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Anesthesia

A- General Anesthesia:

General anesthesia is a reversible state of central nervous system (CNS) depression, causing loss of response to and perception of stimuli. For patients undergoing surgical or medical procedures, anesthesia provides five important benefits:

1. Sedation and reduced anxiety
2. Lack of awareness and amnesia
3. Skeletal muscle relaxation
4. Suppression of undesirable reflexes
5. Analgesia

Because no single agent provides all desirable properties, several categories of drugs are combined to produce optimal anesthesia. Preanesthetic help calm patients, relieve pain, and prevent side effects of subsequently administered anesthetics or the procedure itself.

Stages of general anesthesia

Stage I: Analgesia: Loss of pain sensation results from interference with sensory transmission in the spinothalamic tract. The patient progresses from conscious and conversational to drowsy.

Stage II: Excitement: The patient displays delirium and possibly combative behavior. A rise and irregularity in blood pressure and respiration occur, as well as a risk of laryngospasm.

Stage III: Surgical Anesthesia: There is gradual loss of muscle tone and reflexes as the CNS is further depressed. Regular respiration and relaxation of skeletal muscles with eventual loss of spontaneous movement occur. This is the ideal stage for surgery. Careful monitoring is needed to prevent undesired progression to stage IV.

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Stage IV: Medullary Paralysis: Breathing and other vital functions cease to function because the severe depression of the respiratory and vasomotor centers occurs. Ventilation and/or circulation must be supported to prevent death.

TYPES OF GENERAL ANESTHETIC AGENTS

There are two broad types of general anesthetics: The inhalation agents and the intravenous agents: -

A- Inhalation Agents: Inhalation anesthetic agents are gases or volatile liquids. These substances are often mixed with oxygen and the patient is allowed to breathe the mixture.

After a period, a sufficient level of the anesthetic agent is obtained in the blood and anesthesia is produced. In general, anesthesia can be well controlled with these agents because the concentration of the agent in the blood can be increased or decreased easily by either increasing or decreasing the concentration of the agent in the air the patient is breathing.

It is relatively uncommon for a patient to have an allergic reaction to one of the inhalation general anesthetic agents. However, the side effects of some of these agents can be quite serious. There is rapid recovery for the patient when this type of agent is used. That is, when the patient is no longer allowed to breathe the agent, the depression of the central nervous system quickly disappears.

Nitrous oxide

Nitrous oxide is commonly referred to as laughing gas. Although nitrous oxide is a safe general anesthetic, it is relatively weak in terms of producing anesthesia and muscle relaxation. Consequently, nitrous oxide is often used in conjunction with other agents. Nitrous oxide is often used in dental surgery and in obstetrical practice during delivery.

Halothane (Fluothane®)

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Halothane is a volatile liquid inhalation anesthetic. It is one of the most widely used general anesthetics. Since halothane does not produce potent analgesia and muscle relaxation, other agents are sometimes administered with halothane on an as-needed basis. Halothane has popularity because it is nonexplosive, rapid acting, pleasant smelling, and is compatible with other drugs.

Enflurane (Erthane®)

Enflurane is a volatile liquid inhalation anesthetic with many of the properties of halothane. It produces greater muscle relaxation than halothane, but like halothane, it is a poor analgesic.

B- Intravenous Agents

IV anesthetics cause rapid induction often occurring within one “arm– brain circulation time,” or the time it takes to travel from the site of injection (usually the arm) to the brain, where it has its effect. Anesthesia may then be maintained with an inhalation agent. IV anesthetics may be used as sole agents for short procedures or administered as infusions to help maintain anesthesia during longer cases. In lower doses, they may be used for sedation.

Propofol

Propofol is an IV sedative/hypnotic used for induction and/or maintenance of anesthesia. It is widely used and has replaced thiopental as the first choice for induction of general anesthesia and sedation. Because propofol is poorly water soluble, it is supplied as an emulsion containing soybean oil and egg phospholipid, giving it a milk-like appearance. **Onset:** Induction is smooth and occurs 30 to 40 seconds after administration.

Thiopental

Thiopental is an ultra–short-acting barbiturate with high lipid solubility. It is a potent anesthetic but a weak analgesic. Barbiturates require supplementary

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analgesic administration during anesthesia. When given IV, agents such as thiopental and methohexital [meth-oh-HEX-uh-tall] quickly enter the CNS and depress function, often in less than 1 minute.

Ketamine (Ketalar®)

Ketamine a short-acting, nonbarbiturate anesthetic, induces a dissociated state in which the patient is unconscious (but may appear to be awake) and does not feel pain. This dissociative anesthesia provides sedation, amnesia, and immobility. Ketamine stimulates central sympathetic outflow, causing stimulation of the heart with increased blood pressure and CO. It is also a potent bronchodilator.

OTHER AGENTS USED DURING SURGERY:

No single anesthetic agent is capable of producing the deep levels of analgesia and skeletal muscle relaxation required during all types of surgery. Consequently, other drugs that have certain desired effects are administered along with the general anesthetic being used. They are:-

1. ANALGESIC AGENTS:

Analgesic agents relieve pain. Although a general anesthetic agent will produce Unconsciousness, the patient might still be able to feel some pain. In these cases, a Pre-anesthetic medication might be administered to the patient in order to relieve the pain. A variety of analgesic agents are available to achieve this purpose. Following are some commonly used agents:

- a. Meperidine (Demerol®).
- b. Morphine.

2. DRYING AGENTS:

It is sometimes advantageous during an operation to have the patient's mucous membranes (that is, nose, throat) dry. Drying agents are administered for just this reason. You are probably familiar with the use of drying agents in certain over-the counter (O.T.C.) cold medications. Like: Atropine sulfate.

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3. *NEUROMUSCULAR BLOCKING AGENTS:*

In some types of surgery (for example, abdominal surgery) it is highly advantageous to have the patient's skeletal muscles (for example, abdominal surgery) in a state of relaxation. Most general anesthetic agents do not produce a sufficient level of skeletal muscle relaxation. Therefore, neuromuscular blocking agents are administered to achieve the desired muscle relaxation effects. Two commonly used neuromuscular blocking agents:

- a. Vecuronium (Norcuron®).
- b. Succinylcholine (Anectine®).

4. *SEDATIVE AND HYPNOTIC AGENTS:*

Patients are sometimes administered either a sedative or a hypnotic agent. Agents commonly used for this purpose are:

- a. Pentobarbital (Nembutal®).
- b. Secobarbital (Seconal®).

5. *ANTI-ANXIETY AGENTS:*

Some surgical cases are highly anxious, such increased anxiety interferes with the functioning of the patient (interferes with rest and decreases appetite). Anti-anxiety agents help to control this anxiety. Diazepam (Valium®) is sometimes used to control anxiety.

LOCAL ANESTHETICS:-

Local anesthetics block nerve conduction of sensory impulses and, in higher concentrations, motor impulses from the periphery to the CNS. Na⁺ ion channels are blocked to prevent the transient increase in permeability of the nerve membrane to Na⁺ that is required for an action potential. When propagation of action potentials is prevented, sensation cannot be transmitted from the source of stimulation to the brain.

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Clinical techniques of local anesthesia include:

- **Surface anesthesia** - application of local anesthetic spray, solution or cream to the skin or a mucous membrane. The effect is short lasting and is limited to the area of contact.
- **Infiltration anesthesia** - injection of local anesthetic into the tissue to be anesthetized. Surface and infiltration anesthesia are collective *topical anesthesia*.
- **Epidural anesthesia** - a local anesthetic is injected into the epidural space where it acts primarily on the spinal nerve roots. Depending on the site of injection and the volume injected, the anesthetized area varies from limited areas of the abdomen or chest to large regions of the body.
- **Spinal anesthesia** - a local anesthetic is injected into the cerebrospinal fluid, usually at the lumbar spine (in the lower back), where it acts on spinal nerve roots and part of the spinal cord. The resulting anesthesia usually extends from the legs to the abdomen or chest.
- **Peripheral nerve block** - injection of local anesthetic in the vicinity of a peripheral nerve to anesthetize that nerve's area of innervation

IDIAL LOCAL ANESTHESIA:

- Non-irritating to nerve
- Low systemic toxicity
- Short induction period
- Adequate duration of action
- No post anesthetic side effects

There are two chemical substances have been added to local anesthetic preparation those are:-

- 1- Adrenaline: is added to the local anesthetic to prolong its action by minimizing its absorption by vasoconstriction.
- 2- Hyaluronidase enzyme is added to the local anesthesia solution to facilitate spread and penetration of local anesthetics at the site of injection.

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Example of local anesthetic agents:

Lidocaine Hydrochloride (Xylocaine®).

Lidocaine is used as a local anesthetic for infiltrations, nerve blocks, spinal anesthesia, topical anesthesia, and for caudal and epidural anesthesia. It has a rapid onset of action and its effects last from 75 to 150 minutes. It has also been used as a cardiac depressant (anti arrhythmic). Lidocaine is available in injection form (various percentage concentrations), jelly form, and in cream form.

Procaine (Novocaine®).

Procaine is used for infiltration, nerve block, and spinal anesthesia. Procaine is not applied topically. Its duration of action is approximately 1 hour. It is a fairly safe local anesthetic to use since it is metabolized quickly. Procaine is available in injection form.

Cocaine.

Cocaine is applied to produce local anesthesia with intensive vasoconstriction on mucous membranes. It is applied to procedure anesthesia in the nose, throat, ear, and in bronchoscopy (a procedure in which an instrument is used to inspect the bronchi). Cocaine is supplied in the form of a white powder, Cocaine solution must be compounded. It is a controlled substance.

Benzocaine (Americaine®).

Bezocaine is used for topical anesthesia of the mucous membranes and skin. It is used in many over-the-counter spray preparations for the treatment of sunburn and itching.

Benzocaine is available in solution, ointment, and spray forms.

Dichlorotetrafluorethane (Freon®)

Dichlorotetrafluorethane is a nonflammable and non-explosive agent for topical anesthesia of the skin. It is especially useful for localized minor surgical procedures. This agent should not be sprayed on the skin for a period that exceeds 45 seconds. Dichlorotetrafluorethane is available in a

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spray form.

Ethyl Chloride.

This agent is used for topical anesthesia of the skin. Ethyl chloride is available in a spray form.