Recurrent Spontaneous Pneumothorax in a 15-Year-Old Female Associated with Electronic Cigarettes

Seth Deskins[1], Samuel Luketich [1], and Saif Al-Qatarneh [1]

[1]West Virginia University

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Abstract

Pneumothorax as a sequalae of vaping is a relatively recent complication being described in the literature. Smoking has classically been associated with increased risk of pneumothorax, and emerging evidence is showing that electronic cigarettes (e-cigarettes) likely carry some of the same risks. Since electronic cigarettes increased in popularity, especially among the adolescent population, there has been reported increased incidence of lung injury, including pneumothorax. We present a case of a 15-year-old female with a history of e-cigarette use admitted for recurrent pneumothorax with failure to re-expand requiring surgical intervention.

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Authors:

Seth J Deskins, MD[1]; Samuel K Luketich, MSIII[1]; Saif Al-Qatarneh, MD[2]

Conflict of Interest:

None to disclose

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Keywords:

Pneumothorax, electronic cigarettes, vaping, case report

Introduction:

E-cigarettes are a popular alternative to traditional nicotine containing cigarettes. The operational mechanism for e-cigarettes involves heating a liquid to produce an aerosol that can be inhaled into the lungs (1). A potential draw to e-cigarettes is the capability of the liquid to contain various chemical compounds ranging from nicotine to tetrahydrocannabinol (THC) and cannabinoids (CBD) oils that can be mixed with additives and flavors (1). However, there are potential consequences though that need to be considered. A now commonly recognized pathology is e-cigarette/vaping associated lung injury (EVALI/VALI). This was

first described in 2019 and by the end of that year, a reported 2807 patients were admitted for EVALI with a total of 68 deaths (2). EVALI is an important consideration in the pediatric realm as adolescents have easy access to electronic cigarettes. The median age of admitted patients was 21 years old with a male predominance (2). Since this is a relatively new diagnosis, there are no prospective studies on the long term impacts on pulmonary health. Recent issues have started to take precedence and to be more recognized in literature, such as spontaneous pneumothorax related to e-cigarette use. Here we present a case of recurrent complicated pneumothorax requiring surgical intervention in an otherwise healthy 15-year-old female with a significant vaping history.

Case:

A 15-year-old female with a significant past medical history of recurrent spontaneous pneumothorax presents as a direct admission after development of sudden onset left-sided chest pain with radiation into her left shoulder. Her pain is worse with deep inspiration, and she endorses a bubbling feeling below her ribs with associated numbness and tingling of the left upper extremity. She denies recent illness, preceding trauma, or history of connective tissue disease. Family history is non-contributory, and social history is positive for daily e-cigarette use containing nicotine and cannabinoid cartridges.

Initial workup with an electrocardiogram reveals normal sinus rhythm. A viral respiratory panel, which includes the novel SARS-CoV-2, is negative, and complete blood count and basic metabolic panel is normal. Chest x-ray (figure 1) performed on admission reveals a small to moderate left-sided pneumothorax. Further analysis with CT chest (figure 2) is performed and only demonstrates the pneumothorax. This is the third episode of pneumothorax in this patient within the past 6 months. Figure 3 shows her chest radiograph from initial hospitalization. She is placed on 100% FiO2 via non-rebreather for nitrogen washout. Pediatric pulmonology and cardiothoracic surgery are consulted. Given her history of recurrent pneumothoraces, the patient is planned to have a left sided partial pleurectomy, blebectomy, and mechanical pleurodesis via video assisted thorascopic surgery (VATS). A chest tube is inserted intraoperatively and maintained on negative pressure. Oxygen is weaned to room air, and her chest tube is placed to water seal. Three days post-operatively, she remains clinically stable and the chest tube is removed. Follow-up imaging is stable with minimal residual pneumothorax. Extensive counseling during the admission is provided to the patient and family regarding cessation of vaping to minimize the risk of recurrence.

Discussion:

The use of e-cigarettes has been found to be associated with significant pulmonary pathology. Although e-cigarettes have been marketed to assist with smoking cessation, they have gained traction in the adolescent population for recreational use. One study found a significant increase in prevalence of e-cigarette use among eighth, tenth, and twelfth graders from 2017 to 2019 (3). In addition to the concern for increased and earlier nicotine addiction in the pediatric population, there are more acute consequences such as EVALI/VALI and spontaneous pneumothorax. EVALI is acute lung injury that has significant morbidity and mortality among e-cigarette users (2). EVALI may present in different ways. Diffuse alveolar damage and organizing pneumonia are most frequently found on radiographic imaging (4).

Primary spontaneous pneumothorax, or pneumothorax in an individual without underlying lung pathology, has historically occurred in individuals who smoke cigarettes. Until recently (5-9), there had been no reports of spontaneous pneumothoraces in individuals who use e-cigarettes. Newer literature on otherwise healthy people with regular e-cigarette usage has emerged relating to pneumothoraces. One study describes the mechanism of injury as inflammation within the lung tissue from e-cigarette chemicals that results in alveoli damage, formation of blebs, and resultant rupture after a coughing event or with no trigger (5). Other reports consider that breathing techniques during inhalation could be the culprit (6).

Comprehensive clinical evaluation, including a thorough history, is fundamental in such cases due to lack of public awareness of e-cigarette impact on health. One case report demonstrated that specific questions regarding e-cigarette use was required to attain discloser of this potential cause of a pneumothorax (7). Therefore, it is advised that providers assess for e-cigarette use along with traditional cigarettes, smokeless

tobacco, and marijuana. E-cigarettes seem to be linked with recurrence of pneumothoraces. One case involved a patient who had recurrent right-sided pneumothoraces following episodes of e-cigarette use which resolved following smoking cessation (6). It is reported that the interval to pneumothorax reoccurrence may be faster in patients who use e-cigarettes compared to traditional cigarettes and non-smokers (5).

Treatment for spontaneous pneumothorax is variable. According to the American College of Chest Physicians, a large pneumothorax, defined as [?]3 cm, should undergo lung expansion with placement of a chest tube or catheter (10). In one study, all e-cigarette using patients with spontaneous pneumothorax required tube thoracostomy (11). VATS is a minimally invasive technique that can be used with blebectomy and/or pleurodesis. Blebectomy is a procedure to remove air blebs from the lung while pleurodesis adheres the lung tissue to the chest wall. VATS is often used for patients with recurrent pneumothoraces (7). Other indications for surgical intervention are bilateral pneumothoraces or failed expansion with tube thoracostomy. There is no specific treatment for pneumothorax related to e-cigarettes. Close follow up and patient education are recommended to prevent recurrent pneumothoraces.

E-cigarette use is an emerging cause of spontaneous pneumothorax, with a predominance to the adolescent population. In this case, ongoing use of e-cigarettes contributed to recurrent pneumothoraces. Initial treatment varies depending on severity, but typically consists of supplemental oxygen and/or tube thoracostomy. Recurrent episodes may require surgical intervention. Additionally, providers should be cognizant and provide education to patients and families about known adverse outcomes secondary to e-cigarette use.

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Images:

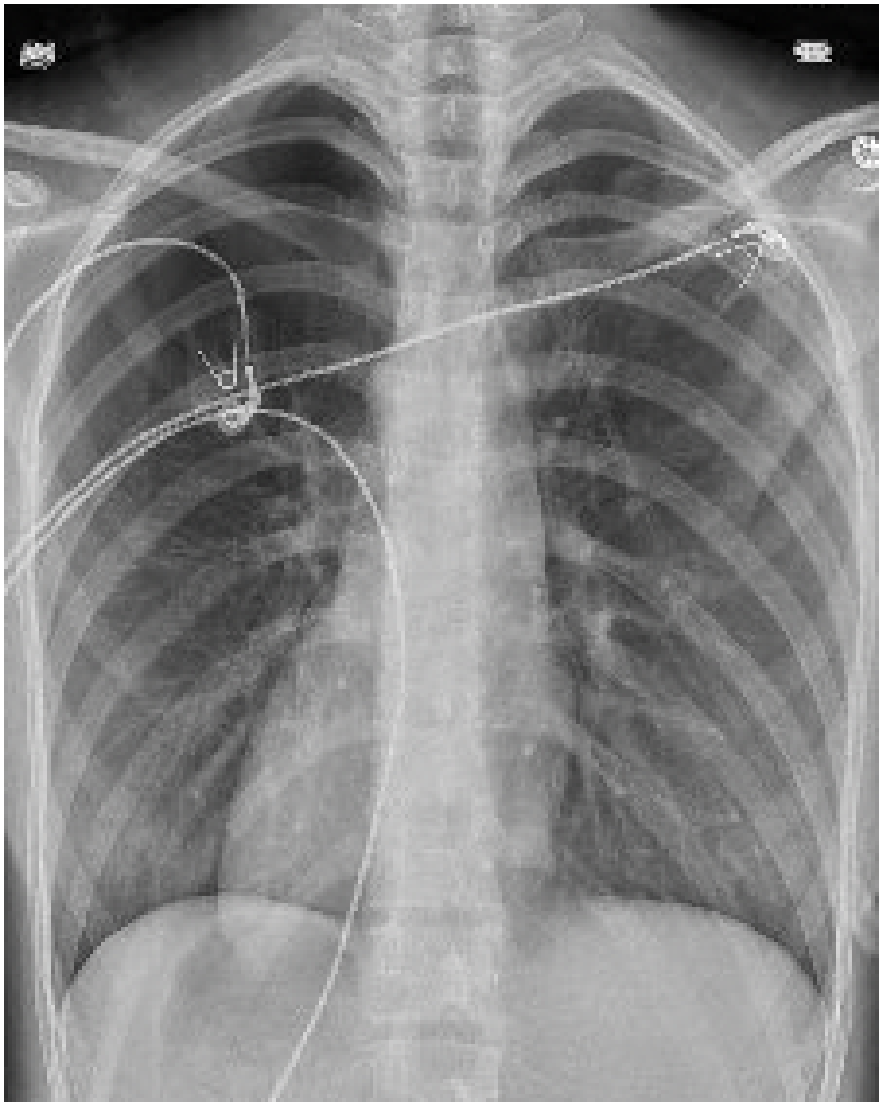

Figure 1: Chest radiograph showing small to moderate pneumothorax at admission

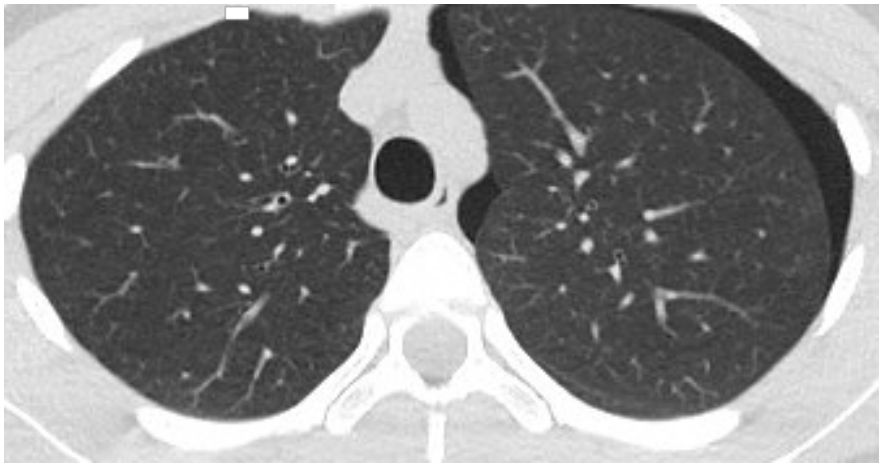

Figure 2: CT chest showing small to moderate pneumothorax at admission

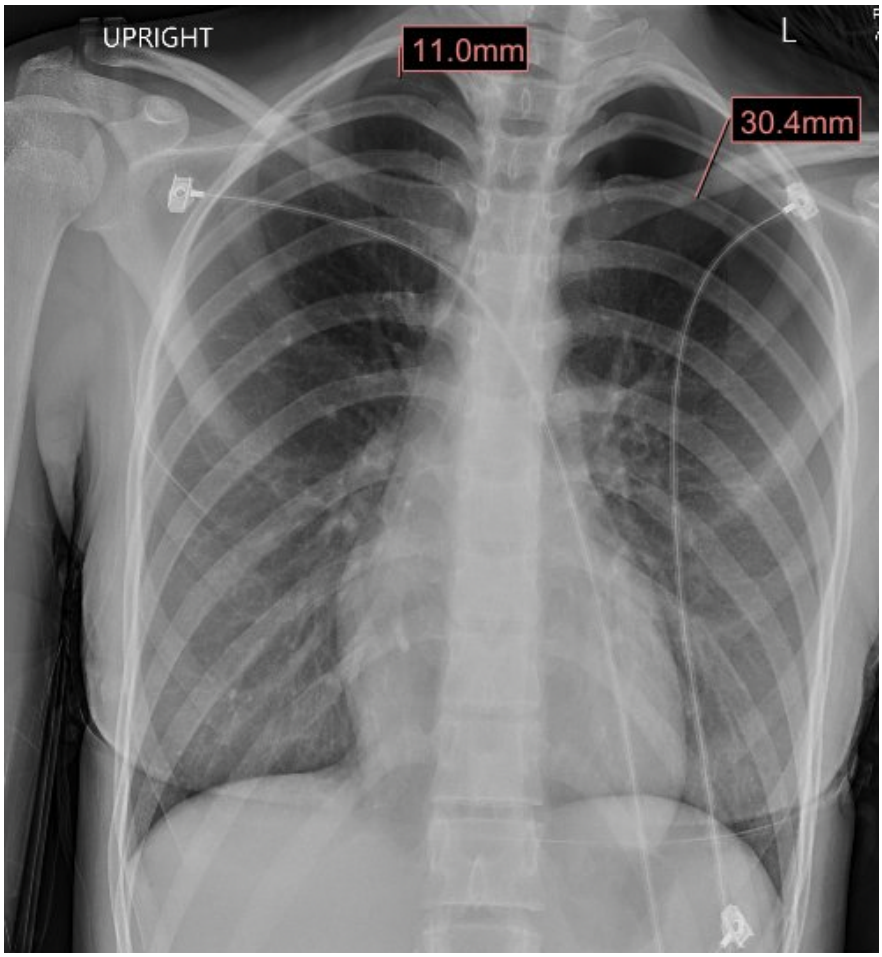

Figure 3: Chest radiograph from prior admission showing moderate sized pneumothorax