

Excessive cola-based drink consumption as a criminal for hypokalemia and rhabdomyolysis

Aşırı kola bazlı içecek tüketimine bağlı hipokalemi ve rabdomiyoliz

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ABSTRACT

A 33-year-old man was admitted to our emergency department with leg pain. His serum potassium level was 2.3 mmol/L. Laboratory tests ruled out renal potassium wasting. A dietary history revealed that he had been consuming at least 1 liter of cola per day for several months. We present a case of hypokalaemic myopathy induced by chronic cola-based drink consuming.

Keywords: Cola-based drink consumption, Hypokalemia, Rhabdomyolysis

ÖZ

Otuz üç yaşında erkek hasta acil servisimize bacak ağrısı şikayeti ile başvurdu. Potasyum seviyesi 2.3 mmol/L saptandı. Laboratuvar testleri ile böbrekten potasyum kaybı ekarte edildi. Diyet anamnezinde son birkaç aydır günde en az 1 litre kola tükettiği ortaya çıktı. Bu yazıda, kronik kola bazlı içecek tüketiminin neden olduğu hipokalemi miyopatili bir olguyu sunduk.

Anahtar kelimeler: Kola bazlı içecek tüketimi, Hipokalemi, Rhabdomiyoliz

Introduction

The negative impacts of consumption of soft drinks on people's health have increasingly continued to be defined in parallel with increase in soft drinks consumption in recent years [1]. Among them, the cola-based preparations are possibly the refreshments with the largest sales worldwide. During the previous years, important concerns have been raised about the effects of cola-based drinks on human

health. In addition to the complications of nephrogenic diabetes insipidus, hypokalemic myopathy and hypokalemic nephropathy, it is also frequently seen in neuropsychiatric, cardiovascular, respiratory and metabolic derangements due to excessive amount of caffeine it includes [2]. Here, we describe a patient who showed hypokalemia and rhabdomyolysis after habitual consumption of cola-based soft drinks.

Case Report

A thirty-three-year old male patient presented with leg pain to the emergency department. He had no trauma, existing disease or past operation history. In his history of illness there were no fever, recent infection, diarrhea, extreme physical activity, or exposure to any drug or herbal medicine that could reveal his pain. He consumed at least one liter of all kinds of cola-based drinks(diet, zero, normal etc) for several months. Vital signs were as follows: 36.7°C, spO₂:100%, pulse:91 beats per minute, blood pressure: 134/81 mmHg . His physical examination was normal. The patient's electrocardiography (ECG) showed normal sinus rhythm (NSR) and no ischemic changes with a 88 of heart rate. Biochemical tests include CBC, electrolytes, renal and liver functions, creatine phosphokinase and arterial blood gase analysis showed that patient's values were within the normal limits except potassium 2.3 mEq/L (normal limit 3.5-5.1 mEq/L) and creatine phosphokinase (CPK) 1001 U/L (normal limit 30-200 U/L). His 24-hour urine potassium level was 23.4 (normal limit 25-125 g/hr) and urine osmolality was 221 mosm/kg. The results of plasma renin activity (PRA; 4.8 ng/mL/h; reference range 1.9-6.0 upright and aldosterone (312 pg/mL; reference range 38-313), available the day after his presentation. There were nothing for the etiology hypokalemia and high levels of CPK other

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than cola-based drink consumption. After potassium and fluid replacement, patient was discharged from the hospital with diet recommendations. One week later after cessation of cola-based drink consumption, patient's potassium value was 3.9 mmol/L and creatine phosphokinase value was 166 U/L.

Discussion

Hypokalemia induced by cola-based drink consuming was first defined by Matsunami and his friends in 1993 [3]. A few years later a similar case was diagnosed by Appel and Myles on a pregnant woman [4]. There are some pathophysiological mechanisms that may underlie the development of this rare, but potentially severe side effect.

The main ingredients of cola-based drinks are high-fructose corn syrup, sugar, colorings, phosphoric acid, caffeine, citric acid, and natural flavors [5]. It contains 9.8 mg/liter of sodium and 42.3 mg/liter of potassium. There are 110.4 g/liter of high-fructose corn syrup in cola, so our patient was consuming minimum 110.4 grams of high-fructose corn syrup per day. Fructose is absorbed in limited quantities (only about 40% as compared with glucose) by a facilitated transport mechanism in the small intestine [6]. Majority of unabsorbed fructose will continue to the column causing osmotic diarrhea and further led to chronic potassium deficiency. But because there is no history of diarrhea in our patient, we cannot explain his hypokalemia with osmotic diarrhea.

Excessive caffeine consumption can also cause hypokalemia. It is known that an oral intake of only 180–360 mg caffeine can provoke serious hypokalemia [7]. There are 130 mg of caffeine per liter of some of cola-based drinks, so our patient consumed at least 130 mg of caffeine every day for several months. One of the reasons that can explain this situation is the potassium loss from the kidneys due to the increase in renin secretion [5]. But, the normal plasma renin activity, normal serum aldosterone, and low urine potassium suggest that this patient's hypokalemia was not caused by renal potassium wasting. Caffeine also induces the release of catecholamines which leads to hypokalemia based on excessive beta-adrenergic stimulation. Caffeine also induces hyperventilation that causes respiratory alkalosis. This will lead to the hypokalemia [8], but our patient did not have hyperventilation. There was no respiratory alkalosis.

Also the normal plasma renin activity, normal serum aldosterone, and low urine potassium suggest that this patient's hypokalemia was not caused by renal potassium

wasting. Normal aldosterone levels in addition to severe hypokalemia, may suggest the presence of an aldosterone-like substance. Glycyrrhizin, active metabolite of licorice, mimics mineralocorticoids in its action. It is stated to be less than 0.15% according to the US food and drug administration (FDA) in nonalcoholic beverages. Each 100 g of some of cola-based drinks may contain up to 0.15 g (150 mg) glycyrrhizin. Glycyrrhizin, due to its sweetening power and distinct licorice taste, is widely available as a flavoring agent in foods and drugs. The minimum level of glycyrrhizin required to produce the described adverse effects is no more than about 100 mg glycyrrhizin, which is equal to 50 g licorice sweets. Mostly, consuming 400 mg glycyrrhizin/day is enough to experience side effects. Till now the lowest level that can cause adverse effect in a regular intake is 100 mg glycyrrhizin/day [9]. Chronic ingestion of glycyrrhizin induces a syndrome similar to primary hyperaldosteronism characterized by sodium retention, hypertension, hypokalemia. In a case report it was described that chronic consumption of even smaller doses of glycyrrhizin (20 mg/day) might produce severe hypokalemic rhabdomyolysis [10]. In our patient, this may be the mechanism of hypokalemia.

Conclusion

Hypokalaemia may be a cause of increased morbidity because of fatigue, loss of productivity and muscular symptoms that vary from mild weakness to profound paralysis. Hypokalemic effect of cola-based drinks possibly depends on osmotic diuresis, osmotic diarrhea, hyperinsulinemia and excessive caffeine content and aldosterone like substances [11]. Diet histories of patients having unexplained hypokalemia, should be examined in detail. It is important for physicians to keep excessive cola-based drink consumption in mind as a possible cause for hypokalemic myopathy and rhabdomyolysis.

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