

## General anesthetics

### General information :

General anesthesia is typically a state of:

- 1- analgesia
- 2- amnesia ( قرك اذلا نادق ف )
- 3- loss of consciousness
- 4- inhibition of sensory and autonomic reflexes
- 5- skeletal muscle relaxation.

- these effects achieved by a combination of IV and inhaled drugs

General anesthesia → IV : immediate in order to sleep ( induction >> rapid onset)  
→ INHALED : maintained anesthesia

- IV agents used alone or in combination with other anesthetic agents to reach the effects

#### Types of General Anesthesia:

A. Intravenous agents used **alone**, or in **combination** with other anesthetic agents, to achieve an **anesthetic state** or **sedation**. These drugs include:

1. **Barbiturates**: Thiopental, methohexital.
2. **Benzodiazepines**: Midazolam, diazepam.
3. **Propofol**.

#### 4. **Ketamine**.

5. **Opioid analgesics**: Morphine, fentanyl, sufentanil, alfentanil, remifentanil.

6. **Miscellaneous sedative-hypnotics**: Etomidate, dexmedetomidine.

B. Inhaled anesthetics which include:

1. **Volatile liquids**: Halothane, isoflurane, desflurane, enflurane, methoxyflurane, and sevoflurane.
2. **Gases**: Nitrous oxide.

- **Balanced anesthesia** employs multiple drugs (inhaled anesthetics, sedative-hypnotics, opioids, neuromuscular blocking drugs) to minimize unwanted effects.
- **General anesthesia (GA)** can be by only IV or only Inhaled
- modern anesthesia typically involves a combination of:
  - 1- IV agents for induction of anesthesia.
  - 2- Inhaled agents for maintenance of anesthesia.
  - 3- Muscle relaxants.
  - 4- Analgesics.
  - 5- Cardiovascular drugs to control autonomic responses.

#### IV :

- 1- used to provide sedation for patient in ICU settings
- 2- lipophilic >> highly perfused >> rapid onset
- 3- Recovery is rapid >> use for short procedures

Can cross BBB in reverse direction → Redistribution into less vascular organs

→ it is the mechanism of termination action of intravenous Anesthetics

## Propofol :

- 1- Interacts with **GABA<sub>A</sub>** and glycin-gated currents
  - 2- it is **hypnotic** not analgesic
  - 3- most popular IV anesthetic
  - 4- rate onset similar to barbiturate but recovery more rapid than barbiturate (**important**)
  - 5-agent of choice for ambulatory surgery
  - 6-can be used for induction and maintenance of anesthesia >>reduced the required concentration of inhaled **Anesthetics**
  - 7- When used for maintainanc can be combined with IV opioids and neuromuscular blockers to completely avoid inhaled
  - 8-for maintaining produce prolonging sedation ( we need ) , but can lead to arousal ( bad )
  - 9- recovery more complete with **less hangover** than thiopental
- adverse effect**
- 10- the draw back to use it to maintaining >>raise serum lipids
  - 11-**Acidosis** in presence of RS infection and neurologic sequelae upon withdrawal >>in young children for sedation
  - 12- produces depression of central ventilator drive and apnea
  - 13- decrease blood pressure during Induction through arterial & veno dilation
  - 14- high direct negative inotropic than other IV >>bradycardia, asystole ( atropine used as premedication to prevent these effects )
  - 15-pain at site of injection ( reduced by admixture with lidocaine )
  - 16- **in rare case during prolonged use : Muscle movements, hypotonus and rarely tremors have been reported after prolonged use.**
  - 17- decrease cerebral blood flow >>decrease ICP & intraocular pressure & cerebral perfusion pressure

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## Fospropofol :

- prodrug for propofol , is water soluble , prolonged onset & recovery compared with propofol due to converted to active form , No injection site pain .

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## Etomidate :

No analgesic effect

- hypnotic - primarily potentiation of GABA<sub>A</sub>
- Used induction for patient with limited cardiovascular reserve .( it has minimal effect on cardiovascular & respiratory depression & minimal hypotension )
- Rapid loss of consciousness >>rapid distribution
- Recovery less than propofol
- Short duration
- Potent cerebral vasoconstriction >>decrease cerebral blood flow and ICP Like thiopental

Intracranial pressure

### Adverse effect :

- 1- Pain upon injection as propofol.
  - 2- myoclonic activity
  - 3- postoperative nausea and vomiting against propofol
  - 4- may activate seizure Foci
  - 5- in long term >> inhibition of steroidogenesis ( inhibit 11b hydroxylase ) decrease level of cortisol & hypoadrenalism>> hypotension , electrolyte imbalance & oliguria (**important**)
- No used as continuous infusion

Ketamine → Rapidly distributed into well perfused organs including brain, then Redistributed to less perfused tissue

## Ketamine :

- Dissociative anesthetic state characterized by:
- 1- catatonia (muscular rigidity and mental stupor, sometimes alternating with great excitement and confusion, eyes remain open with a slow nystagmic gaze),
- 2- amnesia and
- 3- analgesia
- with or without loss of consciousness.
- drug of abuse from phencyclidine → mechanism of action
- It blocks glutamic acid NMDA receptor

High lipid soluble

Short duration ( redistribution )

Only IV anesthesia have both analgesic properties & dose related cardiovascular stimulation

Administered by multiple routes ( IV , INTRAMUSCULAR, ORAL , RECTAL , EPIDURAL )

Stimulate central sympathetic & inhibit Reuptake of norepinephrine

Increase heart rate , cardiac output , arterial blood pressure [ transient if IV single dose )

Increase cerebral blood flow , oxygen consumption , ICP

**DANGEROUS IN PATIENT WITH ELEVATED ICP**

It decreases respiratory rate but upper airway muscle tone is well maintained and airway reflexes are usually preserved.

It relaxes bronchial smooth muscle

Increase lacrimation and salivation

May cause laryngospasm especially in children.

Not complete recovery >> postoperative disorientation , sensory and perceptual illusions, and vivid colorful dreams, out-of body experiences and increased and distorted visual, tactile, and auditory sensitivity. (This is called emergence phenomena).

- can be associated with fear & confusion

Cause euphoria >> abuse

- effects of emergence phenomena and fear & confusion & euphoria can be reduced by premedication with BDZ ( diazepam , midazolam )

- Ketamine It is specially useful in patients undergoing painful procedures such as burn dressing
- Ketamine reduces opioid tolerance and opioid-induced hyperalgesia

Drugs depress cardiovascular: propofol & thiopental

Drugs no role or minimal on depress cardiovascular: Etomidate

Drugs stimulate cardiovascular: ketamine

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