A case of hemorrhagic pneumonitis resulting from heavy use of cannabis vaporizer products

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ABSTRACT

The use of vaporizer products for the consumption of nicotine and cannabis extracts has seen large increases in recent years, especially among young people, but the long-term health effects from the use of these products are unclear. Unsubstantiated claims suggest that vaporizers are safer than smoked tobacco or cannabis plant material, but recent reports of acute and severe respiratory illness resulting from their use has led to some jurisdictions temporarily banning their sale. These devices contain complex chemical preparations that include solvents, diluents, flavoring and possibly biproducts from heating elements within the device. Here, we report a case of 22-year-old otherwise healthy patient who developed hemorrhagic pneumonitis with hypoxic respiratory failure requiring intubation for respiratory support in a heavy user of cannabis vaporizer products. Extensive testing for inflammatory and infectious conditions did not reveal clear alternative explanation. Given the increasing availability and use of these products, emergency medicine practitioners and medical toxicologists should be aware of this potential toxicity and inquire about use of these products to patients presenting with respiratory symptoms and hemoptysis.

KEYWORDS

Cannabis; pneumonitis; vaporizers; pulmonary toxicity

Introduction

The use of vaporizer products have increased steadily since their introduction in the early 2000s, especially among youth [1, 2]. Although, primarily used as a delivery system for nicotine, vaporizer products are emerging as a drug delivery system for THC and other drugs [3, 4]. The long term health effects of vaporizer use, including e-cigarettes, is not yet clear [1].

Cannabis use is steadily rising over the last 10–15 years [5]. Currently, 33 states have programs to allow for medical use of cannabis, 10 states, the District of Columbia and American Somoa allow adult recreational use, and most other states allow use of low THC cannabis products such as cannabidiol (CBD) [6]. Cannabis extracts are frequently consumed via vaporizers [7].

Vaporizer use (“vaping”) has recently been associated with acute respiratory toxicity [8], including vaping of both traditional nicotine products and cannabis extracts. Here, we present a case of hemorrhagic pneumonitis associated with cannabis vaporizer use.

Case

The patient is a 22-year-old male with no significant past medical history presenting to the emergency department for chest pain, difficulty breathing and hemoptysis for one day. He has moderate respiratory distress with a respiratory rate of 27 and an oxygen saturation of 90% on room air. He denies recent travel and personal or family history of coagulopathy or bleeding disorder. He admits to using cannabis via vaporizer, but denied any other drug or alcohol use. He was placed on supplemental oxygen. Lab results were notable for leukocytosis of 26.7 k/µL with 75% neutrophils and 19% bands, a serum lactate of 2.21 mmol/L, and a venous pH of 7.33. Hemoglobin and hematocrit were normal and a basic metabolic panel was notable for only mild hyperglycemia at 136 mg/dL. CT pulmonary angiography revealed diffuse ground glass opacities and no evidence of pulmonary embolism (Figure 1).

Respiratory and neurologic toxicity progressed during the patient’s evaluation in the emergency department.
He experienced a tonic-clonic seizure, received an initial dose of 5 mg of midazolam, and generalized seizure activity terminated after approximately 30 s. The patient’s mental status remained persistently depressed, an additional 1 mg of lorazepam was administered to treat possible non-convulsive seizure without improvement in mental status. Endotracheal intubation was then performed due to depressed mental status and persistently low oxygen saturation despite supplemental O₂ by bag-mask ventilation. Laryngoscopy was complicated by substantial blood in the airway and intubation was completed on the second pass with suction and video laryngoscopy. A non-contrast CT scan of the head after the seizure was normal.

Bronchoscopy with bronchoalveolar lavage (BAL) was performed after admission to the intensive care unit. Although, the visualized trachea, bronchus and larger airways were normal, BAL returned grossly bloody fluid that did not clear with serial lavages, suggesting diffuse alveolar hemorrhage. Flow cytometry on BAL was not suggestive of sarcoidosis or hypersensitivity pneumonitis. Numerous pulmonary macrophages were seen in BAL specimen, but confirmatory Oil-Red-O stain was not performed in this case. Histopathology of BAL specimens from other cases of vaporizer-related pulmonary toxicity has revealed the presence of lipid-laden macrophages [9].

Testing for infectious etiology including bacterial and fungal cultures, legionella and streptococcal antigens, respiratory viral assays and HIV testing were all normal. Testing for autoimmune disease including an ANA screen, anti-myeloperoxidase antibody, and anti-basement membrane antibodies were also negative. An electro-encephalogram showed no ongoing seizure like activity. A urine drugs-of-abuse screen was positive for cannabinoids and benzodiazepines (he received midazolam prior to intubation). A qualitative urine screen for 12 common synthetic cannabinoids was also negative.

The patient was treated for a presumed diagnosis of acute respiratory distress syndrome (ARDS). He received intravenous antibiotics for presumed severe community-acquired pneumonia and was successfully extubated on hospital Day #3. He was discharged with oral antibiotics for presumed atypical pneumonia. At two month follow-up, the patient has recovered with no residual symptoms of shortness of breath or seizures.

The patient had been using an Eleaf vaporizer and purchasing cartridges for the device from a friend. He was taking 30-40 “puffs” per day for the last 6 months. Although, the cartridges carried were labelled “TKO Extracts” these were likely counterfeit as the company does not manufacture disposable cartridges for vaporizers. The source of the patient’s presentation remains speculative without chemical analysis of the product, although, similar cases involving counterfeit vaporizer products have been reported in the news media [10].

Conclusion

We report unexpected pulmonary and neurologic toxicity as a result of heavy use of a cannabis vaporizer product. Acute pneumonitis has been reported following smoking cannabis [11–13]. Chemical pneumonitis with CT findings similar to this case has also been reported in a patient who was using butane honey oil (BHO), a compound produced by extracting ground cannabis plant material with butane and then vaporizing the resulting waxy product at high temperatures [14, 15]. This was attributed to respiratory irritants such as benzene and acrolein produced from heating BHO to very high temperatures [15].
The principal component in most vaporizer fluids or e-liquids is the diluent for the psychoactive compound, usually composed of glycerol and propylene glycol, both of which can be irritants to eyes and mucous membranes [1]. Chemical analysis of e-liquid vaporized using a commercial vaporizer product has detected known irritants and carcinogens such as benzene, acrolein, formaldehyde and acetaldehyde [16]. Exposure to some of these compounds could easily be in excess of daily exposure limits published by National Institute of Occupational Safety and Health (NIOSH) even with relatively light use [16]. In addition, heavy metals such as cadmium, nickel and lead can be detected in vaporized product, possibly from the device’s heating element [1].

The preparation of cannabis to make extracts that are compatible for use with commercial e-cigarettes or vaporizers is complex. There is currently no widely accepted methods for testing and quality control of these products [7]. Cannabis vaporizer products may contain the previously mentioned compounds or other chemical irritants which could lead to the case presented here. As vaporizer products become more common, especially in the light of the cannabis legalization, incidence of respiratory toxicity may increase. We encourage emergency medicine providers and medical toxicologists to explore the use of these products in patients presenting with respiratory complaints or hemoptysis.

Disclosure statement
No potential conflict of interest was reported by the authors.

References

[1] Grana R, Benowitz N, Glantz SA. E-cigarettes. Circulation. 2014;129(19):1972–1986.
[2] Miech R, Johnston L, O’Malley PM, et al. Trends in adolescent vaping. 2017–2019. N Engl J Med. 2019;381(15):1490–1491.
[3] Meacham MC, Paul MJ, Ramo DE. Understanding emerging forms of cannabis use through an online cannabis community. An analysis of relative post volume and subjective highness ratings. Drug Alcohol Depend. 2018;188:364–369.
[4] Thurtle N, Abouchedid R, Archer JRH, et al. Prevalence of use of electronic nicotine delivery systems (ENDS) to vape recreational drugs by club patrons in south London. J Med Toxicol. 2017;13:61–65.
[5] Kerr WC, Lui C, Ye Y. Trends and age, period and cohort effects for marijuana use prevalence in the 1984-2015 US National Alcohol Surveys. Addiction (Abingdon, England). 2018;113(3):473–481.
[6] O’Connor M. Virginia’s Medical Cannabis Firms Banding Together. Virginia Business [Published 2019 Jan 10; cited 2019 Sept 26]. Available from: http://www.virginiabusiness.com/news/article/va-s-medical-cannabis-firms-banding-together
[7] Giroud C, de Cesare M, Berthet A, et al. E-cigarettes: a review of new trends in cannabis use. IJERPH. 2015;12(8):9988–10008. doi: 10.1056/NEJMoa1911614
[8] Layden JE, Ghinai I, Pray I, et al. Pulmonary illness related to E-cigarette use in Illinois and Wisconsin—preliminary report. N Engl J Med.
[9] Maddock SD, Cirulis MM, Callahan SJ, et al. Pulmonary lipid-laden macrophages and vaping. N Engl J Med. 2019;381(15):1488.
[10] Dickson EJ. Counterfeit Weed Vape Cartridges Are Everywhere — and They’re Making People Sick. Rolling Stone [Published 2019 Aug 28; cited 2019 Sep 26]. Available from: https://www.rollingstone.com/culture/culture-features/counterfeit-thc-vapes-cdc-vaping-health-alert-875931/
[11] Hashmi HRT, Duncalf R, Khaja M. A case report of cannabis induced hemoptysis. Medicine. 2016;95(13):e3232–e3233.
[12] Gilbert O, Mathieu D, Hanquet O, et al. [Hemoptysis in a young man]. Rev Mal Respir. 2006;23(5):471–476.
[13] Monfort M, Larakeb A, Gouraud F. Hemoptysis in a young man smoking cannabis. Arch Pediatr. 2013;20(6):637–639.
[14] McMahon MJ, Bhatt NA, Stahlmann CG, et al. Severe pneumonitis after inhalation of butane hash oil. Annals ATS. 2016;13(6):991–992.
[15] Anderson RP, Zechar K. Lung injury from inhaling butane hash oil mimics pneumonia. Respir Med Case Rep. 2019;26:171–173.
[16] Logue JM, Sleiman M, Montesinos VN, et al. Emissions from electronic cigarettes: assessing vapers’ intake of toxic compounds, secondhand exposures, and the associated health impacts. Environ Sci Technol. 2017;51(16):9271–9279.