



SNS COLLEGE OF ALLIED HEALTH SCIENCE
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DEPARTMENT OF OPERATION THEATRE AND ANAESTHESIA TECHNOLOGY - II YEAR

COURSE NAME: PHARMACOLOGY

TOPIC – INHALATIONAL AGENTS

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INHALATIONAL ANESTHETIC AGENTS



- Inhalational agents are substances administered via inhalation to induce and maintain general anesthesia.
- Primarily used in surgical procedures to provide analgesia, amnesia, muscle relaxation, and unconsciousness.
- Advantages: Rapid onset/offset, titratable, non-invasive delivery via respiratory system.
- Disadvantages: Potential for airway irritation, environmental pollution, and side effects like nausea.
- **Key Concepts:**
- Mechanism: Act on the central nervous system (CNS) by enhancing GABA activity or other neurotransmitter modulation.



INHALATIONAL ANESTHETIC AGENTS



- Broadly divided into two main categories:
- Volatile Anesthetics:** Liquids at room temperature that are vaporized for inhalation (e.g., halothane, isoflurane).
- Gaseous Anesthetics:** Gases at room temperature (e.g., nitrous oxide, xenon).
- Historical vs. Modern: Older agents (e.g., ether, chloroform) are obsolete due to toxicity; focus on current agents.
- Factors Influencing Choice: Potency, solubility, side effects, cost, and patient factors (e.g., age, comorbidities).

- **Definition:** Halogenated hydrocarbons or ethers that are liquids at ambient temperature but easily vaporized.
- **Key Properties:**
 - High potency, low blood:gas solubility for rapid induction/recovery.
 - Delivered via vaporizers in anesthesia machines.
 - Common Agents: Halothane, Enflurane, Isoflurane, Sevoflurane, Desflurane.
 - Mechanism: Primarily potentiate GABA-A receptors; also affect NMDA and glycine receptors.



HALOTHANE



- Volatile Anesthetics: Halothane
- Content:**
- Introduction: Introduced in 1956; fluorinated hydrocarbon; now less used due to hepatotoxicity.
- Pharmacokinetics:
 - MAC: 0.75% (potent).
 - Blood:Gas Partition Coefficient: 2.3 (moderate solubility, slower onset/recovery).
 - Metabolism: hepatic, produces trifluoroacetic acid (linked to toxicity).
- Advantages: Pleasant odor, non-irritating, good muscle relaxation, bronchodilation.
- Disadvantages: Myocardial depression, arrhythmias (sensitizes heart to catecholamines), rare malignant hyperthermia trigger, hepatotoxicity (halothane hepatitis).
- Clinical Uses: Pediatric induction (sweet smell); avoided in adults with liver issues.
- Side Effects: Hypotension, bradycardia; contraindicated in pheochromocytoma.



ENFLURANE



- introduction: Halogenated ether, introduced in 1972; less common today.
- Pharmacokinetics:
- MAC: 1.7% (less potent than halothane).
- Blood:Gas Partition Coefficient: 1.9 (similar onset to halothane).
- Metabolism: hepatic.
- Advantages: Stable hemodynamics, muscle relaxation, suitable for outpatient surgery.
- Disadvantages: Seizure potential at high concentrations, airway irritation, nephrotoxicity (fluoride release).
- Clinical Uses: Maintenance of anesthesia; avoided in epilepsy patients.
- Side Effects: Dose-dependent CNS excitation, increased intracranial pressure.



ISOFLURANE



- Introduction: Halogenated ether, widely used since 1980s; "gold standard" for many procedures.
- Pharmacokinetics:
- MAC: 1.15% (moderate potency).
- Blood:Gas Partition Coefficient: 1.4 (faster onset/recovery than halothane).
- Metabolism: <0.2% (minimal, low toxicity).
- Advantages: Cardiovascular stability, minimal hepatic/renal effects, cost-effective.
- Disadvantages: Pungent odor (airway irritation), coronary steal phenomenon in CAD patients.
- Clinical Uses: Cardiac surgery, neurosurgery; good for long procedures.
- Side Effects: Vasodilation leading to hypotension; triggers malignant hyperthermia.



SEVOFLURANE



- Introduction: Fluorinated ether, introduced in 1990s; popular for induction.
- Pharmacokinetics:
- MAC: 2.0% (lower potency).
- Blood:Gas Partition Coefficient: 0.65 (rapid onset/recovery).
- Metabolism: 3-5% (produces Compound A, potential nephrotoxin with soda lime).
- Advantages: Non-pungent, sweet smell (ideal for mask induction in children), rapid recovery.
- Disadvantages: Higher cost, emergence delirium in pediatrics, rare seizures.
- Clinical Uses: Ambulatory surgery, pediatrics; combined with nitrous oxide.
- Side Effects: Minimal cardiovascular depression; avoid in closed-circuit systems long-term.



DESFLURANE



- Introduction: Fluorinated ether, introduced in 1990s; requires special vaporizer due to high vapor pressure.
- Pharmacokinetics:
 - MAC: 6.0% (low potency, high concentrations needed).
 - Blood:Gas Partition Coefficient: 0.42 (fastest onset/recovery).
 - Metabolism: <0.02% (negligible).
- Advantages: Ultra-rapid recovery (ideal for outpatient), minimal organ toxicity.
- Disadvantages: Very pungent (coughing, laryngospasm), high cost, environmental impact (greenhouse gas).
- Clinical Uses: Bariatric surgery, short procedures; not for induction due to irritation.
- Side Effects: Tachycardia, hypertension at induction; malignant hyperthermia trigger.



NITROUS OXIDE



- Introduction: "Laughing gas," discovered in 1772; most common gaseous anesthetic.
- Pharmacokinetics:
- MAC: 104% (weak potency, used at 50-70% with oxygen).
- Blood:Gas Partition Coefficient: 0.47 (rapid equilibrium).
- Metabolism: None (excreted unchanged via lungs).
- Advantages: Analgesic, anxiolytic, minimal respiratory depression, cheap.
- Disadvantages: Diffusion hypoxia on discontinuation, emetogenic, expands air-filled spaces (contraindicated in pneumothorax).
- Clinical Uses: Dental procedures, labor analgesia, adjunct in general anesthesia.
- Side Effects: Vitamin B12 inactivation (chronic use leads to neuropathy), greenhouse gas.



XENON



- Introduction: Noble gas, investigated since 1950s; expensive and rare.
- Pharmacokinetics:
- MAC: 71% (more potent than N₂O).
- Blood:Gas Partition Coefficient: 0.115 (very rapid onset/recovery).
- Metabolism: None.
- Advantages: Hemodynamic stability, neuroprotective, no environmental impact.
- Disadvantages: Extremely high cost, limited availability, requires special equipment.
- Clinical Uses: Research in cardiac/neuro surgery; not routine.
- Side Effects: Minimal; potential for nausea.



THANK YOU