Elmer Press

Case Report

J Med Cases. 2016;7(10):455-458

Pneumomediastinum: A Complication of Synthetic Cannabinoid K2 Use

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Abstract

The use of synthetic cannabinoid K2 (SCK2) continues to rise. Products are sold in different flavors and mixed with various herbal products resulting in innumerable presenting symptoms. Common presentations are psychomotor activity, dystonia, hypertension, tachydysrhythmia, rhabdomyolysis, and renal failure. We present a 21-year-old woman who was admitted for severe nausea associated with several bouts of vomiting and upper abdominal pain. She had used SCK2 for recreation prior to the onset of her symptoms and she has been using SCK2 regularly for about a year. Chest and abdomen roentgenogram revealed pneumomediastinum. Esophagogram ruled out esophageal injury. She was managed conservatively with resolution of pneumomediastinum. We hypothesize that hyperemesis secondary to SCK2 use can increase the alveolar pressure leading to barotrauma. Although pneumomediastinum is a benign and self-limiting condition, esophagogram should be performed to exclude esophageal perforation which is a potentially life-threatening condition. Awareness of this presentation is important in order to evaluate for complications of barotrauma.

Keywords: Pneumomediastinum; Spice; K2; Synthetic marijuana

Introduction

The use of synthetic cannabinoid K2 (SCK2) continues to rise. These products are sold in different flavors and mixed with various herbal products resulting in innumerable clinical presentations. The most common manifestations are anxiety, tremors, hypertension, tachycardia, and tachy-dysrhythmia. Chest pain is a common complaint, and a case of myocardial infarction and death has been reported [1]. Due to the increased psychomotor activity and dystonia, rhabdomyolysis and renal failure have been also reported [2, 3]. We present a young patient with complications of SCK2 abuse.

Case Report

A 21-year-old woman with history of polysubstance abuse was admitted to the intensive care unit with severe nausea associated with several bouts of vomiting and upper abdominal pain of 3 days duration. Symptoms started after using SCK2. She had two prior hospital visits due to similar complaints, which resolved spontaneously with hydration. She reported being a regular smoker of marijuana for the past 2 - 3 years and she started using spice/K2 for recreation in the last few months. She denied use of alcohol or other recreational agents. She had no other personal or family medical history.

On examination, she had respiratory distress, were afebrile, normotensive, tachycardic (HR 105 beats per minute), and tachypneic (RR 20 cycles per minute) and had a body mass index of 20.3 kg/m^2. Lung was clear to auscultation, and cardiovascular was normal. Mild diffuse tenderness was elicited on epigastric exam with no rebound tenderness or visceromegaly. Laboratory investigations revealed leukocytosis, acute kidney injury and anion gap metabolic acidosis (Table 1). Urine toxicology revealed cannabinoids. Abdominal computed tomogram (CT) revealed pneumomediastinum which was confirmed by a chest CT (Fig. 1). Esophagogram ruled out esophageal injury. She was managed conservatively with resolution of pneumomediastinum. Echocardiogram was normal.

Discussion

SCs were initially developed to serve as an analgesic with a mechanism of action different from opiods and non-steroidal anti-inflammatory drugs. This led to the discovery of cannabinoid (CB) receptors [3-5]. Activation of CB receptors causes elation, irritability and anxiety. CB receptors are located in the immune system and podocytes in glomeruli [3-8]. They are

Manuscript accepted for publication September 16, 2016

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doi: http://dx.doi.org/10.14740/jmc2653w

Table 1. Laboratory Results

Parameters	Admission day	Day 2	Day 3
Venous pH	7.369	7.37	
Venous pCO_2	47.6	45.1	
Hemoglobin (g/dL)	16.2	13.4	12.7
Hematocrit (%)	49.3	40.9	38.7
Platelets (× 10^3/µL)	295	173	158
WBC (× 10^3/µL)	27.3	16.7	10.9
Sodium (× 10^3/µL)	130	130	136
Chloride (× 10^3/µL)	73	89	101
Potassium (× 10^3/µL)	3.8	3.4	3.8
Bicarbonate (× 10^3/µL)	18	21	24
BUN (mg/dL)	34	43	13
Creatinine (mg/dL)	7.1	3.7	1.0
CPK (unit/L)	5,562	15,691	1,507
Urine toxicology	Cannabinoids		

thought to play a role in control of pain and emesis. SCs are full agonists of CB receptors with biologically active metabolites [9-11].

SCs are in vogue, especially among the young generation who use it for relaxation and recreation without being detected on routine toxicology screens [10, 12].

Some of the common side effects of SCs include altered mentation, hypertension, tachycardia, arrhythmias, myocardial ischemia, seizures, nausea, vomiting, and electrolyte abnormalities. All these can lead to multi-organ dysfunction, acute kidney injury and severe rhabdomyolysis [1-3, 13-18]. Cannabinoids have also been found to have caused fulminant liver failure and pulmonary edema [14]. Neuropsychiatric effects include confusion, agitation, aggression, psychosis and dependence [2, 15-19]. K2 or spice, one of the formulations of SCs causes tachycardia, diaphoresis, conjunctival injection, hypokalemia and seizures [20, 21]. Chronic use of SCs has been reported to cause acute gastric dilation and hepatic portal venous gas that is postulated to be mediated by CB receptors. Chronic hyperemesis syndrome (CHS) is also mediated by CB receptors in the gastric mucosa; the syndrome is characterized by chronic cannabis use, cyclic episodes of nausea and vomiting and frequent hot bathing. SCK2 owing to the molecular similarity with cannabinoids can potentially cause this syndrome. Some reports suggest that warm water ameliorates symptoms of CHS [22].

Pneumomediastinum is classified as non-traumatic (primary or spontaneous) and traumatic (secondary). The cause of pneumomediastinum is alveolar rupture related to an increase in alveolar pressure, resulting in pressure gradient between alveoli and surrounding blood vessel. Common causes of increased alveolar pressure in a normal lung include trauma, coughing, emesis, Valsalva maneuver and airway obstruction. Usual clinical presentations of pneumomediastinum include chest pain aggravated by deep breathing and coughing, dyspnea, dysphagia and rarely shocking sensation. The exam may reveal subcutaneous emphysema or crepitus appreciated over the neck and anterior chest wall. Hamman's mediastinal crunch may be appreciated [23].

The diagnosis of pneumomediastinum can be made by a chest roentgenogram showing the continuous diaphragm sign and prominent aortic knob. Lateral view showing air in the retrosternal space is more sensitive. Chest CT has the greatest sensitivity. In a study that evaluated the sensitivity and specificity of CT scan for detection of pneumomediastinum after blunt chest trauma, it was found that CT chest had 89% sensitivity for detection of pneumomediastinum [24]. Another study showed that the negative predictive value and sensitivity for detecting esophageal rupture on CT chest with or without contrast was 100% in trauma and non-trauma patients [25]. Our patient experienced recurrent vomiting following use of K2 which most likely resulted in pneumomediastinum [26, 27].

The effects of SC in the lungs range from non-specific pulmonary infiltrates, pulmonary hemorrhage and acute respiratory failure likely due to allergic alveolitis [28]. Cannabinoids cause inflammatory responses in the airways and lung parenchyma leading to histopathological changes [28]. There are cases reporting barotrauma associated with recreational substance especially with cocaine and marijuana [29, 30]. Pneumothorax and pneumomediastinum secondary to a positive pressure device used for smoking/inhaling the drugs have been reported. Spontaneous or primary pneumomediastinum is postulated to be secondary to increased intra-alveolar pressure. Underlying lung parenchymal inflammation weakens the alveolar wall, thus making it more vulnerable for alveolar web rupture [30].

Diagnosis of SC-related complications remains a challenge, as there are many substances mixed in each preparation of these drugs. Liquid chromatography and homogenous enzyme immuno-assay (HEIA) spectrometry have been proposed as diagnostic methods [31, 32]. Sensitivity, specificity, and efficiency of HEIA K2 spice kit is based on quantitative

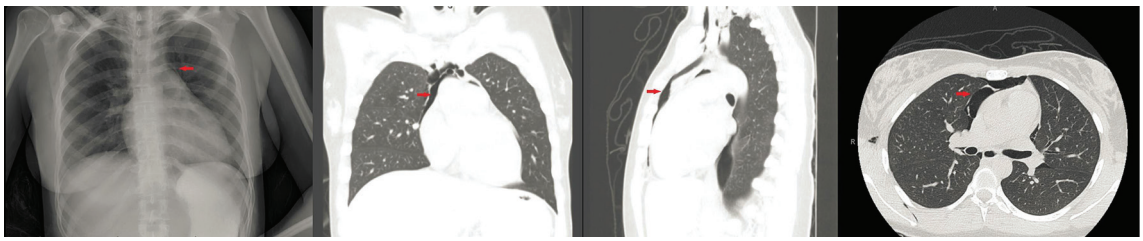

Figure 1. CXR and sagittal and coronal view of chest CT. Red arrow points to pneumomediastinum. Normal lung parenchyma.

cut-off points. Based on the trails, the manufacturer's recommended cut-off point was 10 μg/L. The sensitivity, specificity, and efficiency for that cut-off were 75.6%, 99.6% and 96.8%, respectively [31]. Management of SC/K2 intoxication is mainly supportive, aimed at fluid resuscitation, airway protection, management of electrolyte imbalance and minimizing organ damage. Intravenous lipid emulsion therapy has been used in few cases of acute intoxication with promising results [33].

Our patient presented with typical manifestations of SC toxicity which included hyponatremia, severe rhabdomyolysis, acute kidney injury, hyperglycemia and possible CHS. We attribute pneumomediastinum due to increased alveolar pressure due to two pathophysiological mechanisms. First is Valsalva maneuvers during inhalation of the drug and second is CHS with recurrent vomiting. Due to the relative short duration of K2 and normal lung parenchyma, it is unlikely that the patient had a direct pulmonary insult leading to barotrauma [34].

Conclusion

Increasing incidence of cannabinoids use among adolescents and young adults, and the difficulties in detection on routine toxicology screening tests present a challenge for clinicians. A low clinical suspicion for complications of SC is required especially when confronted with young patients with a myriad of symptoms. Development of novel screening techniques is needed. Use of SCK2 should be included in the differential diagnosis of barotraumas, with patients with CHS likely having an increased risk for it. Esophagogram should be considered to exclude esophageal perforation.

Consent

Written informed consent was obtained for the patient for the publication of this case report and accompanying images.

Conflicts of Interest

Authors declare no conflicts of interest regarding the publication of this paper.

Abbreviations

SCK2: synthetic cannabinoid K2; JWH-018: 1-pentyl-3-(1-naphthoyl)indole; CB: cannabinoid; SC: synthetic cannabinoid; CHS: chronic hyperemesis syndrome; HEIA: homogenous enzyme immuno-assay

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