



Case Report

A Newborn Case of Esophagus and Vocal Cord Burn After CS (O-Chlorobenzylidene Malononitrile) Gas Inhalation

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Abstract

Among the agents used for self-defense, O-chlorobenzylidene malononitrile (CS) is the most commonly used substance. It has been suggested that CS use is characterized by rapid onset of action, short duration of action, and minimal side effects. When the clinical situations and case series resulting from exposure to CS were examined, we saw that no cases of exposure during the neonatal period were identified. A male baby born at 40 weeks, weighing 3260 grams, was brought to the emergency room on the 24th postnatal day with bruising and respiratory distress due to a stranger spraying CS into his mouth. There was a widespread hyperemic erosive lesion in the mouth, tongue exfoliation, and leg ecchymosis. Widespread edema and hyperemia were observed in the vocal cords, and the patient was intubated and followed up. An epithelial defect involving the corneal limbus and conjunctiva was detected in the upper and lower eyelid membranes. Endoscopy revealed a grade 2 burn in the esophagus, and normal pseudomembrane and gastric mucosa in some areas. It was observed that the lesions around the patient's mouth and tongue completely resolved. After discharge, the esophagus-stomach-duodenum radiograph showed no suspicion of obstruction. At the 3rd-month post-discharge check-up, his eye examination was normal, and his stridor and wheezing at rest continued. This case, in which we have shown that CS used for self-defense or riot suppression, seriously threatens the life of a newborn patient for the first time and may perhaps cause permanent morbidities during follow-up, suggests the need to restrict access to such substances.

Keywords: CS, newborn, O-chlorobenzylidene malononitrile, tear gas

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Agents used for self-defense include various chemicals. O-chlorobenzylidene malononitrile (CS) is the most commonly used substance in these agents. It has been suggested that CS use is characterized by rapid onset of action, short duration of action, and minimal side effects.^[1] On the contrary, there is also available data showing that it has long-term side effects and life-threatening consequences.

^[2] CS has been suggested to be an alkylating agent that reacts with glutathione, SH-containing enzymes, pro-

teins, and nucleic acids. Data on CS mutagenicity, that is, its physical or chemical effect on the organism in question by changing the molecular structure of cellular information and management chains such as DNA or RNA, causing it to mutate, are controversial.^[3] Additionally, CS solvent is considered dangerous^[4,5], but its health effects have not been well studied.^[4]

CS is highly irritating to the mucous membranes lining the eyes, nose, throat, and stomach. Initial effects after exposure

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include: excessive tearing, conjunctivitis, uncontrolled blinking (blepharospasm), and burning and painful sensations.^[5] These initial symptoms may be followed by chest tightness, coughing, sneezing, burning sensation in the tongue and mouth, salivation, vomiting, and laryngospasm.^[6]

When the clinical situations and case series resulting from exposure to CS used for self-defense or riot suppression were examined, we found that no cases of exposure during the neonatal period were identified. In this article, a neonatal case who developed vocal cord edema, tracheal diffuse edema and obstruction, bronchopneumonia, and esophageal burn after CS spray exposure was presented.

Case Report

The first live male baby was born in a private hospital, weighing 3260 grams, after a 40-week normal spontaneous vaginal birth from the 28-year-old mother's 3rd pregnancy. On the 24th postnatal day, the patient developed bruising and respiratory distress due to a stranger entering the house and spraying an unknown substance into his mouth and was brought to the pediatric emergency room by ambulance. In the physical examination of the patient, the general condition is fair. There is hyperemia and discharge in both eyes. Their breath sounds are rough and tachypneic, he has difficulty breathing, and there are intercostal retractions. There is a widespread hyperemic erosive lesion in the mouth, exfoliation on the tongue (Fig. 1), and distal ecchymosis and petechiae on both legs, which are thought to be traumatic.



Figure 1. Diffuse intraoral erosive lesions, exfoliation, and hyperemia in the tongue occur after CS contact.

When the patient's deep mouth was examined, it was observed that there was widespread edema and hyperemia in the vocal cords, and since obstruction could occur, the patient was intubated and followed up. Because the patient had intense vocal cord edema, he could be intubated. The patient was started on medical treatment for sedation and analgesia, and a control chest X-ray was requested. The patient was consulted by the pediatric surgery department. Considering the possibility of extensive esophageal burn in the acute period, an endoscopic evaluation was requested; however, due to the high risk of perforation, endoscopy was planned to be performed 10 days later.

An epithelial defect involving the limbus and conjunctiva was detected on the nasal side of the right cornea, and membrane on the lower and upper eyelids, and an epithelial defect involving the limbus and conjunctiva was detected inferior to the left pupil level.

Since the patient was a forensic case, we were informed about the foreign substance that was thought to have been sprayed, and we learned that it contained CS, which is used as a defense tool and is popularly known as pepper gas. Since we wanted to evaluate the patient toxicologically, we investigated the chemical substance to which the patient was exposed. While it was learned that there was no previous encounter with the toxicological chemical used in this age group, close vital follow-up and symptomatic follow-up were recommended. The Pamukkale University Non-interventional Clinical Research Ethics Committee approved the study (date: 26.11.2024, number: 20). Written informed consent was obtained from the patient's family for the publication of the case report and accompanying images.

The patient's echocardiography was performed in terms of cardiological pathologies, and his cardiological examination was found to be normal. After the patient's endoscopy was performed on the scheduled day, it was observed that there was a second-degree burn in the entire esophagus, there was a pseudomembrane in some areas, and the gastric mucosa was normal. A permanent nasogastric (NG) tube was placed and it was decided to start NG feeding. It was observed that the hyperemia and edema in the patient's trachea and vocal cords decreased during the endoscopic evaluation. The patient was then monitored in nasal synchronized intermittent mandatory ventilation mode for another 5 days and did not require oxygen thereafter. During the follow-up of the patient during this period, we observed that mediastinitis and pneumothorax did not develop in the posterior-anterior chest radiography (PA-CR) and examinations, but bronchopneumonia developed (Fig. 2).

Inhaler bronchodilator therapy was started when rhonchi was heard during the patient's respiratory system examina-



Figure 2. The patient's PACR and bilateral broncho-pneumonic infiltration.

tion. In the patient's daily eye examination, it was observed that there was improvement in the eye epithelium and it did not progress to perforation. On the 20th day of the patient's hospitalization, a second endoscopy was performed and it was observed that the esophagus and stomach were normal and the burn areas were healed. Bronchoscopy was not considered to evaluate lower airway obstruction in the patient whose upper airways appeared normal, who did not need oxygen, who did not need inhaler therapy, and who did not hear rales or rhonchi during respiratory system examination. It was observed that the patient's erosive lesions around the mouth and the exfoliation on his tongue completely resolved on the 21st day of hospitalization (Fig. 3).

The esophagus-stomach-duodenum radiograph taken after discharge showed that there was no suspicion of obstruction. At the postnatal 3-month follow-up after discharge, the eye examination was normal, and the otorhinolaryngologist examination revealed that mild edema con-



Figure 3. Healing of intraoral erosive lesions and tongue exfoliation caused by CS on the 21st day of hospitalization.

tinued in the arytenoids, but no stenosis was observed. The patient is followed closely for possible late complications.

Discussion

Tear agents are solid chemicals dispersed as a fine powder or aerosol spray. They are used by law enforcement for riot control but are used with increasing frequency by civilians in small personal protection devices. These devices are often called tear gas, mace, and more recently "pepper spray." Lacrimators produce several desired effects that temporarily incapacitate the victim. Immediate effects include intense irritation of the skin and eyes leading to blepharospasm and epiphora, as well as irritation of the mucous membranes of the nose, trachea, and lungs. The most commonly used lacrimation agents are chloroacetophenone (CN), CS, chloropicrin, and capsicum oleoresin.^[7,8] The presented patient was exposed to CS.

The onset of symptoms within minutes of exposure and medically significant acute reactions are associated with overapplication and close-range exposure.^[9] As in our current case, acute symptoms were very serious due to exposure in a closed area, exposure from a very close range, long-term ventilation, and inadequate self-protection.

Fatal effects of CS inhalation in animals result from bronchopneumonia secondary to lung injury or airway injury leading to asphyxia and circulatory failure.^[5] In healthy human volunteers, low-dose CS exposure has previously been shown to produce no acute effects on lung mechanisms or diffusion capacity.^[10] Developing severe respiratory distress within the first hour and then developing respiratory failure and being intubated, as in our patient, may be an indication of high exposure. Additionally, when the literature was examined, it was thought that the low lung capacity of newborns may have caused the clinical condition to become serious even at low exposure, as there were no cases of exposure to CS in this age group and the fact that no voluntary work could be done in this age group.

High-dose CS inhalation can cause pulmonary edema (ARDS) and/or diffuse airway lesions in humans, but only two cases of parenchymal injury have been reported in the literature. To our knowledge, there is no fatal case due to exposure to CS in the literature.^[11] A lethal dose of CS gas is thought to occur at concentrations possibly several hundred times higher than the normal exposure dose.^[7] In our case, mechanical ventilation was required at the beginning of hospitalization due to pulmonary edema and airway edema, and bronchopneumonia developed as a late complication 21 days after hospitalization. Early and appropriate medical therapy was applied to our patient; thus, mortality was prevented and treated.

When clinical situations and case series resulting from exposure to CS are examined, we present the first case exposed in the neonatal period. When the literature was examined, a case was reported in which a 4-month-old male baby developed pneumonia after prolonged exposure to tear gas (CS or orthochlorobenzylidene malononitrile).^[8] There is also a report from Chile linking tear gas to health effects on infants under 1-year-old or older adults. In this report, the interaction between the healthcare level and the period of social upheaval observed a statistically significant increase in the relative frequency of respiratory emergencies in infants under 1 year of age during the exposure period.^[11]

Conclusion

Reports regarding CS gas safety are still controversial, and several human deaths have been attributed to CS exposure. This case, in which we have shown that CS used for self-defense or riot suppression seriously threatens the life of a newborn patient for the first time and may perhaps cause permanent morbidities during follow-up, suggests the need to restrict access to such substances.

Disclosures

Ethics Committee Approval: The Pamukkale University Non-interventional Clinical Research Ethics Committee approved the study (date: 26.11.2024, number: 20).

Informed Consent: Written informed consent was obtained from the patient's family for the publication of the case report and accompanying images.

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