

## A Case of Intravenous Suicide: Sodium Hypochlorite & Benzalkonium Chloride

Bir İntravenöz İntihar Olgusu: Sodyum Hipoklorit & Benzalkonyum Klorür

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### ABSTRACT

*Sodium hypochlorite as a strong oxidant- bleaching agent and benzalkonium chloride as a biocide are frequently used agents for cleaning and sterilization purposes, both in health care units and at home. Despite the injection of sodium hypochlorite into the venous system has been described many times before, to our knowledge self-administration of a mixture of sodium hypochlorite and benzalkonium chloride has not been reported by a way of suicide. Our patient was a health Professional who was running a sport and beauty center. The amount of total concentration intake that patient said prepared by himself (400 ml of sodium hypochlorite, 400 ml of benzalkonium chloride, and 1000 ml of isotonic liquid ) was unknown but it was known that >150–200 mL of hypochlorite in adults is enough for systemic poisoning. The cross effects of chemicals on human tissues and organs are unpredictable, our patient was discharged by recovering all systemic damages except permanent kidney damage. This study aims to present a rare suicide poisoning event and adverse clinical sequelae.*

### ÖZET

*Sodyum hipoklorit güçlü oksitleyici, ađartıcı, benzalkonyum klorür ise biyosit özellikli olan temizlik ve sterilizasyon amaçlı hem sađlık kuruluřlarında hem de evlerde sık kullanılan ajanlardır. Venöz sisteme sodyum hipoklorit enjeksiyonu daha önce birçok kez raporlanmış olsa da, bildiđimiz kadarı ile, intihar yöntemi olarak sodyum hipoklorit ve benzalkonyum klorür karıřımının kendi kendine uygulanması hiç bildirilmemiřtir. Olgumuz spor ve güzellik merkezi iřleten bir sađlık uzmanı idi. Hastanın kendi hazırladıđını söylediđi toplam deriřimden (400 ml sodyum hipoklorit, 400 ml benzalkonyum klorür ve 1000 ml izotonik sıvı) alım miktarı belirsizdi, ancak yetiřkinlerinde > 150-200 mL hipokloritin sistemik zehirlenme için yeterli olduđu bilinmektedir. İnsan doku ve organları üzerinde kimyasalların apraz etkileri öngörülemezken, olgumuz kalıcı böbrek hasarı dıřında sistemik tüm bulguları iyileřerek taburcu olmuřtur. Bu alıřmanın amacı, nadir bir intihar amaçlı zehirlenme olayı ile klinik sekeli sunmaktır.*

### Key Words:

Benzalkonium chloride,  
Poisoning,  
Suicide,  
Sodium hypochlorite.

### Anahtar Kelimeler:

Benzalkonium chloride,  
Zehirlenme,  
İntihar,  
Sodium hypochlorite

### INTRODUCTION

Sodium hypochlorite is a strong oxidizing and chlorinating agent. It is not flammable, but it makes explosive hazards when it comes into contact with organic materials such as paper, wood, grease, and oil (1). Due to its antimicrobial and tissue-dissolving properties, sodium hypochlorite is also widely used by dentists to clean the root canals during endodontic treatment, too. Multiple reports document skin burns and permanent nerve injury when sodium hipoklorit contacts oral tissues. It has demonstrated esophageal edema, hemorrhage, and stricture formation following ingestion (2-5). In cases of suicide poisoning, many intravenous injection has been reported. Especially during the late 1980s, doctors advised intravenous drug users to sterilize their shared needles with a sodium hypochlorite solution (5.25 %) to reduce transmissible illnesses. (6-8)

Toxidromas or Toxicological Syndromes are clinical syndromes that can be useful to determine the etiology in cases of poisoning. However, symptoms alone may not be sufficient for diagnosis. Also, there are common poisoning symptoms for many toxic substances, as well as symptoms that vary from person to person. A

definitive diagnosis should be made only with the support of laboratory findings besides toxidrome (9). In the case of oral sodium hypochlorite poisoning; the diagnosis can typically be made with a careful history, including details of the specific product used, the hypochlorite concentration, and the relevant amount. Since hypochlorite (bleach) produces a characteristic chlorine smell, this can provide a diagnostic hint. In severe cases, it appears hypersalivation, difficulty swallowing, retrosternal pain, or hematemesis due to corrosive injury (2). Although limited supporting data are provided, estimates of >40mL or 5 mL/kg in children or >150–200mL in adults of dilute solutions have been suggested as amounts likely to cause corrosive or systemic poisoning (2)

The biocide activity of benzalkonium chloride (BAC) is based on interaction with lipids and proteins of biological membranes. Benzalkonium chloride can also be added to nasal preparations to prevent microbial contamination (10). In the production chain of minimally processes fruits and vegetables, washing with sanitizing solutions is usually, the only step by which the number of pathogenic and spoilage microorganisms can be reduced. Sanitizing with chemical, that generally

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**Table 1:** Evaluation of the laboratory test results on the emergency application

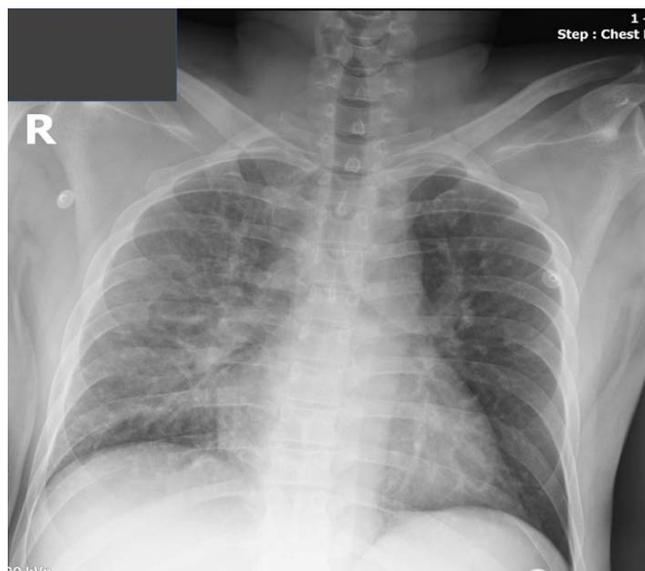
Laboratory test	Results	Range of laboratory
Glucose	155 mg/dL	74 - 106
Leukocyte	12.7 10 <sup>3</sup> /uL	4.10-11.0
Neutrophil	11.64 10 <sup>3</sup> /uL	0.1-1.0
Sodium	146 mmol/L	135 - 145
Potassium	3.9 mmol/L	3.5 - 5.1
Calcium	7.70 mg/dL	8.8 - 10.6
Chlorine	115 mmol/L	101 - 109
Blood Urea Nitrogen (BUN)	45 mg/dL	17 - 43
Creatinine	1.97 mg/dL	0.67 - 1.17
Albumin	3.68 g/dL	3,5-5
Indirect bilirubin	1.72 mg/dL	0-0.8
Total bilirubin	2.07 mg/dL	0.3-1.2
ALT	18 U/L	0 - 50
AST	50 U/L	0 - 50
Lactate dehydrogenase (LDH)	2246 U/L	230-460
C-reactive protein	30.5 mg/L	0-6
Procalcitonin	5.78 ng/mL	procalcitonin < 0,5 ng/ml normal 0,5-2,0 ng/ml pozitif (sepsis?) 2,0-10,0
Amylase	112 U/L	28 - 100
Lipase	198 U/L	0 - 67
Prothrombin Time (PT)	>120 second	8.2-12
D-dimer	2600 ug/L	80 - 630
Troponin-I	16.8 ng/L	< 19.8
CK-MB	2.70 ng/mL	0.6 - 6.3
Ethanol	3 mg/dL	0 - 50
pH	7.30	7.35-7.45
pO <sub>2</sub>	54.5 mm/Hg	83.0-108.0
pCO <sub>2</sub>	39.6 mm/Hg	32.0-48.0
cHCO <sub>3</sub>	19.3 mEq/L	-

includes chlorine compounds (benzalkonium chloride, sodium hypochlorite etc.), is the primary contribution to the safety and preservation of these products (11). At the same time, dentists apply both chemicals to eliminate bacterias in dental tissues as a disinfection method, too (12). Although poisoning cases related to intake of benzalkonium chloride or sodium hypochlorite have been reported in the literature, suicide attempts both mixing sodium hypochlorite and benzalkonium chloride have not been reported before.

#### CASE

A 39-years-old male patient with no psychiatric or chronic disease was brought to our emergency room by syncope attack. It was learned that he was a health professional who was running a sport and beauty center. He injected in his vein for a suicide attempt by mixing 5 tea glasses (400 ml) of zefiran (benzalkonium chloride),

5 tea glasses (400ml) of bleach (sodium hypochlorite) and 1000 cc of isotonic liquid. On physical examination, the general condition of the patient was poorly confused. The pupils were isochoric (3/3) and pupillary light reflex (PLR) were bilaterally positive. His Glasgow Coma Score was 9 points (Eye Opening=2, Verbal=2, Motor=5). In his biochemistry (Table 1), high values for; leukocyte, neutrophil, glucose, sodium, chlorine, urea-creatinine, C-reactive protein (CRP), amylase, lipase, indirect bilirubin, lactate dehydrogenase (LDH), protrombin time (PT), D-dimer were detected. His blood gas showed metabolic acidosis. Potassium (K<sup>+</sup>), ALT, and AST levels were normal. Urine output was anuric. Blood pressure was 160/100 mmHg, pulse 52 / minute, S1 S2 hearth sounds were natural and ECG has shown bradyarrhythmia. The respiratory rate was 30 /min, and respiratory sounds of both lungs were decreased and common rough rales were detected. Posteroanterior



**Figure 1:** Posterior anterior chest X-ray image

(PA) chest view demonstrated bilateral infiltrations, more prominent in the right lung (Figure 1). 50% oxygen was administered by a non-rebreather mask. The pH in repeated arterial blood gas: 7.32, PaCO<sub>2</sub>: 24 mmHg, PaO<sub>2</sub>: 36 mmHg, Oxygen-free SpO<sub>2</sub>: 72%, respiratory rate: 50/min, PaO<sub>2</sub> / FiO<sub>2</sub><200. As a result of the development of acute respiratory distress syndrome, non-invasive mechanical ventilation was applied. The patient, who was consulted with the anesthesia department transferred to the external center at the 3rd level intensive care unit. A continuous venous-venous hemodiafiltration (CVVHDF) was connected to him. After 3 months of hospitalization, the patient returned to chronic renal failure and was discharged with a nephrology follow-up. The patient, who had a good general condition in the outpatient follow-up for the 6th month, did not have any complaints and continued his nephrology follow-up. As seen in Table 2, low Glomerular Filtration Rate (GFR) has become permanent.

## DISCUSSION

In a study for evaluation of forensic cases applied to the emergency department by Küçük et al. the poisoning

rate was found at 8.68%. It was observed that 454/6412 (7.1%) of the cases aimed at self-suicide. 21/6412 (0.3%) of cases were poisoning due to liquid agents such as ethyl alcohol, methyl alcohol, and sodium hypochlorite. 13/6412 (0.2%) of poisoning cases were suicide with organophosphates (6).

In a case report, accidentally sodium hypochlorite mixing with hemodialysis fluid had caused widespread hemolysis, cyanosis, sudden drops in serum electrolytes, hyperkalemia, cardiac and respiratory arrest (13, 14). Another example was the development of acute hydrocephalus and ventriculitis that occurred as a result of self-injecting 5 cc of mixed chemical-containing toilet cleaning detergent such as sodium hypochlorite into its ventriculoperitoneal shunt reservoir for suicide attempt by the patient with a history of the bipolar disease (13).

Benzalkonium chloride is a germicide that is used as a disinfectant for cleaning surfaces and instruments, and as an antiseptic in the skin, mucous membranes, and body cavities. Sodium hypochlorite is a widely used chemical solution for household cleaning (13). BAC is also included in most medical preparations, such as nasal sprays. The siliotoxic effect of BAC is neutralized after nasal administration, and BAC-related pro-inflammatory effects have not been observed in vivo in healthy individuals. High doses of BAC are irritating even for people without the nasal disease. Today, the authors state that nasal preparations similar to inhalation preparations have taken a useless risk for BAC (10). Deaths have been reported due to accidental ingestion. Shortness of breath and pulmonary edema may develop as a result of inhalation exposure (2). Cases of poisoning have been reported with oral BAC intakes, for example, a case of esophagitis due to caustic burns resulting from accidental BAC (zefiran forte solution) intake by the mother instead of medication (tavegyl syrup) (15). However, the case related to BAC intake directly by vascular path has not been seen before.

On the other hand, intravenous suicide attempts are more narcotic drug-related because vascular drug users are at risk-taking behaviors related to substance use (16) but our patient had no narcotic drug history.

**Table 2:** Evaluation of the renal function before and after hospitalization based on the data system (GFR was calculated by Cockcroft Gault formula)

Date	Plasma Creatinine level	Range of laboratory	Glomerular Filtration Rate (GFR)
04.02.2020	1.14 mg/dL	0.67 - 1.17	79.06 mL/min per 1.73 m <sup>2</sup>
02.08.2019	1.30 mg/dL	0.67 - 1.17	71.60 mL/min per 1.73 m <sup>2</sup>
09.07.2019	2.70 mg/dL	0.67 - 1.17	34.47 mL/min per 1.73 m <sup>2</sup>
10.07.2019	2.44 mg/dL	0.67 - 1.17	40.24 mL/min per 1.73 m <sup>2</sup>
11.06.2019	1.55 mg/dL	0.67 - 1.17	60.05 mL/min per 1.73 m <sup>2</sup>
11.06.2019	1.94 mg/dL	0.67 - 1.17	47.98 mL/min per 1.73 m <sup>2</sup>
17.11.2017	0.90 mg/dL	0.70 - 1.20	103.42 mL/min per 1.73 m <sup>2</sup>

In literature, simultaneous poisoning with both was observed in our case for the first time. In our patient, mostly acute hemolysis findings were observed, lung and kidney functions were affected, and acute renal failure developed. He was discharged with chronic kidney failure after 3 months of hospitalization.

## CONCLUSION

The risk of progression to multi-organ failure in toxic substance intake increases with dose and time. Our case would contribute to the toxicology literature with the development of chronic renal failure as a result of intravenous sodium hypochlorite and benzalkonium chloride with mixing toxicity to human tissues.

## Conflicts of Interest

All other co-authors have no conflicts of interest.

## REFERENCES

1. Clayton GD, Clayton FE: Patty's industrial hygiene and toxicology. Vol. 2A. Toxicology: John Wiley & Sons, Inc., Baffins Lane, Chichester, Sussex PO19 1DU; 1981.
2. Slaughter RJ, Watts M, Vale JA, Grieve JR, Schep LJ: The clinical toxicology of sodium hypochlorite. *Clinical toxicology* 2019, 57(5):303-311.
3. Kleier DJ, Averbach RE, Mehdipour O: The sodium hypochlorite accident: experience of diplomates of the American Board of Endodontics. *Journal of Endodontics* 2008, 34(11):1346-1350.
4. Serper A, Özbek M, Çalt S: Accidental sodium hypochlorite-induced skin injury during endodontic treatment. *Journal of endodontics* 2004, 30(3):180-181.
5. Sabala CL, Powell SE: Sodium hypochlorite injection into periapical tissues. *Journal of Endodontics* 1989, 15(10):490-492.
6. Küçük E, Günel C: Demographic characteristics of forensic investigation in emergency service. *Sakarya Tıp Dergisi* 2016, 6:100-105.
7. Froner GA, Rutherford GW, Rokeach M: Injection of sodium hypochlorite by intravenous drug users. *JAMA* 1987, 258(3):325-325.
8. Morgan DL: Intravenous injection of household bleach. *Annals of emergency medicine* 1992, 21(11):1394-1395.
9. Akkan AG: Toksikolojik Sendromlar (Toksidromlar) ve İlaç Zehirlenmeleri-I. *İÜ Cerrahpafla Tıp Fakültesi Sürekli Tıp Eğitimi Etkinlikleri Sempozyum dizisi* 2002, 32:21-53.
10. Gasset AR: Benzalkonium chloride toxicity to the human cornea. *American journal of ophthalmology* 1977, 84(2):169-171.
11. São José JFB, Vanetti MCD: Effect of ultrasound and commercial sanitizers in removing natural contaminants and Salmonella enterica Typhimurium on cherry tomatoes. *Food Control* 2012, 24(1-2):95-99.
12. ARSLAN İ, BAYGIN Ö: Çocuk diş hekimliğinde kullanılan kavite dezenfeksiyon yöntemleri. *Atatürk Üniversitesi Diş Hekimliği Fakültesi Dergisi*, 29(1):124-132.
13. Signorelli JW, Osbun JW, Arias EJ, Reynolds LC, Chyatte D, Reynolds MR: Self-injection of household cleaning detergents into a ventriculoperitoneal shunt reservoir during a suicide attempt: a case report and literature review. *Acta neurochirurgica* 2016, 158(9):1655-1660.
14. Hoy RH: Accidental systemic exposure to sodium hypochlorite (Clorox) during hemodialysis. *American journal of hospital pharmacy* 1981, 38(10):1512-1514.
15. Yılmaz HL: Çocukluk döneminde zehirlenme olgularına genel yaklaşım. In: *Çukurova Üniversitesi Tıp Fakültesi Çocuk Acil Tıp Birimi*. <http://cat.cu.edu.tr/Egitim/%C7OCUKLUK%20D%6NEM%DDNDE%20ZEH%DDRLENME%20OLGULARINA%20GENEL%20YAKLA%DEIM-Kita.pdf>.
16. Şahinkaya HH, Tekgöl ZT, Özkalkanlı MY, Horsanalı B, Yeniay O: İntihar amaçlı çoklu ilaç kullanımı. *Tepecik Eğitim Hast Derg* 2014, 3:173-176.