Esophageal Rupture after Ingestion of Household Bleach: A Case Report

Seet-Foong Yong1, I-Yin Lin2, Khoot-Peng Cheah1, Yung-Hung Liu1, Joe-Sharg Li1, Cheuk-Sing Choy1

Ingestion of household bleach is usually benign, as it is a mild esophageal irritant that rarely produces any significant mucosal injury or necrosis. Therefore most poison centers advocate a conservative home management treatment. In this report, we present a case of esophageal rupture due to ingestion of household bleach. A 90-year-old woman visited our emergency department complaining of unexplained mild dyspnea and sudden puffiness of the face. After a thorough investigation, she was found to have an esophageal rupture with subcutaneous emphysema, which was the result of a suicide attempt by ingesting household bleach at around 06:00am that morning. Emergency surgery was performed to repair the esophageal rupture. We have reviewed the literature and discuss the possible mechanisms relating to esophageal rupture.

Key words: household bleach ingestion, esophageal rupture

Introduction

The exact incidence of household bleach ingestion in Taiwan is uncertain. However, it is the most common alkaline substance to which people are exposed, according to the American Association of Poison Control Centers (AAPCC) data, accounting for more than 49,000 exposures per year(1). The most common household alkali is bleach, a 3%-6% sodium hypochlorite solution with a pH of approximately 11. Although household liquid bleach is not corrosive to the esophagus, its ingestion may cause emesis secondary to gastric irritation or pulmonary irritation, which is related to chlorine ion production in the stomach or being mixed with other substances2. Other injuries reported include pneumonitis after aspiration and sight-limiting ocular injuries. In spite of the high incidence of exposure, household bleaches are of relatively low toxicity. However, it can be a harmful substance: we describe a rare complication of household bleach ingestion that manifested as an esophageal rupture. Doctors and medical personnel in the emergency department (ED) should use caution when treating patients who have ingested toxic substances such as household bleach.

Case Report

A 90-year-old woman was brought to the ED at approximately 11:00 am complaining of unexplained mild dyspnea and a puffy face. She denied having any chest pain, hematemesis, dysphagia, abdominal pain, vomiting or cough. The patient also denied...
any trauma, alcohol ingestion or any recent instrumentation history such as a panendoscopy. According to her medical history, she had hypertension controlled with regular medication. The surgical history included an operation for a perforated peptic ulcer 20 years previously. Additionally, she had undergone a left-side total hip replacement about two months ago and had been bedridden ever since.

At initial presentation, the patient was weak but could follow instructions. A physical examination revealed crepitus over her face and neck. Her breathing sounds were symmetrically clear without respiratory distress. There was no pain, tenderness or lesions over the chest. Her blood pressure was 158/76 mmHg, pulse rate was 90/min, temperature was 36.5 °C and respiratory rate was 18/min. Laboratory data revealed a white blood cell count of 13,130/mm³ with a neutrophil/lymphocyte ratio of 22.7/70, hemoglobin 15.1 g/dL, platelets 262,000/mm³, BUN 10 mg/dL, Na 143 mEq/L, Cl 115 mEq/L, arterial blood gas pH 7.39, PCO₂ 40 mmHg, PO₂ 60 mmHg and HCO₃⁻ of 23.9 mmol/L (by nasal cannula at four L/min). A chest and neck soft-tissue roentgenogram subsequently revealed subcutaneous emphysema over the neck, gas within the prevertebral soft tissue (Fig. 1), pneumomediastinum and cardiomegaly (Fig. 2). The initial impression based upon the aforementioned image was subcutaneous emphysema with a bronchial tear or esophageal rupture. Chest computed tomography showed diffuse subcutaneous emphysema over the bilateral neck and anterior chest; abnormal free air was also noted in the upper and posterior mediastinum and around the distal esophagus. There were also findings of bilateral pleural effusions and partial collapse of the bilateral lower lobes (Fig. 3). Thus, esophageal rupture with diffuse subcutaneous emphysema was highly suspected. To investigate possible causes of her esophageal rupture we reviewed events prior to her presentation in the ED. Upon further inquiry into our patient’s history, she acknowledged attempting suicide by ingesting around 250 ml of a commercial brand of household bleach that morning at around 06:00am, with subsequent episodes of vomiting, that she initially denied.

An emergency esophagogram was then performed and showed extravasation of contrast medium at the distal esophagus just above the diaphragm (Fig. 4), thus providing evidence of distal esophageal rupture. A chest surgeon was then consulted and emergency surgery was performed on the advice of the surgeon. The operative findings included a 2.5-cm perforation on the posterior wall of the esophagus just 3-cm proximal to the hiatus; this was subsequently repaired. In addition to hemorrhage, whitish membrane exudates with deep, discrete ulceration were also noted over the esophagus (grade 2b burn injury). A moderate amount of coffee-like fluid was cleaned out of the pleural cavity of the posterior mediastinum, the area was irrigated with normal saline and a chest tube was inserted for drainage. A resected segment of the perforated esophagus was sent for histopathology and revealed acute inflammation but no evidence of malignancy, chronic esophageal ulcer or hiatal hernia. Postoperatively, the patient was admitted to the intensive care unit for further treatment. Two months later, she was discharged in a stable condition.

**Discussion**

Ingestion of a variety of caustic substances including alkali, acid, bleach, thermal agents and detergents can cause significant injury to the mucosa of the gastrointestinal tract, leading to acute or long-term esophageal sequelae²⁻⁴. However, most patients who ingest household bleach suffer either minor or no damage, with only 0.001% of patients having any major negative health effects. In 2002, only two deaths in the US were reported involving ingestion of household bleach: one was from ingestion of an unknown amount and the other from inhalation¹. This second patient suffered cardiac arrest before arriving at the
Fig. 1 Subcutaneous emphysema over the neck, and gas within the prevertebral soft tissue.

Fig. 2 Pneumomediastinum and cardiomegaly with calcification of the aortic knob.
Fig. 3 Distal esophageal rupture with profuse subcutaneous emphysema.

Fig. 4 Extravasation of contrast medium at the distal esophagus.
ED and a postmortem examination revealed dark mucosal discolorations over the lesser curvature of the stomach in addition to pulmonary congestion and edema; the cause of death was pneumonia. Thus far, no significant esophageal injury or perforation has been reported.

Several clinical studies have validated the relatively benign nature of liquid bleach ingestion. After esophagoscopic evaluation, Karnak et al. reported that all 91 children who had accidentally ingested household bleach had experienced only mild oropharyngeal injury\(^2\). Using esophagoscopic examination, Pike et al. reported that two out of 129 patients who had ingested liquid bleach experienced mild esophageal injury\(^6\). In a report by Metin Topal, endoscopic examination of 24 patients who had ingested sodium hypochlorite showed that six (25%) had grade 0 injury, 14 (58.3%) had grade 1 injury, two (8.3%) had grade 2a injury, two (8.3%) had grade 2b injury and no patients had grade 3 injury\(^7\).

Yarrington studied the low morbidity of liquid bleach on the canine esophagus, with the conclusion that accidental liquid household bleach ingestion in children should cause only transient mucosal contact injury, thus precluding esophageal burns or perforation\(^8\).

The harmful effects of household bleach mainly depend on the solvent action of the product. When sodium hypochlorite is dissolved in water, hypochlorous acid (HOCl, pH 2-7.5) and hypochlorite ions (OCl\(^-\), predominately in the alkaline range) are generated, depending on the medium’s pH. Thus, the harmful effects are related to the concentration of chlorine and the pH. A hypochlorite solution with a concentration exceeding 10% is corrosive, whereas a solution with a concentration of <10% is a mere irritant\(^9\). Alkaline corrosion is defined as pH >12\(^10\), and the critical pH for corrosion is believed to be 12.5\(^11\). This may explain the low morbidity associated with commercial liquid household bleach ingestion as the concentration often ranges between 3% to 6%, with a pH of 10-12.

Upon further investigation of our patient’s history, we determined that she had attempted suicide by ingesting 250 ml of a commercial brand of household bleach that morning at around 06:00 am and had initially denied having vomited several times. Several possibilities exist to explain this particular case of household bleach inducing deep esophageal ulceration. First, this particular brand of bleach is in the higher end of the pH spectrum of bleaches, consisting of a 6% sodium hypochlorite solution with a pH of around 12. Second, her vomiting may have raised her intraesophageal pressure to a level that could cause esophageal rupture after the initial esophageal wall injury. Moreover, the possibility of contamination exists, although the patient denied mixed ingestion. Third, the contact time and the amount of the alkaline substance ingested by the patient may have further caused an increased risk of perforation\(^14\).

Esophageal rupture often mimics an acute myocardial infarction, pulmonary embolism, peptic ulcer disease, aortic catastrophe or acute abdomen, due to the predominantly acute, severe, unrelenting and diffuse pain over the chest, neck or abdomen. In a study by Gorman and colleagues, they found that all patients with serious esophageal injuries after caustic ingestion had some initial signs or symptoms of toxin ingestion (drooling, abdominal pain, etc)\(^3\). It is rare and unusual to see, as in this patient, a presentation of sudden onset puffiness of the face and mild dyspnea with no initial toxin ingestion symptoms such as chest pain, abdominal pain, drooling, dysphagia or respiratory distress. Therefore, if a physical examination had been improperly performed, it might have led us to the wrong conclusion that fluid overload was causing her facial swelling.

In retrospect, the initial history-taking seemed unreliable and insufficient. Therefore, a more complete history and thorough physical examination are mandatory. Although household bleach rarely produces significant mucosal injury or necrosis, early
investigation with esophagoscopy should be considered in symptomatic patients as depth of burns cannot be predicted based on signs or symptoms\textsuperscript{(15)}. Bleach can cause prominent, rapid esophageal rupture with subcutaneous emphysema, without initial toxic ingestion symptoms, as in this case. The non-invasive technique of esophagogram has limitations in gauging burn injury depth and could have easily missed the esophageal perforation in our patient had she not been symptomatic due to subcutaneous emphysema or pneumomediastinum\textsuperscript{(16)}. Primary subcutaneous emphysema and pneumomediastinum are usually treated expectantly\textsuperscript{(17)}. The decision for surgery depends on clinical signs suggesting incipient mediastinitis\textsuperscript{(16)}.

References


服食家用漂白劑攝入造成食道破裂：個案報告

楊旭峰¹  林依涵²  謝屈平¹  劉永弘¹
李建典¹  蔡卓城¹

家用漂白劑的誤食所造成的問題，大都是很輕微的，呈現少許的食道傷害，很少會有顯著的黏膜傷害或壞死。有很多的毒藥物諮詢中心，對於漂白劑的食入建議在家做保守性的治療。在我們個案當中，這位九十歲的老婦人在上午6點左右送到急診室，因爲輕微的喘，以及顏部不明原因突然間腫脹。在經過詳細的檢查及詢問後，發現病人企圖自殺而喝下漂白劑，疑似誤食漂白劑後，致食道破裂合併大量皮下氣腫。因此藉由文獻查證回顧及探討，漂白水可能導致食道破裂的機轉。

關鍵詞：家用漂白劑，食道破裂