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Case Report

Vaping Associated Lung Injury – An Unusually Severe Case Rapidly Resolved with a Conservative Steroid Regimen

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Abstract

As of January 2020, over 2600 hospitalized cases of e-cigarette, or vaping, product use-associated lung injury (EVALI) have been reported by the US Centers for Disease Control and Prevention. EVALI is a serious public health concern prompting regulatory intervention by the Food and Drug Administration. Published cases have certain common features including neutrophil-predominant leukocytosis and elevated inflammatory markers. Severe cases may require intubation and mechanical ventilation. Hospitalized patients often improve with steroids although regimens published in the literature are highly variable. We report an unusually severe case of EVALI with abnormally elevated inflammatory markers, unusually severe transaminitis and lymphopenia that was nevertheless successfully managed with a relatively conservative regimen of glucocorticoids.

Keywords: EVALI; Lung Injury; Vaping; Vaping Injury; VAPI

Background

As of January 2020, the US Centers for Disease Control and Prevention (CDC) has recorded over 2600 hospitalized cases of e-cigarette, or vaping, product use-associated lung injury (EVALI) [1]. EVALI is a serious public health concern prompting a ban on certain vaping products and intervention by the Food and Drug Administration [2]. Published cases tend to present with neutrophil-predominant leukocytosis [3,4] and resolve over days to weeks, often with steroids [5], although regimens published in the literature are highly variable, up to 1 g of methylprednisolone a day [6,7]. Inflammatory markers may be elevated [8]. We report a case of EVALI with unusually severe hypoxia, elevated inflammatory markers and evidence of systemic involvement, unique among published cases in the literature. Despite the unusually severe presentation, resolution was achieved with a conservative steroid regimen.

Case Presentation

An otherwise healthy 25-year old male presented to our hospital complaining of one week of worsening fever, dyspnea, pleuritic chest pain, abdominal pain and nausea and emesis. He had initially been diagnosed with community acquired pneumonia (CAP) at an outside hospital and prescribed antibiotics four days prior, but these had not provided relief. He reported vaping nicotine and THC-containing products daily but had a minimal oxygen requirement and we first suspected failed outpatient treatment for CAP and initiated broad spectrum antibiotics. Workup revealed a neutrophil predominant (94%) leukocytosis of 15k. ESR and CRP were elevated to 118 mm/hr and 177 mg/dL, respectively. He also had a slight transaminitis – alanine transaminase (ALT) and aspartate transaminase (AST) both elevated to 79 IU/L. Pulmonary imaging demonstrated bilateral infiltrates and enlarged hilar lymph nodes. Lymphocyte count was only 600, which also raised concern for possible immunodeficiency.

Our patient clinically deteriorated despite antibiotics and by hospital day three had a supplemental oxygen requirement of over four liters, as well as refractory nausea, vomiting and abdominal and pleuritic chest pain. However, he was only slightly febrile to 100.5 degrees Fahrenheit and both infectious and immunologic workup were nondiagnostic. Interval chest imaging demonstrated severe progression of disease, with diffuse interstitial and alveolar infiltrates. Procalcitonin was only 0.27 µg/L but ESR and CRP remained elevated to 117 mm/hr and 187 mg/dL, respectively.

Based on our patient's course and similarity of reported of vaping related injuries known to us, we suspected possible EVALI and administered a challenge dose of 125 mg of methylprednisone. Within four hours, his symptoms greatly improved, including almost full resolution of his nausea and abdominal pain, and he developed an appetite. After another hour he had no resting dyspnea and his oxygen requirement decreased. We added 40 mg of methylprednisone at eight-hour intervals and noticed further clinical improvement.

On day four, our patient continued to improve with declining inflammatory markers (ESR 114 mm/hr, CRP 134 mg/dL), although his transaminitis had worsened to ALT 301 IU/L and AST 385 IU/L. Interval chest imaging demonstrated decreased infiltrates. We administered another 125 mg of methylprednisone in addition to his scheduled doses which eliminated his supplemental oxygen re-

quirement and his symptoms fully resolved except for some minor fatigue.

On day five, his inflammatory markers declined further to ESR 88 mm/hr and CRP 58 mg/dL and his transaminitis also decreased (ALT 362 IU/L, AST 255 IU/L). His leukocytosis was still present to 20k, although his lymphopenia had resolved. He felt completely well, and his vital signs were all normal. He was discharged on a 14-day course of 60 mg prednisone followed by a two-week taper. Unfortunately, he was lost to follow up and we were not able to follow his progress further, although based on social media reports he appears to have made a full recovery.

Discussion

Published cases of EVALI have certain commonly appearing features. An October 2019 study in the New England Journal of Medicine noted neutrophil predominant leukocytosis and mild elevation of inflammatory markers in the vast majority of 53 investigated cases [4]. Transaminitis was less common and generally mild, with only two cases in the above study exceeding 105 IU/L. Almost 60% of cases required admission to an intensive care unit and almost one-third underwent intubation and mechanical ventilation [ibid]. Another published study noted erythrocyte sedimentation rates of round 100 mm/hr in most cases, and C-reactive protein levels from 20-30mg/dL [8]. In published reports of hospitalized patients, cases usually resolve rapidly with steroids [5].

Our patient's case was unusual for several reasons. Workup was unique in the constellation of unusually high inflammatory markers, comparatively severe transaminitis, and a presenting lymphopenia initially concerning for possible immunodeficiency. Our patient was also severely hypoxic. In the case series referenced above, one third of cases had an oxygen saturation of below 88% on ambient air, and a similar proportion of patients underwent intubation and mechanical ventilation [4]. Our patient was hypoxic even on four liters of supplemental oxygen, and we initially contemplated transferring him to intensive care, but even with the foregoing found that relatively modest amounts of glucocorticoids delivered rapid resolution.

Conclusion

EVALI is an ongoing problem despite regional bans on vaping products and FDA intervention. Challenges include appropriate triage within the hospital system and appropriate management, including optimal steroid dosing in cases where this is appropriate. Our case demonstrates that a conservative steroid regimen of between 125 mg – 265 mg of daily methylprednisone is effective even in relatively severe cases of EVALI with evidence of systemic involvement, and that inflammatory markers are valuable in charting the course of this disease. Our case also demonstrates that EVALI may present with findings concerning for possible immunodeficiency, given our patient's initial lymphopenia.

Conflicts of Interests

The authors declare that they have no conflicts of interest.

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