INHALATIONAL ANESTHETICS

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HALOTHANE

• It is a halogenated alkane, MAC 0.75%
• Nonflammable and nonexplosive due to the carbon-fluoride bonds
• Rarely used in the US
EFFECTS ON ORGAN SYSTEMS (CARDIOVASCULAR) - HALOTHANE

• Dose-dependent myocardial depression causing decreased BP
• Interferes with sodium-calcium exchange and intracellular calcium utilization
• Causes coronary vasodilation but coronary blood flow decreases due to decrease in BP
• Low systemic BP should cause reflex tachycardia but halothane blunts this reflex
• It sensitized the heart to the arrhythmogenic effects of epinephrine (doses above 1.5mcg/kg should be avoided)
EFFECTS ON ORGAN SYSTEMS (RESPIRATORY ) - HALOTHANE

- Causes rapid, shallow breathing
- Increase in RR can’t counteract decrease in tidal volume so alveolar ventilation drops and Paco2 is elevated
- Apneic threshold rises
- Effects are due to central and peripheral mechanisms
- Effects are exaggerated by underlying lung disease and attenuated by surgical stimulation
- Potent bronchodilator by inhibiting intracellular calcium mobilization
- Depresses clearance of mucus promoting postoperative hypoxia and atelactasis
EFFECTS ON ORGAN SYSTEMS (CEREBRAL) - HALOTHANE

- Dilated cerebral vessels, so lowers resistance and increases blood flow
- Auto regulation is blunted
- Rises in ice can be prevented by establishing hyperventilation prior to administration of halothane
- Cerebral activity is decreased
EFFECTS ON ORGAN SYSTEMS (NEUROMUSCULAR) - HALOTHANE

- Relaxes skeletal muscle and potentiates nondepolarizing neuromuscular-blocking agents
- It is a trigger for malignant hyperthermia
EFFECTS ON ORGAN SYSTEMS (RENAL) - HALOTHANE

- Reduces renal blood flow, gfr, and urinalysis output
- Preop hydration prevents these changes
EFFECTS ON ORGAN SYSTEMS (HEPATIC) - HALOTHANE

- Decreases hepatic blood flow
- Hepatic artery vasospasm has been reported
- Metabolism of some drugs is impaired by halothane (fentanyl, phenytoin)
- Minor liver transaminase elevations
TOXICITY - HALOTHANE

• Oxidized in the liver by CYP to its principal metabolite trifluoroacetic acid
• In absence of oxygen small amounts of hepatotoxic metabolites might form, elevated fluoride levels signal significant anaerobic metabolism
• Halothane hepatitis is extremely rare
• Risk factors are: Middle-aged obese women, multiple exposures at short intervals, familial predisposition, personal hex of toxicity
CONTRAINDICATIONS- HALOTHANE

• Withhold it from patients with unexplained liver dysfunction following previous anesthetic exposure
• Use with care in patient with intracranial lesions because of possibility of intracranial hypertension
• Patients with reductions in left ventricle function may not tolerate negative ionotrophic effects
• Combination with aminophylline resulted in serious ventricular arrhythmias
ISOFLURANE

- Nonflammable volatile anesthetic with a pungent ethereal odor
- MAC 1.15%
EFFECTS ON ORGAN SYSTEMS (CARDIOVASCULAR) - ISOFLURANE

- Minimal left ventricular depression
- Cardiac output is maintained due to rise in heart rate
- Rapid increases in isoflurane conc lead to transient increases in heart rate, BP, and plasma levels of epinephrine
- Dilates coronary arteries
EFFECTS ON ORGAN SYSTEMS (RESPIRATORY) - ISOFLURANE

- Causes respiratory depression but tachypnea is less pronounced when compared to other volatile anesthetics
- Irritates upper airway reflexes but is considered a good bronchodilator, not as good as halothane
EFFECTS ON ORGAN SYSTEMS (CEREBRAL) - ISOFLURANE

• At greater than 1 MAC, it increases cerebral blood flow and blood pressure
• Effects are reversed by hyperventilation
• In contrast to halothane, hyperventilation doesn’t have to be started before using isoflurane
• It reduces cerebral metabolic oxygen demand
• At 2 MAC, it produces an electrically silent EEG
EFFECTS ON ORGAN SYSTEMS (NEUROMUSCULAR) - ISOFLURANE

• Relaxes skeletal muscle
EFFECTS ON ORGAN SYSTEMS (RENAL) - ISOFLURANE

- Decreases renal blood flow, gfr, and urinary output
EFFECTS ON ORGAN SYSTEMS (HEPATIC) - ISOFLURANE

- Total hepatic blood flow may be reduced.
- Hepatic oxygen supply is better maintained with isoflurane than with halothane because hepatic artery perfusion is preserved.
- LFTs are usually not affected.
TOXICITY – ISOFURANE

• Nephrotoxicity is extremely unlikely although serum fluoride may rise
• Its limited oxidative metabolism minimizes any risk of significant hepatic dysfunction
CONTRAINDICATIONS - ISOFLURANE

- Patients with severe hypovolemia may not tolerate vasodilating effects
- It can trigger malignant hyperthermia
- NMBAs may be potentiated by isoflurane
SEVOFLURANE

- Halogenated with fluorine
- Nonpungency and rapid increases in alveolar conc make it an excellent choice for smooth and rapid inhalation inductions
- MAC 2.0%
EFFECTS ON ORGAN SYSTEMS (CARDIOVASCULAR) - SEVOFLURANE

- Depresses myocardial contractility
- Vascular resistance and BP decline less than with isoflurane
- Causes no increase in heart rate so output is not maintained
- May prolong QT interval
EFFECTS ON ORGAN SYSTEMS (RESPIRATORY) - SEVOFLURANE

- Depresses respiration and reverses bronchospasm to an extent similar to that of isoflurane
EFFECTS ON ORGAN SYSTEMS (CEREBRAL) - SEVOFLURANE

• Causes an increase in CBF and ICP

• High concentrations may impair autoregulation of CBF thus allowing a drop in CBF during hemorrhagic hypotension

• Effect on autoregulation less pronounced that with isoflurane
EFFECTS ON ORGAN SYSTEMS (NEUROMUSCULAR ) - SEVOFLURANE

• Produces adequate muscle relaxation for intubation but most practitioners use a combination of anesthetics and neuromuscular blockers
EFFECTS ON ORGAN SYSTEMS (RENAL) - SEVOFLURANE

• Slightly decreases renal blood flow
EFFECTS ON ORGAN SYSTEMS (HEPATIC) - SEVOFLURANE

- Decreases portal vein blood flow, but increases hepatic artery blood flow and oxygen delivery.
- Generally not associated with immune-mediated anesthetic hepatotoxicity.
TOXICITY – SEVOFLURANE

• Potential nephrotoxicity with rising fluoride levels
• Another nephrotoxic agent can be for emend when sevoflurane is degraded by alkali substances
• It can also be degraded into hydrogen fluoride which can produce an acid burn
CONTRAINDICATIONS – SEVOFLURANE

- Severe hypovolemia
- Susceptibility to malignant hyperthermia
- Intracranial hypertension
- Potentiates NMBAs
- Doesn’t sensitize the heart to catecholamine-induced arrythmias
ENFLURANE AND DESFLURANE

- MAC of enflurane is 1.68% (potent cardiovascular depressant)
- MAC of desflurane is 6.0%
Thank you for listening!