

Diagnostic pitfalls of acute eosinophilic pneumonia in an adolescent boy following cigarette smoking

A case report

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Abstract

Rationale: Acute eosinophilic pneumonia (AEP) is characterized by acute febrile respiratory symptoms, bilateral lung infiltrates, and pulmonary eosinophilia. AEP is closely related to cigarette smoking but is rarely suspected in pediatric cases despite the fact that there is a relatively high incidence of cigarette smoking among adolescents in Taiwan.

Patient concerns: We report a case of a previously healthy 15-year-old boy who presented with fever and acute progressive dyspnea. Due to lack of awareness of cigarette smoking history in adolescents and the nonspecific signs and symptoms of AEP at early stages, the patient was initially treated as community-acquired pneumonia (CAP) but was unresponsive to antibiotics treatment.

Diagnoses: A combination of a recent onset smoking history and pulmonary eosinophilia on bronchoalveolar lavage confirmed the diagnosis of cigarette-induced AEP.

Interventions: Corticosteroid treatment was prescribed.

Outcomes: The condition improved within 24 hours, with resolution of alveolar infiltrates on chest radiographs.

Lessons: With the increasing incidence of smoking amongst adolescents in Taiwan, careful history questioning regarding cigarette smoking is necessary. Due to similarities in initial clinical and radiographic features of AEP and CAP, adolescents with suspected CAP who are unresponsive to antibiotic treatment but have a subsequent rise in peripheral eosinophils should raise the clinician's suspicion of AEP related to cigarette smoking.

Abbreviations: AEP = acute eosinophilic pneumonia, BAL = bronchoalveolar lavage, CAP = community-acquired pneumonia.

Keywords: acute eosinophilic pneumonia, adolescent, cigarette smoking

1. Introduction

Acute eosinophilic pneumonia (AEP) is characterized by acute febrile respiratory symptoms, bilateral lung infiltrates and pulmonary eosinophilia.^[1] AEP is highly associated with cigarette smoking but is rarely reported in pediatric cases. Clinical features of AEP at early stages resemble those of community-acquired pneumonia (CAP), hence frequently resulting in delayed diagnosis.

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Herein, we present a case of AEP in a 15-year-old adolescent boy who was initially misdiagnosed as CAP but re-evaluation of the patient's history led to eventual diagnosis of cigarette-induced AEP.

2. Case report

A previously healthy 15-year-old boy presented to the Emergency Department for the chief complaint of shortness of breath for one day. He reported a sudden onset of mild chest pain, accompanied by mild cough. The patient had no fever or other systemic symptoms and also denied any personal and family history of any allergic conditions.

On arrival at the emergency department, the patient's initial vital signs revealed tachycardia and tachypnea. Arterial blood gas determination on room air showed pH of 7.451, PaCO₂ of 34.4 mm Hg, PaO₂ of 55.1 mm Hg, HCO₃⁻ of 23.4 mmol/L and saturation of 90.6%. Physical examination revealed bilateral coarse crackles breathing sounds without wheezing. Laboratory data revealed leukocytosis of 20.8 × 10³ cells/μL, with 83% segments, 9% lymphocytes, and 8% monocytes. Chest radiograph showed increased perihilar infiltration, without signs of cardiomegaly and pleural effusion (Fig. 1A).

After admission, patient developed fever and worsening hypoxemia. Follow-up chest radiograph on the first hospital day revealed bilateral perihilar infiltration with right lower lobe



Figure 1. Patient's chest x-ray image: (A) At the emergency department: increased perihilar infiltration, without signs of cardiomegaly and pleural effusion, and (B) after admission: bilateral perihilar infiltration with right lower lobe consolidation. Bronchoalveolar lavage (C) revealed 88% eosinophils, 7% neutrophils, and 5% lymphocytes.

consolidation (Fig. 1B). Due to suspected bacterial pneumonia, the patient received antibiotic therapy. However, patient's symptoms persisted despite two days of antibiotic treatment. Laboratory tests were re-checked, which showed normal white blood cells count of 6.4×10^3 cells/ μL with eosinophilia of 9.8%, and highly elevated C-reactive protein (223.2 mg/L) levels. The increase in eosinophilic count prompted re-evaluation of the history-taking process, which revealed that the patient's symptoms arose after he took one deep breath of cigarette smoke. Under the impression of AEP, bronchoalveolar lavage (BAL) was performed on the third hospital day and showed a white blood cell count of 372/ μL , with 88% eosinophils, 7% neutrophils, and 5% lymphocytes (Fig. 1C). With the confirmation of the diagnosis of AEP, the patient was treated with corticosteroids. His condition improved with resolution of infiltration at the right lower lobe within 24 hours.

Informed written consent was obtained from the patient for publication of this case report and accompanying images.

3. Discussion

AEP is characterized by acute febrile illness, severe hypoxemia, diffuse bilateral lung opacities, pulmonary eosinophilia on BAL, and the absence of any known causes of eosinophilic lung disease.^[1] It rarely occurs in childhood, with a prevalence of $<1/1,000,000$.^[2] AEP has been closely associated with cigarette smoking, and can occur with a recent onset or change in smoking habits, and renewal following cessation of smoking.^[3,4]

Our patient is a 15-year-old teenage boy who developed AEP after a recent onset of cigarette smoking. In Taiwan, there is an increasing trend in the number of adolescent smokers, with 25.5% of 13- to 15-year-old students having once experimented with cigarette smoke while 5.5% of the students are regular smokers.^[5] Despite a relatively high smoking rate amongst adolescents, specific descriptions of pediatric AEP were rarely reported.^[6,7] The infrequent reports of pediatric AEP, along with the high prevalence of cigarette smoking, have often led to delayed diagnosis of AEP in youths. Potential AEP patients may also conceal their smoking history for various reasons, as in our case, further complicating the diagnosis of AEP. Thus, history questioning of patients should be verified

initially, especially with the high smoking rate amongst youths in Taiwan.

Chest radiographs of AEP demonstrate diffuse bilateral infiltrates, airspace opacities, and interstitial reticulo-nodular densities, which eventually evolve into alveolar infiltrates.^[1] Patients with AEP often present with neutrophilic leukocytosis but no peripheral blood eosinophilia initially.^[8] However, peripheral blood eosinophil count may rise within days after presentation. Due to the nonspecific signs and symptoms, AEP is frequently misdiagnosed as CAP. In our case, similarities in radiographic features, along with absence of peripheral eosinophils during early stages, had led to the misdiagnosis of AEP as CAP.

A recent report had stated that a normal eosinophil count at initial presentation was more common in smoking-related AEP compared to medication-related AEP,^[9] making initial diagnosis of smoking-related AEP more difficult. Thus, it is imperative to follow-up on the laboratory data of patients with suspected pneumonia when they are unresponsive to antibiotic treatment. The presence of peripheral eosinophilia thereafter should lead to inclusion of AEP in the list of differential diagnoses. Furthermore, our case demonstrated the importance of including AEP as a differential diagnosis in pediatric patients, especially with the rising incidence of smoking amongst adolescences in Taiwan. With the diagnosis of AEP, patients can be treated with corticosteroids. The response to corticosteroids is usually rapid with few relapses and improvement of radiographic abnormalities.^[10] Thus, clinicians should maintain a high index of suspicion for AEP in adolescents with suspected CAP who are unresponsive to usual care and have a subsequent rise in peripheral eosinophils.

In conclusion, AEP should be considered as a potential cause of acute febrile hypoxemic respiratory failure in pediatric patients. With the increasing incidence of smoking amongst adolescents in Taiwan, careful history questioning regarding cigarette use is necessary. Clinical features of AEP could be similar to CAP, leading to frequent misdiagnosis at early stages. Hence, it is essential to review laboratory and radiographic findings when patients are unresponsive to antibiotic treatment. Prompt treatment of AEP with corticosteroids yields excellent prognosis with complete recovery and absence of relapse.

Author contributions

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