


A case report on unintentional ingestion of formaldehyde solution

Formaldehit solüsyonunun yanlışlıkla yutulmasına ilişkin bir olgu sunumu

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ABSTRACT

Formaldehide (FA) or formaldehyde solution, whose industrial name is formalin ad systematic name is methanal (CH₂O), is an organic compound in the aldehyde structure. Industrially, FA is used for its preservative and sterilizing agent properties. Fish farms use FA solutions against bacterial diseases in juvenile fish, protecting and disinfection purposes. Although FA is a frequently used substance in the industrial, laboratory, and cosmetic fields, the literature is very scarce in terms of toxic doses or symptoms in cases of oral intakes. This case describes the clinical course and wrong mismanagement acute oral FA ingesting.

Keywords: Formaldehide, anatomy, ingestion, toxicology.

ÖZ

Formaldehit (FA) veya endüstriyel adı formalin, sistematik adı metanal (CH₂O) olan formaldehit çözeltisi, aldehit yapısında bulunan organik bir bileşiktir. Endüstriyel olarak FA, koruyucu ve sterilize edici madde özellikleri nedeniyle kullanılır. Balık çiftlikleri yavru balıklarda bakteriyel hastalıklara karşı, balıkları koruma ve dezenfeksiyon amacıyla FA solüsyonlarını kullanmaktadır. FA endüstriyel, laboratuvar ve kozmetik alanlarda sıklıkla kullanılan bir madde olmasına rağmen literatürde toksik dozlar veya oral alımlarda ortaya çıkan semptomlar açısından oldukça korkutucudur. Bu vaka, akut oral FA alımının klinik gidişatını ve yanlış yönetimi anlatmaktadır.

Anahtar Sözcükler: Formaldehit, anatomi, oral alım, toksikoloji.

INTRODUCTION

Formaldehide (FA) is an aldehyde compound, systematically known as methanal (CH₂O). While FA occurs naturally as a metabolite in living organisms, its pure form possesses a pungent odor and irritates the senses. Industrial contexts refer to a solution containing 35-40% FA as formalin (1, 2). Beyond industrial use, FA serves as a biocidal agent, inhibiting bacterial and parasitic growth in diverse settings like animal farms, medical labs, and personal care items (1).

Within aquaculture, solutions with FA concentrations ranging from 0.2% to 5% find application in disinfection, disease prevention in juvenile fish, and portioning of fish (3).

Although the chronic effects of FA exposure are well-documented, oral exposure to the compound is infrequent (4). In this case report, we present an instance of unintentional FA ingestion by a fish farm worker. We will discuss the patient's clinical progression and the implications of incorrect management.

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CASE

A 52-year-old man, previously in good health, with a weight of 72 kg, accidentally ingested approximately 50 mL of a 1% aqueous FA solution (equivalent to 5 mg of FA). He promptly vomited and experienced persistent nausea, vomiting, and epigastric pain within an hour. Subsequently, he was admitted to the Emergency Department (ED) of a rural hospital. At admission, he was alert, oriented, and displayed stable vital signs. Physical examination yielded no significant findings, and baseline laboratory results, encompassing blood biochemistry and complete blood count, were normal.

Imaging studies, including abdominal and chest X-rays, along with abdominopelvic computed tomography scans, showed no abnormalities. The patient underwent gastric lavage using 2000 cc of tap water, followed by a single oral dose of activated charcoal (1 g/kg). Approximately six hours post-ingestion, he was transferred via EMS to the ED of an academic tertiary hospital for comprehensive assessment and management.

Upon arrival at our ED, the patient was conscious and alert, displaying stable vital signs. Examination of the oropharyngeal region showed no signs of corrosive injury, and rectal examination revealed no evidence of gastrointestinal bleeding. Although mild epigastric tenderness was present, defensive or rebound signs were absent. Laboratory results, including toxicological screening for plasma ethanol and methanol, yielded negative results. Notably, our hospital does not routinely conduct toxicology tests for FA in urine or blood, thus precluding information on FA levels or its metabolites. The National Poisoning Surveillance Center advised against administering further activated charcoal and recommended nil per os due to the risk of ineffective treatment and gastrointestinal bleeding.

The patient was kept nil per os and received intravenous pantoprazole (40 mg) and metoclopramide (10 mg) for symptomatic relief during his ED stay. Subsequently, he was admitted to an observation unit to monitor potential complications. Following approximately 10 hours of uneventful observation, the patient was discharged with instructions to recognize signs of gastrointestinal bleeding.

DISCUSSION

While extensive literature focuses on the long-term consequences of occupational FA exposure and the heightened cancer risk linked with industrial use (5), studies addressing FA ingestion are less common. FA, present in plastics used for water transportation and pipe fixing, poses a potential hazard. However, research also demonstrates that FA consumption through food is comparable to exposure through these other sources (6).

The literature offers limited insights into the effects of low-concentration oral FA intake, although the irritant nature of FA to tissues is well-established. It's important to note that FA is usually used in concentrations that pose minimal toxicity risk, even in direct contact with skin or hair. Numerous studies assessing the safety of FA in cosmetic products consistently affirm its safe use for consumers (7,8).

Initial exposure to FA prompts inflammation in the affected tissue, followed by cellular apoptosis due to mitochondrial damage. Additionally, disruptions in DNA and RNA function, as well as damage induced by oxidative stress in membrane lipids, occur. The literature highlights both the local impact of FA on respiratory mucosa and its systemic effects, underscoring its respiratory toxicity due to its high water solubility. FA exposure has been associated with adverse effects on the kidneys, bone marrow, central nervous system, and various other systems (9). Despite limited data on low-level oral FA exposure, the literature suggests potential damage to both the digestive and respiratory systems, alongside systemic effects (10).

Upon ED evaluation, our patient presented with typical gastrointestinal symptoms following oral FA ingestion. However, due to the relatively low volume and concentration of the ingested FA solution, resultant toxicity symptoms were relatively mild. We hypothesize that the FA solution caused localized damage to the gastrointestinal mucosa, resulting in epigastric pain and nausea. The absence of respiratory and other systemic findings in our case can be attributed to the very low level of FA exposure.

The treatment administered in the rural ED solely aimed to eliminate the toxic substance through gastric lavage, without considering FA's erosive effects on gastrointestinal mucosa. This approach could exacerbate mucosal irritation and bleeding risk. Activated charcoal, used for

decontamination, isn't recommended for patients at risk of bleeding or perforation; it's also ineffective against acid, alcohol, and aldehyde toxins. While imaging suggested potential issues such as gastrointestinal perforation and chemical pneumonia, a cost-effective, step-wise diagnostic approach would have been more appropriate.

For patients with low-level and limited FA exposure, the literature suggests that symptomatic treatment and ED monitoring are adequate. Following symptom alleviation, patients can be discharged with outpatient follow-

up to address potential long-term exposure and occupational health concerns.

In conclusion, our case report underscores the hazards of accidental FA ingestion, leading to damage of gastric and respiratory mucosa, as well as systemic toxicity. Additional research is required to comprehend the implications of low-dose FA exposure on human health, and improved decontamination and treatment strategies should be developed.

Conflict of interest: The authors have not reported any conflicts of interest.

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