EDITION

ANAESTHESIA

ED.08

PRE ANAESTHETIC CHECKUP : PART 1

Identify the problem → Optimise patient's general condition → Safely tolerate → surgery.

Components :

- History taking.
- Physical examination.
- Systemic examination.
- Airway examination.

HISTORY TAKING :

Factors	Components
Identification	Name, age, sex, address, ID no
medical history	Chief complaints, present history, past medical history, personal history, family history, allergy history
Surgical history	Past surgical history
Others	Menstrual history, immunization history

Past Medical History

HYPERTENSION :

Significance :

Anaesthesia → Sudden hypotension → Disrupted autoregulation of vital organs → Hypoperfusion of brain, Kidney, heart.

Cut-off value :

BP <180/110 mmHg can be taken up for surgery.

Management :

Anti-hypertensives :

- Continued till the day of surgery to prevent rebound hypertension.
- ACE inhibitors, ARBs stopped prior to surgery d/t risk of orthostatic hypotension.
- ACE inhibitors continued in minor surgeries with minimal blood loss (Ex : Cataract).

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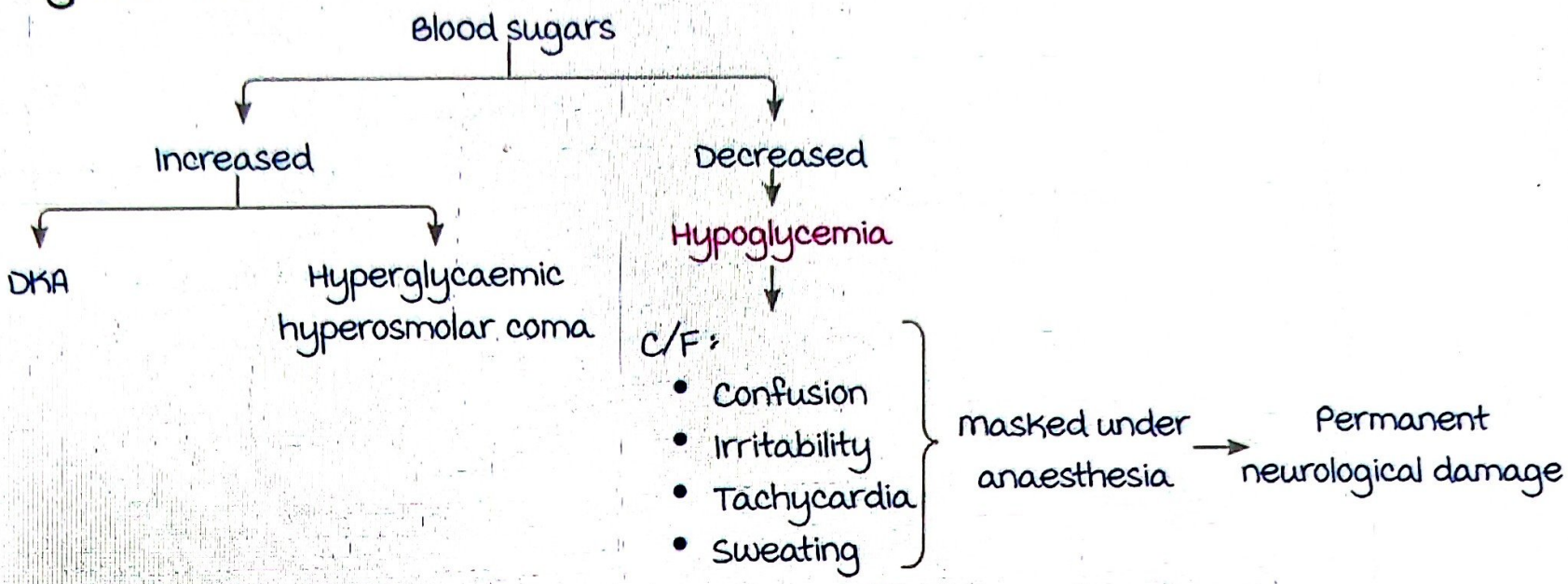
DIABETES :

Significance :



Management :

Oral hypoglycaemic agents, insulin.

Drugs stopped	Drugs continued
OHA & insulin skipped on day of Sx Reason : Hypoglycemia	Long actin insulin : Dose reduced (1/3 to 1/2)
SGLT-2 inhibitors : Stopped 24 hours prior to surgery Reason : Euglycaemic Ketoacidosis	

Intraoperative monitoring :

- monitor blood sugars every 30 minutes.
- Short acting insulin : If blood sugars ↑.
  a. Dose : 120-200 mg/dL.
  b. Onset : 7-10 minutes.
  c. Duration : 30 minutes.

EPILEPSY :

Significance :

Epilepsy : Abnormal excitation of brain cells.

Falling back of tongue

↓

Hypoxia, hypercarbia, acidosis
(Precipitation agents)

↓

Subsequent episodes

↓

Status epilepticus
(Permanent neurological defect)

management :

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Evaluation :

- After the first episode of seizure :
  a. Radiological investigations.
  b. Start anti - epileptic drugs (AED) - if necessary.
- Known case of seizure on AED :
  a. Complete blood count.
  b. Liver function test.
- S/E of AED : Bone marrow suppression, leucopenia, electrolyte abnormalities, macrocytic anemia.
- AED continued till the day of surgery.

For acute seizure :

In public setting	In hospital setting
• Jaw thrust manoeuvre. • Left lateral position : If pulse (+), breathing (+).	• Call for help. • medications. Short acting BZD (midazolam 0.3 mg/kg) ↓ If seizure persists Phenytoin sodium (10-15 mg/kg in 100 ml NS) ↓ If seizure persists Newer AED (levetiracetam, piracetam) ↓ If seizure persists General anaesthesia + muscle relaxants

THYROID DISORDERS :

	Hypothyroidism	Hyperthyroidism
Signific ice	Hypothyroid ↓ ↓↓ basal metabolic rate	Hyperthyroidism ↓ Palpitations
Effect of anaesthesia	Delayed metabolism of drug ↓ Delayed recovery	Precipitate supraventricular arrhythmia.
Management	Thyroxine	Antithyroid drugs (Carbimazole, methimazole, propylthiouracil)
Day of surgery	Continue the drug	Continue the drug
Presentation of unprepared patient	myxedema coma : • Severe bradycardia. • Hypotension. • Hypothermia. • Delayed recovery.	Thyroid storm : • Sudden unexplained tachycardia. • Hypertension. • Hyperthermia. • Atrial fibrillation/supraventricular tachycardia.

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PSYCHIATRIC DISORDERS :

Continue antipsychotics on the day of surgery.

Exceptions :

- monoamine oxidase inhibitors (MAO) stopped 2-3 weeks prior to surgery.
  - Reason : Older MAO inhibitors $\xrightarrow{\text{Interact with}}$ meperidine & ephedrine $\rightarrow$ Hypertensive crisis.
- Lithium (used in bipolar disorder)
  - Stop 24 hours prior only if short acting muscle relaxants aren't available.
  - Current guideline : Continue lithium on the day of surgery if short acting muscle relaxants (Atracurium, mivacurium) are available.

Note : $MgSO_4$ $^{a+}$ used in pre-eclampsia should be continued on the day of surgery (Mg^{a+} same action as lithium).

PRE ANAESTHESIA CHECKUP : PART 2

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CORONARY HEART DISEASE :

Significance :

1. Blood thinners
   - Aspirin
   - Clopidogrel
   - Stopped prior to surgery.
   - Reason : To avoid bleeding in closed cavities (Vertebral column, orbital cavity, cranial cavity) during regional anaesthesia.
   - Complications of stopping blood thinners : Re-infarction.
   - Prophylaxis :
     - Start low dose LMWH (Bridging)
       a. Duration of action : 12 hours.
       b. Stop 12 hours prior to surgery.
2. All other cardiac medications to be continued on the day of surgery.

Minimum duration for discontinuing drugs prior to regional anaesthesia :

Drugs	Duration of discontinue
Aspirin	• Low dose : Continue. • High dose/risk of bleeding (+) : Stop prior 3 days.
Clopidogrel, warfarin	Prior 5-7 days
Ticagrelor	5-7 days
Prasugrel	7-10 days
Ticlopidine	10 days
Cangrelor	3 hours

Note :

- Duration of high dose LMWH : 24 hours.
- Continue all medication in topical anaesthesia.

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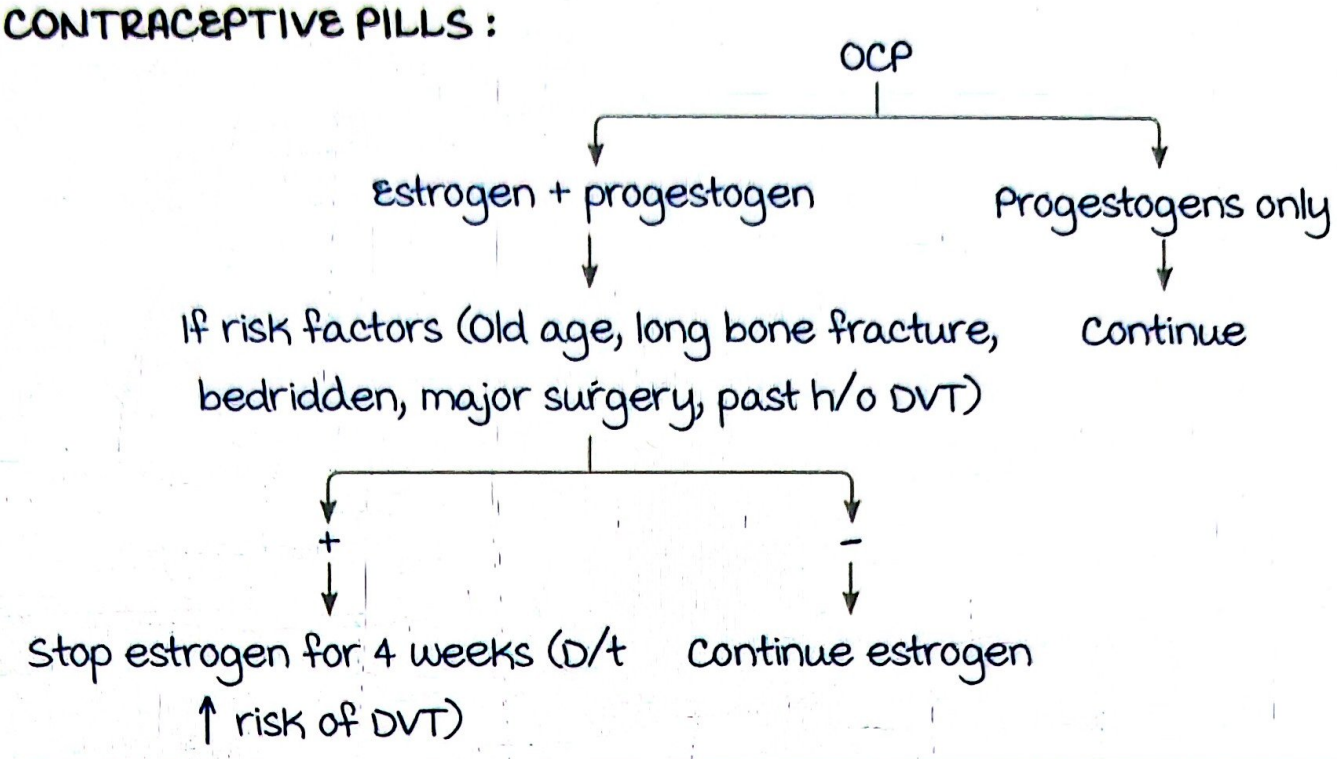
ORAL CONTRACEPTIVE PILLS :



Drugs	Continuation/discontinuation
Antitubercular drugs	• Continue the drug. Stopping drug → multidrug resistance. • Check LFT prior to surgery.
Steroid	• Continue the drug : Sudden stoppage → HPA axis suppression. • Additional steroid supplement. (Inj Hydrocortisone 1–2 mg/kg) Yes: If on high dose of steroid No: If dose <5 mg, duration <3 wks
Herbal medication	Check LFT Normal → Continue procedure Abnormal → Repeat after 1–2 weeks
Antiretroviral therapy	• Continue. • Check LFT, serum electrolytes, CBC. Note : Viral load >10000 CD_4 <200 → ↑ mortality.
NASIDs	648c85cfee3b03a74e182fab • Paracetamol : Continue. • COX inhibitors : Stop prior 24 hrs. • Stop all other NSAIDs 48 hrs prior d/t ↑ chance of bleeding, renal injury.
Sildenafil (Phosphodiesterase inhibitor)	• Stop 24 hrs prior to surgery d/t severe hypotension. • Used in pulmonary artery hypertension, erectile dysfunction.
Diuretics	Except thiazide diuretics, all others are stopped.
Topical ointments	Stopped prior to surgery.

Personal History

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Factors	Interaction with anaesthesia
Smoking	Stop prior 6–8 wks (minimal of 3–4 wks) Chronic smoking ↓ **Bronchospasm** • C/F : Sudden unexplained tachycardia, hypertension. • Capnography ($EtCO_2$) : Shark fin appearance. • Rx : Bronchodilators (Inhaled β_2 agonist). **Laryngospasm (m/c in extubation)** • C/F : Stridor, ↑ SpO_2 (D/t sudden forceful contraction of laryngeal muscles). • Rx : 100% O_2 + larsons manouevre Propofol 10 mg iv during extubation ↓ if uncontrolled Quick acting muscle relaxant (Succinyl choline) ↓ Intubate
Alcohol	• Hepatic microsomal inducers. • Stop prior 24–48 hrs. • Complication in post op : Acute fulminant hepatic necrosis (Rare).
Tobacco	Difficult intubation (D/t restricted mouth opening).
Breast feeding	Major Sx : Drugs secreted in breast milk ↓ Expres breast milk for 24 hrs post sx Minor Sx : Short acting drugs not secreted in breast milk ↓ Continue breast feeding after 4–6 hrs
Drug addiction	• Sympathetic stimulants. • Risk of HIV infection/infective endocarditis. • Stop drug after physician consultation.

FAMILY HISTORY :

Malignant hyperthermia.

Allergy History

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Causes anaphylactic shock.

m/c drugs : Antibiotics > latex > muscle relaxants > local anaesthetics.

Note : Pholcodine (Cough syrup) : ↑ allergic reactions to muscle relaxants.

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Pathophysiology

Antigen + antibody
↓
Degranulation of mast cells
↓
Release of histamine

Clinical presentation :

- Sudden unexplained tachycardia.
- Hypotension.
- Wheeze (D/t ↑ airway resistance).
- Edema of face, lips, airways.

management :

- Adrenaline (DOC) :
  - Dosage based on route (1 ampoule = 1 mg = 1 : 1000).
  - IV = 1 ml of 1:10,000.
  - S/c or IM = 0.5 mL of 1 : 1000.

ASA Grading

00:39:39

(American society of anaesthesiologist grading) :

Grade	Characteristics	Examples
I	Healthy patient	Normal BMI, non-smoker, non-alcoholic
II	Mild disease with no functional limitation	• medical disease under control (HTN, DM, Epilepsy). • Smoker, BMI = 30–40. • Pregnancy
III	Severe disease with functional limitation	• medical diseases with poor control (HTN, DM, Epilepsy). • CKD, CLD, COPD. • morbid obesity (BMI >40). • Chronic alcoholic, Drug abusers, Active hepatitis. • Implantable cardiac device.
IV	Severe disease with threat to life	Recent MI, CVA, unstable angina, ruptured aneurysm
V	moribund patient	Death <24 hours
VI	Brain dead patient	-

"E" along with a grade : Emergency surgery.

Disadvantage : No information regarding :

- mortality.
- Blood loss.
- Days of hospital stay.
- Type of anaesthesia.

Note : Other gradings

- Eurograde score.
- John Hopkin score.

PRE-OPERATIVE OPERATION

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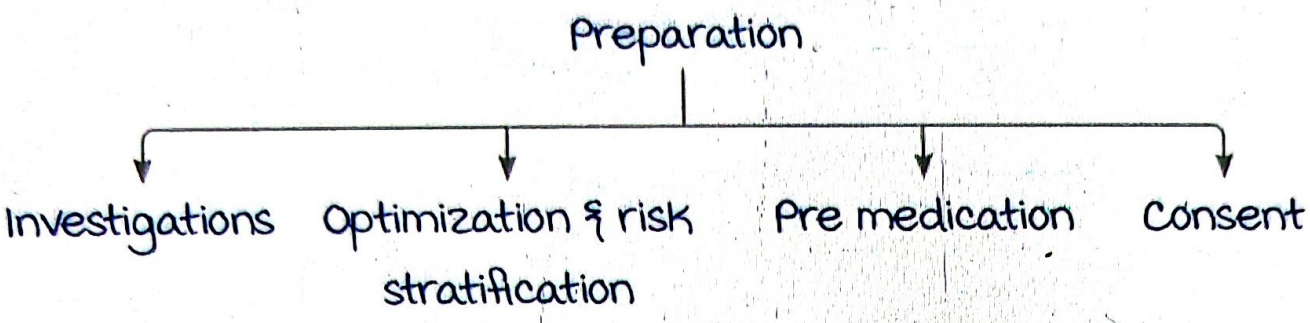

Investigations

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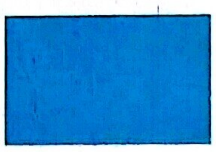
Investigation	Parameters/ Indications
CBC	• Hemoglobin cut off : a. Minimum : 8 g/dl → Risk of post operative complications. b. Systemic disease (Epilepsy, seizures, IHD, major Sx) : 10 g/ dl (D/t loss of blood). c. Severe disease (On ventilator, in ICU) : 12 g/dl.
	• Platelet count cut off : – Regional anaesthesia : a. In closed cavity spaces : 1,00,000/µL. b. Non closed cavity : 80,000/µL. – Biopsy (Eg : Liver, renal) : 80,000/µL. – Invasive procedure (Central venous catheter) : 50,000/µL. Note : Indications of platelet transfusions : • < 20,000/µL. • H/o bleeding.
RFT	Indications : • Chronic kidney disease. • H/o reduced urine output. • H/o nephrotoxic drugs.
LFT	Indications : • H/o herbal medications intake. • H/o antiepileptic drugs. • H/o antitubercular therapy. • H/o chemotherapy.
Coagulation studies	Indications : • H/o bleeding disorders. • On warfarin therapy. • massive blood transfusion.
Urine examination for casts	• Hyaline cast, proteinuria (Risk of kidney injury).
UPT	• Reproductive age group females.
CXR	Indications : • COPD, bullous lung disorders, mediastinal tumors, pneumonia, pulmonary edema, positive clinical examination for RS pathology.

10  Anaesthesia

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	ECHO	ECG
mandatory	• Dyspnoea of unknown origin. • Heart failure patients with worsening dyspnoea.	• K/C/O IHD. • Significant arrythmia PAD*, CVD*. • Significant, structural heart disease.
may be done	• Past h/o LV dysfunction not evaluated since 1 yr.	• Major Sx in asymptomatic patients without h/o coronary heart disease.
Not performed	• As routine investigation.	• Asymptomatic patients. – Low risk surgical procedures.

PAD : Peripheral arterial disease.

CVD : Cerebrovascular disease.

Note : Validity of investigation → 2 months.

Optimization & Risk Stratification

00:14:45

CARDIAC DISEASES :

ACC/ AHA guidelines in cardiac patients :

Step 1 :

High risk Sx :

- Emergency Sx (< 6 hrs). Eg : Fetal distress
- Urgent Sx (< 24 hrs). Eg : Laparotomy
- Time sensitive Sx (within 3 min). Eg : Ortho, onco Sx

→ Proceed for Sx with high risk

Step 2 :

Elective Sx :

Presence of active cardiac disease :

- Acute coronary syndrome (ACS).
- Decompensated heart failure.
- Significant arrythmia.
- Severe valvular heart disease.

→ Do not proceed d/t risk of mortality

Step 3 : Assess risk of perioperative MI/death.

Parameter	Score
High risk Sx (Suprainguinal Sx, emergency Sx, thoracotomies)	1
H/o IHD	1
H/o congestive cardiac failure	1
H/o cerebrovascular accident	1
H/o diabetes mellitus requiring insulin	1
Serum creatinine > 2.0	1

Interpretation :

Score	Risk of cardiac complication
0	0.04 %
1	1.0 %
2	2.4 %
≥ 3	5.4 %

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Proceed to Sx if risk < 1 %.

Step 4 :

Assess functional capacity → > 4 METs : Proceed with Sx.

- METs : metabolic equivalents.
- Amount of oxygen consumed by 70/ Kg person at rest.
- 1 MET = 3.5 ml/ Kg/ min.

Step 5 :

- Stress testing.
- Low METs → Dobutamine stress test (or) stress test using treadmills.

Step 6 :

- Proceed with Sx or alternative plan of Rx.

Canadian society guidelines :

Step 1-3 same as ACC/ AHA guidelines.

Step 4 : Check BNP < 92 or pro BNP < 300 µg/l.

Step 5 : Proceed to Sx.

- measure troponin daily for 48-72 hr after Sx.
- Obtain ECG post operatively.

ACC/ AHA guidelines for patients with coronary stenting :

	Drug eluting stent	Bare metal stent
Elective Sx	Wait for 6 months	Wait for 1 month
Time sensitive Sx	Plan Sx b/w 3 - 6 months	

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Indications for IE prophylaxis :

- H/o infective endocarditis (IE).
- Prosthetic valves.
- Unrepaired cyanotic congenital heart disease.
- Repaired CHD with residual defect.
- Cardiac transplant.

RESPIRATORY DISEASES :

1. URTI/ LRTI :
   - Postpone Sx by 2 - 3 wks (Airway hyper reactive).
2. Obstructive lung diseases : Eg. Asthma, COPD.
   - CXR.
   - ABG (In case of acute exacerbation).
3. Restrictive lung diseases : Eg. Silicosis, asbestosis.] Pulmonary
4. Lung Surgeries : Eg. Lobectomy, pneumonectomy.] function tests

Note : ECHO is done to rule out cor pulmonale.

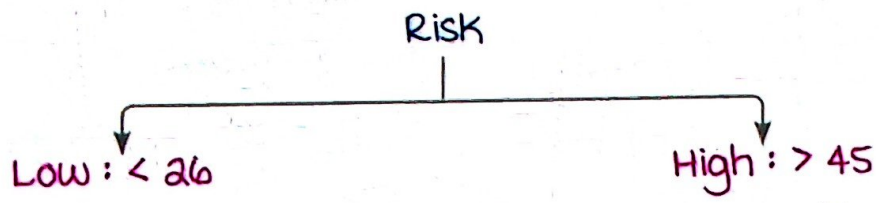
RISK FACTORS FOR POST OPERATIVE PULMONARY COMPLICATIONS :

Patient related	Procedure related	Laboratory test
• Old age. • Cigarette smoker. • Abnormal findings on CXR.	• Aortic aneurysm repair. • Upper abdominal Sx. • Emergency Sx.	• Albumin concentration < 3.5 g/ dl. • Chest radiograph abnormalities.

ARISCAT scoring :

- Assess respiratory risk in surgical patients in catatonia.
- Parameters :
  a. Age.
  b. Preop saturation.
  c. Preop Hb.
  d. Incision.
  e. Recent respiratory tract infection (< 1 month).
  f. Duration of Sx.
  g. Emergency Sx.

Interpretation :



CNS DISEASES :

- Recent h/o CVA :
  a. Avoid elective Sx upto 9 months.
  b. Continue aspirin.

b. Continue aspirin.

Pre Medication

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Goal	Premedication
1. Relieve anxiety & induce sedation	• Short acting benzodiazepine (Eg : Midazolam).
2. Reduction of secretions	• Anticholinergic agents (To prevent aspiration) : Eg. Atropine, glycopyrrolate. • Indication : In children, mentally retarded patient, head & neck Sx.
3. Decrease aspiration	a. Prior elective Sx : • Adult : 6 – 8 hrs (Nothing by mouth). • Children : – Clear liquid : 2 hrs – Non human milk : 6 hrs. – Breast milk : 4 hrs. – Healthy fatty meal : 8 hrs. – Solids : 6 hrs. b. Emergency Sx : ↑risk of aspiration. 1. NG tube/ ryles tube aspiration. 2. Prokinetic agent (↑ gastric motility). – Eg : metaclopramide. 3. To reduce gastric acidity : – PPI/ H_a receptor blockers. – Gastric acid neutralized by antacid : Eg. Sodium acetate (0.3 0.3m, 30ml, 30 min prior).
4. Reduction of infections	• Antibiotics 30 minutes prior to Sx.
5. Reduction of nausea & vomiting	• Antiemetic agents : – Ondansetron : $5HT_3$ blocker. – S/E : Arrythmia d/t prolonged QT. • APFEL score : – Female. – Non smoker. – H/o postoperative nausea & vomiting. } High risk – H/o opioids.
6. Analgesia	• Pre emptive analgesia (Providing analgesia before surgical incision). • Use : – Decrease post operative pain. – Drug : Short acting opioids (Eg : Fentanyl).

Note : Last step → Consent taken & prepared for Sx

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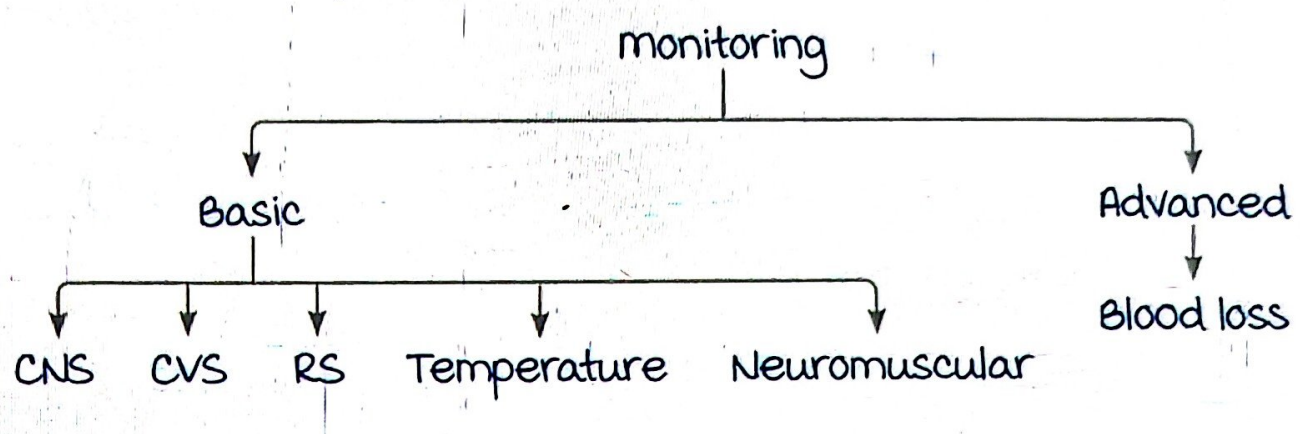
MONITORING UNDER ANAESTHESIA : PART 1



Central Nervous System Monitoring

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Components of balanced anaesthesia :

- Amnesia (Indicative of deeper planes).
- Analgesia.
- Abolition of reflexes.
- Adequate muscle relaxation.

DEPTH OF ANAESTHESIA :

Maintained by :

- Inhalational anaesthetics / benzodiazepines.

Inadequate depth :

- Can lead to laryngospasm while extubating.
- Signs of inadequate depth (Lighter planes).

1. Tachycardia.
2. ↑ Blood Pressure (BP).
3. Reflex movement.
4. Lacrimation.
5. Salivation.

Objective measures :

1. Bispectral index (BIS).

Bispectral index

Bispectral index system value	Depth of a sedation
0	Flatline EEG
0–40	Deep hypnotic state, memory function lost, increasing burst suppression
40–60	Recommended range for general anesthesia
60–90	Recommended range for sedation
100	Awake, memory intact

BIS monitoring

Cardio Vascular System Monitoring

00:11:22

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1. PULSE RATE/HEART RATE :

		Bradycardia	Tachycardia
	Rate	<60bpm	>100bpm
Causes	Physiological	Deep sleep Old age	Children Pregnancy
	Physiological	• Sick sinus syndrome. • Heart blocks. • Obstructive jaundice. • Hypothyroidism.	• Fever. • Anxiety. • Stress. • Pain.

2. BLOOD PRESSURE :

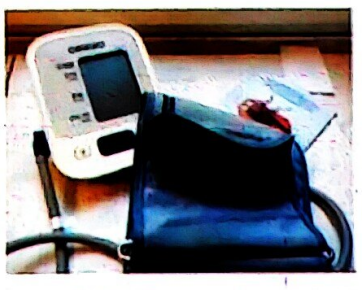
methods :

- Non invasive devices
  - Sphygmomanometer
    - methods :
      - Palpation.
      - Auscultatory.
      - Oscillatory.
  - Automatic NIBP
    - methods :
      - Oscillatory.
- Invasive

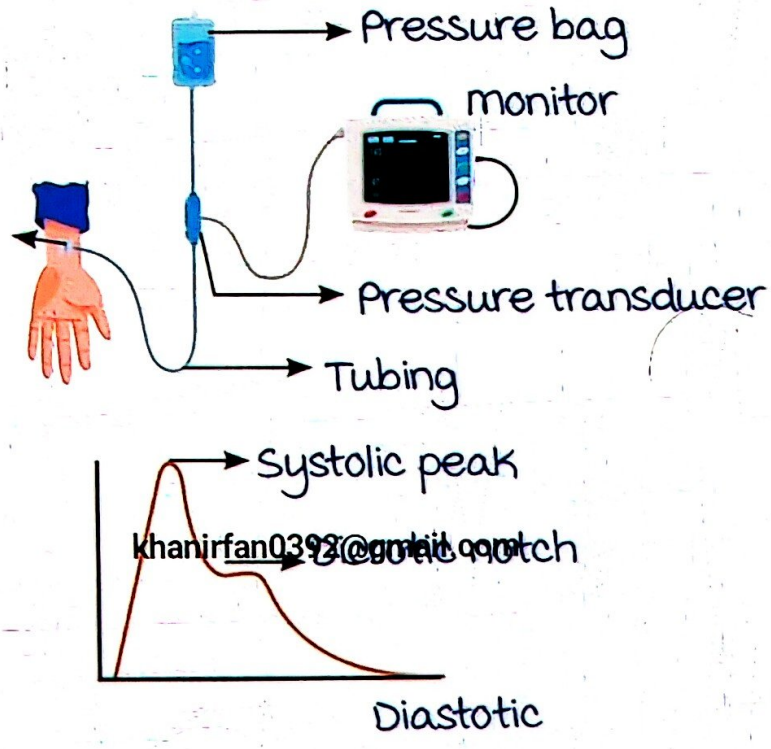
Size of cuff:

- 1.5 times arm size.
- Should cover 2/3 of arm.

Sphygmomanometer



NIBP machine



monitoring : every 2 minutes.

C/I : A-V fistula.

Invasive blood pressure :

Indications : Major Sx.

Prerequisite : modified Allen's test positive (To ensure adequate collateral circulation).

Allen's test	modified Allen's test
Clench the fist. Apply pressure on radial artery with 2 hands. Release the pressure.	• Elevate the limb. • Clench the fist. • Apply pressure on both radial and ulnar arteries.

Feedback

16 Anaesthesia

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Allen's test	modified Allen's test
• Hand turned to pink : Negative = normal. • Positive : No adequate collateral.	• Release the pressure on one side. • Positive : No pallor = normal. • Negative : No adequate circulation.
The average time required for change in the color should be less than 7 seconds.	

Complications :

- Artery injury.
- Vessel spasm.
- Ischemia.
- Thrombosis.
- Fistula formation.
  - Prevention : Continuous flushing of cannula with normal saline/heparin.

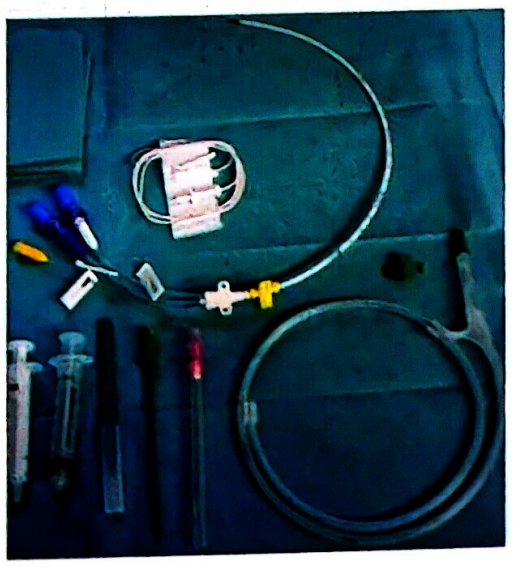
Sites for monitoring :

Population	Artery	Features
Adults	Radial	m/C used
	Ulnar	-
	Brachial	Adv : Less chance of ischaemia (D/t collaterals) Disadv : Uncomfortable
	Femoral	mimics central pulsation
Children	Axillary	mimics central pulsation
	Dorsal pedis	-
	Posterior tibial A.	-
	Superficial temporal A.	-

3. CENTRAL VENOUS PRESSURE :

Techniques :

- Seldinger's technique :
  a. Guide wire inserted first (monitor for arrhythmias).
  b. Catheter is inserted following guide wire.



Central venous (CV) set

- m/C size used in adult : 7Fr/(20 cm).
- Normal CVP : 0-5 mmHg.

Sites :

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Vein		Features
Internal Jugular vein	Right	m/c used
	Left	Not preferred (D/t risk of pleural, thoracic duct, and vascular injury)
External Jugular vein		J tipped guide wire is used
Subclavian vein		Preferred by surgeons. Highest risk of pneumothorax.

Vein	Features
Femoral vein	m/c site for infection & thrombo-embolic complications
Axillary vein	Uncomfortable site

Note: PICC (Peripherally inserted central catheter) is used for chemotherapy.

Indications for Central venous catheter (CV) insertion :

1. For ionotrope infusion.
2. Dialysis.
3. Aspiration of emboli.
4. Repeated sampling.
5. Total parenteral nutrition.
6. To monitor the fluid status.
7. Transvenous pacing.

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Complications of CV catheter insertion :

1. Injury to nerves & arteries.
2. Pneumothorax.
3. Cardiac tamponade.
4. Thrombosis.
5. Prevention : USG guided hematoma formation.

Raised CVP causes :

- Right heart failure.
- Fluid overload.
- Positive pressure ventilation (Slightly).

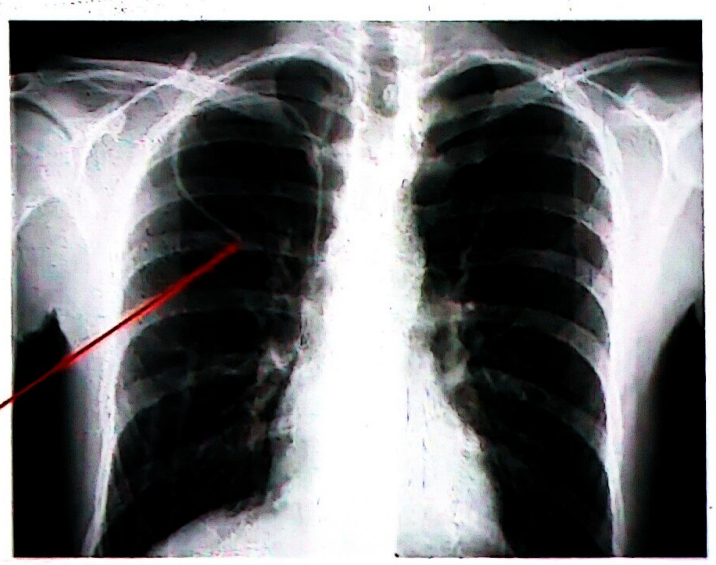
Note :

↓ CVP, ↓ BP : Hypovolemia (Rx : Fluids).

↑ CVP, ↓ BP : Right heart failure (Rx : Ionotropes).

Correct placement of CV catheter :

- Parallel to SVC.
- Below inferior border of clavicle.
- At level of 3rd (T4 – T5 interface).



Identification of CV catheter

Feedback

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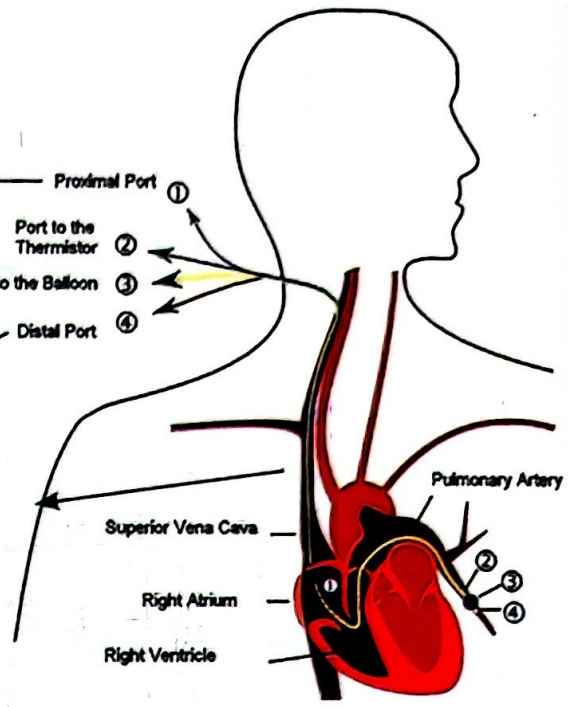
4. PULMONARY CAPILLARY WEDGE PRESSURE :

Pulmonary artery catheter/
Swan Ganz catheter

Size :
- Fr : 7.0 – 9.0
- Length : 110 cm

Uses :
- To measure core body temperature.
- monitor CVP.
- To administer fluids.
- monitoring pulmonary artery pressure.



Parts of catheter

Other uses :
- To assess left ventricular function.
- Assess cardiac output.
- Calculate cardiac index.
  - Measure mixed venous O_2 saturation (Best indicator of tissue perfusion).

Applied aspects :

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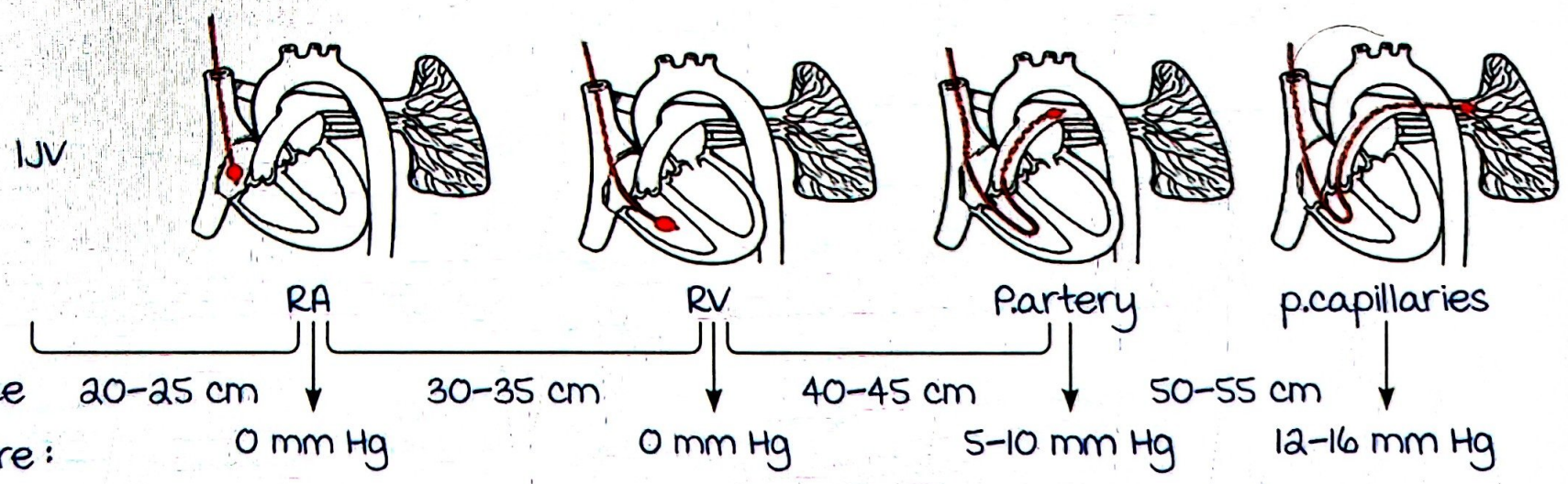
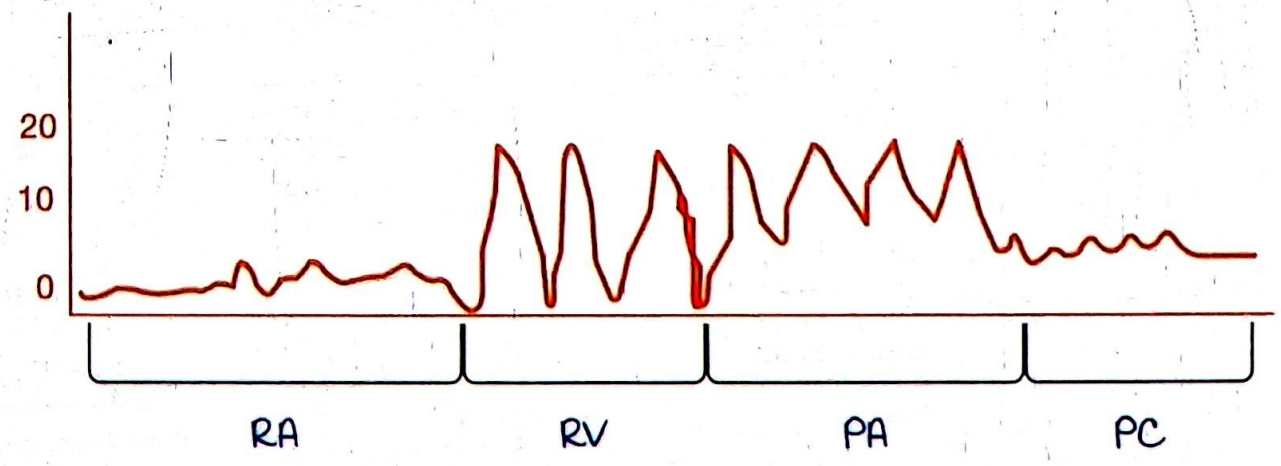
measures pressure in each chamber of heart.





Complications of catheter insertion :

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- Arrhythmias.
- Thromboembolism.
- Infections.
- Pulmonary A. rupture.
  - Presentation : Sudden hemoptysis.
  - Rx : Start fluids; Endobronchial intubation.
- mechanical / catheter knots.
- Pulmonary infarction.
- Endocardial damage/valve injury.

5. TRANS ESOPHAGEAL ECHO CARDIOGRAPHY :

- Semi invasive.
- Use : To assess LV function.
  - By normalizing regional wall motion abnormality (Seen as paradoxical motion).