5) Postoperative Complications - Dr. Gona

Postoperative Respiratory and Airway Complications

- Respiratory problems are the most frequently encountered complications in the PACU (post-anaesthesia care unit), with the majority related to airway obstruction, hypoventilation, or hypoxemia.

### Hypoxaemia

- This is the most important respiratory complication after anaesthesia and surgery.
- It may start at recovery and in some patients persist for 3 days or more after surgery.
- The presence of cyanosis is very insensitive and when detectable the arterial PO2 will be <8kPa (55 mmHg)
- Causes
  - Hypoxaemia can be caused by a number of factors, either alone or in combination:
    - Alveolar hypoventilation
    - Ventilation and perfusion mismatch within the lungs
    - Diffusion hypoxia
    - Pulmonary diffusion defects
    - A reduced inspired oxygen concentration

#### Alveolar hypoventilation

This is the commonest cause of hypoxaemia and results in insufficient influx of oxygen into the alveoli to replace that taken up by the blood, common causes are:

1. **Obstruction of the airway:** due to the tongue, vomit, blood or swelling (e.g. post-thyroid surgery)
   - Noisy breathing; or little noise despite vigorous efforts, ‘see-saw’ or paradoxical pattern of ventilation, tracheal tug may be seen.
   - It is prevented by recovering patients in the lateral position
   - If it is not possible to turn the patient perform a chin lift or jaw thrust
   - An oropharyngeal or nasopharyngeal airway may be required to help maintain the airway
   - Laryngospasm and laryngeal edema: Laryngospasm is a forceful involuntary spasm of the laryngeal musculature caused by sensory stimulation of the superior laryngeal nerve.
   - Triggering stimuli include pharyngeal secretions or extubating in stage 2. The large negative intrathoracic pressures generated by the struggling patient in laryngospasm can cause pulmonary edema
   - treatment includes 100% oxygen, anterior mandibular displacement,

2. **Central respiratory depression**
   - The residual effects of anaesthetic drugs decrease the ventilatory response to hypoxia and hypercarbia and also reduce the level of consciousness.
   - Support ventilation until effects have worn off or reversed.
   - Opioid analgesics (in excess) cause respiratory depression and reduce the level of consciousness. If severe, the administration of the specific antagonist (naloxone) may be required

3. Hypothermia:
   - Reduces ventilation

4. Cerebral haemorrhage or ischaemia:
   - May cause direct damage to the respiratory centre
   - Or, more commonly, a deeply unconscious patient unable to maintain a patent airway.
5. Impaired mechanics of ventilation:
   - Pain (upper abdominal or thoracic surgery, prevents coughing, leading to sputum retention and atelectasis) Provide adequate analgesia
   - Residual neuromuscular blockade is suggested by unsustained, jerky movements with rapid, shallow breathing in a hypertensive, tachycardic patient.
   - The patient should be given oxygen, reassured, sat upright to improve the efficiency of ventilation, and a (further) dose of neostigmine and an anticholinergic given.

6. Pneumothorax or haemothorax
   - Prevents ventilation of the underlying lung.
   - Will require insertion of chest drain.

7. Diaphragmatic splinting
   - Abdominal distension & obesity push the diaphragm into the thorax & increase work of breathing.
   - Such patients are greatly helped by being sat up.

Ventilation and perfusion mismatch within the lungs

During anaesthesia and the recovery period ventilation/perfusion (V/Q) mismatch may occur

The etiology of V/Q mismatch:

- Mechanical ventilation reduces cardiac output.
- A reduced functional residual capacity (FRC). In supine, anaesthetized patients, over 50 years of age.
- Pain restricts breathing and coughing, leading to poor ventilation of the lung bases, sputum retention, basal atelectasis and, ultimately, infection.
- This is more prevalent in (Smokers, Obesity, pre-existing lung disease, elderly, after upper gastrointestinal or thoracic surgery, 3 days after surgery)
- Small areas of V/Q mismatch = corrected by ↑ the inspired O2

Diffusion hypoxia

- Nitrous oxide absorbed during anaesthesia has to be excreted during recovery. As it is very insoluble in blood, it rapidly diffuses down a concentration gradient into the alveoli, where it reduces the partial pressure of oxygen in the alveoli, making the patient hypoxaemic.
- This can be treated by giving oxygen via a facemask to increase the inspired oxygen concentration.

Pulmonary diffusion defects

- Any chronic condition causing thickening of the alveolar membrane, for example fibrosing alveolitis, impairs transfer of oxygen into the blood.
- In the recovery period it may occur secondary to the development of pulmonary edema following fluid overload or impaired left ventricular function.
- It should be treated by first administering oxygen to increase the partial pressure of oxygen in the alveoli and then by management of any underlying cause.

A reduced inspired oxygen concentration

- As the inspired oxygen concentration is a prime determinant of the amount of oxygen in the alveoli, reducing this will lead to hypoxaemia.
- There are no circumstances where it is appropriate to administer less than 21% oxygen
Management of hypoxaemia

- All patients should be given oxygen in the immediate postoperative period to:
  - counter the effects of diffusion hypoxia when nitrous oxide has been used;
  - compensate for any hypoventilation;
  - compensate for V/Q mismatch;
  - meet the increased oxygen demand when shivering.
- Patients who continue to hypoventilate, have persistent V/Q mismatch, are obese, anaemic or have ischaemic heart disease, will require additional oxygen for an extended period of time.
- This is best determined either by arterial blood gas analysis or by using a pulse oximeter.

Hypotension

This can be due to a variety of factors, alone or in combination, that reduce the cardiac output, the systemic vascular resistance or both.

- Hypovolaemia;
- Reduced myocardial contractility;
- Vasodilatation;
- Cardiac arrhythmias.

Hypovolaemia

- This is the commonest cause of hypotension after anaesthesia and surgery.
- Although intraoperative blood loss is usually obvious, continued bleeding.
- Fluid loss may also occur as a result of tissue damage leading to oedema, or from evaporation during prolonged surgery on body cavities, for example the abdomen or thorax.

Diagnosis

- Reduced peripheral perfusion; cold clammy skin or delayed capillary refill (>2s) in the absence of fear, pain and hypothermia.
- Tachycardia; a pulse rate >100 beats/min of poor volume.
- Hypotension. Initially, systolic blood pressure ↓minimally but the diastolic ↑ as a result of compensatory vasoconstriction (narrow pulse pressure). The blood pressure must always be interpreted in conjunction with the other assessments.
- Inadequate urine output (<0.5mL/kg/h)

Consider also the following as causes of reduced urine output:

- A blocked catheter (blood clot or lubricant);
- Hypotension;
- Hypoxia;
- Renal damage intraoperatively (e.g. during aortic aneurysm surgery).

Management

- Ensure adequate oxygenation and ventilation.
- Intravenous fluid (crystalloid or colloid) should be given, using a pressure infuser to speed administration.
- Consider cross-matching blood if not already done.
- Stop any external haemorrhage with direct pressure.
- Get surgical assistance if internal haemorrhage suspected.
- Monitoring of the patient’s CVP may be indicated if cardiac function is in question.
- The trend of the patient’s acid–base status is a useful indicator of therapeutic success.
Reduced myocardial contractility

- The commonest cause is ischaemic heart disease, causing any degree of left ventricular failure. The diagnosis should be considered on finding:
  - Poor peripheral circulation;
  - Tachycardia;
  - Tachypnoea;
  - Distended neck veins;
  - Basal crepitations on auscultation of the lungs;
  - Wheeze with a productive cough;
  - A triple rhythm on auscultation of the heart.
- It is not uncommon to mistake this condition for hypovolaemia based on the first three findings. A chest X-ray is usually diagnostic.

Management

- Sit the patient upright.
- Give 100% oxygen.
- Monitor the ECG, blood pressure and peripheral oxygen saturation.
- If the diagnosis is unclear, a fluid challenge (maximum 5mL/kg) can be given and observe; an improvement in the circulatory status suggests hypovolaemia.
- If no doubt about the diagnosis, fluids can be restricted initially and a diuretic (e.g. frusemide 20–40mg) given intravenously.
- Trends in the CVP can be monitored as a guide to therapy.
- If there is acute myocardial infarction, contractility may only improve with the use of inotropes in conjunction with vasodilators, and this is best undertaken on the intensive care unit (ICU).
- Unfortunately thrombolysis is contraindicated after surgery

Vasodilatation

- This is common during spinal or epidural anaesthesia.
- Another example is following prostate surgery under spinal anaesthesia. As the legs are taken down from the lithotomy position, vasodilatation in the lower limbs is unmasked, and as the patient is moved to the recovery area he becomes profoundly hypotensive.
- The development of septic shock may present initially as peripheral vasodilatation, hypotension and tachycardia in the absence of blood loss, ↑body temp. and cardiac output is measured.
- Gradually, vasoconstriction ensues along with a fall in cardiac output.

Management

- Hypotension secondary to regional anaesthesia is corrected by the administration of fluids (crystalloid, colloid), the use of vasopressors (e.g. ephedrine), or a combination of both.
- Oxygen should always be given.
- The combination of hypovolaemia and vasodilatation will cause profound hypotension.
- Patients developing septic shock require early diagnosis, invasive monitoring and circulatory support in a critical care area. Antibiotic therapy should be guided by a microbiologist.
Cardiac arrhythmias

- Occur more frequently in the presence of:
  - Hypoxaemia;
  - Hypovolaemia;
  - Hypercarbia;
  - Hypothermia;
  - Sepsis;
  - Pre-existing ischaemic heart disease;
  - Electrolyte abnormalities; (Hypo/hyperkalaemia, hypocalcaemia, hypomagnesaemia)
  - Acid–base disturbances;
  - Inotropes, antiarrhythmics, bronchodilators;
  - Antidepressants in overdose.

- Tachycardia result in insufficient time for ventricular filling, thereby reducing cardiac output, while bradycardia reduce the heart rate below the point where no further increase in ventricular filling can occur to maintain cardiac output

Management

- Correction of the underlying problem will result in spontaneous resolution of most arrhythmias. Specific intervention is required if there is a significant reduction in cardiac output and hypotension. The

  **Sinus tachycardia (>100 beats/min)** The commonest arrhythmia after anaesthesia and surgery, usually as a result of pain or hypovolaemia. If there is associated pyrexia, it may be an early indication of sepsis. Treatment consists of oxygen, analgesia and adequate fluid replacement. If the tachycardia persists, then providing there is no contraindication a small dose of a beta blocker may be given intravenously whilst monitoring the ECG.

- **Supraventricular tachycardia** The most common is atrial fibrillation usually secondary to ischaemic heart disease or the presence of sepsis. Treatment will depend on the rate and reduction in cardiac output:
  - Heart rate 100–150/min with critical perfusion will require cardioversion followed by IV amiodarone 300mg over 1h;
  - Heart rate <100/min with good perfusion, consider amiodarone 300mg IV over 1 h.

- **Sinus bradycardia (<60 beats/min)** Usually the result of:
  - An inadequate dose of an anticholinergic (e.g. glycopyrrolate) given with neostigmine to reverse neuromuscular block;
  - Excessive suction to clear pharyngeal or tracheal secretions;
  - Traction on the viscera during surgery;
  - Excessive high spread of spinal or epidural anaesthesia;
  - The development of acute inferior myocardial infarction;
  - Excessive beta-blockade preoperatively or intraoperatively.

- Treatment should consist of removing any provoking stimuli and administering oxygen. If symptomatic, atropine 0.5mg intravenously may be required.

Hypertension

- This is most common in patients with pre-existing hypertension. It may be exacerbated or caused by:
  - Pain
  - Hypoxaemia
  - Hypercarbia
  - Confusion or delirium
  - Hypothermia.

- A coexisting tachycardia is particularly dangerous in the presence of IHD as this may cause an acute MI.
- If BP remains elevated after correcting the above, a vasodilator or beta blocker may be necessary.
Postoperative nausea & vomiting (PONV)

Occurs in 80% of pts following anaesthesia & surgery. A variety of factors increase the incidence:

A. Patient risk factors: short fasting status, anxiety, younger age, female, obesity, gastroparesis, pain, history of postoperative nausea/vomiting or motion sickness

B. Surgery-related factors: gynecological, abdominal, ENT, ophthalmic, and plastic surgery; endocrine effects of surgery; duration of surgery.

C. Anesthesia-related factors: premedicants (morphine and other opioids), anesthetics agents (nitrous oxide, inhalational agents, etomidate, methohexital, ketamine), anticholinesterase reversal agents, gastric distention, longer duration of anesthesia, mask ventilation, intraoperative pain medications, regional anesthesia (lower risk).

D. Postop factors: pain, dizziness, movement after surgery, premature oral intake, opioid administration

• Pts identified as being at risk of PONV should be given an anti-emetic before emergence from anaesthesia.
• Failure of tx may be addressed by giving a 2nd or 3rd drug from different classes of compound.

Drugs used to treat nausea and vomiting

First it is essential to make sure that the patient is not hypoxaemic or hypotensive.

• Antihistamines Cyclizine. Adults 50mg I.M, up to 6 hourly.
• 5-HT3 (hydroxytryptamine) antagonists Ondansetron (Zofran). Adults 4–8mg I.V or P.O, 8 hourly. Has both central and peripheral actions.
• Dopamine antagonists Metoclopramide (Maxolon).
  o Adults 10mg I.V, I.M, or P.O 6 hourly. Has an effect at the CTZ and increases gastric motility.
• An alternative is domperidone (Motilium) 10mg P.O.
• Phenothiazine derivatives Prochlorperazine (Stemetil).
  o Adults 12.5mg I.M 6 hourly or 15–30mg P.O, daily in divided doses. May cause hypotension due to alpha-blockade.
• Anticholinergic drugs Atropine and hyoscine; the latter is available as a transdermal patch. Severe side-effects, particularly dry mouth and blurred vision.
• Steroids Dexamethasone 8mg IV may be useful in resistant cases.

Post-operative pain

Postoperative Neurologic Complications

1. Delayed awakening: most frequent cause of a is persistent effect of anesthesia or sedation.
   • Other causes include recurarization, severe hypothermia, hypoglycemia, and neurologic disorders.
2. Emergence delirium (agitation): is characterized by excitement, alternating with lethargy, disorientation, and inappropriate behavior.
   • Potential causes include arterial hypoxemia, hypercapnia, pain, unrecognized gastric dilation, urinary retention, and previous administration of atropine.
   • Treatment includes haloperidol, titrated in 1-2 mg IV increments. Benzodiazepines may be added if agitation is severe. Physostigmine (0.5-2.0 mg IV) may reverse anticholinergic delirium.

Miscellaneous Complications

1. Renal dysfunction: oliguria (urine output less than 0.5 mL/kg/hour) most likely reflects decreased renal blood flow due to hypovolemia or decreased cardiac output.
2. Bleeding abnormalities: causes include inadequate surgical hemostasis or coagulopathies.
   • Shivering (hypothermia): Shivering can occur 2° to hypothermia or effects of anesthetic agents (usu. volatile anesthetics). Shivering should be treated with warming measures
   • Small doses of meperidine (12.5-25 mg) IV