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جامعة المستقبل
كلية التقنيات الطبية
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Title: Anaesthesia for Thoracic Surgery

Anaesthesia for Thoracic Surgery

Thoracic anaesthesia is a field requiring mastery of pulmonary anatomy and physiology, as well as technical skills in the stabilization of an adequate airway through various modalities.

+ Particular anesthetic challenges of thoracic anaesthesia:

- Control of airway during bronchoscopy.
- Protection of the airway in patients with esophageal disease, lung abscess, bronchopleural fistula or hemoptysis.
- Positioning a double-lumen tracheal tube to maintain anaesthesia in the lateral position with the chest opened and one lung collapsed.
- Postoperative care of a patient after lung tissue resection

+ One-lung anaesthesia:

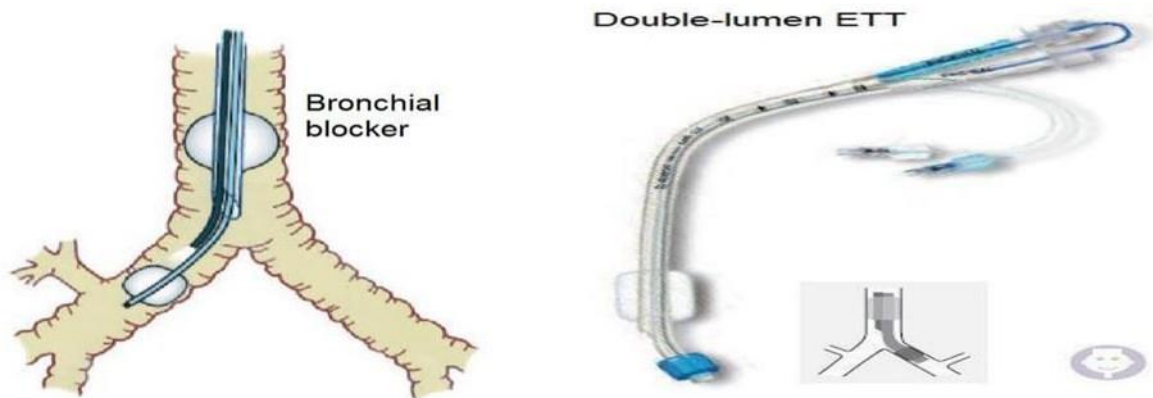
In thoracic anaesthesia, one-lung ventilation is used, so only a single (non-operative) lung is ventilated.

Principal indications for one-lung anaesthesia:

- 1) Isolation of the lungs.
- 2) Ventilation of one lung alone.
- 3) Bronchopulmonary alveolar lavage.
- 4) Collapse of one lung to allow surgical access to other structures

Ventilation of one lung alone requires either a double-lumen tracheal tube or a bronchial blocker.

Traditionally, in one-lung ventilation, the **same minute volume used in two-lung ventilation is applied to the single lung**. However, a **smaller tidal volume** or pressure controlled ventilation may reduce stretch-related lung injury.



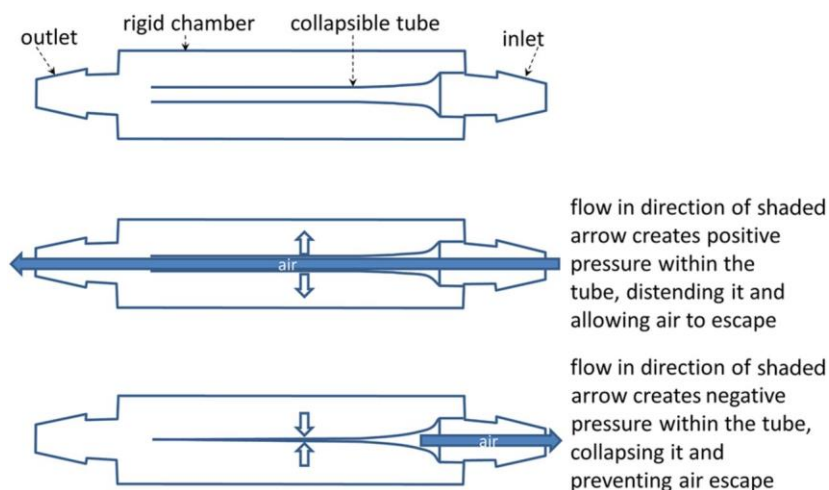
MANAGEMENT OF HYPOXAEMIA DURING ONE-LUNG VENTILATION

- Increase inspired oxygen to 100%.
- Check position of tube with fibre-optic bronchoscope.
- Suctioning of secretions may be required.
- Ensure adequate blood pressure and cardiac output.
- PEEP 5–10 cmH₂O to the dependent lung to decrease atelectasis and increase FRC. Excessive PEEP increases pulmonary vascular resistance and may increase shunt.

- CPAP 5–10 cmH₂O with 100% oxygen to the non-ventilated lung to facilitate oxygen uptake in this lung whilst not adversely affecting the surgical conditions.
- Abandon one-lung ventilation and intermittently ventilate the collapsed lung after warning the surgeon.
- Early clamping of the appropriate pulmonary artery will stop the shunt

✚ Thoracotomy:

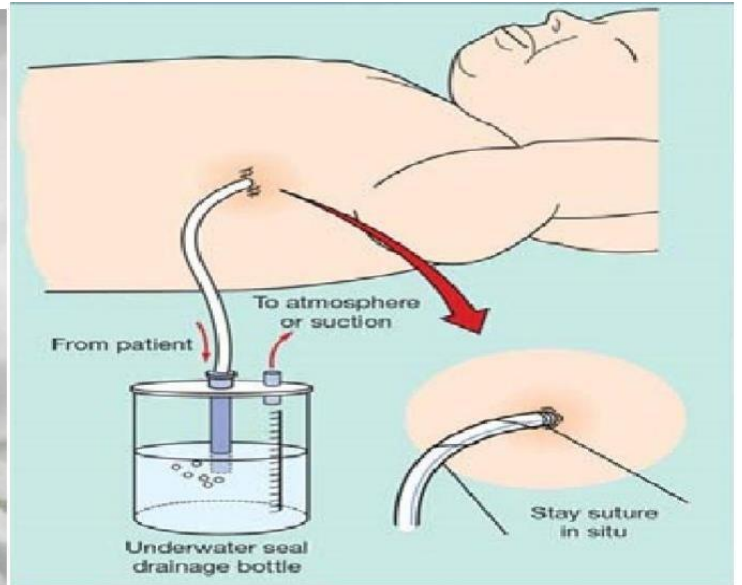
- Median sternotomy in supine position is used for access to the **thymus, retrosternal goiters** and **anterior mediastinum**;
- lateral thoracotomy is used for most other thoracic operations.
- Blood loss may be extensive, **at least one large-bore cannula** is essential. A **central venous catheter** allows venous pressure monitoring and more rapid drug delivery.
- The lungs should be fully expanded before closure.
- Residual air in the pleural cavity can be removed by an intrapleural drain connected to an underwater seal or a Heimlich flutter valve.



- Accidental pneumothorax during thoracotomy can be caused, it is a risk during any operation near the pleura or where local blocks are performed in the region of the thorax. It may be a cause of cardiovascular collapse and be difficult to diagnose. Puncture of the lung itself will usually close spontaneously, but chest drains are usually required as a precaution.



Heimlich flutter valve



Underwater seal drain

Postoperative considerations:

- 1) Postoperative hypoxemia: Patients who have undergone a thoracotomy will require oxygen in the immediate postoperative period for 24 hours and chest physiotherapy,

factor may contribute postoperative hypoxemia are:

 - a) Pneumothorax: which it should be excluded by routinely postoperative chest radiograph.
 - b) Atelectasis.
 - c) Sputum retention.
 - d) Poor pain relief.
 - e) Fluid overload.
- 2) Cardiac arrhythmia: The most common one after thoracotomy is atrial fibrillation.
- 3) Torsion of remaining lobe: It is may occur after lobectomy. The presentation may be up to 2 weeks postoperatively. Chest radiology

shows engorgement and increased density of the affected lobe. Resection of the affected lobe is usual.

- 4) Herniation of the heart: Removal of pericardium together with lung resection, may allow the heart to be displaced from the mediastinum. Cardiovascular collapse is usually profound. Emergency re-exploration is required.

Pneumonectomy

- A lateral approach is usual, but the prone or supine positions may be used,
- a double-lumen tube is usual, but a single-lumen tube may be adequate (with or without a bronchial blocker).
- When the chest is closed at the end of surgery, the remaining lung is fully inflated and the chest drain to the pneumonectomy space is clamped. Clamps are released for 5 minutes every hour to ensure that no air, blood or excess fluid accumulates in the pneumonectomy space.
- Post-operative pulmonary edema carries a high mortality rate. It appears to be related to the perioperative use of blood products and higher ventilatory inflation pressures.

Pulmonary lobectomy

- There will be a large air leak and difficulty with ventilation unless one-lung anesthesia is used.
- There will be considerable alveolar air leak afterwards, which decreases when IPPV is stopped.
- Low-pressure suction (-5 cmH₂O) should be applied postoperatively

to pleural drains to keep the lungs expanded.

✚ Lung cyst and bullae

- Intermittent positive pressure ventilation (IPPV) and coughing may cause further distension of large cysts compress surrounding tissue or even a tension pneumothorax.
- Early isolation of the cyst from ventilation with a double-lumen tube or bronchial clamp is desirable.
- Nitrous oxide may distend lung cysts because of its much greater solubility than nitrogen and should be avoided.
- Accidental rupture of a pulmonary hydatid cyst into the bronchi during surgery risks dissemination of the disease. Endobronchial intubation is indicated.

✚ Thymectomy for myasthenia gravis

- The approach for thymectomy for myasthenia gravis is trans-cervical or by splitting.
- A single-lumen endotracheal tube is required.
- Hemorrhage may be significant and large-bore venous access is essential.

Implications for anesthesia for myasthenia gravis:

- 1) Increased sensitivity to non-depolarizing muscle relaxants.
- 2) Resistance to depolarizing muscle relaxants.
- 3) Increased sensitivity to the neuromuscular effects of volatile agents.
- 4) Risk of aspiration due to bulbar weakness (a weakness due to impairment of function of the lower cranial nerves).

- 5) Risk of postoperative respiratory failure with respiratory muscle weakness.
- 6) Risk of cholinergic crisis with excessive doses of anticholinesterases.
- 7) Effects of immunosuppressant therapy

Maintenance of anesthesia with propofol has the advantages of avoiding the neuromuscular effects of volatile agents. And in combination with **thoracic epidural analgesia** has been reported to reduce the requirement for postoperative ventilatory support.

Cautious use of other respiratory depressants such as opiates is recommended, non-opioid analgesics and local anesthesia should be used where possible. **Neostigmine** should be used cautiously because of the risk of precipitating a cholinergic crisis.

✚ Rigid bronchoscopy

- It is performed most often to **obtain tissue** diagnosis and determine if a lesion may be **resected**.
- Other indications include **removal** of foreign bodies and secretions, and **control** of hemorrhage.



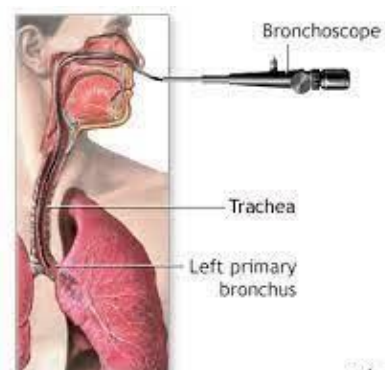
The principles of anesthesia for rigid bronchoscopy are:

- 1) To maintain oxygenation and carbon dioxide removal during the procedure.
- 2) Hypnosis and reduction of autonomic response.
- 3) Muscle relaxation to allow passage of the scope and to facilitate the conduct of endotracheal and endobronchial manipulation.

- The anesthetist stands beside the patient, intermittently releasing a high pressure gas (ventilation is normally maintained by using a 4 bars gas injector via a cannula attached to the proximal end of the bronchoscope).
- The chest and abdomen are observed as a monitor of adequate tidal volume.
- At the end of the procedure, the bronchoscope is removed and the pharynx sectioned carefully. Ventilation is maintained with a bag and face or laryngeal mask, anesthesia is discontinued and muscle relaxation reversed if a non-depolarizing agent has been used.
- The patient is normally recovered in a sitting position. Nebulized adrenaline, I.V dexamethasone and CPAP via a tight-fitting mask may help relieving of the post-procedure laryngeal spasm, which may be an occasional complication.

- **✚ Fiber-optic bronchoscopy**

Commonly, fiber-optic bronchoscopy is performed under topical anesthesia and sedation with midazolam or diazepam. Opioids may be used in addition, but apnea



must be avoided.

- A flexible fiber-opticscope may be passed via an **endotrachealtube** or **laryngeal mask** airway under general anesthesia

MCQ TEST

- 1- Cause of post-operative hypoxemia after thoracotomy (**all true except one**)
 - a) Sputum retention.
 - b) Pain.
 - c) Pneumothorax.
 - d) Dehydration
 - e) atelectasis
- 2- Rigid bronchoscopy (**all true except one**)
 - a) Laryngeal spasm post operatively treated by IV dexamethasone and CPAP.
 - b) Recovery of the patient in left lateral position
 - c) Not performed under local anesthesia.
 - d) Muscle relaxants to allow passage of scope.
 - e) For foreign body removal.
- 3- Thymectomy for myasthenia gravis (**all true except one**)
 - a) A single lumen endotracheal tube is required.
 - b) Increased sensitivity to atracurium.
 - c) Risk of aspiration due to bulbar weakness.
 - d) Resistance to succinylcholine.
 - e) Hemorrhage may be non-significant
- 4- One lung anesthesia (**all true except one**)
 - a) One lung is ventilated.
 - b) Requires either a double lumen tracheal tube or a bronchial blocker.

- c) Double minute volume used
 - d) Indicated for bronchopulmonary alveolar lavage.
 - e) Not indicated in thymectomy.
- 5- Management of hypoxemia during one lung ventilation (**which one is true**)
- a) Check the position of tube with videolaryngoscopy.
 - b) Increase tidal volume to double.
 - c) Apply PEEP 5-10cmH₂O to non-dependent lung.
 - d) Apply CPAP 5-10cmH₂O to the dependent lung.
 - e) Suctioning of secretions may be required
- 6- Post-operative complications of thoracotomy
- a) Hypoxemia.
 - b) Atrial fibrillation.
 - c) Torsion of remaining lobe.
 - d) Cardiovascular collapse.
 - e) All the above
- 7- Fiber-optic bronchoscopy (**all true except one**)
- a) Commonly perfumed under general anesthesia
 - b) Use of opioids with caution to avoid apnea
 - c) Midazolam good sedative drug.
 - d) Flexible fiber optic scope may be passed via endotracheal tube under GA.
 - e) Not need muscle relaxants.

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GOOD LUCK

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