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Case report

Acute eosinophilic pneumonia following aromatherapy with essential oil

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ABSTRACT

Essential oils are liquid extracts of various plants with potential health benefits and are often used in aromatherapy. Contact allergy, including skin irritation, is a well-known side effects of these extracts. A Japanese woman visited our emergency department complaining of dyspnea, cough, and fever. Two weeks earlier, she had started aromatherapy using a humidifier and essential oil. Based on clinical and imaging findings, and the results of bronchoalveolar lavage, we diagnosed acute eosinophilic pneumonia due to inhalation of essential oil. Her symptoms resolved after steroid therapy. This case makes the clinicians aware the possibility of acute eosinophilic pneumonia induced by aromatherapy using essential oil.

1. Introduction

Acute eosinophilic pneumonia (AEP) is an eosinophilic lung disease associated with environmental substances such as tobacco smoke. Many causative agents have been reported [1,2,3,4]. Botanical essential oils are concentrated plant extracts that can be used in aromatherapy, which is used for relaxation and treatment of anxiety [5]. This report presents the case of a Japanese woman who developed acute respiratory failure following aromatherapy using an aroma humidifier and essential oil.

2. Case presentation

An otherwise healthy 35-year-old Japanese woman who had never smoked, presented to our emergency department with complaints of dyspnea, cough, and fever. Two weeks earlier, she had started aromatherapy using an aroma humidifier and an essential oil extracted from lavender. She did not have any allergic disease such as asthma or other atopic disease. There was no history of medication or health supplement use or contact with animals.

On admission, she had a temperature of 36.5 °C, blood pressure of 125/78 mmHg, pulse rate of 95 beats/min, and respiratory rate of 22 breaths/min. Oxygen saturation was decreased to 88% on room air. On physical examination, the lungs were clear to auscultation bilaterally. There were no abnormal neurological findings. Skin rash and lymphadenopathy were not seen.

Laboratory findings showed an elevated C-reactive protein level. Lactate dehydrogenase, surfactant protein-D, Krebs von den Lungen-6 levels and Brain natriuretic hormone were within normal limits. A radioimmunosorbent test for IgE was normal. Auto-

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immune antibodies were negative. Sputum culture were negative for bacteria and acid-fast bacilli. There were no fungal isolates. Cardiac function was maintained by cardiac ultrasound. Chest radiographs revealed opacities in the right upper and left lower lung fields (Fig. 1). Chest computed tomography revealed bilateral ground-glass opacities and bilateral pleural effusion (Fig. 2).

Bronchoalveolar lavage fluid (BALF) was obtained from the right B⁴ bronchus. The results were as follows: total cell count 1.4×10^5 /mL, macrophages 22%, eosinophils 55%, and lymphocytes 17% (Fig. 3). Gram staining and cultures of BALF were negative for bacterial, fungal, mycobacterial, and viral pathogens. However, a drug lymphocyte stimulation test (DLST) for botanical essential oil in peripheral blood was positive (stimulation index 432%). A diagnosis of AEP was made using the criteria proposed by De Giacomo et al., in 2018 [4]. The findings in our patient met all these criteria, namely, acute onset of respiratory failure, diffuse pulmonary infiltrates on chest radiography, a differential cell count in BALF showing eosinophilia >25%, and no known cause of eosinophilic pneumonia, such as medication, infection, or multisystem disorders. Therefore, we made a diagnosis of AEP induced by aromatherapy with inhalation of botanical essential oil.

Prednisolone was administered, starting at 25mg per day for 7 days. Her symptoms of fever and cough improved, as did her blood eosinophilia and opacities in both lungs. Thereafter, the dose was tapered by 5mg per week while her response was observed. She required no further systemic corticosteroids during outpatient follow up. There has been no recurrence of AEP in 2 years.

3. Discussion

It has been suggested that AEP is an acute hypersensitivity reaction to an inhaled antigen, such as tobacco smoke, in an otherwise healthy individual. Although various etiologies for AEP have been reported, the exact cause of AEP remains unknown.

Botanical essential oils are widely used for aromatherapy. Although the therapeutic claims for aromatherapy are not well supported by clinical studies, aromatherapy has been used in the treatment of anxiety and pain states, such as postoperative pain and cancer-related pain [6,7].

According to a systematic review of the adverse effects of aromatherapy, the most common adverse effect of therapeutic use of essential oil is dermatitis. Several cases of dyspnea have also been reported [8]. However, it is unclear whether those cases involved AEP.

Our patient used an aroma diffuser for aromatherapy. Therefore, the route of administration was inhalation. A differential diagnosis was ultrasonic humidifier lung, which is a rare form of hypersensitivity pneumonitis. Humidifier lung is a term used to describe hypersensitivity pneumonitis caused by inhalational exposure to contaminated ventilation units. Water in ultrasonic humidifiers that are not carefully cleaned is easily contaminated with microorganisms, including bacteria, fungi, and nontuberculous bacteria. Generally, prolonged exposure to a contaminating fungal or bacterial antigen results in immune sensitization and causes immune-mediated lung injury in susceptible individuals [9].

According to the clinical interview, the patient used the diffuser and botanical essential oil for the first time after purchasing them together. Culture of the tap water remaining in the diffuser grew *Stenotrophomonas maltophilia*, which has not previously been associated with humidifier lung. A predominance of lymphocytes and macrophages is usually found in BALF from patients with hypersensitivity pneumonia [10,11]. The most common chest CT findings for humidifier lung were faint ground-glass opacities and mosaic attenuation. Pleural effusion was not usually seen [11]. Therefore, we consider that a diagnosis of humidifier lung was unlikely.

Although a drug provocation test is useful for identifying the causative agents of AEP and hypersensitivity pneumonitis [1,2,10,11], we did not perform a challenge test in our patient for ethical reasons.

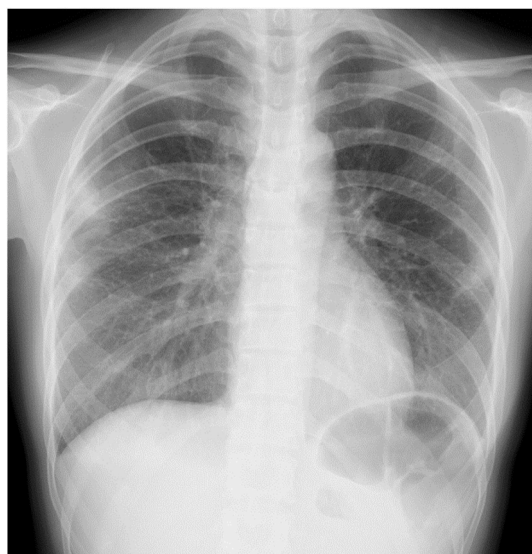


Fig. 1. Chest radiograph showed ground glass opacities in both middle lung fields.

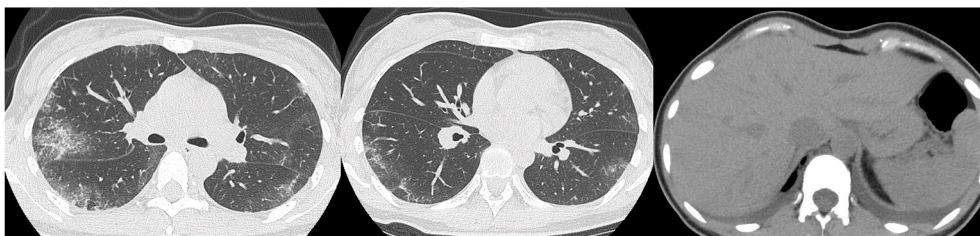


Fig. 2. The thin-slice chest computed tomography showed bilateral patchy area of ground-glass opacities and interlobular septal thickening with subpleural distribution and pleural effusion.

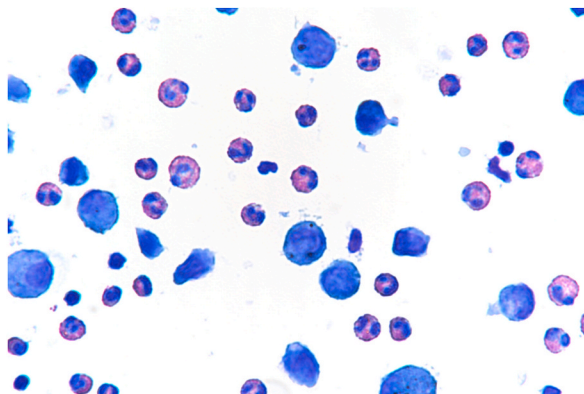


Fig. 3. Giemsa stain of the bronchoalveolar lavage fluid. Representative image showed many eosinophils. Original magnification, $\times 800$.

We performed a DLST for botanical essential oil as a reference finding. According to a review, a DLST is positive if the stimulation index is more than 300% [12]. In our case, the stimulation index was 432%. Therefore, we considered the DLST positive as the reference finding of essential oil induced AEP.

In recent years, a few cases of AEP associated with aromatherapy using essential oil have been reported [13,14]. However, this is not yet known to clinicians. The use of aromatherapy has expanded and the number of AEP cases associated with it is expected to increase. The possibility of AEP induced by this type of aromatherapy should be kept in mind.

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Declaration of competing interest

All authors do not have any conflict of interests.

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