

Chemical and environmental toxins

Dr. nihad H. Ahmed

HYDROCARBONS

- A hydrocarbon is an organic compound made up primarily of carbon and hydrogen atoms, typically ranging from 1 to 60 carbon atoms in length.
- Hydrocarbons are a diverse group of xenobiotics that can cause toxicity by inhalation, ingestion, or dermal absorption. Most hydrocarbons occur as mixtures of several to many chemicals.
- This definition includes products derived from plants (pine oil, vegetable oil), animal fats (cod liver oil), natural gas, petroleum, or coal tar.
- There are two basic types of hydrocarbon molecules, aliphatic and aromatic .

PATHOPHYSIOLOGY AND CLINICAL FINDINGS

- Populations at particular risk for toxicity include children who ingest hydrocarbon compounds, workers who are occupationally exposed by inhalation or dermal absorption, and youths who intentionally inhale volatile hydrocarbons.
- Toxicity is largely determined by the route of exposure, and is xenobiotic-specific. Aspiration pneumonitis is the primary concern after hydrocarbon ingestion.
- Many hydrocarbons are poorly absorbed from the gastrointestinal tract and unlikely to produce systemic poisoning.

Aliphatic Hydrocarbons

- These agents find wide use as industrial solvents, degreasing agents, and cleaning agents.
- The substances include carbon tetrachloride, chloroform, trichloroethylene, tetrachloroethylene (perchloroethylene), and 1,1,1-trichloroethane (methyl chloroform).
- In laboratory animals, the halogenated hydrocarbons cause central nervous system depression, liver injury, kidney injury, and some degree of cardiotoxicity.
- These substances are depressants of the central nervous system in humans, although their relative potencies vary considerably; chloroform is the most potent and was widely used as an anesthetic agent.

Halogenated Aliphatic Hydrocarbons

- Hepatotoxicity is also a common toxic effect that can occur in humans after acute or chronic exposures, the severity of the lesion being dependent on the amount absorbed.
- The acute effects of excessive exposure are nausea, vertigo, locomotor disturbances, headache, and coma.
- Chronic exposure leads to hepatic dysfunction and nephrotoxicity.
- Long-term exposure to tetrachloroethylene or to trichloroethane has caused peripheral neuropathy.
- Carbon tetrachloride is the most potent of the series in this regard.
- Removal from exposure is the only specific treatment available.
- Serious CNS depression must be treated with support of vital signs

Aromatic Hydrocarbons

- Benzene, toluene, and xylene are important aromatic hydrocarbons.
- Benzene is widely used for its solvent properties and as an intermediate in the synthesis of other chemicals.
- Acute inhalation exposure to any of these hydrocarbons leads to CNS depression with ataxia and coma .
- Long-term exposure to benzene is associated with hematotoxicity (thrombocytopenia, aplastic anemia, pancytopenia) and various types of hematologic cancers, especially leukemia.
- Removal from exposure is the only specific way to reduce toxicity.
- CNS depression is managed by support of vital signs.

Treatments

- Identify the ingested hydrocarbons.
- Examination of respiratory, CNS and radiographic for pneumonitis.
- Emesis induced by ipecac syrup
- Various oils for increase viscosity
- Symptomatic and supportive treatments.

ANTISEPTICS and DISINFECTANTS

- Sodium hypochlorite, found in household bleaches, remains a commonly used disinfectant.
- First used in the late 1700s to bleach clothes, its usefulness arises from its oxidizing capability, measured as “available chlorine,” and its ability to release hypochlorous acid slowly.
- It is used to clean blood spills and to sterilize certain medical instruments.
- Toxicity from hypochlorite is mainly a result of its irritant effects.
- The ingestion of large amounts of household liquid bleach (5% sodium hypochlorite) on rare occasions can result in esophageal burns.

IODINE and Povidone-iodine

- Iodine is one of the oldest topical antiseptics. ¹⁵⁵ Iodine usually refers to molecular iodine, also known as I_2 , free iodine, and elemental iodine which is the active ingredient of iodine-based antiseptics.
- Iodine is used to disinfect medical equipment and drinking water.
- Iodine is an effective antiseptic against bacteria, viruses, protozoa, and fungi, and is used both prophylactically and therapeutically
- Problems associated with the use of iodine include unpleasant odor, skin irritation, allergic reactions and clothes staining.
- Ingestion of iodine may cause abdominal pain, vomiting, diarrhea, GI bleeding, delirium, hypovolemia, anuria, and circulatory collapse

ANTISEPTICS and DISINFECTANTS

- Phenol, also known as carbolic acid, is one of the oldest antiseptic agents.
- Phenol is also a component (0.1%–4.5%) of various lotions, ointments, gels, gargles, lozenges, and throat sprays.
- Clinical manifestations can be divided into local and systemic symptoms. Systemic symptoms from gastrointestinal (GI) or dermal absorption of phenol are usually more dangerous than the local effects.
- Manifestations of systemic toxicity include CNS and cardiac symptoms. CNS effects include central stimulation, seizures, lethargy, and coma.

QUATERNARY AMMONIUM COMPOUNDS

- Quaternary ammonium compounds are a type of cationic surfactant they are used as disinfectants, detergents, and sanitizers.
- Complications of these ingestions include burns to the mouth and esophagus, CNS depression, elevated liver enzyme concentrations metabolic acidosis, and hypotension.
- Treatment recommendations following the ingestion of the quaternary ammonium compounds and other cationic surface-active agents are similar to those for other potentially caustic ingestions.
- Soap the best antidote for topical QAC poisoning.

Mothball

- Healthcare providers occasionally must determine whether a mothball is made of naphthalene, paradichlorobenzene, or camphor since management and prognosis differ.
- Paradichlorobenzene has largely replaced both camphor and naphthalene as the most common active component of moth repellent and moth flakes because of its decreased toxicity.
- Because life-threatening camphor and naphthalene toxicity still occur, all of these xenobiotics need to be considered in evaluating possible exposure moth repellent.

NAPHTHALENE

- Naphthalene toxicity has resulted from its use as an antihelminthic and an antiseptic. Toilet-bowl and diaper-pail deodorizers containing naphthalene have also caused toxicity.
- Occupational exposures to naphthalene may occur during the manufacture of dyes, synthetic resins, celluloid, solvents, and fuels.
- Ingestion and inhalational exposures to naphthalene commonly cause headache, nausea, vomiting, diarrhea, abdominal pain, fever, altered mental status, dermatitis and hemolysis or methemoglobinemia.
- Most patients with an unintentional exposure to all or part of one naphthalene-containing mothball do not require medical evaluation.