



A Case of Hypokalemia with Synthetic Cannabinoid Use

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Abstract

Synthetic cannabinoids cause a variety of central nervous symptoms, tachycardia and hypokalemia. We report a 27 old male patient was admitted to emergency room due to altered consciousness and vomiting. The patient declared that he smoked herbal incense named Bonzai. After a few hours he was found by his friends with impaired consciousness, no verbal response, and tonic seizure of upper extremities. He vomited once and denied intractable vomiting and diarrhea. His past medical history was nonsignificant and he was not taking any prescription drugs. Potassium (K⁺) and ethanol concentration was low at the time of admission (2.7 meq/l and 18 mg/dl, respectively). After infusion of 60 meq potassium chloride (KCl), repeat K⁺ value was 3.5 meq/l. Twenty four hours after admission K⁺ level dropped to 3.2 meq/l. Potassium level reached to normal value (5 meq/l) after 40 meq KCL infusion. He was discharged uneventfully. Hypokalemia due to synthetic cannabinoid usage may be due to a number of mechanisms including potassium loss via kidneys, potassium loss due to excessive sweating and diarrhea, and potassium shift into cells. Although our patient vomitted once, gastrointestinal loss may not be the sole explanation to hypokalemia. It must be kept in mind that there may be causes of hypokalemia other than vomiting in setting of synthetic cannabinoid use.

Key Words: Hypokalemia, synthetic cannabinoid, vomiting

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Introduction

Synthetic cannabinoids cause a variety of central nervous symptoms including anxiety, hallucinations, agitation, paranoia, disorganization, agitation as well as tachycardia and hypokalemia [1]. Bonzai is a smoking type of synthetic cannabinoid. It is banned due to legal restrictions in Turkey [2]. It contains a variety of synthetic cannabinoid compounds encoded as JWH-018, JWH-081, JWH-210, JWH-250, and JWH-122 [3]. JWH-018 is different from delta-9-tetrahydrocannabinol (THC), which is the main active component of *Cannabis sativa* [4]. It is an aminoalkylindole [4].

Cannabis sativa known as marijuana intoxication does not typically affect serum potassium (K⁺) levels, but mild hypokalemia may ensue from poor nutrition in chronic abuse [5]. In the literature there are a few reports about hypokalemia developed after herbal incense smoking containing synthetic cannabinoid compounds [3,5]. We report a case of hypokalemia developed after synthetic cannabinoid use.

Case report

A 27 old male patient was admitted to emergency room due to altered consciousness and vomiting approximately nine hours after eating fetucelli pasta with mushrooms at dinner. His friend having the same meal showed no symptoms. The patient declared that he smoked herbal incense named Bonzai. After a few hours he was found by his friends with impaired consciousness, no verbal response, and tonic seizure of upper extremities. He vomited once and denied intractable vomiting and diarrhea. His past medical history was nonsignificant and he was not taking any prescription drugs.

On examination the patient was alert and oriented to time and place. The pupils were normal. He had no goiter. His blood pressure was 120/80 mmHg with a regular heart rate of 84 bpm. His temperature was 36.5°C. His lungs were clear. No cardiac murmurs were heard. computed tomography scan of the head revealed no evidence of mass or haemorrhage. The laboratory data are shown in Table 1. He was moderately hypokalemic at the time of admission (K⁺ 2.7 meq/l). Blood ethanol concentration was 18 mg/dl low enough to cause mild nervous system symptoms. Electrocardiogram showed sinus rhythm with no ST segment and T wave changes. Sixty

milliequivalent potassium chloride (KCL) in one liter saline was infused for the first day of admission. A repeat K^+ value obtained 11 hours after first measurement and five hours after infusion was 3.5 meq/l. Twenty four hours after admission and 16 hours after infusion K^+ level dropped to 3.2 meq/l. Forty milliequivalent KCL was infused. Potassium level reached to normal value (5 meq/l).

After admission convulsions, vomiting and diarrhea did not develop during hospitalization. He was discharged uneventfully.

Table 1. Laboratory admission and follow-up data of the patient

Laboratory data	Admission	11th hour	24th hour	48th hour
Potassium (meq/l)	2.7	3.5	3.2	5.0
Sodium (meq/l)	138	141	141	138
Creatinine (mg/dl)	0.79	NA	NA	NA
Random glucose (mg/dl)	163	NA	NA	NA
ALT (U/l)	18	18	15	NA
Ethanol (mg/dl)	18	NA	NA	NA
TSH (μ IU/l)	4.09	NA	NA	NA
Free T4 (ng/dl)	1.32	NA	NA	NA
Vitamin B12 (pg/ml)	380	NA	NA	NA
Corrected calcium (mg/dl)	9.48	NA	NA	NA
Leukocyte (mm^3)	14340	NA	NA	NA
Haemoglobin (g/dl)	16.1	NA	NA	NA
Platelet (mm^3)	238000	NA	NA	NA

Discussion

Apart from addiction and neurologic and psychiatric effects, synthetic cannabinoids bear importance to the cardiovascular system and kidneys [4,6,7]. Increased sympathetic activity may lead to tachycardia, hypertension and myocardial infarction [6,7]. There are case series on acute kidney injury (AKI) related to synthetic cannabinoid abuse in the literature [6,7]. A few of them presented with hypokalemia and vomiting-diarrhea. Severe volume depletion was not evident in these cases. Renal biopsy revealed acute tubular necrosis and interstitial nephritis. Some presented as oliguric AKI and required dialysis. In contrast to these reports creatinine level was normal at admission and intractable vomiting and diarrhea was absent in our patient.

Hypokalemia due to synthetic cannabinoid usage may be mild (3.0-3.4 meq/l), moderate (2.5-2.9 meq/l) or severe (<2.4 meq/l) [5]. Our case was an example of moderate severity. In the study of 29 patients, 28% had hypokalemia. Only one had severe hypokalemia (2.3 meq/l). Among those who are hypokalemic, 62% required intravenous potassium supplementation. Three mechanisms were proposed for hypokalemia: potassium loss via kidneys, potassium loss due to excessive sweating and diarrhea, and potassium shift into cells.³ Although our patient vomited once, gastrointestinal loss may not be the sole explanation to hypokalemia.

Synthetic cannabinoids act via cannabinoid receptors (CB1 and 2) throughout the brain and peripheral nervous system [4]. JWH018 is approximately 4 times more potent at CB1 receptors [3]. It mainly acts via CB2 receptors. CB2 receptors are absent or weakly expressed in human intestinal epithelium [8]. Plasma cells in lamina propria also express CB2 receptors [8].

CB1 receptors are also expressed in tubules of kidney [9]. But its physiologic significance and its role in hypokalemia in synthetic cannabinoid users is unknown. Cannabinoid receptor agonists also have apparent CB1 receptor independent effects through ion channels (sodium, potassium, and calcium channels) [10]. Synthetic cannabinoids elicit stronger effects than THC [4].

Another possible mechanism proposed for hypokalemia is increased sympathetic activity due to adulteration [11]. There is a number of reports in the literature about adulteration with clenbuterol, a β_2 -agonist [11]. But the absence of tachycardia, hypertension, diaphoresis, and hyperglycemia does not support this mechanism in our case.

The chemical analysis of the product was unavailable. We did not have the chance to evaluate neither synthetic cannabinoid compounds nor potassium excretion in urine. Potassium shift into cells may be responsible for hypokalemia.

Conclusion

Herbal incense smokers can present with signs and symptoms other than neurological and psychiatric ones. Hypokalemia is amongst them and the patient may deny illicit drug use. Urine analysis of synthetic cannabinoids is not available at every hospital. It must be kept in mind that there may be causes of hypokalemia other than vomiting in setting of synthetic cannabinoid use.

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