

Acute eosinophilic pneumonia following heat-not-burn cigarette smoking

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Keywords

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Abstract

A 20-year-old man was admitted with acute respiratory failure. He had started smoking 20 heat-not-burn cigarettes (HC) per day 6 months previously, then purchased a second device for smoking HC to increase smoking to 40 cigarettes per day 2 weeks before hospitalization. Acute eosinophilic pneumonia (AEP) was diagnosed based on medical history, chest high-resolution computed tomographic findings, and bronchoalveolar lavage fluid eosinophilia. On starting treatment with prednisolone, the patient exhibited complete recovery. A relationship between cigarette smoking and AEP has been suggested. HC were released in September 2015 in Japan, Italy, and Switzerland. HC attract attention as a cigarette generating less harmful substances than a conventional cigarette. We herein report the first case of AEP caused by smoking HC. HC are expected to spread around the world. In the same way as a conventional cigarette, HC should be recognized as a potential cause of AEP.

Introduction

Acute eosinophilic pneumonia (AEP) is a rare disorder characterized by hypoxemia, pulmonary infiltrates, and pulmonary eosinophilia. AEP occurs secondary to drug exposure or hypersensitivity reactions to an inhaled antigen. Tobacco smoking is one of the main causes of AEP [1,2].

Heat-not-burn cigarettes (HC) were released in September 2015 in Japan, Italy, and Switzerland, and spread explosively (Fig. 1). Use of HC results in reduced levels of a wide range of toxicologically important cigarette smoke and harmful and potentially harmful constituents (HPHCs), and significantly lowers the biological activity of mainstream smoke compared to conventional lit-end cigarettes in laboratory-based test systems and in clinical trials [3,4]. However, HC contain HPHCs and their potential risk remains known. We herein report the first case of AEP caused by smoking HC.

Case Report

A 20-year-old man presented with fever and shortness of breath since the previous night. He was not on any

medication including over-the-counter drugs, Chinese herbal medicines, or supplements. He had no history of dust inhalation, and he kept no pets. He had started smoking 20 cigarettes of HC per day 6 months previously and then he purchased a second device for smoking HC to increase smoking HC to 40 cigarettes a day 2 weeks before hospitalization. On physical examination, no wheezes were heard but fine crackles were heard in both sides of the posterior chest; however, there were no findings of skin eruption or arthritis. Chest radiograph showed bilateral opacities (Fig. 2A) and chest high-resolution computed tomography revealed bilateral infiltrations, smooth interlobular septal thickening, and pleural effusion (Fig. 2B). White blood cell count was $15,690/\text{mm}^3$, with 88% neutrophils, 7% lymphocytes, and 1% eosinophils. The results of routine blood chemistry tests were within normal range, except for C-reactive protein levels of 10.12 IU/L mg/dL. Immunoglobulin E was within normal range. The arterial blood gas analysis, performed with the patient breathing 10 L oxygen with non-rebreathing mask, revealed PaO_2 , 90.3 Torr with PaCO_2 as 38.0 Torr and pH as 7.412. The BAL returns were not increasingly haemorrhagic. The cells recovered



Figure 1. How to smoke the heated-not-burn cigarette (HC). The HC is heated in the device and people smoke in the same way as smoking conventional cigarettes.

from the bronchoalveolar lavage fluid (BALF) were $8.6 \times 10^5/\text{mL}$, which comprised 60% eosinophils, 20% lymphocytes, 15% macrophages, and 5% neutrophils. Microorganisms including fungi were not identified in the BALF culture. AEP was diagnosed and we started treatment with prednisolone 2 weeks treatment course as reported by Rhee et al. [2]. On the fourth day, the abnormal shadows on the chest X-ray film improved remarkably (Fig. 2D), and oxygen treatment was no longer necessary. No relapse was observed after cessation of taking prednisolone.

Discussion

The exact aetiology of AEP is unknown. However, a relationship between cigarette smoking and AEP has been suggested [1,2]. In the study carried out by Uchiyama et al., around 70% of the patients who

developed AEP just began smoking and AEP was induced by cigarette smoking provocation test in 100% of the cases [1].

Although the relationship between the amount of inhaled antigen and pathogenesis in AEP is unknown, we believe that the rapid increase in amount of HC smoking caused AEP in this case. Rhee et al. reported that in the month prior to developing AEP, 13 of 125 (10.4%) had increased the number of cigarettes smoked per day [2]. Of the 125 patients who had recently changed their smoking habits, the time from initiation of smoking or increased number of cigarettes to presentation of symptoms was 17 (13–26) days [2].

HC is a device which distributes tobacco smoke with a reduction in HCPCs through heating but not burning the tobacco. By heating tobacco, the temperature reached is lower than that reached in the burning cone of a conventional lit-end cigarette. This results in reduction in the levels of HPHCs [3]. Results from clinical trials of HC have been demonstrated in Japan, which examined the changes in concentration of HPHCs in blood and urine by switching from conventional cigarettes to HC or no-smoking [4]. In this trial, though switching to HC reduced the concentration of HPHCs, a smaller reduction in concentration of HPHCs was observed in the HC group than in the no-smoking group. Clinical trials of HC in the United Kingdom, Korea, and Poland have also shown similar results. In these trials, no side effects of HC were reported. We should recognize that smokers of HC are surely exposed to harmful contents.

Like electronic cigarettes which have also been reported as a possible cause of AEP [5], HC are expected to spread around the world. There is a possibility that young patients who start smoking with HC do not recognize HC as cigarettes. We have to recognize HC as cigarettes and a potential cause of AEP.

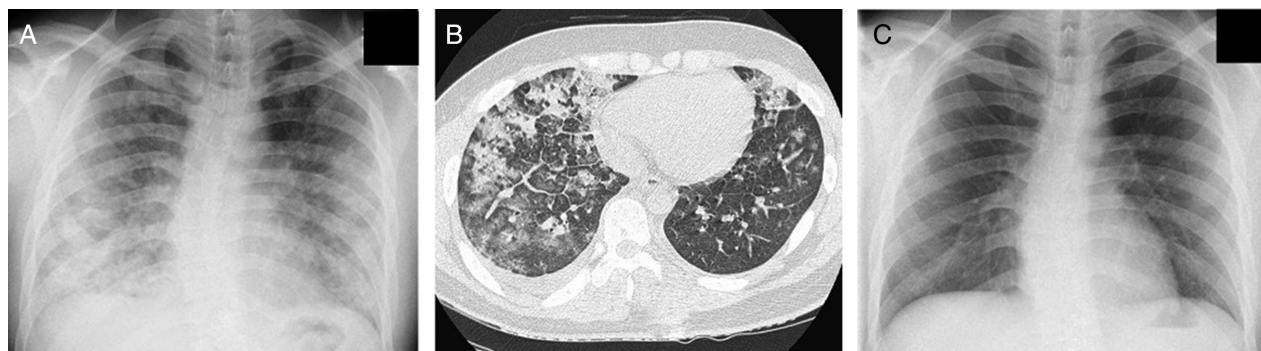


Figure 2. (A) Initial chest radiograph reveals bilateral opacities; (B) corresponding high-resolution computed tomography revealed bilateral infiltrations, smooth interlobular septal thickening, and bilateral pleural effusion; and (C) chest radiograph on day 4 indicating clearing.

Disclosure Statements

No conflict of interest declared.

Appropriate written informed consent was obtained for publication of this case report and accompanying images.

References

1. Uchiyama H, Suda T, Nakamura Y, et al. 2008. Alterations in smoking habits are associated with acute eosinophilic pneumonia. *Chest* 133:1174–1180.
2. Rhee CK, Min KH, Yim NY, et al. 2013. Clinical characteristics and corticosteroid treatment of acute eosinophilic pneumonia. *Eur. Respir. J.* 41:402–409.
3. Werley MS, Freelin SA, Wrenn SE, et al. 2008. Smoke chemistry, in vitro and in vivo toxicology evaluations of the electrically heated cigarette smoking system series K. *Regul. Toxicol. Pharmacol.* 52:122–139.
4. Tricker AR, Kanada S, Takada K, et al. 2012. Reduced exposure evaluation of an electrically heated cigarette smoking system. Part 5: 8-day randomized clinical trial in Japan. *Regul. Toxicol. Pharmacol.* 64 (Suppl.):S54–S63.
5. Thota D, and Latham E 2014. Case report of electronic cigarettes possibly associated with eosinophilic pneumonitis in a previously healthy active-duty sailor. *J. Emerg. Med.* 47:15–17.