Anesthesia
Anesthesia

From Greek *anaisthesis* means ”not sensation”

Listed in Bailey’s English Dictionary 1721.

When the effect of *ether* was discovered””*anesthesia*”” used as a name for the new phenomenon.
Basic Principles of Anesthesia

- **Anesthesia** defined as the abolition of sensation
- **Analgesia** defined as the abolition of pain
- “**Triad of General Anesthesia**”
  - need for unconsciousness
  - need for analgesia
  - need for muscle relaxation
History of Anesthesia

- Ether synthesized in 1540 by Cordus
- Ether used as anesthetic in 1842 by Dr. Crawford W. Long
- Ether publicized as anesthetic in 1846 by Dr. William Morton
- Chloroform used as anesthetic in 1853 by Dr. John Snow
History of Anesthesia

- Endotracheal tube discovered in 1878
- Local anesthesia with cocaine in 1885
- Thiopental first used in 1934
- Curare first used in 1942 - opened the “Age of Anesthesia”
General Anesthesia

- Sleep induction
- Loss of pain responses
- Amnesia
- Skeletal muscle relaxation
- Loss of reflexes
General Anesthesia

Stages of Anesthesia

- Stage I
  - Analgesia
- Stage II
  - Disinhibition
- Stage III
  - Surgical anesthesia
- Stage IV
  - Medullary depression
Types of anesthetics

I. Inhalation anesthetics

II. Intravenous anesthetics

III. Local anesthetics
I. Inhalation anesthetics

Mechanisms of Action

- Activate Potassium ($K^+$) channels
- Block sodium ($Na^+$) channels
- Disrupt membrane lipids

- In general, all general anesthetics increase the cellular threshold for firing, thus decreasing neuronal activity.
I. Inhalation anesthetics

Ether (diethyl ether)

- Spontaneously explosive
- Irritant to respiratory tract
- High incidence of nausea and vomiting during induction and post-surgical emergence
I. Inhalation anesthetics

**Nitrous Oxide**

Physical properties:

- It is a laughing gas.
- It is only inorganic anesthetic gas in clinical use.
- Colorless and odorless
- Non Explosive and Non Inflammable
- Gas at room temperature and can be kept as a liquid under pressure.
- It is relatively inexpensive.
I. Inhalation anesthetics

**Halothane (Fluothane)**

- Volatile liquid
- Narrow margin of safety
- Less analgesia and muscle relaxation
- Hepatotoxic
- Reduced cardiac output leads to decrease in mean arterial pressure
- Increased sensitization of myocardium to catecholamines
I. Inhalation anesthetics

Enflurane (Ethrane)

- Similar to Halothane
- Less toxicities

Isoflurane (Forane)

- Volatile liquid
- Decrease mean arterial pressure resulting from a decrease in systemic vascular resistance
Effects of Inhalation anesthetics on Organ System

1. CARDIOVASCULAR SYSTEM

- Stimulate sympathetic nervous system.
- Directly depresses myocardial contractility.
- Arterial blood pressure, heart rate and cardiac output are slightly increased.

2. RESPIRATORY SYSTEM:

- Increases respiratory rate with decreases respiratory volume.
- Minimal change in minute ventilation.
3. CEREBRAL:
➢ Increases intracranial pressure.

4. RENAL SYSTEM:
➢ It decreases renal blood flow thus leads to drop in glomerular filtration rate and urinary output.

5. HEPATIC SYSTEM:
➢ Decreases the Hepatic blood flow

6. GASTROINTESTINAL:
➢ It causes post operative Nausea and Vomiting.
II. Intravenous anesthetics

Ketamine (Ketaject, Ketalar)

- Block glutamate receptors
- Dissociative anesthesia:
  - Catatonia, analgesia, and amnesia without loss of consciousness
  - Post-op emergence phenomena: disorientation, sensory and perceptual illusions, vivid dreams
- Cardiac stimulant
II. Intravenous anesthetics

Etomidate (Amidate)

- Non-barbiturate
- Rapid onset
- Minimal cardiovascular and respiratory toxicities
- High incidence of nausea and vomiting
II. Intravenous anesthetics

Propofol (Diprivan)
- Mechanism similar to ethanol
- Rapid onset and recovery
- Mild hypotension
- Antiemetic activity

Short-acting barbiturates
- Thiopental (Pentothal)

Benzodiazepines
- Midazolam (Versed)
III. Local anesthetics

Structure-Activity Relationships

❖ Benzoic acid derivatives (Esters)

❖ Aniline derivatives (Amides)
### III. Local anesthetics

<table>
<thead>
<tr>
<th>Drug</th>
<th>Duration of Action</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Esters</strong></td>
<td></td>
</tr>
<tr>
<td>Cocaine</td>
<td>Medium</td>
</tr>
<tr>
<td>(Procaine (Novocain</td>
<td>Short</td>
</tr>
<tr>
<td>(Tetracaine (Pontocaine</td>
<td>Long</td>
</tr>
<tr>
<td>Benzocaine</td>
<td>Topical use only</td>
</tr>
<tr>
<td><strong>Amides</strong></td>
<td></td>
</tr>
<tr>
<td>(Lidocaine (Xylocaine</td>
<td>Medium</td>
</tr>
<tr>
<td>(Mepivacaine (Carbocaine, Isocaine</td>
<td>Medium</td>
</tr>
<tr>
<td>(Bupivacaine (Marcaine</td>
<td>Long</td>
</tr>
</tbody>
</table>
III. Local anesthetics

Structure-Activity Relationships

(Procaine (Novocain

(Lidocaine (Xylocaine, etc
III. Local anesthetics

Techniques of administration

- **Topical**: benzocaine, lidocaine, tetracaine
- **Infiltration**: lidocaine, procaine, bupivacaine
- **Nerve block**: lidocaine, mepivacaine
- **Spinal**: bupivacaine, tetracaine
- **Epidural**: bupivacaine
- **Caudal**: lidocaine, bupivacaine
III. Local anesthetics

Toxicities:

- CNS-sedation, restlessness, nystagmus, convulsions
- Cardiovascular - cardiac block, arrhythmias, vasodilation (except cocaine)
- Allergic reactions - more common with esters
Airway intubation
Methods:

- Endotracheal intubation
  - Orotracheal
  - Nasotracheal
- Cricothyrotomy
- Tracheotomy
Endotracheal Intubation

➢ Placement of a flexible plastic tube into the trachea to:
  ➢ maintain an open airway,
  ➢ serve as a conduit through which to administer certain drugs.

➢ Is performed in critically injured, ill or anesthetized patients:
  ➢ to facilitate ventilation of the lungs, including mechanical ventilation,
  ➢ to prevent the possibility of asphyxiation or airway obstruction.
Indications:

- For supporting ventilation in patient with pathologic disease:
  - Upper airway obstruction,
  - Respiratory failure,
  - Loss of consciousness

- For supporting ventilation during general anaesthesia:
  - Type of surgery:
    - Operative site near the airway,
    - Thoracic or abdominal surgery,
    - Prone or lateral surgery,
    - Long period of surgery

- Patient has risk of pulmonary aspiration

- Difficult mask ventilation
Airway Assessment

Condition that associated with difficult intubation:

- Congenital anomalies → Pierre Robin syndrome, Down’s syndrome
- Infection in airway → Retropharyngeal abscess, Epiglottitis
- Tumor in oral cavity or larynx
- Enlarge thyroid gland → trachea shift to lateral or compressed tracheal lumen
Airway Assessment

2) **Interincisor gap**: normal → more than 3 cms
Laryngoscopic view

Grade 3,4 → risk for difficult intubation!
- **Thyromental distance**: more than 6 cms

- **Flexion and extension of neck**
Movement of TemperoMandibular Joint (TMJ)

Grinding
...Preparing the procedure

Essentials that **must be present** to ensure a **safe intubation**!

They can be remembered by the mnemonic **SALT**

- **Suction.** This is extremely important. Often patients will have material in the pharynx, making visualization of the vocal cords difficult.

- **Airway.** the oral airway is a device that lifts the tongue off the posterior pharynx, often making it easier to mask ventilate a patient. The inability to ventilate a patient is bad. Also a source of O2 with a delivery mechanism (ambu-bag and mask) must be available.

- **Laryngoscope.** This lighted tool is vital to placing an endotracheal tube.

- **Tube.** Endotracheal tubes come in many sizes. In the average adult a size 7.0 or 8.0 oral endotracheal tube will work just fine.
1) Laryngoscope: handle and blade
LARYNGOSCOPIC BLADE

- Macintosh (curved) and Miller (straight) blade
- Adult: Macintosh blade, small children: Miller blade
2) Endotracheal tube
Endotracheal tube cuff

- High volume, Low pressure cuff
- Low volume, High pressure cuff

- Pilot Balloon
- Bevel
- Murphy's eye
Instruments used...

Self-refilling bag-valve combination (eg, **Ambu bag**) or bag-valve unit (Ayres bag), connector, tubing, and oxygen source. Assemble all items before attempting intubation.

1. Tincture of **benzoin** and precut **tape**
2. **Introducer** (stylets or **Magill forceps**)
3. Suction apparatus (tonsil tip and catheter)
4. **Syringe**, 10-mL, to inflate the cuff
5. **Mucosal anesthetics** (eg, 2% lidocaine)
6. Water-soluble sterile lubricant
7. **Gloves**
Tecnique:

Sniffing position

Flexion at lower cervical spine
Extension at atlanto-occipital joint
Complications

Tube malpositioning (esophageal intubation

Tube malfunction or physiologic responses to airway instrumentation

Trauma such as tooth damage, lip/tongue/mucosal laceration, sore throat, dislocated mandible

Mucosal inflammation and ulceration and excoriation of nose can occur while the tube is in place

Laryngeal malfunction and aspiration, glottic, subglottic or tracheal edema and stenosis, vocal cord granuloma or paralysis during extubation

Physiologic responses to intubation include hypertension, tachycardia, intracranial hypertension and laryngospasm
Laryngeal Masks (LMA)

The Laryngeal Mask Airway is an alternative airway device used for anesthesia and airway support.

- They cause less pain and coughing than an endotracheal tube, and are much easier to insert.

It consists of an inflatable silicone mask and rubber connecting tube. It is inserted blindly into the pharynx, forming a low-pressure seal around the laryngeal inlet and permitting gentle positive pressure ventilation.

All parts are latex-free.
Cuff and airway tube molded as single unit for extra safety

Convenient depth marks

Built-in, anatomically correct curve for easy insertion

Inflation line is firmly affixed to airway tube for 3-6 cm to prevent tangles

Ergonomically shaped for firm grip during insertion

Eight convenient sizes from #1 to #6.

Reinforced tip will not bend during insertion so placement is always correct

Extra soft cuff ensures the best possible seal with least possible internal pressure

Color-coded pilot balloon identifies mask size and provides precise tactile indication of degree of inflation

Universal check valve
Regional Anesthesia

- Spinal & epidural Anesthesia
Commonly R.A techniques include:

- Spinals (subarachnoid block), epidurals (extradural space), caudals, and major peripheral nerve blocks.
Spinal Cord

- Spinal Cord
  - Adult
    - Begins: Foramen Magnum
    - Ends: L1
  - Newborn
    - Begins: Foramen Magnum
    - Ends: L3
- Terminal End: Conus Medullaris
- Filum Terminale: Anchors in sacral region
- Cauda Equina: Nerve group of lower dural sac
Spinal Anatomy

- 33 Vertebrae
  - 7 Cervical
  - 12 Thoracic
  - 5 Lumbar
  - 5 Sacral
  - 4 Coccygeal
- High Points: C5 & L5
- Low Points: T5 & S2
Saggital Sections

- Supraspinous Ligament
  - Outer most layer
- Intraspinous Ligament
  - Middle layer
- Ligamentum Flavum
  - Inner most layer
Spinal Technique

➢ Midline Approach
  ➢ Skin
  ➢ Subcutaneous tissue
  ➢ Supraspinous ligament
  ➢ Interspinous ligament
  ➢ Ligamentum flavum
  ➢ Epidural space
  ➢ Dura mater
  ➢ Arachnoid mater

➢ Paramedian or Lateral Approach
  ➢ Same as midline excluding supraspinous & interspinous ligaments
Clinical techniques include: cont…

- **Epidural anesthesia** - a local anesthetic is injected into the **epidural space**. 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**. The resulting anesthesia usually extends from the legs to the abdomen or chest.
Spinal Block - Position

**FIG. 24-15** Spinal block—lateral position.

**FIG. 24-16** Spinal block—sitting position.
Spinal and Epidural Anaesthesia
Spinal and Epidural Anaesthesia
Clinical techniques include:

- **Peripheral nerve blocks** - injection of local anesthetic in the vicinity of a peripheral nerve to anesthetize that nerve's area of innervation.

- **Plexus anesthesia** - injection of local anesthetic in the vicinity of a nerve plexus, often inside a tissue compartment that limits the diffusion of the drug away from the intended site of action. The anesthetic effect extends to the innervation areas of several or all nerves stemming from the plexus.
Peripheral nerve blocks
Plexus Blockade

- Injection of local anesthetic adjacent to a plexus, e.g. cervical, brachial or lumbar plexus
- Uses:
  - surgical anesthesia or post-operative analgesia in the distribution of the plexus
- Advantages:
  - large area of anesthesia with relatively large dose of agent
- Disadvantages:
  - technically complex, potential for toxicity and neuropathy.
Clinical techniques include:

- **Peripheral nerve blocks** - injection of local anesthetic in the vicinity of a peripheral nerve to anesthetize that nerve's area of innervation.

- **Plexus anesthesia** - injection of local anesthetic in the vicinity of a nerve plexus, often inside a tissue compartment that limits the diffusion of the drug away from the intended site of action. The anesthetic effect extends to the innervation areas of several or all nerves stemming from the plexus.
Local Anaesthesia
Local Anesthesia
Cardiopulmonary Resuscitation
Introduction

➢ Cardiopulmonary resuscitation is a technique for rescue breathing combined with chest compression. The purpose of CPR is to temporarily maintain the circulation sufficient to preserve brain function until specialized treatment is available.
Chain of Survival

➢ In order for a person to survive

Early "Access "9-911

Early First Aid/CPR You

Early Defibrillation EMS on Scene

Early Advanced Care Hospital
Chain of Survival

When to start CPR?

➢ Rescuers should start CPR if the victims have no signs of life (Unconscious, unresponsive, not moving and not breathing at all).

➢ Even when the victims take occasional gaps, rescuers should suspect that cardiac arrest has occurred and start CPR.
Diagnosis of cardiac arrest

Blood pressure measurement

Take the pulse on peripheral arteries

Auscultation of cardiac tones

Symptoms of cardiac arrest

- absence of pulse on carotid arteries – a pathognomonic symptom
- respiration arrest – may be in 30 seconds after cardiac arrest
- enlargement of pupils – may be in 90 seconds after cardiac arrest

!!! Loss of time
Sequence of operations

- Check responsiveness
- Call for help
- Correctly place the victim and ensure the open airway
- Check the presence of spontaneous respiration
- Check pulse
- Start external cardiac massage and artificial ventilation
Main stages of resuscitation

A (Airway) – ensure open airway by preventing the falling back of tongue, tracheal intubation if possible

B (Breathing) – start artificial ventilation of lungs

C (Circulation) – restore the circulation by external cardiac massage

D (Differentiation, Drugs, Defibrilation) – quickly perform differential diagnosis of cardiac arrest, use different medication and electric defibrillation in case of ventricular fibrillation
Assessment of spontaneous breathing should immediately follow the opening or establishment of the airway.

Initially 2 breaths are slowly administered.

If these breaths cannot be delivered, either the airway is still obstructed and the head and neck need repositioning or a foreign body is present that must be removed.
CIRCULATION

- The circulatory system must be supported by combination of external chest compressions, intravenous drug administration, and defibrillation when appropriate.
WHERE TO COMPRESS

The desired compression point for CPR in adults is **over the lower half of the sternum**. The other hand should be placed over the hand on the sternum with the fingers interlocked or extended. The rescuer's shoulders should be positioned directly over the hands with the elbows locked in position and the arms extended so that the weight of the upper body is used for compressions.
The sternum is depressed 4-5 cm in adults or 2-4 cm in children and then allowed to return to its normal position.
Either 2 breaths are administered every 15 compression (15:2) or (30:2) are also recommended.

The cardiac compression rate should be 100/min regardless of numbers of rescuers.

Chest compression force blood to flow either by increasing intra-thoracic pressure or by directly compressing the heart (cardiac pump).
Automated External Defibrillator (AED)

- AEDs come in various models.
- Some operator interaction required.
- A specialized computer recognizes heart rhythms that require defibrillation.
AED Plus

**ONLY Advises Treatment**

Deliver one shock if there is a Shockable Rhythm

- Push Shock Button
- No Shock Needed
Provide Life Support •

(...as needed)

Until EMS Arrives
...Whether shocks are delivered or not advised

Open Airway ▪ Check for Breathing ▪ Signs of Circulation ▪
Re-packaging the AED Plus
Maintain Airway
  - Chin Lift
  - Empty Mouth
  - "Recovery Position"
  - Place PASS

Assist Breathing

Give Emotional Support
Passive Airway Support System

The ZOLL AED Plus offers the unique option of a Passive Airway Support System (PASS). The AED lid can be removed, inverted and used as a “wedge” placed under the patient’s shoulders.
When Breathing & Pulse Do Not Return

Continue CPR •
Follow Voice Prompts •
Rhythm Re-analysis •
(Repeat Shock(s •

Until EMS Arrives...
When Breathing & Pulse Return

Support Life

Airway • Breathing • Circulation •

Be as Efficient & Effective as Possible

Until EMS Arrives...
Precautions & Concerns

**Implanted Heart Devices**
- Pacemaker
- Defibrillator

If scar or “bulge” on right side of chest
Don't put pad over device

Slightly “Rotate” Padz

Medication Patches
- Remove Patch – Wipe Chest Clean
Battery Replacement
DEFIBRILLATION

➢ Ventricular fibrillation is found most commonly in adults who experience non-traumatic cardiac arrest.

➢ The chance of survival decreases 7-10% for every minute without defibrillation.

➢ Defibrillators deliver energy in either mono-phasic or biphasic waveforms.
You Can Do It