


Necrotizing Pneumonia: A Rare Complication of Pneumonia in Child Who Used Vape Cigarette – A Case Report

Arya Marganda Simanjuntak[1], Riza Iriani Nasution[2], Elmi Ridar[3], Citra Cesilia[2], Riky Candra[1]

[1]Clinical Clerkship, [2]Pulmonary Division, [3]Oncology and Hematology Division, Department of Child Health, Faculty of Medicine, Riau University, Arifin Achmad General Hospital, Pekanbaru, Riau, Indonesia

ABSTRACT

Introduction: Necrotizing pneumonia (NP) is a severe complication of pneumonia characterized by lung parenchymal destruction, cavitation, and significant morbidity in children. It is commonly associated with virulent bacterial infections and inadequate response to initial antibiotic therapy. Certain risk factors, including exposure to cigarette smoke and electronic cigarettes (vaping), may influence immune defense mechanisms and contribute to disease severity. **Case:** A 15-year-old boy presented to the emergency room with shortness of breath, persistent fever, productive cough, and bloody sputum for 2 weeks. He had no history of TB contact but had used vape and smoke cigarettes regularly during the past year. Physical examination revealed tachypnea and rhonchi on auscultation. Chest radiography demonstrated extensive consolidation, and thoracic CT scan showed cavitary lesions consistent with necrotizing pneumonia. GeneXpert sputum testing was negative for *Mycobacterium tuberculosis*. The diagnosis was necrotizing pneumonia (NP). Broad-spectrum antibiotics and supportive management were administered. **Discussion:** Early recognition of NP in children is essential to prevent complications and prolonged hospitalization. Inhalational exposures such as vaping may compromise pulmonary defense and potentially exacerbate infectious processes. **Conclusion**: Necrotizing pneumonia should be suspected in children with severe pneumonia unresponsive to initial therapy. Timely diagnosis and appropriate management are critical to improving clinical outcomes. Vaping is likely to play a role in this rare complication because its chemicals can damage the pulmonary defense, making it susceptible to and potentially worsening infection. Future research and awareness towards vape health effects should be enhanced to suppress the use, especially in children.

Keywords: Case report, electronic cigarettes, necrotizing pneumonia, vape.

ABSTRAK

Pendahuluan: *Necrotizing pneumonia* (NP) merupakan komplikasi berat dari pneumonia yang ditandai dengan destruksi parenkim paru, pembentukan kavitas, serta morbiditas yang signifikan pada anak. Kondisi ini umumnya berhubungan dengan infeksi bakteri yang virulen dan respons yang tidak adekuat terhadap terapi antibiotik awal. Beberapa faktor risiko, termasuk paparan asap rokok dan rokok elektronik (vape), dapat memengaruhi mekanisme pertahanan imun dan berkontribusi terhadap beratnya penyakit. **Kasus**: Seorang anak laki-laki berusia 15 tahun datang ke unit gawat darurat dengan keluhan sesak napas, demam persisten, batuk produktif, dan hemoptisis selama 2 minggu. Tidak terdapat riwayat kontak tuberkulosis; namun pasien memiliki kebiasaan menggunakan vape dan merokok secara rutin dalam 1 tahun terakhir. Pemeriksaan fisik menunjukkan takipnea dan ronki pada auskultasi. Foto toraks memperlihatkan konsolidasi luas, dan *CT scan* toraks menunjukkan lesi kavitas yang konsisten dengan necrotizing pneumonia. Pemeriksaan sputum GeneXpert negatif terhadap *Mycobacterium tuberculosis*. Diagnosis ditegakkan sebagai *necrotizing pneumonia* (NP). Pasien mendapatkan terapi antibiotik spektrum luas dan penatalaksanaan suportif. **Pembahasan**: Pengenalan dini NP pada anak sangat penting untuk mencegah komplikasi dan perpanjangan masa rawat inap. Paparan inhalasi seperti vape berpotensi mengganggu pertahanan paru dan memperberat proses infeksi. **Kesimpulan**: *Necrotizing pneumonia* perlu dipertimbangkan pada anak dengan pneumonia berat yang tidak responsif terhadap terapi awal. Diagnosis yang tepat waktu dan penatalaksanaan yang sesuai sangat penting untuk memperbaiki luaran klinis. Penggunaan vape kemungkinan berperan dalam komplikasi yang jarang ini karena kandungan bahan kimianya dapat merusak pertahanan paru, sehingga meningkatkan kerentanan terhadap infeksi dan memperburuk perjalanan penyakit. Penelitian lanjutan serta peningkatan kesadaran mengenai dampak kesehatan vape perlu diperkuat untuk menekan penggunaannya, terutama pada anak-anak. **Arya Marganda Simanjuntak, Riza Iriani Nasution, Elmi Ridar, Citra Cesilia, Riky Candra. *Necrotizing Pneumonia*: Komplikasi Langka dari Pneumonia pada Anak yang Menggunakan Rokok Vape - Laporan Kasus.**

Kata Kunci: Laporan kasus, rokok elektrik, *necrotizing pneumonia, vape.*

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Alamat Korespondensi *arya.marganda@gmail.com*


INTRODUCTION

A very uncommon advanced type of pneumonia is necrotizing pneumonia (NP).[1] NP is regarded as a severe illness that necessitates extended hospital stays.[1] While parapneumonic effusion, empyema, lung abscess, and local complications are among the various kinds of complicated pneumonia that are still considered rare, the prevalence of pediatric NP has grown.[2] From 2006 to 2009, the percentage of NP incidence varied between 4.5% and 9%, and between 2009 and 2011, increased to 9%.[3] Although the underlying illness processes are not well known, they most likely have to do with a combination of bacterial virulence factors and host susceptibility factors, with potential viral–bacterial interactions.[2]

Electronic ciggarettes, commonly known as vapes, have become risk factors to this disease. Vitamin E acetate in vape may damage surfactant and result in reduced lung function.[4] Furthermore, the liquid content is ambiguous, which allows different chemicals to harm the lungs. According to Simanjuntak's 2023 literature review,[4] these substances include nicotine, propylene glycol (PG), dialethyl, metals and metalloids, and other substances that can impair lung defense and function. Users of vape devices are therefore far more susceptible to infection and other harm, such as E-Vaping Acute Lung Injury (EVALI).[4] This case is a 15-year-old boy with severe lung damage and a history of vape use, with potential for pneumonia complications.

CASE

A 15-year-old boy presented with complaints of shortness of breath for 2 weeks, increased in the last 2 days. The shortness of breath was not triggered by activity, weather, and temperature changes, accompanied by a cough with little phlegm and very difficult to expel. Fluctuated fever was also felt for 2 weeks, self-treated with acetaminophen. Weight loss was denied, but he was underweight. The patient and family did not have a history of using anti-tuberculosis drugs and no history of contact with other TB patients in the neighborhood. The patient had come to his neighborhood hospital and a chest x-ray was done **(Figure 1A)** revealing lung infiltrates. The patient was then referred to Arifin Achmad General Hospital. The patient has a habit of smoking e-cigarettes (vapes) and conventional cigarettes, 5 cigarettes per day, for 4 years. The vape belongs to his friend and used alternately for approximately one year. The patient uses a vape with different types of mods and pods as well as liquid of unknown content.

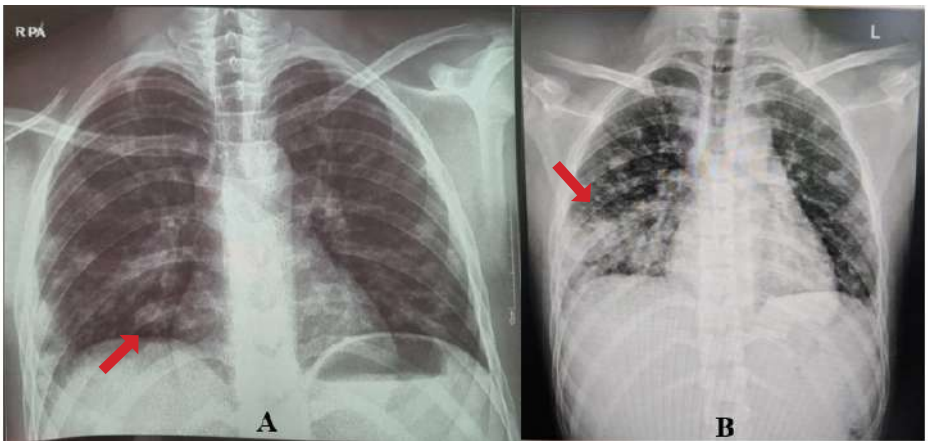

Photo documentation by Citra Cesilia.

Figure 1. Chest x-ray of the patients; (A) A day before admission, and (B) At admission. Red arrow signifies infiltrates.

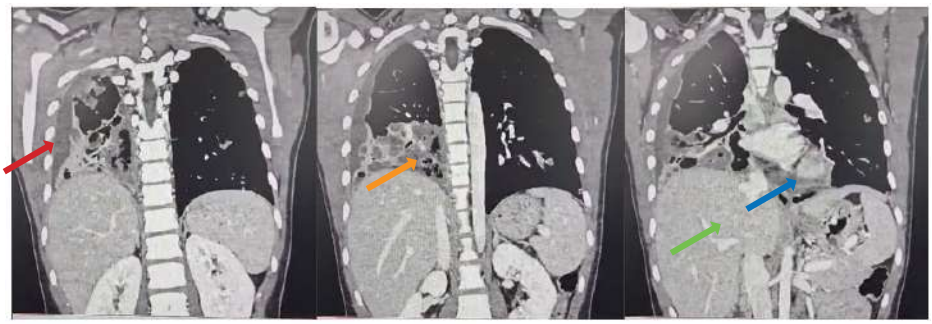

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Figure 2. CT scans with and without contrasts found multiple cavitary nodules in both lung fields accompanied by consolidation in the lower right lobe (orange), pleural effusion (red), pericardial effusion (blue), and hepatomegaly (green).

The patient's vital signs were within normal limits with a body weight of 48 kg and height of 158 cm. Physical examination of the thorax found no chest wall retraction, right and left vesicular lung sounds with fine rhonchi in both lung fields without wheezing. The patient's blood test results found leukocytosis (28,420/uL) with increased neutrophils (79.6%) and monocytes (12.2%). HIV test was negative. Chest x-ray **(Figure 1B)** after 2 days, revealed infiltrates and multiple nodules in both lungs, suspected as metastasis. Consultation with pediatric oncology-hematology did not find the primary cause. Sputum culture found *Klebsiella pneumoniae* and *Salmonella spp* isolates and GeneXpert results were negative for *Mycobacterium tuberculosis*. Sputum culture showed multi resistance to various antibiotics but still sensitive to meropenem. Thorax CT-Scan with and without contrast was performed **(Figure 2)** and revealed multiple cavitary nodules in both lungs with consolidation in the inferior right lobe with pleural effusion, pericardial effusion, left subclavian vein thrombus and hepatomegaly. The patient was diagnosed as necrotizing pneumonia (NP). The therapy consists of KaEn 2A infusion 25 drops/min, meropenem 3 x 750 mg intravenous, fluconazole 1 x 500 mg intravenous, methylprednisolone 3 x 16 mg intravenous. The patient was discharged after 15 days with general improvement and normal blood laboratory results. Clinical and x-ray evaluation was scheduled in the next 1 month.

DISCUSSION

The suspected diagnosis was tuberculosis. But an in-depth history, TB score assessment and GeneXpert found no evidence of


tuberculosis. Further investigations revealed that he used conventional cigarettes and e-cigarettes alternately with his friend for about a year. Previous chest X-ray did not show any suspicion of a severe lung infection, but the patient appears to be clinically worse. A repeat x-ray showed a widespread lung damage. Interpretations from radiology suggest a possible lung metastasis, so the case is further investigated by pediatric oncology-hematology division. Sputum sample culture along with GeneXpert were ordered to look for possible infection.

Diagnosis of NP is primarily based on clinical presentation, imaging findings, and microbiological evidence.[1] The patient presented with shortness of breath, fever, and cough for 2 weeks, indicative of a severe respiratory infection.[1,2] TB as the primary diagnosis may be excluded due to absence of weight loss and lack of TB contact history. Physical examination revealed bilateral rales and leukocytosis with neutrophilia, pointing towards a bacterial infection. Radiological findings of cavitary nodules, consolidations, and pleural and pericardial effusions, combined with the isolation of *Klebsiella pneumoniae* and *Salmonella spp.* in sputum culture, confirmed the diagnosis. While these pathogens are rare causes of NP in children, history of vaping likely contributed to compromised lung defenses, exacerbating the infection and enabling rapid progression.[3]

E-cigarettes (vapes) use has become a significant concern due to its potential link to lung and airway diseases. Vaping involves inhaling aerosolized liquid, often containing nicotine, flavorings, and other chemicals.[5-7] This practice has increased among teenagers and children, with alarming rates, particularly among adolescents.[8,9] The impact on lung can be severe, with evidence to chronic respiratory conditions such as bronchitis, lung inflammation, and more severe diseases like chronic obstructive pulmonary disease (COPD) or increased susceptibility to infections.[4,10,11] The long-term effects are still being studied, but early findings indicate lung tissue damage, impaired lung function, and increased risk of chronic lung diseases.[4,5]

The use of both conventional cigarettes and electronic cigarettes by the patient became the key consideration. The shared and prolonged use of vape devices with unknown liquid content introduced potential factors for lung damage. Research on the impact of vaping on health is still ongoing. In vape use, the various chemicals contained in the liquid can lower the host's defense through damage to the integrity of the lung layer, decreased macrophage function, reduced pulmonary clearance and immunity.[4,5] These changes compromise the lungs' ability to clear pathogens.[4,11] These factors collectively increase susceptibility to infections and exacerbate lung damage, as observed in this case.

NP is rare in children, with incidence rates reportedly rising from 4.5% to 9% over recent years.[3] This trend may correlate with emerging risk factors like vaping.[3] The rapid progression observed in this case highlights the importance of recognizing vaping as a potential contributor to severe lung pathology. As Simanjuntak, *et al*., (2023) noted, substances in vape liquid, such as nicotine, propylene glycol, and metals, can significantly impair lung defense mechanisms.[4] Raduka, *et al*., (2023) found that the use of vapes can cause dysfunction and damage to the respiratory tract epithelium, increasing the intensity of infection.[11] This case initially had a radiological picture of lung inflammation **(Figure 1A)**, then had a significant change **(Figure 1B)**; the causative factor still has to be investigated.

The most common NP pathogens are *Streptococcus pneumoniae*, *Staphylococcus aureus*, and *Klebsiella pneumoniae*.[12,13] While these pathogens are not typically associated with necrotizing pneumonia in healthy children, they can exploit compromised lung defenses.[4,6] The identification of *Klebsiella pneumoniae* and *Salmonella spp* in the patient's sputum further supported the role of secondary infection. It reinforces the damage and decrease in lung immunity function, and triggered more serious damage.[3,6]

The association between vaping and the risk of lung complications, particularly NP, is increasingly evident through case studies and research.[3] These effects can be especially pronounced in children with still developing lungs. This case illustrates this risk, as he developed extensive lung damage and was diagnosed with NP caused by *Klebsiella pneumoniae* and *Salmonella spp*., likely exploiting the vaping-compromised lung environment. The rapid progression of symptoms, as evidenced by imaging and clinical findings, highlights vaping's potential to exacerbate lung injury and promote opportunistic infections.[11-15]

Vape use caution has also been socialized by the World Health Organization (WHO) on various social media platforms. Public health efforts must address the growing use of vaping among adolescents.[14] Education campaigns targeting youth and parents should emphasize the risks associated with e-cigarettes, including their potential to cause severe lung complications like necrotizing pneumonia.[14,15] Additionally, stricter regulations on e-cigarette products, including clear labeling of liquid contents, are necessary to reduce exposure to harmful substances. Further research is crucial to deepen our understanding of vaping's impact on pediatric lung health. Studies should explore molecular mechanisms of lung damage, interactions between vaping and specific pathogens, and long-term outcomes in affected children.[14,15] This case underscores the urgent need for robust data to guide clinical management and prevention strategies.

CONCLUSION

Necrotizing pneumonia is a rare but serious complication in children, with an increased risk in the presence of predisposing factors such as impaired immunity. Vape use may compromise immune function and weaken pulmonary defense mechanisms, potentially contributing to severe lung infections in pediatric patients. Greater caution regarding e-cigarette use among children and adolescents is therefore warranted to prevent severe and potentially persistent pulmonary complications. Necrotizing pneumonia may occur in children who use e-cigarettes, and increased awareness as well as further research are needed to better clarify the impact of vape exposure on pediatric lung health.


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