


Chemical Pneumonia Associated with Electronic Cigarette Use: An Article Review

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ABSTRACT

The use of electronic cigarettes has gained worldwide popularity as an alternative to conventional cigarettes, often promoted as a less harmful option for health. However, growing evidence associates the use of these devices with a range of respiratory complications, including lipoid pneumonia and other forms of acute lung injury. This study reviews the existing literature on the role of electronic cigarettes in the pathogenesis of pneumonia, highlighting the biological mechanisms involved, the impact of chemical components in the liquids used and the clinical implications. The analysis points to the need for stringent regulation and greater public awareness regarding the risks associated with electronic cigarette use.

Keywords: Pneumonia; Electronic cigarette; Pleural effusion; Lung injury

Introduction

Electronic cigarettes, initially marketed as less harmful devices, have gained a diverse audience, particularly among young people and former smokers^{1,2}. These devices deliver nicotine through the vaporization of liquids containing solvents, flavorings and other chemicals. However, recent studies have linked the use of these devices to severe lung injuries, particularly EVALI (e-cigarette or vaping product use-associated lung injury)^{3,4}. Chemical pneumonia is one of the most reported conditions among users, characterized by pulmonary inflammation caused by inhaling toxic agents present in aerosols⁵⁻⁷. Among the suspected elements are vitamin E acetate,

used as a thickener in THC-containing liquids and other chemical additives. These compounds can trigger acute inflammation, damage the epithelial barrier of the lungs and impair respiratory function. Clinical cases show patients presenting symptoms such as cough, dyspnea and chest pain, often accompanied by radiological findings of ground-glass opacity, commonly seen in severe inflammatory conditions⁸.

Despite advancements in the diagnosis and management of EVALI, significant gaps remain regarding the exact mechanisms of toxicity and the long-term effects of using these devices. This review aims to compile updated information on the respiratory impacts of electronic cigarette use, exploring the relationship

between exposure to its components and the occurrence of chemical pneumonia⁹.

Objective

This study aims to review the scientific literature on the association between electronic cigarette use and pneumonia, identify the main pathophysiological mechanisms involved and describe the clinical and diagnostic manifestations of the condition.

Materials and Methods

A review was conducted in the PubMed, Scielo and Web of Science databases. Inclusion criteria were articles published between 2010 and 2024, written in English, Portuguese or Spanish.

Discussion

Studies indicate that electronic cigarette use can cause chemical pneumonia due to the inhalation of toxic compounds present in the liquids used¹⁰. Vitamin E acetate, frequently found in illegal e-cigarette liquids, has been linked to severe lung injury cases. Additionally, compounds like formaldehyde and heavy metals can induce intense inflammatory reactions in the lungs¹¹. Clinical presentations vary, ranging from mild respiratory symptoms to severe respiratory failure. Main symptoms include dyspnea, fever, chest pain, cough and, in severe cases, respiratory failure. Radiological imaging often reveals diffuse pulmonary opacities¹². Diagnosis relies on a combination of detailed clinical history, imaging exams like computed tomography and the exclusion of other causes. Differential diagnosis includes bacterial, viral, fungal pneumonia and other pulmonary conditions.

Treatment generally includes ventilatory support and corticosteroids, though no universal protocol has been established. From a regulatory perspective, the lack of standardization in the production and commercialization of e-cigarette liquids contributes to exposure to harmful substances¹³. Efforts should focus on stricter regulation and public education to mitigate these risks. The use of electronic cigarettes can lead to lipid deposition in the alveoli, resulting in lipoid pneumonia. Components such as propylene glycol, glycerol and essential oils are suspected contributors to this deposition. Furthermore, *in vitro* studies have demonstrated that aerosols released by electronic cigarettes increase oxidative stress and inflammation in lung tissues, predisposing them to injury.

E-cigarette liquids contain a mix of chemicals, including nicotine, flavorings and heavy metals. When heated, these liquids can release toxic compounds that exacerbate lung toxicity^{14,15}. Prolonged exposure to these products has resulted in cases of acute respiratory distress syndrome (ARDS) associated with pneumonia. Recent studies report a significant increase in lipoid pneumonia and lung injury cases linked to electronic cigarette use, particularly in young adults without prior respiratory conditions. Cases of EVALI have also been widely documented in the United States¹⁶.

Conclusion

The use of electronic cigarettes represents an emerging public health concern. The association between these devices and conditions like chemical pneumonia highlights the need for strict

regulation and educational campaigns. Identifying agents like vitamin E acetate as potential causes of lung injury reinforces the importance of future investigations. Preventive measures, such as banning toxic substances in vaping products, are essential to reduce vaping-related risks. Despite advancements, gaps remain. Longitudinal studies are needed to assess the long-term effects of electronic cigarette use and better understand the toxicity of chemical additives. In this context, healthcare professionals must remain vigilant for clinical signs of EVALI and reinforce messages about the risks of vaping, especially among vulnerable populations.

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