# ANAESTHESIA– AN OVERVIEW

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ABSTRACT:

Anaesthesia is the agent which induces temporary unconsciousness, memory loss, relieves algesia and muscle relaxants. General anaesthesia targets the CNS to resulting in unconsciousness and lack of sensation. Local anesthetics used directly into localized area to produce the state of loss of sensation or analgesia

## INTRODUCTION

 Anaesthesia is a temporary state consisting of unconsciousness, loss of memory, lack of pain, and muscle relaxants. It is a medical intervention which does not itself offers any particular medical benefits and instead enables the performance of other medications. The first demonstration of general anaesthesia was in 1846 by Boston dentist named William T.G. Morton at Massachusetts General Hospital, he gave ether anaesthetics to remove the neck tumor. On large, cocaine was the first discovered viable local anaesthetics. It can be administered via injection or through inhaled gases or vapors, which can affects the nervous system in different ways by blocking the nerve impulses and therefore, pain. Nowadays in hospitals and in surgery centers, highly trained professionals use a wide variety of safe, modern medications, and extremely capable monitoring technology. An anaesthesiologists is a doctor, who specializes in giving and managing anaesthetics – the medication that numbs an area of the body or helps to fall asleep.[2]

However, the scientific discoveries over late 18th and 19th centuries had paved the way for the development of modern anaesthetic techniques. In late 19th century, there was a two major advancement over the modern surgery: the advent of antiseptics which results in germ theory of disease, leads to reduced morbidity and mortality rates and also advancement in pharmacology and physiology that led to the development over general anaesthesia and pain control. In 20th century, with the use of tracheal intubation and improved airway management techniques made further development over general anesthesia’s safety and pain control. Moreover, in 20th and 21st centuries, the business administration of principles and application of economic to healthcare led to the initiation of management practices , such as transfer pricing, to improve the efficacy of anesthetics.[1]

# 1.1 CLASSIFICATION OF ANAESTHESIA

 Anaesthesia is classified into four types. They are;

* General anaesthetics
* Regional anaesthetics
* Sedation
* Local anesthetics [3]

##  1.1.1 General anaesthetics

 It suppress the activity of the central nervous system, resulting in unconsciousness and lack of sensation. [4]

### 1.1.1.1 Types

* Inhalational anaesthetics
* Intravenous anaesthetics

###### Inhalational anaesthetics

 It can be administered at determined concentration, since the brain is highly perfused organ it can be achieved very quickly. This state makes to reach the partial pressure of the brain and the lung becomes equal and makes it to monitor the anaesthesia. [5]

For example: *Nitrous oxide* is a gas which consists of sweetish odour and can produces light anaesthesia without any depression of vasomotor centre. [7]

###### Intravenous anaesthetics

 When the anaesthetics are administered through intravenous route, it helps to attain the higher concentration, which is especially important with drugs of narrow range of the therapeutic value. [6]

 For example: *Thiopentone sodium* is a short acting drug and has rapid onset of action which acts over the cardiovascular and profound respiratory depression and it is known as ‘truth serum’ in medicolegal use. [7]

###  1.1.1.2 Stages

* Analgesia
* Delirium
* Surgical anaesthesia
* Medullary or respiratory paralysis

####   **Stage: 1 – Analgesia**

 It is the stage between the inhalation of anaesthetic and the loss of consciousness, which is characterized by a mild depression of neurons that is suitable for the minor surgical procedures.

####  Stage: 2 – Delirium

 It starts from the loss of sensation to the surgical anaesthesia which is associated with exhilaration and leads to involuntary muscle activities.

####  Stage: 3 – Surgical anaesthesia

 This stage is divided into four plane characterizes by increasing central nervous system depression: first, loss of spinal reflexes; second, decreased skeletal muscle reflexes; third, paralysis of intercostal muscles; and fourth, loss of most muscle tone.

####  Stage: 4 – Medullary or respiratory paralysis

 This stage occurs only during overdose which is characterized by vasomotor and respiratory paralysis.

Nowadays, these stages are not preferred in the actual use of anaesthesia due to its related use of other drugs. [4] [7]

###  1.1.1.3 Mechanism of action

 The exact mechanism of action of general anaesthetics is not known. But the most accepted mechanism of action are as follows:

* General anaesthetics binds on the GABA receptor chloride channels and activates the receptors (figure 1.1) , which leads to inhibit the neurotransmission and depresses the CNS.

 

 Figure 1.1 - GABA receptor complex

* For inhalational anaesthetics - Minimum Alveolar Concentration ( MAC ) is defined as the concentration ( or partial pressure ) of an anaesthetic in the alveoli is directly equal to that in the brain, which is closely reflects at the site of anaesthetic measures.
* For intravenous agents - Potency of IV is defined as the plasma concentration ( at equilibrium ) that produces loss of response to surgical incision in 50% of subjects. [4]

##  1.1.2 Regional anaesthetics

 The goal of regional anaesthesia is to attain the loss of sensation in a specific extremity or area of the body. It offers the patient with selective to maintain the consciousness of the patient. Regional anaesthesia is also used in orthopedic surgeries on an extremities such as arm, leg, hand, or foot and in female reproductive surgery such as gynecological procedures and cesarean section and in male reproductive surgery, then it is used for operations on the bladder and urinary tract. [8]

###  1.1.2.1 Types and its action

* Epidural anaesthetics
* Spinal anaesthetics
* Nerve blocks
* ***Epidural anaesthetics***

 It is injected in the extradural spaces which is directly acts on the nerve roots whereas the small quantities get diffused into subarachnoid spaces. Minimal uses of epidural opioids may require to compare the oral dose, which produces better analgesia.

#### Spinal anaesthetics

 It is injected into the subarachnoid space between L2 – L4 or below the lower end of the spinal cord, which acts on the nerve roots. In this type of anaesthetics, the lower abdomen and lower limbs are get anaesthetized and paralysed. The level of anaesthetics can be changed by the volume of injection, specific gravity of the solution and posture of the patients.

#### Nerve blocks

 Injected about / around individuals peripheral nerves or nerve plexuses produces larger areas of the anaesthesia with the smaller amount of the drug then the above techniques. Anaesthesia starts a few centimeters distal to the injection. [7]

## 1.1.3 Sedation

 Sedation is defined as the relaxed state or temporary decrease in the level of consciousness.

### 1.1.3.1 Levels of sedation:

* Mild sedation
* Moderate sedation
* Deep sedation

#### Mild sedation

 It acts as relaxants when the patient is awake and can respond to the verbal commands.

 Example: antihistamines such as diphenhydramine ( Benadryl ), dimenhydrinate ( Dramamine ).

#### Moderate sedation

 Sleepy and can be awakened or to respond to verbal tactile stimuli.

 Example: morphine, diazepam, ketamine, and midazolam.

#### Deep sedation

 Deep sleep can occur in this case and can be easily aroused; which is nearly in unconscious state.

 Example: oral ketamine and midazolam . [9]

## 1.1.4 Local anaesthetics

 Local anaesthetic agents depresses the action potential in excitable tissues by blocking the sodium channels, which inhibits the action potential leads to blockade in the transmission of pain impulse. It can be either given by topical or administered directly into localized area to produce the state of loss of sensation or analgesia. [7]

### 1.1.4.1 Types

* Surface anaesthesia
* Infiltration anaesthesia

#### Surface anaesthesia

 It is directly applied by topical application over the mucous membrane such as eye, nose, mouth, tracheobronchial tree, oesophagus and genitourinary tract. In topical applications, phenylephrine ( but not adrenaline as its penetration is poor ) causes vasoconstriction, which prolongs the duration of action. Local anaesthetics are also used on abraded skin. [7]

For example: Local anaesthetics used only on the eye is *Benoxiate HCl* within 60 seconds of administration , the cornea of the eye becomes anaesthetized. [7]

#### Injectable anaesthesia

 It is the type of local anaesthetics which is directly injected into the body tissues.

 For example: *Lignocaine* is the widely used local anaesthetics which is rapid and long acting which causes drowsiness and mental clouding. It is also acts as a good corneal anesthetic.

### 1.1.4.2 Mechanism of action

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 The amino-ester type LA are rapidly hydrolyzed by the plasma cholinesterase ( also known as pseudocholinesterase ), which gets distributed all over the body tissues ( figure 1.2 ). Then it gets metabolized in the blood, kidneys and liver to lesser the extent, at the site of administration. [9]

 

 Figure 1.2 - Mechanism of action of LA

# 1.2 Anesthetic Management

#### In Cardiovascular management

 The primary site in the cardiovascular system is myocardium, in which the local anaesthetics are administered and can leads to decreased excitability, conduction rate and force of contraction. Whereas the inhalational anesthetics tends to reduce the myocardial contractility, oxygen requirement, arterial pressure and also produces some coronary vasodilation.

#### In Respiratory management

 All inhalational anaesthetic agents are acts as a respiratory depressants, which may leads to decreased tidal volume, ventilation and also mucociliary function and are widely used as bronchodilators.

#### In Central nervous management

 Inhaled anaesthetics increase the cerebral blood flow by decreasing cerebral vascular resistance, they also decreases the metabolic rate of the brain and may increase intracranial pressure.

 Local anaesthetics suppresses the cortical inhibitors pathway, thereby it allows the agonistic activity of excitatory components. When the central stimulation is followed by the generalized CNS depression, death may results from the respiratory failure.

#### In Renal and Hepatic management

 Volatile anaesthetics decrease the Glomerular Filtration Rate, renal and hepatic blood flow. Halothane and its derivatives decrease cardiac output and arterial pressure. The effect on heart rate is viable and some may cause tachycardia and bradycardia. [3]

# 1.3 Adverse effect of Anaesthesia

#### Hypersensitivity reactions

 It includes skin rashes, dermatitis, asthma or rarely anaphylaxis are more common with ester type of drugs. To manage such reactions, drugs should be kept read. Moreover, allergy is often occurs due to the preservative methylparaben.

#### In central nervous system

 Dizziness, sedation, auditory and visual impairment, mental confusion and disorientation may occur. Higher doses may leads to anxiety, nystagmus, muscle tremors, convulsions and respiratory failure due to the depression in the cortical inhibitory pathways leading to CNS stimulant effects. LA including for infiltration, pre-medication with BZD helps.

#### In cardiovascular system

 Blockade of sodium channels in the myocardium may results in myocardial depression with reduces in the force of contraction, bradycardia, excitability and conduction velocity; rarely cardiac arrest can occur. As the local anesthetics can cause vasodilation, hypotension may occur. Bupivacaine is the most cardiotoxic. Rarely cardiac arrest may occur.

#### Others

 As a result of therapeutic error, local anaesthetics toxicity may occurs generally. Situations leading to toxicity include inadvertent venous or arterial injection or topically administered local anaesthetic containing preparations.

 Repeated use of halothane may occasionally cause hepatitis, comparing to other inhalational agents. A metabolite of enflurane may leads to nephrotoxicity due to prolonged exposure.

 Malignant hyperthermia and megaloblastic anemia are including adverse effects. [5] [7]

In conclusion, anesthesia is the use of medicine to prevent the feeling of pain or another sensation during surgery or other procedures that might be painful. However, it causes some side effects, it is very important to both the minor and major surgeries.[3] .In spite of these ADR’s use of anaesthetic agents is need of the hour and increasing day by day. Intervention of new anaesthetic agents with very minimal side effects may be the highlights of the anaesthetics in near future

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