Acute lung injury secondary to e-cigarettes or vaping

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ABSTRACT

As of October 2019, 1299 cases of “e-cigarette, or vaping, product use associated lung injury” (EVALI) have been reported in the USA, with 26 deaths. Multiple patterns of lung injury have been reported, including lipoid pneumonia, organizing pneumonia, and acute eosinophilic pneumonia, with radiographic findings including diffuse pulmonary infiltrates. We report a case of lipoid pneumonia secondary to EVALI. Physicians should be alert to recognizing these patterns of lung injury, as well as emphasizing to patients the importance of e-cigarette cessation.

KEYWORDS E-cigarette or vaping; EVALI; imaging findings for EVALI; lipoid pneumonia; product use associated lung injury; vaping

E-cigarettes were introduced in the United States in 2006 as a healthier alternative to smoking to aid in smoking cessation; however, recreational use has since skyrocketed, particularly among adolescents. These devices aerosolize a liquid that contains either nicotine or tetrahydrocannabinol (THC), flavorings, and a solvent such as vegetable glycerin or propylene glycol via a heating mechanism.¹ The aerosol is then inhaled orally and travels into the lungs, a process known as “vaping.” “E-cigarette, or vaping, product use associated lung injury” (EVALI) has been emerging at a rapidly increasing rate, with evidence of lipoid pneumonia, organizing pneumonia, and acute eosinophilic pneumonia.^{2,3} Here we present a case of a young man with pathology-proven lipoid pneumonia related to vaping.

CASE DESCRIPTION

A 27-year-old man with known asthma presented to the emergency department with dyspnea. The symptoms began 5 days earlier associated with fever and nonproductive cough. A diagnosis of bilateral pneumonia was made. He refused to be admitted and was discharged on oral antibiotics, but his dyspnea progressively worsened. He had a history of daily nicotine and THC vape use after quitting cigarettes 2 years ago, with his last reported vape use about 3 months prior. A

urine drug screen was not performed. On presentation, his heart rate was 121 beats per minute, temperature was 100.9°F, and oxygen saturation was 93% on room air. Crackles were heard bilaterally at the lung bases.

The patient was admitted and started on intravenous antibiotics for treatment. His fever continued to rise to 103.4°F, and the dyspnea continued to worsen despite supplemental oxygen. Computed tomography (CT) of the chest revealed diffuse ground-glass opacities (*Figure 1*). Bronchoscopy with bronchial alveolar lavage disclosed intra-cytoplasmic Oil Red O staining of alveolar macrophages indicative of the presence of lipids. The bronchial alveolar lavage was negative for fungal, viral, and bacterial pathogens. Intravenous methylprednisolone for acute lung injury was initiated. Repeat bronchoscopy with transbronchial biopsy confirmed an organizing pattern of acute lung injury with the distinct feature of vacuolated macrophages, as seen in lipoid pneumonia. The patient’s respiratory status improved, and he was stable on room air and oral prednisone prior to discharge.

DISCUSSION

According to the recent Centers for Disease Control and Prevention report, EVALI remains a diagnosis of

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Figure 1. Chest CT demonstrating diffuse ground-glass opacities and consolidation, with a subpleural pattern of sparing, as can be seen in cases of EVALI.

exclusion, with emphasis placed on first excluding entities such as influenza or bacterial pneumonia. Patients often present with respiratory symptoms including cough, dyspnea, and chest pain.⁴ The initial imaging workup should include a chest radiograph, which will often show bilateral infiltrates. On chest CT, findings consistent with acute eosinophilic pneumonia, hypersensitivity pneumonitis, diffuse alveolar damage, diffuse alveolar hemorrhage, organizing pneumonia, and lipoid pneumonia have been identified. Most patterns display diffuse ground-glass opacities and consolidation, predominantly in the basilar lobes, with subpleural sparing. Exceptions include hypersensitivity pneumonitis, which presents with a pattern of upper- and mid-lung-predominant ground-glass opacities and organizing pneumonia, which is typically more peripheral.⁵ Bronchial alveolar lavage can be performed on a case-by-case basis, along with staining for lipid-laden macrophages with Oil Red O or Sudan stain. Treatment typically includes broad-spectrum antibiotics until infection is ruled out and corticosteroids.⁴

The exact etiology of lung injury in these patients has not been clearly elucidated. Most cases are linked to the use of THC-containing products, but individuals who have only used nicotine products have also been affected. In the case of patients presenting with lipoid pneumonia, one theory describes aerosolized oils inhaled from e-cigarettes causing an inflammatory response.⁶ A report from Utah found that several THC cartridge samples had vitamin E acetate, which is now a common diluent.⁷ While research continues on the etiology of EVALI, it is of paramount importance to encourage e-cigarette cessation for not only those who have

sustained lung injury, but those who are actively using THC or nicotine-containing products.

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