ANAESTHETIC EMERGENCIES IN THE OPERATING THEATRE & POST OPERATIVE COMPLICATION

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Lecture Objectives..

Students at the end of the lecture will be able to:

1. Learn a common approach to emergency medical problems encountered in intraoperative and postoperative period.
2. Understand post-operative respiratory and hemodynamic problems and learn how to manage these problems.
3. Learn about the predisposing factors, differential diagnosis and management of PONV.
4. Understand the causes and treatments of post-operative agitation and delirium.
5. Learn about the causes of delayed emergence and know how to deal with it.
6. Learn about different approaches of post-Operative pain management

Anaesthetic emergencies in the operating theatre

- Introduction
- Emergencies are not common but when they do occur they are often life threatening and require immediate action.
- Factors in the mnemonic **COVER ABCD** accounts for approximately 95% of critical incidents.

- **C**olour – saturation, central cyanosis;
- **O**xygen – ensure adequate and correct delivery;
- **V**entilation – e.g. breathing circuit, air entry, CO2 trace, vaporizer;
- **E**ndotracheal tube – kinks, obstruction, endobronchial;
- **R**eview monitors – correctly sited, checked, calibrated;
- **Airway** – failed intubation, laryngeal spasm, foreign body, aspiration;
- **Breathing** – difficult to ventilate, e.g. tube occlusion, bronchospasm, pneumothorax, aspiration, lack of neuromuscular blocking drug (NMBD), pulmonary oedema;
- **Circulation** – hypotension: excess anaesthetic agent, dysrhythmia, myocardial ischaemia/MI, hypovolaemia from any cause (e.g. dehydration, bleeding), sepsis, tension pneumothorax, sympathetic block (e.g. spinal or epidural anaesthetic);
- **Drugs** – anaphylaxis, wrong drug/dose/route;
- Embolism – air/fat/cement/amniotic fluid;
- Others – related to CVP line (pneumothorax [see Chapter 25]/cardiac tamponade); awareness; endocrine and metabolic (MH, phaeochromocytoma).

Aspiration

- **Definition**
- Inhalation of gastric contents can occur in patients who have impaired protective airway reflexes.

- **Signs**

• Gastric contents visible within breathing circuit/airway adjunct (e.g. LMA)

• ↓ SaO_2

• Wheeze/stridor

• Tachycardia

• ↑ Airway pressure

- Risk for aspiration seen in patients with:

• Inadequate period of preoperative starvation

• Delayed gastric emptying (e.g. opiates, pain, bowel obstruction, pregnancy at term; see Figure 6.2)

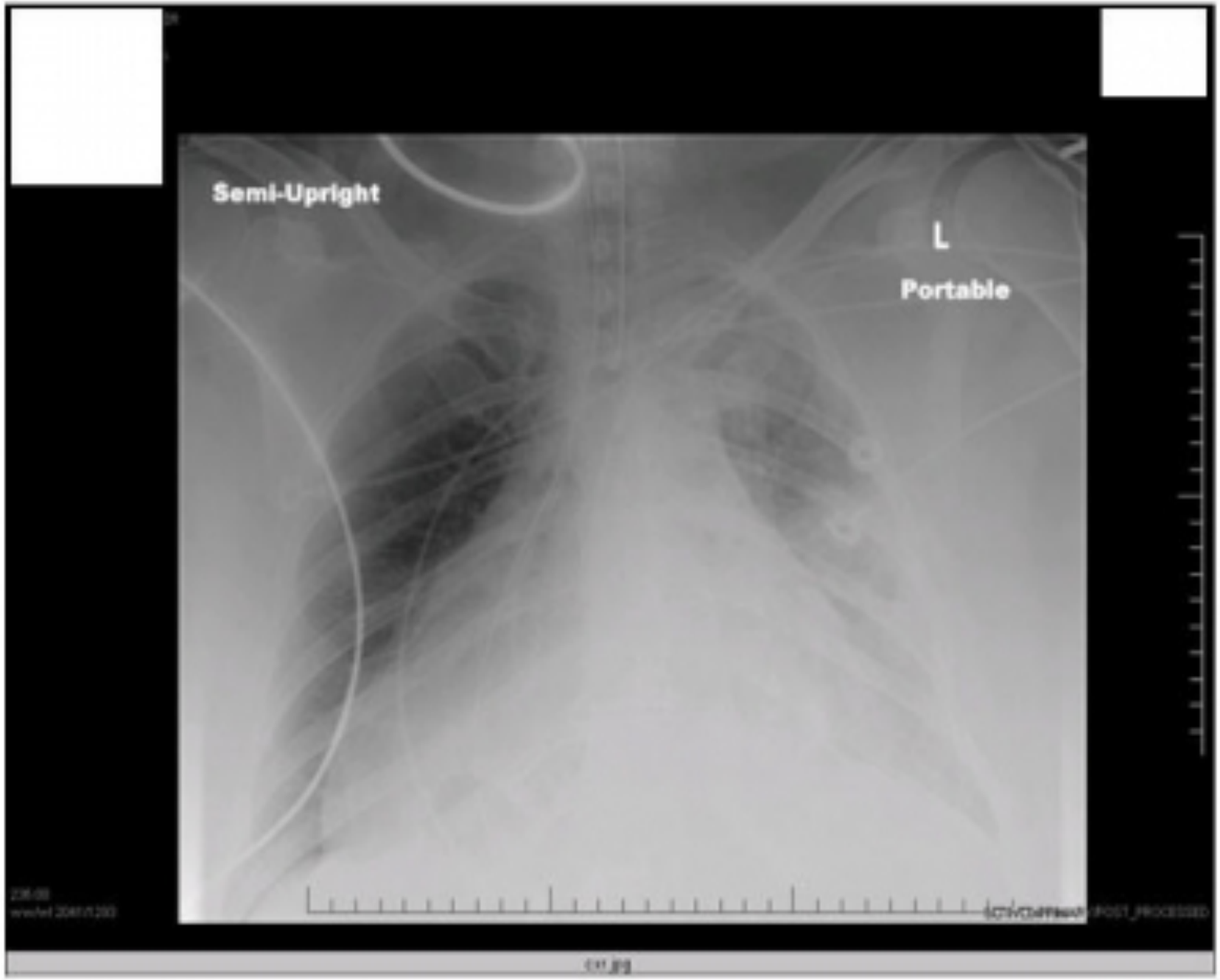
• Insufficient/lack of cricoid pressure at induction of anaesthesia

- early extubation in an at-risk patient in supine postion .

Treatment

- 100% oxygen
- Call for help
- 30% Head-down position to prevent/limit aspiration
- Oropharyngeal suction
- Tracheal intubation if needed, including tracheal suctioning
- Postoperatively: physiotherapy, oxygen.

Some advocate antibiotics and steroids


Semi-Upright
L
Portable

Air embolism

Definition:- air embolism results from inadvertent introduction of air into the circulation, usually via the venous system.

Causes:

- Neurosurgery (dural sinuses are non-collapsible)
- Caesarean section (e.g. if exposed veins are raised above level of heart)
- Central line insertion/removal
- Epidural catheter placement
- (if loss of resistance to air is used)
- Entrainment through an intravenous line (especially if pressure-assisted)
- Situations where high pressure
- gas is used (laparoscopy)

Signs:

- ↑ HR
- ↓ BP
- ↓ SaO2
- ↓ ETCO2 (acute due to ventilation–perfusion mismatch)
- Murmur (millwheel,due to air circulating around the cardiac champers)

Treatment:

- 100% Oxygen
- Airway, breathing, circulation and call for help
- Flood surgical site with saline
- Position patient in Trendelenburg/left lateral decubitus position
- Consider inserting a central venous catheter to aspirate gas
- Consider hyperbaric chamber if indicated.

Laryngospasm

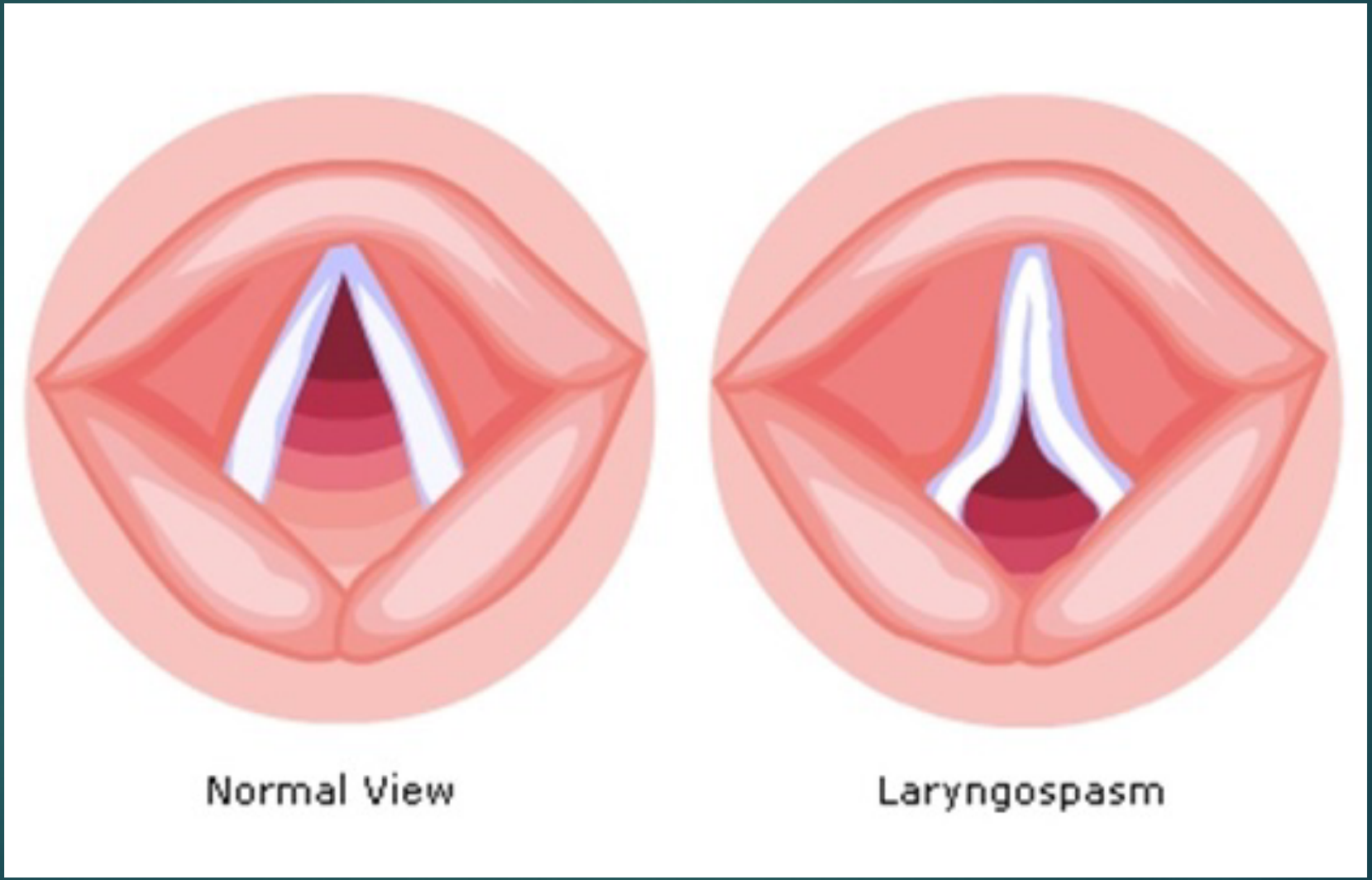
Definition:- is the complete or partial adduction of the vocal cords, resulting in a variable degree of airway obstruction.

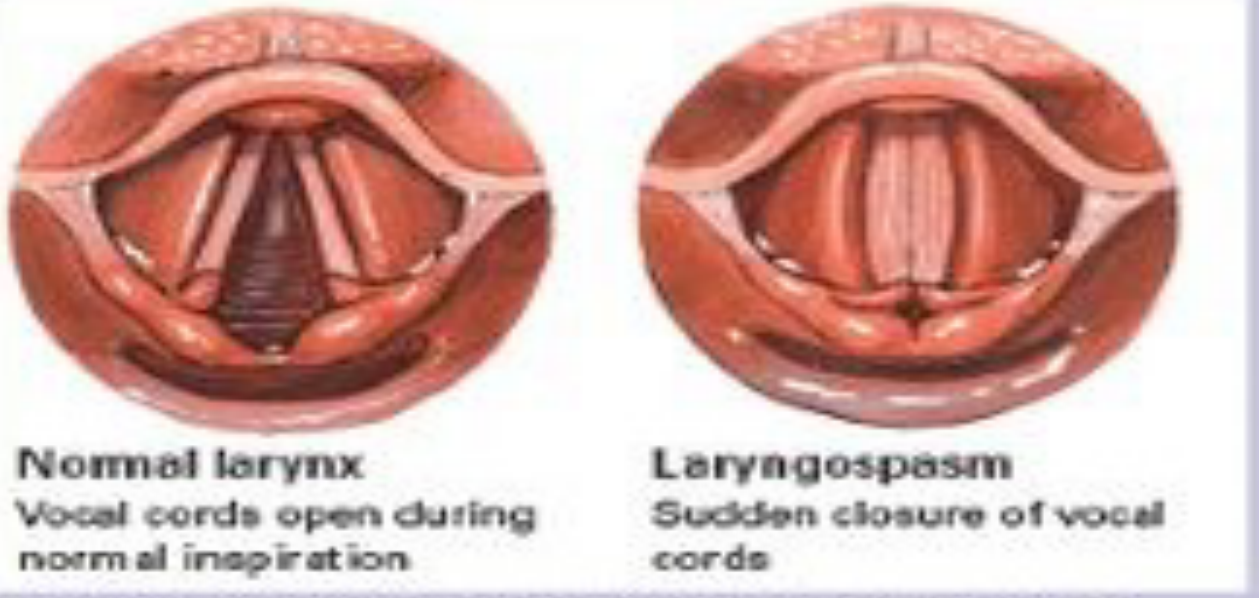
Causes:

- Airway manipulation
- Blood/secretions in oropharynx
- Patient movement
- Surgical stimulus
- Failure to deliver anaesthetic agent

Signs

- Partial/complete airway obstruction
- Paradoxical respiratory effort in a spontaneously breathing patient (abdominal/ chest see-saw movements as respiratory effort attempts to overcome the obstruction).


Normal View
Laryngospasm



Normal larynx
Vocal cords open during normal inspiration

Laryngospasm
Sudden closure of vocal cords

Source: *Surgical Care made Incredibly Visual*. Philadelphia, PA: Lippincott Williams & Wilkins; 2007:196.

Treatment

Some or all might be needed:

- Positive pressure ventilation with high flow oxygen (e.g. CPAP or IPPV)
- Deepening of anaesthesia (e.g. i.v. propofol)
- Suxamethonium with or without tracheal intubation – causes rapid muscle relaxation and ceases vocal cord opposition .

Complications

- SaO_2
- Aspiration
- Bradycardia (especially in children)
- Pulmonary oedema

Failed intubation

Failed intubation

1. Assess the likelihood and clinical impact of basic management problems:

- Difficulty with patient cooperation or consent
- Difficult mask ventilation
- Difficult supraglottic airway placement
- Difficult laryngoscopy
- Difficult intubation
- Difficult surgical airway access

Failed intubation

Direct laryngoscopy

Any problems

Call for help

2. Actively pursue opportunities to deliver supplemental oxygen throughout the

process of difficult airway management.

3. Consider the relative merits and feasibility of basic management choices:

- Awake intubation *vs.* intubation after induction of general anesthesia
- Non-invasive technique *vs.* invasive techniques for the initial approach to intubation
- Video-assisted laryngoscopy as an initial approach to intubation
- Preservation *vs.* ablation of spontaneous ventilation

Plan A: Initial tracheal intubation plan

.Initial tracheal intubation plan

- Direct laryngoscopy

  – check: neck flexion and head extension

- Laryngoscope technique and vector
- External laryngeal manipulation

  – by laryngoscopist

- Vocal cords open and immobile
- If poor view:

Introducer (bougie) – seek clicks or hold-up

and/or alternative laryngoscope

Plan B

Secondary tracheal intubation plan

- ILMA or LMA
  - Not more than 2 insertions
  - Oxygenate and ventilate
- **Failed oxygenation**
  - **(e.g. SpO2 < 90% with FiO2 1.0)**
  - **via ILMATM or LMATM**

Plan C

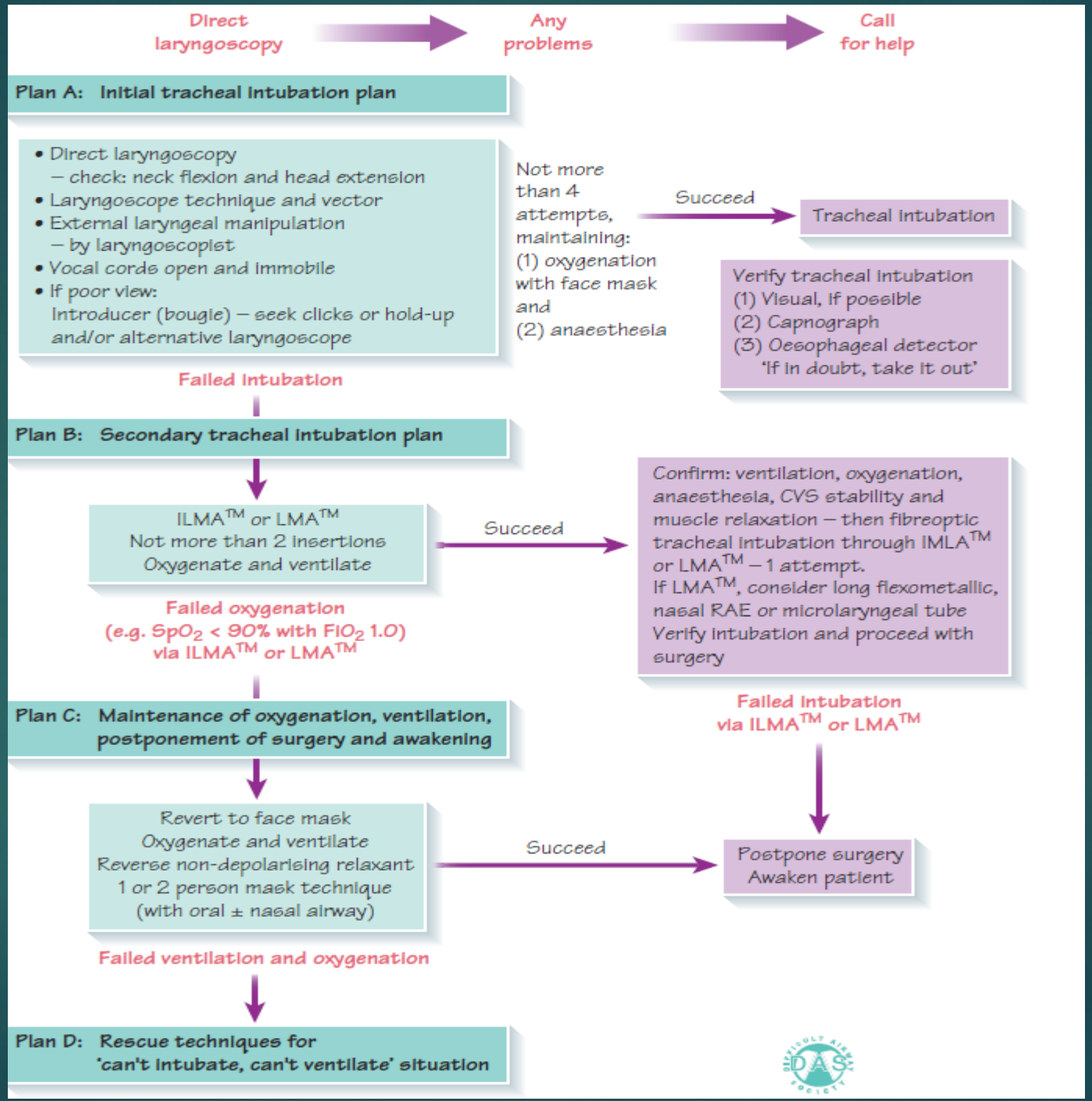
Maintenance of oxygenation, ventilation, postponement of surgery and awakening

- Revert to face mask
- Oxygenate and ventilate
- Reverse non-depolarising relaxant
- 1 or 2 person mask technique
- (with oral ± nasal airway)

Failed ventilation and oxygenation

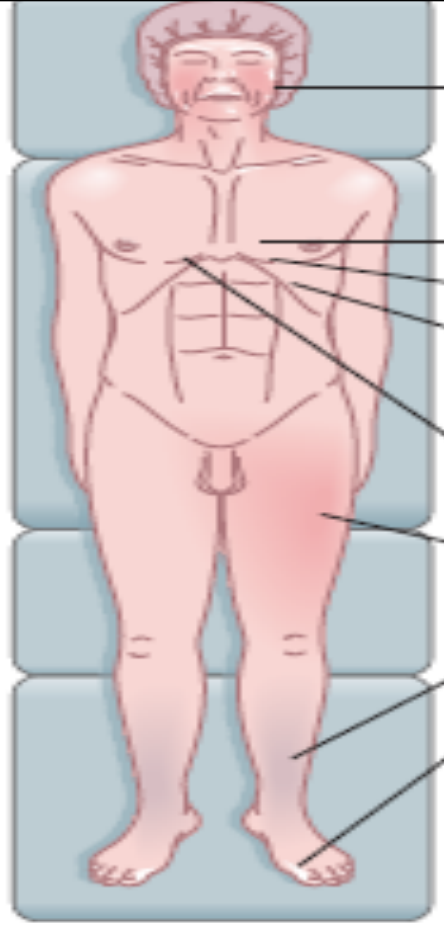
Plan D

- Rescue techniques for
- can't intubate, can't ventilate' situation


Direct laryngoscopy
Any problems
Call for help
Plan A: Initial tracheal intubation plan
• Direct laryngoscopy – check: neck flexion and head extension
• Laryngoscope technique and vector
• External laryngeal manipulation – by laryngoscopist
• Vocal cords open and immobile
• If poor view: introducer (bougie) – seek clicks or hold-up and/or alternative laryngoscope
Not more than 4 attempts, maintaining: (1) oxygenation with face mask and (2) anaesthesia
Succeed
Tracheal intubation
Verify tracheal intubation (1) Visual, if possible (2) Capnograph (3) Oesophageal detector 'If in doubt, take it out'
Failed intubation
Plan B: Secondary tracheal intubation plan
ILMA™ or LMA™ Not more than 2 insertions Oxygenate and ventilate
Succeed
Confirm: ventilation, oxygenation, anaesthesia, CVS stability and muscle relaxation – then fibreoptic tracheal intubation through ILMA™ or LMA™ – 1 attempt. If LMA™, consider long flexometallic, nasal RAE or microlaryngeal tube Verify intubation and proceed with surgery
Failed oxygenation (e.g. SpO2 < 90% with FIO2 1.0) via ILMA™ or LMA™
Failed intubation via ILMA™ or LMA™
Plan C: Maintenance of oxygenation, ventilation, postponement of surgery and awakening
Revert to face mask Oxygenate and ventilate Reverse non-depolarising relaxant 1 or 2 person mask technique (with oral ± nasal airway)
Succeed
Postpone surgery Awaken patient
Failed ventilation and oxygenation
Plan D: Rescue techniques for 'can't intubate, can't ventilate' situation

Malignant hyperthermia

Definition:- this occurs after exposure to a triggering agent (volatile anaesthetics or suxamethonium) and results in loss of normal calcium homeostasis within skeletal muscle cells.



Signs

- Muscle rigidity
  - especially masseter muscles noticed on intubation
- Tachycardia
- Cardiovascular instability
- Hypercapnia (a progressively increasing CO_2 capnograph reading)
- Acidosis
- Hyperkalaemia
- Cyanosis
- Hyperthermia/sweating

Treatment

- Call for help/stop surgery if possible
- Stop trigger/change anaesthetic breathing circuit
- Give 100% oxygen
- Hyperventilate
- Active cooling
- Dantrolene I.v.
- Treat complications as they arise:
  - renal failure/hyperkalaemia
  - coagulopathy
  - cardiovascular complications

Anaphylaxis

Definition:- this is an acute severe type 1 hypersensitivity reaction when an antigen (trigger) reacts with immunoglobulin IgE bound to histamine rich mast cells and basophils.

Symptoms

- Anxiety, feeling of impending doom
- Rash, itch
- Wheeze, shortness of breath
- Abdominal pain, diarrhoea, vomiting
- Chest pain

Signs

- Angioedema, e.g. skin, lips, throat
- Rash, flushing, urticaria
- Tachycardia, bradycardia, dysrhythmias
- Hypotension
- Bronchospasm

Treatment

- Basic resuscitation based on Airway Breathing Circulation (ABC)
- Remove suspected cause
- Call for help
- Give patient 100% oxygen, tracheal intubation if necessary
- Elevate legs if hypotension (increases venous return)
- Start cardiopulmonary resuscitation (CPR) if needed
- Give epinephrine 50µg in repeated doses; consider epinephrine infusion
- Give large volumes of fluid, e.g. normal saline or Hartmann's solution

Secondary treatment

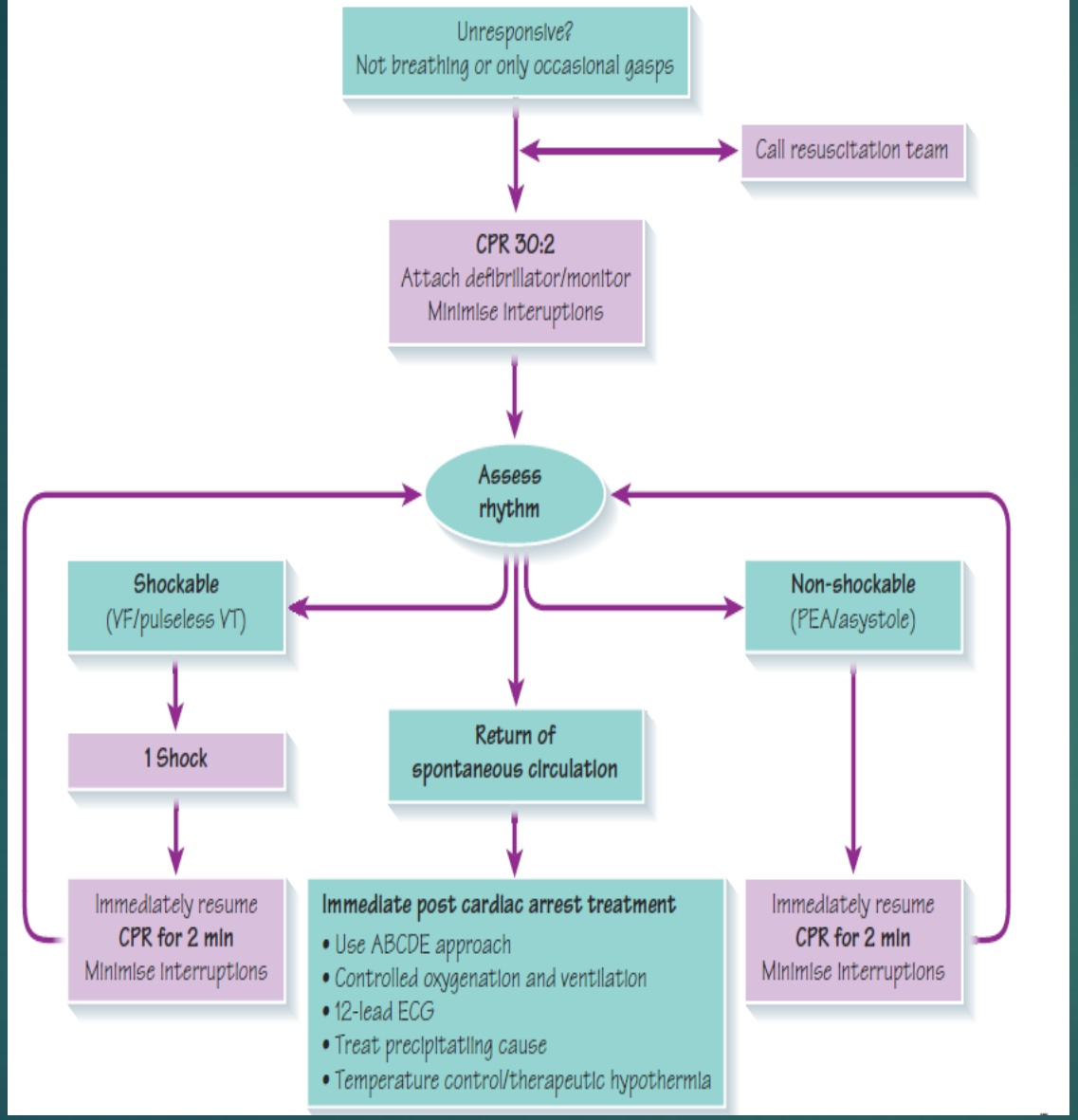
- Chlorpheniramine 10mg (H1 antagonist)
- Hydrocortisone 200mg
- Consider alternative vasopressor if unresponsive to epinephrine
- Consider salbutamol i.v./nebulizer, aminophylline, for persistent

bronchospasm

- High dependency or intensive care transfer

Cardiac arrest
Advanced life support algorithm

Figure 24.2 Advanced life support algorithm



VF – ventricular fibrillation
VT – ventricular tachycardia
PEA – pulseless electrical activity

During CPR

- Ensure high-quality CPR rate, depth, recoil
- Plan actions before interrupting CPR
- Give oxygen
- Consider advanced airway and capnography
- Continuous chest compressions when advanced airway in place
- Vascular access (intravenous, intraosseous)
- Give adrenaline every 3–5 min
- Correct reversible causes

Reversible causes

- Hypoxia
- Hypovolaemia
- Hypo-/hyperkalemia/metabolic
- Hypothermia
- Thrombosis – coronary or pulmonary
- Tamponade – cardiac
- Toxins
- Tension pneumothorax

Status asthmaticus

- **This is a severe acute exacerbation of asthma refractory to conventional β2 agonist therapy and is a medical emergency.**

- **Signs:-**

• tachypnoea;

• use of accessory respiratory muscles (e.g. abdominal, sternocleidomastoid),

and intercostal and subcostal recession;

• wheeze might be minimal or absent;

• tachycardia;

• pulsus paradoxus >10 mmHg (a reduction in blood pressure on

inspiration);

• sweating;

• tiring;

• confusion.

- **Treatment**

• give supplemental oxygen to maintain SaO294–98%;

• β2 agonist (either salbutamol or terbutaline) via O2 driven nebulizer;

• continuous nebulization can be used if there is a poor initial response;

• intravenous β2 agonists should only be used when the inhaled route
is unreliable;

• steroids – either oral prednisolone or i.v. hydrocortisone;

• nebulized ipratropium (anticholinergic);

• consider i.v. magnesium sulphate when life-threatening or poor
initial response to treatment; aminophylline might also be considered
in this situation.

Post Anesthesia Care Unit (PACU)

The role of the anaesthetist is not limited to operation theatres. There may be a number of postoperative responsibilities to undertake, both in the recovery room and on the surgical ward.

After receiving anesthesia for a surgery or procedure a patient is sent to the PACU to recover and wake up .

The PACU is similar to a critical care unit where the patient's vital signs are closely observed ,pain management begins , and fluids are given .

The nursing staff is skilled in recognizing and managing problems in patients after receiving anesthesia .

The PACU is under the direction of the Department of Anesthesiology.

PACU

- Design should match function
- Location:
  - Close to the OR.
  - Access to x-ray, blood bank & clinical labs.
- Monitoring equipment
- Emergency equipment
- Personnel

Admission to PACU

Steps:

- Coordinate prior to arrival,
- Assess airway,
- Administer oxygen,
- Apply monitors,
- Obtain vital signs,
- Receive report from anesthesia personnel.

PACU - ASA Standards

1. **Standard I**

   All patients should receive appropriate care

2. **Standard II**

   All patients will be accompanied by one of anesthesia team

3. **Standard III**

   The patient will be reevaluated & report given to the nurse

4. **Standard IV**

   The patient shall be continually monitored in the PACU

5. **Standard V**

   A physician will signing for the patient out of the PACU

Patient Care in the PACU

- Admission
  - Apply oxygen and monitor
  - Receive report
- Monitor & Observe & Manage
  - ➔ To Achieve
    - Cardiovascular stability
    - Respiratory stability
    - Pain control
- Discharge from PACU

Monitoring in the PACU

- Baseline vital signs.
- Respiration
  - RR/min, Rythm
  - Pulse oximetry
- Circulation
  - PR/min & Blood pressure
  - ECG
- Level of consciousness
- Pain scores

Initial Assessment

1. Color
2. Respiration
3. Circulation
4. Consciousness
5. Activity

Aldrete Score

Score	Activity	Respiration	Circulation	Consciousness	Oxygen Saturation
2	Moves all extremities	Breaths deeply and coughs freely.	BP ± 20 mm of preanesth. level	Fully awake	Spo2 > 92% on room air
1	Moves 2 extremities	Dyspneic, or shallow breathing	BP ± 20-50 mm of preanesth. level	Arousable on calling	Spo2 >90% With suppl. O2
0	Unable to move	Apneic	BP ± 50 mm of preanesth. level	Not responding	Spo2 <92% With suppl. O2

Discharge From the PACU

- Standard Aldrete Score:
  - Simple sum of numerical values assigned to activity, respiration, circulation, consciousness, and oxygen saturation.
  - A score of 9 out of 10 shows readiness for discharge.

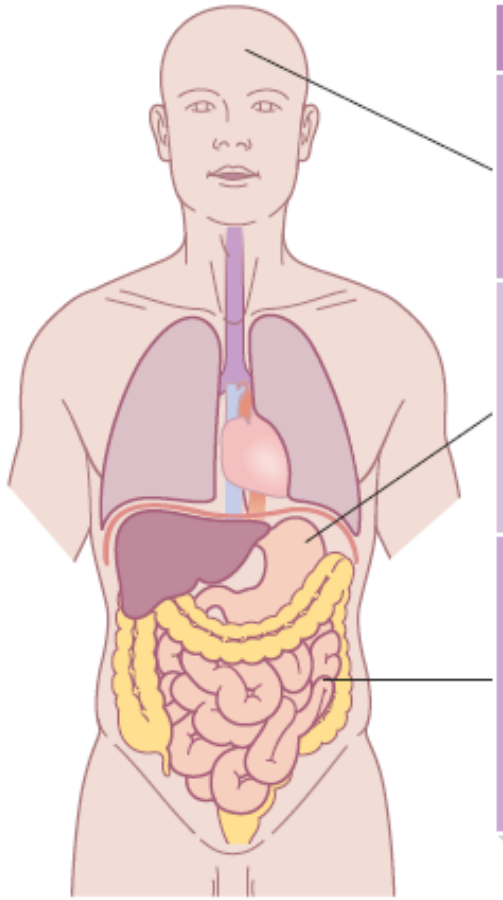
- Post-anesthesia Discharge Scoring System:
  - Modification of the Aldrete score which also includes an assessment of pain, N/V, and surgical bleeding, in addition to vital signs and activity.
  - Also, a score of 9 or 10 shows readiness for discharge.

Discharge criteria from PACU

- Easy arousability
- Full orientation
- Ability to maintain & protect airway
- Stable vital signs for at least 15 – 30 minutes
- The ability to call for help if necessary
- No obvious surgical complication (active bleeding)

Postoperative management

Figure 34.1 Side effects of opioids



Side effect	Potential problems
Respiratory depression, sedation and **cough suppression**	• Apnoea, • Gastric aspiration • Respiratory infection
Nausea and vomiting	• Electrolyte imbalance • Dehydration and malnutrition • Wound dehiscence • Delayed discharge
Reduction in peristalsis	• Constipation • Ileus and urinary retention • Slow return to GI function after bowel surgery

Common PACU Problems

- Airway obstruction
- Hypoxemia
- Hypoventilation
- Hypotension
- Hypertension
- Cardiac dysrhythmias
- Hypothermia

- Bleeding
- Agitation
- Delayed recovery
- "PONV"
- Pain
- Oliguria

1. Airway Obstruction

- Most common: tongue fall back

  ➔ posterior pharynx

- May be foreign body
- Inadequate relaxant reversal
- Residual anesthesia

Management of Airway Obstruction

- Patient's stimulation,
- Suction,
- Oral Airway,
- Nasal Airway,
- Others:
  - Tracheal intubation
  - Cricothyroidotomy
  - Tracheotomy

2. Hypoventilation

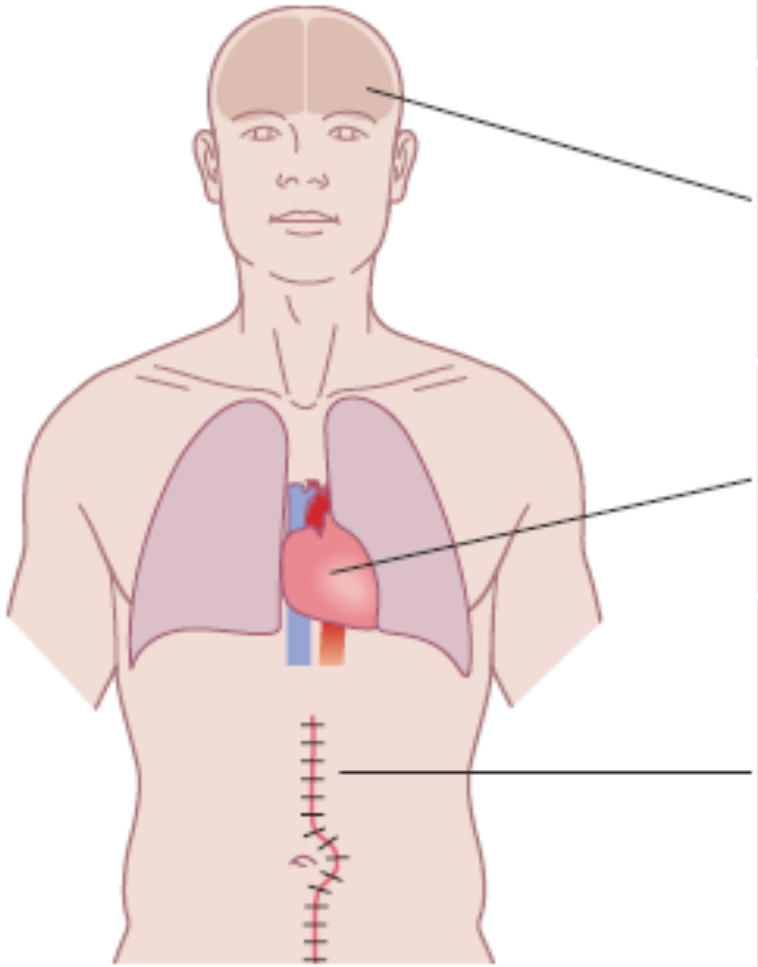
- Residual anesthesia
  - Narcotics
  - Inhalation agent
  - Muscle Relaxant
- Post oper - Analgesia
  - Intravenous
  - Epidural

Treatment of Hypoventilation

- Close observation,
- Assess the problem,
- Treatment of the cause:
  - Reverse (or Antidote):
    - Muscle relaxant ⇦ Neostigmine
    - Opioids ⇦ Naloxone
    - Midazolam ⇦ Anexate

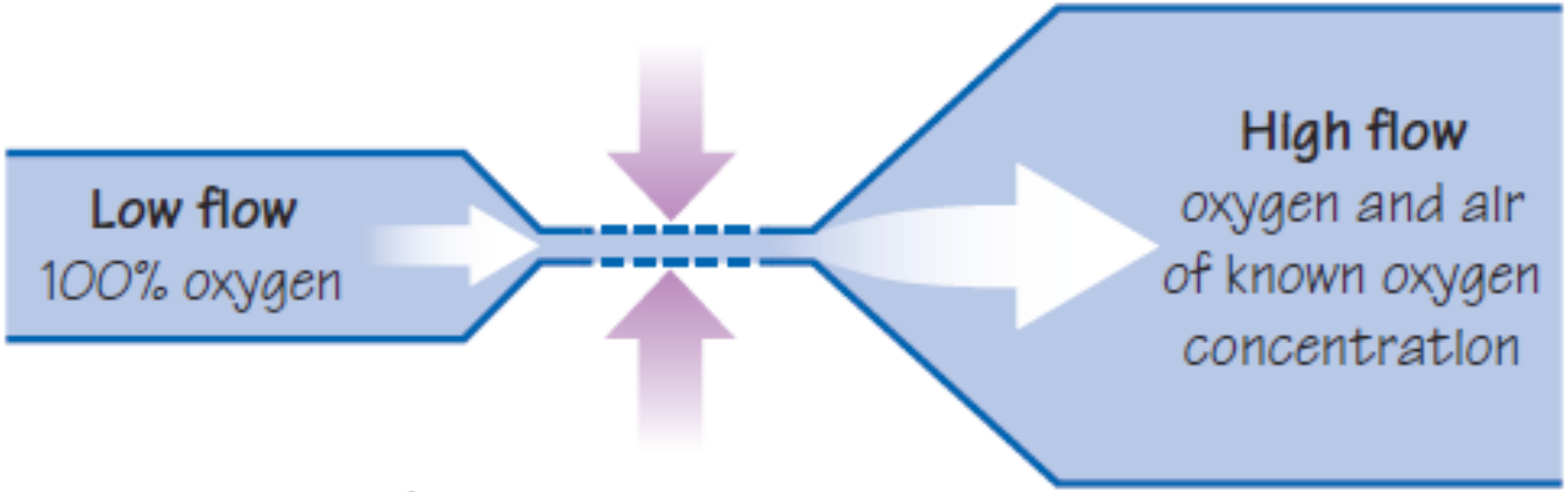
Oxygen therapy

Figure 34.2 Hazards of postoperative hypoxaemia



Hazards	Consequences
CNS	• Cerebral ischaemia • Confusion • Postoperative cognitive dysfunction (see Chapter 28)
CVS	• Myocardial ischaemia and infarction • Arrhythmias
Other	• Reduced wound healing • Increased postoperative infections • ? Anastomotic breakdown • ? Bacterial translocation across bowel wall leading to sepsis

Figure 34.3 Venturi effect



Air entrainment occurs
at this narrowed point
as the velocity of the gas
increases so the gas
pressure falls

Treatment of Hypoventilation

- Close observation,
- Assess the problem,
- Treatment of the cause:
  - Reverse (or Antidote):
    - Muscle relaxant ⇦ Neostigmine
    - Opioids ⇦ Naloxone
    - Midazolam ⇦ Anexate

3. Hypertension

- Common causes: e.g.
  - Pain
  - Full Bladder
- Hypertensive patients
- Fluid overload
- Excessive use of vasopressors

Treatment of Hypertension

- Effective pain control
- Sedation
- Anti-hypertensives:
  - Beta blockers
  - Alpha blockers
  - Hydralazine (Apresoline)
  - Calcium channel blockers

4. Hypotension

- Decreased venous return
  - Hypovolemia,
    - ⬇ fluid intake
    - ⬆ losses
    - Bleeding
  - Sympathectomy,
  - 3rd space loss,
  - Left ventricular dysfunction

Fluids

Patients will require i.v. fluids until they are able to drink normally

- maintenance and interoperative fluid losses;
- replacement of pre-existing losses (e.g. dehydration preoperatively);
- replacement of postoperative losses (e.g. nasogastric losses, bleeding).

The types of fluid are:

- isotonic crystalloid (most often used);
- colloids (for maintaining intravascular volume, early bleeding);
- blood and blood products (for significant haemorrhage, coagulopathy).

5. Dysrhythmias

- Secondary to
  - Hypoxemia
  - Hypercarbia
  - Hypothermia
  - Acidosis
  - Catecholamines
  - Electrolyte abnormalities.

Treatment of Dysrhythmia

- Identify and treat the cause,
- Assure oxygenation,
- Pharmacological

6. Urine Output

- Oliguria
  - Hypovolemia,
  - Surgical trauma,
  - Impaired renal function,
  - Mechanical blocking of catheter.
- Treatment:
  - Assess catheter patency
  - Fluid bolus
  - Diuretics e.g. Lasix

7. Post op Bleeding

Causes:

- Usually Surgical Problem,
- Coagulopathy,
- Drug induced

Treatment of Post op Bleeding

Treatment:

- Start i.v. lines ➢ push fluids
- Blood sample,
  - CBC,
  - Cross matching,
  - Coagulopathy
- Notify the surgeon,
- Correction of the cause

8. Hypothermia

- Most of patients will arrive cold
- Treatment:
  - Get baseline temperature
  - Actively rewarm
  - Administer oxygen if shivering
  - Take care for:
    - Pediatric,
    - Geriatric.

9. Altered Mental Status

- Reaction to drugs?
  - Drugs e.g. sedatives, anticholinergics
  - Intoxication / Drug abusers
- Pain
- Full bladder
- Hypoventilation
- Low COP
- CVA

Treatment of Altered Mental Status

- Reassurances,
- Always protect the patient,
- Evaluate the cause,
- Treatment of symptoms,
- Sedatives / Opioids if necessary.

10. Delayed Recovery

- Systematic evaluation
  - Pre-op status
  - Intraoperative events
  - Ventilation
  - Response to Stimulation
  - Cardiovascular status

Delayed Recovery

- The most common cause:
  - Residual anesthesia ➢ Consider reversal
- Hypothermia,
- Metabolic e.g. diabetic coma,
- Underlying psychiatric problem
- CVA

11. Postoperative Nausea & Vomiting "PONV"

- Risk factors
  - Type & duration of surgery,
  - Type of anesthesia,
  - Drugs,
  - Hormone levels,
  - Medical problems,
  - Autonomic involvement.

Prevention of PONV

- NPO status
- Dexamothasone,
- Droperidol,
- Metoclopramide,
- H_2 blockers,
- Ondansetron,
- Acupuncture

Analgesia

Table 34.1 Drugs used for multimodal analgesia

Drug	Side effects
Opioids	See Figure 34.1
NSAIDs	• Bleeding, especially gastrointestinal • Gastrointestinal perforation • Asthma, renal failure • Myocardial and cerebral thrombosis
Paracetamol	• Liver dysfunction in overdose
Local anaesthetics	• Cardiac and CNS toxicity

12. Postoperative Pain

- **Causes:**
- **Incisional** Skin and subcutaneous tissue
- **Laparoscopy** Insuflation of Co_2
- Others:
  - Deep cutting, coagulation, trauma
  - Positional nerve compression, traction & bed sore.
  - IV site needle trauma, extravasation, venous irritation
  - Tubes drains, nasogastric tube, ETT
  - Surgical complication of surgery
  - Others cast, dressing too tight, urinary retention

Table 34.2 Common methods of administering analgesics

Analgesic	Method
Opioids	I.m., I.v. (PCA), epidural/spinal, oral, intra-articular
Paracetamol	I.v. and oral (rarely p.r.)
NSAIDs	Oral, p.r., I.v.
Local anaesthetic	Wound, epidural/spinal, various nerve blocks. Intra-articular

Referral to high dependency unit/intensive care unit

Table 34.3 Levels of postoperative care

Level of care	
0 (ward)	Patients needs met on normal ward
1 (HDU)	Patients at risk of their condition deteriorating, or who require advice from the ICU team
2 (ICU)	Patients with a single failing organ system or requiring detailed observation/intervention
3 (ICU)	Patients requiring ventilation (alone), advanced respiratory support alone or support of at least two organ systems

Thank you