Case Report - Olgu Sunumu

A Rare Cause of Acute Respiratory Distress Syndrome: Near Drowning in Detergent and Sodium Hypochlorite Containing Solution

Akut Respiratuvar Distres Sendromunun Seyrek Görülen Bir Nedeni: Deterjan ve Sodyum Hipoklorit İçeren Solüsyonda Boğulayazma

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ÖZET

Boğulayazma çocuklar ve erişkinlerde yüksek morbidite ve mortalite nedeni olmaya devam etmektedir. Çocuk yoğun bakım ünitelerinin ve teknolojinin gelişmesiyle boğulayazma olgularının yaşatılabilirliği de artmıştır. Boğulayazmanın kısa vadeli sağ kalımındaki gelişmeye karşın, kurbanlarda akut solunum yetmezliği sendromu ve kalıcı hipoksik-iskemik merkezi sinir sistemi hasarında artışa neden olmuştur. Bu nedenle, batma olayı sonrası kurbanların akut dönemde yoğun bakımdaki tedavisi önemlidir. Bu yazıda, sodyum hipoklorit ve deterjan içeren su dolu kova içinde gerçekleşen boğulayazma olgusu sunulmuştur CAYD 2015;2(1):49-54.

Anahtar Kelimeler: Akut solunum yetmezliği sendromu, boğulayazma, hipoksik-iskemik merkezi sinir sistemi hasarı, sodyum hipoklorit

SUMMARY

Near-drowning continues to be associated with high mortality and morbidity in both children and adults. With the availability of sophisticated technologies and pediatric intensive care units, victims of near-drowning are now more likely to survive. However this improvement in short-term survival of near-drowning, victims after an acute submersion episode has also resulted in an increase of acute respiratory distress syndrome and persistent hypoxic-ischemic central nervous system injury. Therefore, it is important both to know the acute intensive care unit management of victims of near-drowning and also to understand the progression of the disease. We report a patient who had been near-drowned in bucket filled with sodium hypochlorite and detergent containing water CAYD 2015;2(1):49-54.

Keywords: Acute respiratory distress syndrome, hypoxic-ischemic central nervous system injury, near-drowning, sodium hypochlorite

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INTRODUCTION

Drowning, defined as a process resulting in primary respiratory impairment from submersion/immersion in a liquid medium, is a major cause of pediatric unintentional death worldwide (1-3). Drowning continues to be associated with high mortality and morbidity in both children and adults. Although differences in lifestyle and exposure to water may affect the circumstances under which drowning occurs in different countries, drowning consistently remains a leading cause of death throughout the world (2). Near-drowning, defined as survival following submersion, was described as a clinical problem in pediatric intensive care units (1). With the availability of sophisticated technologies and pediatric intensive care units, victims of near-drowning are now more likely to survive (4-7). However this improvement in short-term survival of near-drowning, victims after an acute submersion episode has also resulted in an increase of acute respiratory distress syndrome (ARDS) and persistent hypoxic-ischemic central nervous system (CNS) injury (8). Therefore, it is important for the acute intensive care unit (ICU) management of victims of near-drowning but also understand the progression of the disease.

Household bleaches that contain sodium hypochlorite (NaOCl) and sodium hydroxide are the common domestic agents used all around the world, which are frequently accidently ingested by children (9). Commercial household bleaches are known to have minor adverse effects when ingested, as being mucosal irritants, emetics and weak corrosives. However, our clinical observations of pneumonitis among household bleach ingested by patients without a history of aspiration foretell some possible systemic toxic effects of household bleaches (9).

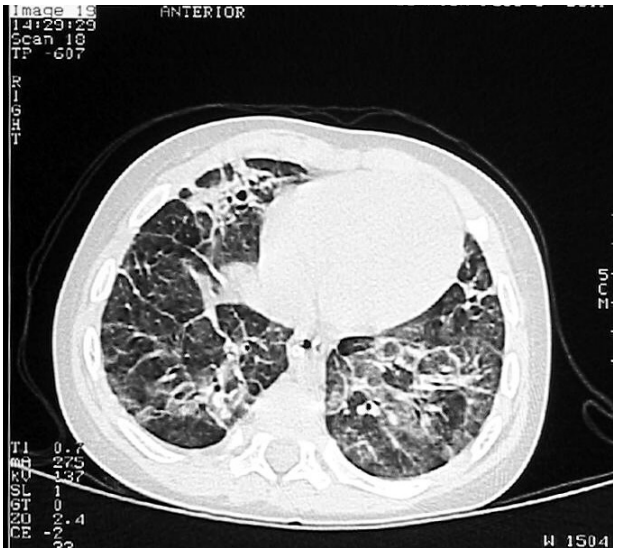
We report a patient who had been near-drowned in bucket filled with NaOCl and detergent containing water.

CASE REPORT

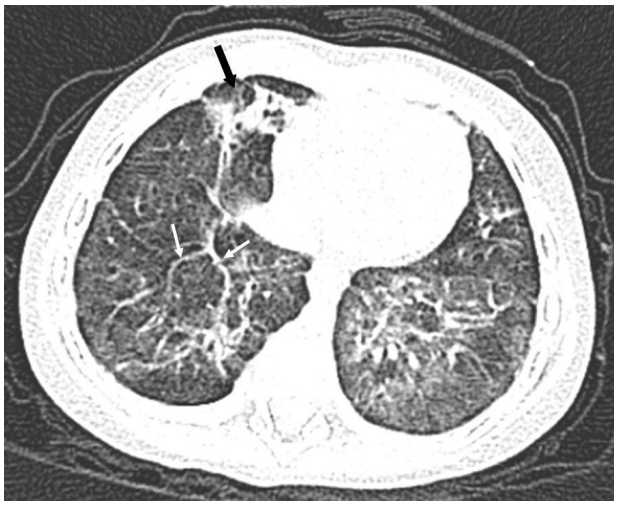
A 11-months old boy who had been pulled from bucket filled with sodium NaOCl and detergent containing water. Her mother left the child was behind the bucket. The bucket was approximately one-half full of water. The mother was gone approximately five minutes, and upon returning she found the child's head in the bucket. Five minutes later, they arrived at the hospital. After the initial resuscitation he was transported to our pediatric intensive care unit. On physical examination the patient was lethargic, Glasgow Coma Scale (GCS) score was 10 point. He has cyanosis, with a heart rate 160/minute, respiratory rate 60/minute, temperature 36°C, arterial blood pressure 75/40 mm Hg, and delayed capillary refill time (5 seconds). Oral mucosa was hyperemic with hypersalivation. He was tachypneic, respiratory efforts were irregular with retractions and rales on auscultation. His cardiac examination findings were unremarkable. Abdomen was soft and no tender. Tonus was decreased. Pupils were bilaterally equal and reactive. The patient was intubated and ventilated immediately, because of severe hypoxemia. Initial fluid resuscitation was done. The seizure was observed and treated with anticonvulsant drugs. The chest x-ray showed small patchy diffuse pulmonary infiltrates. ARDS was developed on the first day. PaO_2/FiO_2 was found low (80). Low tidal volume with high PEEP was applied as mechanical ventilation strategy. Bilateral pneumothorax was developed in the second hospitalization day. On the 21th hospital day, tracheotomy operation was done because of the weaning difficulty. On the 30th hospital day, the patient weaned from the ventilator. The patchy ground-glass opacities, parenchymal fibrosis and traction bronchiectasis were showed in high-resolution computed tomography (HRCT) examination (Figure 1). Fibrosis was revealed after 11 months by HRCT (Figure 2). Bilateral basal ganglia infarcts were showed in cranial magnetic resonance imaging (Figure 3). Tracheotomy was closed at 2.5 months after the admission. The patient was discharged from the hospital with severe neurological sequela.

DISCUSSION

Drowning is a major cause of pediatric unintentional death worldwide (3). It is the third leading cause of death in children aged 1–5 and the leading cause of mortality due to injury, with the mortality rates in male children being almost twice as high as those in female children (3). Young children under the age of 5 are at particularly increased risk of drowning, with drowning rates peaking among children ages 1 to 2 years (5,10-12). Death by drowning is not the sole outcome of distress in the water. Near-drowning is also a serious problem. One study (13) found that for every 10 children who die by drowning, 140 are treated in emergency rooms and 36 are admitted to hospitals for further treatment (14,15), although some never recover (14,17).



Şekil 1. High-resolution computed tomography (HRCT) examination showed patchy ground-glass opacities, parenchymal fibrosis and traction bronchiectasis.



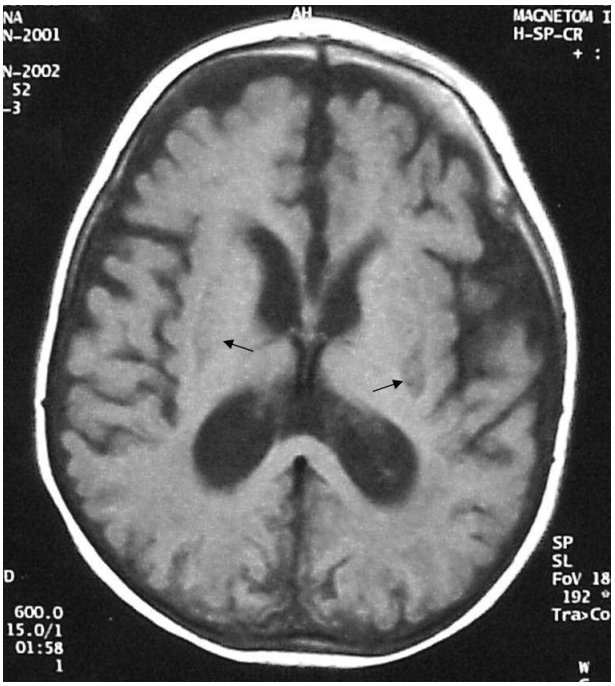
Şekil 2. HRCT obtained 11 months later revealed mostly fibrosis.

This is a very lethal injury; 50% of pediatric submersion victims die which is among the highest percentage of all ruptured injuries (1). In Uganda, drowning has been shown to be responsible for 27% of all injury fatality (16). Death by drowning is not the sole outcome of distress in the water. In the Netherlands, it has been reported that on average there are about 300 drowning fatalities a year and an additional 450 cases who survive the drowning incident, of these 390 are admitted to hospital for further treatment (18). The recovery rate from neardrowning may be lower among young children than among teenagers and adults. Some survivors suffer subsequent hypoxic encephalopathy, leading to long-term neurological deficits (7,11,19,20).

Drowning rates vary with age in discernible percentage (1). Drowning rates are highest among children younger than 5 years and second highest among 15 to 19-year-olds (1). As with all injuries males predominate (3,21). Males, however, predominate even in the earliest age-groups, possibly because young boys are often granted more freedom from supervision than young girls enjoy, making it more likely that they will stumble into danger and less likely that they will attract an adult's attention in time for a quick rescue. Submersion among infants younger than 1 year of age usually occur in bathtubs, 1 to 4 year olds typically fall into swimming pools (4,11,23). More than 50% of unintentional infant drowning deaths occur in the bathtub (24).

Among children ages 14 and younger, toddlers are at particularly high risk, both in large bodies of water, such as pools, rivers, lakes or irrigation ditches, as well as smaller bodies of water, such as bathtubs, fountains or even buckets. Small children have drowned or almost drowned in bathtubs, toilets, industrial-size cleaning buckets, and washing machines (8) Drownings in this age group frequently occur during a lapse in supervision (25). The majority of bathtub drownings involved children under age five. Buckets may be common risk sites (26). Our patient was 11-months old, male and was near-drowned in bucket. Hypoxemia has been described as the single most important consequence of near-drowning (27). Individuals who survive the initial course near-drowning are at risk for the development secondary drowning: the development of ARDS (25). In our patient additive risk factor for development of ARDS was, near-drowned in water containing sodium hypochlorite. Bleaches based on solutions of NaOCl are widely used in the household to disinfect and clean hard surfaces and to bleach the laundry. (9). Commercial household bleaches are known to have minor adverse effects, but they cause pneumonitis even though they ingested via gastric way (9). When they aspirate from the respiratory tract, acute respiratory failure may occur (28,29). In household bleaches aspiration, late death occur especially from progressive lung damage (28,30). Our pateint serial HRCT examination of the lungs showed especially fibrosis, no progression or regression was found on control HRCT imaging.

The majority of patients entering the ICU in a flaccid, comatose state will suffer cerebral death or



Şekil 3. Bilateral basal ganglia infarcts were showed in cranial magnetic resonance imaging.

severe long-term neurologic sequelae. Trials aimed at restoring hypoxic-damaged brain have been largely unsuccessful (31). However, as many as 30% of patients will survive as neurologically intact (32), predicting the outcome in individual patients has proven to be difficult. Suggested indicators include: temperature of submersion medium (33), duration of submersion, GCS, rapidity of restoration of heart rate, state of pupils, minimum blood pH, intracranial pressure, reduction in regional blood flow, EEG, and blood glucose (34). CNS dysfunction may be secondary to the initial hypoxic injury and may be caused by progressive CNS injury because of post resuscitation cerebral hypoperfusion. Studies have results suggest that pupillary unresponsiveness in the emergency department and initial GCS score of less than 5 on arrival to the ICU are associated independently with poor CNS outcome (35). Intact survival is associated with submersion durations fewer than 5 minutes (36). Even though at admission GCS was 11 and pupils were reactive in our patient, he developed severe hypoxic-ischemic injury. Duration of submersion may be more predictive for CNS injury. A prognosis score for pediatric near-drowning victims has been derived by Orlowski (33). It is based on five indicators: age younger than 3 year, maximum submersion estimated longer than 5 min, post-rescue delay in resuscitation for greater than 10 min, coma at time of admission and initial pH less than or equal to 7.1 (33). We thought that our patient's submersion duration was longer than 5 minutes.

Remarkably, submersion injury has received little attention even though the number of drowning in most countries greater than the total number of drowning in most countries. The key to minimizing morbidity and mortality secondary to submersion accidents is successful prevention.

The mortality rates of ARDS were reported from 18.2% to 70% (37-40). This wide disparity in mortality could be related to many factors including causes and severity of illness. The most common causes of ARDS were sepsis, extra-pulmonary organ failure, multiple trauma, and lung diseases including pneumonia, lung contusion, drowning (37-40). The rate of drowning as a cause of ARDS was reported %2 by Li et al (40).

CONCLUSION

Lack of adult supervision and judgment is by far the biggest risk factor related to the drowning death of a young child. Infants most often drown in bathtubs when left unattended or when the supervising adult becomes distracted. Because even nonfatal drownings can be serious, with many requiring hospitalization and some resulting in brain damage or other long-term adverse effects, prevention is critical. Many patients who have nearly drowned and who need ventilatory support may develop ARDS. Despite agressive care, neurologic injury with long term sequelae secondary to hypoxic ischemic injury remains a major problem in the management of submersion accidents. Prevention is important in the chain of survival for the submersion victim. Participants, parents, caregivers, and supervisors should be aware of the hazards, use appropriate prevention strategies, and be prepared with the skills to save lives in the event of emergencies.

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