

Boric Acid

- Boric acid had significant medical uses in the past as a **topical antiseptic and irrigant**.
- At one time it was **mixed with honey and glycerine** and sold to treat topical mucosal sores in children.
- Because of its weak antiseptic properties and significant toxicity it is **no longer used** in medicinal preparations.
- A common cause of exposure today is related to **accidental ingestion** of powdered boric acid used to kill cockroaches.



- Suicidal ingestions of large amounts (**280 g** in one case) may be fatal.

Pathophysiology

- Boric acid is easily absorbed **across**
 1. mucosal surfaces
 2. abraded skin, and
 3. gastrointestinal tract.
- It is eliminated **unchanged in the kidneys** with a half-life of 21 hours in patients with normal renal function.
- **Excretion** is markedly **prolonged** in seriously poisoned patients.

Clinical Presentation

- The characteristic presentation of boric acid poisoning is the development of **blue-green vomiting and diarrhea**
- followed by intense erythroderma that has a **boiled lobster appearance**.
- This progresses **to desquamation and erosion** of mucosal surfaces.



Clinical Presentation

- Renal, bone marrow, and hepatic injuries occur.
- **CNS symptoms** include seizures, delirium, and coma.

Treatment

- Treatment in most cases is supportive.
- **Activated charcoal does not absorb** boric acid effectively.
- Ipecac-induced **emesis for 200 to 400 mg/kg**,
- **lavage** and emergency department evaluation for more than **400 mg/kg**. Lavage was recommended for a 12-g ingestion in larger patients.
- **Hemodialysis** may be indicated for severely poisoned patients.
- **Exchange transfusions** have been used in severely poisoned neonates.

DISINFECTANTS AND STERILANTS

- **Disinfectants** are agents that are applied to **inanimate** objects to inhibit or kill microorganisms.
- **Sterilants** kill all forms of microorganisms, including **spores**.

Formaldehyde

- It is used as a disinfectant in either a **2-8 %** solution
- formulated in **10-15 %** methanol that is added to prevent polymerization. As in **37% aqueous** soln. called formalin



- It is also used in the manufacture of **tissue fixatives**, textiles, resin glues, plastics, and urea-formaldehyde foam insulation.



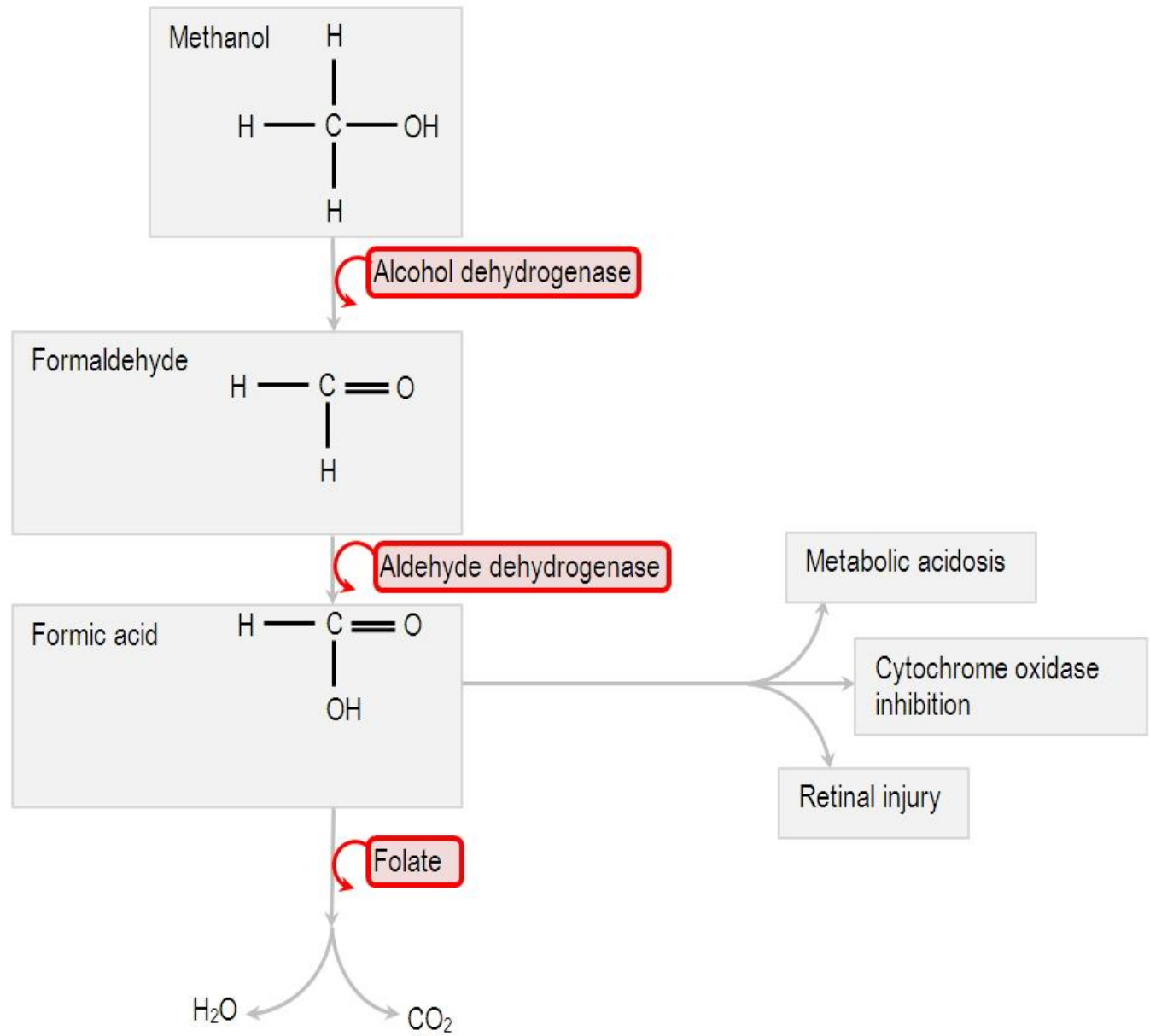
- Formaldehyde is **released** into ambient air from these products either as **excess free formaldehyde** or as a result of **decomposition**.
- It is also a product of **combustion** from appliances and **cigarette smoke**.



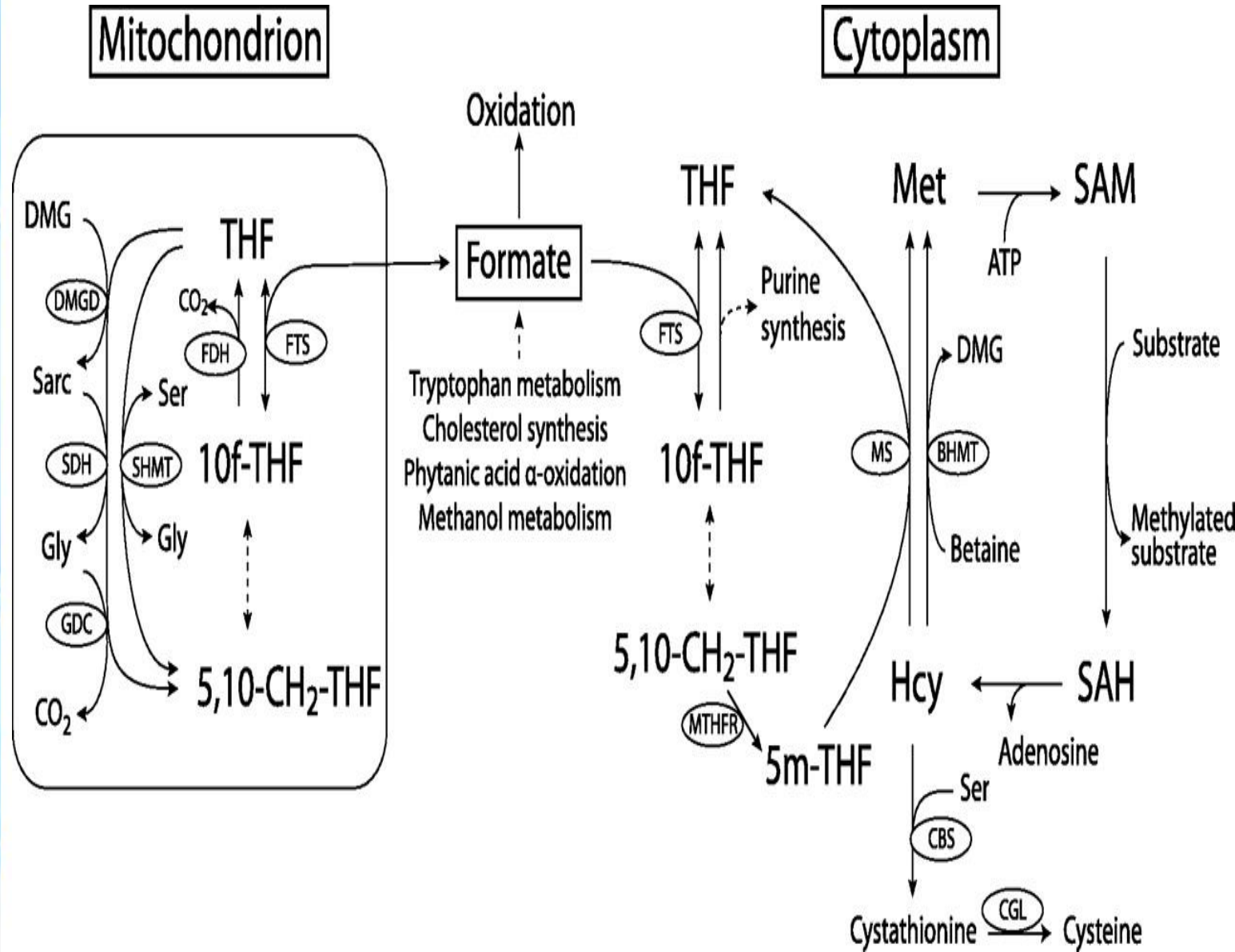
Pathophysiology

- Formaldehyde is **a protoplasmic** poison, denaturing proteins and causing coagulation necrosis.
- It promotes **allergic reactions** by binding to and altering tissue proteins.
- Repeated exposure is believed to result in **allergic contact dermatitis** (type IV hypersensitivity reaction).
- **Type I hypersensitivity** reactions are thought to precipitate the **bronchospastic** disease associated with formaldehyde

- Formaldehyde is **readily absorbed** from the gut and lungs and rapidly metabolized through **formate** to carbon dioxide and water by the liver and erythrocytes.



- **Formate** is a naturally occurring **product of tetrafolate reactions** with endogenous tissue levels of 3 to 12 ng/g.



Clinical Presentation

- **Inhalational Exposure**
- Formaldehyde has an **easily detectable odor** at **0.5 ppm**
- **frankly irritating** to upper airways and mucous membranes at **1 ppm**.
- These **unpleasant** attributes serve as an **early warning** and tend to limit inhalational exposure.
- **Severe respiratory irritation** develops at **10 ppm** producing dyspnea
-
- **Inhalation of 100 ppm** may be life threatening.

Clinical Presentation

- **Inhalational Exposure**
- Formaldehyde is believed to be a potent sensitizer in **immune-mediated bronchospasm**.
- **Chronic** low-level exposure to up to **1.6 ppm** produced
 - ✓ fatigue, headache
 - ✓ mucous membrane irritation
- The incidence of dermal sensitization may be as high as **5 per cent in the general population**.

Oral Exposure

- Ingestion of formaldehyde results in **gastrointestinal injury** with nausea, vomiting, diarrhea, abdominal pain, and lethargy.
- **Serious ingestions** may be complicated by **hemorrhage, shock, coagulation necrosis** of stomach and distal esophagus, severe metabolic acidosis, and death.
- **Multiple factors contribute to the acidosis**, including
 1. the metabolism of formaldehyde to formate,
 2. increased tissue lactate, and
 3. concomitant methanol poisoning.

Oral Exposure

- **Methanol** levels were elevated for **over 13 hours**. This prolonged course was attributed to delayed absorption due to “**fixation**” of the gastric mucosa.
- **Perforation and strictures** of the gastrointestinal tract may limit recovery.
- Inadvertent **parenteral exposure to 2 % formalin** from incompletely purged **hemodialysis machines** has resulted in intravascular hemolysis.

Phenol

- **Phenol** (C_6H_5OH) is also known as carbolic acid.
- it is **currently found in** disinfectants, solvents, toiletries, analgesic preparations, and wood preservatives.
- It is used in the **chemical industry as an intermediary** as a phenol-formaldehyde **resin adhesive** for wood and plastics.



Phenol

- In addition, it is present in **cigarette smoke**.
- Phenol is used in many OTC preparations for its local **anesthetic properties**.

- It is present in **Chloraseptic**
- oral rinse (1.7 per cent)



- Campho-Phenique
- topical anesthetic (4.7%). And
- 10.8% camphor
- The odor **threshold of phenol is**
- **7.9 ppm** in water and 0.05 ppm
- in air.



A vertical blue abstract graphic on the left side of the slide, featuring flowing, wavy lines and a gradient from light to dark blue.


Pathophysiology

- Phenol is **a protoplasmic toxin that disrupts cell walls** and denatures proteins. These properties promote rapid pulmonary and gastrointestinal absorption.
- **Dermal absorption is rapid** even through intact skin.
- **High concentrations** of phenol **disrupt the dermal barrier** and penetrate skin effectively.
- Its local anesthetic action produces a relatively painless coagulum.
- Although a small amount of phenol undergoes conjugation with glucuronic and sulfuric acids within 1 to 2 days of exposure, most is excreted unchanged in the urine.



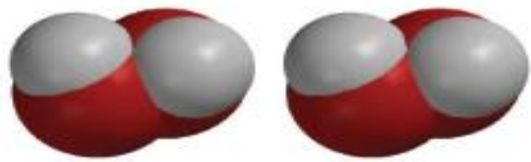
Clinical Presentation

- Topical exposure to phenol results in **brown painless patches** on the **skin** and **whitish patches** on the **mucous membranes**.
- Ingestion results in **gastrointestinal symptoms** that range in severity from nausea, vomiting, diarrhea, and abdominal pain to **hematemesis and hematochezia**.
- **Inhalation or aspiration** produces coughing, stridor, and an aromatic odor of the breath.
- **Systemic complaints from acute exposure include**
 - A. CNS stimulation and depression,
 - B. seizures, coma,
 - C. tachycardia, ventricular dysrhythmias, hypotension
 - D. hypothermia, metabolic acidosis, and acute tubular necrosis.

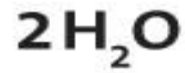
- 
- Chronic exposure has been associated with
 - sore throat, diarrhea, oropharyngeal sores
 - dark bilirubin-free urine the substance responsible for darkening the urine is probably an oxidative product of phenol metabolism.
 - “**Phenol marasmus**” is a syndrome that was described in health care workers chronically exposed to **nebulized phenol (5-10 %)** applied as a disinfectant .
 - They developed anorexia, **weight loss**, headache, vertigo, salivation, muscle aches and weakness, dark urine, and hepatitis

Hydrogen Peroxide

- Hydrogen peroxide is used in
 - ✓ disinfectants,
 - ✓ bleaching textiles and paper
 - ✓ manufacture of other chemicals, and in rocket fuel production.
- It is produced as a 3 % solution in water for household use.
- Concentrations of industrial solutions range from greater than 10 % to 70 %.
- Recently, the ingestion of a 35 % solution of hydrogen peroxide has been advocated for hyperoxygenation therapy.



hydrogen peroxide



water



oxygen



Pathophysiology

- Local toxicity from hydrogen peroxide results from direct oxidation by peroxide and by hydroxyl radicals produced from peroxide.
- The extent of injury is dependent on the **concentration** of hydrogen peroxide and the **duration** of exposure.
- Local tissue injury ranges from **mere irritant** effects by dilute solutions to **caustic injury** from more concentrated preparations.
- **the catalase-mediated** breakdown of hydrogen peroxide to oxygen and water produces large volumes of gas. One milliliter of 3 per cent hydrogen peroxide liberates 10 mL of oxygen under standard conditions of temperature and pressure.
- Massive distention may occur, exacerbating local injury or leading to life-threatening gas embolization.

Clinical Presentation

- **Toxic injuries occur after** inhalation, dermal and mucous membrane exposure, wound irrigation, or ingestion.
- Intense respiratory exposures may lead to **pulmonary edema**, coma, and seizures.
- High concentrations (**>30 per cent**) pose an explosion hazard.
- Dermal application produces symptoms ranging from **irritation** and erythema **with dilute solutions** to blistering and necrosis from concentrations **greater than 30 per cent**.
- Ingestion of hydrogen peroxide produces **a whitish discoloration or erythema of mucous membranes**, vomiting, abdominal pain, and **bloating**.

Clinical Presentation

- Ingestion of more concentrated solutions may produce **seizures** and gastric **mucosal hemorrhage** and edema.
- **Portal gas has** also been reported after the ingestion of dilute hydrogen peroxide.
- **hematemesis and hepatic air** after ingesting of 3 per cent hydrogen peroxide.
- Bowel irrigation with 1 per cent hydrogen peroxide led to mesenteric embolization and gut necrosis in a neonate.
- **Subcutaneous emphysema** and Embolic complications have resulted from forceful wound irrigation with 3 per cent hydrogen peroxide.



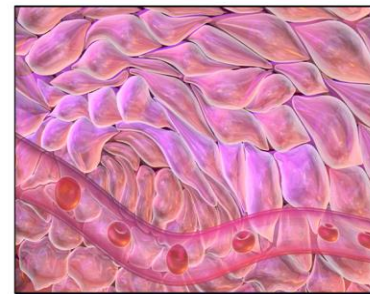
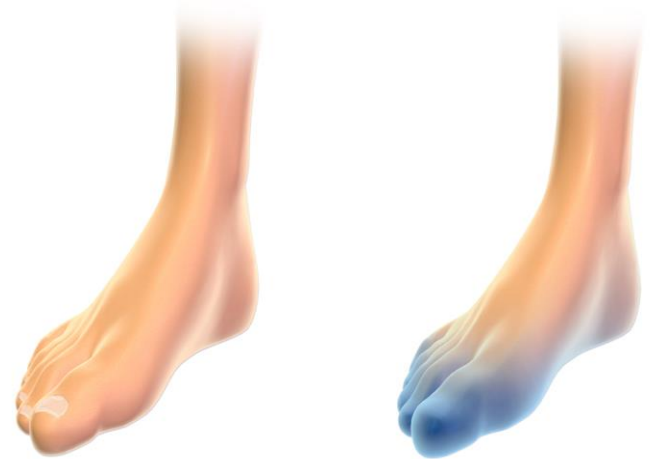
Ethylene Oxide

- Ethylene oxide is used in the **cold sterilization** of heat-sensitive medical instruments
- as an **intermediate** in the synthesis of other chemicals, and in the **manufacture of rocket propellants**.
- It is an **alkylating agent** that binds **covalently to DNA** and RNA, leading to the formation of point mutations.
- The limit of detection for odor is high at 700 ppm, at which point the odor is similar to that of ether.
- **Type I hypersensitivity** reactions
- have been reported after **chronic**
- **exposure**.

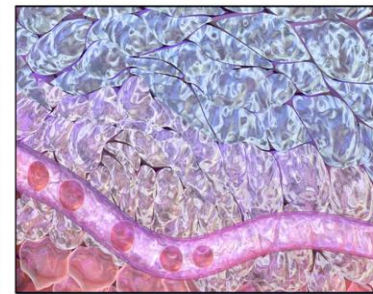


Clinical Presentation

- Acute exposure **causes irritation** to the skin, mucous membranes, conjunctivae, upper airway, and gastrointestinal tract.
-
- Significant dermal exposures may result **in burns, vesication, and frostbite.**



Normal



Frostbite

Clinical Presentation

- Nausea, lightheadedness, headache, malaise, ataxia, syncope, and seizures also occur after acute exposure.
- Anaphylactoid reactions have occurred when ethylene oxide was used to disinfect hemodialysis machines, leading to symptoms such as
 - ✓ dyspnea, chest pain,
 - ✓ urticaria, sweating,
 - ✓ flushing, itching, bronchospasm,
 - ✓ tachycardia, and hypotension.

HYDROGEN PEROXIDE

"Medical Miracle"

- * Treats Whooping Cough & Cholera
- * Stimulates Natural Killer Cells
- * Fights Fungus (including Candida)
- * Natural Whitening Agent
- * Cheap Mouthwash & Toothpaste
- * Kills E.Coli & Salmonella & Syphilis
- * Used for Tuberculosis & Typhus



WWW.CANCERTRUTH.NET



Clinical Presentation

- Chronic exposures have been associated with motor and sensory neuropathies and muscular atrophy
- There is some evidence that the rate of spontaneous abortion is increased in workers occupationally exposed to ethylene oxide.

A vertical blue abstract graphic on the left side of the slide, featuring flowing, wavy lines and a gradient from light to dark blue.

Treatment

- Resuscitation, including airway management, seizure control, and volume replacement should proceed simultaneously with decontamination.
- Topical exposures require thorough irrigation of the skin and eyes.
- Gentle aspiration of material through a small-bore flexible nasogastric tube may limit absorption and is a reasonable treatment.
- Emesis is contraindicated.
- Activated charcoal may adsorb selected chemicals but may also hinder endoscopic visualization of gastrointestinal mucosa.
- Volume losses and metabolic acidosis should be treated with appropriate intravenous fluids and sodium bicarbonate for severe metabolic acidosis.



Formaldehyde

- Intravenous ethanol or fomepizole, as well as hemodialysis, may be indicated in the treatment of methanol toxicity that follows a significant ingestion of formalin.
- Hemodialysis effectively clears formaldehyde as well as methanol and formate.

Phenol

- Water, low molecular weight polyethylene glycol, and isopropyl alcohol have been used for dermal decontamination of phenols.

Hydrogen Peroxide

- In the event of radiographic evidence of air in the heart after hydrogen peroxide exposure, immediate Trendelenburg positioning should be maintained to free the right ventricular outflow tract and prevent embolization to the CNS.



Trendelenburg Position