

Silver nitrate ingestion: report of a case with an uneventful course and review of the literature

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Abstract

Silver nitrate is commonly recognized for the toxic effects followed by the direct contact with the skin and mucosa known as argyria, but there is surprisingly little information about the adverse effects of silver nitrate after ingestion. Since only a few cases were reported in the literature, the aim of this case is to enrich the little experience existent about the possible effects of silver nitrate ingestion. We describe the case of a 15-year-old female who intentionally ingested 15cc of silver nitrate solution in a suicidal attempt. The clinical picture included an excruciating burning sensation in her throat and nostrils followed by vomiting and poor oral intake. The presence of a whitish membrane on the oral and buccal mucosa without bleeding or erosions was the only remarkable finding at physical examination. Unlike the rest of the cases described in the literature the clinical and endoscopic follow up of the patient was benign and without sequela or signs of oesophageal damage. Even though very uncommon, it is very important for physicians to keep in mind the possible toxic effects and appropriate management of silver nitrate ingestion. The outcome is not always devastating as reported, and a good early approach and follow up is important in the anticipation of sequela.

Introduction

Silver metal and its derivative salts have been used in the medical community for many reasons over the past decade. Of these compounds, the one mainly used has been silver nitrate. The most common frequent but benign condition associated with the ingestion of silver salts is argyria, which is a permanent blue-gray discoloration of the skin.¹ However, the more critical complication of ingesting silver salts is a painful death due to the caustic

nature of the compound. It is critically important to manage these individuals emergently in extremely well controlled settings which should include close monitoring for signs of oesophageal burns. This case report describes the clinical characteristics and management of a 15 year old girl who was brought in to the emergency room as a case of acute silver nitrate ingestion.

Case Report

A 15-year-old female patient was brought in by the emergency medical service after ingesting 15cc of silver nitrate by mouth as a suicidal attempt. She stated that she obtained the solution from the chemistry laboratory at school. After ingestion, she started experiencing excruciating burning sensation in her throat and nostrils. She tried to spit it out and even attempted to rinse her mouth with water but it only provoked several episodes of vomiting.

The vomitus consisted initially of water and then some mucus and food were also noted. She denied any abdominal pain, dysphagia, drooling, difficulty breathing or headache. At physical exam, a whitish membrane on the oral and buccal mucosa without bleeding or erosions was the only remarkable finding. The rest of the examination was within normal limits. The Regional Poison Control Center was informed about the case and then the patient was transferred to the inpatient unit as a case of acute silver nitrate poisoning for observation, hydration and symptomatic support as needed. Laboratory investigations including complete white blood cell count, electrolytes, renal and liver functions test were unremarkable. The patient was placed on nothing by mouth and started on intravenous fluids for the first 24 hours. No additional symptoms or physical findings were reported during her stay in the hospital. Upper gastrointestinal endoscopy was performed without any abnormal findings and patient was discharge without any medication. Subsequent follow up after discharge did not show any new manifestation or signs of gastrointestinal obstruction.

Discussion

Silver nitrate has been used therapeutically since 1881.² It is used medicinally as a topical anti-infective, antiseptic and caustic. With the vast medical influence that silver nitrate has, it is interesting that we know so little about its toxic effects. There is surprisingly little literature about the adverse effects after ingestion of silver nitrate. Our case looks into those effects as we examine a patient who purpose-

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fully swallowed silver nitrate.

Silver nitrate (AgNO₃) is more widely known for causing Argyria. A slate gray discoloration of the skin that is more pronounced in sun-exposed areas. The color comes from the deposition of silver in the skin and, it is theorized, because of a silver-induced increase in melanin. Silver granules have been reported mostly in the basal lamina of the skin, sweat glands, blood vessels, connective tissue, hair follicles and leptomeninges and choroids plexus in severe cases.^{3,4}

The toxicity of silver nitrate is varied. Silver ions can bind to proteins resulting denaturation which is thought to account Silver nitrate's caustic and corrosive effect. Other experiments have shown that silver nitrate leads the production of superoxide radicals and hydrogen peroxide.⁵ Silver ions have been shown to be associated with a loss in cellular identity, reduced proliferative capacity and degenerative changes in the cytoplasmic organelles and nucleus.⁶

Nitrates also act as vasodilators, which may lead to hypotension and circulatory collapse. Nitrate however is most toxic when it is converted by bacteria into nitrite. Nitrite is then converted to nitrate in the blood when it interacts with oxyhemoglobin, resulting in the formation of methemoglobin that can rapidly lead to cyanosis and death due to hypoxia.⁷

In this case, the patient ingested silver nitrate. The reports of ingested silver nitrate are few and far between. However, the effects may be disastrous. In one case a 17-day-old girl was given silver nitrate by her mother. The mother had been prescribed the agent for use on an umbilical granuloma but misunderstood the route of administration. The infant presented with severe burns to the oropharynx and oesophagus, respiratory distress syndrome and collapse of the right lung. Oesophageal strictures followed, so severe that a fine wire

could not be passed.⁸ Two other cases of accidental administration to children were reported; a 15-year-old was given 60 mL and a 15-month-old 16 mL of silver nitrate.⁹ Both children vomited immediately and no burns were noted on examination. Additionally, a 40 year old was reported to have taken an unknown amount of silver nitrate in a suicide attempt. He did not admit this upon hospital admission and died 12 hours after ingestion. Autopsy showed severe injury to the esophageal mucosa, multiple deposits of brown pigment and residual tissue edema.¹⁰

Current management recommendations for silver nitrate ingestion are to rinse the mouth with water and to give milk and fluids to dilute stomach contents, unless gastric perforation is suspected.⁹ Gastric emptying is contraindicated because silver nitrate is corrosive.⁷ Electrolytes should be monitored and corrected. Endoscopy may be indicated and an electrocardiogram (ECG) may be necessary for patients with significant hypotension or cyanosis. Give oxygen and ventilate as required. Surgical intervention may be necessary. Several antidotes to silver have been suggested though there is no clinical evidence that they are necessary as silver is rapidly

cleared from the blood stream. Dimercaptosuccinic acid and Glutathione have been shown to chelate silver and act as antidotes respectively.¹¹ If methemoglobin presents, methylene blue has been used to reverse methemoglobinemia.⁷

Even though very uncommon, it is very important for physicians to keep in mind the possible toxic effects and management of silver nitrate in the emergency room. The progress of this case was completely benign and without complications. The correct initial approach and recognition of symptoms are significant in the prognosis of these patients.

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