




# Throat irritation associated with e-cigarette use: a case report

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## Abstract:

Electronic cigarette (e-cigarette) is a device popular among non-smoker young adults. We report a case of a patient with the complaint of acute throat irritation secondary to chronic vaping. A 23-year-old male, without a significant past medical history, presented to the emergency department complaining of sore throat. The patient tested negative for Streptococcus (group A strep) and sexually transmitted infections. Due to persistent throat symptoms, he went to the Oral Medicine and Oral Oncology Clinic, at Miami Cancer Institute. He was an avid e-cigarette user, taking the maximum number of puffs from his device in a single day. The intraoral examination revealed erythema of the posterior oropharyngeal wall. The patient was diagnosed with pharyngitis secondary to vaping and instructed to discontinue the use of e-cigarette until the next visit. At 1-month follow-up the patient reported successfully quitting vaping, and had a complete resolution of the throat symptoms, with resolution of the oropharyngeal erythema. This case illustrates the importance of documenting patients' vaping habit. This information was essential to better understand the source of the throat irritation in the patient. We encourage dental professionals to document patients' vaping habits, educate them about e-cigarettes and the possible complications associated with the habit.

**Keywords:** E-cigarettes; Vaping; Sore throat; Substance-related disorders.

## INTRODUCTION

Electronic cigarettes (e-cigarettes) or electronic nicotine delivery systems (ENDS), are electronic devices, commonly advertised as smoking cessation tools<sup>1</sup>. The device produces a vapor that, in addition to nicotine may contain several chemicals, tobacco, or cannabis. Recent studies have shown a significant growth in the prevalence of e-cigarette users, especially among young adults who never smoked<sup>1</sup>. Despite being a relatively new product, evidence of the acute effects of e-cigarettes on health is emerging. In the respiratory system, e-cigarette use has been associated with several negative symptoms involving the nose, mouth, throat, and airways<sup>2</sup>. One of the most frequent acute effects of vaping is mouth and/or throat irritation<sup>3,4</sup>. This condition can be caused by exposure to the contents of the vapor, including propylene glycol<sup>2</sup>, nicotine<sup>5</sup>, heavy metals such as nickel, and chromium<sup>6</sup>. Even though throat irritation is a common effect,

### Statement of Clinical Significance

The present case report describes a patient with a severe sore throat associated with heavy vaping habit. This case illustrates the importance of documenting patients' vaping habits and presents the approach used to collect this information.

severe cases can lead to other important diagnoses such as vaping-induced acute epiglottitis, airway obstruction and e-cigarette or vaping use-associated lung injury (EVALI)<sup>2,7,8</sup>.

The present case report describes a patient with severe sore throat associated with a heavy vaping habit.

## CASE REPORT

A 23-year-old male, with a non-contributory past medical history, presented at the emergency department of Baptist Health South Florida with complaints of

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painful “bumps” at the back of his throat. The patient was initially diagnosed with pharyngitis. A *Streptococcus* (group A strep) throat test was negative. The patient was discharged on the same day with a prescription for Non-Steroidal Anti-Inflammatory Drugs and advised to perform warm saltwater gargles regularly. Due to the persistence of his throat symptoms after a couple of weeks, the patient presented to the Oral Medicine and Oral Oncology Clinic, at Miami Cancer Institute for a more comprehensive assessment and treatment.

During the patient interview, he expressed concerns that his throat symptoms could be related to Human Papillomavirus (HPV) infection after learning that his girlfriend had a sexual intercourse with another man. Before going to the emergency department, he visited a nearby community health center where he underwent testing for chlamydia, gonorrhea, and syphilis, with negative results for all three infections, based on both urine and throat swab tests. The patient had completed the HPV vaccine series a month before the visit (3<sup>rd</sup> dose). He also disclosed that the preceding two months had been significantly stressful for him, and he relied on daily vaping with nicotine (he did not recall the concentration) and regular marijuana consumption as coping mechanisms. Additionally, he had a history of occasional cocaine and other recreational drugs use.

During the visit to the Oral Medicine and Oral Oncology Clinic, the patient was asked additional questions about vaping habits, following a modified questionnaire based on Lee (Supplementary Material 1)<sup>9</sup>. He reported that he had been vaping for a few years, using a rechargeable device, but he could not remember the brand. He mentioned consuming the maximum number of puffs in a single day and needing to recharge the device daily. Due to the absence of information regarding the device’s brand, we were unable to ascertain the capsule/device volume or the nicotine concentration. The patient clarified that the device had a combination of nicotine and various flavors.

The extra oral examination was within normal limits while the intraoral examination revealed enlarged bilateral palatine tonsils and erythema of the posterior oropharyngeal wall. (Figure 1). The patient was diagnosed with throat irritation secondary to vaping.

The adverse impact of vaping on overall health was thoroughly discussed with the patient. In terms of oral and oropharyngeal health, we delved into the potential consequences of e-cigarette use, which encompass a higher plaque index, increased periodontal pocket depth, alterations in the microbiological composition of the subgingival biofilm, the potential to enhance fungal virulence<sup>10-12</sup>. He was instructed to discontinue the use



**Figure 1.** Clinical presentation at the first visit showing enlarged bilateral palatine tonsils and erythema of the posterior oropharyngeal wall.

of e-cigarette and marijuana until the next visit. As the patient remained apprehensive about the possibility of throat cancer, we had a thorough conversation about HPV-related throat symptoms and the risk of HPV infections, and HPV associated oropharyngeal cancers. Nevertheless, taking into account the patient's age and the fact that he had received HPV vaccination, the likelihood of an HPV-related oropharyngeal cancer diagnosis appeared remote.

At one month follow-up, the patient reported he had quit vaping and that the throat symptoms had subsided (Figure 2). However, he was still smoking marijuana twice a week. The intraoral examination revealed complete resolution of the erythema of the posterior oropharyngeal wall. As the throat irritation resolved with the cessation of the vaping habit, the patient received further clarification regarding the device's impact on health. Even though the association between HPV and oropharyngeal cancer had been well discussed with the patient during the first visit, the patient remained extremely anxious and was therefore referred to an otolaryngologist.

## DISCUSSION

We reported on a patient with severe throat inflammation and erythema associated with the use of e-cigarette. The inflammation and symptoms resolved after he quit the vaping habit.

Pharyngitis refers to the inflammation of the mucous membranes of the oropharynx, with most cases resulting from either a bacterial or viral infection. Less common causes of pharyngitis include trauma, cancer, acid reflux, allergies and chemical exposures<sup>13,14</sup>. Approximately 50 to 80% of cases of pharyngitis, commonly known as a sore throat, are of viral origin. The predominant viruses include rhinovirus, influenza virus, adenovirus, coronavirus, and parainfluenza virus. Less common viral pathogens include herpes simplex virus, Epstein-Barr virus, human immunodeficiency virus (HIV), and coxsackievirus. More severe cases of pharyngitis are often bacterial, with some developing after an initial viral infection. The most prevalent bacterial cause is Group A beta-hemolytic streptococci, which account for 5 to 36% of acute pharyngitis cases<sup>15,16</sup>.



**Figure 2.** Clinical presentation at the 1-month follow-up showing reduced bilateral palatine tonsils and decreased erythema of the posterior oropharyngeal wall.



When assessing the patient's history and conducting a physical examination, it is essential to identify findings consistent with uncomplicated pharyngitis and exclude other potentially serious and life-threatening conditions. Clinical manifestations often include fever, tonsillar exudates, painful cervical adenopathy, pharyngeal erythema, and ear pain. Both viral and bacterial forms of uncomplicated infectious pharyngitis are typically self-limited, resolving within 5 to 7 days without progression. Symptoms are bilateral, do not involve trismus, and do not present evidence of airway obstruction<sup>17</sup>.

In the present case report, the patient's symptoms had persisted for more than 15 days, despite ongoing medication, leading to the conclusion that his pharyngitis was likely not caused by a bacterial or viral infection, but rather by continuous exposure to a substance. Furthermore, while viral pharyngitis often includes additional symptoms such as coughing, rhinorrhea, conjunctivitis, headache, and rash, the patient exhibited none of these<sup>18</sup>. This lack of additional symptoms further supported our conclusion that the patient was not experiencing a viral infection.

Given that pharyngitis can also be caused by allergies and chemical exposures<sup>13,14</sup> and considering that the patient continued to experience symptoms despite medication — specifically in areas exposed to e-cigarette vapor — along with his heavy e-cigarette use, we concluded that vaping was likely the cause of his condition.

E-cigarettes are battery-operated devices that heat a liquid solution (e-liquid or e-juice), which may contain propylene glycol or glycerol (or both), nicotine, flavors, metals (e.g., tin, silver, iron, nickel) among other components<sup>19</sup>. Vaping is the act of inhaling the aerosol produced by the heat of this liquid. This product was created in 2003, and despite being a relatively new device, evidence has shown several acute health effects associated with its use. Among these effects, throat irritation is frequently mentioned<sup>3,4</sup>. Farsalinos et al., assessed the characteristics and experiences of 19,414 e-cigarette users. The most common symptom associated with vaping was “sore” or “dry” mouth and throat<sup>4</sup>. The oxidative stress on the oropharyngeal mucosa caused by vaping may increase the production of inflammatory cytokines, decrease the activity of innate immune cells, increase viral replication, and decreased antimicrobial activity of neutrophils and macrophages, resulting in immunosuppression and likely a secondary infection<sup>20</sup>.

Sore throat can be explained by a couple of factors. Exposure to propylene glycol and glycerol has been associated with airway irritation, which may be explained by a water-absorbing property of this substance<sup>2</sup>. Propylene

glycol is responsible for the “throat hit” which is the specific sensation felt in the posterior pharyngeal wall by users when vaping. This sensation is popular among smokers because it leads to satisfaction and resembles the puff of a tobacco cigarette<sup>4</sup>. Studies have shown that patients may develop allergic reactions to propylene glycol following repeated dermal applications<sup>21</sup>. Although most dermal reactions associated with the substance result from irritation, true immunological reactions have been confirmed through patch testing<sup>22</sup>. Some individuals are allergic to propylene glycol so exposure to the substance can lead to allergic reactions such as irritation of the airways and airway obstruction<sup>2</sup>. Further research is still needed to determine if propylene glycol could induce allergic reactions via inhalation from e-cigarettes<sup>23</sup>.

Moreover, data have shown that exposure to ultrafine particles like metals such as nickel, chromium, and manganese could also play a role in producing this inflammatory reaction, which can have the potential to induce several side effects, including irritations of the mucous membranes of the eyes and upper respiratory tract<sup>6</sup>. In this context, chronic exposure to nickel is known to cause allergic asthma, rhinitis, chronic sinusitis, bronchitis, and dermatitis<sup>24</sup>. A recent systematic review reported five cases of allergic contact dermatitis associated with nickel<sup>25</sup>. In all cases, the dermatitis was treated similarly to the present case report, by avoiding contact with e-cigarettes.

Nicotine exposure can also lead to throat irritation. E-cigarettes come in four generations, and while they share a common operating system, each generation has its own unique characteristics. The 1<sup>st</sup> and 2<sup>nd</sup> generations of e-cigarettes are more likely to contain a nicotine-free base. Alkaline free-base nicotine is bitter and irritates the airways<sup>5</sup>. The 3<sup>rd</sup> and 4<sup>th</sup> generations, which are the most recent, may contain nicotine salt. This type of nicotine is the combination of a nicotine-free base with an acid (the acid can vary). Nicotine salt is less bitter and less irritant. Instead, it is sweeter, smoother, and more palatable<sup>5</sup>.

E-cigarettes and cannabis have shown similar trends in use among adolescents, as these two substances are the most used drugs among youth. Studies have indicated that an e-cigarette user is more likely to also use cannabis<sup>26</sup>. Our patient was smoking cannabis and did not use an electronic device to consume the product. However, there are several e-cigarette devices available for consuming cannabis. While more research is needed to establish the health effects of concurrent cannabis and e-cigarette use, studies have shown that using these

products simultaneously leads to increased substance use and mental health problems, learning and memory issues, nicotine addiction, difficulties in quitting tobacco smoking, and reduced motivation to quit<sup>27</sup>. Moreover, exposure to tobacco or marijuana smoke, or e-cigarette aerosols, can cause vascular endothelial dysfunction. The use of conventional cigarettes and/or e-cigarettes impairs blood vessel function and increases various signs of inflammation. A recent study suggested that acute endothelial dysfunction caused by various products is not due to a single substance or class of substances but rather to a mechanism dependent on the vagus nerve, resulting from airway irritation<sup>28</sup>.

It is important to highlight three key aspects of the diagnosis and treatment in this case report. First, we conducted a thorough review of the patient's laboratory test results and medical records. Second, understanding the patient's vaping habits was crucial to identifying the source of his symptoms. Third, effective communication played a vital role in educating the patient about the risks of vaping and encouraging healthier behaviors.

To gather comprehensive information about the patient's vaping habits, we asked specific questions, as detailed in Supplementary Material 1.

We explored the following topics:

1. The duration of their vaping habit;
2. The brand of the vaping device, which is crucial for obtaining more information about the specific device, including the capsule volume and nicotine concentration, as different types may be available under the same brand;
3. The volume of the capsule/device and the nicotine concentration;
4. The type of device (whether it is rechargeable or disposable);
5. The frequency with which the patient needed to purchase a new device or recharge it. This question was particularly significant, as the patient reported depleting a single charge within the same day, indicating a high usage pattern. For context, a device with an 11 mL liquid capacity can yield up to 3,000 puffs, while a conventional cigarette typically provides about 20 puffs before it is finished;
6. The volume of the capsule/device and/or the nicotine concentration;
7. The flavors the patient typically purchases; and
8. How the device is disposed of once it is empty.

This approach is based on the method suggested by Lee<sup>9</sup> and aligns with a recently published strategy by our group<sup>29</sup>. We emphasize the importance for health-care professionals to collect detailed information about e-cigarette use, in addition to traditional inquiries about smoking and drinking habits<sup>29</sup>. This is crucial for understanding the short- and long-term health implications for patients. We outline key aspects that should be explored and documented in medical and dental records.

A limitation of this case report was the fact that the patient was emotionally affected by the events in his life. He was still extremely anxious because he was afraid that he might have oropharyngeal cancer. This prevented us from exploring the patient's vaping habit in more detail. Moreover, at the follow-up visit he had stopped using the e-cigarette and did not bring the device he used. Thus, we could not obtain more specific information about the device and the brand.

## CONCLUSION

This case illustrates the importance of documenting patients' vaping habit. This information was essential to better understand the source of the throat irritation in the patient. As health professionals it is our duty to educate the patients about e-cigarettes, this is important to encourage better health behaviors. That said, we encourage dental practitioners to document patients' vaping habits, educate them about e-cigarettes and the possible complications associated with the habit.

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## AUTHORS' CONTRIBUTIONS

**BNFLM:** conceptualization, formal analysis, investigation, methodology, writing – original draft, writing – review & editing. **CAM:** writing – original draft, writing – review & editing. **AV:** conceptualization, formal analysis, investigation, methodology, resources, supervision, visualization, writing – original draft, writing – review & editing.

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