OSU Pediatrics

Suspected vaping associated lung injury in a 16-year old female

CENTER FOR HEALTH SCIENCES
OKLAHOMA STATE UNIVERSITY

Genevieve Febbraro, DO; Meagan McCall, DO; Laura Bode, DO

Background

There have been multiple reports of young people being diagnosed with severe lung disease with the common link of recent electronic cigarette (E-cigarette) use. The disease is described as a patient having acute respiratory disease with no apparent infectious cause and significant findings on lung imaging. It is also known as Vaping Associated Lung Injury (VALI).

Reports reveal a surge of cases based in the Midwest, but the CDC also reports outbreaks across the country. Imaging of the disease commonly shows diffuse ground-glass appearance with pan-injury, but there are still many inconsistencies in the reported cases making it difficult for definitive action to be taken by the FDA and health officials.

Case Presentation

History of present illness:

- A 16-year old female with 5 days of shortness of breath and constitutional symptoms was admitted from the ER after failed outpatient treatment of pneumonia.
- She used tobacco e-cigarettes regularly and recently used THC oil from an illicit dealer in her e-cigarette.
- Initial imaging demonstrated bilateral lower lobe pneumonia, and labs were significant for leukocytosis, elevated inflammatory markers, and a negative Respiratory Panel PCR.

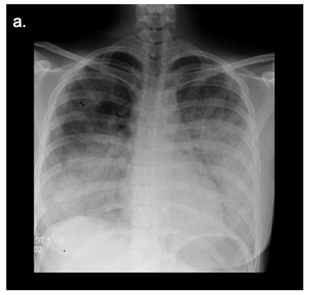
Hospital Course:

- The Patient's respiratory status rapidly declined despite aggressive pulmonary toileting therapies and broad-spectrum antibiotics. By day 2 of admission, repeat imaging showed worsening pneumonia with pulmonary edema and pleural effusions (a and b). She required transfer to the pediatric intensive care unit for non-invasive positive pressure ventilation and eventually was intubated and placed on mechanical ventilation.
- A chest CT scan was significant for diffuse bilateral ground glass and interstitial infiltrates with air bronchograms (c and d). She was started on high dose steroids in addition to her antimicrobial therapy for concern of chemical pneumonitis. Due to worsening oxygen requirement and concern of ARDS-like illness with air leak, she was transitioned to high frequency oscillatory ventilation and was also treated with inhaled nitric oxide for pulmonary hypertension.
- During her stay, pediatric infectious disease and pediatric pulmonary physicians were consulted. She had an extensive infectious work up including bronchoscopy and multiple bacterial, viral, and fungal tests-- all results were negative.

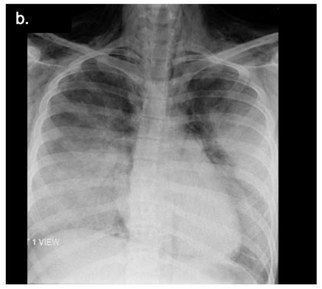
Outcome:

- The patient eventually weaned from her respiratory support and recovered over several weeks, but no infectious cause was ever determined.

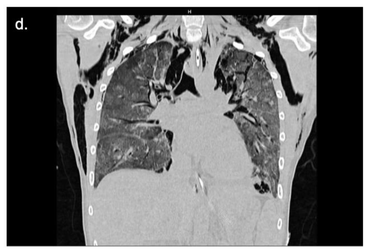
Imaging



a) Plain film, demonstrating extensive patchy airspace disease, greater in lower lung fields with pulmonary edema.



b) Plain film taken 24 hours after film a., demonstrating new bilateral pneumomediastinum, soft tissue emphysema with unchanged bilateral opacification of bilateral lung fields, worse in the lower fields with air bronchograms.



c) Transverse and d) coronal sections of a CT Chest without contrast demonstrating diffuse bilateral interstitial and ground glass infiltrates

Discussion

In electronic cigarettes, the fluid filled cartridges that are heated by the device are often flavored with fruits such as watermelon, cherry, mango (etc), which are likely appealing to youth. These flavors, that may unintentionally target younger users are not harmless, and some research has shown damaging effects due to components that derive the flavoring. According to one study, the measured amounts of benzaldehyde in flavored nicotine solutions used in e-cigarettes were significantly higher in concentrations of cherry flavored solutions [1]. Furthermore, approximately ¾ of reported cases were linked to recent THC use in the device.

Among patients whom have been diagnosed with VALI, as many as 86% report using THC-Containing products; exclusive use of THC-containing products are reported by 34% of patients according to the CDC [2]. Among the various formulations of cannabis, concentrates are seemingly problematic for adolescent population [3]. 72% of high school students surveyed use concentrated formulation of THC products [4]. Even with most VALI cases being linked to THC containing products, there is no specific pattern of pathology identified. All cases of confirmed VALI demonstrate histopathological findings with patterns consistent with acute lung injury, acute fibrinous pneumonitis, diffuse alveolar damage, or organizing pneumonia– Similar to findings in figure C. and D. [5]

CONCLUSION

The number of VALI cases are on the rise daily. Many cases reported involve a history of THC use in the devices, and most of the samples being tested by the state and the FDA are being identified as containing THC [6]. However, at least ¼ of cases do not. This has caused much distress to government agencies not being able to take definitive action to help stay the public health crisis. This puts a great strain on the healthcare system and its resources. Quick action needs to be taken by scientists, investigators, law makers, public health officials and tobacco industry to better understand both long-term and short-term consequences of increased popularity of vaping in the US.

REFERENCES

1. Perrine, C. G., Pickens, C. M., Boehmer, T. K., King, B. A., Jones, C. M., DeSisto, C. L., … Briss, P. A. (2019). Characteristics of a Multistate Outbreak of Lung Injury Associated with E-cigarette Use, or Vaping-- United States, 2019. Morbidity and Mortality Weekly Report , 68 (39), 860–864. Retrieved from https://www.cdc.gov
2. Centers for Disease Control and Prevention . (2019, November 5). Retrieved from https://www.cdc.gov/tobacco/basic_information/e-cigarettes/severe-lung-disease.html#latest-outbreak-information.
3. Kosmider, L., Sobczak, A., Prokopowicz, A., Kurek, J., Zaciera, M., Knysak, J., … M., & Aberegg, S. K. (2019). Pulmonary Lipid-Laden Macrophages and Vaping. New
4. Meier MH, Docherty M, Leischow SJ, Grimm KJ, Pardini D. Cannabis concentrate use in adolescents. Pediatrics. 2019; 144(3).
5. England Journal of Medicine , 381 (15), 1488–1489. doi: 10.1056/nejmc1912038
6. Commissioner, O. of the. (n.d.). U.S. Food and Drug Administration. Retrieved September 21, 2019, from https://www.fda.gov/.

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