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Review Article

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A COMPLICATED COURSE OF BORIC ACID TOXICITY

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ABSTRACT

Boric acid poisoning is a rare, but fatal toxicity that can potentially cause multi-organ failure. We present a case of a patient with ingested boric acid poisoning who became critically ill with systemic involvement. This case report is important because it highlights the classic physical exam findings of boric acid poisoning, its life-threatening course, and potential options for management. Diagnosis of boric acid toxicity remains difficult without appropriate history because of the lack of laboratory assays, therefore clinical suspicion is important. Toxin elimination is the preferred treatment, whether with dialysis in severe boric acid poisoning or with a conservative approach in mild poisoning. Despite a complicated course, our patient fortunately survived without dialysis. Had we known that the patient suffered from boric acid poisoning, early dialysis may have shortened her hospital course.

KEYWORDS: Boric acid, boric acid toxicity, pesticide toxicity.

INTRODUCTION

Acute boric acid toxicity is an infrequent occurrence, and most often implicated in the setting of suicidal ideation given its ease of access due to use in day-to-day items. Boric acid compounds are used in eyewashes, mouthwashes, skin powder, diaper rash creams and topical disinfectants.[1,2] Other uses of boric acid involve manufacturing of nylon, glass and ceramic products.[3] Boric acid compounds have also been used in the field of medicine as ointments, wound irrigants, cutaneous burns, 2% ophthalmic solution, vaginal trichomonas, bacterial vaginosis and in recurrent vaginitis.[4,8] Borax, also referred to sodium borate, is used in household cleaning items, as a fungicide in vegetable and fruit trees and in the aqueous solution of household pesticides. Borate, as an ingredient in household pesticides, brings forth the relevance of our case report describing a 30-year-old female with insecticide ingestion.

Case

The patient is a 30 year old female with history of bipolar 2 disorder who presented to the emergency room with chief complaint of dizziness. Patient was reportedly taken to an inpatient psychiatric facility after having suicidal ideations 3 hours prior to presentation. She was brought to the emergency department by staff of the psychiatric facility after the patient complained of dizziness and was found to be hypotensive. Patient was acutely encephalopathic and could not offer any history.

Per records from the psychiatric facility, the patient stated using methamphetamines approximately twice a week. Her home medications included lurasidone, aripiprazole and trazodone and it was unclear if she was taking these medications.

On arrival to the emergency room, the patient presented with slurred speech. She was oriented to self and able to follow commands but unable to answer any other questions. Vitals were: temperature 37.1 C, heart rate 100 bpm, blood pressure 65/30 mmHg and respiratory rate 15/min with 95% saturation on room air.

Physical exam was remarkable for a well-nourished young female who was alert, oriented to self, but not oriented to time and place. She had a diffuse macular erythematous skin rash occupying her face, upper torso, palms of the hand, and soles of the feet. She had dry mucous membranes, but a clear oropharynx and no stridor. She was tachycardic with no audible murmurs. Lungs were clear to auscultation and abdomen was soft without tenderness. No lower extremity edema was exhibited.

Patient was given 4 liters of crystalloids and 0.3mg epinephrine IM without improvements in blood pressure. A right internal jugular central line was placed and norepinephrine was started with titration to maintain mean arterial pressure > 65 mmHg. A head CT was negative for intracranial hemorrhage. Patient was subsequently admitted to the medical intensive care unit for further

management.

Initial labs
Sodium of 126 mmol/L Chloride of 95 mmol/L Potassium 4 mm/L Bicarbonate of 13 mmol/L Anion gap 18 mmol/L Creatinine of 6.96 mg/dL Urinalysis with hyaline casts Lactic acid 2.6 mmol/L.

Serum osmolality 291 mmol/L Serum ethanol level negative.

Urine methanol and ethylene glycol levels were negative Urine drug screen positive for amphetamines Osmolality gap was 22 mmol/L.

Urine electrolytes on the patient's initial urinalysis prior to fluid administration revealed a FeNa (functional excretion of sodium) indicating pre-renal disease. Given these findings, severe dehydration was suspected, and fluids were given until ultrasound of the inferior vena cava showed a width of ~2.5cm without collapsibility indicating adequate volume resuscitation. Given the patient's continuing hypotensive state, blood cultures were drawn and she was started on vancomycin and pipercillin-tazobactam.

Shortly thereafter, the patient developed atrial fibrillation with rapid ventricular response (RVR) with a heart rate of >180 bpm. Electrolytes and thyroid stimulating hormone were within normal limits. Norepinephrine was down titrated and phenylephrine and vasopressin were added. This was done in an attempt to reduce beta 1 adrenergic stimulation and maintain alpha adrenergic agonist activity. A bolus of amiodarone was given and an amiodarone drip was initiated for chemical cardioversion. Despite efforts, the patient became increasingly hemodynamically unstable with blood pressure 60s/30s despite appropriate vasopressor support.

Thus, synchronized cardioversion was initiated with 100 joules and she was successfully converted to normal sinus rhythm. Intubation was not indicated at this time.

Patient was polyuric with approximately 3.5 liters of urine output in the first 10 hours. Subsequent labs 12 hours after admission showed an improved creatinine of 3 mg/dL, bicarbonate of 10 mmol/L and anion gap of 10 mmol/L. Re-examination of the patient's skin showed resolution of the initial erythematous rash, but new skin sloughing was noted on the patient's chest, back, axilla, palms of the hand, soles of the feet and in the mucous membrane of the mons pubis/labia. On pelvic exam, she did not have a retained tampon. Given suspicion for toxic shock syndrome, scalded skin syndrome and Steven Johnson Syndrome, dermatology was consulted. The diagnosis was favored to be symmetrical drug related intertriginous and flexural exanthema.

The etiology of the patient's shock state was unclear. An echocardiogram was done, while on three pressors, which showed an ejection fraction (EF) of 54%, but no valvular vegetation. Given her young age and on vasopressor support, a more hyperdynamic EF would be expected. It was unknown if she had history of methamphetamine-induced cardiomyopathy. Given worsening skin sloughing and affected mucous membranes, the patient was intubated for airway protection and transferred to the burn unit at approximately 24 hours into admission.

Vasopressors were able to be weaned off and the patient remained hemodynamically stable. Within 48 hours of admission, her creatinine and urine output normalized. By approximately 72 hours of admission, the patient was extubated successfully.

On day 4 of admission, the patient's boyfriend, who reportedly lived with the patient, found an empty box of household pesticide with the main composition of boric acid. The empty container was confirmed by the toxicologist. The patient was also found to have a normocytic anemia, leukopenia and thrombocytopenia starting the day of admission. Approximately 96 hours after admission, her thrombocytopenia and leukopenia resolved and the anemia improved.

Due to concern of tissue necrosis caused by concentrated levels of boric acid, the patient underwent an esaphagogastroduodenoscopy (EGD) twice during the admission. Once on day 4 and once on day 10. On day 4, patient was found to have necrosis of the superficial gastric mucosa, therefore we proceeded with post-pyloric feeding. By day 10, there was only diffuse patchy non-erosive gastropathy with subepithelial hemorrhage and therefore was able to begin a clear liquid diet.

After a few more days of physical therapy and occupational therapy, patient was near her baseline. Just prior to discharge, the patient confessed to drinking ~1 liter of "roach killer" as a suicide attempt. Patient was discharged to an inpatient psychiatric facility for further mental health evaluation. Her medication list on discharge included only aripiprazole and quetiapine as recommended by the psychiatrist. She had a 17 day hospital stay.

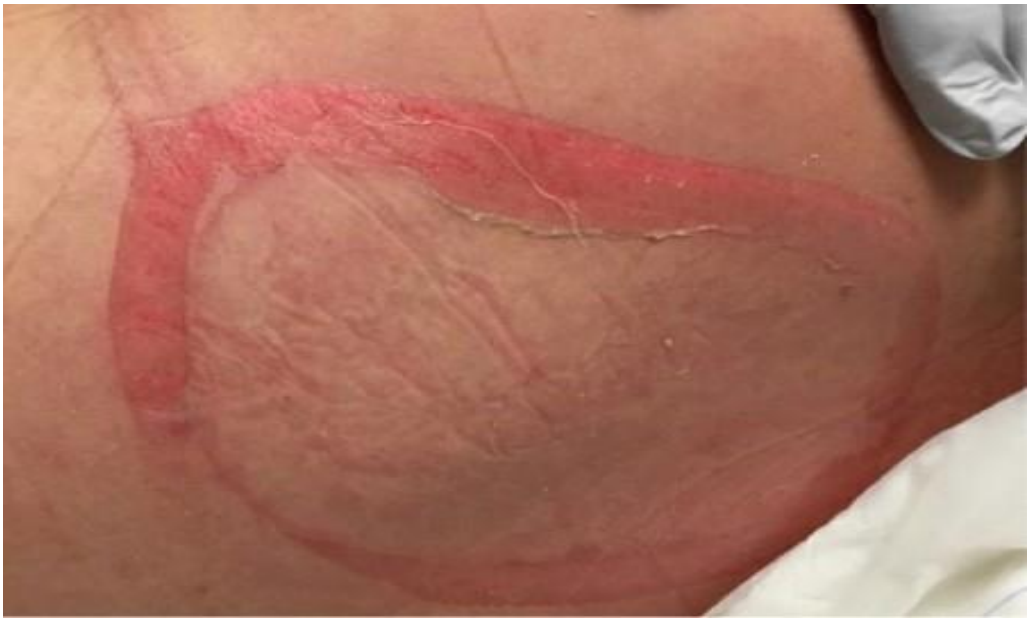

Image set 1: Skin desquamation after removal of cardioversion pads.

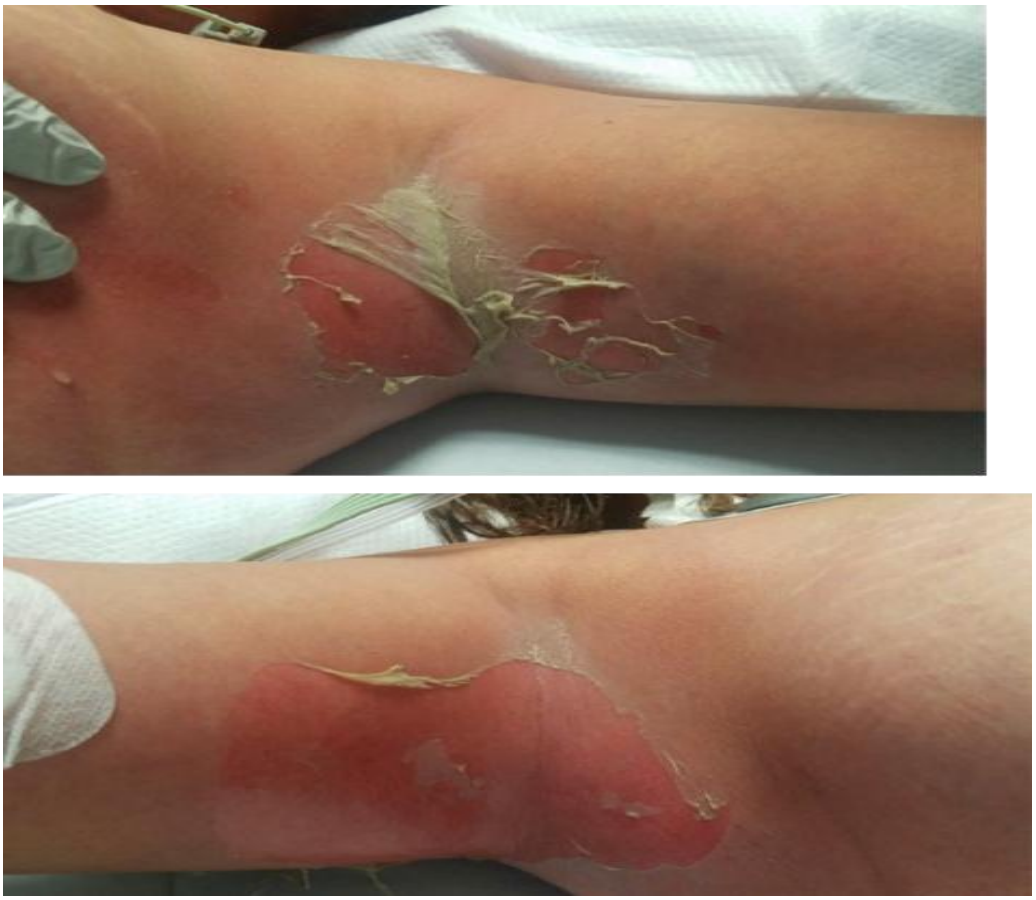

Image set 2: Skin desquamation of intertriginous areas as exemplified in the left and right axillas in this image.

DISCUSSION

Awareness of boric acid toxicity is a relevant educational point because of the presence of boric acid in a large number of products used in day-to-day life and their potential to cause an acute toxicity. In patients presenting with suspected suicidal ideation, physicians often consider substance or medication overdose in their differential. If an anion gap metabolic acidosis with an elevated osmolality gap (>10 mmol/L) without an alternate explanation is identified, substance intoxication with examples such as ethanol, ethylene glycol, propylene glycol, and methanol are often considered. As in our patient demonstrating an anion gap metabolic acidosis and elevated osmolality gap, other case reports have also

identified this finding in boric acid toxicity.[9,10] The likely explanation is that boric acid is an added osmotically active solute. Adding boric acid to the list of toxins noted above is reasonable given its availability for overdose and similar laboratory findings.

Acute ingestion of boric acid is lethal in adults at a dose of 15 to 20 grams, although the minimum oral dose of boric acid capable of causing toxic effects is unknown.[11] The presentation of boric acid toxicity can be grouped in early and late symptoms. Reported early symptoms are nonspecific and encompass headache, nausea, vomiting, diarrhea and agitation.[1,12] Blue-green vomit and similarly colored diarrhea are a hallmark of toxicity.[10] The late and more serious manifestations include renal failure, hypotension, cardiovascular collapse, abnormal liver function tests, seizures and skin desquamation.[9,13] The onset of late symptoms are typically 1-2 days after ingestion, but will largely depend on the amount ingested.[8]

As in our patient who became unstable with atrial fibrillation with RVR, Restuccio et al also describes a case where their patient also developed unstable atrial fibrillation with RVR.[9] Unfortunately, their patient did not respond to electrocardioversion.

The physical exam finding most specific for boric acid toxicity is diffuse skin erythema, which has been termed "boiled lobster" appearance followed by desquamation.[1,13] The erythema may involve the whole body including the palms of the hand and soles of the feet as in our patient.[13] Exfoliated patches of skin may be seen several hours following the rash and may certainly involve mucous membranes as in our patient, hence placing Steven Johnson Syndrome and Toxic Epidermal Necrolysis in the differential. Intertriginous areas may be affected first, followed by generalized desquamation and eventual de-gloving of extremities. These skin findings are present in 76% of reported cases.[13]

The diagnosis of acute boric acid poisoning in an encephalopathic patient relies largely on recognition of the signs and symptoms as described above. Suspicion can be confirmed by measuring serum and urine boric acid concentration, however many centers may not have readily available assays and send-out labs may take several days before results are available. Historically, diagnosis used to rely on the tumeric acid paper test to detect boric acid in the urine, but this has been abandoned due to high rates of false positives.[12,14]

Boric acid has no antidote, therefore management is mostly related to elimination. Most success in management of toxicity appears to be early hemodialysis, although no specific recommendations are available.[8,9,13,15] Other means of boric acid elimination are by aggressive fluid resuscitation with concurrent diuresis. After reviewing 15 cases of acute boric acid poisoning, it appears that the maximum concentration was more a predictor of mortality as oppose to method of management.[5,8,9,11,15,23]

To date, the highest survived measured boric acid level (C_{max} 1800 µg/mL) is reported by Corradi et al. where hemodialysis was used even before the onset of renal failure. Unfortunately, we were unable to measure the concentration of boric acid in our patient, but with supportive care she was able to make full recovery. The lack of readily available means of boric acid measurement in most laboratories make it difficult to dialyze a patient based on level. It is therefore prudent to have suspicion and make an early diagnosis of boric acid poisoning in order to consider management options. Further studies would be needed to identify the benefit of hemodialysis on mortality.

CONCLUSION

This case illustrates the clinical presentation and management of acute boric acid toxicity. Although uncommon, it is a potentially fatal toxicity and one that can be suspected based on classic clinical presentation as demonstrated in this case and in many other case reports. Although dialysis appears to be the most promising modality of treatment, more studies or possibly a meta-analysis would be important to identify the preferred management.

REFERENCES

1. Baliah T, Mac Leish H, Drummond K. Acute boric acid poisoning: report of an infant successfully treated by peritoneal dialysis. *Canadian Med Association J*. 1969; 101: 166-168.
2. Pfeiffer C, Hallman L, Gersh I. Boric acid ointment. A student of possible intoxication in the treatment of burns. *J American Med Association*., 1945; 128: 266-274.
3. Moseman R. Chemical disposition of boron in animals and humans. *Environ Health Perspect*., 1994; 102: 113-117.
4. Baselt R. Disposition of toxic drugs and chemicals in man. 7th ed. Foster City: Biomedical Publications, 2004; 121-123.
5. Jordan J, Crissy J. Boric acid poisoning. A report of fatal adult case from cutaneous use. A critical evaluation of the use of this drug in dermatologic practice. *AMA Arch Derm*., 1957; 75: 720-728.
6. Iavazzo C, Gkegkes I, Zarkada I, Falagas M. Boric acid for recurrent vulvovaginal candidiasis: the clinical evidence. *J Womens Health*., 2001; 20(8): 1245-1255.
7. Brittingham A, Wilson W A. The antimicrobial effect of boric acid on trichomonas vaginalis. *Sex Transm Dis*., 2014; 41(12): 718-22.
8. Teshima D, Morishita K, Ueda Y, et al. Clinical Management of Boric Acid Ingestion: Pharmacokinetic Assessment of Efficacy of Hemodialysis for Treatment of Acute Boric Acid Poisoning. *J Pharmacobio-Dyn*., 1992; 15: 287-294.
9. Restuccio A, Mortenson M, Kelley M. Fatal Ingestion of Boric Acid in an Adult. *American J of Emergency Med*., 1992; 10(6): 545-547.
10. Wong LC, Heimbach MD, Truscott DR, Duncan BD. Boric acid poisoning: report of 11 cases. *Can Med*

Assoc J., 1949; 90: 1018-1023.
11. Linden CH, Hall AH, Kulig KW, Rumack BH. Acute ingestion of boric acid. *Clinical Toxicology.*, 1986; 24: 269-279.
12. Goldbloom RB, Goldbloom A. Boric acid poisoning. Report of four cases and a review of 109 cases from the world literature. *J Pediatr.*, 1953; 43: 631-643.
13. Hamilton R, Wolf B. Accidental Boric Acid Poisoning Following the Ingestion of Household Pesticide. *J Forensic Sci.*, 2007; 52(3): 706-708.
14. Valdes-Dapena MA, Arey JB. Boric acid poisoning. A report of fatal adult case from cutaneous use. A critical evaluation of the use of this drug in dermatologic practice. *AMA Arch Derm.*, 1957; 75: 720-728.
15. Corradi F, Brusasco C, Palermo S, Belvederi G. A case report of massive acute boric acid poisoning. *European J of Emergency Med.*, 2010; 17(1): 48-51.
16. Ishii Y, Fujizuka N, Takahashi T, Shimuzu K, Tuchida A, Yano S et al. A fatal case of acute boric acid poisoning. *J Toxicol Clin Toxicol.* 1993; 31: 345-352.
17. Potter C. A case of borax poisoning. *JAMA.*, 1921; 16: 378.
18. McNally WD, Rust CA. The distribution of boric acid in human organs in six deaths due to boric acid poisoning. *JAMA.*, 1928; 90: 382-383.
19. Litovitz TL, Baily KM, Schmitz BF. 1990 annual report of the American association of poison control centers national data collection system. *American Journal of Emergency Medicine.*, 1991; 9: 461-509.
20. Baker DH, Wilson RE. Lethality of boric acid in the treatment of burns. *JAMA.*, 1963; 186: 1169-1170.
21. Peyton HA, Green D. Boric acid poisoning. *South Med J.*, 1941; 34: 1286-1288.
22. Stolpmann R, Hopmann G. Haemodialysis in a single case of boric acid poisoning. *Dtsch Med Wochenschr.*, 1975; 100: 899-901.
23. Naderi AS, Palmer BF. Successful treatment of a rare case of boric acid overdose with haemodialysis. *Am J Kidney Dis.*, 2006; 48: 95-97.