

Lec:4

Anesthesia effects on the respiratory system..

Osama Aziz & Muaid abdallah

B.M.TCH ANAESTHESIA

2024- 2023

College of Health and Medical
Techniques Anesthesia Techniques
Department Al_Mustaqbal University
Babylon, Iraq



The primary functions of the respiratory system are:

- * **Ventilation**; the movement of air into and out of the lungs.
- * **Gas exchange**; is the transfer of oxygen into the blood and carbon dioxide removal.

General anesthesia..

Has several effects on both of these key functions.

***The passage of gas into the lungs may be impaired by obstruction of the airway; the distribution of gas within the lungs may change and the transfer of oxygen**

Anesthetic Gases: into the blood may be impaired. Most of these adverse effects can be seen during anesthesia and in many patients, these extend into the postoperative period.

HOW ANAESTHESIA AFFECTS VENTILATION..

1. Airway obstruction

G.A, with or without the use of neuromuscular blocking drugs, results in the **loss of airway patency** due to the **relaxation of the pharyngeal muscles and posterior displacement of the tongue**. **The ability to manage secretions is lost, and saliva and mucous can obstruct the oropharynx**. The loss of the cough reflex allows secretions with gastric contents onto the vocal cords, causing **laryngospasm**, or to enter the trachea and lungs **causing bronchospasm**. These effects result in airway obstruction and **prevent the passage of gases into and out of the lungs** resulting in hypoxia and hypercapnia.

2. Reduced ventilation

All anesthetic drugs (except ketamine, ether, and nitrous oxide) cause a dose-dependent reduction in minute ventilation → → reduced the respiratory rate (e.g., opioids) → → reduction in the tidal volume (e.g., volatile anesthetics), or both (e.g., propofol). The ventilatory response to carbon dioxide is reduced by all anesthetic drugs, as a result, anesthetized patients become hypercapnic. .

HOW ANAESTHESIA AFFECTS GAS EXCHANGE..

Oxygen is the gas of primary importance, but the exchange of anesthetic gases will also be influenced.

Oxygenation is dependent upon:

1. The inspired oxygen content.
2. The presence of a patent airway.
3. Adequate alveolar ventilation.
4. Appropriate matching between ventilation and perfusion in the lung .
5. The transfer of oxygen across the alveolar and endothelial membranes.

Anesthesia affects gas exchange by:

1. Changes in functional residual capacity (FRC).
2. Changes in ventilation and perfusion.
3. Hypoxic pulmonary vasoconstriction (HPV).

HOW MECHANICAL VENTILATION CAN DAMAGE LUNG TISSUE..

a. Acute Respiratory Distress Syndrome (ARDS)..

Mechanical ventilation can directly damage lung parenchyma. Large tidal volumes (>12ml/kg) cause alveoli shearing stress, releasing inflammatory substances. These inflammatory mediators result **in edema** in the interstitial wall of the alveoli, which reduces lung compliance and gas transfer causing hypoxia. This is termed acute respiratory distress syndrome (ARDS) and results in prolonged stays in the intensive care unit (ICU) with a mortality of up to 40%.

b. Pneumothorax (Barotrauma).

Pneumothorax occurs when air is trapped between the **two pleural layers of the lungs** with a loss of negative pressure that causes **the lung to collapse**. High inspiratory pressures or large tidal volumes can cause pneumothorax, which is more likely in the stiff, noncompliant lungs caused by ARDS or in the non-elastic lungs of chronic obstructive airway disease. The pressure required to keep one group of alveoli open may rupture another group causing a pneumothorax.

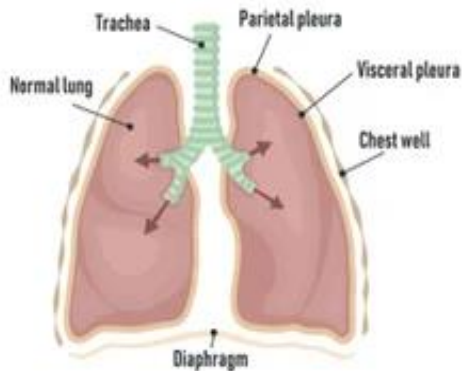
ARDS

ACUTE RESPIRATORY DISTRESS SYNDROME

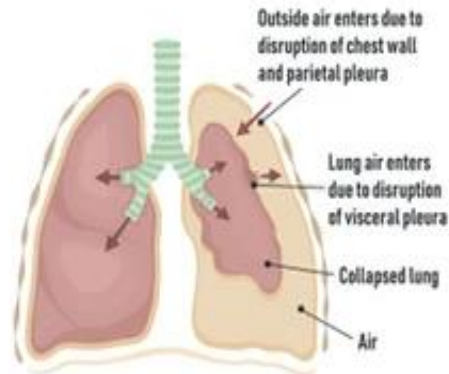


shutterstock.com · 2095162804

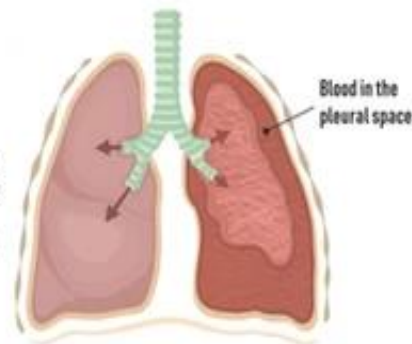
HEALTHY LUNGS



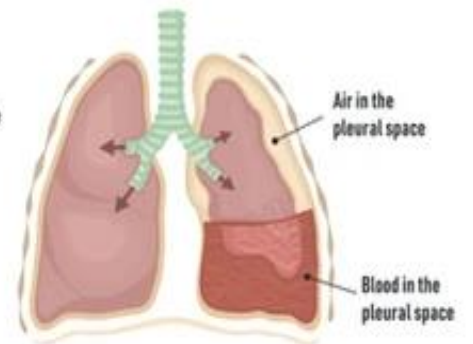
PNEUMOTHORAX



HEMOTHORAX



HEMOPNEUMOTHORAX



shutterstock.com · 1405120004

Inhalational agents effect..

Inhalational agents	Positive effect	Negative effects
Isoflurane	Bronchodilator	Reduced MV Reduced response to hypoxia & hypercarbia Pungent – causes coughing Increased secretions
Sevoflurane	MV stable Bronchodilator Non-irritant	Hypercarbia Depressed response to CO2
Halothane	Bronchodilator Non-irritant Reduced bronchial secretions	Reduced MV, Blunted response to hypoxia and hypercarbia

..

Iv Induction agents

Iv Induction agents	Positive effects	Negative effects
Thiopentone		Dose dependent respiratory depression Increased bronchial smooth muscle tone with increased bronchospasm & laryngospasm
Propofol .	Laryngeal relaxation – ease of LMA insertion Bronchodilator	Respiratory depression Reduced response to hypoxia & hypercarbia
Ketamine	Preserved laryngeal reflexes Maintain patent airway Less respiratory depression Reduction in bronchial smooth muscle tone	Increased saliva and mucous production
Opiates	Anti-tussive	Respiratory depression Chest wall rigidity Bronchospasm

MANAGING THE EFFECTS OF ANAESTHESIA ON THE RESPIRATORY SYSTEM..

1. Pre-operatively.
2. Intra-operatively.
3. Post-operatively.

Pre-operatively:

- a. Positioning patients at a 45° angle before induction helps to reduce the fall in the FRC.
- b. Pre-oxygenation to maximize the oxygen content of the FRC can significantly increase the time from apnea to hypoxia.
- c. Antimuscarinic drugs (atropine, glycopyrrolate) given before induction reduce the quantity of saliva in the airway

Intra-operatively;

- a. Mechanical ventilation, in particular for obese patients, reduces airway collapse and atelectasis (PEEP) helps to maintain alveolar patency and prevent hypoxia. If the patient is breathing spontaneously, continuous positive airway pressure (CPAP) will have the same effect.
- b. PEEP and recruitment maneuvers can be used to open collapsed portions of the lung. Recruitment is achieved by prolonged periods of high PEEP, Lung protective strategies that are used to treat ARDS can also be used safely for obese patients, bariatric and laparoscopic surgery, and the elderly during anesthesia to reduce atelectasis and increase oxygenation. This effect is not continued after extubating.

Post-operatively;

Oxygen can be continued into the postoperative period in patients at risk of hypoxia. Head-up tilt increases the FRC and helps prevent atelectasis. In obese patients, extubation onto a CPAP mask may help prevent airway collapse and atelectasis and maintain arterial oxygenation. Similarly, extubating ICU patients onto bi-level noninvasive ventilation has been shown to reduce the rate of re-intubation. Make sure the patient has good postoperative analgesia. Patients should be able to take deep breaths and cough.

