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جامعة المستقبل
كلية التقنيات الطبية
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Title: Anaesthesia for Thoracic Surgery

Anaesthesia for Thoracic Surgery

Thoracic anesthesia 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 anesthesia:

- 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 anesthesia in the lateral position with the chest opened and one lung collapsed.
- Postoperative care of a patient after lung tissue resection

One-lung anesthesia:

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

Principal indications for one-lung anesthesia:

1) Isolation of the lungs.

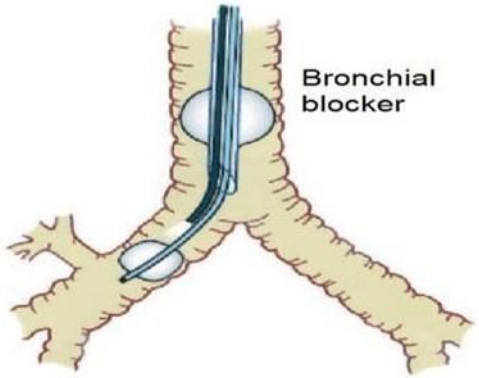
2) Ventilation of one lung alone.

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.

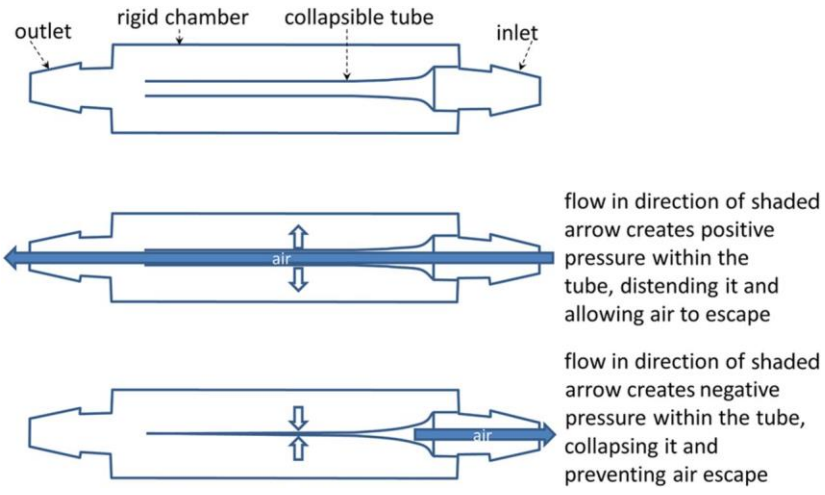
• CPAP 5–10 cmH2O with 100% oxygen to the non-ventilated lung to facilitate oxygen uptake in this lung whilst not adversely affecting thesurgical conditions.

• 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

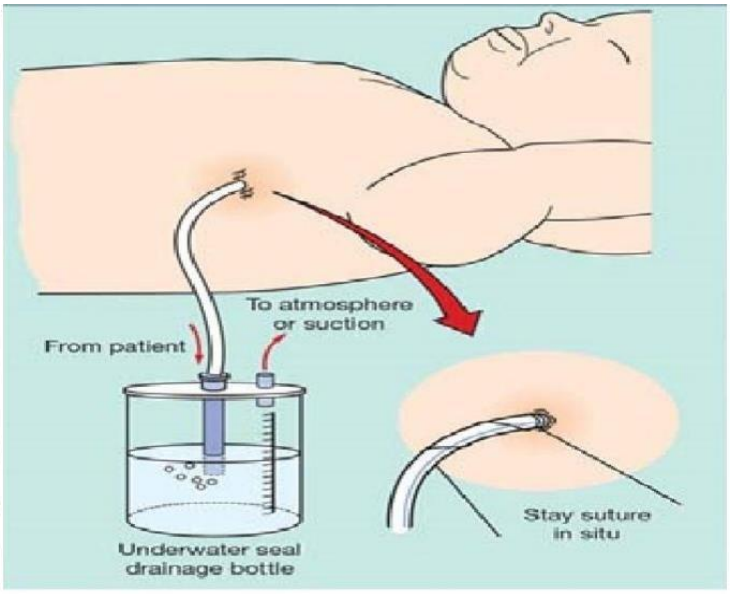
Thoracotomy:

- 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 rapiddrug 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 andbe 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 ventilatoryinflation 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 thelungs 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 bysplitting.
- 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:

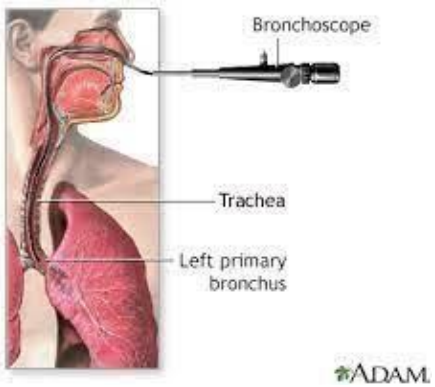
1) To maintain oxygenation and carbon dioxide removal during the procedure.

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 isperformed under topical anesthesia andsedation 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 atracurioum.
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 <u>true</u>)**

a) Check the position of tube with vediolaryngoscopy.
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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