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Case Series

Gas repellents herbal drugs could induce hyperkalemia in infants: case series in tertiary centers in Saudi Arabia

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ABSTRACT

This is a case series involving four infants who experienced hyperkalemia (high levels of potassium in the blood) after using herbal gas repellents that contained potassium sorbate as an antimicrobial preservative. The first patient was a ten-day-old male who presented with jaundice and incidental hyperkalemia, which resolved with treatment. The second patient was a three-month-old male who had a history of neonatal critical care admission and presented with vomiting and incidental hyperkalemia, which resolved spontaneously. The third patient was a two-month-old female who presented with failure to thrive and incidental hyperkalemia, which resolved after discontinuation of the herbal gas repellent. The fourth patient was a one-month-old male who presented with vomiting and incidental hyperkalemia, which also resolved after discontinuation of the herbal gas repellent. All patients underwent investigations to determine the underlying cause of hyperkalemia, but no specific cause was found other than the use of the herbal gas repellents. The abstract highlights the importance of physicians being aware of the potential effects of potassium-containing herbal gas repellents and the occurrence of unexplained hyperkalemia in infants, urging caution in their use.

Keywords: Gas repellent, Potassium sorbate, Hyperkalemia, Infant, Herbal drug

INTRODUCTION

Hyperkalemia is a common metabolic disturbance and might eventually lead to cardiac dysrhythmias, and it is associated with increased mortality. Several extrarenal and intrarenal homeostatic processes control potassium levels between 3.5-5 mmol/l. However, there is a hidden source of potassium in the form of food additives that elevate potassium levels in the blood.[1]

Antimicrobial preservative additives, referred to as antimicrobial agents or preservatives, are substances incorporated into different products to prevent or suppress the growth of microorganisms such as bacteria, fungi, and viruses. These additives find widespread application in pharmaceuticals, personal care items, cosmetics, food, and beverages to prolong product shelf life and uphold their quality. Main role of antimicrobial preservatives is to safeguard products from contamination

and microbial growth throughout storage and usage. Potassium sorbate is 1 example of such a preservative.[2,3]

Furthermore, potassium sorbate is one of the preservative herbal drug additives such as the gas repellents composed of (Fennel fruit dried extract, and Caraway fruit dried extract). It is an antispasmodic herbal medication that comes in the form of capsules or drops, that are used widely by the parents of infants as an over-the-counter drug (OTC). Currently, growing availability of processed foods or herbal drugs on the market may now provide patients with a new hidden source of potassium, which worries healthcare providers who treat those patients.[4]

This case series aims to report the clinical manifestations of hyperkalemia associated with using of gas repellent herbal drugs that contain potassium sorbate as an antimicrobial preservative. Additionally, elevates the healthcare professional and family awareness regarding some herbal medications and their additives and proposes appropriate management of this electrolyte derangement.

CASE SERIES

Case 1

A 10-day-old baby boy presented to emergency due to yellowish skin discoloration that was noticed by mother 3 days before he arrived at emergency department (ED).

His prenatal history was unremarkable, and his vaccinations are up to date. He is a product of term (38 weeks) normal vaginal delivery with assistance. Delivery was smooth with no complications nor neonatal intensive care unit (NICU) admission. He did get admitted to the nursery for one day due to left eye discharge which was sent for culture. Upon hospitalization, a complete assessment was done, and a new systolic murmur was heard. Cardiology on-call was consulted, and an echocardiogram (ECHO) was arranged with a report of a patent foramen ovale, atrial septal defect with a small patent ductus arteriosus. The patient was discharged to home with his parents with a prescription for a topical eye antibiotic after cultures were reassuringly negative. A neonatal clinic follow-up in one week in addition to a cardiology follow-up in 3 months have been scheduled.

Family history includes a mother with hypothyroidism, a healthy father and three healthy siblings with no history of neonatal jaundice or kidney disease.

Upon physical examination in the current emergency room presentation, he was sleeping comfortably and looked well-hydrated with no signs of distress or cyanosis. He did exhibit mild jaundice. His vital signs on arrival revealed a blood pressure of 100/57 mmHg, heart rate of 150 beats/ min, respiratory rate of 38 breaths/min, temperature of 36.9°C (axillary), oxyhemoglobin Saturation of 96% and weighs 4000 grams. Sclera was white, and his pupils were equal and reactive bilaterally. The patient's fontanelles were normal in size and palpation, and the suture lines were palpable. Tearing of eyes, and moist mucous membranes were detected. Warm extremities and palpable peripheral pulses bilaterally were felt. Respiratory, abdominal, cardiovascular and genitourinary systems examinations were unremarkable. No lymphadenopathy, ulcers/rashes were observed.

Investigations were carried out and disclosed a high potassium level of 6.3 mmol/l confirmed by a repeat test of 6.1 mmol/l. The patient had normal total bilirubin and normal blood gas. The electrocardiogram (ECG) did not show any abnormal changes. ABO blood grouping was O, with an RH positive and a negative Coombs test direct and qualitative, reported respectively.

Further questioning in ED encounter revealed that parents had been administering drops of OTC gas-repellent herbal drug composed of fennel fruit dried extract, caraway fruit dried extract and potassium sorbate as an antimicrobial preservative (Figure 1), every other day for colic symptoms. They advised to discontinue medication and return for another potassium titer the following day. Repeated level remained elevated at 6.9 mmol/l. Hence, the toxicology center was consulted for a case of medication toxicity with hyperkalemia. The toxicology center recommended admitting patient for observation under general pediatric ward on cardiopulmonary monitor, initiating hyperkalemia management, and serial repeats of blood gas every 6 hours. If the levels were not dropping with routine management, a nephrology specialist consultation was recommended.

Figure 1: Gas-repellent herbal drug composed of fennel fruit dried extract, caraway fruit dried extract and potassium sorbate as an antimicrobial preservative.

Patient was managed in ED as per toxicology recommendations. He was given dose of sodium polystyrene sulfonate, nebulized salbutamol, and intravenous normal saline drip. Potassium levels improved in next blood work, down to 5.6 mmol/l with no ECG variations detected. After a 1-day stay in general pediatric ward for monitoring, the patient was discharged with stable clinical status and potassium levels, no abnormalities in lab tests, and no new concerns. Parents

received detailed instructions on when to seek further medical attention. At 3 months follow-up, patient's labs remained normal, and he had no new medical concerns. A repeat ECHO showed normal cardiac function and structure, prompting discharge from cardiology care.

Case 2

A 3-month-old boy, preterm with a corrected age of 21 days, was referred to pediatric surgery from a local hospital for further investigations and management of bilateral inguinal hernias and circumcision.

He was delivered prematurely at 27 weeks and 2 days by cesarean section due to a low birth weight of 700 gm for which he was admitted for 75 days in the NICU. He was then discharged with a weight of 2.1 kg. Upon his admission, he was found to have intraventricular and pulmonary hemorrhage which was managed then in the NICU. In addition, patent ductus arteriosus was detected by ECHO and the patient has follow-ups with cardiology in his local hometown for this condition.

Presented to ED with ravenous hunger and vomiting for 3 days, with decreased bowel movements, nevertheless, there were no other associated symptoms.

Physical examination revealed a playful, active child well hydrated with no signs of distress, cyanosis or jaundice. His vital signs on arrival revealed a blood pressure of 99/39 mmHg, heart rate of 181 beats/ minute, respiratory rate of 36 breaths/minute, temperature of 36.9°C (axillary), oxyhemoglobin saturation of 97% and weighs 3000 grams. Glasgow coma scale (GCS) was 15 out of 15 with equal and reactive pupils bilaterally. The patient's fontanelle was normal in size and the suture lines were palpable. Tearing of the eyes, and moist mucous membranes were detected. Warm extremities and palpable peripheral pulses bilaterally were felt. Respiratory, abdominal, and cardiovascular systems examinations were unremarkable. Genital examination revealed an uncircumcised penis with a hydrocele and bilateral reducible large inguinal hernias. No lymphadenopathy, ulcers, or rashes were observed.

Further evaluation was done in the emergency department to rule out pyloric stenosis as a top differential diagnosis. Ultrasound of the abdomen and the inguinal region were both unremarkable. However, lab investigations were only significant for increased potassium levels of 6.3 mmol/l, with a repeated level of 5.9 mol/l. A thorough history was taken from the mother for which she disclosed giving the patient drops of OTC gas-repellent herbal drug composed of Fennel fruit dried extract, Caraway fruit dried extract and potassium sorbate as an antimicrobial preservative, to relieve his colic (Figure 1). She was instructed to stop the remedy and to come back to reevaluate the titer.

Two days later, the patient came back for a follow-up level of potassium, which turned out to be normal at 5.3 mmol/l with no complaints. The mother was advised to stop the herbal medication with clear instructions given when to come back to the ED. Moreover, the patient was seen by pediatric surgery to book the elective herniotomy next month.

Case 3

A 4-month-old male infant, a product of cesarean section, was brought to the emergency department by his parents due to vomiting once and poor feeding for the past 24 hours. The vomiting was milk content, non-projectile, and not containing blood. The parents reported that the infant had been fussier than usual and had been intermittently refusing feeds over the past few days.

Infant's medical history was significant for a prolonged NICU stay due to prematurity (34 weeks) and respiratory distress syndrome. He was discharged home at 4 weeks of life in stable condition. Upon further questioning, the parents revealed that they had been giving the infant an OTC gas-repellent herbal medication containing fennel fruit dried extract, caraway fruit dried extract, and potassium sorbate as a preservative to help with reported gas and fussiness. They had been administering the drops according to the product instructions for past two weeks.

On physical examination, the infant appeared lethargic but was responsive to stimuli. Vital signs were notable for a heart rate of 160 beats per minute, respiratory rate of 35 breaths per minute, and a temperature of 37.2°C. The infant's skin was slightly dry, and his mucous membranes were tacky. Cardiovascular, respiratory, and abdominal examinations were otherwise unremarkable.

Initial laboratory evaluation revealed a serum potassium level of 6.8 mmol/l (normal range: 3.5-5.0 mmol/l), the repeated sample was also high (6.7 mmol/l). Other electrolytes, renal function, and liver function tests were within normal limits. An ECG was unremarkable.

The parents were advised to discontinue the gas-repellent herbal medication immediately. The local toxicology center was consulted for a case of medication toxicity with hyperkalemia. They recommended admitting the patient for observation under the general pediatric ward, initiating hyperkalemia management, and serial repeats of blood gas every 6 hours. If the levels were not dropping with routine management, a nephrology specialist consultation was recommended.

The patient was managed in the ward as per the toxicology recommendations. He was given a dose of sodium polystyrene sulfonate, nebulized Salbutamol, and intravenous normal saline bolus. Subsequent serum potassium levels gradually normalized, and the infant's condition improved with supportive care. The infant was discharged home after 1 day, with instructions to the

parents to avoid any further use of gas-repellent herbal medication and instructions about breastfeeding and proper habits to minimize gastric reflux symptoms.

Case 4

A 2-month-old female infant was brought to the emergency department by her parents due to decreased feeding and lethargy over the past 12 hours. The parents reported that the infant had been fussy and seemed uncomfortable, leading them to administer an OTC gas repellent herbal medication containing fennel fruit dried extract, caraway fruit dried extract, and potassium sorbate as a preservative.

The infant's medical history was unremarkable, with a normal delivery and newborn course. She had been growing and developing appropriately since birth.

On physical examination, the infant appeared lethargic and slightly dehydrated. Vital signs were notable for a heart rate of 165 beats per minute, respiratory rate of 40 breaths per minute, and a temperature of 36.8°C. The infant's skin was slightly dry, and her mucous membranes were tacky. Cardiovascular, respiratory, and abdominal examinations were otherwise unremarkable.

Initial laboratory evaluation revealed a serum potassium level of 6.9 mmol/l (normal range: 3.5-5.0 mmol/l). Repeated sample revealed 5.9 mmol/l. Other electrolytes, renal function, and liver function tests were within normal limits.

The parents were immediately instructed to discontinue the gas-repellent herbal medication and to come back to reevaluate the potassium level. Moreover, the mother was encouraged to breastfeed, and supportive care and soothing care to relieve the infant's colic. The patient was tolerating orally and looked in a good state upon discharge.

Two days later, the patient came back for a follow-up level of potassium, which turned out to be normal at 5.4 mmol/l with the improvement of the previous presentation. The mother was advised to stop the herbal medication with clear instructions given when to come back to the ED.

DISCUSSION

This study presents a case series involving 4 infants who were brought to emergency departments and incidentally found to have hyperkalemia. The hyperkalemia was attributed to the supplementation of herbal gas repellents (Fennel fruit dried extract, and caraway fruit dried extract) given by their parents, which contained potassium sorbate as an antimicrobial preservative. Notably, the reported patients did not have any pre-existing medical conditions that could explain the occurrence of hyperkalemia, suggesting that the potassium sorbate in the herbal extracts played a role. In the literature review, there were no previous studies in the literature reporting this specific association between potassium sorbate and hyperkalemia.

In this study, it was reported the use of herbal drugs by parents as an OTC drug. Approximately 75-80% of the global population, particularly in developing countries, relies on herbal drugs due to the perception that they are safer than synthetic drugs.[5] One of the essential substances used by the parents as herbal drugs is the gas relievers such as (fennel fruit dried extract, and caraway fruit dried extract) which contain potassium sorbate as antimicrobial preservative additives. The effectiveness of fennel and caraway fruits has been documented in disrupting gastrointestinal foam, likely due to their ability to stimulate the secretion of gastric and intestinal fluids. It is safe if used judiciously.[6]

Potassium sorbate is widely used as a preservative in the food, cosmeceutical, and pharmaceutical industries, and its safety for human consumption must be considered. Potassium sorbate is commonly used in processed foods such as fruit juice, soda, soy sauce, and ketchup to inhibit mold growth, prevent spoilage, and maintain product freshness.[7] Although potassium sorbate is legally used in foods, excessive intake beyond the permitted limits can be harmful. Most of the studies discussed the effect of PS on chronic kidney disease patients.[8,9] Until the time of this study, there is a lack of reports and studies regarding the impact of potassium sorbate-containing herbal drugs on infants. This presents a notable challenge for both parents and pediatric physicians, as they may encounter cases of unexplained hyperkalemia. However, it is worth noting that hyperkalemia in these cases may resolve without any intervention, similar to the patient described in this study. It is crucial to manage hyperkalemia appropriately and investigate the underlying cause before attributing it solely to the presence of potassium sorbate additives.

This study has several limitations, including its level within the evidence-based medicine hierarchy, limited generalizability of the results, and the inability to establish a definitive cause-and-effect relationship. Despite these limitations, the study highlights the impact of potassium additives on infant blood potassium levels. Moreover, it raises concerns regarding the use of herbal drugs by parents without consulting healthcare professionals. These concerns lack sufficient documentation and require further research to address the knowledge gap and mitigate the risk of hyperkalemia in infants using potassium sorbate-containing herbal drugs.

CONCLUSION

The use of herbal gas repellents containing potassium sorbate as a preservative substance should be cautious in infants. The patients using these herbal drugs and additives could be presented with hyperkalemia, as in our

case series. Hyperkalemia should be investigated and managed accordingly in this population.

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