BASF Chemical Emergency Medical Guidelines

Phenol (C_6H_5OH) C 1

Information and recommendations for doctors at hospitals/emergency departments

- **Patients whose clothing or skin is contaminated with phenol can secondarily contaminate rescue and medical personnel, by direct contact or through evaporation of phenol.**
- **Phenol is a highly corrosive chemical which is very well and rapidly absorbed by all exposure routes. Thus, phenol can cause severe burns at the contact site as well as systemic poisoning resulting in central nervous system disturbances, cardiovascular and renal failure.**
- **Extensive local damage may be caused before pain is felt.**
- **Rapid decontamination by immediate extensive irrigation with polyethylene glycol and water is the most critical measure after dermal exposure.**
- **There is no systemic antidote to be administered to counteract the effects of phenol. Treatment consists of supportive measures.**

1. Substance information

Phenol (C_6H_5OH), CAS 108-95-2
Synonyms : carbolic acid, hydroxybenzene, phen(yl)ic acid, phenyl(ic) alcohol
At room temperature, phenol has a low vapor pressure and is a clear or light-pink crystalline mass, white powder, or thick liquid. Phenol is well soluble in alcohol and slightly soluble in water. It has a sweet, sharp odor.
Phenol is obtained by organic synthesis or fractional distillation of coal tar. It is used in the manufacture of a variety of products including artificial resins, plastics, photographic developers, rubber, and dyes. Phenol is a general disinfectant and also, in dilute solutions, is used as a preservative, an antipruritic or a local anesthetic in some medical preparations.

2. Routes of exposure

Inhalation

Inhaled phenol is rapidly and significantly absorbed from the lungs, leading to systemic toxicity. However, because of its low volatility, inhalation hazard at room temperature is limited. Phenol's odor usually provides an adequate warning of hazardous concentrations.

Skin/eye contact

Skin contact is the major route of toxic phenol exposures. Phenol vapor and liquid are absorbed very well and rapidly through the skin and eyes and cause systemic toxicity. If more than 100 cm^2 (15 square inches) of skin are affected, there is risk of imminent death. Even dilute solutions (<2%) may cause severe skin or eye burns if contact is prolonged.

Ingestion

Accidental ingestion of phenol may occur and rapidly lead to severe systemic toxicity. Deaths in adults have been described after ingestion of 1 g or more.

3. Acute health effects

As a corrosive substance, phenol denatures proteins and generally acts as a protoplasmic poison. **At all sites of oral, esophageal, dermal, respiratory or ocular contact, phenol can cause severe burns with irreversible tissue destruction.**

CNS	**Systemic poisoning by any route may result in CNS stimulation, followed rapidly by CNS depression with loss of consciousness, respiratory depression, and coma.** Initial signs and symptoms may include nausea, excessive sweating, headache, and dizziness. Seizures and coma usually occur within minutes to a few hours after exposure but may be delayed for 24 hours.
Cardiovascular	Hemolysis and cardiovascular symptoms such as tachycardia, arrhythmias and hypotension may occur and impair oxygen transport.
Respiratory	Mild exposure may cause upper respiratory tract irritation. With more serious exposure, swelling of the throat, inflammation of the trachea, tracheal ulceration, and pulmonary edema can occur.
Gastrointestinal	Vomiting and diarrhea are common effects of phenol toxicity by any exposure route. In cases of ingestion diffuse corrosive mucosal injury can involve the entire gastrointestinal tract. Ingestion may lead to death from respiratory failure.
Renal	Acid-base imbalance and acute renal failure have been reported in acute poisoning.
Ocular	Contact with concentrated phenol solutions can cause severe eye damage including clouding of the eye surface, inflammation of the eye and eyelid.
Dermal	When phenol is applied directly to the skin, a white covering of precipitated protein forms. This soon turns red and eventually sloughs, leaving the surface stained slightly brown. If phenol is left on the skin, it will penetrate rapidly and lead to cell death and gangrene. If more than 100 cm^2 (15 square inches) of skin are affected, there is risk of imminent death. Phenol appears to have local anesthetic properties and can cause extensive damage before pain is felt.
Potential sequelae	Chronic nerve damage has been reported due to acute exposure. Skin, eye, and mucous membrane damage caused by chemical burns may be irreversible, e. g. gangrene, blindness, or narrowing of the esophagus.

4. Actions

Self-protection	Patients whose clothing or skin is contaminated with liquid phenol may secondarily contaminate rescue and medical personnel, by direct contact or through evaporation of phenol. Exposure to high concentrations of phenol vapor may cause absorption of phenol onto clothing; caution should be exercised in decontamination.
Decontamination	All patients exposed to phenol require immediate decontamination. Patients who are able and cooperative may assist with their own decontamination. If the exposure involved liquid phenol and if clothing is contaminated, remove and double-bag the clothing. **Assure that exposed or irritated eyes have been irrigated with copious amount of water or saline for at least 20 minutes**. Remove contact lenses if present and easily removable without additional trauma to the eye. Continue other basic care during flushing. **In any case of dermal phenol exposure, if not already done, sponge exposed skin and hair repeatedly for at least 20 minutes with a number of sponges soaked in polyethylene glycol 300 or 400. If polyethylene glycol is not immediately available, flush for at least 20 minutes exposed skin and hair with copious amounts of plain water. After decontamination with polyethylene glycol flush the**

contaminated area again with copious amounts of plain water for at least 10 minutes. Continue other basic care during decontamination.
In case of phenol ingestion, **do not induce emesis. The vomitus may contain phenol and result in secondary contamination.** Only **if a large dose has been ingested less than 30 minutes before evaluation** of the patient's condition, consider immediate gastric lavage with a small-bore tube.
Patients who are conscious and able to swallow should be given a slurry of 30 g activated charcoal with 240 ml water.

Initial treatment

Early and consequent decontamination is the prerequisite for any successful therapy. Therapy will be empiric; there is no antidote to be administered to counteract the effects of phenol.
If signs of hypoxemia are present, humidified supplemental oxygen should be administered.
Intubation of the trachea or an alternative airway management should be considered in cases of respiratory compromise. When the patient's condition precludes this, consider cricothyrotomy if equipped and trained to do so.
Any phenol inhalation and/or ingestion and any dermal exposure to liquid phenol affecting more than 100 cm^2 (15 square inches) of skin should be considered as serious exposure.
Establish intravenous access in all patients with serious exposure.
Treat cardiovascular, renal, gastrointestinal, pulmonary, and CNS disturbances; provide supportive care.
After eye exposure chemical burns may result; treat as thermal burns. Immediately consult an ophthalmologist. If phenol vapor or liquid have been in contact with the skin, chemical burns may result; after decontamination, treat as thermal burns: adequate fluid resuscitation and administration of analgesics, maintenance of the body temperature, covering of the burn with a sterile pad or clean sheet.

Further evaluation and treatment

All seriously exposed patients should be examined as follows:
To the standard intake history, physical examination, and vital signs add monitoring of complete blood count, hemoglobin, blood glucose, electrolytes, and urinalysis. Additional studies for patients exposed to phenol include peripheral blood smear, renal function tests, and ECG. Arterial blood gases measurement and PA chest X-ray should be performed if cyanosis or dyspnea is present.
Urinary phenol levels above 80 mg/l may confirm overexposure.
Patients should be observed for a minimum of 6 hours and reexamined frequently.
Hemolysis may begin up to 24 hours or more after exposure. Observe hospitalized patients for signs of acute renal failure and dysrhythmias.
A therapeutic use of enhanced diuresis is proposed based on several case reports. However, its effectiveness is not yet proven.

Patient release/ follow-up instructions

Clinically asymptomatic patients as well as patients **who have a normal clinical examination and no signs or symptoms of toxicity** may be discharged **after an appropriate observation period** in the following circumstances:

a) The evaluating physician is experienced in the evaluation of individuals with phenol exposure.
b) Information and recommendations for patients with follow-up instructions are provided verbally and in writing. Patients are advised to seek medical care promptly if symptoms develop or recur.
c) The physician is comfortable that the patient understands the health effects of phenol.

d) Site medical is notified, so that the patient may be contacted at regular intervals in the 24-hour period following release from the emergency department.
e) Heavy physical work should be precluded for 24 hours.
f) Exposure to cigarette smoke should be avoided for 72 hours; the smoke may worsen the condition of the lungs.

All patients with skin or eye burns should be reexamined after 24 hours. Patients who have skin or eye exposure should be reexamined in 24 hours.

In this document BASF has made a diligent effort to ensure the accuracy and currency of the information presented but makes no claim that the document comprehensively addresses all possible situations related to this topic. This document is intended as an additional resource for doctors at hospitals/emergency departments in assessing the condition and managing the treatment of patients exposed to phenol. It is not, however, a substitute for the professional judgement of a doctor and must be interpreted in the light of specific information regarding the patient available to such a doctor and in conjunction with other sources of authority.

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