

## **Agents Used In General Anesthesia**

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### **Learning Objectives:**

- Describe the actions, effects and precautions associated with agents used in anesthesia.
- Describe anesthesia delivery systems

## **Introduction To Anesthesia**

### **Goals of surgical anesthesia- achieve lack of sensation with:**

- Safety
- Comfort
- Convenience

### **Anesthesia Procedure**

- Preoperative preparation
  - ◆ patient assessment
  - ◆ initial cleansing (shower)
  - ◆ pre-anesthetic medication

### **Anesthesia Procedure**

- Induction- initial entry to surgical anesthesia
- Maintenance- continuous monitoring and medication
- Emergence- resumption of normal CNS function

Link to background information on anesthesia  
[http://www.institute-shot.com/anesthesia\\_and\\_surgery.htm](http://www.institute-shot.com/anesthesia_and_surgery.htm)

### Desired effects of general anesthesia

- Rapid induction
- Sleep
- Analgesia
- Secretion control
- Muscle relaxation
- Rapid reversal

### Anesthesia stages

#### I. Amnesia

- ◆ induction to loss of consciousness
- ◆ pain sensation intact

#### II. Excitement

- ◆ uninhibited response to stimuli
- ◆ desirable to shorten, bypass this stage

### Anesthesia stages

#### III. Surgical anesthesia- planes 1-4

- ▲ Gaze central, pupils constricted
- ▲ Absent somatic & physiologic responses

#### IV. Medullary paralysis (overdose)

- ▲ Pupils dilated
- ▲ Hypotension, circulatory failure

## Anesthetic Agents

### Types of agents for anesthesia

- Pre-anesthetic agents
- Intravenous anesthetics
- Anesthetic gases
- Neuromuscular blockers
- Anticholinesterase agents

### Premedications for anesthesia

- Anticholinergics- atropine, rubinol
  - ◆ Reduce vagal response
  - ◆ Reduce pulmonary secretions
  - ◆ Reduce gastric motility
- Analgesics- reduce pain, anxiety
- Tranquilizer (benzodiazepines)- to reduce anxiety
- H2 antihistamine - to avert emesis

### **Barbiturate IV Anesthetics**

- Rapid-acting
- Short duration

### **Barbiturate IV Anesthetics**

- Agents
  - ◆ Thiopental (pentothol)- previously almost universally used
  - ◆ Suritol NA
  - ◆ Brevital Na

Link to information on IV anesthetics  
<http://anesthesiologyinfo.com/articles/01072002.php>

### **Non-barbiturate IV Anesthetics**

- Propofol (Diprivan)- largely replaced thiopental
  - ◆ Hypnotic
  - ◆ Antiemetic
  - ◆ No analgesia
  - ◆ Cardiovascular depression
  - ◆ Painful to inject

### **Non-barbiturate IV Anesthetics**

- Etomidate - intubation
  - ◆ rapid-acting
  - ◆ short duration
- Ketamine- intubation
  - ◆ strong analgesia
  - ◆ bronchodilator

### **Non-barbiturate IV Anesthetics**

- Midazolam (Versed)
  - ◆ benzodiazepine
  - ◆ rapid-acting sedative
  - ◆ reversible with flumazenil (Romazicon)

### **Anesthetic Gas Kinetics**

- Factors affecting gas tension
  - ◆ Inspired concentration
  - ◆ Flow rate of anesthetic
  - ◆ Minute volume - affects uptake & excretion

### Anesthetic Gas Kinetics

- Factors affecting gas tension
  - ◆ Blood gas partition coefficient- rate of exchange of gases between compartments:
    - f* alveoli
    - f* blood
    - f* brain
  - ◆ Tissue perfusion

### Inhaled Anesthetics

- Nitrous oxide (N<sub>2</sub>O)
  - ◆ weak- used with other medications, gases
  - ◆ safe
  - ◆ adverse effects:
    - f* hypoxemia
    - f* inhibition of hypoxic vasoconstriction
    - f* diffusion into ETT cuffs

### Inhaled Anesthetics

- Halogenated volatile liquids
  - ◆ potent- low concentrations as 2nd gas
  - ◆ adverse effects
    - f* hepatotoxicity
    - f* congenital anomalies and spontaneous abortions in OR personnel

### Inhaled Anesthetics

- Halogenated volatile liquids
  - ◆ adverse effects
    - f* malignant hyperthermia- muscular rigidity ==> heat production

### Inhaled Anesthetics

- Halogenated volatile liquids
  - ◆ Halothane (Fluothane)
  - ◆ Enflurane (Ethrane)
  - ◆ Isoflurane (Forane)
  - ◆ Desflurane (Suprane)
  - ◆ Sevoflurane (Ultane)
  - ◆ Methoxyflurane (Penthrane)

Link to more information on inhaled anesthetics  
<http://www.ispub.com/ostia/index.php?xmlFilePath=journals/jja/vd3n2/inhal1.xml>

### Adverse effects of general anesthetics

- Depress all components of CNS
- Respiratory depression
- Negative inotropic effects
- Decreased threshold for premature ventricular contractions (PVCs)

**Adverse effects of general anesthetics**

- Depress all components of CNS
- Respiratory depression
- Negative inotropic effects
- Decreased threshold for premature ventricular contractions (PVCs)
- Peripheral vasodilation (shock)
- Decreased uterine contractions
- Depressed fetal activity ==> hypotonic newborn

**Anesthesia machine**

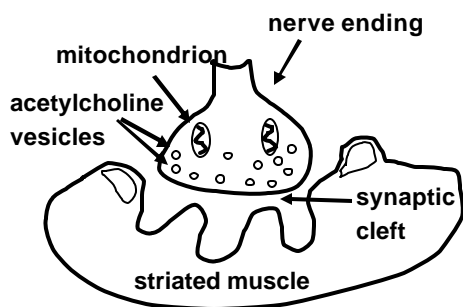
- Ventilator, anesthesia bag
- Gas cylinders- O2, N2O
- Precision flowmeters
- Calibrated vaporizer- for liquid anesthetics
- CO2 absorber

**Anesthesia machine**

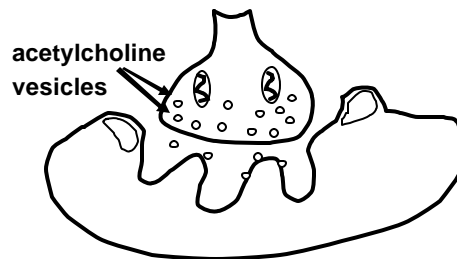
- Rebreathing bag
- Tubing
- Gas scavenging equipment
- Pulse oximeter
- CO2 monitor, indicator

**Neuromuscular Blocking Agents**

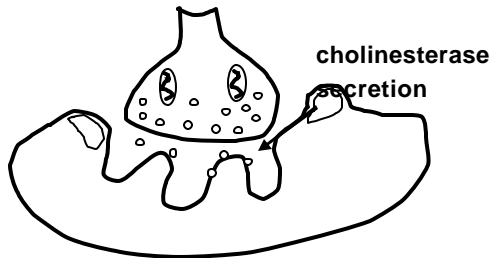
**Physiology of neuromuscular junction**



**Nerve impulse ==> release of Ach ==> depolarization of muscle**

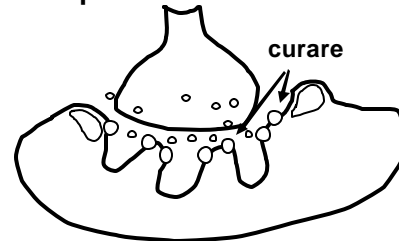


Ach-ase ==> hydrolyzes Ach ==> repolarization of muscle



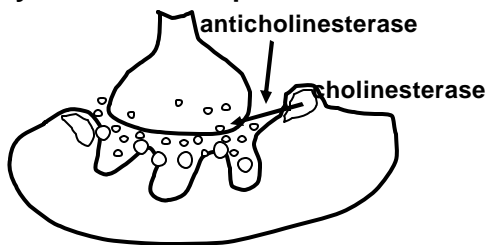
Action of non-depolarizing agents (curariform)

Occupy Ach receptor sites ==> prevent depolarization



Reversal of non-depolarizing agents

cholinesterase hydrolyzes cholinesterase ==> increase acetylcholine ==> depolarization



Indications for neuromuscular blockers

- Relaxation for intubation, surgery
- Prevent asynchronous breathing with ventilator (esp. neonates)

Non-depolarizing agents

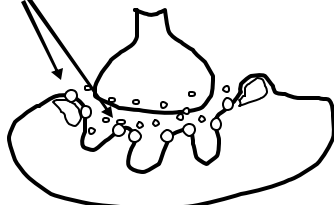
- Side effects
  - ◆ Histamine release ==>
    - f flushing
    - f bronchospasm
  - ◆ Vagolysis ==> tachycardia, hypertension
  - ◆ Hypoventilation, apnea
  - ◆ Aspiration

Non-depolarizing agents

- Contraindications
  - ◆ myasthenia gravis
  - ◆ asthma
  - ◆ electrolyte disturbance
- Interaction- potentiated by
  - ◆ aminoglycosides
  - ◆ tetracyclines

### Non-repolarizing agent (succinylcholine)

Drug attaches to Ach receptor  $\Rightarrow$  depolarizes muscle  $\Rightarrow$  inhibits repolarization



### Non-repolarizing agent

- Normally, very short-acting
- Not reversible with drugs
- Pseudocholinesterase deficiency  $\Rightarrow$  slow hydrolysis of agent  $\Rightarrow$  prolonged action

### Non-repolarizing agent

- Side effects
  - ◆ fasciculation  $\Rightarrow$  muscle soreness
  - ◆ hyperkalemia
  - ◆ increased ocular pressure
  - ◆ increased intracranial pressure
  - ◆ malignant hyperthermia

### Specific NRP NM blocking agent

Succinylcholine (Anectine, Sucostrin)

Onset.....1 min

Duration.....4-6 min

### Specific NDP NM blocking agents

- Tubocurarine Cl- prototype agent
- Pancuronium Br (Pavulon)
- Atracurium besylate (Tracrium)
- Vecuronium Br (Norcuron)
- Rapacurium (Raplon)
- Doxacurium (Nuromax)
- Cisatracurium (Nimbex)
- Rocuronium (Zemuron)

Link to properties of specific NDP agents  
[http://en.wikipedia.org/wiki/Neuromuscular\\_blocking\\_drugs](http://en.wikipedia.org/wiki/Neuromuscular_blocking_drugs)

### Summary & Review

- Balanced anesthesia- for safety, comfort and convenience.
- Four stages of anesthesia
- Pre-anesthetic medications
- General anesthetics- IV and gases
- Anesthesia machine
- Neuromuscular blockers- NDP & NRP

## **References**

- Cottrell GP, Surkin HB. Pharmacology for respiratory care practitioners 1995 Chaps 7, 27. FA Davis, Phila.
- Wenker O: Review of currently used inhalation anesthetics; Part I. The Internet Journal of Anesthesiology 1999; Vol3N2:  
<http://www.ispub.com/journals/IJA/Vol3N2/inhal1.htm>
- Dosch MP. The anesthesia gas machine, vaporizers, compressed gases,safety: Avoiding the pitfalls  
<http://ourworld-top.cs.com/doschm/agmpart1.htm>

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