A Case of Vaping-Associated Lung Injury in Rhode Island

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ABSTRACT

The Centers for Disease Control and Prevention (CDC) is currently investigating a nationwide outbreak of e-cigarette, or vaping, associated lung injury (EVALI). The objective of this case report is to review a suspected case of EVALI in Rhode Island and discuss how to identify and manage this condition.

KEYWORDS: e-cigarettes, lung injury, EVALI (e-cigarette associated lung injury), vaping, respiratory failure

INTRODUCTION

The Centers for Disease Control and Prevention (CDC), the Food and Drug Administration (FDA), and state and local health departments are currently investigating a nationwide outbreak of e-cigarette, or vaping, associated lung injury (EVALI).[1] This widespread outbreak has been observed in all 50 states, the District of Columbia, and the US Virgin Islands and Puerto Rico. As of December 27, 2019, a total of 2,561 cases and 55 deaths from e-cigarette, or vaping, product use-associated lung injury (EVALI) have been reported to the US Centers for Disease Control.[2] In this article we report a suspected case of EVALI in Rhode Island and discuss how to identify and manage this condition.

CASE PRESENTATION

An 18-year-old male with past medical history of major depressive disorder and cannabis use disorder on maintenance therapy with risperidone and fluoxetine presented to the Emergency Department with two weeks of progressive shortness of breath. At baseline he was very active, regularly running and partaking in parkour; however, he had spent the majority of the preceding two weeks in bed due to breathlessness. One month prior to his presentation he had been hospitalized with acute psychosis attributed to cannabis use. He was discharged to a partial hospital program for intensive daytime treatment of his acute psychiatric concerns; however, he only attended two sessions prior to quitting the program. Three days before admission he was seen in the emergency department for severe nausea and vomiting and discharged home on omeprazole. On the day of admission, his brother called EMS after noting him to be breathing very rapidly in his sleep.

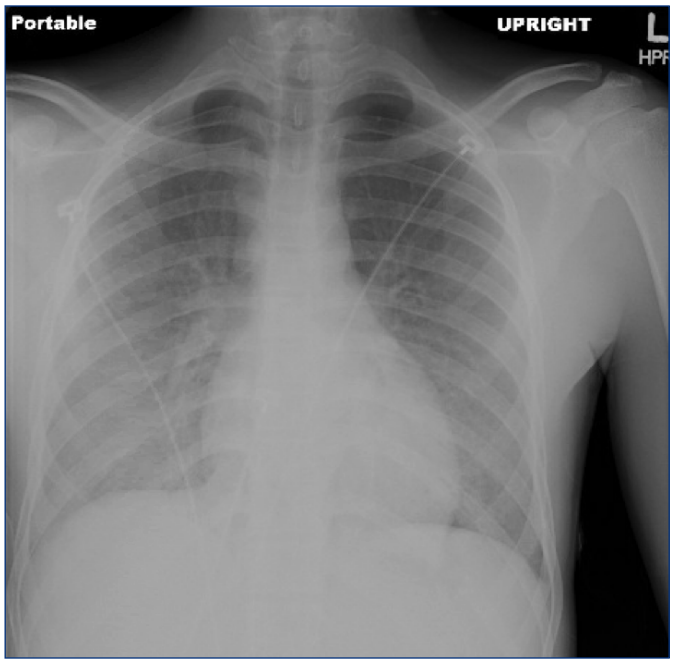

Figure 1. A portable AP Chest Radiograph on admission showing moderate bilateral pulmonary infiltrates.

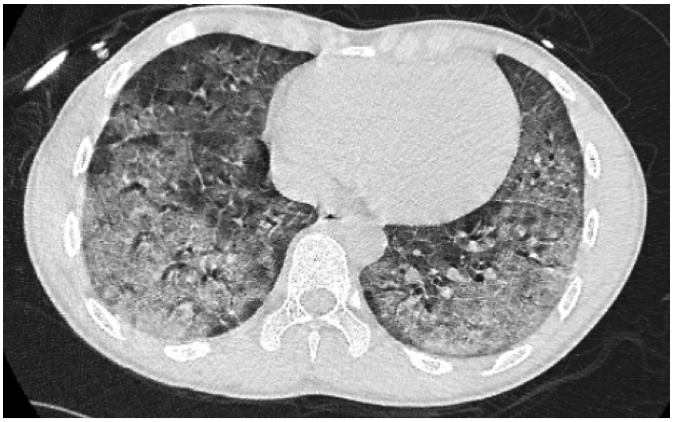

Figure 2. High Resolution Chest CT showing diffuse bilateral ground glass opacities predominantly involving the mid and lower lung zones.

At presentation, the patient was noted to be a thin young man in clear respiratory distress with increased accessory

muscle use. He had nasal flaring and was only able to speak in short sentences. His initial vital signs were temperature 100.1 F, BP 126/74, HR 104, RR 28, and O2 saturation 85% on room air. On interview, he stated that he vaped tetrahydrocannabinol (THC) products obtained on the street all day long. He used a vape pen and went through approximately 4 cartridges per day. He was unsure where his contacts obtained the oil cartridges, or what else they contained apart from THC. He was not using any commercially branded or flavored products available for retail purchase. He did not vape nicotine products, only THC. He noted that he had recently dropped out of school and was working as a clerk in a pharmacy. He grew up in East Africa before moving to the United States at age 8. Significant laboratory values on presentation included leukocyte count of 13,700 per mL, hemoglobin of 10.8 g/dL (baseline 11-13 g/dL), mean corpuscular volume of 79.5 fL (baseline 72-80 fL), ESR of 130 mm/hr and CRP of 382 mg/L.

The admission chest X-ray showed moderate diffuse interstitial prominence and a high-resolution chest CT showed diffuse bilateral ground glass opacities predominantly involving the mid and lower lung zones (**Figures 1 and 2**).

HOSPITAL COURSE

The patient was admitted to a medical step-down unit on 2L/min supplemental oxygen via nasal cannula. Treatment for presumed community acquired pneumonia was initiated with Ceftriaxone and Azithromycin. Molecular PCR performed on a nasopharyngeal swab was negative for influenza A/B, respiratory syncytial virus A/B, adenovirus, rhinovirus/enterovirus, parainfluenza 1–4, and coronaviruses. A pulmonary consultation was obtained. The differential for the patient's acute respiratory failure included infection (community acquired bacterial pneumonia, undetected viral process, Aspergillus, Pneumocystis Jirovecii), inflammatory disorders of the lung (pneumonitis, ARDS, non-specific interstitial pneumonia, EVALI or other inhalant lung injury, pulmonary hemorrhage, autoimmune disorder) and medication effect (risperidone is rarely associated with eosinophilic pneumonia,[3] and fluoxetine is rarely associated with an ARDS-like syndrome).[4] Further diagnostic testing was sent, including HIV assay, urine legionella antigen, blood smear, sputum and blood gram stain and cultures, and a toxicology screen.

On hospital day 1, the patient developed a fever to 103.7 F and increasing supplemental oxygen requirement to 100% FiO2 at 25L/min via high-flow nasal cannula, with respiratory rate 45 breaths per minute. He was transferred to the ICU, intubated, and placed on mechanical ventilation for worsening hypoxic respiratory failure. Bronchoscopic examination to the subsegmental level bilaterally revealed normal appearing airways without mucus or hemorrhage. Three serial bronchoalveolar lavages performed in the right upper lobe yielded diagnostic samples showing clear, non-bloody fluid, ruling out diffuse alveolar hemorrhage. Samples were sent for bacterial culture, basic microbiology, and cytopathology. The patient was successfully extubated several hours after the bronchoscopy. His supplemental oxygen requirement decreased to 40% FiO2 at 8L/min via high flow nasal cannula by hospital day 2.

Results of diagnostic testing as detailed above were unrevealing, with negative HIV assay, urine legionella antigen, blood smear, sputum and blood gram stain and cultures. Toxicology screen was positive for cannabinoids. BAL studies showed no evidence of infectious organisms or malignancy and were negative for eosinophils, herpes simplex virus, cytomegalovirus, acid-fast bacilli, and galactomannan. Cytology showed reactive bronchial cells, pulmonary macrophages, and acute inflammation. Because bronchoscopy results were suspicious for a non-infectious process,[5] empiric IV steroids were initiated in addition to continuation of empiric antibiotics.

On hospital days 2–5 the patient was maintained on supplemental oxygen, empiric antibiotics, and IV steroids. He became afebrile by hospital day 3 and his oxygen requirement slowly weaned to room air. He was discharged home on day 5 with a short oral steroid taper. The autoimmune panel returned after his discharge and showed a very mildly positive ANA and anti-RNP titer not thought to be clinically significant. He was also diagnosed with sickle cell trait (Hb AS) by hemoglobin electrophoresis during his hospital stay. While HbAS has been reported to rarely cause acute chest syndrome,[6] we do not believe that this was the cause of his acute illness.

The patient was discharged home with outpatient follow-up and counseling for abstinence of THC vaping. He was able to follow up with his behavioral health provider and reported that he had been unable to stop vaping. He did not follow up with pulmonary. He revealed insight into the negative effects vaping was having on his health, finances, depression, and stress and continues to work with his PCP to quit.

OUTBREAK DISCUSSION

Electronic cigarettes, introduced to the US market in 2007, have often been marketed as a safe alternative to smoking and for smoking cessation[7] without clear evidence to support these claims. Starting in the fall of 2019, a national outbreak of a life-threatening respiratory condition termed e-cigarette, or vaping, associated lung injury (EVALI) has been widely reported. Information about this outbreak has been moving rapidly and the CDC is working closely with state health departments to investigate possible cases and provide public outreach. As of December 27, 2019, a total of 2,561 cases and 55 deaths from e-cigarette, or vaping, product use-associated lung injury (EVALI) have been reported in the United States, Puerto Rico, and the US Virgin Islands. Seventy-eight

percent of the patients were less than 35-years-old; however, ages ranged from 13–77 years old. Data does suggest that the outbreak might have peaked in mid-September; however, new cases continue to be reported.[2]

The case was reported to the RI Department of Health and treated as a probable case of EVALI. As of January 16, 2020, Rhode Island has six probable/confirmed cases of EVALI reported to the CDC. All six cases were discharged home after the hospitalization for EVALI and one of the six cases subsequently passed away. The extent to which EVALI contributed to the cause of death is unclear and remains a continued area of focus for the CDC. Please see the most recent RIDOH Provider Advisory [https://mailchi.mp/health/january2020_evali_cdc_guidance_updates] for additional information and details.[8]

There may be more than one underlying cause of EVALI. E-cigarettes and their contents are very heterogeneous (more than 460 legal brands of e-cigarettes and more than 7000 flavors have been described),[9] with many more counterfeit and THC-containing products available. Overall, more than 150 different THC-containing products have been reported by the CDC in EVALI patients. This has led to broad regional differences regarding use across the country; therefore, it is not likely that one product brand can be implicated. Lung biopsies from patients with EVALI have shown a variety of histopathologic findings including acute fibrinous pneumonitis, diffuse alveolar damage, organizing pneumonia, interstitial edema and intra-alveolar fibrin accumulation.[10] Most recently, Vitamin E has been identified in the BAL samples of many cases of EVALI and has been suggested as a cause,[11] but there are many different substances that are being investigated, and there may be more than one cause. Of note, commercially available, legal THC-containing products seem not to contain vitamin E.[12]

CONCLUSIONS

In patients with new pulmonary infiltrates, shortness of breath, gastrointestinal and/or constitutional symptoms, EVALI needs to be considered. Health care providers should ask about the use of e-cigarette or vaping products, and should do so in a confidential and non-judgmental manner, especially with adolescents and young adults.[13] It is also important to note that patients who use e-cigarettes may not identify with that term and may deny e-cigarette use. Instead, they may endorse using e-hookahs, "mods", vapes or vape pens, tank systems, electronic nicotine delivery systems (ENDS), or a brand name product, such as JUUL. In this case report, detailed information about the source and type of THC-containing product was not readily available; every effort should be made to characterize the exact product via a detailed social history.

In most cases, health care providers should evaluate for causes of community-acquired pneumonia and consider treatment according to established guidelines. Additional microbiology testing, including influenza testing and viral panels should also be conducted, especially during influenza season. Published reports of hospitalized patients with EVALI have commonly reported elevated ESR, CRP and total leukocytes, but no eosinophilia.[14] Many have reported rapid improvement with the use of corticosteroids,[15] so their use should be strongly considered. It might be advisable to hold corticosteroids while evaluating patients for infectious etiologies that might worsen with corticosteroid treatment. Some patients in the above studies improved without the addition of corticosteroids, with just supportive care and withdrawal of the vaping products.

Of course, advising patients to discontinue use of e-cigarette, or vaping, products is essential. Inhaled marijuana formulations are clearly associated with more acute illness than edible formulations,[16] so there may be a role for edible formulations to help reduce overall use. Patients with ongoing use causing impairment or distress might have a cannabis use disorder and may benefit from consultation with addiction medicine services.

Acknowledgment

We would like to acknowledge the assistance of Ailis Clyne, MD, MPH, the Medical Director of the Division of Community Health and Equity and James Rajotte, MS, the Chief of the Center for Health Promotion at the Rhode Island Department of Health. They provided valuable insight and information about the current national and local epidemic.

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