

Case Report

Accidental Potassium Bromate Poisoning Causing Acute Renal Failure

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Citation

Adeleke SI, Asani MO. Accidental Potassium Bromate Poisoning Causing Acute Renal Failure
Online J Health Allied Scs. 2009;8(1):11

URL

<http://www.ojhas.org/issue29/2009-1-11.htm>

Submitted: Nov 28, 2008; Accepted Apr 9, 2009 Published: May 5, 2009

Abstract:

Accidental poisoning is common in children. Potassium bromate is commonly used additive and raising agent in many edibles especially bread which is a staple food in Nigeria. This communication is that of an unusual case of acute renal failure following accidental ingestion of potassium bromate tablets.

Key Words: Childhood Poisoning, Bromate, Renal failure, Nigeria

Introduction:

Potassium bromate is an oxidizing agent used as food additives mainly in bread baking, but also as a neutralizer in many hair kits.¹ It has been shown to cause severe and irreversible changes including carcinogenesis in experimental animals^{2,3} and humans.^{4,5} Accidental poisoning by various agents is well documented in children.^{6,7} This communication reports a case of potassium bromate ingestion by a child who subsequently developed acute renal failure.

Case Report:

A two year old boy presented to the Emergency Paediatric Unit of Aminu Kano Teaching Hospital, (AKTH) Kano with vomiting, frequent and loose watery stools and weakness, all of a day's duration. He had been well until the day of presentation. Past medical history was not contributory. He was the second child of a 26 year old mother who is a fulltime house wife while the father was a 35year old baker. On examination, he was well nourished, weighing 12kg with signs of some dehydration, mild pallor, watery rhinorrhea and hepatosplenomegally. An initial diagnosis of acute diarrhea disease with some dehydration was entertained. He received oral rehydration salts solution but the diarrhea and vomiting persisted; he was therefore commenced on intravenous ringer's lactate. By 24hours of admission, the diarrhea and vomiting had subsided; he was well hydrated, ambulant and looked well. He was reverted to oral rehydration therapy (ORT).

By 48hours however, it was observed that he had not passed any urine despite good hydration. On further questioning mother volunteered the history of ingestion of at least one and half tablets of potassium bromate kept at home for baking bread about six hours before presentation, but that his mouth was rinsed with water. At 72hours and despite good hydration, he was unable to pass urine despite being well hydrated. A frusemide renal challenge was carried out, but a suprapubic needle aspiration yielded no urine. An assessment of acute renal failure secondary to potassium bromate poisonings was made. By the following day, he had developed facial puffiness and pedal oedema, his weight was 12.8kg, blood pressure 140/90mmHg. Pulse rate 120beats per minutes and packed cell volume 28 percent. The serum urea and electrolytes on days 4, 5, 7 and 18 are shown in Table 1.

He had peritoneal dialysis and his fluid intake was restricted to 400mls/m²/24hours. He was also commenced on intravenous calcium gluconate and sodium bicarbonate. On the evening of the sixth day, he made urine (250ml in 24hours) and by the eighth day, he was less puffy and weighed 12.5kg. By the 9th to the 12th days, he had entered the polyuric phase of acute renal failure making between 390 - 420ml of urine in 24hours. His blood pressure was now 100/50mmHg. The mother then requested to be discharged on the 14th day. Due to financial constraints. He was seen in the Paediatric Nephrology Clinic on the 24th day, he weighed 12.1kg and serum electrolyte and urea are normal.

Table 1: Serum Urea and Electrolyte levels in the patient.

	Day 4	Day 5	Day 7	Day 18
Creatinine (mmol/L)	690	590	340	145
Urea (mmol/L)	15.8	14.8	12.0	2.5
Sodium (mmol/L)	130	127	122	120
Potassium (mmol/L)	5.4	4.2	3.9	3.5
Bicarbonate (mmol/L)	25	15	18	15

Discussion

Accidental poisoning is very common in childhood, mostly in those aged five years and below. It usually involves a single substance often commonly used at home, with ingestion being the most common used at home, with ingestion being the most common route of exposure. Most cases are also manageable at home.⁸ This case fits the above scenario except poisoning was by potassium bromate, few cases of which have been reported before. Potassium bromate is being use despite the well orchestrated media report against it.

Potassium bromate is an oxidizing agent widely consumed in bread in which it is used as an additive in the baking process.⁹ It is also readily available in thioglycolate containing hair kits.¹ However, in the reported case, potassium bromate in the form of goppus tablet which the patient's father, a baker, had stored at home. Following the accidental ingestion, the mother only rinsed the patient's mouth and thought she had done the best for her child. He presented

with some known side effects of potassium bromate toxicity which include vomiting, diarrhea, renal damage with oliguria. Other known side effects include hypotension, pulmonary oedema, hepatitis and cardiac failure from toxic myocarditis.^{10,11} None of these serious effects occurred in our patients. The acute renal failure was initially not noticed hence the initial omission of urinalysis and monitoring of blood pressure.

Potassium bromate is particularly nephrotoxic.¹² It is known that death from renal failure may occur in one to two weeks in rats. It is also carcinogenic in experimental animals^{12,13} and in human kidney tissue in vitro.¹⁴ It has also been shown to induce renal failure and irreversible sensorineural hearing loss in guinea pigs,⁴ testicular and peritoneal mesotheliomas in rats¹⁵ and immediate and delayed signs of vestibular dysfunctions in dogs.⁴ The carcinogenic risks to humans have been evaluated and WHO has recommended acceptable limits of daily intake.³

Various methods have been described for the determination of bromate residues with accuracy in a variety of baked goods.^{16,17} The nephrotoxicity is thought to result from an interplay of increased formation of reactive oxygen species,¹⁸ lipid peroxidation,¹⁹ induced DNA fragmentation,²⁰ micronuclei formation and induced cellular proliferation.²¹ A clear sex difference has been reported in the susceptibility of rat kidney to the generation of the oxidative stress.²⁰ Male rats show a rapid and persistent response as against an increase that only becomes apparent three weeks after exposure in the females, the significance of this to humans is not known. The antioxidants, ascorbic acid (vit C), vitamin E, cysteine and glutathione are the only substances documented to have potential against carcinogenicity of potassium bromate.⁴ Attempts have been made to find an acceptable substance for potassium bromate in the baking process. A Venezuelan study demonstrated the technical feasibility of replacing 80ppm of potassium bromate for 20ppm of ascorbic acid in the flour without affecting the bread acceptability.¹

Potassium bromate has been banned in various countries. There is legislation against its use in the bread baking industry in Nigeria, while the National Agency for Food and Drug, Administration and Control had in the past destroyed bread made with potassium bromate in some cities in the country. The legislation has however not been widely enforced. As shown in this report, the average hospital in the country may be unable to cope with the effects of poisoning by this substance. Therefore education on the prevention of poisoning by the substance should be carried out in place such as well child clinics and over the electronic media. Parents should be counselled about potential poisons and how to prevent access to them. They should also be informed on what to do if poisoning occurs. This would reduce serious morbidity from such exposure.

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