Section: Radiology

Original Research Article

ORGANIZING PNEUMONIA PATTERN ON COMPUTED TOMOGRAPHY: A RETROSPECTIVE STUDY OF ETIOLOGICAL SPECTRUM AND MORPHOLOGICAL PATTERN ON HRCT CHEST IN 22 PATIENTS

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ABSTRACT

Background: Organizing pneumonia (OP) is a nonspecific pulmonary response to alveolar injury characterized by intra-alveolar granulation tissue formation. It may occur as cryptogenic organizing pneumonia or secondary to diverse etiologies. Due to overlapping imaging features, diagnosis remains challenging.
Materials and Methods: A retrospective observational study was conducted in a tertiary level teaching hospital in Hyderabad including 22 patients demonstrating computed tomography (CT) features suggestive of organizing pneumonia over a defined study period. Clinical data, etiological associations, and high-resolution computed tomography (HRCT) findings were analyzed. Diagnosis was established based on clinicoradiological correlation and exclusion of alternative diagnoses.
Results: A total of 22 patients were included, demonstrating a heterogeneous etiological spectrum comprising cryptogenic organizing pneumonia, post-infectious organizing pneumonia (including post-COVID), drug-induced organizing pneumonia, connective tissue disease–associated organizing pneumonia, and radiation-induced organizing pneumonia. HRCT most commonly showed patchy peripheral and peribronchovascular consolidations along with ground-glass opacities. Atypical imaging presentation in the form of unilateral disease distribution was observed in five cases, including one with Amiodarone induced lung toxicity.
Conclusion: Organizing pneumonia represents a common radiological pattern arising from multiple etiologies. Recognition of its imaging spectrum and clinical context is essential for accurate diagnosis and differentiation from mimicking conditions.
Keywords: Organizing pneumonia, Cryptogenic organizing pneumonia, Interstitial lung disease, High-resolution CT, Secondary organizing pneumonia.

INTRODUCTION

Organizing pneumonia (OP) represents a distinctive pattern of pulmonary injury characterized histologically by the presence of granulation tissue plugs within alveolar ducts and alveoli, commonly referred to as Masson bodies.[1-3] These lesions represent a reparative response following injury to the alveolar epithelium rather than a specific disease entity.[2,3] OP may occur without an identifiable cause, in which case it is termed cryptogenic organizing pneumonia (COP), or it may develop secondary to a wide variety of clinical conditions.[4,6] Secondary organizing pneumonia has been described in association with infections, drug toxicity, connective tissue diseases, radiation therapy,

malignancy, and environmental exposures.[4,6] The clinical manifestations are often nonspecific and include cough, dyspnea, and systemic symptoms.[4,6] Radiologically, high-resolution computed tomography (HRCT) commonly demonstrates patchy peripheral or peri-bronchovascular consolidation or ground-glass opacities.[7-9] Because these findings may resemble infection, malignancy, eosinophilic lung diseases or other interstitial lung diseases, diagnosis may be challenging.[7-9]

In recent years, organizing pneumonia has also been increasingly recognized following viral infections such as COVID-19, where persistent inflammatory lung injury may lead to secondary OP.[12]

The present case series aims to illustrate the diverse etiologic spectrum and radiological variability of organizing pneumonia encountered in clinical practice, highlighting the importance of clinicoradiological correlation in establishing the diagnosis

MATERIALS AND METHODS

This retrospective study was conducted in Malla Reddy Medical College for Women & Malla Reddy Narayana Multispeciality Hospital, Jeedimetla, Hyderabad. Medical records and imaging data of patients having organizing pneumonia pattern on HRCT Chest done between January 2024 to December 2025 were reviewed. It included 22 patients with HRCT features of organizing pneumonia. All the imaging examinations were done at the Department of Radiology, on a 128 slice GE Revolution CT system, manufactured by General Electric (GE Healthcare, Milwaukee, WI, USA). The following HRCT scan parameters were used: kVp = 120–140; mA = Automatic dose modulation; Thickness = 1.0-1.25 mm; interval = overlapped images.

The inclusion criteria were the following:

- Imaging features suggestive of organizing pneumonia pattern on HRCT Chest
- Availability of clinical and demographic data
- Final diagnosis of organizing pneumonia (cryptogenic or secondary)

We excluded patients with incomplete clinical and/or imaging data.

We consulted the medical records and collected drug history, medical history, laboratory results and results of pulmonary function tests. Diagnosis was primarily based on clinico-radiological correlation and histopathology, when available.

RESULTS

Out of the twenty-two patients in our study, 9 were males and remaining 13 were females. The mean age of patients was 56 with ages ranging between 39 to 74 years.

In our study, 6 patients were smokers and 5 were patients following up in our oncology department (three underwent chemotherapy and two underwent radiotherapy). The most common symptoms were dyspnea and dry cough, observed in 19 and 17 patients respectively. Other symptoms included fever, fatigue and weight loss. The symptomatology is summarized in [Table 1]. On respiratory system examination, inspiratory crackles were the most common finding seen in 15 patients.

Pulmonary function tests showed a predominantly restrictive pattern (77.3%), with normal (13.6%) and mixed (9.1%) patterns in the remainder; Forced Vital Capacity (FVC) and Total Lung Capacity (TLC) values were 81 ± 16.2% and 75 ± 12.6% predicted, with preserved FEV_1/FVC ratio (0.84 ± 0.05), and reduced DLCO (68 ± 16.4% predicted) in 15 out of 22 patients. The results are summarized in [Table 2].

The distribution of various etiologies of organizing pneumonia seen in our study is depicted in [Table 3]. [Table 4] summarizes the various HRCT patterns observed in our patients while [Table 5] and [Table 6] demonstrate the distribution of lung involvement, either unilateral or bilateral and diffuse, multifocal patchy and focal organizing pneumonia patterns. The majority of patients (77.3%) demonstrated bilateral involvement, while unilateral disease was observed in 5 cases (22.7%), including two cases of radiation pneumonitis–related organizing pneumonia and one case each of amiodarone-induced lung toxicity, post-infectious organizing pneumonia, and cryptogenic focal organizing pneumonia.

Illustrative cases and representative imaging patterns, including typical bilateral involvement and atypical unilateral disease, are illustrated in Figures 1–8. A histologic diagnosis was obtained in only two patients, bronchoalveolar lavage was done in 6 patients with all patients being diagnosed based on clinical and radiological data and multidisciplinary discussion.

Table 1: Symptomatology of patients with Organizing pneumonia

Symptom	n	%
Dyspnoea	19	86.3
Dry cough	17	77.2
Fever	10	45.4
Fatigue	15	68.1
Weight loss	10	45.4

Table 2: Pulmonary Function Test (PFT) Findings in Patients with Organizing Pneumonia

Parameter	Value
FVC (% predicted)	81 ± 16.2
FEV_1 (% predicted)	79 ± 15.8
FEV_1/FVC ratio	0.84 ± 0.05
TLC (% predicted)	75 ± 12.6
DLCO (% predicted)	68 ± 16.4
Restrictive pattern, n (%)	17 (77.3%)
Normal PFT, n (%)	3 (13.6%)
Mixed pattern, n (%)	2 (9.1%)
Reduced DLCO (<80%), n (%)	15 (68.2%)

Note: Values are expressed as mean ± standard deviation or number (%). A restrictive ventilatory defect was defined as reduced lung volumes (TLC <80% predicted) or, when not available, reduced FVC with a normal or increased FEV_1/FVC ratio. TLC was not available for all patients

Table 3: Etiological Spectrum of Organizing Pneumonia

Etiology	n	%
Cryptogenic OP	5	22.7
Post-infectious	4	18.2
Post-COVID	4	18.2
Drug-induced	4	18.2
CTD-associated	3	13.6
Radiation-induced	2	9.1

Table 4: HRCT Patterns in patients with Organizing Pneumonia

Features	n	%
Peripheral consolidation	18	81.8
Peribronchovascular consolidation	15	68.1
Ground-glass opacities	16	72.7
Perilobular pattern	6	27.3
Reverse halo sign	5	22.7
Nodular pattern	4	18.1
Band like opacities	5	22.7

Table 5: Laterality of pulmonary Involvement

Distribution	n	%
Bilateral involvement	17	77.3
Unilateral involvement	5	22.7

Table 6: Distribution Pattern of Pulmonary Involvement on Imaging (n = 22)

Distribution	n	%
Multifocal patchy involvement	17	77.3
Focal involvement	3	13.6
Diffuse involvement	2	9.1

Note: Multifocal patchy involvement referred to multiple non-contiguous areas of pulmonary opacity, whereas focal involvement denoted localized involvement confined to a limited pulmonary region or lobe. Diffuse involvement was defined as widespread pulmonary opacities involving a large extent of the lung parenchyma without discrete localization.

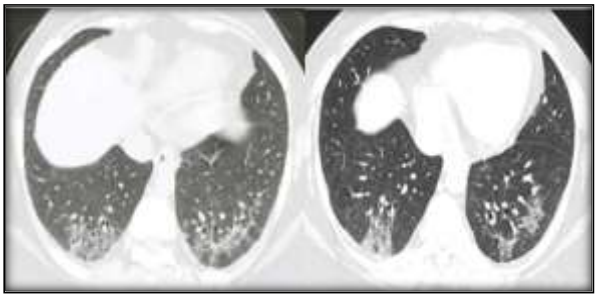

Figure 1 (A & B): Organizing pneumonia in a patient with underlying mixed connective tissue disease. Axial HRCT images showing patchy peripheral sub-pleural consolidation and ground glass opacities in posterobasal segment of right lower lobe and peri-lobular and peri-bronchovascular distribution of consolidation in posterobasal segment of left lower lobe of lung.

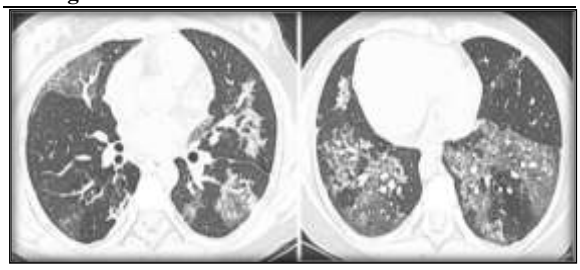

Figure 2 (A & B): Organizing pneumonia in a patient of Sjogren's syndrome: Multifocal, patchy subpleural and peri-bronchovascular ground glass opacities and consolidations seen scattered in both lungs. The involvement in superior segment of left lower lobe shows a reverse halo (Atoll) sign with central ground glass and peripheral consolidation.

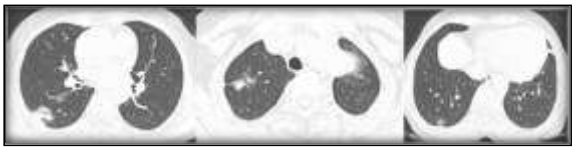

Figure 3: (Post-infectious organizing pneumonia. (A): Circumscribed rounded focal sub-pleural patch of consolidation in superior segment of right lower lobe with tiny air bronchograms within. (B): Small nodular consolidation with adjacent ground glass opacity noted in apical segment of right upper lobe of same patient. (C): Ground glass density sub-solid nodule seen in peripheral sub-pleural location of postero-basal segment of right lower lobe of lung

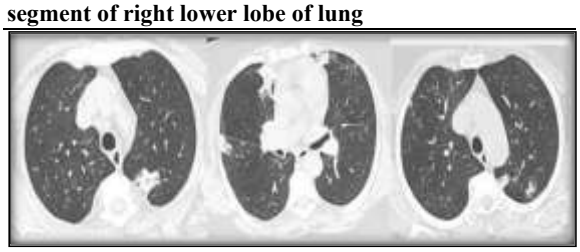

Figure 4 (A, B & C): Post COVID organizing pneumonia. Multifocal circumscribed sub-pleural consolidations scattered in apicoposterior segment of left upper lobe, medial segment of right middle lobe, anterobasal segment of right lower lobe and anteriorly in lingular segments of left upper lobe

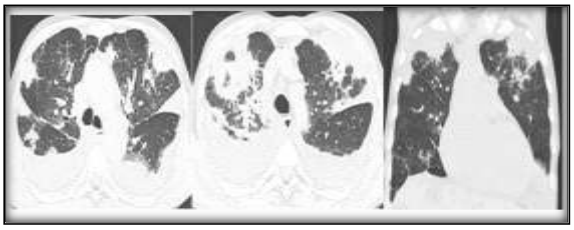

Figure 5: Cryptogenic organizing pneumonia. Multifocal predominant peripheral sub-pleural and few peri-bronchovascular consolidations in both upper lobes of lungs and in superior segment of right lower lobe. Note is also made of cardiomegaly and bilateral mild to moderate pleural effusions. There was no eosinophilia in the blood or BAL aspirate, ruling out esoniophilic penumonia. Microbiological studies ruled out infective process. Biopsy confirmed cryptogenic organizing pneumonia.

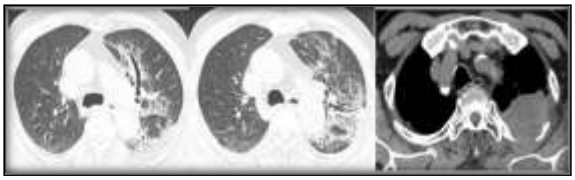

Figure 6: Radiation-induced pneumonitis with organizing pneumonia pattern. (A & B) Patchy consolidations and ground glass opacities in peri-bronchovascular and peripheral, sub-pleural distribution in left upper lobe and superior segment of left lower lobe with associated mild reticulation and bronchiectasis. (C): Soft tissue attenuation mass lesion in apico-posterior segment of left upper lobe with destruction of overlying posterior rib- representing primary lung malignancy (squamous cell carcinoma).

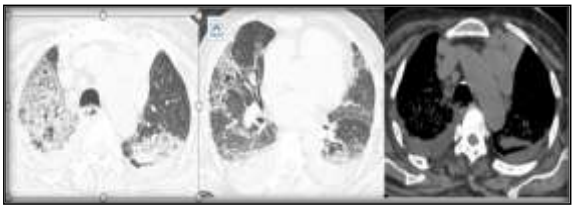

Figure 7: Bleomycin-induced lung toxicity with organizing pneumonia pattern in a patient of Hodgkin's lymphoma. (A & B): Multifocal consolidations and ground glass opacities in both lungs with mild bronchiectasis. Pleural effusions also noted bilaterally. (C): Enlarged prevascular and right paratracheal lymph nodes are seen, in keeping with underlying Hodgkin's lymphoma.

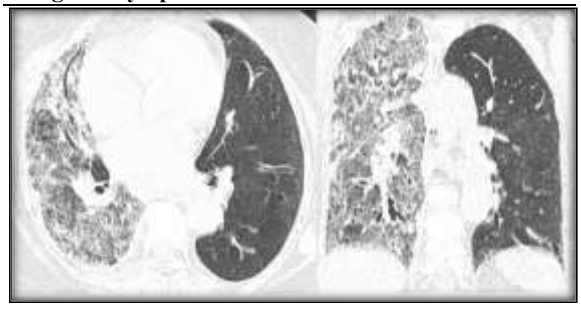

Figure 8 (A & B): Amiodarone-induced lung toxicity with organizing pneumonia pattern in a patient of atrial fibrillation. (A & B): Unilateral diffuse ground glass opacities, consolidation, mild reticulation and mild traction bronchiectasis involving almost the entire right lung. The cause for the striking unilateral distribution of disease in this patient was not understood.

DISCUSSION

Organizing pneumonia (OP) is a well-recognised clinicopathological entity representing a nonspecific inflammatory response of the lung to a variety of injurious stimuli.[1-3] Histologically, the condition is characterised by intra-alveolar buds of granulation tissue composed of fibroblasts and connective tissue matrix within the distal airspaces.[2,3] Unlike fibrosing interstitial lung diseases, the underlying pulmonary architecture is typically preserved, reflecting a potentially reversible reparative process.[2,5]

OP may be broadly classified into cryptogenic organizing pneumonia and secondary organizing pneumonia.[4,6] Cryptogenic organizing pneumonia is idiopathic and is classified as an interstitial lung disease.[2] Secondary forms occur in association with infections, drugs, connective tissue diseases, radiation therapy, and malignancy.[4,6] The cases presented in this series demonstrate the diverse etiologic spectrum through which this pathological pattern may arise.

Organizing pneumonia (OP) lacks distinctive clinical features, which often leads to a delay in diagnosis due to the nonspecific nature of presenting symptoms.[4,6] Patients commonly present with dry cough, flu-like illness, and exertional dyspnea.[4] Systemic manifestations such as fever, fatigue, and weight loss may also be observed.[6] No specific clinical features

reliably distinguish cryptogenic organizing pneumonia (COP) from secondary organizing pneumonia (SOP). Patients with focal organizing pneumonia may be asymptomatic and are often diagnosed incidentally on imaging. OP typically presents in the fifth to sixth decades of life and is more frequently observed in nonsmokers.[4,6]

Physical examination in organizing pneumonia (OP) may reveal inspiratory crackles, although it can be normal in up to 25% of patients.[4] Given the association of secondary OP with connective tissue diseases, evaluation for underlying autoimmune features is essential.

No specific laboratory markers exist for OP. Leukocytosis is present in approximately 50% of cases, and inflammatory markers are often elevated.[4,6] Pulmonary function tests usually show a mild to moderate restrictive pattern with reduced diffusing capacity, though results may be normal in focal OP.

Histopathological confirmation may be required in some cases; however, in patients with characteristic clinical and radiological findings, empiric therapy may be appropriate. Bronchoscopy with bronchoalveolar lavage (BAL) and transbronchial biopsy is often used as an initial diagnostic approach to exclude alternative diagnoses such as infection or malignancy.[11] BAL typically shows mixed cellularity with predominant lymphocytes as the most frequent pattern in COP disease.[11] A multidisciplinary approach is important for diagnosis and management, and evaluation for secondary causes should be performed once OP is identified.

From a conceptual perspective, organizing pneumonia may be viewed as a final common pathway of pulmonary injury. In the present series, the etiologies observed can be broadly grouped into idiopathic disease, infectious or post-infectious lung injury, immune-mediated inflammation associated with connective tissue disorders, and treatment-related injury including drug toxicity and radiation exposure. The drugs implicated in lung toxicity in our study included Bleomycin and Amiodarone. The temporal relationship between inciting factors and symptom onset, as observed in post-infectious and treatment-related cases, underscores the importance of detailed clinical history in establishing the diagnosis.

Radiologically, organizing pneumonia most commonly manifests as patchy peripheral or peri-bronchovascular consolidations on HRCT, frequently accompanied by ground-glass opacities and, in some cases, a perilobular pattern.[7-10] In the present study, these classical imaging features were consistently observed across different etiologies. Notably, while bilateral involvement is typically described, five patients demonstrated a unilateral distribution of disease including two with radiation induced pneumonitis, one each with post-infectious and cryptogenic focal organizing pneumonia patterns and one patient of Amiodarone-induced lung toxicity. The cause for the striking unilateral involvement in the setting of Amiodarone-induced lung toxicity was not understood. Similar unilateral involvement with Amiodarone is described previously in literature as isolated case reports which showed features of pneumonitis and rapidly progressive lung fibrosis, showing improvement with corticosteroids and cessation of Amiodarone.[13,14] Such atypical presentations can pose diagnostic challenges and highlight the need to consider fibrosing organizing pneumonia even when imaging findings deviate from classical patterns. “Reverse halo sign” or “Atoll sign” seen as an area of consolidation surrounding ground glass opacity, though originally described with organizing pneumonia, can be seen in other conditions.[7,8] It was observed in only 5 out of 22 patients in our series. In addition, the occurrence of nodular consolidation, band like opacities and diffuse, focal or multifocal patchy involvement across different lobes further reflects the heterogeneity of radiological manifestations.

From a functional standpoint, a vast majority of patients demonstrated a restrictive pattern on pulmonary function testing, with a forced vital capacity (FVC) of 81 ± 16.2% predicted, and reduced diffusing capacity for carbon monoxide (DLCO) observed in a subset of patients. These findings are in keeping with the pathophysiological basis of organizing pneumonia, where intra-alveolar exudates and interstitial inflammation contribute to impaired gas exchange and reduced lung compliance.[4,6] The relative preservation of lung volumes in some patients, despite symptomatic disease, may reflect the patchy or focal distribution of involvement noted on imaging.

Several conditions may mimic organizing pneumonia radiologically. Important differential diagnoses include eosinophilic pneumonia, pulmonary lymphoma, invasive fungal infection, and adenocarcinoma with lepidic growth pattern.[7,8] In the present study, exclusion of infectious etiologies through microbiological investigations, along with clinicoradiological correlation, played a crucial role in establishing the diagnosis, particularly in cases presenting after recent infection or in immunocompromised settings.

Corticosteroid therapy remains the cornerstone of treatment, especially for idiopathic / cryptogenic forms of organizing pneumonia.[1,2,4] Patients typically show rapid clinical and radiological improvement following initiation of therapy, although some patients may progress to fibrosis despite steroid therapy and supportive treatment.[5] Management of secondary organizing pneumonia usually involves identification and treatment of the underlying cause, as illustrated by cases requiring withdrawal of offending drugs or optimisation of immunosuppressive therapy in autoimmune disease.[4,6]

The findings of this study highlight the importance of considering organizing pneumonia in patients presenting with persistent pulmonary opacities that fail to resolve with conventional therapy. The

variability in clinical presentation, radiological patterns, and underlying etiologies observed in this series emphasises the need for a comprehensive, multidisciplinary approach integrating clinical history, imaging, and functional assessment for accurate diagnosis.

The present study has certain limitations. The sample size was relatively small, and histopathological confirmation was not available for most patients, with diagnoses based on clinicoradiological correlation and response to treatment. In addition, the retrospective nature of the observations limits detailed analysis of disease progression and long-term outcomes.

CONCLUSION

Organizing pneumonia represents a common inflammatory response to diverse forms of lung injury rather than a single disease entity. This case series highlights the wide etiologic spectrum and radiological variability associated with organizing pneumonia, including post-infectious, autoimmune, drug-related, radiation-induced, and idiopathic causes. Awareness of atypical imaging patterns, such as unilateral disease distribution, is important to avoid diagnostic delay. Early recognition and appropriate treatment, including initiating corticosteroid therapy in selected patients or managing the underlying etiology, are associated with favourable clinical outcomes.

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