Chemical pneumonitis secondary to ingestion/inhalation of corrosive substances- Ethylenedioxy Dimethanol & Glutaraldehyde

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Abstract

Chemical Pneumonitis is a chemical-induced lung injury caused by inhalation or ingestion of certain chemicals or toxic fumes. It may be caused due to cleaning agents, industrial chemicals or organophosphate poisoning. Lung injury caused by household chemicals, called Corrosive poisoning, is a common clinical entity seen in adults and children. It is often seen in young females, who are usually the victims of suicide. One commonly used corrosive agent in floor cleaners is Ethylenedioxy Dimethanol and Glutaraldehyde. Aspiration of these chemicals causes severe respiratory complications. The gold standard for diagnosis is HRCT. However, the acute injury is conservatively managed. Here we present a case of a young female who had a history of alleged consumption of floor cleaner (Bacillocid, composed of Ethylenedioxy Dimethanol and glutaraldehyde) later diagnosed with chemical pneumonitis secondary to Ethylenedioxy Dimethanol and Glutaraldehyde. The severity of the condition depends on the type or volume of chemical ingested.

Keywords: Chemical pneumonitis, Corrosive poisoning, Ethylenedioxy Dimethanol and Glutaraldehyde-induced lung injury, Household chemicals, Toxic fumes

Introduction

Chemical pneumonitis can occur due to various irritant chemicals, toxins, occupational/environmental exposure, or corrosive poisoning. Most commonly ingested household agents are Ethylenedioxy Dimethanol, Glutaraldehyde, sodium hydroxide, sodium hypochlorite, ammonia, sulfuric acid, and hydrochloric acid, used as sanitizing or floor cleaning agents, or in car batteries and button batteries. EDDM (Ethylenedioxy Dimethanol) is a highly effective and versatile biocide used in various industries for its antimicrobial properties [12]. It is a clear, colorless liquid with a pungent smell and has excellent stability and solubility. It is commonly used in water treatment systems, textiles, adhesives, paints and antiseptic solutions. These chemicals are known to be toxic to the respiratory system when exposed to high concentrations. According to Chibishev et,.al about 75-80 corrosive poisoning cases have been recorded annually, most commonly in women [1]. Acute complications of corrosive poisoning depend on the degree of injury- stenosis of the mid and distal esophagus, along the gastric antrum and pylorus [2]. A few cases were reported to have aspiration pneumonia due to aspiration of ingested substances. These intoxicated chemicals cause a lot of upper gastrointestinal tract complications. However, there are minor cases where corrosive poisoning leads to respiratory complications as well. In this case, we tried to emphasize the respiratory issues of the patients, which makes the treatment a bit more complicated.

Case presentation

A 23-year-old young female with no known underlying conditions presented to the ER with an alleged history of consumption of 100 ml of floor cleaner (Bacillocid Extra- composed of Ethylenedioxy Dimethanol and glutaraldehyde) at her residence this morning, followed by heartburn, 5-6 episodes of non-bilious vomiting, and shortness of breath. On evaluation, she had a temperature of 98.6^0 F, blood pressure 110/70mmHg, heart rate 130 bpm and respiratory rate 36cpm. ABG analysis showed respiratory alkalosis with severe metabolic and lactic acidosis. The patient was immediately started on oxygen support. Systemic examination showed tachypnea with bilateral basal crackles. 2D Echo showed good LV systolic function. CXR(Fig-01) showed bilateral hyperinflated lung fields.

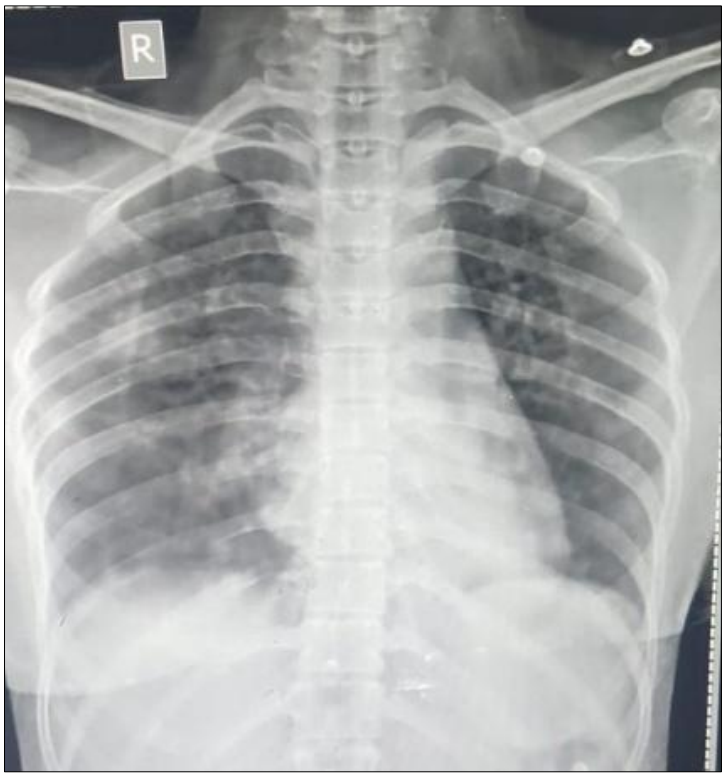

Fig1: CXR showed Bilateral hyperinflated lung fields

Blood investigations showed neutrophilic leucocytosis (TLC-12600, NEU-93), Elevated LDH (419U/L), Elevated liver enzymes (SGOT- 89U/L & ALP-102U/L), Elevated bilirubin (TB-1.4/IB-0.9). Initially, she was placed in ICU and started on IV antibiotics (3rd generation cephalosporins), IV steroids(methylprednisolone), nebulized bronchodilators and other supportive medications. Upper GI endoscopy (Fig-03) showed Grade I esophageal injury and gastric fundal injury. Medical Gastroenterologist and Pulmonologist cross-consultation was taken. HRCT chest (Fig-02) showed Bilateral ground-glass opacities in the middle and lower lobes of the lungs, signifying Chemical Pneumonitis. Because of persistent febrile episodes, antibiotics were upgraded to Piperacillin-Tazobactam. She improved symptomatically with normal lab values and was discharged with follow-up advice. The patient came for follow-up after a month; she was hemodynamically stable with no active symptoms. A repeat CXR was performed, showing clear lung fields.

Fig 2: HRCT Chest showing Bilateral Ground Glass Opacities in the middle and lower lobes

Fig 3: Upper GI Endoscopy showing Grade-I esophageal and gastric fundal injury

Discussion

Chemical pneumonitis can develop after exposure to a variety of industrial chemicals, respiratory irritants, and ingestion of corrosive substances. The treatment is supportive, although steroids are believed to be the first-line treatment. A chemical agent can cause lung injury either by ingestion(aspiration) or by reaching the lungs through systemic circulation [6]. Chemical agents such as Dimethanol and glutaraldehyde provoke direct or indirect lung injury. Several factors of the ingested substances decide the severity of injury- nature of corrosive substance, pH value, quantity and concentration ingested, duration of exposure and the act of swallowing [3].

Ethylenedioxy Dimethanol (EDDM) is an organic compound used in a variety of scientific experiments due to its unique properties. EDDM has a high efficiency, a broad spectrum, good stability, rapid onset of action. It is effectively used to eradicate bacteria and fungi and prevent bacteria from developing resistance to a certain extent. Glutaraldehyde solutions are also used as biocides and fixatives. It is a strong sterilant, a toxic and strong irritant. When exposed, it causes nausea, severe shortness of breath and headaches. The physical characteristics of the ingested substance influence the localization of post-corrosive injury. Injury to the oropharynx or proximal segment of the esophagus is due to a solid chemical, while liquid substances cause injury at the mid or distal third of the esophagus [4]. After caustic ingestion, patients usually complain about burning throat/chest pain, stomach pain and vomiting. Aspiration of corrosive substances may cause bronchial or endotracheal necrosis with mediastinitis, which may cause fatal outcomes.

A substance with a pH less than 2 and greater than 12 is highly corrosive and causes severe tissue necrosis. A concentrated chemical substance in contact with the esophageal lining can cause severe perforation and mediastinitis [7]. Corrosive chemicals often cause respiratory injury accompanied by GI tract injuries. Most of the patients are usually treated for obstructed airways, laryngitis, or dysphonia. In a study conducted in Europe, Perara *et al.,* described a case of a young girl who ingested glyceraldehyde, which is used as a sanitizer [8]. The patient exhibited severe metabolic acidosis and respiratory distress and eventually had an endotracheal tube intubation due to a difficult airway. Our case is similar to this case, our patient ingested 100ml of Bacillocid floor cleaner, which was made from glyceraldehyde, Ethylenedioxy Dimethanol and didecyl dimethyl ammonium chloride concentrate. However, she had respiratory complications and was kept on Non-Invasive Ventilation (NIV) until stabilization. Lethal respiratory complications can be observed in acute corrosive poisonings besides upper GI conditions.

HRCT chest remains the gold standard for the diagnosis of chemical pneumonitis. The most common complications are pneumonia or tracheal stenosis of the respiratory tract [10]. Treatment is mainly conservative. The use of corticosteroids in acute corrosive poisoning is still under debate. However, dexamethasone of 1 mg/kg/day or prednisolone of 2 mg/kg/day is commonly used to prevent Esophageal/tracheal stenosis [9]. Mortality is mainly due to tracheal stenosis, acute respiratory distress syndrome (ARDS) and Esophageal perforation leading to mediastinitis or pneumoperitoneum [11]. Timely intervention and management are necessary to reduce the risk of mortality in such cases.

Conclusion

The purpose of this study was to highlight the respiratory complications of acute corrosive poisoning caused by Dimethanol and glutaraldehyde, which are often misdiagnosed when treating the upper gastrointestinal symptoms in patients. They often lead to fatal outcomes. All physicians must be

educated on post-corrosive complications and the necessity of proper diagnostic workup.

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