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CLINICAL VIGNETTE

A Case of Ground Glass Opacities and Hypoxia

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Case Presentation

A 33-year-old male with a past medical history of obesity, sleep apnea, and electronic cigarette and cannabis use presented to the Emergency Department with a one-day history of shortness of breath, non-productive cough, pleuritic chest pain and left lower extremity swelling/paresthesia. The patient stated that he woke up with sudden onset of symptoms. He denied fevers or chills, and reported no recent trauma or extremity injury. His initial vital signs were temperature 37.0°C, BP 162/82, pulse 118/min, respirations 26 min and oxygen saturation 88% on room air. Patient was initially given 2L of nasal oxygen with improvement to 94% saturation.

On exam the patient was speaking in short sentences, coughing vigorously, with increased work of breathing. There was decreased inspiratory effort due to pain and decreased breath sounds in both lung bases. Cardiac exam was unremarkable. He had decreased sensation to light touch circumferentially in the left foot.

Laboratory values were notable for a white blood cell count of 19.18 k/uL with predominantly neutrophils at 85.2%. Lactate was normal and Covid-19 PCR was negative.

The chest x-ray revealed diffuse bilateral hazy opacities. Computed tomography angiography of the chest showed no pulmonary embolism but revealed multifocal nodular ground-glass opacities in both lungs.

The patient was admitted and started on ceftriaxone and azithromycin for presumed community acquired pneumonia and further management of acute hypoxic respiratory failure.

Blood cultures, HIV, viral respiratory panel, fungal and autoimmune results were negative. High admissions pretest probability for Covid19 was ruled out with three nasopharyngeal PCR tests. He improved rapidly. It was later discovered that the patient had recently switched to a new cannabis cartridge for vaping. A diagnosis of electronic cigarette or vaping product use-associated lung injury (EVALI) was felt most likely by the treating team. Bronchoscopy was deferred during his admissions due to his rapid improvement. The etiology of his lower extremity paresthesia was never identified, but the symptoms resolved spontaneously.

Discussion

Electronic cigarettes also known as e-cigarettes or e-cigs are a form of nicotine delivery system. They were originally developed for smoking cessation,¹ and were hypothesized to be a safer alternative to smoking. Electronic cigarettes function through the conversion of a liquid to aerosol by heat.¹ The liquid contains a solvent composed of propylene glycol and vegetable glycerin with the addition of other chemicals, including nicotine, flavorings, cannabinoids (tetrahydrocannabinol (THC), cannabidiol), and additives (propellants, solvents, oils, and glycerol).¹⁻³ The inhaled aerosol can include lead, other metal mixtures, volatile organic compounds (VOC), ultrafine particles, low molecular weight carbonyl compounds (formaldehyde, acetaldehyde, and acetone), and tobacco-specific nitrosamines.⁴ These can cause direct toxicity to the lungs, increase the risk for respiratory infections, and risk of cancer.^{1,5,6}

The Center for Disease Control and Prevention (CDC) reported in early 2020 a total of 2,807 hospitalized EVALI cases in the United States with 68 confirmed deaths.⁷ Of adults using tobacco everyday those between ages 18-24 had the greatest prevalence of habitual e-cigarette users at 9.3%. This decreased with age, with 6.4% of those between 25-44 habitual vapers, 3.0% for those between 45-64, and 0.8% for individuals greater than 65. Men were more frequent e-cigarette users at 5.5% compared with 3.5% of females using daily tobacco.⁸

The exact etiology of EVALI is unknown, however, additives such as Vitamin E acetate have been postulated to be causative based on bronchioalveolar lavage.⁶ EVALI is currently a diagnosis of exclusion. Diagnostic criteria for EVALI includes e-cigarette use within 90 days of symptoms onset, pulmonary infiltrate on imaging, absence of pulmonary infection, viral, bacterial, and fungal and no evidence of alternative diagnoses such as rheumatologic, cardiac, or oncologic.^{6,9} Patients with EVALI usually have lower respiratory symptoms (shortness of breath or cough) without upper respiratory symptoms like rhinorrhea. Fever is present in 33% of cases.⁶ There is no specific laboratory test to identify EVALI, however, leukocytosis with neutrophil predominance and elevated inflammatory markers are frequently reported. Radiography most commonly shows bilateral ground-glass opacities. Rapid identification and accurate diagnosis allow for targeted counseling about smoking cessation and may identify public health risks from specific brands.

Treatment of EVALI is mainly supportive with the use of non-invasive and invasive ventilation as needed. Empiric antibiotics are usually initiated until bacterial pneumonia is ruled out. There is weak observational evidence that the use of glucocorticoids may prevent worsening of disease.⁶ Their use, however, must be weighed against causing immunosuppression when infectious etiologies have not been excluded. Extracorporeal membrane oxygenation (ECMO) is an option in severe cases.

The similarities between EVALI and lower respiratory infections makes the diagnosis particularly challenging. This case highlights the importance of taking a complete social history, including recent e-cigarette use to consider EVALI as a possible diagnosis. This is important, since resuming to e-cigarette use after discharge could put the patient at risk of recurrence.

REFERENCES

1. **Chun LF, Moazed F, Calfee CS, Matthay MA, Gotts JE.** Pulmonary toxicity of e-cigarettes. *Am J Physiol Lung Cell Mol Physiol.* 2017 Aug 1;313(2):L193-L206. doi: 10.1152/ajplung.00071.2017. Epub 2017 May 18. PMID: 28522559; PMCID: PMC5582932.
2. **Kosmider L, Sobczak A, Fik M, Knysak J, Zaciera M, Kurek J, Goniewicz ML.** Carbonyl compounds in electronic cigarette vapors: effects of nicotine solvent and battery output voltage. *Nicotine Tob Res.* 2014 Oct;16(10):1319-26. doi: 10.1093/ntr/ntu078. Epub 2014 May 15. PMID: 24832759; PMCID: PMC4838028.
3. **Goniewicz ML, Knysak J, Gawron M, Kosmider L, Sobczak A, Kurek J, Prokopowicz A, Jablonska-Czapla M, Rosik-Dulewska C, Havel C, Jacob P 3rd, Benowitz N.** Levels of selected carcinogens and toxicants in vapour from electronic cigarettes. *Tob Control.* 2014 Mar;23(2):133-9. doi: 10.1136/tobaccocontrol-2012-050859. Epub 2013 Mar 6. PMID: 23467656; PMCID: PMC4154473.
4. US Department of Health and Human Services. E-cigarette use among youth and young adults: a report of the Surgeon General [PDF-8.47 MB]pdf icon Atlanta, GA: US Department of Health and Human Services, CDC; 2016. Available at: https://www.cdc.gov/tobacco/data_statistics/sgr/e-cigarettes/pdfs/2016_sgr_entire_report_508.pdf.
5. **Kligerman S, Raptis C, Larsen B, Henry TS, Caporale A, Tazelaar H, Schiebler ML, Wehrli FW, Klein JS, Kanne J.** Radiologic, Pathologic, Clinical, and Physiologic Findings of Electronic Cigarette and Vaping Product Use-associated Lung Injury (EVALI): Evolving Knowledge and Remaining Questions. *Radiology.* 2020 Mar;294(3):491-505. doi: 10.1148/radiol.2020192585. Epub 2020 Jan 28. PMID: 31990264.
6. **Layden JE, Ghinai I, Pray I, Kimball A, Layer M, Tenforde MW, Navon L, Hoots B, Salvatore PP, Elderbrook M, Haupt T, Kanne J, Patel MT, Saathoff-Huber L, King BA, Schier JG, Mikosz CA, Meiman J.** Pulmonary Illness Related to E-Cigarette Use in Illinois and Wisconsin - Final Report. *N Engl J Med.* 2020 Mar 5;382(10):903-916. doi: 10.1056/NEJMoa1911614. Epub 2019 Sep 6. PMID: 31491072.
7. Center for Disease Control and Prevention. Outbreak of lung injury associated with the use of e-cigarette, or vaping, products. Available at: https://www.cdc.gov/tobacco/basic_information/e-cigarettes/severe-lung-disease.html.
8. **Cornelius ME, Wang TW, Jamal A, Loretan CG, Neff LJ.** Tobacco Product Use Among Adults - United States, 2019. *MMWR Morb Mortal Wkly Rep.* 2020 Nov 20;69(46):1736-1742. doi: 10.15585/mmwr.mm6946a4. PMID: 33211681; PMCID: PMC7676638.
9. **Schier JG, Meiman JG, Layden J, Mikosz CA, VanFrank B, King BA, Salvatore PP, Weissman DN, Thomas J, Melstrom PC, Baldwin GT, Parker EM, Courtney-Long EA, Krishnasamy VP, Pickens CM, Evans ME, Tsay SV, Powell KM, Kiernan EA, Marynak KL, Adjemian J, Holton K, Armour BS, England LJ, Briss PA, Houry D, Hacker KA, Reagan-Steiner S, Zaki S, Meaney-Delman D; CDC 2019 Lung Injury Response Group.** Severe Pulmonary Disease Associated with Electronic-Cigarette-Product Use - Interim Guidance. *MMWR Morb Mortal Wkly Rep.* 2019 Sep 13;68(36):787-790. doi: 10.15585/mmwr.mm6836e2. Erratum in: *MMWR Morb Mortal Wkly Rep.* 2019 Sep 27;68(38):830. PMID: 31513561; PMCID: PMC6755818.