

Propofol (diprivan): It is an intravenous anesthetic agents used for induction and maintenance of general anesthesia which produces rapid induction and rapid recovery, it is supplied as an emulsion white in color in concentration of 10 mg/ml.

Properties:

- It is used for induction of anesthesia in a dose of 2-3mg/kg
- The anesthesia will appear within 40 sec.
- Anesthesia will last in 10-12 min.
- It will not increase laryngeal reflexes.
- It has no analgesic effect.
- Propofol may cause hypotension.
- Usually there is a pain along the vein of injection.
- Nausea and vomiting are rare.
- Should not be used in patient have sensitivity to propofol or a patients allergic to eggs
- It is metabolized in the liver.
- It is a good anticonvulsant drug.

Ketamine: has an unusual anesthetic properties, in that it produces unconsciousness with profound analgesia, it can be given intravenous and intramuscular.

Properties:

- It has the advantage that cardiovascular system is relatively stable, there may be increase in heart rate.

- Oropharyngeal reflexes are maintained as well as a good airway passages.
- Ketamine has a disadvantage of unpleasant dreams by patients during recovery period, for this reason recovery should be adopted in quiet room with minimal interference of the patients and even some times we need to give tranquilizer (diazepam).
- Ketamine has a useful role for repeated anesthetic procedures e,g change of burns dressing.
- It is very useful in casualty, and in shocked patient.
- Intramuscular dose is 10 mg/kg this will give 12-25 min of surgical anesthesia.
- Intravenous dose is 1-3 mg/kg this will produce up to 10 min of surgical anesthesia. This dose should be given slowly over 1 min to reduce the incidence of respiratory depression. Repeated dose should be half of the previous when the patient shows the following signs: a) movement in response to stimulation, b) nystagmus , c) phonation.
- It increases intraocular and intracranial pressure.
- It is contraindicated in patient with hypertension, coronary disease (angina), epilepsy.

Total intravenous anesthesia (TIVA) :

Total intravenous anesthesia (TIVA) is a technique of general anesthesia which uses a combination of agents given exclusively by the intravenous route without the use of inhalation agents (Gas Anesthesia)¹.

use of TIVA:

1- in some patient where the delivery of inhaled anesthetics is impossible or dangerous .

2- where traditional anesthetic delivery systems may be unavailable or impractical.

Advantages of TIVA :

Compared generally to traditional volatile anesthetic techniques, TIVA offers several potential advantages. These include:

- 1- reduced incidence of post-operative nausea and vomiting,
- 2- reduced atmospheric pollution,
- 3- more predictable and rapid recovery,
- 4- greater hemodynamic stability, preservation of hypoxic pulmonary vasoconstriction,
- 5-reduction in the intracerebral pressure and reduced risk of organ toxicity.

Method of administration of TIVA :

TIVA can be conducted either with a single drug or with a combination of drugs. The most commonly groups of drugs include hypnotics and short-acting opioid.

Propofol is the best hypnotic agent suitable for the induction and maintenance of anesthesia.

Propofol-based TIVA techniques offer many advantages including:

- 1- rapid recovery of consciousness and psychomotor function,
- 2- enhanced recovery speed,
- 3- anti-emetic effect and a lower incidence of post-operative nausea and vomiting. The Propofol can be given with opioids, muscle relaxants, NSAIDs etc. depending on the patient case or the type of procedure to be performed. When using TIVA via TCI, short-acting opioids such as Remifentanyl are preferred. Recently, it was seen that TIVA via a TCI

combining Remifentanyl & Propofol effectively controlled intra-operative responses while allowing for rapid emergence from anesthesia in elective inpatient surgery⁷.

As TIVA is conducted exclusively via an intravenous infusion, the choice must be made from either a peripheral or a central venous access device. This selection depends on the patient condition, or the number and types of drugs being infused. For short term procedures, venous access is not considered necessary,

an Intravenous Catheter could be used for patients where it is expected that post-procedure infusions would be required (for e. g. in critically ill patients)

For neonatal or pediatric patients, a scalp vein set could also be used.

TIVA can also be performed via TCI (Target Controlled Infusion, refers to a system by which a drug is given intravenously with a pump controlled by a computer)

When using TIVA via TCI, short-acting opioids such as Remifentanyl are preferred. Recently, it was seen that TIVA via a TCI combining Remifentanyl & Propofol effectively controlled intra-operative responses while allowing for rapid emergence from anesthesia in elective inpatient surgery.

Neuroleptanalgesia

A form of analgesia achieved by the combined administration of a neuroleptic agent such as droperidol and an analgesic such as fentanyl. Anxiety, motor activity, and sensitivity to painful stimuli are reduced; the person is quiet and indifferent to surroundings and is able to respond to

commands. If nitrous oxide with oxygen is also administered, neuroleptanalgesia can be converted to neuroleptanesthesia

a semiconscious nonreactive state induced by certain drug combinations, as fentanyl with droperidol. We use a combination of 2.5 mg droperidol and 50 µg (micrograms) of fentanyl in a ratio of 50:1. This combination is characterized by immobility, analgesia, and variable amnesia



تفدير عملي

مخاطرة 1

MR_TOFE



MR_TOFE



Lec 1

Anesthesia - an introduction

What is anaesthesia?

Conscious Sedation - sedation and anxiolysis with retention of consciousness at all times.

Unconscious ('deep') Sedation - sedation sufficient to induce sleep from which arousal to consciousness is easy

Neuroleptic Analgesia - analgesia, disinterest and psychomotor retardation typically induced by a combination of a major tranquilizer (e.g. droperidol) and a narcotic analgesic. Patient may appear calm but be anxious.

General Anesthesia -, reversible loss of consciousness and usually drug induced.

Local anesthesia - rendering a part of the body numb.

Topical anesthesia - anesthesia of skin or mucous membranes by topical application of local anesthetics.

Infiltration anesthesia - anesthesia of tissues by direct injection of local anesthetic where it is needed - i.e. for excision of skin lesions.

Regional anesthesia ('conduction blocks' or 'blocks') - anesthesia of a part of the body by injecting local anesthetic into the nerves that go there. Simple blocks include finger blocks, ankle blocks, etc.; more complex blocks include plexus blocks, and 'major regionals' mean epidural or spinal anesthesia.

What do Anesthetists do?

Patients are usually seen by an anesthetist (or a trainee anesthetist) preoperatively in a pre-admission clinic. This person may or may not actually do the case. The patient's health, pre-operative tests, and any specific concerns are reviewed in the context of the planned procedure. A discussion of the risks and benefits of the various approaches or techniques required should result in an agreed plan. Selecting the safest technique in the circumstances is important, and the details of that technique, including the management of post-operative pain, should be explained.

Common risks such as : (pain, nausea, sore throat, muscle aches, etc.) are rare but

Management of the anesthetic is the responsibility of the anesthetist, not the surgeon.

The anesthetist stays with the patient from the time anesthesia starts until care is passed on to recovery staff, however their responsibility legally covers to the entire period from premedication until full recovery from the anesthetic.

Once the patient is asleep, the Anesthetist continuously monitors the adequacy of breathing and the circulation; additional monitoring is used in special circumstances

Anesthetists adjust the doses of the anesthesia-inducing drugs individually on a patient by patient basis. Subconscious hearing is preserved during most anesthetics. Fortunately memory is strongly impaired with small doses of anesthetics, so most people don't remember much from just before they go to sleep until sometime after they actually wake up

Anesthesia practice is a combination of technical skill, experience, and science;

At the end of the operation the anesthetic drugs are turned off or reversed, and once the patient is awake they will be transported to recovery, or ICU. The anesthetist will wait awhile to make sure the patient is OK. We arrange appropriate post-operative analgesia.

Anesthetists run most acute pain services and often have substantial input to ICU and the recovery room ..

Anesthesia alone in healthy patients has a mortality (due to unexpected drug reactions, haste, device malfunction, etc.) of 1:250,000.. Overall the risk of death due to anesthesia in all patients undergoing surgery is about 1:30,000..

History of anesthesia :

The specialty of anesthesia began in the mid-nineteenth century and became firmly established in the following century.

Ancient civilization had used opium poppy. Coca leaves, mandrake root, alcohol, and even phlebotomy (to the point of unconsciousness) to allow surgeon to operate.

Ancient Egyptians used the combination of opium poppy (containing morphine) and hyoscyamus (containing scopolamine) for this purpose.

Regional anesthesia in ancient time consist of compression of nerve trunks (nerve ischemia) or the application of cold (cryoanalgesia) . the Incas may have practiced local anesthesia as their surgeon chewed coca leaves and applied them to the operative field.

Inhalation anesthesia : Because the hypodermic needle was not invented until 1955,the first general anesthetic was given by inhalation. Diethyl ether (known at the time as sulfuric ether,(because it was produced by a simple chemical reaction between alcohol and sulfuric acid) was used as anesthetic for human being On October 16, 1846,by Boston dentist William

T.G. Morton . used sulfuric ether to anesthetize a man who needed surgery to remove a vascular tumor from his neck, Morton started buying ether from a local chemist Satisfied with its safety and reliability, he began using ether on his dental patients, but quickly perceived that ether was good for far more than pulling teeth

First Surgical Procedure Using Anesthesia



FIRST AMERICAN

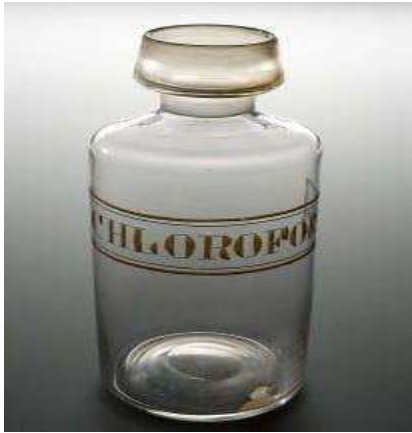
PROCEDURE USING ANESTHESIA: Illustration of dentist William T.G. Morton & surgeon John Warren giving anesthesia to patient Glenn Abbott at Boston's Massachusetts General Hospital on October 16, 1846.



WILLIAM T.G. MORTON: Boston dentist

In Scotland in 1847, obstetrician Professor James Y. Simpson starts giving women chloroform to ease the pain of childbirth "Chloroform quickly becomes a popular anesthetic for surgery and dental procedures as well

, Dr. Snow popularizes obstetric anesthesia by chloroforming Queen Victoria for the birth of Prince Leopold (1853) and Princess Beatrice.



chloroform

Ether and Chloroform were the first drugs to make inhalational anaesthesia possible. Ether was used first, but Chloroform was easier to administer. Commenced in 1847, Simpson, for obstetrics; but its use ended in 1900's due to cardiac irritability and hepatic damage (obligate hepatotoxin via phosgene). Ether then regained popularity. They were usually given by open drop onto wire frames, but machines not unlike those in use now were made by Boyle in the 1920's.

Halothane, the first potent volatile agent was first use in 1956; Isoflurane in the 1980's.

Nitrous Oxide was first 'abused' by travelling entertainers; then in 1890's successfully used for dental extractions and anesthesia by "Dr. Edmund Andrews proposes using nitrous oxide mixed with oxygen as an anesthetic in the Chicago Medical Examiner."

The next major advance was the introduction of local anaesthesia - cocaine - in 1877. Then came local infiltration, nerve blocks and then spinal and epidural anaesthesia

Spinal anaesthesia became popular as an alternative to ether, but suffered in the late 1930's when several patients became paraplegic. Now spinal and epidural anaesthesia are much more common.

Early anaesthetics were given by assistants to the surgeon, and in the USA it was more common for a non-medical person to do so under the supervision of the surgeon . In England, doctors with a particular interest in anaesthesia became anesthetists and the specialist practice of anaesthetics is the result.

The next important innovation was the control of the airways with the use of tubes placed into the trachea. This permitted control of breathing and techniques introduced in the 1910s were perfected in the late 1920s and early 1930s.



HOLLOW HYPODERMIC SYRINGE:
barbiturates which enabled the patient to go off to sleep quickly, smoothly and pleasantly and therefore avoided any unpleasant inhalational agents.



THIOPENTAL: Became the first widely used intravenous anesthetic gas. Used primarily from late 1930s to 1950s.

1929: “The Anesthetists’ Dr. John S. Lundy, who will popularize use of the intravenous anesthetic thiopental (Pentothal)

Then in the 1940s and early 1950s, there came the introduction of muscle relaxants, firstly with curare (the South American Indian poison!) and then over subsequent decades a whole series of other agents.

In the mid-1950s came halothane, a revolutionary inhalational agent, which was much easier to use..

Anesthetists are now highly trained physicians who provide a whole range of care for patients - not just in the operating theatre. They are usually consulted in the preoperative period to optimize the patients’ condition and they usually run High Dependency and Intensive Care Units. They are involved in obstetric analgesia and anesthesia, emergency medicine in Accident and Emergency Departments, resuscitation, major accident care, acute and chronic pain management and patient transfers between hospitals.

Anesthesia is now very safe, with mortality of less than 1 in 250,000 directly related to anesthesia in most high income countries. Nevertheless, with today’s sophisticated monitoring systems and a greater understanding of bodily functions



تفدير عملي

محاظرة 2

MR_TOFE



MR_TOFE



Lec 2

Anatomy and physiology of the respiratory system

The respiratory system is a biological system, consisting of specific organs and structures used for gas exchange in human.

Organs of Respiratory System:

Nose and nasal cavity. • Pharynx • Larynx • Trachea • Two bronchi • Bronchioles
• Two Lungs

NOSE AND NASAL CAVITY

Main route of air entry .It consist of two cavities divided by a Septum . Anteriorly consist of hyaline cartilage. The roof is formed by ethmoid bone The floor is formed by roof of the mouth. The medial wall formed by the septum. The lateral wall formed by the maxilla.

Respiratory function of the nose :

- 1- Warming of the air :- Due to the high vascularity of the mucosa.
- 2- Filtering and cleaning:- This occurs due to hairs which trap larger particles.
- 3- Humidification: - As air travels over the moist mucosa,it becomes saturated with water vapour.

PHARYNX :

The pharynx is the part of the throat that is behind the mouth and nasal cavity and above the esophagus and the larynx. Length- 12-14cm (extends from the base of the skull to the level of 6th cervical vertebra.)

Position Superiorly-Base of the skull.

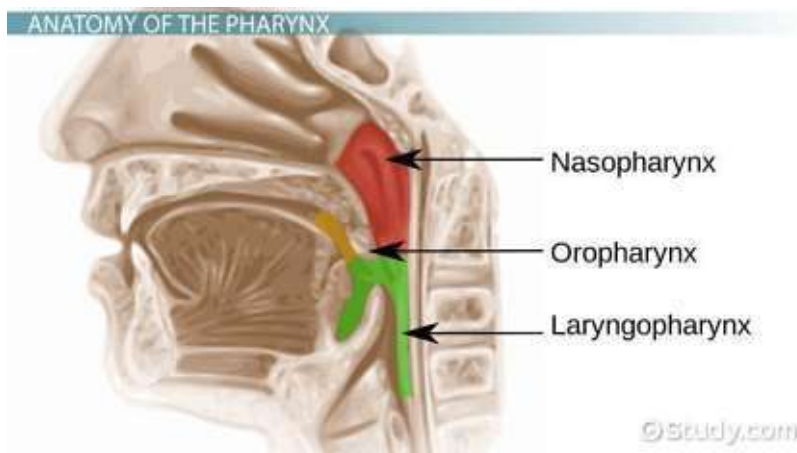
Inferiorly-Continuous with the oesophagus.

Anteriorly-Incomplete wall because of the nose, mouth and larynx opening.

Posteriorly-Areolar tissue & first 6 vertebra.

the pharynx is divided into three parts:

- 1- The nasopharynx The nasal part of the pharynx lies behind the nose. •
- 2- The oropharynx The oral part of the pharynx lies behind the mouth. •
- 3- The laryngopharynx The laryngeal part of the pharynx extends from the oropharynx.



Functions :

- 1- Passage way for air and food.
 - 2- Warming and humidifying.
 - 3-Taste. There are olfactory nerve endings.
 - 4- Hearing. The auditory tube, extending from the nasopharynx to each middle ear.
 - 5- Protection. The lymphatic tissue of the pharyngeal tonsils produces antibodies. •
- Speech. Act as a resonating chamber for sound ascending from the larynx.

At the top of the nasopharynx are the pharyngeal tonsils, also called an adenoid,(is an aggregate of lymphoid tissue). The function of the pharyngeal tonsil is not well understood, but it contains a rich supply of lymphocytes and is covered with ciliated epithelium that traps and destroys invading pathogens that enter during inhalation. The pharyngeal tonsils are large in children, but tend to regress with age and may even disappear.

The uvula is a small, teardrop-shaped structure located at the apex of the soft palate. Both the uvula and soft palate move during swallowing, swinging upward to close off the nasopharynx to prevent ingested materials from entering the nasal cavity. In addition, auditory (Eustachian) tubes that connect to each middle ear cavity open into the nasopharynx. This connection is why colds often lead to ear infections.

LARYNX :

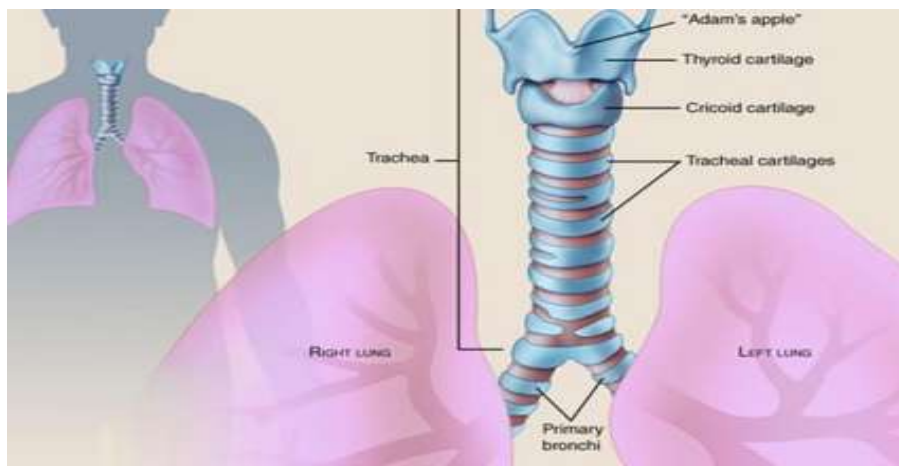
The larynx or voice box extends from the root of the tongue. • It lies in front of the laryngopharynx at the level of 3rd , 4th ,5th and 6th cervical vertebra. • Until the puberty there is little difference in the size of the larynx between the sexes. • It grows larger in the male.

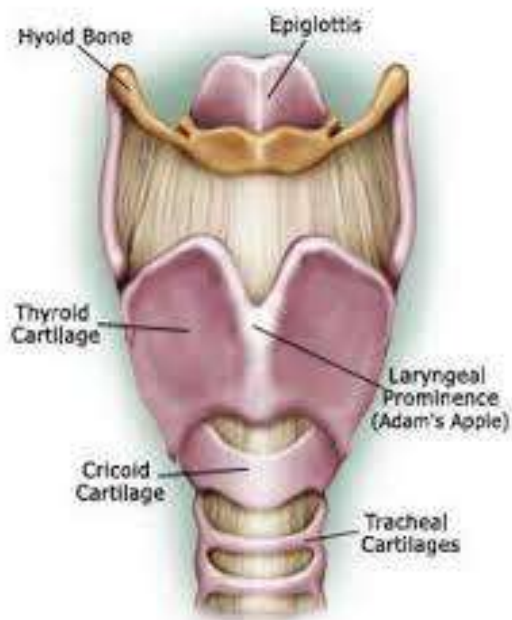
The structure of the larynx is formed by several pieces of cartilage. Three large cartilage pieces

1- thyroid cartilage (anterior),

2-epiglottis (superior),

3-cricoid c The thick **cricoid cartilage** forms a ring, with a wide posterior region and a thinner anterior region.





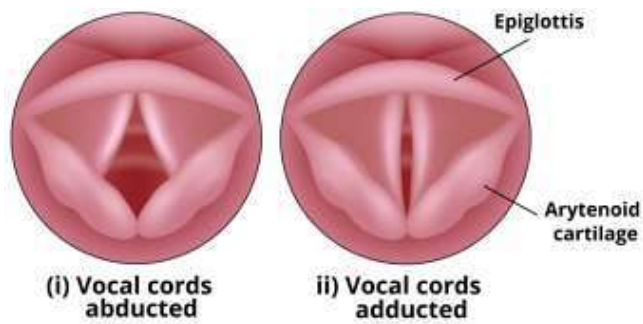
The larynx extends from the laryngopharynx and the hyoid bone to the trachea.

The epiglottis, attached to the thyroid cartilage, is a very flexible piece of elastic cartilage that covers the opening of the trachea

The **glottis** is composed of

1- A **vestibular fold**, or false vocal cord, is one of a pair of folded sections of mucous membrane.

2- A **true vocal cord** : white, membranous folds attached by muscle to the thyroid and arytenoid cartilages of the larynx on their outer edges. The size of the true vocal cords differs between individuals, producing voices with different pitch ranges. Folds in males tend to be larger than those in females, which create a deeper voice.



FUNCTIONS :

- 1- Production of sound • Speech
- 2- Protection of the lower respiratory tract : During swallowing the larynx moves upwards and hinged epiglottis closes over the larynx.
- 3- Passageway for air
- 4- Humidifying • Filtering • Warming



تفدير عملي

محاظرة 3

MR_TOFE



MR_TOFE



Tracheobronchial tree :

The trachea begins at the lower border of the cricoid cartilage, extends to the carina.

It has average length of 10-13 cm.

It is composed of C-shaped cartilaginous rings, (16 to 20), which form the anterior and lateral wall of the trachea and are connected posteriorly by the membranous wall of the trachea .

The cricoid cartilage is the narrowest part of the trachea, with an average diameter of 17mm in man and 13 mm in women .

The trachea bifurcates in to right and left main stem bronchi at the level of the sternal angel

The right bronchus lies in a more linear arrangement with the trachea while the left bronchus lies in a more angular orientation with the trachea .

The right main bronchus continue as the bronchus intermedius after the take- off the right upper lobe bronchus.

The left main bronchus is longer than the right main bronchus .the left main bronchus divides into left upper lobe bronchus and the left lower lobe bronchus .

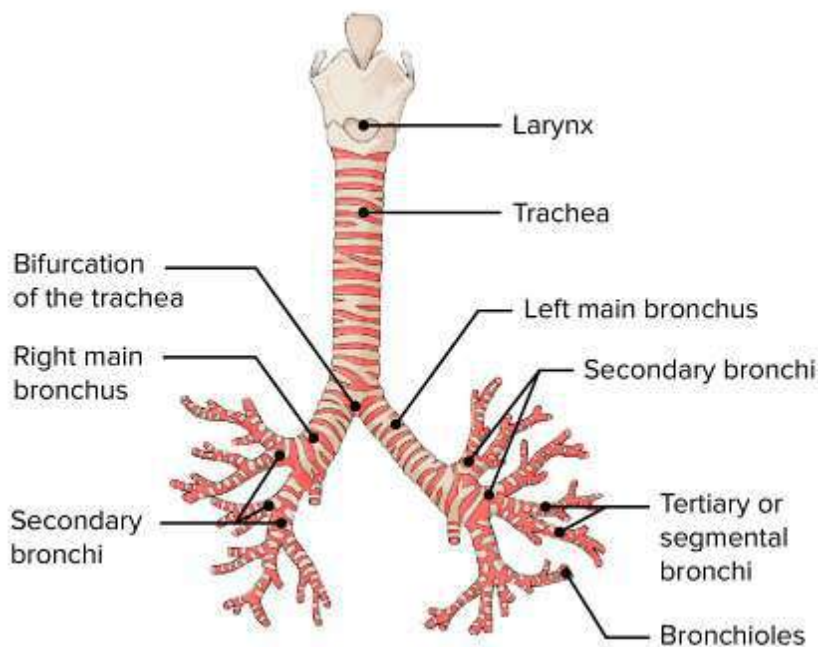
Humidification and filtering of inspired air are function of the upper airway (nose, mouth, and pharynx).

The tracheobronchial tree serves to conduct gas flow to and from the alveoli . each bronchus divided into two smaller branches , starting from the trachea and ending in the alveolar sacs, is estimated to involve 23 divisions.

A **bronchiole** branches from the tertiary bronchi. Bronchioles, which are about 1 mm in diameter, further branch until they become the tiny terminal bronchioles, which lead to the structures of gas exchange.

Lungs :

The lungs are paired, cone-shaped organs .Their role is to take oxygen into the body, to help us get rid of carbon dioxide,. We have two lungs, a left lung and a right lung. These are divided up into ‘lobes’, by ‘fissures’. The right lung has three lobes but the left lung has only two, The lungs can also be divided up into even smaller portions, called ‘bronchopulmonary segments’ .



Alveoli :Each alveoli is in close contact with a network of pulmonary capillaries . gas exchange occurs primarily on the thin side of the alveolocapillary membrane

Pleura : The pleura consists of a closed sac of serous membrane, one for each lung which contains a small amount of serous fluid. • The lung is invaginated or pushed into this sac. • It forms two layers: (i)The visceral pleura (ii)The parietal pleura •

1- The visceral pleura :This is adherent to the lung, covering each lobe & passing into the fissures that separate them. •

2- The parietal pleura: This is adherent to the inside of the chest wall & the thoracic surface of the diaphragm.

The pleural cavity: The two layers of pleura are separated by a thin film of serous fluid which allows them to glide over each other. • Preventing friction between them during breathing. • The serous fluid is secreted by the epithelial cells of the membrane.

RESPIRATION: The term respiration means the exchange of gases between body cells and the environment.

Breathing or pulmonary ventilation: This is movement of air into and out of the lungs. • • Breathing supplies oxygen to the alveoli, and eliminates carbon dioxide.

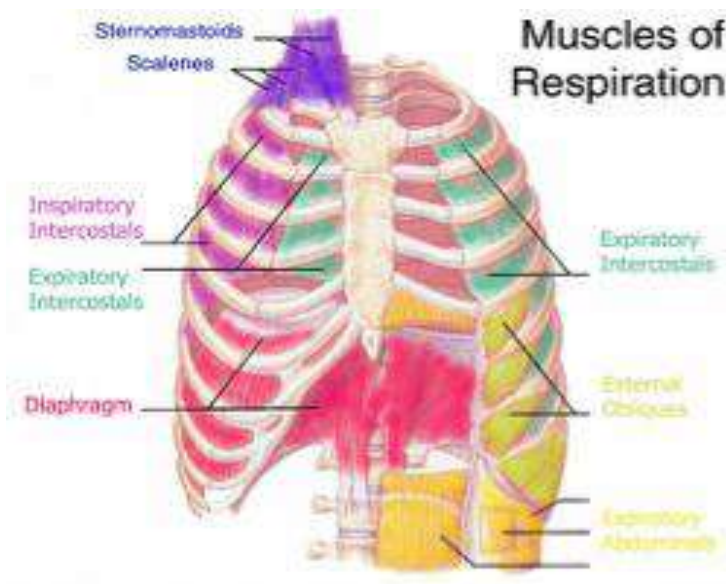
Exchange of gases: This takes place:

1- In the lungs: external respiration.

2- In the tissues: internal respiration.

Muscles Of Breathing:

Expansion of the chest during inspiration occurs as a result of muscular activity, partly voluntary and partly involuntary. • The main muscles used in normal quiet breathing are the INTERCOSTAL MUSCLES and the DIAPHRAGM. • During difficult or deep breathing they are assisted by muscles of the neck, shoulders and abdomen.



Intercostal Muscles:

There are 11 pairs of intercostal muscles that occupy the spaces between the 12 pairs of ribs. • They are arranged in two layers, the external and internal intercostal muscles • The first rib is fixed. • Therefore, when the intercostal muscles contract they pull all the other ribs towards the first rib. Because of the shape and sizes of the ribs they move outwards when pulled upwards, enlarging the thoracic cavity.

Diaphragm:

The diaphragm is a dome-shaped muscular structure separating the thoracic and abdominal cavities. • It forms the floor of the thoracic cavity and the roof of the

abdominal cavity and consists of a central tendon from which muscle fibers radiate to be attached to the lower ribs and sternum and to the vertebral column, When the muscle of the diaphragm is relaxed, the central tendon is pulled downwards to the level of the T-9, enlarging the thoracic cavity in length. • This decreases pressure in the thoracic cavity and increases it in the abdominal and pelvic cavities.

The intercostal muscles and the diaphragm contract simultaneously, enlarging the thoracic cavity in all directions.

Cycle of Breathing:

The average respiratory rate is 12 to 15 breaths/minute. • Each breath consists of three phases: • (i) Inspiration • (ii) Expiration • (iii) Pause.

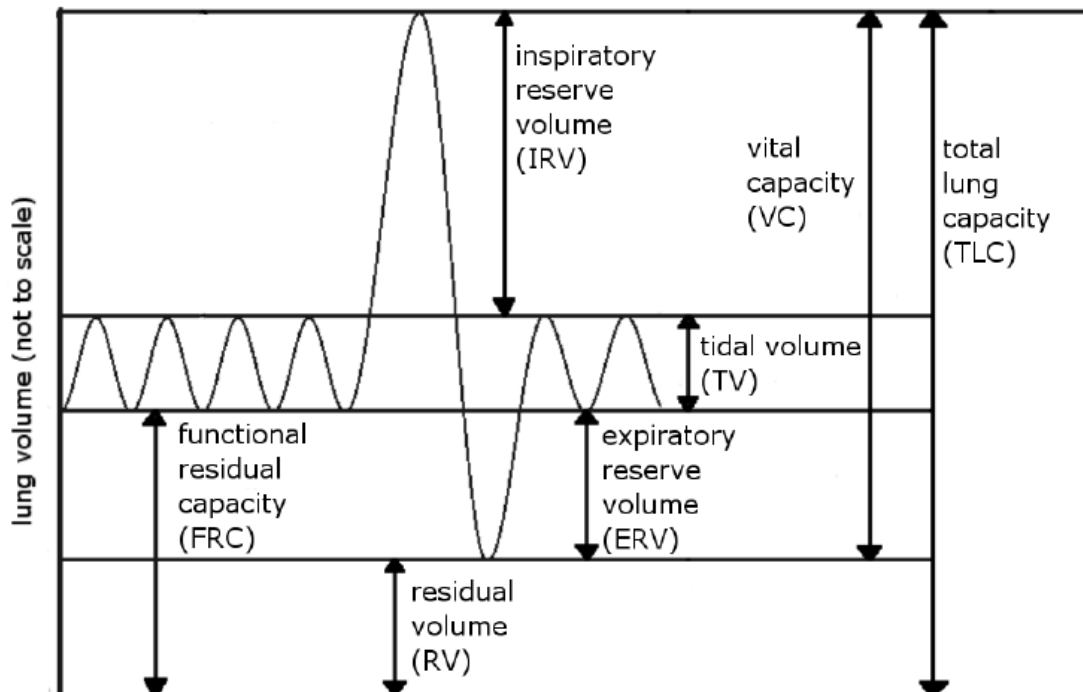
1- Inspiration • When the capacity of the thoracic cavity is increased by simultaneous contraction of the intercostal muscles and the diaphragm. • The parietal pleura move with the walls of the thorax & the diaphragm. • This reduces the pressure in the pleural cavity to a level considerably lower than atmospheric pressure. • The visceral pleura follows the parietal pleura, pulling the lungs with it. This expands the lungs and the pressure within the alveoli and in the air passages, drawing air into the lungs in attempt to equalize the atmospheric and alveolar air pressure.

The process of inspiration is ACTIVE, as it needs energy for muscle contraction. Inspiration lasts about 2 seconds.

2- Expiration: Relaxation of the intercostal muscles and the diaphragm results in downward and inward movement of the rib cage and elastic recoil of the lungs. As this occurs, pressure inside the lungs exceeds that in the atmosphere and so air is expelled from respiratory tract. • The still contain some air, are prevented from

collapse by the intact pleura. • This process is **PASSIVE** as it does not require energy.

Lung Volumes and Capacities



Respiratory cycles : 15/minute

Tidal volume (TV): this is the amount of air passing into and out of the lungs during each cycle of breathing. • About 500ml is tidal volume.

Exchange Of Gases :

Inhaled oxygen enters the lungs and reaches the alveoli. The layers of cells lining the alveoli and the surrounding capillaries are each only one cell thick and are in very close contact with each other. • Oxygen passes quickly through air-blood barrier into the blood in the capillaries. • Similarly, carbon dioxide passes from the blood into the alveoli and is then exhaled.

Diffusion of oxygen & carbon dioxide depends on pressure differences. •

Diffusion of Gases

1- External respiration :

External respiration refers to gas exchange across the respiratory membrane in the lungs. • Each alveolar wall is one cell thick and surrounded by a network of tiny capillaries. • Carbon dioxide diffuses from venous blood down its concentration gradient into the alveoli. • By the same process, oxygen diffuses from the alveoli into the blood.

2- Internal respiration :

Internal respiration refers to gas exchange across the membrane in the metabolizing tissues, like your skeletal muscles, for example. •

Blood arriving at the tissues has been cleansed of its CO₂ & saturated with O₂ during its passage through the lungs, therefore has a higher O₂ & lower CO₂ than the tissues. • This concentration gradients between capillary blood and the tissues lead to gas exchange. •

O₂ diffuses from the bloodstream through the capillary wall into the tissues. • CO₂ diffuses from the cells into the extracellular fluid, then into the bloodstream towards the venous

Transport Of Gases In The Bloodstream:

Transport of blood oxygen & carbon dioxide is essential for internal respiration to occur.

Oxygen • Oxygen is carried in the blood in as combination with hemoglobin as oxyhemoglobin.

Carbon Dioxide • It is excreted by the lungs & transported by combined with hemoglobin as carbaminohaemoglobin.

Control Of Respiration: The respiratory center: Medulla oblongata



تفدير عملي

محافظة 4

MR_TOFE



MR_TOFE



General Pharmacology

Pharmacology is consist of two Greek words “Pharma” which means Drug and “Logos” which means Knowledge

Classification of Pharmacology

1- Pharmacodynamics: What the drug does to the body. It shows pharmacological actions that is the study of the therapeutic and side effects of drug.

2- Pharmacokinetics: What the body does to the drug. It includes the study of ADME (Absorption, Distribution, Metabolism and Excretion)

Other terms

Drug : any chemical that can affect living processes

Pharmacotherapeutics:- It is branch of medicine concerned with the cure of diseases or relief of symptoms and includes drug treatment.

Toxicology:- science of poisons. Poisons are substances that cause harmful, dangerous or shows fatal symptoms in animals and human beings; many drugs in large dose acts as poisons Like, aspirin in less dose acts as anticoagulant useful for heart patients and in high dose causes the ulceration

Chemotherapy:- it is concerned with the effect of drug upon microorganisms and parasites,

Sites of Action: The organ or cellular target of drug action.

Receptors ; Specialized target macromolecules present on the cell surface or intracellularly. Drugs bind with receptors & initiate events leading to alterations in biochemical activity of a cell, and consequently, the function of an organ.

Source of Drugs :

Drugs are obtained from various sources.-

1- Drugs may be synthesized within the body (hormones)

2- Natural drugs

A. Plants E.g. . Digoxin from *Digitalis purpurea* . Atropine from *Atropa belladonna* .

B. Animals E.g.. Insulin from pork/beef . Cod liver oil from Cod fish liver.

C. Minerals: Iron, Iodine, Potassium salts.

D. Micro – organisms: Penicillin from *penicillium notatum*, Chloramphenicol from *Streptomyces venezuelae*

first-pass effect:

is the term used for the hepatic metabolism of a pharmacological agent when it is absorbed from the gut and delivered to the liver via the portal circulation. The greater the first-pass effect, the less the agent will reach the systemic circulation when the agent is administered orally.

Routes of Drug administration :

Is the path by which a drug, fluid, poison or other substance is brought into contact with the body

1- Oral Route :

Advantages : Safe , Convenient , Economical , Usually good absorption , Can be self-administered

Disadvantages : Slow absorption slow action , Irritable and unpalatable drugs , Unco-operative & unconscious pts. , Some drugs destroyed , First-pass effect

2- Sublingual Route

Advantages : Quick termination , First-pass avoided , Drug absorption is quick , Can be self-administered

Disadvantages : Unpalatable & bitter drugs , Irritation of oral mucosa , Large quantities not given

3- Rectal Route :

Advantages : Used in children , Little or no first pass effect , Used in vomiting/unconscious , Higher concentrations rapidly achieved

Disadvantages : Inconvenient , Absorption is slow and erratic , Irritation or inflammation of rectal mucosa can occur

4- Vaginal Routes :

Drug may be administered locally in the vagina in the form of pessaries. E.g. Antifungal vaginal pessaries

5- Parenteral Route:

- A. Intradermal injection .
- B. Subcutaneous injection .
- C. Intramuscular injection
- D. Intravenous injection

Intravenous Route :

Advantages :

- 1. Absorption phase is bypassed (100% BA)
- 2. Precise, accurate and almost immediate onset of action.
- 3. Large quantities can be given, fairly pain free
- 4- IV is the most common parenteral route for drugs that are not absorbed orally.

Disadvantages :

- a. High concentration attained rapidly
- b. Risk of embolism

Intramuscular Route(IM)

Advantages : Absorption reasonably uniform , Rapid onset of action for drugs in aqueous solution. .slow release preparations ,First pass avoided , Gastric factors can be avoided

Disadvantages : Only up to 10ml drug given , Local pain and abscess , Infection ,Nerve damage

Subcutaneous route(SC):

- 1. Slow and constant absorption
- 2. Absorption is limited by blood flow
- 3. Concurrent administration of vasoconstrictor will slow absorption

6- Inhalation :

- 1. Aerosols (gaseous & volatile agents)-lungs
- 2. Rapid onset of action due to rapid access to circulation A. Large surface area B. Thin membranes separates alveoli from circulation C. High blood flow

Topical :

Mucosal membranes (eye drops, nasal drops, antiseptic, sunscreen, callous removal)

Pharmacokinetics :

(The life cycle of a Drug) ,Action of body on drug/ how body handles drugs]
Pharmacokinetics includes : ADME

1- Drug absorption •

Transfer of a drug from its site of administration to the bloodstream. • The rate and efficiency of absorption depend on the route of administration. – For IV delivery, absorption is complete; that is, the total dose of drug reaches the systemic circulation. – Drug delivery by other routes may result in only partial absorption and, thus, lower bioavailability

Bioavailability :

Fraction of administered drug that reaches the systemic circulation in a chemically unchanged form. – Amount of drug available in the circulation/site of action – It is expressed in percentage – It is 100% for drugs given IV. • For example, if 100 mg of a drug is administered orally and 70 mg of this drug are absorbed unchanged, the bioavailability is 0.7 or 70%. Factors

2- Drug distribution :

Reversible movement of drug from bloodstream to extracellular fluid and/or cells.

Factors affecting drug distribution

1. Plasma protein binding – Albumin
2. Tissue uptake of drugs/tissue binding -Adipose tissue -Bone-Liver
3. Barriers –capillary permeability , Blood brain barrier (BBB) , Placental blood barrier (PBB)
4. Rate of blood flow : Brain, Kidney (highly perfused) , Liver & Lung
5. Plasma concentration

3- Drug metabolism (biotransformation) :

Enzymatically mediated alteration in drug structure. ♣ Transforms lipophilic drugs into more polar readily excretable products. Liver is the major site for drug metabolism, but specific drugs may undergo biotransformation in other tissues, such as the kidney and the intestines. Note: Some agents are initially administered as inactive compounds (pro-drugs) and must be metabolized to their active forms
Inducers :

4- Drug excretion :

Removal of a drug from the body occurs via a number of routes.

The major routes of excretion include renal excretion, hepatobiliary excretion & pulmonary excretion.

The minor routes of excretion are saliva, sweat, tears, breast milk, & hair.

The rate of excretion influences the duration of action of drugs. If the drug is excreted slowly, the concentration of drug in the body is maintained and the effects of the drug will continue for longer period.

Pharmacodynamics:

Pharmacodynamics include:

Mechanism of actions of the drug. } How does a drug act in the body? Effects of the drug: both beneficial & harmful effects.

Mechanisms of drug action : It is of two types:

A- Receptor mediated mechanism } Receptors- targets of drug action. }

B- Non-receptor mechanisms by Simple physical or chemical reaction.

Dose response relationship

Dose: amount of a drug required to produce desired response in an individual.

Dosage: the amount, frequency and duration of therapy.

Potency: measure of how much a drug is required to elicit a given response. The lower the dose, the more potent is the drug.

Agonist and Antagonist

Agonists facilitate receptor response.

Antagonists inhibit receptor response

Potency : Is relative strength of response for a given dose.

Therapeutic index

Median Lethal Dose (LD50): dose which would be expected to kill one half of a study population.

Median Effective Dose (ED50): dose which produces a desired response in 50% of the test population.

Therapeutic Index gives a rough idea about the potential effectiveness and safety of the drug in humans

Side effect and toxicity :

Side effects often are predictable from knowledge of the pharmacology of a particular drug.

1- Allergic reactions: The number of serious allergic reactions to drugs involving antigen-antibody reactions

is low but when they occur the physician must have sufficient knowledge to manage these problems.

2- Blood dyscrasias: These are very serious and sometimes fatal complications of drug therapy. They include: agranulocytosis, aplastic anemia, hemolytic anemia, thrombocytopenia and defects in clotting factors.

3- Hepatotoxicity and nephrotoxicity: Because many chemicals and drugs are eliminated and metabolized by the liver and kidney, damage to these organs is seen commonly.

4- Teratogenic effects: The thalidomide tragedy dramatically emphasized that drugs may adversely influence fetal development.

5- Behavioral toxicity: This is a term used to describe suppression of normal anxiety, reduction in motivation, impairment of memory and learning, distortion of judgement, impairment of reflexes,

6- Drug dependence and drug abuse: The repeated administration of some chemicals may lead to drug dependence. Drugs likely to be abused and upon which drug dependence may develop are the various psychopharmacological agents such as opiates, barbiturates, amphetamines, nicotine and ethanol. Dependence on tobacco (nicotine) is also well known.

7- Carcinogenesis: Carcinogenesis is a delayed type of toxicity with a latency of many years.

8- Pharmacogenetic toxicities: Certain genetically-predisposed individuals have a markedly toxic reaction to certain otherwise safe drugs. Examples are prolonged apnea after succinylcholine, or malignant hyperthermia associated with anesthetics.



تفدير عملي

معاظرة 5

MR_TOFE



MR_TOFE



Anesthesia

The word anesthesia means no sensation and it can be defined as relief of pain during operation and postoperative day also to provide an optimal operative condition for both patient and surgeon so that to keep the patient alive.

General anesthesia is similar to a comatose state and different from sleep.

The situation of operations is:

- 1-Emergency operation: life-threatening condition requiring immediate action (e.g. ruptured aneurysm, penetrating trauma, and peritonitis).
- 2-Urgent operation: surgery required within few hrs. (e.g. intestinal obstruction and appendicitis)
- 3-Elective operation: (e.g. hernia and varicose vein)

General Anesthesia

General anesthesia is a medically induced coma (not sleep), characterized by reversible loss of consciousness and all sensations. General anesthetic drugs are given systematically and exert their action on the CNS.

The aim of general anesthesia is to induce:

- 1- Unconsciousness
- 2- Analgesia
- 3- Muscle relaxation
- 4- Amnesia
- 5- Inhibition of automatic reflexes.

Mechanism of action of general anesthesia

Many theories have been developed to explain how the anesthetic drug acts, but till now no single theory can explain their action. It is clear that the primary site of action is located in the brain. Some said that their action is induced by interaction with protein in the neural cell membrane. Other theory said that the anesthetic effect is exerted through some change in the lipid bilayer membrane.

Site of action of general anesthetic drugs :

General anesthetics are known to act at a number of sites within the central nervous system (CNS). These sites include:

- 1- Cerebral cortex: The brain's outer layer involved in memory, attention, perception among other functions
- 2- Thalamus: Its roles include relaying information from the senses to the cerebral cortex and regulating sleep, wakefulness, and consciousness.
- 3- Reticular activating system: Important in regulating sleep-wake cycles
- 4- Spinal cord: Passes information from the brain to the body and vice versa. It also controls reflexes and other motor patterns.

A number of different neurotransmitters and receptors are involved in the action of general anesthesia.

General anesthetic drugs act either by:

- 1- potentiate the action of the inhibitory neurotransmitters at the receptor site, GABA-amino-butyric-acid (GABA) and glycine. Or by

- 2- inhibiting the excitatory receptors,: N-Methyl-D-Aspartic Acid (NMDA) , 5-Hydroxytryptamine (5-HT) and Nicotinic Acetylcholine .

Stages of anesthesia (Guedel stages)

General anesthesia can be classified into 4 stages of increasing depth of CNS depression (according to the depth of anesthesia) beginning with loss of higher function and progressing to the lower area of the brain and spinal cord. Guedel stages only seen during ether anesthesia in un pre-medicated patient. These stages are:

- 1- stage 1 (stage of analgesia): start from the beginning of anesthesia until loss of consciousness. During this stage there is progressive loss of pain sensation but the patient remain conscious, feel dream like state. Reflexes and respiration are normal. No surgical procedure performed in this stage.
- 2- Stage 2 (stage of excitation or uninhibited reflexes): start from loss of consciousness to the beginning of regular respiration. The eye reflex disappear while the other reflexes remain intact and there is violent behavior (shout, struggle, breath holding) and the muscle tone increased and there may be vomiting and involuntary micturition. This is a bad stage and modern anesthesia try to reduce this stage by rapid induction of anesthesia and good pre-medication.
- 3- Stage 3 (surgical stage): start from the onset of regular respiration to the respiratory paralysis. In this stage the muscles relax, vomiting stops and breathing is depressed. Eye movements slow and then cease. The patient is ready to be operated on. This stage can also be divided into 4 planes according to the degree of intercostal paralysis (plane 1 to 4)

- 4- Stage 4(medullary paralysis): : Too much medication has been administered, leading to brain stem or medullary suppression. This results in respiratory and cardiovascular collapse. Death occur if the patient cannot be revived quickly . this stage should not be reached,

Anesthesia is characterized by three phases:

- 1- Induction phase: This is from the time of administration of anesthetic to the development of stage of surgical anesthesia. Induction of anesthesia usually with intravenous agent. Fast and smooth induction is desired to avoid the dangerous excitatory stage (stage 2).
- 2- Maintenance phase: patient remain in sustained stage of surgical anesthesia. The depth of anesthesia depends on concentration of anesthetic drug in the CNS. This phase is usually maintained by the administration of gases or volatile liquid anesthetic.
- 3- Recovery phase: This is the time from the discontinuation of anesthetic until consciousness and reflexes return.

Inhalational anesthetics

The use of inhalational anesthetics enables prolonged surgery and diagnostic procedures in a safe and efficient manner.

These drugs are most commonly used to maintain anesthesia. They are halogenated hydrocarbons with relatively low molecular boiling points, so they are evaporated easily and the resulting vapor is breathed by the patient and once the drug reaches the lung, they diffuse into the blood and distributed via the systemic circulation into the brain and other tissues. The partial pressure of the drug in the brain is responsible for the anesthetic effect and this is closely related to the partial pressure of the drug in the alveoli.

- Inhalation anesthetics provide quicker changes of anesthetic depth than injectable anesthetics, and reversal of central nervous depression is more readily achieved, explaining for its prolonged action (less risk of overdosing, less accumulation and quicker recovery)
- Commonly administered inhalant anesthetics include volatile liquids such as isoflurane, halothane, sevoflurane and desflurane, and inorganic gas, nitrous oxide (N_2O). Except N_2O , these volatile anesthetics are chemically 'halogenated hydrocarbons' and all are closely related.

The volatile anesthetics are administered as vapors after their evaporation in devices known as vaporizers. All the inhaled anesthetic drugs cause dose

dependent depression of the central cardiovascular system and respiratory system

Minimal Alveolar Concentration (MAC):

It measures the potency of the anesthetic agent and can be defined as the concentration of the inhaled anesthetic drug required to prevent movement in response to surgical stimulus in 50% of subjects.

Drugs with low potency (e.g. desflurane) will have high MAC while those with high potency (e.g. isoflurane) will have low MAC.

Inhaled anesthetic drugs are available either as gases or volatile liquids

anesthetic machine

apparatus or equipment used to administer gaseous anesthetic agents; the functions of the apparatus should include,

1. delivery of oxygen
2. removal of carbon dioxide,
3. delivery of anesthetic vapor or gas, and
4. capability of providing artificial respiration to the patient.

Properties of Ideal Inhalational Anesthetic Drug:

several different inhalational compounds have become available. Some are no longer used while others are in regular use. Of the latter, each one has advantages and disadvantages. The properties of the ideal inhaled anesthetic agent are:

- (1) Stable over a range of temperatures
- (2) Non-flammable and not explosive
- (3) Odorless or has a pleasant smell
- (4) Environmentally safe and has a boiling point above room temperature
- (5) Minimal respiratory depression, does not cause coughing or bronchospasm
- (6) Minimal cardiovascular effects and not sensitized the heart to the action of catecholamine
- (7) No increase in cerebral blood flow (and therefore intracranial pressure).
- (8) not toxic to liver or kidney and does not trigger malignant hyperpyrexia



تفدير عملي

محافظة 6

MR_TOFE



MR_TOFE



Inhalation anesthetics

The inhaled anesthetics are among the most rapidly acting drugs.

Rapid induction and recovery may lead to faster operating room turnover times and shorter recovery room stays.

Only nitrous oxide and xenon are true gases, while other agents are vapors of volatile liquids. But for simplicity, all of them are referred to as gases because they are all in the gas phase when administered via the lungs. These agents are all non-ionized and have low molecular weights. This allows them to diffuse rapidly without the need for facilitated diffusion or active transport from bloodstream to tissues. The other advantage of gases is that they can be delivered to the bloodstream via the lungs.

Gases in Mixtures

For any mixture of gases in a closed container, each gas exerts a pressure proportional to its fractional mass. This is its partial pressure. The sum of the partial pressures of each gas in a mixture of gases equals the total pressure of the entire mixture (Dalton's law).

Partial pressure is expressed in millimeters of mercury (mm Hg) or torr (1 torr = 1 mm Hg) or kilopascals (kPa).

Anesthetic Transfer:(from Machine to Central Nervous System):

When the fresh gas flow and the vaporizer are turned on. With spontaneous patient ventilation by mask, the anesthetic gas passes from circuit to airways . the gas comprising the dead space in the airways (trachea, bronchi) and then to the alveoli . The anesthetic then passes across the alveolar–capillary membrane and dissolves in pulmonary blood according to the partial pressure of the gas and its blood solubility. The anesthetic then passes via simple diffusion from blood to tissues as well as between tissues.

The vascular system delivers blood to three physiologic tissue groups; the

1- vessel-rich group (VRG),

2- muscle group

3- fat group

Table show the distribution of Cardiac Output by Tissue Group

Group	% Body Mass	% Cardiac Output
Vessel-rich	10	75
Muscle	50	19
Fat	20	6

The VRG includes the brain, heart, kidney, liver, digestive tract, and glandular tissues.. The CNS tissues of the VRG are referred to as tissues of desired effect. The other tissues of the VRG that comprise the compartment are referred to as tissues of undesired effects. The tissues of the muscle and fat groups comprise the tissues of accumulation.

Anesthetic is delivered most rapidly to the VRG because of high blood flow. Here it diffuses according to partial pressure gradients. CNS tissue takes the anesthetic according to the tissue solubility, and when it reach a high enough tissue concentration, unconsciousness and anesthesia are achieved. Increasing CNS tissue concentrations cause progressively deeper stages of anesthesia. As this is occurring, anesthetic is also distributing to other VRG tissues.

anesthetic is delivered—more slowly to muscle and fat, where it accumulates and may affect the speed of recovery from the anesthetic..

The concentration of inhaled anesthetic in a given tissue at a particular time during the administration depends not only on tissue blood flow, but also on tissue solubility,. These relative solubility are expressed by a partition coefficient, , which is the ratio of dissolved gas (by volume) in two-tissue compartments at equilibrium

Alveolar concentration of the inhalation agent

This depends on three factors:

1-Inspired concentration of agent: The concentration of inhaled anaesthetic affects the rate of increase of the alveolar concentration (F_A) towards the inspired concentration (F_i). The greater the inspired concentration, the more rapid the increase in the F_A/F_i ratio, and the faster the induction of anaesthesia..

2-Alveolar ventilation: Increased alveolar ventilation results in faster increase in alveolar partial pressure by constantly replacing the inhalation agent taken up by the pulmonary blood flow.

3-Functional residual capacity (FRC): A larger FRC dilutes the inspired concentration of gas resulting initially in a lower alveolar partial pressure and therefore slower onset of anaesthesia.

Uptake from lung into the blood:

Inhalational anesthetics are taken up passively via diffusion, which depends on

1-Blood solubility of the anesthetic

Blood-gas partition coefficient: the ratio of anesthetic concentrations in the blood and alveolar space when partial pressures in the two compartments are equal → The higher the blood-gas partition coefficient of an inhalational anesthetic, the higher the solubility of that substance in the blood.

2-Lung ventilation, volumes, and perfusion

Distribution and uptake into the brain:

Transport to and uptake into the brain depend on cerebral perfusion and the fat solubility of the inhalational anesthetic.

blood-brain partition coefficient: : the ratio of anesthetic concentrations between blood and brain tissue when partial pressures are equal → The higher the blood-brain partition coefficient, the higher the solubility of that substance in brain tissue.

Onset of effect:

The lower the Blood-gas partition coefficient of an inhalational anesthetic, the faster the substance takes effect (rapid induction)

Elimination :

1-Inhalational anesthetics are eliminated by the lungs

The lower the partition coefficient of an inhalational anesthetic, the faster the effect ceases (rapid recovery)

2-Inhalational anesthetics are metabolized only to a small degree

Exception: Halothane is metabolized in the liver

3- inhalational anesthetics with a high fat solubility can accumulate in adipose tissue with prolonged duration of anesthesia in obese patients, and slow recovery from anesthesia



تفدير عملي

محاظرة 7

MR_TOFE



MR_TOFE



Nitrous oxide (N₂ O)

Commonly known as laughing gas or happy gas, It has remained one of the most widely used anesthetics in both dental and medical applications.

Properties:

Nitrous oxide is small inorganic chemical molecule .it is strong analgesic but weak anesthetic

Nitrous oxide is a colorless gas with a slightly sweetish odor. It is neither flammable nor explosive. It is a cerebral depressant and produces light anaesthesia without depressing the respiratory or vasomotor center provided that normal oxygen tension is maintained.

Advantages:

Nitrous oxide reduces the requirement for other more potent and more toxic anaesthetic agents. It has a strong analgesic action. Induction is rapid and pleasant Recovery time rarely exceeds 1-4 minutes even after prolonged administration.

Disadvantages:

N₂O is weak anesthetic so it must be used in conjunction with more potent anaesthetics and muscle relaxants to produce a state of full surgical anaesthesia.

Uses of N₂O:

- 1- Maintenance of surgical anaesthesia in combination with other anaesthetic agents (halothane, thiopental or ketamine) and muscle relaxants.
- 2- In subanaesthetic doses, to provide analgesia for obstetric practice, for emergency management of injuries

Dosage and administration

- 1- For the maintenance of anaesthesia, a concentration of 70% nitrous oxide mixed with 30% oxygen.
- 2- For analgesia, a concentration of 50% nitrous oxide with 50% oxygen usually used (Entonox)

Storage

Nitrous oxide is supplied under pressure in cylinders, which must be kept below 25°C.

Cylinders containing premixed oxygen 50% and nitrous oxide 50% are available for analgesia in some countries.

cylinders containing nitrous oxide should be colored blue. Cylinders containing nitrous oxide and oxygen mixtures (Entonox) should be similarly labeled, and the neck coloured white and blue.

Adverse effects of nitrous oxide.

- 1- Hypoxia, ('diffusion hypoxia'), can occur with the administration of inadequate amounts of oxygen during or immediately after a N₂O anaesthetic, due to rapid excretion of the drug into the alveoli causing washing of the lungs from

O₂ and CO₂ resulting in hypoxia, this can be avoided by administration of 100% of O₂ at the end of operation.

2-N₂O will diffuse into air-containing cavities within the body cavities e.g. pneumothorax and tension pneumocephalus. N₂O should not be used for patients with bowel obstruction, pneumothorax, middle ear and sinus disease,

3- N₂O has ability to oxidize and inactivate the vitamin

4- Causes mild myocardial depression and increases pulmonary vessel resistance → should not be used in patients with conditions such as pulmonary hypertension

5- increase incidence of nausea and vomiting

6- Prolonged and repeated exposure may be associated with bone-marrow depression and a teratogenic risk; precautions should be taken to minimize ambient concentrations in operating theatres.

Xenon

A modern anaesthesia gas. The name is derived from the Greek 'Xenos', 'strange'.

Xenon (noble gas) is an inert, odorless gas. It is non-flammable and not explosive. Xenon is present in the atmosphere in extremely low concentration (0.0000087%). Xenon produces inhalation anesthesia similar to Nitrous Oxide; however, there is not enough xenon in the earth's atmosphere to be used for this purpose.

Xenon has minimal hemodynamic effects; it is more potent than nitrous oxide. It is an inhaled agent with analgesic and anesthetic effects. Not metabolized in the body and is eliminated via the lungs. Xenon has more potent narcotic

properties than nitrous oxide due to its higher inertness so safer for patients. . Due to its lower solubility in blood, xenon is quickly eliminated from the body: upon stopping the gas supply, patient recovery is immediate. . However, despite all of the advantages of Xenon over the anesthetics in current use, the use of this inert gas is limited by its high price.

Manufacture

Xenon is produced by the fractional distillation of air, at about 2000 times the cost of producing N₂O.

Mechanism of action:

The anesthetic property of xenon is mainly conferred by the inhibition of *N*-methyl-D-aspartate receptors in the central nervous system.

Effects

Respiratory system:

In contrast to other inhaled anaesthetic agents Xenon slows the respiratory rate, while the tidal volume is increased so that the minute volume remains constant. It does not cause respiratory irritation. Despite its use at high concentrations it does not appear to result in diffusion hypoxia as seen with N₂O.

Cardiovascular system:

It is highly cardio stable with no reduction in contractility, but a small decrease in heart rate may be seen. Xenon does not sensitize the myocardium to catecholamine's.

Central nervous system:

it increase cerebral blood flow and its use in neuroanaesthesia is not recommended..

Elimination

Xenon is not metabolized in the body and is eliminated via the lungs.

Advantage:

. Xenon has many properties of an ideal anesthetic gas:

- 1-potent narcotic and analgesic properties
- 2- Hemodynamic stability.
- 3- Quick induction and recovery from anesthesia.
- 4-not sensitized the heart to the action of catecholamine
- 5- Xenon is not associated with malignant hyperthermia

Disadvantages:

, there are certain disadvantages to xenon anesthesia.

- 1-Similar to N₂O, but to a lesser extent, xenon may accumulate in closed spaces
- 2-Xenon may also increase the risk of postoperative nausea and vomiting (PONV)



تفدير عملي

محاظرة 8

MR_TOFE



MR_TOFE



Volatile liquids

Ether :

It is the first volatile agent introduced. It has a good anesthetic and analgesic properties with good muscular relaxation. It is irritant to the respiratory system also it dissolves in the saliva and causes postoperative vomiting.

Ether is flammable and explosive so using a diathermy cautery cannot be used during anesthesia .

Chloroform :

One of the earliest agents used since mid-19th century . fast induction and recovery . good analgesic and fair muscle relaxation. Dose related respiratory and cardiovascular depression ,also sensitizes the heart to epinephrine and induced arrhythmia (more than halothane) and also causes liver toxicity so it is not used now a day .

Halothane (Fluthane) :

Description : A nonflammable, halogenated, hydrocarbon anesthetic that provides relatively rapid induction with little or no excitement.

Analgesia may not be adequate. nitrous oxide is often given concomitantly. Because halothane may not produce sufficient muscle

relaxation, supplemental neuromuscular blocking agents may be required.

Therapeutic uses :

Halothane is a potent anesthetic but a relatively weak analgesic. Thus, it is usually co-administered with nitrous oxide, opioids, or local anesthetics.

It is a potent bronchodilator.

Halothane relaxes both skeletal and uterine muscles and can be used in obstetrics when uterine relaxation is indicated.

Halothane is not hepatotoxic in children (unlike its potential effect on adults). • Combined with its pleasant odor, it is suitable in pediatrics for inhalation induction, although sevoflurane is now the agent of choice.

Metabolism :

20-40% is metabolized in liver by oxidation. 60-80% is excreted unchanged by lungs.

Disadvantages :

- 1- Weak analgesic (thus is usually coadministerd with N₂O, opioids) •
- 2- it is a strong respiratory depressant
- 3- it is a strong cardiovascular depressant cause hypotension and bradycardia.

4- Cardiac arrhythmias: halothane Sensitize the heart to catecholamine's

5- Hepatotoxic: halothane metabolized in the liver to tissue-toxic hydrocarbons lead to hepatitis.

6- Malignant hyperthermia: In a very small percentage of susceptible patients, a rare life-threatening condition

Exposed patient : including those of anesthetist and operating theater staff. Hepatic damage occurs in a small proportion of exposed patients .

Typically fever develops 2-3 days after anesthesia, accompanied by anorexia, nausea and vomiting . in more severe cases this is followed by transient jaundice or, very rarely, fatal hepatic necrosis .severe hepatitis is a complication of repeatedly administered halothane anesthesia (incidence of 1 in 50 000) .

Contraindications :

1- Liver dysfunction

2- History of unexplained jaundice or pyrexia after a previous exposure to halothane is an absolute contraindication to its future use in that patient.

3- Halothane is contraindicated in patients with known, or suspected, genetic predisposition to malignant hyperthermia.

4- Hypovolemic shock

Halothane Dosage and Administration

The induction dose varies from patient to patient.

The maintenance dose varies from 0.5 to 1.5%

Halothane may be administered with either oxygen or a mixture of oxygen and nitrous oxide .

Halothane is maintained by the addition of 0.01 thymol and storage is in amber colored bottles .

Halothane should be kept in vaporizer specifically designed for its use. It is recommended that vaporizer be emptied at the end of each operating day .

Thymol, which does not volatilize along with halothane, accumulates in the vaporizer , and may in time, impart a yellow color to the remaining liquid or to vaporizer . the development of such discoloration may be used as an indicator that the vaporizer should be drained and cleaned, and the discolored halothane discarded. Accumulation of thymol may be removed by washing with diethyl ether .



تفدير عملي

محاظرة 9

MR_TOFE



MR_TOFE



Enflurane:

. It was increasingly used for inhalational anesthesia during the 1970s and 1980s but is no longer in common use.

Nonflammable agent. It is less potent than halothane, used in a concentration of 1-5% and recovery from anesthesia is more rapid.

Enflurane does not sensitize the heart to the action of catecholamine and does not cause arrhythmia. The incidence of hepatitis is much less than halothane.

Side effects

- 1-Clinically, enflurane produces a dose-related depression of myocardial tissue
- 2- Between 2% and 5% of the inhaled dose is oxidized in the liver, producing florid which may cause acute renal failure .
- 3- Enflurane may cause epileptic convulsion and should not be used in epilepsy
- 4-Like all potent inhalation anaesthetic agents it is a known trigger of malignant
- 5-It relaxes the uterus in pregnant woman which is associated with more blood loss at delivery

Isoflurane: the trade name Forane

Forane (isoflurane) is a general inhalation anesthetic drug used to induce and maintain general anesthesia

It is the most commonly agent used nowadays, it is not flammable and not explosive and not cause epileptic convulsion. It is also potent like halothane but it has less cardiac depressant effect and not precipitate arrhythmia but it may produce hypotension due to vasodilation

Side effects include

1- respiratory depression

2- it may produce hypotension due to vasodilation

3-Serious side effects may include malignant hyperthermia and high blood potassium It should not be used in people with a history of malignant hyperthermia

4-shivering, nausea, vomiting

Dose :

For induction:, the dose of Forane used in a concentrations of 1.5 to 3.0%. For maintenance ,the dose is 1.0 to 2.5%

Desflurane (suprane)

Desflurane used for maintenance of general anesthesia

Together with sevoflurane, it is gradually replacing isoflurane for human use, except in economically undeveloped areas, where its high cost precludes its use. It has the most rapid onset and offset of the volatile anesthetic drugs used for general anesthesia due to its low solubility in blood.

Disadvantages:

1-low potency, its pungency

2- high cost

3- It may cause tachycardia and airway irritability when administered at concentrations greater than 10 %. Due to this airway irritability, desflurane is infrequently used to induce anesthesia via inhalation techniques.

Dose :

Induction: Initial 3% inhaled, increase by 0.5-1%

Maintenance: 2.5-8.5% with or without nitrous oxide

Sevoflurane (Ultane, Sevorane)

Sevoflurane is a sweet-smelling, nonflammable, used as an inhalational anesthetic for induction and maintenance of general anesthesia. After desflurane, it is the volatile anesthetic with the fastest onset and offset.

Therapeutic indications

It is one of the most commonly used volatile anesthetic agents, particularly for outpatient anesthesia, across all ages. Together with desflurane, sevoflurane is replacing isoflurane and halothane in modern anesthesiology. It is often administered in a mixture of nitrous oxide and oxygen.

Sevoflurane has an excellent safety record.

Sevoflurane is indicated for induction and maintenance of general anaesthesia in adult and pediatric patients for inpatient and outpatient surgery.

Sevoflurane should be delivered via a vaporizer specifically calibrated for use with sevoflurane so that the concentration delivered can be accurately controlled. MAC

(minimum alveolar concentration) values for sevoflurane decrease with age and with the addition of nitrous oxide

Induction:

Dosage should be individualized and titrated to the desired effect according to the patient's age and clinical status. A short acting barbiturate or other intravenous induction agent may be administered followed by inhalation of sevoflurane.

Induction with sevoflurane may be achieved in oxygen or in combination with oxygen-nitrous oxide mixtures. In adults inspired concentrations of up to 5% sevoflurane usually produce surgical anaesthesia in less than 2 minutes. In children, inspired concentrations of up to 7% sevoflurane usually produce surgical anaesthesia in less than 2 minutes

Maintenance:

Surgical levels of anaesthesia may be sustained with concentrations of 0.5 - 3% sevoflurane with or without the concomitant use of nitrous oxide.

Emergence:

Emergence times are generally short following sevoflurane anaesthesia. Therefore, patients may require early post-operative pain relief.

Older people:

MAC decreases with increasing age. The average concentration of sevoflurane to achieve MAC in an 80 year old is approximately 50% of that required in a 20 year old.

Contraindications

Sevoflurane should not be used in patients with known or suspected sensitivity to sevoflurane or other halogenated anaesthetics).

Sevoflurane is also contraindicated in patients with known or suspected genetic susceptibility to malignant hyperthermia.



تفدير عملي

محاظرة 10

MR_TOFE



MR_TOFE





Al – Noor University College

Department of anesthesiology

المرحلة / الثانية

محاضرة تخدير (10)

د. نزار الحياي

Malignant Hyperthermia

Malignant hyperthermia (MH) is a dominantly inherited disorder of skeletal muscle that occur in susceptible individuals . It is a life threatening adverse reaction result from exposure to potent volatile anesthetics (halothane, isoflurane, sevoflurane, desflurane, etc.) and the skeletal muscle relaxant succinylcholine.

MH is due to abnormal metabolism of Ca^{2+} ion in the skeletal muscle , The anesthetic drugs trigger an uncontrolled calcium (Ca^{2+}) release from the muscle.

Epidemiology

The incidence of MH reactions ranges from 1/50,000- 1/100,000 . More common in male than female

Clinical description

The classic signs of MH include :

- 1- Marked increase in the body temperature (about 1 C° every 5-10 min.).
- 2- Tachycardia (increase in pulse rate),
- 3-Tachypnea (increase in the respiratory rate)
- 4-Cardiac arrhythmia,
- 5-increased carbon dioxide production, and increased oxygen consumption, acidosis,
- 6- isolated masseter muscle spasm or generalized muscle rigidity.
- 7-In untreated patients, multi-organ failure (including acute renal failure) and circulatory collapse are the end-stage of the disease..

Management and treatment

Dantrolene sodium is a specific treatment and should be available wherever general anesthesia is administered.

- 1- When MH is suspected, administration of triggering agents should be ceased immediately and anesthesia continued with intravenous propofol, opioids and/or sedatives,
- 2-Give i.v. fluid.
- 3-Give 100% oxygen

4- Dantrolene should be administered at a dosage of 2.5 mg/kg, every 5-10 minutes until patient is stabilized.

5-Cooling the patient (with cold intravenous fluids, topical ice or special cooling blankets) is essential

Prognosis

The syndrome is likely to be fatal if untreated.

Intravenous general anesthesia

Intravenous anesthetics are a group of fast-acting drugs that are used for Induction of anesthesia . it is the method of choice for induction of anesthesia except for children and other with difficult veins.

Mechanism of action :

Intravenous (i.v.) anesthetics include , etomidate, midazolam, propofol, thiopental, ketamine, and opioid agonists. The first four agents act by enhancing the activity of the inhibitory neurotransmitter γ -amino butyric acid (GABA) in the CNS.

Ketamine antagonizes the effect of the excitatory neurotransmitter *N*-methyl-D-aspartate (NMDA) on NMDA receptors, and opioid agonists stimulate opioid receptors.

advantages of i.v. anesthesia are:

- 1- It is rapid and pleasant for the patient
- 2- The stage 2 of anesthesia (excitation) is avoided

3- No pollution of the theater by anesthetic gases.

The main disadvantage of i.v. anesthesia is that it is easy to give over dosage which may cause respiratory or cardiac complication

Drugs used for i.v. anesthesia:

A-barbiturate group: e.g.

Thiopental :

Thiopental is a very short-acting barbiturate that induces anaesthesia smoothly, within one arm-to-brain circulation time (< one min.) . It is given in aqueous solution in a concentration of 2.5%.The duration of action is 4-7 min

The typical induction dose is 3–5 mg/kg. Repeated doses or continuous infusion lead to significant accumulation in fat and lead to very prolonged recovery.

Thiopental is metabolized in the liver. The incidence of nausea and vomiting after thiopental is slightly higher than that after propofol. Thiopental is strong alkaline (PH is 11) and extravasation causes considerable local damage. Accidental intra-arterial injection will also cause serious injury distal to the injection site (gangrene)

Effects :

Central nervous system:

Thiopental has no analgesic activity. It is a potent anticonvulsant. Cerebral oxygen consumption is reduced, causing cerebral vasoconstriction, reduction in cerebral blood flow and intracranial pressure.

Cardiovascular system:

Thiopental reduces vascular tone, causing hypotension and a slight compensatory increase in heart rate.

Respiratory system:

Thiopental reduces respiratory rate and tidal volume.

Indications

1-This drugs are used mainly for the induction of anesthesia and as a sole agent for short surgical procedures

2-Reduction of intracranial pressure for brain edema following trauma or surgery

3-Sedation for electroconvulsive therapy (ECT)

4-Treatment of convulsion during or after anesthesia

adverse effects of thiopental include :

1-thiopental depress cerebral blood flow and cause a decrease in intracranial pressure, and also act as respiratory and circulatory depressants.

2-Anaphylactic reactions with use of the drug.

3-Tissue necrosis with extravasation (if the drug injected outside the vein)

4-intra-arterial injection of the drug cause arterial constriction and thrombus

5- Not be used in severe anemia ,liver and kidney disease

2-Methohexital:

other barbiturate but more potent than thiopental used in a conc. Of 1% .the sleeping dose is 1 mg./kg.

, its use is confined almost entirely to inducing anaesthesia for electroconvulsive therapy (ECT).

B-Non-barbiturate group:

1-propofol:

It is a short-acting general anesthetic drug, with an onset of action of approximately 30 seconds. Recovery from anesthesia is usually rapid. Given in a concentration of 1% .A smooth induction of anesthesia usually follows a dose of 2-2.5mg/kg. The duration of action is up to 20 min.

It decrease the cerebral blood flow and has anticonvulsant effect, so it can be used in epileptic patient

Propofol causes the most marked fall in blood pressure of all the induction drugs. This is mainly due to systemic vasodilatation . The fall in blood pressure is dose dependent and is most marked in the elderly and in shocked patients. Also propofol cause respiratory depression and it is irritant to the vein so Lidocaine (20 mg) is injected prior to the injection of propofol

The recovery from propofol is rapid, and the incidence of nausea and vomiting is extremely low

2-Etomidate

Etomidate is imidazole derivative. It is available as a solution of 2% concentration Pain on injection is common and there is a high rate of thrombophlebitis in the

post-operative period. The standard induction dose is 0.3mg/kg, and recovery is rapid. Induction of anesthesia can be accompanied by involuntary movements. Recovery is frequently unpleasant and accompanied by nausea and vomiting.

Etomidate causes adrenocortical suppression and for this reason, it is not used for prolonged infusion. Even after a single dose of **etomidate**, adrenocortical suppression can last for as long as 72 h and in septic patients is associated with an increased incidence of organ failure. Despite all of these disadvantages it remains in common (although decreasing) use, particularly for emergency anaesthesia, because it causes less cardiovascular depression and hypotension than thiopental or propofol.

It should not be used in patients with sepsis .

Side effects

- 1- Transient acute adrenal insufficiency (due to adrenal cortex suppression → reduced cortisol production)
- 2- Postoperative nausea and vomiting
- 3- Painful injection (avoid by administering an opioid prior to injection)
- 4- Myoclonus (involuntary movement)

Indications

Anesthesia for patients with hemodynamic instability

Of all the IV anesthetics, etomidate has the least effect on the cardiovascular system.



تفدير عملي

معاظرة 11

MR_TOFE



MR_TOFE



Barbiturates

Thiopentone sodium(Thiopental; pentothal)

It is a yellow amorphous powder with odour resembling H₂S. soluble in water ,and its solution is not very stable but can be left for 24 – 48 hrs without harm on subsequent injection. It is supplied in vials of 500 or 1000 Mgs to be dissolved in water to make 2.5% solution(25Mg/ml.), the solution is having high PH and if injected accidentally intra-arterial will cause severe symptoms may be followed by gangrene in the distal tissues, and if injected intramuscular it causes necrosis. Average dose is 5Mg(4-7).

Actions

Central nervous system; It causes depression ,narcoses ,anesthesia and respiratory depression, depending on the dose and rate of injection. There is anticonvulsant action. High dose can cause medullary depression. Cerebral blood flow and CSF pressure are reduced .It is antanalgesic especially in sub anesthetic dose. Acute tolerance is seen with pentothal ; the grater the initial dose the grater the increments required to maintain the surgical anesthesia.

Respiratory system: laryngeal reflexes are not depressed until the deep levels of thiopental narcosis are reached and stimulation, local or remote, may provoke laryngeal spasm at light levels of narcosis especially if there is predisposing cause like sensitive bronchial tree or presence of mucus, the patient may develop bronchospasm or laryngospasm.

Respiration is depressed, when thiopental is given slowly there is a few deeper breath followed by brief of apnea due to direct effect of thiopental on respiratory center. Respiration returns gradually and then fades away as more drug is given.

Cardiovascular system; Cardiac output is reduced, the tone of systemic capacitance vessels is reduced, leading to pooling of the blood, in the periphery. This shift causes reduction in the left ventricular diastolic filling and stroke volume, this is dangerous in patient with fixed cardiac output like mitral stenosis or complete heart block. blood pressure is reduced for short time and return to normal after few minutes in normotensive patient. Rapid injection of too much thiopentone may have the most grave effect on the circulatory system.

Liver and kidney; pentothal is almost completely metabolized in the body. The liver is the principal site of breakdown, between 10-15% of the drug is metabolized each hr. the products are removed via the kidney. Patient with renal impairment needs smaller dose, and usually narcosis will last longer.

The metabolism in the liver is not responsible for the ultra short action of thiopentone, it is the redistribution to other parts of the body (cumulative compartment) that cause the short time of action.

Advantages:

1. Ease and rapidity of induction
2. Absence of stage of delirium.
3. Rapid recovery (with correct dosage) and relatively freedom from vomiting and postoperative discomfort.
4. Ability to increase depth rapidly.

disadvantages:

1. Respiratory depression.
2. Tendency to laryngeal spasm
3. Poor abdominal relaxation with safe dosage
4. Circulatory depression in poor-risk patient.

Indications:

1. For induction of general anesthesia.
2. For short operations, orthopedic, manipulations, minor gynecology, examinations under anesthesia.
3. For supplementing regional analgesia.
4. For controlling convulsions during general or local anesthesia, eclampsia, epilepsy, tetanus.
5. For narco-analysis in psychiatry, and for electroconvulsive therapy.
6. For easy induction.

Complications of thiopentone anesthesia:

Local complications:

1. Perivenous injection: this may cause pain, redness and swelling, haematoma formation, bruising, rarely ulceration (due to alkalinity of the solution)
2. Intra-arterial injection: this may follow misplacement of the needle or accidental injection into an arterial cannula. The changes in PH of thiopentone which occur when it is mixed with blood in an artery result in precipitation of solid crystals of thiopentone which are swept along and eventually block small vascular channels at arterioles and capillaries. The crystals remain in the small vessels and their irritant properties cause local release of noradrenalin with subsequent vascular spasm. When it occurs the patient feels severe burning pain down the arm and the hand, usually there is white hand and cyanosed fingers with patches of skin discoloration. Treatment of this mishap is; don't remove the cannula, dilute the injected pentothal with saline, relief of arterial spasm and the pain, prevention of thrombosis, postpone the operation if possible, start anticoagulant therapy.

General complications:

1. Respiratory depressions: apnea during intravenous anesthesia may be due to : a) relative over-dose of drug, b) respiratory obstruction above the glottis .e.g the tongue falling back, c) laryngeal spasm.
2. Circulatory collapse: this is usually due to relative over-dose causing vasodilatation and myocardial depression.
3. Laryngeal spasm: this may result from, a) direct local stimulation by an airway, saliva, blood. B) stimulation of some remote area, e.g anal sphincter, cervix uteri, c) part of general anoxic spasm.
4. Coughing. Depth should be gradually increased. Nitrous-oxygen , volatile or analgesic agents may be required in resistant cases, Hiccup occasionally seen.
5. Postoperative vertigo, euphoria and disorientation, because of possibility of this condition, outpatients should be accompanied home and not allowed to drive a car or to cook.
6. True cutaneous allergy can occur either in the form of scarlatiniform rash or as true angioneurotic edema, photosensitivity to thiopentone in patients recently exposed to sunlight has been reported.
7. Severe anaphylactic reactions.

Contraindications:

1. Porphyria
2. History of pentothal anaphylaxis
3. Constrictive pericarditis
4. Status asthmaticus
5. Profound shock



تفدير عملي

محاضرة 14

MR_TOFE



MR_TOFE



Steps for oral tracheal intubation:

Step 1: check the equipment (laryngoscope, curved (Macintosh type) and straight (Miller type) blades of an appropriate size for patient and assure that the light works, check ETT cuff for leaks).

Step 2: Assemble all materials close at hand (Laryngoscope, ET tube size, 10 ml syringe, water-soluble lubricant, suction equipment, stethoscope).

Step 3: position of patient: unless contraindicated-i.e Truma.

If there is no contraindication elevating the patient's head about 5-10 cm with pads under the occiput and extension of the head into the sniffing position this position permits better visualization of the glottis and vocal cords and allows easier passage of the endotracheal tube.

Step 4: Curved blade technique: (Macintosh Laryngoscope)

- a. Hyper-oxygenate the patient with 100% oxygen for 2 minutes.
- b. Open the patient's mouth with the right hand, and remove any dentures.
- c. Grasp the laryngoscope in the left hand.
- d. Spread the patient's lips, and insert the blade between the teeth, being careful not to break a tooth.
- e. Pass the blade to the right of the tongue, and advance the blade into the hypopharynx, pushing the tongue to the left.
- f. Lift the laryngoscope upward and forward, without changing the angle of the blade, to expose the vocal cords. The cricoid pressure is used to lower the Larynx to facilitate tube passage and compress the epiglottis and prevent aspiration. A gentle downward pressure on cricoid cartilage, start slowly and then gradually increase the downward force.
- g. Pass the tube through the vocal cords.

Straight blade technique: (Miller laryngoscope)

Follow the steps outlined above. But advance the blade down the hypopharynx, and lift the epiglottis with the tip of the blade to expose the vocal cords.

Step 5: Sometimes we need to use a stylet to direct the tube toward the larynx. If we do it remove Stylet.

Step 6: connect the bag-valve mask and begin ventilation with 100% oxygen.

Step 7: check the placement by:

1. Visualize tube passing through the cords.
2. Movement of the chest with respirations.
3. Auscultation of the chest (You should hear breath sound on both sides of the chest).
4. Auscultation of the stomach (You should not hear gurgles here when bagging).
5. Rising or stable O₂ saturation.
6. Clinical improvement of the patient.

Size of endotracheal tube

- A cuffed ETT with an internal diameter of 3.0 mm may be used for infant. Up to 1 year of age.
- Uncuffed tube with an internal diameter of 3.5 mm for infants up to 1 year of age.

Endotracheal tube size for children (age 1 to 8 years)

Uncuffed endotracheal tube size = $4 + (\text{Age} / 4)$

Cuffed endotracheal tube size = $3.5 + (\text{Age} / 4)$

Adult Male----- 8.5-9 mm

Adult female----- 7.5-8 mm

Measure the air pressure in the ETT tube

Measuring the pressure created in the airway will help prevent damage to the trachea and lungs.

A safe pressure at the cuff of the ET tube is between 20 and 30 cmH₂O.

Adult:

Estimation of ideal ETT placement length is roughly 21 cm in women and 23 cm in men, “tube taped at the teeth”

Measuring the length of endotracheal tube:

Length = internal diameter (size ×3)

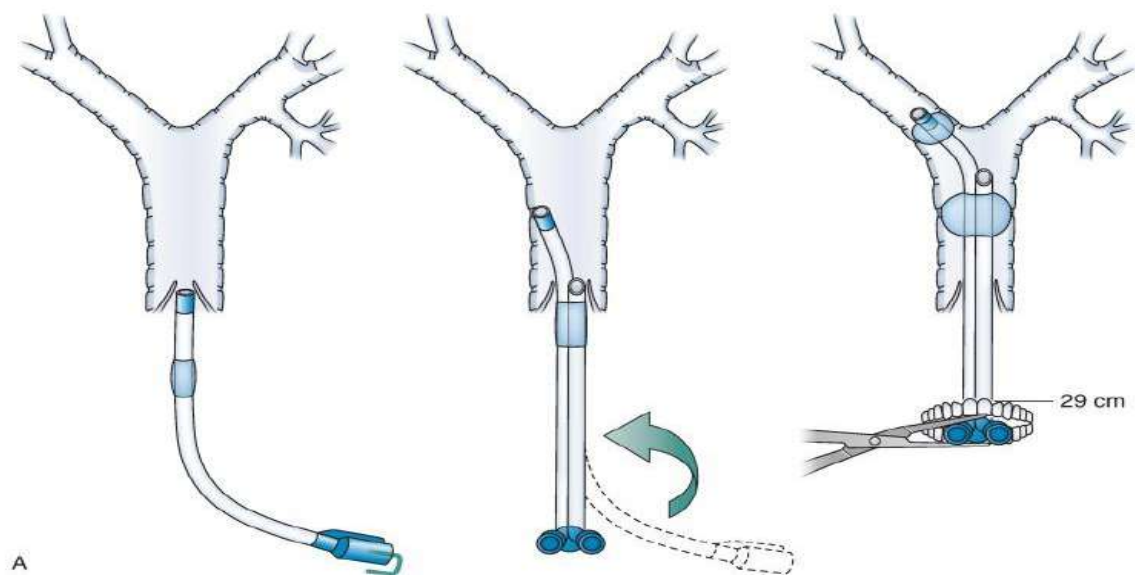
So for example, a 4-year-old child would get intubated with a 5-0 ETT inserted depth of 15 cm (3× ETT).

Double- Lumen Endotracheal tube:

Double-Lumen endotracheal tube (DLT) is the most common technique to achieve lung separation. Isolation of one side from another may be required to:

1. Visualization for certain surgical procedure within the thoracic cavity, such as operations on the lung tissue, esophagus.
2. Lung isolation also allows for management of certain pathological conditions of the lung including unilateral lung hemorrhage, trauma, or bronchopleural fistula.

The DLT, comprising two parallel lumen terminating in the trachea, and a second longer lumen extending into either the left or right main bronchus. Each lumen has a cuff that is inflated to create a seal.



A





تفدير عملي

محاظرة 15

MR_TOFE



MR_TOFE



Patient Positioning

Patient positioning is vital to a safe and effective surgical procedure. Proper patient positioning depends on :

- 1- the type and length of procedure,
- 2- anesthesia access to the patient,
- 3- The devices required during operation .

The aim of proper patient positioning include:

- 1-Maintain the patient's airway and circulation throughout the procedure
- 2-Prevent nerve damage
- 3-Allow surgeon accessibility to the surgical site
- 4-Provide comfort and safety to the patient
- 5-Prevent soft tissue or musculoskeletal injury

Patient Positioning Risk Factors

Various Intrinsic and extrinsic factors can interact to contribute to the risk of developing pressure sores.

Extrinsic factors may include pressure intensity and duration of anesthesia.

Intrinsic factors can include the overall health of the patient, and pre-existing conditions such as respiratory or circulatory disorders, diabetes mellitus, anemia, malnutrition, advanced age, and body size.

Common Patient Positions

Four basic positions include

1. Supine position
 2. Prone position
 3. Lateral position
 4. lithotomy position
-

Positions Variations include :

a-Trendelenburg position

b-Reverse Trendelenburg position

c-Fowler's position

d-Jackknife position

e-Kidney position

Supine Position

Supine position, is the most frequently used position for procedures. In this position, the patient is face-up. The patient's arms should be put at the patient's sides. The arms may be flexed and secured across the body or extended and secured on arm board.

Supine position is commonly used for the following procedures: intracranial, cardiac, abdominal, laparoscopic, lower extremity procedures, and ENT, neck and face operations .

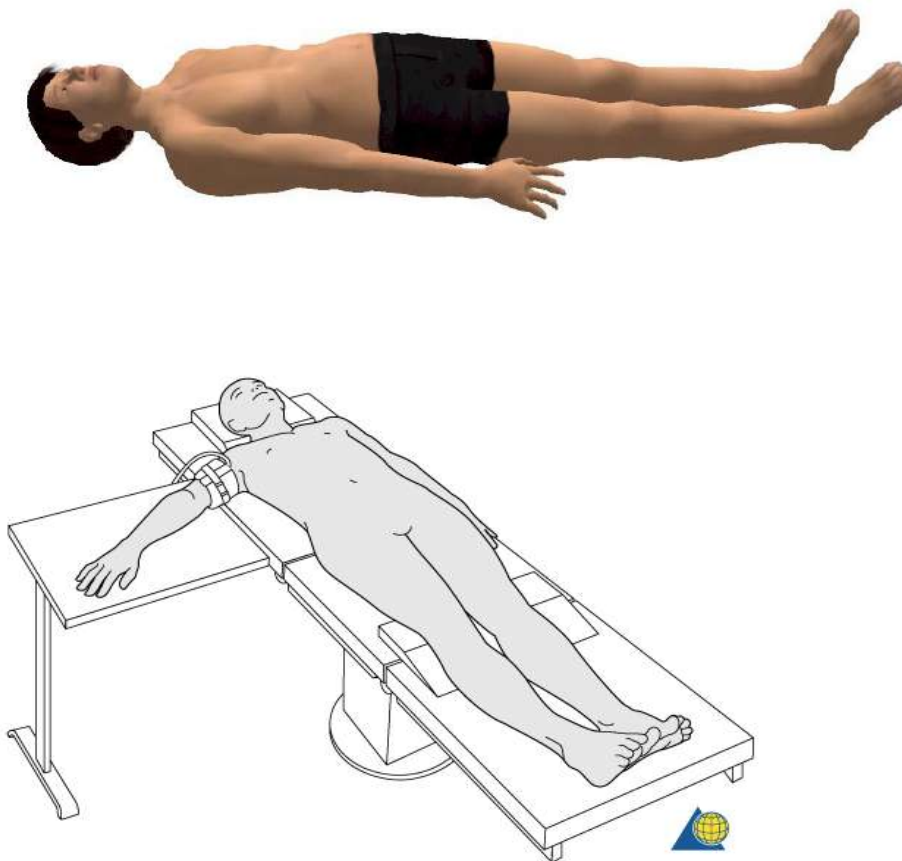


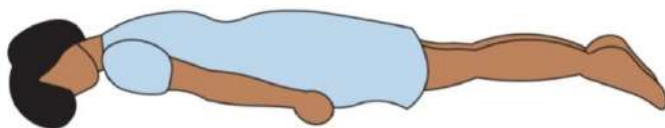
Figure show supine position

Prone Position

Prone- position where the patient lies on his stomach. face-down with his back up. The head is typically turned to one side. This **position** allows for drainage of the mouth after oral or neck surgery.

The prone position is used for posterior craniotomies and for spine-related procedures, such as spinal fusions, resections of masses (e.g. lipoma)

. Risks associated with Prone position include increased abdominal pressures, bleeding, nerve injuries,



Prone

Lateral-position

This position involves the patient lying on either right or left side.

Right lateral means the patient's right side is touching the bed, while left lateral means the patient's left side is touching the bed. A pillow is often placed in between the legs for patient comfort.

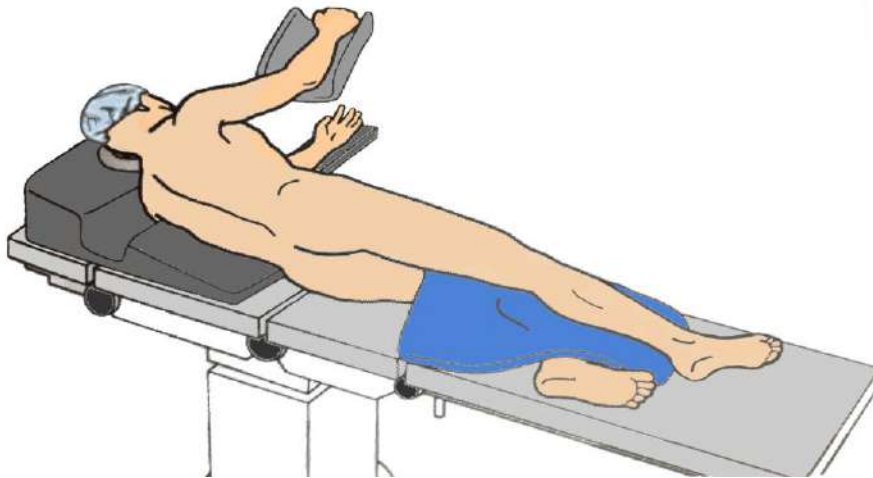


Figure show lateral position

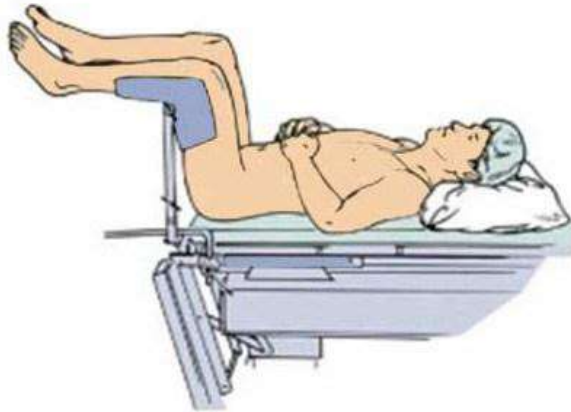
The lateral position has been associated most commonly with cardiothoracic procedures, but may also be used to advantage for renal, obstetric, gynecologic, and orthopedic operations. Orthopedic surgeons have used the lateral position extensively for total hip replacement and for open reduction and fixation of hip fractures

Variations in the lateral position include the lateral jackknife position, the kidney position, the Sims position

Lithotomy Position

The lithotomy position is often used during childbirth and surgery in the pelvic area.

It involves lying on your back with your legs flexed 90 degrees at your hips. Your knees will be bent at 70 to 90 degrees. The position is named for its connection with lithotomy, a procedure to remove bladder stones.



Trendelenburg position

Same as supine position but the upper torso is lowered. The patient must be secured to avoid sliding on the surgical table.

Trendelenburg should be avoided especially in obese patient as it increase in the intracranial pressure, and impaired the lung function

Used for Gallbladder. Thoracic and abdominal operation .



Reverse Trendelenburg position

Same as supine but upper torso is raised and legs are lowered. Risks to a patient in this position include deep vein thrombosis, and sliding

Used for lower abdominal and urology Procedures





تفدير عملي

محاظرة 16

MR_TOFE



MR_TOFE



Fowler's Position

Fowler's position, also known as sitting position

A person is basically in Fowler's position when the top of the bed is raised up. The body of the patient can be inclined at an angle ranging from 90 to 15 degrees The legs of the patient may be straight, or either bent at the knees.

Fowler position is typically used for neurosurgery and shoulder surgeries.

The position is generally preferred in patient with difficult breathing since it allows better chest expansion This position is also suitable for nasogastric feeding also for patients who are incapable of moving, this position allows normal talking and eating .

Types of fowler position :

1- Low Fowler's Position

In this position, the head of the bed is generally inclined at an angle of 15 to 30 degrees.

2- Semi Fowler's Position)

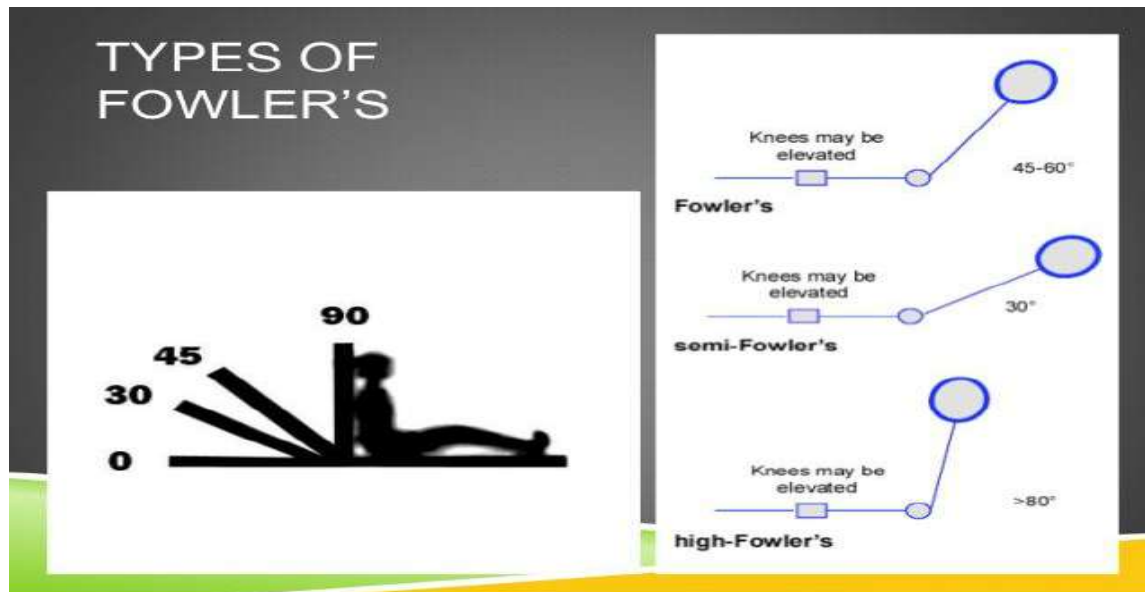
In this position, the head of the bed is generally inclined at an angle of 30- 45 degrees

3- Standard Fowler position

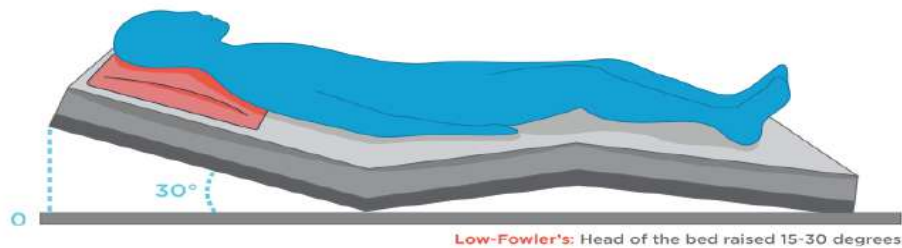
The patient is in semi-sitting position (45-60 degree) the knees either bent or straight

4- High Fowler's Position

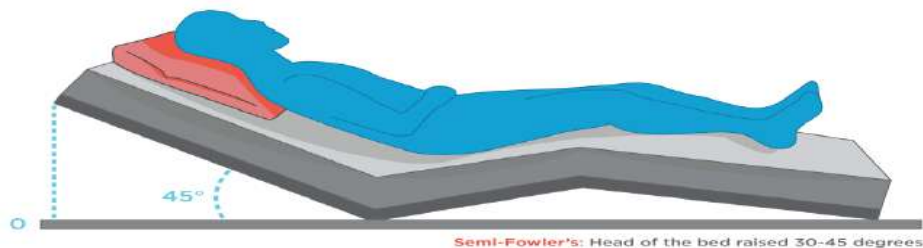
. The upper half of the patient's body is between 60 degrees and 90 degrees in relation to the lower half of their body. The legs of the patient may be straight or bent.



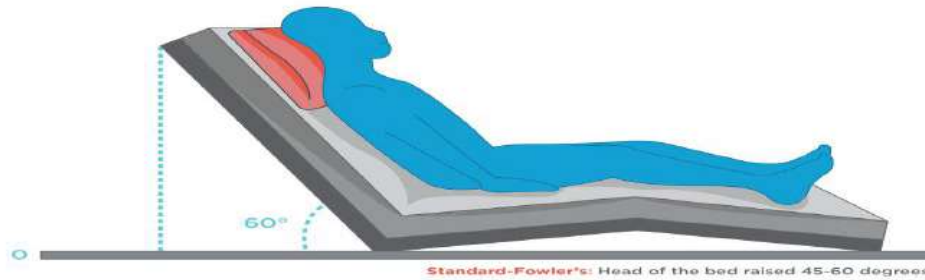
Low Fowler's: head of the bed raised 15-30 degrees



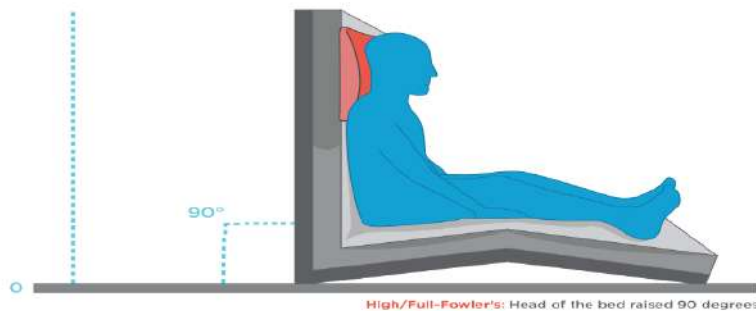
Semi Fowler's: 30-45 degrees



Standard Fowler's 45-60 degrees



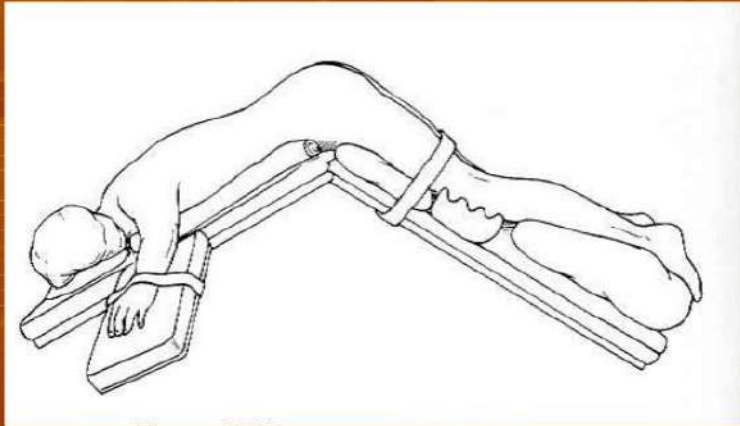
High/Full Fowler's position 90 degrees



Jackknife Position

Jackknife position, also known as Kraske, is similar to Knee-Chest and is often used for colorectal surgeries. This position places extreme pressure on the knees. While positioning, surgical staff should place extra padding for the knee area.

Jack knife position



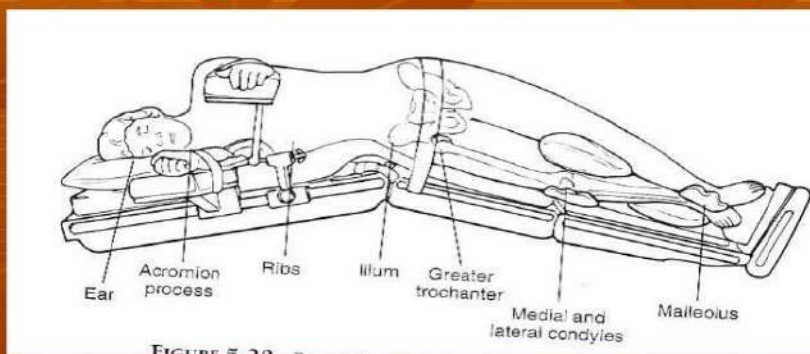
April 26, 2008

60

Kidney Position

The kidney position resembles lateral position, except the patient's abdomen is placed over a lift in the operating table that bends the body to allow access to the retroperitoneal space.

Lateral position with kidney bridge

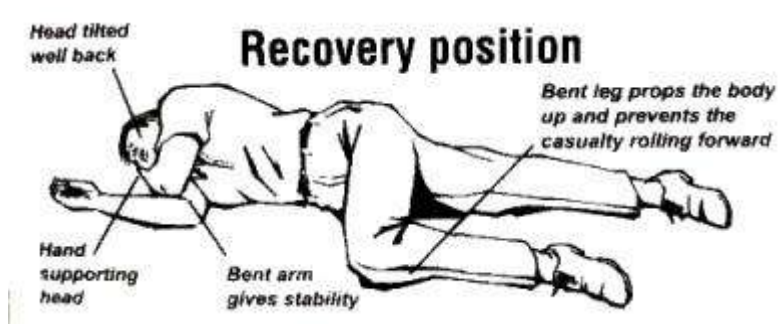
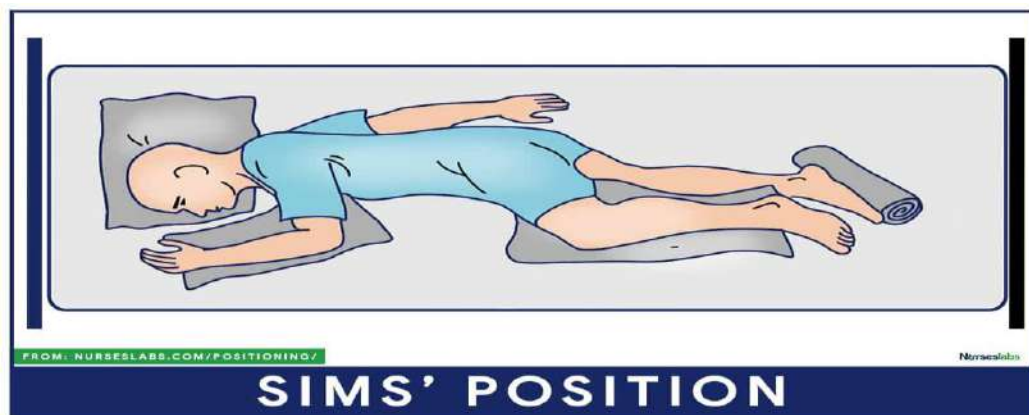


April 26, 2008

37

Sims' Position or semi prone position

when the patient assumes a posture halfway between the lateral and the prone positions. The lower arm is positioned behind the client, and the upper arm is flexed at the shoulder and the elbow. The upper leg is more acutely flexed at both the hip and the knee, than is the lower one.



Some Notes:

- ❖ Prior to achieving any surgical position, the patient must be transferred onto the operating room table. The final position of the patient is of the utmost importance, but achieving these positions requires careful planning and coordination by the operating room team. The overall plan for each patient transfer should be discussed prior to any movement. Frequently, the patient can assist in positioning prior to induction of anesthesia. However, under general anesthesia, the operating room team must carefully move and position each patient.
- ❖ **In supine position**, poor positioning of upper limb leading to nerve traction and compression. Poor positioning of upper limb leading to nerve traction and compression. The classic supine position leads to loss of the natural lumbar lordosis and this is associated with postoperative low back pain
- ❖ **Complication of trendelenburg position:** increase intracranial pressure and intraocular pressure, as well as increased facial/laryngeal edema which can lead to post airway obstruction (consider using the air leak test in these patients). FRC and pulmonary compliance are reduced by the dislocated viscera.
- ❖ **Complication of prone position:** increased intra-abdominal pressure and increased bleeding, abdominal compartment syndrome , limb compartment syndrome, nerve palsies, pressure sores, cardiovascular compromise, thrombosis and stroke, hepatic dysfunction, postoperative vision loss, oropharyngeal swelling.



تفدير عملي

محاضرة 17

MR_TOFE



MR_TOFE



Lec 17

Pre-operative visit

Physical examination:

History & physical examination complement one another, the examination helps detect abnormalities not apparent from the history, while the history helps focus the examination on the organ systems that should be examined closely

General physical examination including :

- 1- vital sign (blood pressure, heart rate, respiratory rate & temperature)
- 2- assessment of the general condition of the patient (if he is anemic, jaundice, pale, cyanosed, or if he is in pain)
- 3- Body mass index (BMI) is a common role for deciding whether a person has an appropriate body weight. It measures a person's weight in relation to their height.

Body Mass Index (BMI) is a person's weight in kilograms divided by the square of height in meters

According to the National institute of Health (NH)

- A BMI of less than 18.5 means that a person is underweight.
- A BMI of between 18.5 and 24.9 is ideal.

- A BMI of between 25 and 29.9 is overweight.
- A BMI over 30 indicates obesity.

4- systemic examination of cardiovascular system, respiratory system, gastrointestinal system, nervous system

An abbreviated neurological examination is important when regional anesthesia is being considered

The patient's anatomy should be specifically evaluated when procedures such as nerve block, regional anesthesia or invasive monitoring procedure are planned.

The important examination of the airway , the patient dentition should be inspected for loose or chipped teeth &, bridges or dentures, prominent upper incisors, a large tongue, limited range of motion of tempromandibular joint or cervical spine, or a short neck suggests that difficulties may be encountered in endotracheal intubation

Assessment of risk of surgery:

ASA PHYSICAL STATUS CLASSIFICATION SYSTEM

- It's a system for assessing the fitness of cases before surgery .
- In 1963 the **American Society of Anesthesiologists (ASA)** adopted the five-category physical status classification system; a sixth category was later added.

There are few patients who have no risk for surgery and it is important to quantify the risk involved so they be discussed with the patient. The American Society of Anesthesiologist, classify patients according to the risk of operation into 6 classes:

- ASA class I: including a normal healthy individual who have no organic, physiologic, or biochemical disturbance.
- ASA class II : patient with mild to moderate disease that doesn't limit activity (e.g. Patient with anemia, obesity, mild hypertension)
- ASA class III : patient with sever systemic disease that limit activity but not incapacitating him (e.g. poorly controlled hypertension, Diabetes Miletus with vascular complication, angina pectoris, chronic pulmonary disease)

- ASA class IV: severe systemic disease that is life-threatening (e.g. new myocardial infarction, advanced pulmonary, renal or hepatic dysfunction)
- ASA class V: moribund patient not expected to survive 24 hrs. With or without operation (e.g. ruptured abdominal aneurysm, cerebral trauma, pulmonary embolism). These patients have little chance of survival and the surgery is considered as the last chance of survival (resuscitation effort)
- ASA class VI: include patient with brain-dead whose organs are being removed for donor purposes.

If the operation is an emergency, the physical status class is usually followed by the letter E.

This classification is very simple and widely accepted. About 50% of patients presenting for elective surgery are in ASA class 1 and the mortality rate for these patients is less than 1 in 10,000.

Full Name : Sex: M / F Age: Years

Preop Assessment

Date of the visit / / 20

Diagnosis pre-op: Planned procedure :

Previous surgical procedures / severe trauma :

1. year :
2. year :
3. year :

Previous anesthetics : None / LA - GA - RA

Adverse reaction to anesthesia : None /

Obstetrical history : pregnancy O / N - Gravity : ... Parity ... ; children alive

Blood transfusion history : No ; Yes incident ?

Medical History :

- | | | | |
|--|-----------------------------------|--|---------------------------------------|
| <input type="checkbox"/> Hypertension | <input type="checkbox"/> Dyspnea | <input type="checkbox"/> Angina pectoris | <input type="checkbox"/> palpitations |
| <input type="checkbox"/> chronic pulmonary disease | <input type="checkbox"/> Asthma | <input type="checkbox"/> Diabetes (NIDDM/IDDM) | |
| <input type="checkbox"/> Jaundice | <input type="checkbox"/> Epilepsy | <input type="checkbox"/> paralysis | <input type="checkbox"/> Peptic ulcer |
| <input type="checkbox"/> Tabacco | <input type="checkbox"/> Alcohol | <input type="checkbox"/> TB | |
| <input type="checkbox"/> Other | | | |

Allergies: None / drugs / food / other :

Present medication:

Clinical Examination :

chest :

heart :

BP = / mmHg; Pulse /min; Respiratory rate /min; Temp °C

Weight: Size: Lumbar column :

Mallampati class : ... teeth :

Pregnancy : Y/N

Lab : Hb / Hct Blood Group A - B - AB - O Rhesus + / -

Other lab results:

Conclusions and anesthetic plan

ASA I / II / III / IV - U Planned anesthesia technic : LA / RA / GA - / GA

Planned transfusion : N / O Volume UI / ml; Auto transfusion: N / O

☐ information to the patient ☐ patient consent

☐ fasting (food) from : h ☐ fasting clear water from: h

☐ last breast feeding at h

☐ i.v. fluid resuscitation

☐ Premedication:; dose :; at h Given ☐

Remarks

Anesthetist



I



II



III



IV

The **Mallampati score** has been used for many years to identify patients at risk for difficult tracheal intubation. The **classification** provides a **score** of 1-4 based on the anatomic features of the airway seen when the patient opens his or her mouth and protrudes the tongue (see the image below).

٢٠٢٠/٠٩/١٥



The anesthetic plan: An anesthetic plan should be formulated that will optimally accommodate the patients. The anesthetic plan include:

1. Premedication
2. Type of anesthesia
3. Intraoperative management
4. Post-operative management

Pre-anesthetic medication:

It is the term applied to the administration of drugs prior to the general anesthesia so as to make anesthesia safer for the patient and to minimize adverse effects of anesthesia. The aims of pre-medication are:

- 1- Relief anxiety and apprehension preoperatively and facilitate smooth induction of anesthesia and potentiate the action of anesthetic drug so less dose is needed
- 2- . Reduce postoperative nausea and vomiting
- 3- Reduce salivary and bronchial secretions;
- 4- - Produce analgesia before surgery and provide a background of analgesia during operation and early postoperative period.
- 5- - Produce amnesia.
- 6- Reduce volume and increase the pH of gastric acid secretion and prevent aspiration.
- 7- to reduce the undesirable vagal reflexes e.g. severe bradycardia.
- 8- Maintain hemodynamic stability.

Premedication is usually given intramuscularly 1-3hr. pre-operatively and also can be given orally at the night before operation.



تفدير عملي

محاضرة 18

MR_TOFE



MR_TOFE



Premedication

It is a term used for drugs which are given to patient before anesthesia . Its purpose is to facilitate the induction and maintenance of, and the recovery from anesthesia.

Reasons for administration

1. Reduction of fear and anxiety before anesthesia and operation.
 2. Reduction of secretion of saliva
 3. Prevention of undesirable reflexes, e.g. cardiac dysrhythmia due to (a) drugs such as volatile agents or scoline ;or (b) Afferent impulses from the eye ,perineum or abdomen ;or post operative vomiting.
 4. As part of anesthetic technique, e.g. narcotic analgesics provide analgesia and reduce the possibility of awareness during light anesthesia.
 5. To produce amnesia. This may be retrograde(loss of memory of events prior to drug administration) or anterograde (following drug administration)
-

Drugs used:

- Anticholinergic agents; Atropine, hyoscine and glycopyrronium.
- Sedatives e.g; barbiturates, benzodiazepines, phenothiazines.
- Narcotic Analgesics Opium and its derivatives; morphine ,pethidine ,codeine
- Neuroleptic Agents such as droperidol (dehydrobenzperidol).
- Amnesic drugs e.g; hyocine.
- antiemetic

Route of administration :

1. orally
2. intramuscular
3. intravenous
4. intranasal
5. dermal

Factor to be considered before premedication

1. Patient's Physical status
2. Age
3. Level of anxiety and pain
4. Type of Surgery
5. Time of surgery
6. History of drug allergy , nausea , vomiting

Anxiolytics , sedation and amnesia :

Careful discussion of the patient's concerns is essential, including the pre-operative assessment.

Sedation is a ranging from minimum anxiolytic to a state of deep sedation but not including G A .

Drugs Used For Sedation

1. Benzodiazepines : are the usual agents used as they provide anterograde amnesia, relief of anxiety and light sedation. If given orally 1-2 hours before surgery they have only a small effect on cardiorespiratory function but large doses can result in delay recovery.

In day-case surgery, short-acting benzodiazepines (eg, temazepam) are often preferred. Temazepam is given orally, the dose is 20-40 mg.30-60 min. before surgery

Lorazepam is longer acting and effective for amnesia. 2 mg i.m.

Midazolam is also commonly used, and is associated with a faster recovery time than diazepam,. Dose : 1 - 2.5 mg slow iv

Diazepam dose 5-10 mg orally. Its uses is not recommended for premedication in children.

2. Barbiturates : e.g.: phenobarbitone 30 mg. Orally
3. Promethazine 25 mg. i.m.

Factors limiting giving sedatives

1. Extremes of age.
2. Head injury
3. Minimal cardio- pulmonary reserve
4. Hypovolemia.
5. Full stomach.

Amnesia :

Especially in the young patient or those having repeated surgery. the most effective agent is Lorazepam and midazolam

Analgesia :

Analgesic drugs given pre-operatively reduce the preoperative acute severe pain also reduce the required dose of anaesthetic agent and provide postoperative analgesia .

Analgesic drugs used include : opioids, paracetamol, non-steroidal anti-inflammatory drugs (NSAIDs) ⁂

NSAIDs are commonly used, particularly in day surgery, unless there are contra-indications.

Opioids are usually the agents of choice in the presence of acute severe pain. Opioids also cause variable sedation and cardiorespiratory depression. All opioids can cause nausea and vomiting. Opioids may also precipitate bronchospasm or anaphylaxis.

1. Opioids drugs include :

Morphine 8-12 mg. i.m.

Pethidine 50-100 mg. i.m.

Fentanyl 0.05-0.1 mg. I.m. or i.v.

2. NSAIDs: eg ; diclofenac 50-70 mg. orally or IM

3. paracetamol 500 mg orally.

Anti-emetics:

Antiemetic drugs are used to reduce the incidence of postoperative nausea and vomiting (PONV)

ASPIRATION

RISK FACTORS FOR ASPIRATION

- 1) Emergency cases
- 2) Type of surgery
- 3) Recent meal
- 4) Pregnancy
- 5) Pain and stress

Preventative measure for nausea and vomiting :

1 - Fasting

2- Reduce gastric volume, and Increase gastric PH : this is done by :

- a) H2 receptor antagonist eg. Ranitidine 150-300 mg. orally or famotidine 20-40 mg. Orally given at the night of operation

- b) Proton pump inhibitor e.g. omeprazole 20-40 mg, given 3-4 hrs. preoperatively.
- c) Antacid such as sodium citrate 15-30 minutes before induction.

3- Increase gastric motility

Metoclopramide 10 mg. given i.m. used as anti-emetic and as prokinetic gastric emptying agent prior to emergency operation.

Domperidone 10 mg. Orally also can be used.

Anti –salivary and Anti-vagal effect:

Anticholinergic drugs are given to reduce salivary and bronchial secretion, and to reduce the undesirable vagal reflex (eg. Bradycardia, and hypotension.)

Atropine 0.5 mg. i.m.

Hyoscine 20 mg. i.m

Continuation and discontinuation of drugs before surgery :

CONTINUATION

•Beta blocker •Bronchodilators •Anti-epileptics

DISCONTINUATION

MAO-inhibitors •Anti-coagulants •Oral hypoglycemic . Aspirin .oral contraceptive .



تفدير عملي

محاظرة 19

MR_TOFE



MR_TOFE



Intravenous therapy

Fluid Balance:

The healthy may have a daily water of 2600 ml (1100 ml in food and 1500 ml as drink). An output of 2600 ml may consist of 1500 ml as urine, 100 ml in faeces, 400 ml from the lungs and 600 ml via the skin. The healthy kidney can concentrate the 24-h excretory products into 500 ml with specific gravity as high as 1032. Fluid control in the postoperative patient is delicate balance between dehydration and water logging. Balance is easily achieved in the younger patient but is difficult in the elderly. The young are often run too dry and the old too wet.

Deficit:

Fluid losses may be increased in many circumstances in hot climates the insensible loss may be as high as 2000 ml in 24 h. losses are also increased with diarrhea, vomiting, paralytic ileus, intestinal fistula and cholera. Clinical signs of dehydration occur when 6% of body water has been lost and in severe dehydration 10% may have been lost.

Diagnosis on clinical and laboratory evidence:

Clinical thirst, dryness of mouth (because of scantiness of saliva) and oliguria. Thirst is more characteristic of fluid than of salt depletion. Loss of skin elasticity, sunken eyes.

Laboratory: raised blood urea, hemoglobin, haematocrit and plasma proteins. High specific gravity of urine with decrease output. Raised plasma osmolarity above 300 mosmol/kg

Treatment: abnormal loss of fluid should be replaced by an equal volume of fluid of the same electrolyte composition to that lost. In addition to the normal fluid requirements of the body. In exceptional cases as much as 6 liters a day may be necessary e.g intestinal fistula.

Prophylactic: use of an intravenous drip during operation.

Curative water by mouth, rectum, vein or hypodermoclysis . isotonic fluids infused i.v include physiological saline, Hartman's solution, and 5% glucose. It is common practice to administer 500 ml 4-hourly, 1 unit of physiological saline to 2 units of isotonic glucose.

Important point about intravenous fluid:

1. Intravenous fluid must be clear, if any haziness or particulate matter present the bottle should be kept for inspection and the batch should be checked by the pharmacy.
2. When drug is added to the bag or bottle of intravenous fluid they must be thoroughly mixed. It is more difficult to mix solution in plastic than glass containers. Rarely should more than one drug be added to the same infusion.
3. Many of the formulations of drugs for intravenous injection or infusion contain stabilizers, preservatives, solubilisers or unusual solvents and these materials are often the cause of unexpected incompatibility. Incompatibility can occur without a precipitate forming.
4. The position of intravenous cannula should be checked before an infusion started.

Type of intravenous fluid:

- 5% dextrose contains 5 g of dextrose in each 100 ml of water. It is isotonic with plasma and has a pH of 4.55 (an acid load of 0.28 mmol/l). It is suitable for diluting drugs to be given by intravenous infusion except those that are labile such as the penicillins and amphotericin B. The dextrose is metabolized leaving the free water.

5% dextrose is the fluid of choice for patients who are likely to retain sodium or who are at risk of heart failure. During the first 24 h after surgery, sodium retention is common and 5% dextrose

should account for most of intravenous fluids.

- 0.9% or 'normal' saline: contains 0.9 g of sodium chloride in each 100 ml of water or 150 mmol/l of sodium and chloride. It has a pH of 4 (an acid load of 0.8 mmol/l) it is (normal) in the physiological sense of being isotonic with extracellular fluid , not in the chemical sense of 1 mole/l.

an average patient require 70-100 mmol of sodium each day or approximately 500 ml of 0.9 % saline. In addition any gastro-intestinal losses such as nasogastric aspirate should be replaced by saline.

- Hartmann's solution (Ringer lactate) was designed to replace extracellular fluid losses and has a similar electrolyte content – sodium 131mmol/l potassium 5 mmol/l, calcium 2 mmol/l , chloride 112 mmol/l and lactate 28 mmol/l but does not have the colloid osmotic effects to replace plasma. The lactate is included as bicarbonate source but its metabolism may be delayed by hypovolaemia and other shock state, hypoxia or sever liver disease.

The high electrolyte content makes it unsuitable for routine use as the sole intravenous fluid in the postoperative patient.

- Dextrose/ saline: some anesthetists favour the use of compromise solution of 0.18 % sodium chloride in 4 % dextrose for infusion in the postoperative period. This combination is isotonic and gives 30 mmol/l of sodium, 30 mmol /l chloride and 40.0g of anhydrous dextrose leading to approximately 150 cal/l.
- 8.4% Sodium Bicarbonate: contains 1 mmol/ml of both sodium and bicarbonate. It is used for the correction of acute metabolic acidosis but must be used with care because:
 1. It can cause fluid to shift from the intracellular to the extracellular component and may precipitate pulmonary edema.
 2. It can cause a hyperosmolar state.
 3. It can precipitate a cardiac arrest by unmasking hypokalaemia in the potassium deficient patient.
 4. A profound metabolic alkalosis may occur after organic acids have metabolized.

For these reasons it is best to give it in 50 ml aliquots with estimation of the patient's acid-base status by arterial blood sampling before and after each aliquot. It is not necessary to completely correct acidosis. Correction to a pH greater than 7.2 is all that is usually required



ANESTHESIA.I

(THEORY)

LEC:

د. نزار

عبدالكریم

Morphine Group: opioid analgesic

Injection: 10 mg in 1-ml ampoule Tablet: 10 mg (sulfate or -hydrochloride)

General information معلومات عامة

It is the most potent of the narcotic analgesics and a dangerous drug of addiction. It is extensively absorbed following oral administration but parenteral administration produces a more reliable and more rapid response. It is largely metabolized in the liver and subsequently excreted in the urine. Its supply is controlled under Schedule I of the Single Convention on Narcotic Drugs,

Uses

- 1- Preoperative management of severe pain.
- 2- Premedication prior to general surgery.
- 3- in combination with inhalational agents during major surgery
- 4- Postoperative analgesia.

Dosage and administration

فأال:



Adults: 150-200 micrograms/kg i.m. or subcutaneously 1 hour before operation. Children: 50-100 micrograms/kg as above

Contraindications

- 1- Bronchial asthma, emphysema or heart failure
- 2- Increased intracranial pressure, head injury or brain tumor.
- 3- Severe hepatic impairment,
- 4- Convulsive disorders, acute alcoholism



Precautions

Vital signs must be monitored regularly in the immediate postoperative period when morphine is administered during anaesthesia since respiratory depression may persist for several hours.

To reduce risk of dependence, opioids should not normally be used for postoperative analgesia for longer than 7 days.

.



Use in pregnancy



Morphine should be used during pregnancy only when the need because its use during labour may produce respiratory depression in the infant, who may require administration of naloxone, 10 micrograms/kg i.m., immediately after birth.

ولادة

Adverse effects

1-  respiratory depression;

2- anorexia, nausea, vomiting and constipation;

3- euphoria, dizziness, drowsiness and confusion; 4- dry mouth and spasm of the urinary and biliary tract; 5- hypotension, bradycardia and palpitations.

6- Prolonged administration may result in physical dependence.


جرعة زائدة Over dosage

Serious over dosage is characterized by respiratory depression, and pinpoint pupils. Cardiovascular collapse and cardiac arrest are terminal events.

Serious over dosage is characterized by respiratory depression, and pinpoint pupils. Cardiovascular collapse and cardiac arrest are terminal events. Supportive therapy includes mechanically assisted ventilation and administration of fluids to maintain the circulating blood volume, naloxone (200 micrograms i.v.), should be administered, as necessary, at 2-minute intervals.

Supportive therapy includes mechanically assisted ventilation and administration of fluids to maintain the circulating blood volume, naloxone (200 micrograms i.v.), should be administered, as necessary, at 2-minute intervals.
 يميز الجسم المفرط بالجرعة بالاختناق التنفسي وتحديد التلاميذ. انهيار القلب والأوعية الدموية.
 ويسمى العلاج الداعم التنفسي الميكانيكية وإعطاء السوائل للحفاظ على حجم الدم المنتشر،
 وينبغي إعطاء النالوكسون (200 ميكروغرام في الوريد) ، حسب الضرورة ، كل دقيقتين.

Pethidine بيثدين

 **Pethidine** Group: opioid analgesic **Injection: 50 mg in 1-ml ampoul**
 المجموعة: المسكنات الأفيونية Group: opioid analgesic

Tablet: 50 mg (hydrochloride) () :

General information معلومات عامة

Pethidine is a synthetic narcotic analgesic that competes for the same drug receptors as morphine in the central nervous system. It is a dangerous 1961. of addiction. Its supply is controlled under Schedule I of the Single . 1961 Convention on Narcotic Drugs,

Pethidine has shorter duration of action than it is well absorbed orally but parenteral administration is more effective. It is largely metabolized in the liver and are excreted in the urine.

مدة تأثير البيثيدين أقصر من. يمتص بشكل جيد عن طريق الفم ولكن الإعطاء بالحقن أكثر فعالية. يتم استقلابه إلى حد كبير في الكبد ويتم إفرازه في البول.

✓ Uses ✓ Uses

- 1- Preoperative management of musculoskeletal and visceral pain.
- 2- Premedication prior to general anaesthesia.
- 3- An adjunct to inhalational and other anaesthetic agents during major surgery.
- 4- Postoperative and obstetric analgesia.
- 5- In combination with diazepam, and in the absence of other agents, for reduction of fractures and other minor interventions.

1- التدبير العلاجي قبل الجراحة لآلام العضلات والعظام والأمعاء.

Dosage and administration

2- تخدير قبل التخدير العام.

Adults: 50-100 mg i.m. or subcutaneously 1 hour before induction.

Children: 1 mg/kg i.m. or subcutaneously 1 hour before induction.

5- بالاشتراك مع الديازيبام وفي حالة عدم وجود عوامل أخرى لتقليل الكسور وغيرها من التدخلات البسيطة.

Dosage and administration الجرعة وطريقة الاستعمال



Dosage should be reduced in elderly patients and those with cardiorespiratory disease. .

Contraindications (same as morphine)

- 1- Bronchial asthma, emphysema or heart failure secondary to chronic lung disease.
- 2- Increased intracranial pressure, head injury or brain tumor.
- 3- Severe hepatic impairment, adrenocortical insufficiency, hypothyroidism.
- 4- Convulsive disorders, acute alcoholism,

Use in pregnancy

Pethidine should be used during pregnancy only when the need outweighs any possible risk to the fetus. Its use during labor may produce respiratory depression in the infant, who may require administration of naloxone 10 micrograms/kg i.m. immediately after birth.



Adverse effect

- 1- respiratory depression
- 2- nausea and vomiting,
- 3- drowsiness and confusion.

4- hypotension, bradycardia and palpitations.

6- Physical dependence may occur with prolonged administration.

Over dosage

Serious over dosage is characterized by respiratory depression, and pin-point pupils. Cardiovascular collapse and cardiac arrest are terminal events. Supportive therapy includes mechanically assisted ventilation and administration of fluids to maintain the circulating blood volume., naloxone (200 micrograms i.v.) should be administered, as necessary, at 2-minute intervals.

therapy includes mechanically assisted ventilation
 يتميز الجسم المفرط بالجرعة بالاكنتاب التنفسي وتحديد التلاميذ. انهيار القلب والأوعية الدموية
 والسكتة القلبية هي أحداث نهائية. يشتمل العلاج على إعطاء النالوكسون (200 ميكروغرام في الوريد) ،
 للحفاظ على حجم الدورة الدموية ، وينبغي إعطاء النالوكسون (200 ميكروغرام في الوريد) ،
 حسب الضرورة ، كل دقيقتين.

2- i.v.) should be administered, as necessary, at

Group: opioid ● Naloxone minute intervals

antagonist

Injection: 0.4 mg (hydrochloride) in 1-ml ampoule

Group: opioid antagonist المجموعة: مناهضات أفيونية المفعول


Injection: 0.4 mg (hydrochloride) in 1-ml ampoule

حقنة: ٠.٤ ملغم (هيدروكلوريد) في أمبولة سعة ١ ميليلتر

General information


Naloxone is a semisynthetic opioid antagonist that competes with opioid analgesics for specific receptor sites in the central nervous system. Its effect occurs within 1-2 minutes of intravenous administration.

Uses

 To counteract respiratory depression induced by opioids administered during anaesthesia or by opioid over dosage.

.

Dosage and administration

 Adults: 200 micrograms i.v. repeated, as necessary, at 2-minute intervals to a maximum of 10 mg..

.. البالغون: 200

Adverse effects

Unnecessarily high doses may cause hypertension and tachycardia.

 Transient nausea, vomiting, sweating, tachycardia,

.



تخدير نظري

محاضرة 1



MR_TOFE



MR_TOFE



Al – Noor University College

Department of anesthesiology

المرحلة / الثانية

محاضرة تخدير (1)

د. نزار الحياي

Introduction to anesthesia

What is anaesthesia?

It is defined as relief of pain during operation and post-operative day, and to provide an optimal operative condition for both patient and surgeon so that to keep the patient alive.

History of anesthesia :

The specialty of anesthesia began in the mid-nineteenth century and became firmly established in the following century.

Ancient civilization had used opium poppy. Coca leaves, mandrake root, alcohol, and even phlebotomy (to the point of unconsciousness) to allow surgeon to operate.

Ancient Egyptians used the combination of opium poppy (containing morphine) and hyoscyamus (containing scopolamine) for this purpose.

Regional anesthesia in ancient time consist of compression of nerve trunks (nerve ischemia) or the application of cold (cryoanalgesia) . the Incas may have practiced local anesthesia as their surgeon chewed coca leaves and applied them to the operative field.

Inhalation anesthesia : Because the hypodermic needle was not invented until 1955,the first general anesthetic was given by inhalation. Diethyl ether (known at the time as sulfuric ether,(because it was produced by a simple chemical reaction between alcohol and sulfuric acid) was used as anesthetic for human being On October 16, 1846,by Boston dentist, William

T.G. Morton . used sulfuric ether to anesthetize a man who needed surgery to remove a vascular tumor from his neck, Morton started buying ether from a local chemist Satisfied with its safety and reliability, he began using ether on his dental patients, but quickly perceived that ether was good for far more than pulling teeth

First Surgical Procedure Using Anesthesia



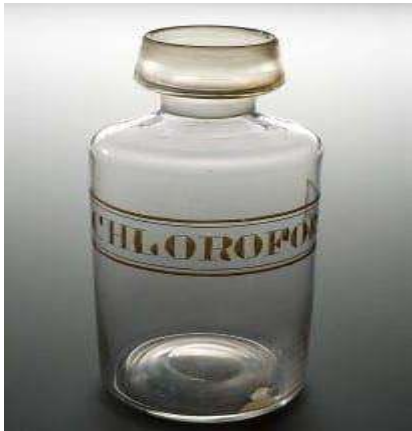
FIRST AMERICAN PROCEDURE USING ANESTHESIA: Illustration of dentist William T.G. Morton & surgeon John Warren giving anesthesia to patient on October 16, 1846.



WILLIAM T.G. MORTON: Boston dentist

In Scotland in 1847, obstetrician Professor James Y. Simpson starts giving women chloroform to relief the pain of childbirth “Chloroform quickly becomes a popular anesthetic for surgery and dental procedures

, Dr. Snow popularizes obstetric anesthesia by chloroforming Queen Victoria for the birth of Prince Leopold (1853) and Princess Beatrice.



chloroform

Ether and Chloroform were the first drugs to make inhalational anaesthesia possible. Ether was used first, but Chloroform was easier to administer.; but its use ended in 1900's due to cardiac irritability and hepatic damage Ether then regained popularity. They were usually given by open drop onto wire frames, but machines not unlike those in use now were made by Boyle in the 1920's.

Halothane, the first potent volatile agent was first use in 1956; Isoflurane in the 1980's.

Nitrous Oxide was first 'abused' by travelling entertainers; then in 1890's successfully used for dental extractions and anesthesia by "Dr. Edmund Andrews proposes using nitrous oxide mixed with oxygen as an anesthetic in the Chicago Medical Examiner."

The next major advance was the introduction of local anaesthesia - cocaine - in 1877. Then came local infiltration, nerve blocks and then spinal and epidural anaesthesia

Spinal anaesthesia became popular as an alternative to ether, but suffered in the late 1930's when several patients became paraplegic. Now spinal and epidural anaesthesia are much more common.

The next important innovation was the control of the airways with the use of tubes placed into the trachea. This permitted control of breathing and techniques introduced in the 1910s were perfected in the late 1920s and early 1930s.



HOLLOW HYPODERMIC SYRINGE:
barbiturates which enabled the patient to go off to sleep quickly, smoothly and pleasantly and therefore avoided any unpleasant inhalational agents.



THIOPENTAL: Became the first widely used intravenous anesthetic gas. Used primarily from late 1930s to 1950s.

1929: “The Anesthetists’ Dr. John S. Lundy, who will popularize use of the intravenous anesthetic thiopental (Pentothal)

Then in the 1940s and early 1950s, there came the introduction of muscle relaxants, firstly with curare (the South American Indian poison!) and then over subsequent decades a whole series of other agents.

In the mid-1950s came halothane, a revolutionary inhalational agent, which was much easier to use..

Anesthetists are now highly trained physicians who provide a whole range of care for patients - not just in the operating theatre. They are usually consulted in the preoperative period to optimize the patients’ condition and they usually run High Dependency and Intensive Care Units. They are involved in obstetric analgesia and anesthesia, emergency medicine in Accident and Emergency Departments, resuscitation, major accident care, acute and chronic pain management and patient transfers between hospitals.

Anesthesia is now very safe, with mortality of less than 1 in 250,000 directly related to anesthesia in most high income countries. Nevertheless, with today’s sophisticated monitoring systems and a greater understanding of bodily functions

Some definitions :

Conscious Sedation - sedation and anxiolysis with retention of consciousness at all times.

Unconscious ('deep') Sedation - sedation sufficient to induce sleep from which arousal to consciousness is easy

Neuroleptic Analgesia - analgesia, disinterest and psychomotor retardation typically induced by a combination of a major tranquilizer (e.g. droperidol) and a narcotic analgesic. Patient may appear calm but be anxious.

General Anesthesia -, reversible loss of consciousness and usually drug induced.

Local anesthesia - rendering a part of the body numb.

Topical anesthesia - anesthesia of skin or mucous membranes by topical application of local anesthetics.

Infiltration anesthesia - anesthesia of tissues by direct injection of local anesthetic where it is needed - i.e. for excision of skin lesions.

Regional anesthesia ('conduction blocks' or 'blocks') - anesthesia of a part of the body by injecting local anesthetic into the nerves that go there. Simple blocks include finger blocks, ankle blocks, etc.; more complex blocks include plexus blocks, and 'major regionals' mean epidural or spinal anesthesia.

What Anesthetists do?

Patients are usually seen by an anesthetist preoperatively in a pre-admission clinic.. The patient's health, pre-operative tests, and any specific concerns are reviewed in the context of the planned procedure.

Selecting the safest technique in the circumstances is important, and the details of that technique, including the management of post-operative pain, should be explained.

Common risks such as : (pain, nausea, sore throat, muscle aches, etc.) are rare and the management of the anesthetic problems is the responsibility of the anesthetist, not the surgeon.

The anesthetist stays with the patient from the time anesthesia starts until care is passed on to recovery staff, however their responsibility legally covers to the entire period from premedication until full recovery from the anesthetic.

Once the patient is asleep, the Anesthetist continuously monitors the adequacy of breathing and the circulation; additional monitoring is used in special circumstances

Anesthetists adjust the doses of the anesthesia-inducing drugs individually on a patient by patient basis. Subconscious hearing is preserved during most anesthetics. Fortunately memory is strongly impaired with small doses of anesthetics, so most people don't remember much from just before they go to sleep until sometime after they actually wake up

Anesthesia practice is a combination of technical skill, experience, and science;

At the end of the operation the anesthetic drugs are turned off or reversed, and once the patient is awake they will be transported to recovery, or ICU. The anesthetist will wait awhile to make sure the patient is OK. We arrange appropriate post-operative analgesia.

Anesthetists run most acute pain services and often have substantial input to ICU and the recovery room ..

Anesthesia alone in healthy patients has a mortality (due to unexpected drug reactions, haste, device malfunction, etc.) of 1:250,000.



تخدير نظري

محاضرة 2



MR_TOFE



MR_TOFE



Al – Noor University College

Department of anesthesiology

المرحلة / الثانية

محاضرة تخدير (2)

د. نزار الحياي

Anatomy and physiology of the respiratory system

The respiratory system is a biological system which consist of specific organs and structures used for gas exchange in human.

Structurally can be divided into:

- 1- Upper respiratory system : Nose, pharynx and associated structures
- 2- Lower respiratory system : Larynx, trachea, bronchi and lungs

Functionally Consists of the respiratory and conducting zones

1- Respiratory zone : Site of gas exchange. It consists of bronchioles, alveolar ducts, and alveoli

2- Conducting zone : Provides rigid structures for air to reach the sites of gas exchange , it Includes all other respiratory structures (e.g., nose, nasal cavity, pharynx, trachea)

Organs of Respiratory System:

Nose and nasal cavity. • Pharynx • Larynx • Trachea • Two bronchi • Bronchioles • Two Lungs

Nose And Nasal Cavities

The framework of the nose consists of bone and cartilage. Two small nasal bones and extensions of the maxillae form the bridge of the nose, which is the bony portion. The remainder of the framework is cartilage and is the flexible portion. Connective tissue and skin cover the framework.

Structure of the Nose

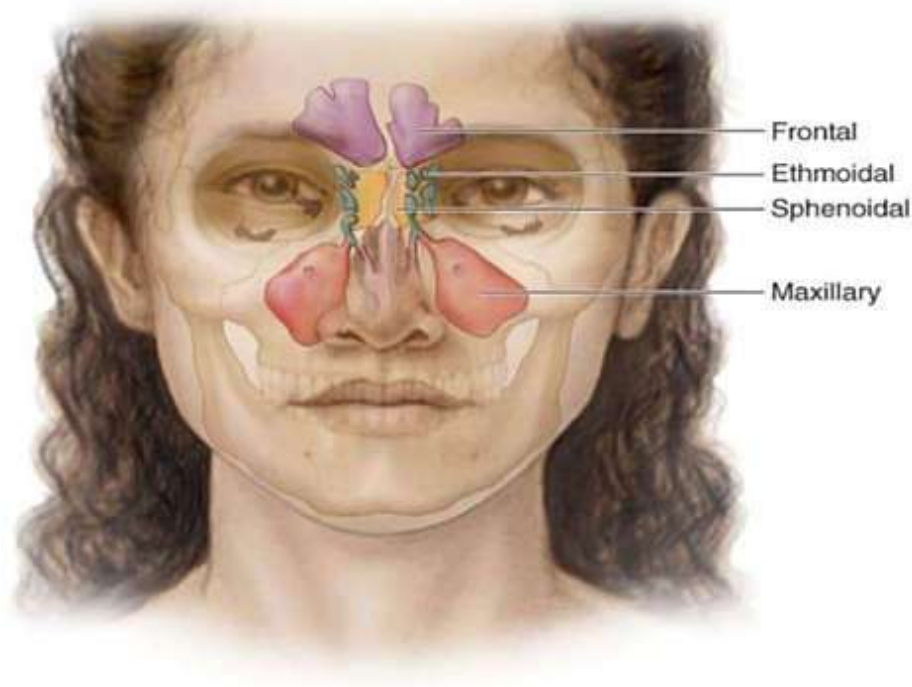


Chapter 22, Respiratory System

Figure 22.2a

Air enters the nasal cavity from the outside through two openings: the nostrils or external nares. The openings from the nasal cavity into the pharynx are the internal nares. Nose hairs at the entrance to the nose trap large inhaled particles.

Anteriorly consist of hyaline cartilage. The roof is formed by ethmoid bone The floor is formed by roof of the mouth. The medial wall formed by the septum. The lateral wall formed by the maxilla.



Respiratory function of the nose :

- 1- Warming of the air :- Due to the high vascularity of the mucosa.
- 2- Filtering and cleaning:- This occurs due to hairs which trap larger particles.
- 3- Humidification: - As air travels over the moist mucosa, it becomes saturated with water vapour.

Pharynx :

The pharynx is the part of the throat that is behind the mouth and nasal cavity and above the esophagus and the larynx. Length- 12-14cm (extends from the base of the skull to the level of 6th cervical vertebra.)

Position Superiorly-Base of the skull.

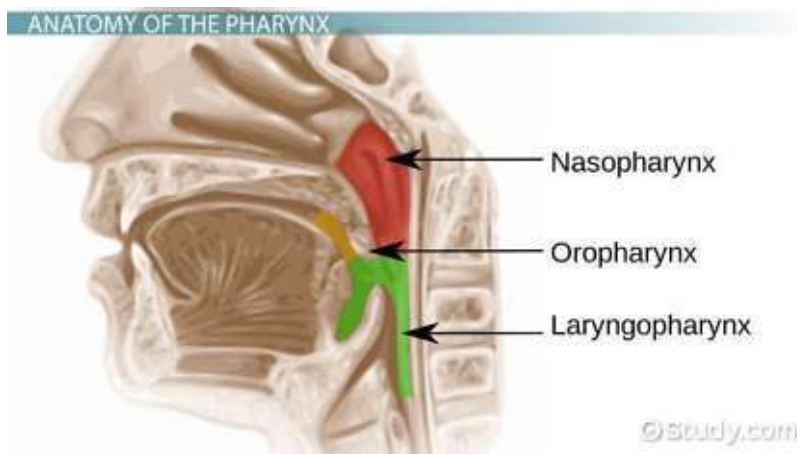
Inferiorly-Continuous with the oesophagus.

Anteriorly-Incomplete wall because of the nose, mouth and larynx opening.

Posteriorly-Areolar tissue & first 6 vertebra.

the pharynx is divided into three parts:

- 1- The nasopharynx The nasal part of the pharynx lies behind the nose. •
- 2- The oropharynx The oral part of the pharynx lies behind the mouth. •
- 3- The laryngopharynx The laryngeal part of the pharynx extends from the oropharynx.



Functions :

- 1- Passage way for air and food.

2- Warming and humidifying.

3-Taste. There are olfactory nerve endings.

4- Hearing. The auditory tube, extending from the nasopharynx to each middle ear.

5- Protection. The lymphatic tissue of the pharyngeal tonsils produces antibodies. •

Speech. Act as a resonating chamber for sound ascending from the larynx.

At the top of the nasopharynx are the pharyngeal tonsils, also called an adenoid,(is an aggregate of lymphoid tissue). The function of the pharyngeal tonsil is not well understood, but it contains a rich supply of lymphocytes and is covered with ciliated epithelium that traps and destroys invading pathogens that enter during inhalation. The pharyngeal tonsils are large in children, but tend to regress with age and may even disappear.

The uvula is a small, teardrop-shaped structure located at the apex of the soft palate. Both the uvula and soft palate move during swallowing, swinging upward to close off the nasopharynx to prevent ingested materials from entering the nasal cavity. In addition, auditory (Eustachian) tubes that connect to each middle ear cavity open into the nasopharynx. This connection is why colds often lead to ear infections.

Larynx :

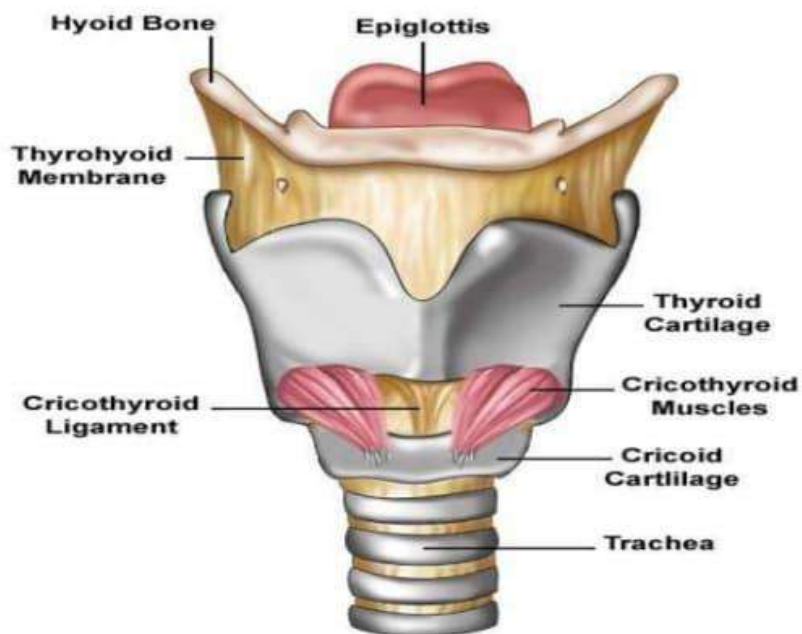
The larynx or voice box extends from the root of the tongue. • It lies in front of the laryngopharynx at the level of 3rd , 4th ,5th and 6th cervical vertebra. • Until the puberty there is little difference in the size of the larynx between the sexes. • It grows larger in the male.

The structure of the larynx is formed by several pieces of cartilage. Three large cartilage pieces

1- thyroid cartilage (anterior),

2-epiglottis (superior),

3-cricoid : The thick **cricoid cartilage** forms a ring, with a wide posterior region and a thinner anterior region.



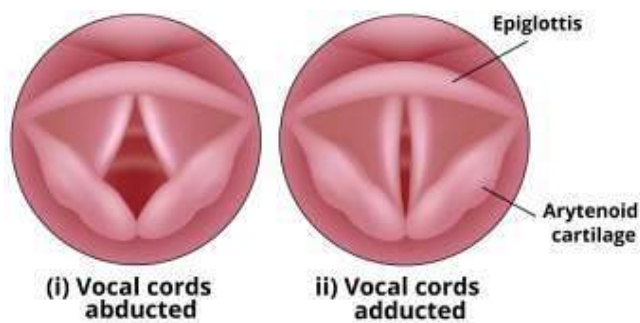
The larynx extends from the laryngopharynx and the hyoid bone to the trachea.

The epiglottis, attached to the thyroid cartilage, is a very flexible piece of elastic cartilage that covers the opening of the trachea

The **glottis** is composed of

1- A **vestibular fold**, or false vocal cord, is one of a pair of folded sections of mucous membrane.

2- A **true vocal cord** : white, membranous folds attached by muscle to the thyroid and arytenoid cartilages of the larynx on their outer edges. The size of the true vocal cords differs between individuals, producing voices with different pitch ranges. Folds in males tend to be larger than those in females, which create a deeper voice.



Functions :

1- Production of sound • Speech

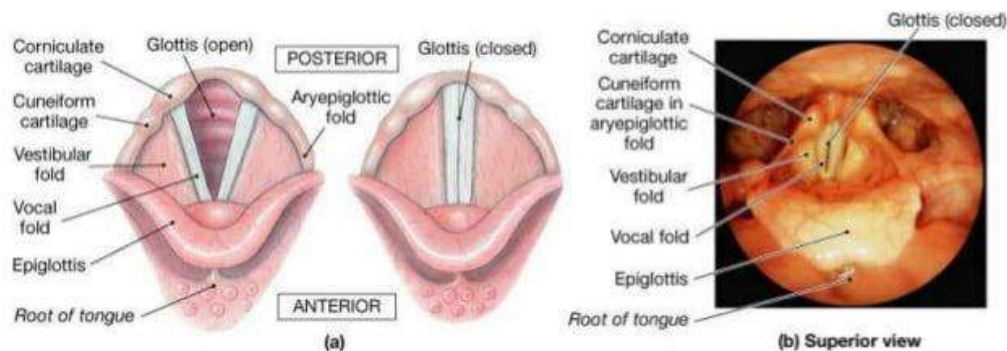
2- Protection of the lower respiratory tract : During swallowing the larynx moves upwards and hinged epiglottis closes over the larynx.

3- Passageway for air

4- Humidifying • Filtering • Warming

Glottis

- **Glottis** – a triangular slit opening containing between the true vocal cords. Its closure helps to prevent food or liquid from entering the trachea.





تخدير نظري

محاضرة 3



MR_TOFE



MR_TOFE



Al – Noor University College

Department of anesthesiology

المرحلة / الثانية

محاضرة تخدير (3)

د. نزار الحياي

Tracheobronchial tree :

The trachea begins at the lower border of the cricoid cartilage, extends to the carina.

It has average length of 10-13 cm.

It is composed of C-shaped cartilaginous rings, (16 to 20), which form the anterior and lateral wall of the trachea and are connected posteriorly by the membranous wall of the trachea .

The cricoid cartilage is the narrowest part of the trachea, with an average diameter of 17mm in man and 13 mm in women .

The trachea bifurcates in to right and left main stem bronchi at the level of the sternal angel

The right bronchus lies in a more linear arrangement with the trachea while the left bronchus lies in a more angular form with the trachea .

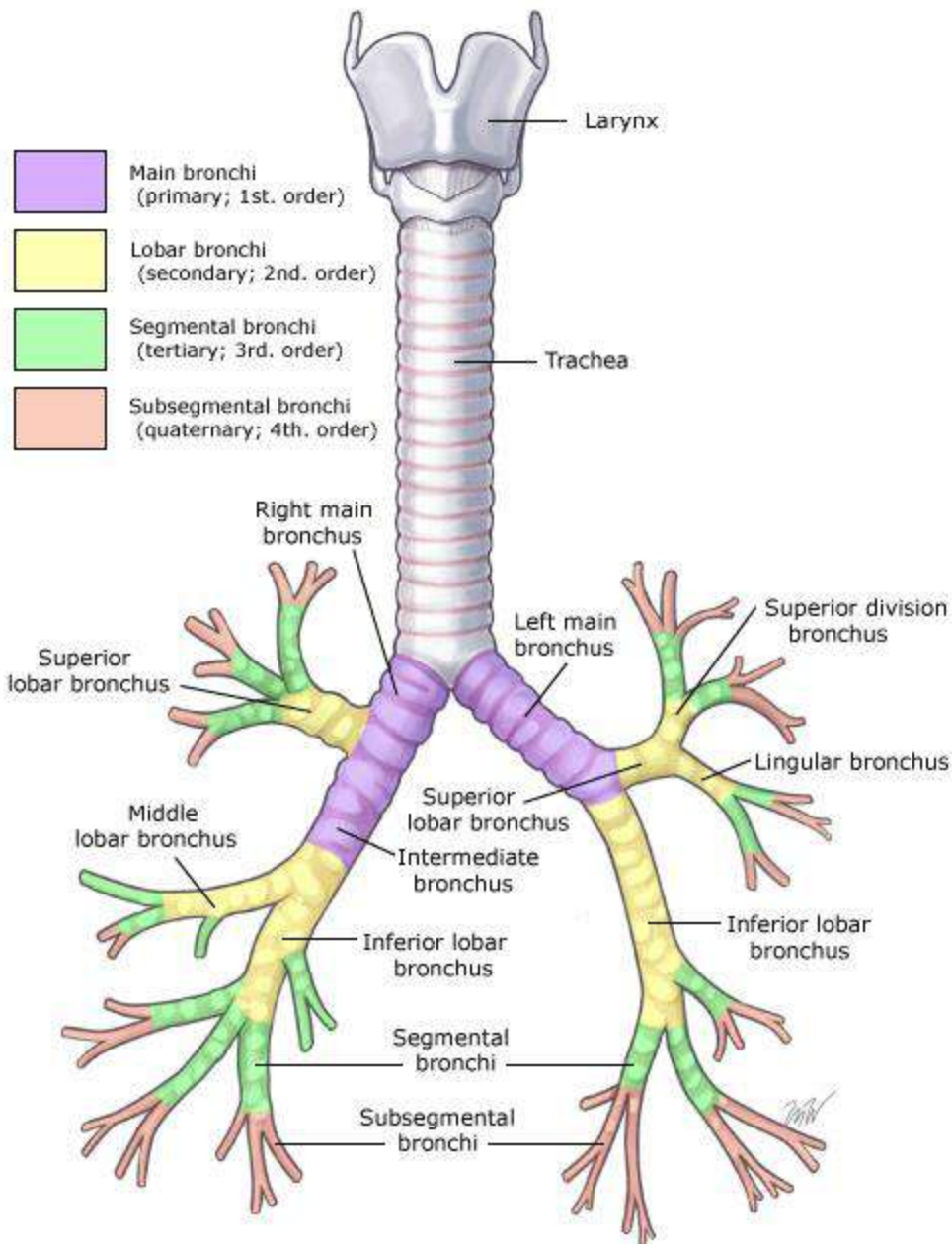
The right main bronchus continue as the bronchus intermedius after the take- off the right upper lobe bronchus.

The left main bronchus is longer than the right main bronchus .the left main bronchus divides into left upper lobe bronchus and the left lower lobe bronchus .

Humidification and filtering of inspired air are function of the upper airway (nose, mouth, and pharynx).

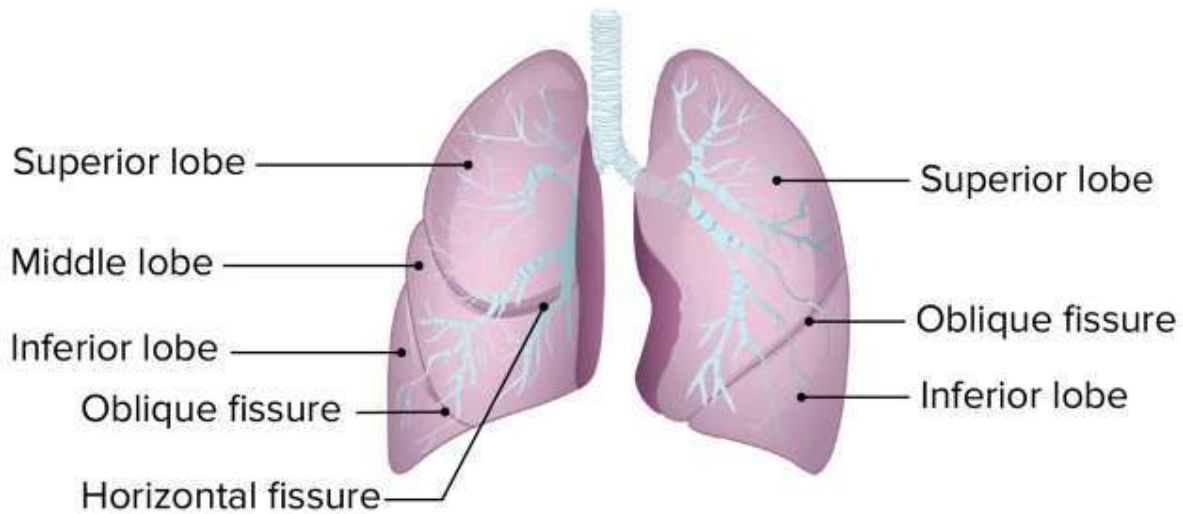
The tracheobronchial tree serves to conduct gas flow to and from the alveoli . each bronchus divided into two smaller branches , starting from the trachea and ending in the alveolar sacs, is estimated to involve 23 divisions.

A **bronchiole** branches from the tertiary bronchi. Bronchioles, which are about 1 mm in diameter, further branch until they become the tiny terminal bronchioles, which lead to the structures of gas exchange.



Lungs :

The lungs are paired, cone-shaped organs .Their role is to take oxygen into the body, to help us get rid of carbon dioxide,. We have two lungs, a left lung and a right lung. These are divided up into 'lobes', by 'fissures'. The right lung has three lobes but the left lung has only two, The lungs can also be divided up into even smaller portions, called 'bronchopulmonary segments' .



Alveoli : Each alveoli is in close contact with a network of pulmonary capillaries . gas exchange occurs primarily on the thin side of the alveolocapillary membrane

Pleura : The pleura consists of a closed sac of serous membrane, one for each lung which contains a small amount of serous fluid. • The lung is invaginated or pushed into this sac. • It forms two layers: (i)The visceral pleura (ii)The parietal pleura •

1- The visceral pleura :This is adherent to the lung, covering each lobe & passing into the fissures that separate them. •

2- The parietal pleura: This is adherent to the inside of the chest wall & the thoracic surface of the diaphragm.

The pleural cavity: The two layers of pleura are separated by a thin film of serous fluid which allows them to glide over each other. • Preventing friction between

them during breathing. • The serous fluid is secreted by the epithelial cells of the membrane

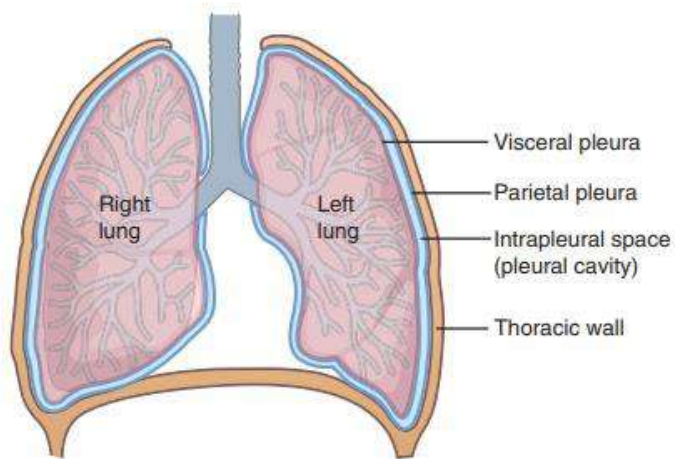


FIGURE 21-7 The lungs reside in the pleural cavities, subdivisions of the thoracic cavity. They are lined with a serous membrane called the pleura. The intrapleural space is located between the visceral and parietal pleura.

RESPIRATION: The term respiration means the exchange of gases between body cells and the environment.

Breathing or pulmonary ventilation: This is movement of air into and out of the lungs. • • Breathing supplies oxygen to the alveoli, and eliminates carbon dioxide.

Exchange of gases: This takes place:

- 1- In the lungs: external respiration.
- 2- In the tissues: internal respiration.

Muscles Of Breathing:

Expansion of the chest during inspiration occurs as a result of muscular activity, partly voluntary and partly involuntary. • The main muscles used in normal quiet breathing are the INTERCOSTAL MUSCLES and the DIAPHRAGM. • During difficult or deep breathing they are assisted by muscles of the neck, shoulders and abdomen.

Intercostal Muscles:

There are 11 pairs of intercostal muscles that occupy the spaces between the 12 pairs of ribs. • They are arranged in two layers, the external and internal intercostal muscles • The first rib is fixed. • Therefore, when the intercostal muscles contract they pull all the other ribs towards the first rib. Because of the shape and sizes of the ribs they move outwards when pulled upwards, enlarging the thoracic cavity.

Diaphragm:

The diaphragm is a dome-shaped muscular structure separating the thoracic and abdominal cavities. • It forms the floor of the thoracic cavity and the roof of the abdominal cavity and consists of a central tendon from which muscle fibers radiate to be attached to the lower ribs and sternum and to the vertebral column, When the muscle of the diaphragm is relaxed, the central tendon is pulled downwards to the level of the T-9, enlarging the thoracic cavity in length. • This decreases pressure in the thoracic cavity and increases it in the abdominal and pelvic cavities.

The intercostal muscles and the diaphragm contract simultaneously, enlarging the thoracic cavity in all directions.

Cycle of Breathing:

The average respiratory rate is 12 to 15 breaths/minute. • Each breath consists of three phases: • (i) Inspiration • (ii) Expiration • (iii) Pause.

1- Inspiration • When the capacity of the thoracic cavity is increased by simultaneous contraction of the intercostal muscles and the diaphragm. • The parietal pleura move with the walls of the thorax & the diaphragm. • This reduces the pressure in the pleural cavity to a level considerably lower than atmospheric pressure. • The visceral pleura follows the parietal pleura, pulling the lungs with it. This expands the lungs and the pressure within the alveoli and in the air passages, drawing air into the lungs in attempt to equalize the atmospheric and alveolar air pressure.

The process of inspiration is ACTIVE, as it needs energy for muscle contraction. Inspiration lasts about 2 seconds.

2- Expiration: Relaxation of the intercostal muscles and the diaphragm results in downward and inward movement of the rib cage and elastic recoil of the lungs. As this occurs, pressure inside the lungs exceeds that in the atmosphere and so air is expelled from respiratory tract. • The still contain some air, are prevented from collapse by the intact pleura. • This process is PASSIVE as it does not require energy.

Lung Volumes and Capacities

Respiratory cycles : 15/minute

Tidal volume (TV): this is the amount of air passing into and out of the lungs during each cycle of breathing. • About 500ml is tidal volume.

Exchange Of Gases :

Inhaled oxygen enters the lungs and reaches the alveoli. The layers of cells lining the alveoli and the surrounding capillaries are each only one cell thick and are in very close contact with each other. • Oxygen passes quickly through air-blood barrier into the blood in the capillaries. • Similarly, carbon dioxide passes from the blood into the alveoli and is then exhaled.

Diffusion of oxygen & carbon dioxide depends on pressure differences. •

Diffusion of Gases

1- External respiration :

External respiration refers to gas exchange across the respiratory membrane in the lungs. • Each alveolar wall is one cell thick and surrounded by a network of tiny capillaries. • Carbon dioxide diffuses from venous blood down its concentration gradient into the alveoli. • By the same process, oxygen diffuses from the alveoli into the blood.

2- Internal respiration :

Internal respiration refers to gas exchange across the membrane in the metabolizing tissues, like your skeletal muscles, for example. •

Blood arriving at the tissues has been cleansed of its CO₂ & saturated with O₂ during its passage through the lungs, therefore has a higher O₂ & lower CO₂ than the tissues. • This concentration gradients between capillary blood and the tissues lead to gas exchange. •

O₂ diffuses from the bloodstream through the capillary wall into the tissues. •
CO₂ diffuses from the cells into the extracellular fluid, then into the bloodstream towards the venous

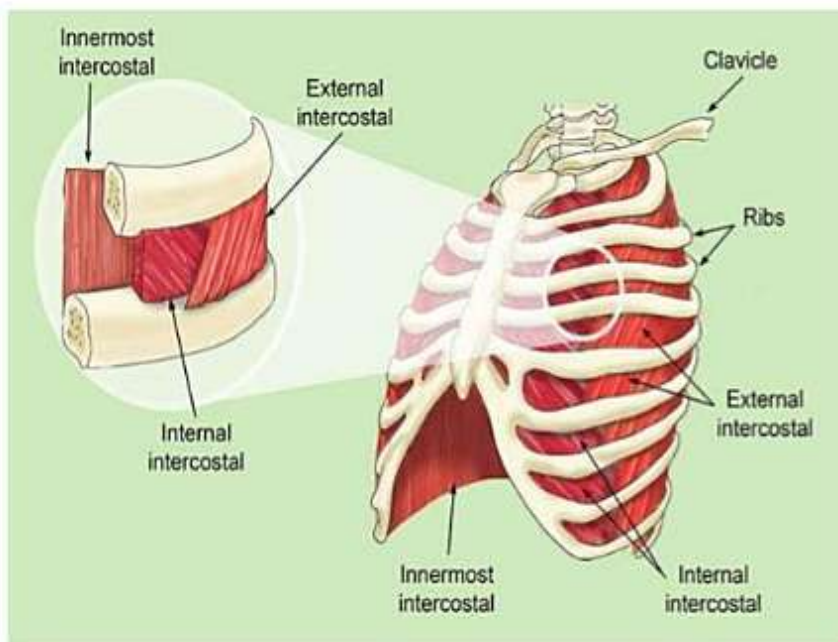
Transport Of Gases In The Bloodstream:

Transport of blood oxygen & carbon dioxide is essential for internal respiration to occur.

Oxygen • Oxygen is carried in the blood in as combination with hemoglobin as oxyhemoglobin.

Carbon Dioxide • It is excreted by the lungs & transported by combined with hemoglobin as carbaminohaemoglobin.

Control Of Respiration: The respiratory center: Medulla oblongata





تخدير نظري

محاضرة 4



MR_TOFE



MR_TOFE



Al – Noor University College

Department of anesthesiology

المرحلة / الثانية

محاضرة تخدير (4)

د. نزار الحياي

General Pharmacology

Classification of Pharmacology

1- Pharmacodynamics: What the drug does to the body. It shows pharmacological actions that is the study of the therapeutic and side effects of drug.

2- Pharmacokinetics: What the body does to the drug. It includes the study of ADME (Absorption, Distribution, Metabolism and Excretion)

Other terms

Drug : any chemical that can affect living processes

Pharmacotherapeutics:- It is branch of medicine concerned with the cure of diseases or relief of symptoms and includes drug treatment.

Toxicology:- science of poisons. Poisons are substances that cause harmful, dangerous or shows fatal symptoms in animals and human beings; many drugs in large dose acts as poisons Like, aspirin in less dose acts as anticoagulant useful for heart patients and in high dose causes the ulceration

Chemotherapy:- it is concerned with the effect of drug upon microorganisms and parasites,

Sites of Action: The organ or cellular target of drug action.

Receptors ; Specialized target macromolecules present on the cell surface or intracellularly. Drugs bind with receptors & initiate events leading to alterations in biochemical activity of a cell, and consequently, the function of an organ.

Source of Drugs :

Drugs are obtained from various sources.-

1- Drugs may be synthesized within the body (hormones)

2- Natural drugs

A) Plants E.g. . Digoxin from *Digitalis purpurea* . Atropine from *Atropa belladonna* .

B) Animals E.g.. Insulin from pork/beef . Cod liver oil from Cod fish liver.

C) Minerals: Iron, Iodine, Potassium salts.

D) Micro – organisms: Penicillin from *penicillium notatum*, Chloramphenicol from *Streptomyces venezuelae*

first-pass effect:

is the term used for the hepatic metabolism of a pharmacological agent when it is absorbed from the gut and delivered to the liver via the portal circulation. The greater the first-pass effect, the less the agent will reach the systemic circulation when the agent is administered orally.

Routes of Drug administration :

Is the path by which a drug, fluid, poison or other substance is brought into contact with the body

1- Oral Route :

Advantages : Safe , Convenient , Economical , Usually good absorption , Can be self-administered

Disadvantages : Slow absorption slow action , Irritable and unpalatable drugs ,Unco-operative & unconscious pts. , Some drugs destroyed , First-pass effect

2- Sublingual Route

Advantages : Quick termination , First-pass avoided , Drug absorption is quick , Can be self-administered

Disadvantages : Unpalatable & bitter drugs , Irritation of oral mucosa , Large quantities not given

3- Rectal Route :

Advantages :Used in children ,Little or no first pass effect ,Used in vomiting/unconscious ,Higher concentrations rapidly achieved

Disadvantages :Inconvenient ,Absorption is slow ,Irritation or inflammation of rectal mucosa can occur

4- Vaginal Routes :

Drug may be administered locally in the vagina in the form of pessaries. E.g. Antifungal vaginal pessaries

5- Parenteral Route:

- A. Intradermal injection .
- B. Subcutaneous injection .
- C. Intramuscular injection
- D. Intravenous injection

Intravenous Route :

Advantages :

1. Absorption phase is bypassed (100% BA)
2. Precise, accurate and almost immediate onset of action.
3. Large quantities can be given, fairly pain free
- 4- IV is the most common parenteral route for drugs that are not absorbed orally.

Disadvantages :

- a. High concentration attained rapidly
- b. Risk of embolism

Intramuscular Route(IM)

Advantages : Absorption is uniform , Rapid onset of action for drugs in aqueous solution. .slow release preparations ,First pass avoided , Gastric factors can be avoided

Disadvantages : Only up to 10ml drug given , Local pain and abscess , Infection ,Nerve damage

Subcutaneous route(SC):

1. Slow and constant absorption
2. Absorption is limited by blood flow
3. Concurrent administration of vasoconstrictor will slow absorption

6- Inhalation :

1. Aerosols (gaseous & volatile agents)-lungs
2. Rapid onset of action due to rapid access to circulation due to:
 - A. Large surface area
 - B. Thin membranes separates alveoli from circulation
 - C. High blood flow

Topical :

Mucosal membranes (eye drops, nasal drops, antiseptic, sunscreen, callous removal)

Pharmacokinetics :

(The life cycle of a Drug) ,Action of body on drug/ how body handles drugs }

Pharmacokinetics includes : ADME

1- Drug absorption

Transfer of a drug from its site of administration to the bloodstream. • The rate and efficiency of absorption depend on the route of administration. – For IV delivery, absorption is complete; that is, the total dose of drug reaches the systemic circulation. – Drug delivery by other routes may result in only partial absorption and, thus, lower bioavailability

Bioavailability :

Fraction of administered drug that reaches the systemic circulation in a chemically unchanged form. – Amount of drug available in the circulation/site of action – It is expressed in percentage – It is 100% for drugs given IV. • For example, if 100 mg of a drug is administered orally and 70 mg of this drug are absorbed unchanged, the bioavailability is 0.7 or 70%. Factors

2- Drug distribution :

Reversible movement of drug from bloodstream to extracellular fluid and/or cells.

Factors affecting drug distribution

1. Plasma protein binding – Albumin
2. Tissue uptake of drugs/tissue binding -Adipose tissue -Bone-Liver

3. Barriers –capillary permeability , Blood brain barrier (BBB) , Placental blood barrier (PBB)
4. Rate of blood flow : Brain, Kidney (highly perfused) , Liver & Lung
5. Plasma concentration

3- Drug metabolism (biotransformation) :

Liver is the major site for drug metabolism, but specific drugs may undergo biotransformation in other tissues, such as the kidney and the intestines.

Note: Some agents are initially administered as inactive compounds (pro-drugs) and must be metabolized to their active forms

4- Drug excretion :

Removal of a drug from the body occurs via a number of routes.

The major routes of excretion include renal excretion, hepatobiliary excretion & pulmonary excretion.

The minor routes of excretion are saliva, sweat, tears, breast milk, & hair.

The rate of excretion influences the duration of action of drugs. If the drug is excreted slowly, the concentration of drug in the body is maintained and the effects of the drug will continue for longer period.

Pharmacodynamics:

Pharmacodynamics include: Mechanism of actions of the drug. } How does a drug act in the body? Effects of the drug: both beneficial & harmful effects.

Mechanisms of drug action : It is of two types:

A- Receptor mediated mechanism } Receptors- targets of drug action. }

B- Non-receptor mechanisms by Simple physical or chemical reaction.

Dose response relationship

Dose: amount of a drug required to produce desired response in an individual.

Dosage: the amount, frequency and duration of therapy.

Potency: measure of how much a drug is required to elicit a given response. The lower the dose, the more potent is the drug.

Agonist and Antagonist

Agonists facilitate receptor response.

Antagonists inhibit receptor response

Therapeutic index

Median Lethal Dose (LD50): dose which would be expected to kill one half of a study population.

Median Effective Dose (ED50): dose which produces a desired response in 50% of the test population.

Therapeutic Index gives a rough idea about the potential effectiveness and safety of the drug in humans

Side effect and toxicity :

- 1- Allergic reactions: due to antigen-antibody reactions
- 2- Blood dyscrasias: These are serious and sometimes fatal complications of drug therapy. They include: agranulocytosis, aplastic anemia, hemolytic anemia, thrombocytopenia
- 3- Hepatotoxicity and nephrotoxicity: drugs are eliminated and metabolized by the liver and kidney, damage to these organs is seen commonly.
- 4- Teratogenic effects: drugs may adversely influence fetal development.
- 5- Behavioral toxicity: This is a term used to describe suppression of normal anxiety, reduction in motivation, impairment of memory and learning,
- 6- Drug dependence and drug abuse: The repeated administration of some chemicals may lead to drug dependence
- 7- Carcinogenesis: Carcinogenesis is a delayed type of toxicity with a latency of many years.
- 8- Pharmacogenetic toxicities: Certain genetically-predisposed individuals have a markedly toxic reaction to certain otherwise safe drugs. Examples are prolonged apnea after succinylcholine, or malignant hyperthermia associated with anesthetics.



تخدير نظري

محاضرة 5



MR_TOFE



MR_TOFE



Al – Noor University College

Department of anesthesiology

المرحلة / الثانية

محاضرة تخدير (5)

د. نزار الحياي

Anesthesia

The word anesthesia means no sensation and it can be defined as relief of pain during operation and postoperative day also to provide an optimal operative condition for both patient and surgeon so that to keep the patient alive.

General anesthesia is similar to a comatose state and different from sleep.

The situation of operations is:

1-Emergency operation: life-threatening condition requiring immediate action (e.g. ruptured aneurysm, penetrating trauma, and peritonitis).

2-Urgent operation: surgery required within few hrs. (e.g. intestinal obstruction and appendicitis)

3-Elective operation: (e.g. hernia and varicose vein)

General Anesthesia

General anesthesia is a medically induced coma (not sleep), characterized by reversible loss of consciousness and all sensations. General anesthetic drugs are given systematically and exert their action on the CNS.

The aim of general anesthesia is to induce:

- 1- Unconsciousness
- 2- Analgesia
- 3- Muscle relaxation
- 4- Amnesia
- 5- Inhibition of automatic reflexes.

Mechanism of action of general anesthesia

Many theories has been developed to explain how the anesthetic drug act, but till know no single theory can explain their action. It is clear that the primary site of action is located in the brain. Some said that their action is induced by interaction with protein in the neural cell membrane . other theory

said that the anesthetic effect is exerted through some change in the lipid bilayer membrane.

Site of action of general anesthetic drugs :

General anesthetics are known to act at a number of sites within the central nervous system (CNS). These sites include:

- 1- Cerebral cortex: The brain's outer layer involved in memory, attention, perception among other functions
- 2- Thalamus: Its roles include relaying information from the senses to the cerebral cortex and regulating sleep, wakefulness, and consciousness.
- 3- Reticular activating system: Important in regulating sleep-wake cycles
- 4- Spinal cord: Passes information from the brain to the body and vice versa. It also controls reflexes and other motor patterns.

A number of different neurotransmitters and receptors are involved in the action of general anesthesia.

General anesthetic drugs act either by:

- 1- potentiate the action of the inhibitory neurotransmitters at the receptor site, Gaba-amino-butyric-acid (GABA) and glycine. Or by
- 2- inhibiting the excitatory receptors, N-Methyl-D-Aspartic Acid (NMDA) , 5-Hydroxytryptamine (5-HT) and Nicotinic Acetylcholine .

Stages of anesthesia (Guedel stages)

General anesthesia can be classified into 4 stages of increasing depth of CNS depression (according to the depth of anesthesia) beginning with loss of higher

function and progressing to the lower area of the brain and spinal cord. Guedel stages only seen during ether anesthesia in un pre-medicated patient. These stages are:

1-stage 1 (stage of analgesia): start from the beginning of anesthesia until loss of consciousness. During this stage there is progressive loss of pain sensation but the patient remain conscious, feel dream like state. Reflexes and respiration are normal. No surgical procedure performed in this stage.

2-Stage 2 (stage of excitation or uninhibited reflexes): start from loss of consciousness to the beginning of regular respiration. The eye reflex disappear while the other reflexes remain intact and there is violent behavior (shout, struggle, breath holding) and the muscle tone increased and there may be vomiting and involuntary micturition. This is a bad stage and modern anesthesia try to reduce this stage by rapid induction of anesthesia and good pre-medication.

3-Stage 3 (surgical stage): start from the onset of regular respiration to the respiratory paralysis. In this stage the muscles relax, vomiting stops and breathing is depressed. Eye movements slow and then cease. The patient is ready to be operated on. This stage can also be divided into 4 planes according to the degree of intercostal paralysis (plane 1 to 4)

4-Stage 4 (medullary paralysis): : Too much medication has been administered, leading to brain stem or medullary suppression. This results in respiratory and cardiovascular collapse. Death occur if the patient cannot be revived quickly . this stage should not be reached,

Anesthesia is characterized by three phases:

1-Induction phase: This is from the time of administration of anesthetic to the development of stage of surgical anesthesia. Induction of anesthesia usually with intravenous agent. Fast and smooth induction is desired to avoid the dangerous excitatory stage (stage 2).

2-Maintenance phase: patient remain in sustained stage of surgical anesthesia. The depth of anesthesia depends on concentration of anesthetic drug in the CNS. This phase is usually maintained by the administration of gases or volatile liquid anesthetic.

3-Recovery phase: This is the time from the discontinuation of anesthetic until consciousness and reflexes return.

Inhalational anesthetics

The use of inhalational anesthetics enables prolonged surgery and diagnostic procedures in a safe and efficient manner.

These drugs are most commonly used to maintain anesthesia. They are halogenated hydrocarbons with relatively low molecular boiling points, so they are evaporated easy and the resulting vapor is breathed by the patient and once the drug reaches the lung, they diffuse into the blood and distributed via the systemic circulation into the brain and other tissues. The partial pressure of the drug in the brain is responsible for the anesthetic effect and this is closely related to the partial pressure of the drug in the alveoli.

Inhalation anesthetics provide quicker changes of anesthetic depth than injectable

anesthetics, and reversal of central nervous depression is more readily achieved, explaining for its prolonged action (less risk of overdosing, less accumulation and quicker recovery

Commonly administered inhalant anesthetics include volatile liquids such as isoflurane,halothane, sevoflurane and desflurane, and inorganic gas, nitrous oxide (N₂O). Except N₂O, these volatile anesthetics are chemically ‘halogenated hydrocarbons’ and all are closely related.

The volatile anesthetics are administered as vapors after their vaporization in devices known as vaporizers .All the inhaled anesthetic drugs cause dose dependent depression of the central cardiovascular system and respiratory system

Minimal Alveolar Concentration (MAC):

It measure the potency of the anesthetic agent and can be defined as the concentration of the inhaled anesthetic drug required to prevent movement in response to surgical stimulus in 50% of subjects.

Drugs with low potency (e.g. desflurane) will have high MAC while those with high potency (e.g. isoflurane) will have low MAC.

Inhaled anesthetic drugs available either as gases or volatile liquid

anesthetic machine

apparatus or equipment used to administer gaseous anesthetic agents; the functions of the apparatus should include,

1. delivery of oxygen
2. removal of carbon dioxide,
3. delivery of anesthetic vapor or gas, and
4. capability of providing artificial respiration to the patient.

Properties of Ideal Inhalational Anesthetic Drug:

several different inhalational compounds have become available. Some are no longer used while others are in regular use. Of the latter, each one has advantages and disadvantage . The properties of the ideal inhaled anesthetic agent are:

- (1) Stable over a range of temperatures
- (2) Non-flammable and not explosive
- (3) Odorless or has a pleasant smell
- (4) Environmentally safe and has a boiling point above room temperature
- (5) Minimal respiratory depression, does not cause coughing or bronchospasm
- (6) Minimal cardiovascular effects and not sensitized the heart to the action of catecholamine
- (7) No increase in cerebral blood flow (and therefore intracranial pressure).
- (8) not toxic to liver or kidney and does not trigger malignant hyperpyrexia



تخدير نظري

محاضرة ٥



MR_TOFE



MR_TOFE



Al – Noor University College

Department of anesthesiology

المرحلة / الثانية

محاضرة تخدير (6)

د. نزار الحياي

Inhalation anesthetics

The inhaled anesthetics are among the most rapidly acting drugs in existence, Rapid induction and recovery may lead to faster operating room turnover times and shorter recovery room stays.

only nitrous oxide and xenon are true gases, while other agents are vapors of volatile liquids. But for simplicity, all of them are referred to as gases because they are all in the gas phase when administered via the lungs. These agents are all non-ionized and have low molecular weights. This allows them to diffuse rapidly without the need for facilitated diffusion or active transport from bloodstream to tissues. The other advantage of gases is that they can be delivered to the bloodstream via the lungs.

Gases in Mixtures

For any mixture of gases in a closed container, each gas exerts a pressure proportional to its fractional mass. This is its partial pressure. The sum of the partial pressures of each gas in a mixture of gases equals the total pressure of the entire mixture (Dalton's law).

Partial pressure is expressed in millimeters of mercury (mm Hg) or torr (1 torr = 1 mm Hg) or kilopascals (kPa). For most drugs, concentration is expressed as mass (milligram [mg]) per volume (milliliter [mL]),

Anesthetic Transfer:(from Machine to Central Nervous System):

When the fresh gas flow and the vaporizer are turned on. With spontaneous patient ventilation by mask, the anesthetic gas passes from circuit to airways .In the lungs the gas comprising the dead space in the airways (trachea, bronchi) and the alveoli further dilutes the circuit gas.. The anesthetic then passes across the alveolar–capillary membrane and dissolves in pulmonary blood according to the partial pressure of the gas and its blood solubility. The anesthetic then passes via simple diffusion from blood to tissues as well as between tissues.

The vascular system delivers blood to three physiologic tissue groups; the

1- vessel-rich group (VRG),

2- muscle group

3- fat group

Table show the distribution of Cardiac Output by Tissue Group

GROUP	% BODY MASS	% CARDIAC OUTPUT	PERFUSION (mL/min/100
Vessel-rich	10	75	75
Muscle	50	19	3
Fat	20	6	3

.

The VRG includes the brain, heart, kidney, liver, digestive tract, and glandular tissues.. The CNS tissues of the VRG are referred to as tissues of desired effect. The other tissues of the VRG that comprise the compartment are referred to as tissues of undesired effects. The tissues of the muscle and fat groups comprise the tissues of accumulation.

Anesthetic is delivered most rapidly to the VRG because of high blood flow. Here it diffuses according to partial pressure gradients. CNS tissue takes the anesthetic according to the tissue solubility, and when it reach a high enough tissue concentration, unconsciousness and anesthesia are achieved. Increasing CNS tissue concentrations cause progressively deeper stages of anesthesia. As this is occurring, anesthetic is also distributing to other VRG tissues.

anesthetic is delivered—more slowly to muscle and fat, where it accumulates and may affect the speed of recovery from the anesthetic.. The concentration of inhaled anesthetic in a given tissue at a particular time during the administration depends not only on tissue blood flow, but also on tissue solubility,. These relative solubilities are expressed by a partition coefficient, λ (which is the ratio of dissolved gas (by volume) in two-tissue compartments at equilibrium)

Alveolar concentration of the inhalation agent

This depends on three factors:

1-Inspired concentration of agent: The concentration of inhaled anaesthetic affects the rate of increase of the alveolar concentration (F_A) towards the inspired concentration (F_i). The greater the inspired concentration, the more rapid the increase in the F_A/F_i ratio, and the faster the induction of anaesthesia..

2-Alveolar ventilation: Increased alveolar ventilation results in faster increase in alveolar partial pressure by constantly replacing the inhalation agent taken up by the pulmonary blood flow.

3-Functional residual capacity (FRC): A larger FRC dilutes the inspired concentration of gas resulting initially in a lower alveolar partial pressure and therefore slower onset of anaesthesia.

Uptake from lung into the blood:

Inhalational anesthetics are taken up passively via diffusion, which depends on

1-Blood solubility of the anesthetic

Blood-gas partition coefficient: the ratio of anesthetic concentrations in the blood and alveolar space when partial pressures in the two compartments are equal → The higher the blood-gas partition coefficient of an inhalational anesthetic, the higher the solubility of that substance in the blood.

2-Lung ventilation, volumes, and perfusion

Distribution and uptake into the brain:

Transport to and uptake into the brain depend on cerebral perfusion and the fat solubility of the inhalational anesthetic.

blood-brain partition coefficient: : the ratio of anesthetic concentrations between blood and brain tissue when partial pressures are equal → The higher the blood-brain partition coefficient, the higher the solubility of that substance in brain tissue.

Onset of effect:

The lower the Blood-gas partition coefficient of an inhalational anesthetic, the faster the substance takes effect (less induction time)

Elimination :

1-Inhalational anesthetics are eliminated by the lungs

The lower the partition coefficient of an inhalational anesthetic, the faster the effect ceases (less recovery time)

2-Inhalational anesthetics are metabolized only to a small degree. Halothane is metabolized in the liver

3-With prolonged duration of anesthesia in obese patients inhalational anesthetics with a high fat solubility can accumulate in adipose tissue and slow down recovery from anesthesia