



Case report

Vaping-associated diffuse alveolar hemorrhage – A case report

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A B S T R A C T

“Vaping” is a rapidly growing habit seen worldwide, especially amongst the younger population. Several aspects of vaping have made it more appealing than cigarettes and have led to the conversion of many smokers. Appeal resides in the belief that it is a healthier alternative to cigarettes. It also has the ability to interchange flavors and type of oil used. The focus of advertisement for vaporized products is its use as a smoking cessation aid. Systematic reviews have failed to display evidence of harmful processes other than exposure to nicotine (Bullen et al., 2013; Burstyn, 2013) [1,2].

We report a clinical case of a woman who suffered diffuse alveolar hemorrhage correlated with e-cigarette usage due to history and negative findings of extensive rheumatologic and infectious disease workup. Her presentation, clinical course, and effective therapy are outlined here.

1. Case presentation

Our patient is a sixty-one-year-old female with past medical history of only mild intermittent asthma and hypothyroidism. Patient was never previously hospitalized. Her only home medications were a rescue albuterol inhaler and levothyroxine. She presented to the emergency department (ED) by her sister with severe shortness of breath that progressively worsened over a few days. Her pulse oximeter was remarkably low, and she was started on continuous positive airway pressure (CPAP) ventilation in the ED. Patient used to be a smoker for 40 years but has quit smoking recently and started vaping instead. Patient said that she has used the regular flavored kinds of e-juice but her husband who also vapes has bought CBD oil and she started vaping it for two weeks prior to admission. She denied fever, chills, coughing blood, runny nose and sore throat. Physical exam was remarkable for extensive wheezing with diffuse crackles. Her laboratory workup was pertinent for partial pressure of oxygen of 115 on 100% fractional inspired oxygen with CPAP, Alkaline phosphatase of 189 (50–120 U/L), ALT of 398 (15–65 U/L), AST of 466 (5–37 U/L), WBC of 17.7 (4.5–10.8) and lactic acid of 3.9 (0.4–2 mmol/L). Chest computed tomography revealed diffuse ground-glass opacification of both lungs with superimposed interlobular septal thickening (Fig. 1). Patient was admitted to the intensive care unit with hypoxemia initially controlled with CPAP. She was started on ceftriaxone and azithromycin as well as steroids. Infectious diseases as well as rheumatological serology workup failed to yield any positive findings. Testing included: complement, hepatitis serology, HIV 4th gen, erythrocyte sedimentation rate (ESR), C-reactive protein (CRP), rheumatoid factor (RF), antinuclear antibody (ANA), and anti-

antineutrophil cytoplasmic antibodies (ANCA). In addition, serum eosinophil count, anti-glomerular basement membrane (GBM) antibodies, Fungitell, Histoplasma urine antigen, legionella urine antigen, Strep urine antigen and respiratory viral panel which were all normal. Bronchoscopy with bronchoalveolar lavage (BAL) revealed increasing blood in four sequential bottles confirming diagnosis of diffuse alveolar hemorrhage (DAH). BAL gram stain, culture and pneumocystis pneumonia polymerase chain reaction (PCR) were also negative. Antibiotics were stopped. Patient markedly improved on steroid treatment and she was discharged home with steroid taper.

2. Discussion

“Vaping” is a term used to describe inhalation of the aerosol produced by battery powered e-cigarettes, or vaporizers. This aerosol is generated by heating a liquid that occasionally contains nicotine, flavorings, and other chemicals. “Dabbing,” on the other hand involves inhalation of an aerosol containing high concentrations of tetrahydrocannabinol (THC) and other plant compounds such as cannabidiol (CBD). Since their emergence in 2004, E-cigarettes have become widely available, and their use has increased exponentially worldwide. E-cigarettes are aggressively advertised as a smoking cessation aid; as healthier, cheaper, and more socially acceptable than conventional cigarettes with systematic reviews failing to demonstrate harm apart from nicotine exposure [1,2].

Major declared constituents in nicotine-based e-cigarettes include propylene glycol and glycerin in addition to nicotine. Identified contaminants include polycyclic aromatic hydrocarbons, nitrosamines,

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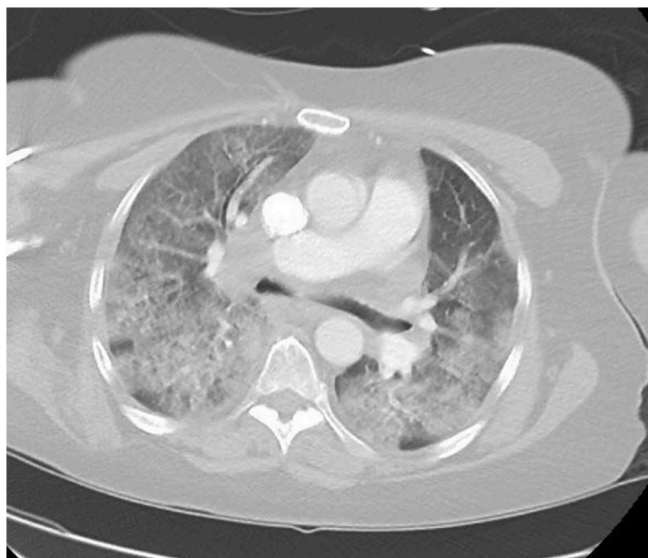


Fig. 1. Axial CT revealing bilateral ground glass opacities with interlobular thickening.

volatile organic chemicals, and inorganic chemicals such as toxic metals, endotoxins, and flavoring compounds such as diacetyl and 2,3-pentanedione have also been detected [2–5].

In July 2019, the Wisconsin Department of Health Services and the Illinois Department of Public Health received reports of pulmonary disease associated with the use of e-cigarettes/vaping and hurried a corresponding public health investigation [6]. With succeeding reports of confirmed and probable cases, it is now of no doubt that severe lung injury and complications may develop from vaping/E-cigarettes. A flood in cases of severe pulmonary illness linked to vaping has been emerging across the United States given by the swelling popularity of this form of inhalation particularly among youth [6–8].

As of February 18, 2020, all 50 states, the District of Columbia (DC), and the U.S. Virgin Islands have reported 2907 cases of E-cigarette, or vaping, product use-associated lung injury (EVALI) to CDC, including 68 deaths from ARDS in 29 states [8].

Lung biopsy specimens from small series of patients with severe pulmonary disease associated with electronic cigarette product use or vaping showed histologic features of acute lung injury. The cases demonstrate a heterogeneous collection of pneumonitis patterns that include acute eosinophilic pneumonia, organizing pneumonia, lipoid pneumonia, diffuse alveolar damage and acute respiratory distress syndrome (ARDS), diffuse alveolar hemorrhage, hypersensitivity pneumonitis, and the rare giant-cell interstitial pneumonitis [9,10].

At this time, FDA and CDC have not recognized the etiological agent behind lung injuries among those cases, and the only association is the use of e-cigarette, or vaping, products. It has also yet to be characterized as to how many of the 68 deaths were due to ARDS or another corresponding lung injury. About 80% of the persons who vaped and became ill reported having used both nicotine products and tetrahydrocannabinol (THC) or cannabidiol (CBD) products [10–12].

Diffuse alveolar hemorrhage (DAH) is well recognized clinical syndrome of hemoptysis, anemia, diffuse radiographic pulmonary infiltrates, and hypoxemic respiratory failure [13]. In up to one-third of patients with DAH, hemoptysis is absent and the diagnosis is founded after sequential BAL demonstrates worsening RBC counts [14]. Multiple causes have been shown to lead to DAH. Flexible bronchoscopy is able to diagnose DAH but not the underlying cause [13,14]. Clues to the primary trigger of DAH may be recognized through a thorough history and physical examination, certain serologic and radiographic findings, bronchoalveolar lavage stains and culture, and biopsy of disturbed

tissues. Identifying the underlying cause is often essential to efficacious treatment.

Corticosteroids might be helpful in treating this injury. Several case reports describe improvement with corticosteroids including our case [12]. However due to the limited information about this emerging disease course, it is possible that patients might recover without corticosteroids or by avoiding use of e-cigarette and vaping products. Limited number of cases has been reported linking vaping or e-cigarettes to DAH. The liquid used in this case had a predominant base of CBD oil. The chronological relations of patient's history of newly vaping, the nature of the liquid used, and the development of diffuse alveolar hemorrhage were the only plausible explanation of her clinical presentation. This is also heartened by the absence of any findings on serological as well as infectious work up.

Until the analysis of the cause of this epidemic of vaping-associated respiratory injury is fulfilled, no conclusions can be drawn as to which compound or compounds are the causes of injury. Yet with increasing use of these devices especially among youth and the growing certainty about their harmful impact, we believe that this is an important diagnosis for pulmonologists to be aware of and should warn their patients against using them.

Declaration of competing interest

We have no known conflict of interest.

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