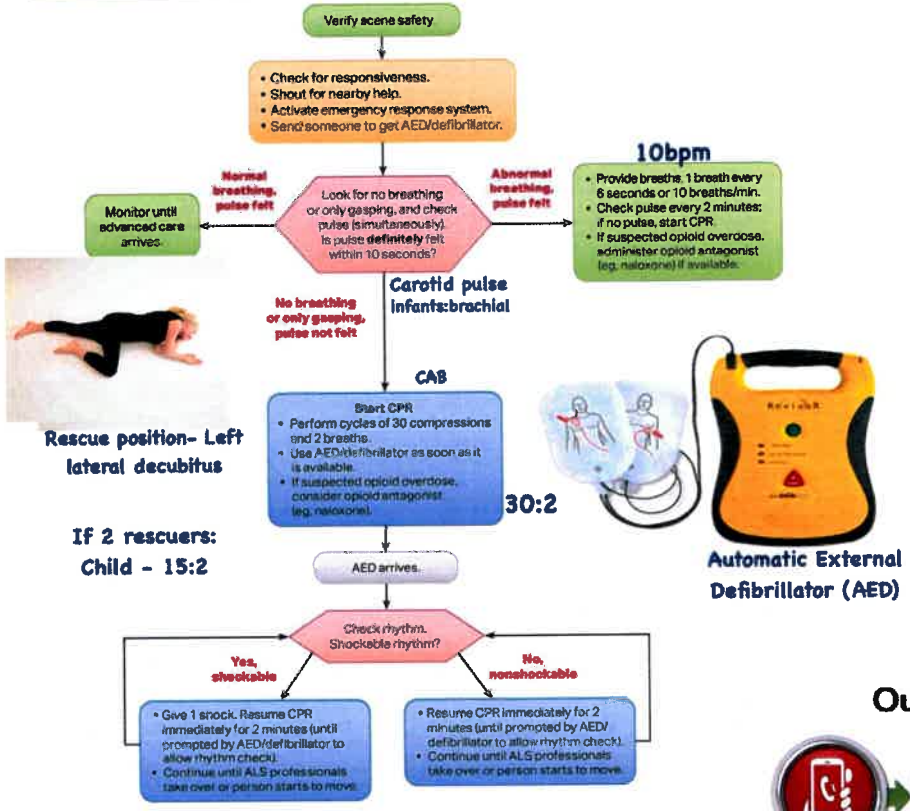


Reversible causes:

5H	5T
Hypovolemia	- Tension ptx
Hypoxaemia	- Thrombus –> PA
Hypothermia	- Thrombus –> Coronary A
H+ - acids	- Toxins
Hyper/Hypo-K	- Tamponade

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BLS

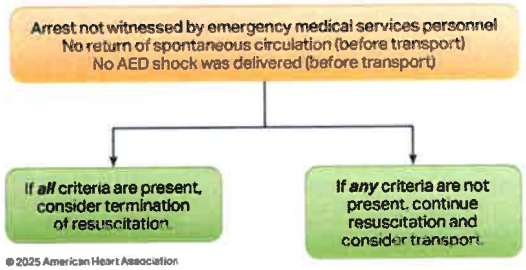


Rescue position- Left lateral decubitus

If 2 rescuers:
Child - 15:2

Automatic External Defibrillator (AED)

BLS/Universal Termination of Resuscitation Rules

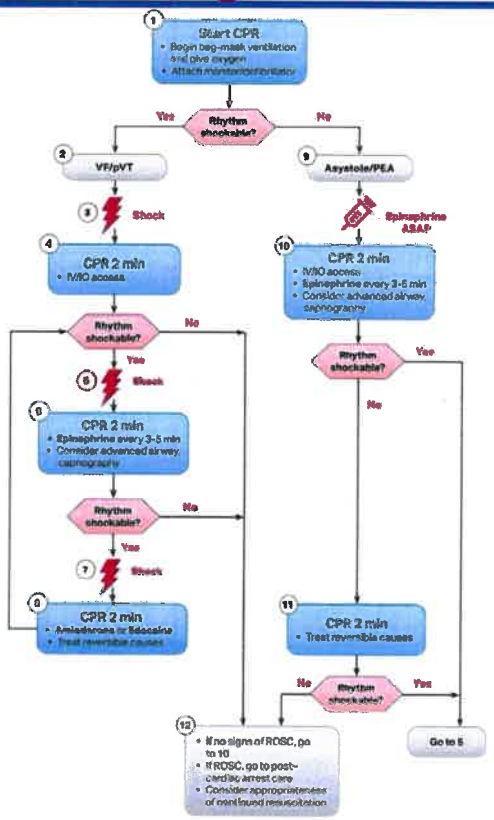


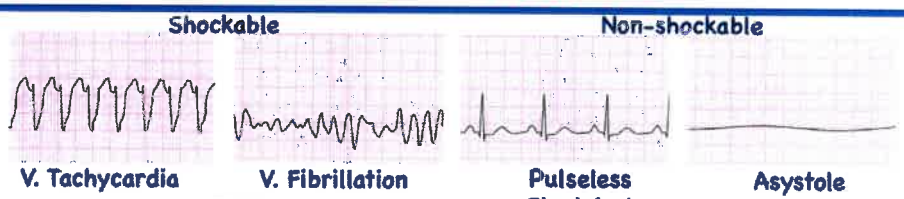
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Out-of-Hospital Cardiac Arrest – CHAIN OF SURVIVAL

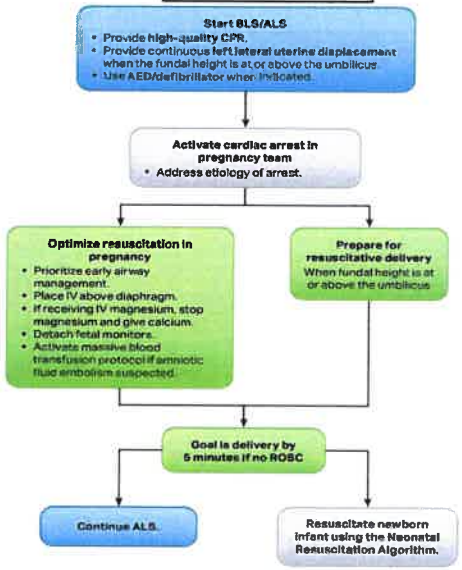


ACLS Algorithm for Cardiac Arrest in Adults





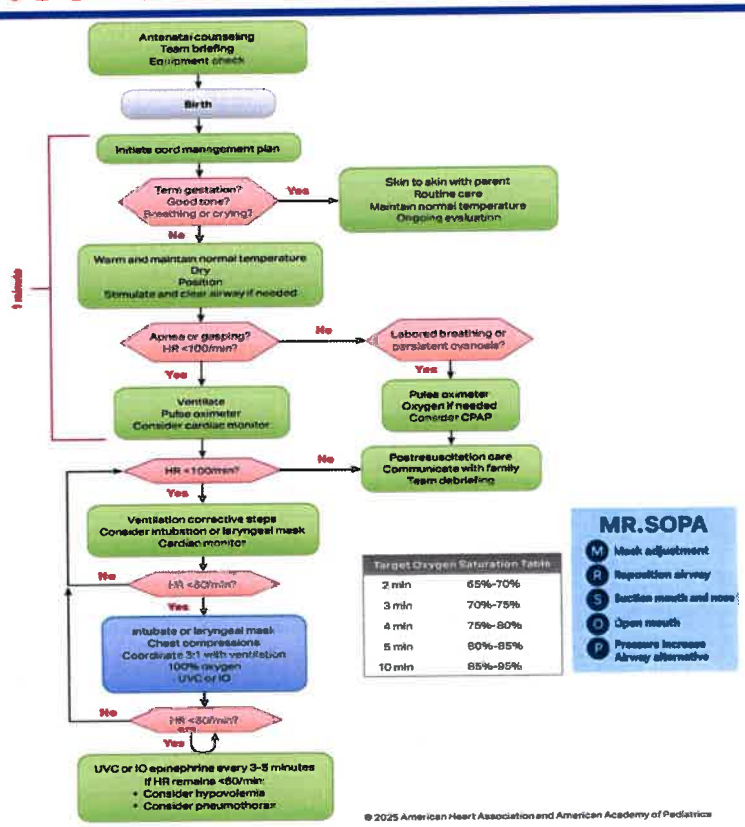
PREGNANCY



OT? X
Pffanelstein? X
LSCS? X

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Neonatal Resuscitation Protocol 2025



Order of suction: Mouth f/b Nose
Temperature of room: 25°C
Delayed cord clamping: stable term/preterm at least 60s
Cord milking: Non-vigorous 35-42wks POG

Bag & Mask Ventilation (BMV)
-Start within: 1 min
-Saturation
>35weeks: 21%
32-24 weeks: 21-30%
<32 weeks: ≥30%
-RR: 30-60bpm
-C/I: CDH, TEF

Saturation monitoring done at: Rt. UL(pre-ductal)

Chest Compressions(CC)
- 2 thumb
- Lower 1/3 body sternum
- 1/3rd depth of AP
CC:PPV- 3:1