A Fatal Case of Saponated Cresol Ingestion

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Abstract

We describe here a case of suicidal poisoning by saponated cresol ingestion. A 41 year-old male was found unconsciousness in a park in the early morning, and an empty bottle of saponated cresol was found beside him. His death was confirmed approximately 2 hours later, despite attempts at resuscitation and intensive care. The autopsy revealed severe morphological damage of the upper gastrointestinal tract and congestion of the lung. We also observed by histopathological examination severe lung edema and severe erosion of the esophagus and stomach. Toxicological analysis also identified a high concentration of cresol isomer in the blood and gastric contents. The cause of death was given as cresol poisoning, based on the results of the autopsy and toxicological examination.

Key words: saponated cresol – morphological damage – high performance liquid chromatography (HPLC) – poisoning

Souhrn

Smrtelný případ požití saponátového roztoku krezolu

**Popsán případ sebevražedné otravy požitím saponátového roztoku krezolu.
41letý muž byl časně ráno nalezen v parku v bezvědomí, vedle něho byla nalezena prázdná láhev saponátového roztoku krezolu. Přes pokusy o resuscitaci a intenzivní péči u něho nastala smrt asi za dvě hodiny. Pitva odhalila četná morfologická poškození horní části zažívacího traktu a překrvení plic. Při histologickém vyšetření byl pozorován těžký edém plic a těžké eroze jícnu a žaludku. Toxikologickou analýzou byla též zjištěna vysoká koncentrace izomeru krezolu v krvi a žaludečním obsahu. Příčina smrti byla stanovena jako otrava krezolem, na základě výsledků pitvy a toxikologického vyšetření.**

Klíčová slova: saponátový roztok krezolu – morfologické poškození – vysoko účinná kapalinová chromatografie (HPLC) – otrava

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Introduction

Cresol is one of the derivatives of phenol, which are used as an antiseptics, disinfectants, chemical intermediates for resin and plasticizers [2]. Saponated cresol, containing approximately 50% cresol is widely available as a disinfectant [9]. Cresol consists of three isomers, p- m- and o-, that are mainly metabolized to glucuronide and sulfate conjugates in the liver and excreted in urine. Acute toxicity of cresol results mainly in respiratory failure or possibly electrolyte imbalance [1]. It also has a corrosive action, causing severe tissue damage in the upper gastrointestinal tract, and also headache, dizziness, vertigo, dyspnea and damage to organs such as liver, lung and kidneys, following ingestion [2]. Several fatal cases of cresol poisoning have been reported [1, 3, 5, 10, 12, 14]. The diagnosis is confirmed by the identification and quantitation of cresol from

autopsy specimens. Here we report a fatal case of saponated cresol ingestion with toxicological analysis and pathomorphological findings.

Case report

A 41-year old man was found lying on a bench at a park with loss of consciousness and hypothermia. A paper cup and an almost empty bottle of saponated cresol were found around him. Immediately, he was delivered to a hospital by ambulance, where he received resuscitation and intensive care, such as gastric lavage and peritoneal perfusion. His death was confirmed approximately 2 hours later. An autopsy was performed approximately 48 hrs after death.

Autopsy findings

The deceased was a well-nourished Japanese male, 168 cm in height and 64 kg in weight. He had a discoloration of the skin in the region of the jaws, approximately 3 x 4.5 cm in size (Figure1). The mucosa of the oral cavity and his lips were also discolored brownish. We detected an irritant odor from his mouth, but no significant external injuries.

Internal examination revealed no distinct injury or disease. The heart weighed 390 g, containing 500ml of blood without coagulum. The liver weighed 1500 g, and the cut surface appeared slightly dark brown in color. The left and right lung weighed 690 g and 915g, respectively, and were severely congested (Figure 2a). The brain weighed 1545 g, and was slightly edematous. There was a sclerotic change with a brownish discoloration of the epithelium in the upper gastrointestinal tract, without evidence of perforation (Figure 3a). There was a small amount of liquid in the bronchus. In the stomach, there were approximately 450 ml of a dark brownish colored liquid emitting a strong odor, without food residue. The whole blood (obtained from the heart and femoral vein), bile, peritoneal effusion, and gastric and intestinal contents were collected for subsequent toxicological examination.

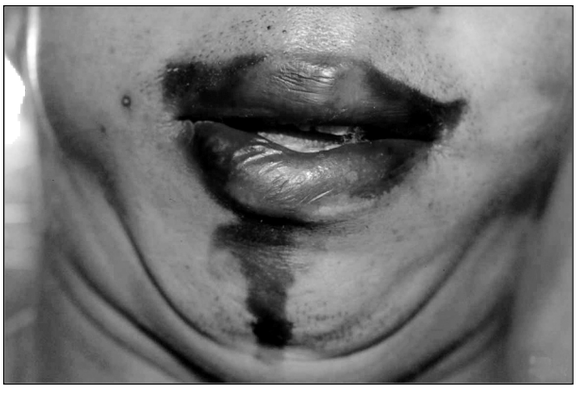

Fig. 1. Discoloration of the skin in the region of the jaw

Histological findings

The lungs showed diffuse congestion with severe edema (Figure 2b). The esophageal epithelium was necrotic and destroyed. The epithelium of the stomach showed coagulative necrosis, with the blood vessels of the mucosa being markedly dilated and hyperemic (Figure 3b). There was a vacuolative degeneration of the hepatocyte with dilation of the sinusoid. Neither fibrosis nor inflammation was observed.

Toxicological Examination

Detection of the three isomers of cresol was carried out according to previous reports with

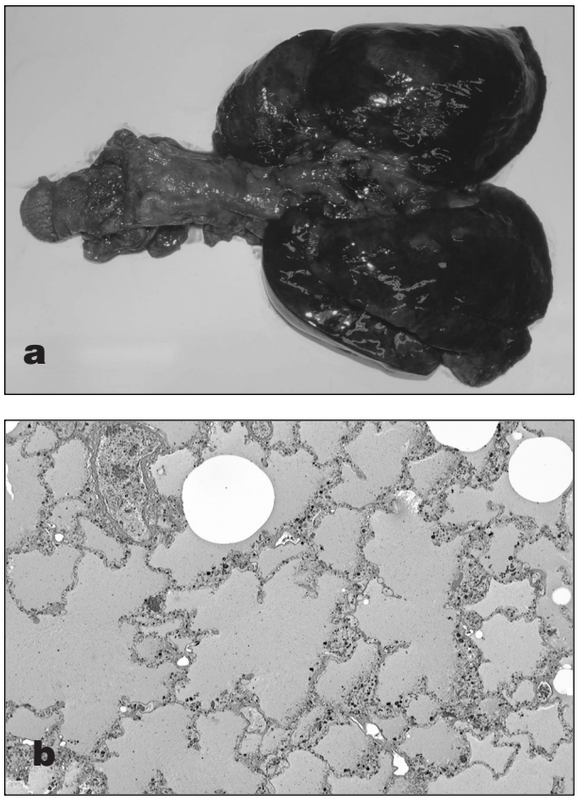

Fig. 2. Severely congested lung (a) and its histological findings (b; HE staining, objectives x 4)

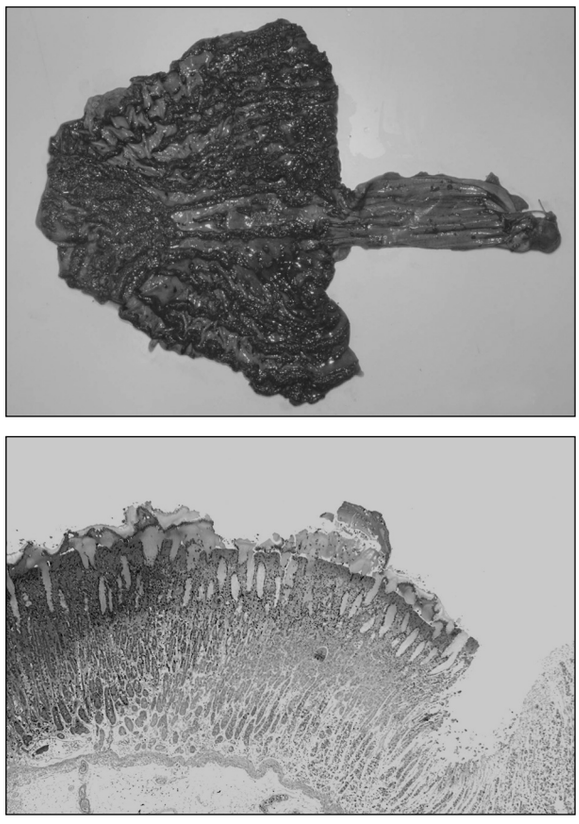

Fig. 3. The epithelium in the upper gastrointestinal tract underwent sclerotic change (a) and necrosis was observed on the epithelium of the stomach (b; HE staining, objectives x 2)

little modification [6, 8]. In brief, a high performance liquid chromatography (HPLC), Shimadzu LC-10A equipped with a fluorescence detector RF-10A (Shimadzu, Kyoto, Japan,) was used. Analysis of drugs was carried out using a Nova-Pak C18 column (3.9 mm i.d. X 150mm, 4 µm, Waters, Milford, MA, USA), at 40@. The mobile phase was acetonitrile/ 20 mmol/l potassium dihydrogen phosphate (15 : 85 v/v) containing 20 mmol/l beta-cyclodextrin (pH 3.0) at a flow rate of 1.0 ml/min. The eluent was monitored by fluorescence detection (excitation at 270 nm and emission at 305 nm).

All the samples obtained at autopsy, the blood and gastric contents on admission, and the contents of the bottle, that was found beside the deceased, underwent toxicological examination. They were kept at -40@ until analysis. Sample preparation was carried out according to the previous reports [6, 8]. Three isomers of cresols were purchased from Wako Pure Chemicals (Osaka, Japan), and beta-glucuronidase and sulfatase were purchased from Sigma (St Louis, MO, USA). All other reagents and solvents were of analytical grade.

Results and Discussion

The concentrations of each unconjugated cresol isomer and its conjugates in each specimen are presented in Table 1. The o-cresol was not detected in any of the samples. Ethanol was not also detected. The toxicity of cresol depends mainly on its unconjugated concentration, while the conjugates are less toxic [6]. The lethal levels of unconjugated cresol in blood have been reported to be 71–190 µg/ml [3, 5, 8, 14]. In the present case, the total free cresol concentration was 300µg/ml in postmortem femoral blood, well over the fatal range.

Cresol is rapidly absorbed through the gastrointestinal tract following oral ingestion [4, 8]. It is conjugated rapidly to glucuronide or sulfate in the liver, and excreted in the urine. The unconjugated cresol rapidly disappears from blood, with an elimination half life of approximately 1.5

Tab. 1. Cresol concentrations in each sample

	p-cresol (µg/ml)			m-cresol (µg/ml)		
	Unconjugated	Glucuronide	Sulfate	Unconjugated	Glucuronide	Sulfate
On admission						
Peripheral blood	198	202	23	337	329	21
Gastric lavage	1983	N.A	N.A	3192	N.A	N.A
At autopsy						
Heart blood	203	156	20	339	256	20
Femoral venous blood	108	146	16	192	234	16
Gastric contents	181	N.A	N.A	301	N.A	N.A
Intestinal contents	112	N.A	N.A	182	N.A	N.A
Bile	133	265	3	205	391	5
Peritoneal effusion	63	N.A	N.A	104	N.A	N.A
Liquid in the bottle	219000			357000		

N.A: not analysed.

hours in human poisoning case [11]. The cresol glucuronide increases rapidly following ingestion, but then disappears in a relatively short time. On the other hand, the cresol sulfate increases gradually in the elimination phase [6–8, 13]. It is well known that the pharmacokinetics of cresol differ with each isomer [6–8, 13], and the ratio of p-/m- isomers in blood shifts gradually with time from the p-/m- ratio of ingested cresol. In the present case, the concentration of unconjugated cresol was similar to that of glucuronide, and the glucuronide concentration was higher than that of sulfate in peripheral blood. Moreover, the ratio of p-/m- isomers (0.60 in heart blood and 0.56 in the femoral blood, respectively) was similar to that of the solution remaining in the bottle (0.61). From these results, we concluded that the victim died a relatively short time after cresol ingestion. This suggests that the measurement of isomers and their metabolite concentrations is useful for the evaluation of time elapsed following cresol ingestion.

We have demonstrated here the morphological damage induced by massive cresol ingestion. There was a diffuse chemical burn in the upper gastrointestinal tract, which was due to the potent corrosive action of cresol. We observed severe congestion and edema of the lungs and degeneration of the liver, corresponding to a previous report [3]. From the autopsy findings and the results of the toxicological examination, we conclude that the cause of death was due to the systemic toxicity of cresol.

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