

## Cryptogenic Organizing Pneumonia: Variety of Radiologic Findings

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**Key words:** cryptogenic organizing pneumonia, high resolution computerized tomography, consolidation, ground-glass opacities

### Abstract

**Background:** Cryptogenic organizing pneumonia is increasingly being recognized as a major cause of diffuse infiltrative lung disease. The differential diagnosis of non-infectious diseases that resemble pneumonia should include this entity. Understanding the radiologic features of this entity will help in defining the correct diagnosis, although lung biopsy is needed to provide histopathologic confirmation. Treatment with steroids achieves an excellent response.

**Objectives:** To present a variety of radiologic findings on high resolution computerized tomography in eight sequential patients with COP, together with clinical and pathologic correlation.

**Methods:** Sequential HRCT examinations of eight patients (four males) aged 53–80 years (mean 65.5 years) with pathologically proven COP were retrospectively analyzed by a consensus of two experienced chest radiologists for the existence and distribution of airspace consolidation, ground-glass opacities, nodular thickening along bronchovascular bundles and small (<1 cm) and large (>1 cm) nodules. The distribution of radiologic findings was classified as unilateral or bilateral, located in the upper, lower or middle lobe, and central or peripheral. Also recorded was the presence or absence of mediastinal lymphadenopathy and pleural effusion. Correlation with clinical symptoms was analyzed.

**Results:** All eight patients had bilateral airspace consolidations: in two cases consolidations were limited to central fields, in four they were peripheral, and in the remaining two cases they were both central and peripheral. Small nodules were noted in six cases and large nodules in three. Ground-glass opacities were found in four cases. All patients had enlarged lymph nodes (1–1.5 cm) in the mediastinum. Radiologic abnormalities resolved or improved after steroid treatment in all patients.

**Conclusions:** HRCT findings of bilateral multiple heterogeneous lung infiltrates and nodules associated with mild mediastinal lymphadenopathy in a patient with non-specific clinical symptoms are suggestive of COP; in such cases lung biopsy is indicated. Radiologic resolution of abnormalities correlates well with clinical improvement under adequate steroid treatment.

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radiologic patterns of COP were depicted on X-ray films for more than 20 years, and later, on computed tomography scans.

Clinically, patients with COP usually present with a non-productive cough, low grade fever and increasing shortness of breath [1–5]. COP can be either idiopathic or associated with a variety of causes, such as infections, aspiration, immunologic disorders, various drugs, chemotherapy, radiation, as well as bone marrow and lung transplantation [6–9].

Histologically, COP is characterized by the presence of granulation tissue polyps (plugs of loose fibroblastic connective tissue) within respiratory bronchioles (Masson bodies) that extend into the alveolar ducts and alveoli. The parenchyma adjacent to the affected bronchioles shows similar fibroblastic tissue in alveolar airspaces as well as mild interstitial fibrosis and chronic inflammation [1,2,10,11]. Lung biopsy is needed to provide histopathologic confirmation. Since numerous conditions and diseases have similar histologic features, clinical, radiologic and laboratory findings are necessary to establish the final diagnosis. Corticosteroids are the current standard treatment for COP [12–14].

We report our 5 year experience of diagnosing COP, together with pathologic confirmation. The purpose of this study is to describe the variety of radiologic findings on high resolution CT scans in patients with COP.

### Materials and Methods

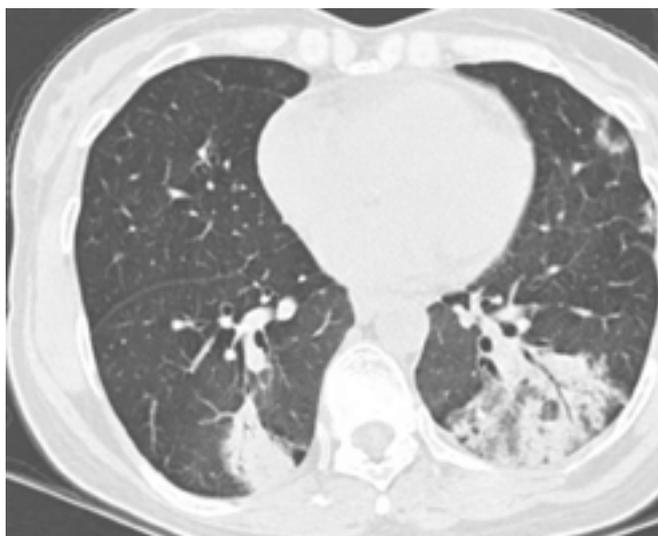
HRCT scans of eight sequential patients who attended our hospital between 2000 and 2004 with proven COP were analyzed by two experienced chest radiologists (J.R. and I.G.-W.). The radiologic findings were classified as follows: areas of airspace consolidation, ground-glass opacities, small nodules (smaller than 1 cm), large nodules (larger than 1 cm), and nodular thickening along bronchovascular bundles. The distribution of radiologic findings was reported as unilateral, bilateral, upper, lower or middle lobe, central or peripheral. Findings located within 2 cm of the pleura were defined as peripheral, and the others as central. Also recorded were the presence and location of mediastinal lymph nodes and pleural effusion. Pathologic examination by an experienced pathologist (M.P.) was performed in all cases.

Lung biopsy specimens were obtained by transbronchial lung biopsy in six cases, by video-assisted thorascopic biopsy in another patient, and by CT-guided needle biopsy in the remaining case. All patients' charts were reviewed and the clinical data were correlated with the radiologic findings.

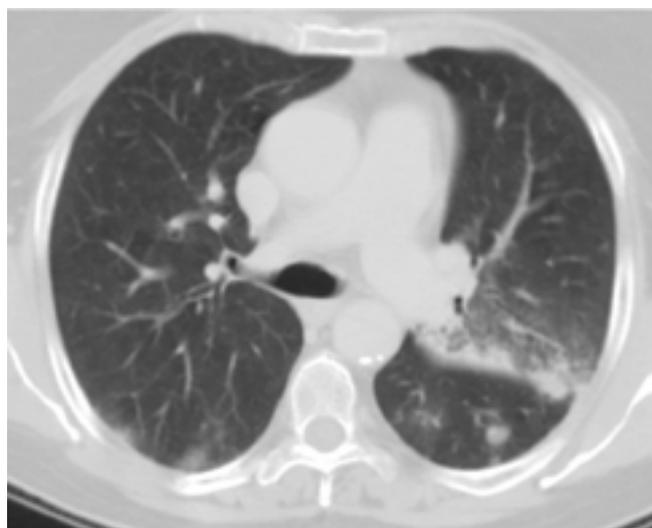
Since the description of cryptogenic organizing pneumonia in 1983 by Davison et al. [1], and the subsequent report on bronchiolitis obliterans organizing pneumonia by Epler and colleagues [2], the name of the disease has changed several times. COP is now an established clinicopathologic entity. Various

COP = cryptogenic organizing pneumonia

HRCT = high resolution computerized tomography



**Figure 1.** CT scan through lower lobes in a 53 year old woman with cryptogenic organizing pneumonia shows bilateral peripheral airspace consolidations in both lower lobes.



**Figure 2.** CT scan through the carina of a 73 year old woman with cryptogenic organizing pneumonia shows consolidation in the left upper lobe, small nodule and ground-glass opacity in the left lower lobe and areas of ground-glass opacities in the right lower lobe.

## Results

All eight patients had bilateral consolidation [Figure 1]; small nodules were noted in six patients, ground-glass opacities were seen in four cases [Figure 2], and three patients had large nodules. Nodular thickening along bronchovascular bundles was seen in one patient. All patients had a few enlarged lymph nodes (1–1.5 cm in size) in the mediastinum: six paratracheal, two paravascular, two in the aortopulmonary window and one sub-carinal. All nodes measured 1–1.3 cm and in one case the nodes measured 1.5 cm. Lymph nodes larger than 1.5 cm were not found.

None of the patients had pleural effusion. All patients were symptomatic: one patient had high fever, one had low grade fever, and six did not have fever. Four patients had a non-productive cough and four complained of shortness of breath. One patient had cough with sputum.

Before biopsy, five patients received antibiotic treatment without any clinical or radiologic improvement. After histologic diagnosis, steroid treatment was given to all patients with good results.

## Discussion

Cryptogenic organizing pneumonia has also been known as bronchiolitis obliterans organizing pneumonia (BOOP). The latter term should be avoided to prevent confusion with constrictive bronchiolitis, which is strictly an airway disease [15].

Heterogenic radiologic features on X-ray and especially on CT scan make correct diagnosis difficult, sometimes resulting in ineffective therapy and unnecessary hospitalization. Most often, CT scan shows unilateral or bilateral airspace consolidation with a predominantly peripheral distribution in lower and middle zones [2,3,8,11,12,16]. In our study, airspace consolidations were bilateral in all cases, with distribution predominantly in peripheral areas and in lower lobes. Ground-glass opacity and small

nodules (<1 cm) are seen more commonly in immunocompromised patients [6,16]. All our patients were immunocompetent and most of them (6/8) had bilateral small nodules. Nodules larger than 1 cm were reported as a predominant finding by Akira and associates [17] and as a frequent finding by Bouchardy and co-workers [7]. We noted large nodules in only three cases. We did not find any reports that sought to establish the presence of lymphadenopathy in patients with COP, but in our study mild mediastinal lymphadenopathy was present in all the patients. Pleural effusion does not seem to be characteristic of this disease. Clinical symptoms were not specific, although only one patient had a high fever.

We conclude that patients with radiologic findings such as airspace consolidations, ground-glass opacities, small and large nodules, and mild mediastinal lymphadenopathy should be referred for histologic confirmation of COP as soon as possible.

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