



Eosinophilic Lung Disease: A Clinical and Radiologic overview.

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ABSTRACT

Eosinophilic lung diseases are a diverse group of pulmonary disorders associated with peripheral or tissue eosinophilia. They are classified as eosinophilic lung diseases of unknown cause (simple pulmonary eosinophilia [SPE], acute eosinophilic pneumonia [AEP], chronic eosinophilic pneumonia [CEP], idiopathic hypereosinophilic syndrome [IHS]), eosinophilic lung diseases of known cause (allergic bronchopulmonary aspergillosis [ABPA], bronchocentric granulomatosis [BG], parasitic infections, drug reactions), and eosinophilic vasculitis (allergic angiitis, granulomatosis [Churg-Strauss syndrome]). The percentages of eosinophils in peripheral blood and bronchoalveolar lavage fluid are essential parts of the evaluation. Chest computed tomography (CT) demonstrates a more characteristic pattern and distribution of parenchymal opacities than conventional chest radiography.

At CT, SPE and IHS are characterized by single or multiple nodules with a surrounding ground-glass-opacity halo, AEP mimics radiologically hydrostatic pulmonary edema, and CEP is characterized by nonsegmental airspace consolidations with peripheral predominance. ABPA manifests with bilateral central bronchiectasis with or without mucoid impaction. The CT manifestations of BG are nonspecific and consist of a focal mass or lobar consolidation with atelectasis. The most common CT findings in Churg-Strauss syndrome include subpleural consolidation with lobular distribution, centrilobular nodules, bronchial wall thickening, and interlobular septal thickening.

Therefore it is very important to integrate clinical, radiologic and pathologic findings which facilitate the initial differential diagnosis of various eosinophilic lung diseases.

KEYWORDS

Eosinophilic lung disease, CT scan

Introduction

The eosinophilic lung diseases are a heterogeneous group of pulmonary disorders characterized by an increase in circulating and tissue eosinophils. Pulmonary eosinophilia can be defined generally as pulmonary infiltrates on radiological imaging together with an increase in the absolute number of eosinophils (> 250/ μ L) in the peripheral blood. More specifically, eosinophilic infiltration of the lungs (with or without peripheral eosinophilia) is established by identifying an excess of eosinophils, either in bronchoalveolar lavage fluid obtained at bronchoscopy, or by open lung biopsy. Pathologically, there may be involvement of the airways, lung parenchyma, or both. Unfortunately, eosinophil biology and the pathophysiology of eosinophilic lung diseases are poorly understood. Eosinophils are a type of granulocyte derived from the bone marrow. Distinguishing morphologic features include a bi-lobed nucleus and specific granules that contain a distinctive electron-dense crystalloid core composed of major basic protein. The eosinophil plays a role in the host defenses against helminth parasites and in allergic reactions. Activated eosinophils, under

the direction of helper T-lymphocytes, can release a variety of cytokines and inflammatory mediators that cause injury to various body tissues, including the lungs. The causes of excess eosinophil production and tissue infiltration are unclear, but abnormal clonal proliferation of T-lymphocytes, resulting in excess production of eosinophilopoietic cytokines, is one possibility.

Classification of Eosinophilic Lung Diseases²

- Simple pulmonary eosinophilia
- Chronic eosinophilic pneumonia
- Acute eosinophilic pneumonia
- Churg-Strauss syndrome
- Idiopathic hypereosinophilic syndrome
- Asthma
- Allergic bronchopulmonary aspergillosis
- Bronchocentric granulomatosis
- Parasitic infections
- Drug reactions

Eosinophilic Lung Diseases Associated With Asthma

- Asthma
- Allergic bronchopulmonary aspergillosis
- Bronchocentric granulomatosis
- Chronic eosinophilic pneumonia
- Churg-Strauss syndrome

Some eosinophilic lung diseases are predominantly airway based, whereas others are parenchymal or a mixture of both. A new disease entity known as eosinophilic bronchiolitis, which is characterized by pathologic and radiologic findings that suggest eosinophilic bronchiolar involvement, has been reported³.

Aim and objectives

In this article, we aim to illustrate the general diagnostic-approach to and the characteristic clinical, histologic, and radiologic findings in the various eosinophilic lung diseases.

Diagnostic modalities

The most valuable clinical information is derived from the patient's history and from physical examination. The duration and severity of symptoms are also of critical importance. A history of asthma may raise suspicion for Churg-Strauss syndrome, ABPA, or BG. Travel history may suggest parasitic infection. A careful history of the use of prescription and illicit drugs should be obtained. A white blood cell differential count is an essential part of the evaluation of eosinophilic lung disease. Although several different normal values have been reported, normal blood generally contains 50–250 eosinophils per microliter. Most eosinophilic lung diseases manifest with peripheral eosinophilia, although AEP may not. Stool examination and serologic testing are helpful in evaluating patients with specific conditions such as parasitic infection and ABPA.

Pulmonary function tests can occasionally be useful in the evaluation of patients with unexplained pulmonary eosinophilia. Some eosinophilic lung diseases (AEP, CEP, tropical pulmonary eosinophilia) are typically accompanied by mainly restrictive ventilatory defects, whereas others (ABPA, Churg-Strauss syndrome) typically cause mainly obstructive ventilatory defects. BAL can also be very useful in the evaluation of patients with eosinophilic lung disease. Normal BAL fluid consists of less than 1% eosinophils. Because some disorders are not accompanied by peripheral eosinophilia, BAL may provide the first (and, perhaps, the only) indication of an eosinophilic lung disease. Patients with eosinophilic lung disease may be identified initially on the basis of pulmonary symptoms or chest radiographic abnormalities accompanied by blood or tissue eosinophilia.

Diverse and nonspecific findings may also be seen at conventional chest radiography. Chest computed tomography (CT) demonstrates a more characteristic pattern and distribution of parenchymal opacities than chest radiography. Although the characteristic CT findings are often helpful, there is still a considerable overlap of CT findings among the various eosinophilic lung diseases. Open lung biopsy may be necessary to confirm diseases such as Churg-Strauss syndrome and BG. Biopsy is generally not required for the diagnosis of ABPA, IHS, drug reactions, or parasitic infections.

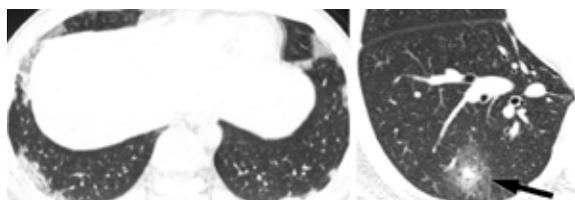


Figure 1: a) Transverse thin-section (1-mm collimation) CT scan (lung windowing) shows consolidation and ground-

glass opacity involving mainly the peripheral regions of both lower lobes. b) Transverse thin-section (1-mm collimation) CT scan (lung windowing) shows an airspace nodule with surrounding ground-glass opacity in the right lower lobe (arrow).

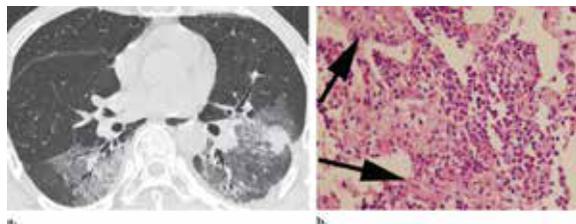


Figure 2:(a) Thin-section (1-mm collimation) CT scan (lung windowing) shows ground-glass opacities

with intralobular interstitial thickening in both lower lobes.(b) High-power photomicrograph (original magnification,400; H-E stain) of a transbronchial lung biopsy specimen shows infiltration of eosinophils and polymorphous inflammatory cells into the alveolar lumen and interstitium and a varying degree of interstitial fibrosis (arrows).

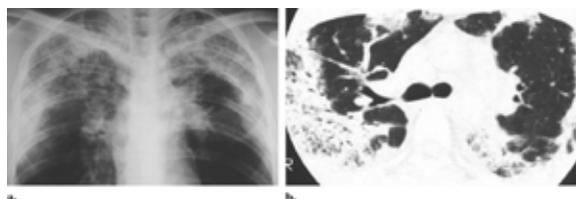


Figure 3: Chest radiograph shows airspace consolidation confined mainly to the peripheral lung (photographic negative shadow of pulmonary edema)(b) Transverse thin-section (1-mm collimation) CT scan (lung windowing) also shows airspace consolidation primarily involving the peripheral lung.

Figure 4: a 31-year-old asthmatic man with 15% peripheral eosinophilia. (a) Chest radiograph shows tubular and cystic lesions in the central portions of both lungs. Note also the mucus plugging with a gloved-finger appearance (arrows). (b) Thin-section (1-mm collimation) CT scan (lung windowing) demonstrates central bronchiectasis with mucus plugging (arrows), centrilobular nodules, and bronchial wall thickening involving predominantly the segmental and subsegmental bronchi of the upper lobes. (c) Photomicrograph (original magnification, 100; H-E stain) of the impacted mucoid material from a bronchoscopic biopsy specimen reveals parallel rows of necrotic eosinophils and cellular debris within a mucinous background.

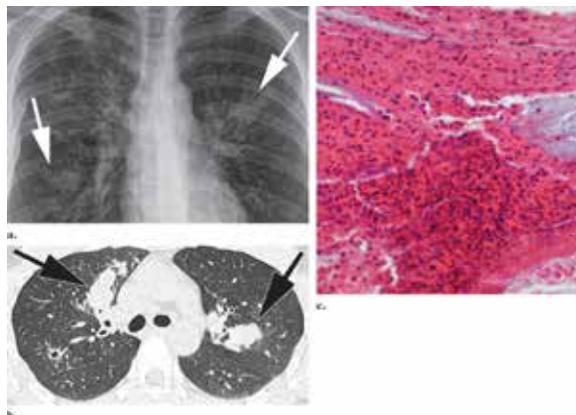


Table 1: Showing an overview of various Eosinophilic lung disease

Clinical, Pathologic and Radiologic features of Eosinophilic Lung Disease							
Clinical entity	Asthma	Initial peripheral eosinophilia	BAL fluid eosinophilia	Increased IgE levels	Extra thoracic manifestations	Pathologic findings	CT findings
SPE	No	Yes	>20%	Yes	No	Infiltration of eosinophils into the alveolar septa and interstitium	Nodules with a GGO halo, transient and migratory
AEP	No	No	>25%	Some	No	Diffuse alveolar damage with interstitial and alveolar eosinophils	Bilateral patchy areas of GGO, interlobular septal thickening
CEP	Yes (50%)	Yes	>25%	Yes (67%)	No	Infiltration of eosinophils into the alveoli and interstitium with interstitial fibrosis	Homogeneous peripheral airspace consolidation
HIS	No	Yes	High up to 73%	Yes (50%)	Yes	Eosinophilic infiltration with disruption of architecture	Nodules with a GGO halo
ABPA	Yes (100%)	Yes	<20%	Yes	No	Bronchocentric granuloma with eosinophils, fungal hyphae	Bronchiectasis with or without mucoid impaction involving the central and upper lungs
BG	Yes (33%)	Yes	<20%	Some	No	Granulomatous inflammation of bronchial and bronchiolar epithelium	Nonspecific: focal mass or lobular consolidation with atelectasis
Parasitic infections	No	Yes	<20%	Yes	No	Variable depending on type of parasitic infestation	Variable depending on Type of parasitic infestation
Drug reactions	No	Yes	<20%	Yes	No	Infiltration of eosinophils and macrophages into the alveoli	Nonspecific: peripheral airspace consolidation and GGO
CSS	Yes (100%)	Yes	>30%	Yes	Yes	Necrotizing vasculitis, extravascular granulomas, eosinophilic pneumonia	Subpleural consolidation with a lobular distribution, centrilobular nodules

Conclusion

Patients may first be recognized as having an eosinophilic lung disease on the basis of pulmonary symptoms or chest radiographic abnormalities accompanied by an increased number of blood, BAL fluid, or tissue eosinophils. Although several radiologic findings can help identify idiopathic eosinophilic lung disease, there is considerable overlap of these findings in the various entities, which precludes a confident diagnosis in the majority of cases. Correlation between CT findings and the results of careful clinical evaluation may be helpful in developing a differential diagnosis for eosinophilic lung disease, although there are diagnostic pitfalls in the form of some overlapping features.

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