HRCT Perspectives on Centri-lobular Pulmonary Nodules: Diagnostic Pathways

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Abstract: Background: Centri-lobular nodules represent the predominant pattern of diffuse pulmonary nodules identified on high-resolution computed tomography (HRCT). Leveraging HRCT with advanced post-processing techniques, such as maximum intensity projection (MIP), enhances the visibility of centri-lobular nodules. This study aims to underscore the pivotal role of HRCT and its reconstruction capabilities in detecting and characterizing centri-lobular pulmonary nodules. Additionally, it seeks to elucidate the most frequent associated findings and establish correlations with clinical presentations to facilitate accurate diagnosis.

Results: The study encompassed 58 patients, comprising 41.4% males and 58.6% females, with ages ranging from 2 to 67 years (mean age: 25.69 years). Analysis revealed patterns in centri-lobular nodule numbers, distribution, shape, and concomitant HRCT chest findings. The top three etiological diagnoses included infection/inflammation in 50.0% of cases, acute viral bronchiolitis in 27.6%, and inhalation bronchiolitis in 19.0% of cases. Correlation between HRCT findings and clinical diagnosis facilitated the development of a diagnostic algorithm for various etiologies of centri-lobular pulmonary nodules.

Conclusions: HRCT emerges as a valuable modality for both detecting and characterizing centri-lobular pulmonary nodules. Its utility extends to distinguishing between diverse etiologies presenting with centri-lobular nodularity. Moreover, the integration of associated features and a multidisciplinary approach proves indispensable for refining the diagnosis of the predominant etiology.

Keywords: Centri-lobular nodules, High-resolution computed tomography (HRCT), Maximum intensity projection (MIP), Diffuse pulmonary nodules, Infection/inflammation, Acute viral bronchiolitis, Inhalation bronchiolitis, Diagnostic algorithm

Background:

Small nodular opacities are a common finding on high-resolution computed tomography (HRCT), necessitating accurate classification for differential diagnosis. Among these, centri-lobular nodules are the predominant pattern. HRCT, coupled with post-processing techniques like maximum intensity projection (MIP) from the original thin-section dataset, enhances the visibility of centri-lobular nodules and tree-in-bud patterns.

Centri-lobular nodules are defined as opacities within the center of the secondary pulmonary lobule, primarily affecting bronchioles, peri-bronchiolar regions, arterioles, or peri-arterial regions. They differ from peri-lymphatic nodules, which are found along the pulmonary lymphatics. When peri-bronchiolar air spaces are involved, centri-lobular nodules may present as ground-glass opacities, while a "tree-in-bud" pattern indicates linear branching, representing dilated bronchioles filled with mucus, pus, or fluid, along with clusters of filled alveoli in a centri-lobular location.

Centri-lobular nodules can be further classified based on extension (focal, segmental, or diffuse), appearance (well-defined or ill-defined), and etiology (inhalation, infection, inflammation, tumor, or vascular causes).

This study aims to emphasize the role of HRCT and its reconstruction capabilities in detecting and characterizing centri-lobular pulmonary nodules. It seeks to interpret frequently associated findings, correlate them with clinical presentations, and develop an algorithm to facilitate the most appropriate diagnosis.

METHODS:

The local institutional review board approved this prospective study, and written informed consent was obtained from all patients.

STUDY POPULATION:

A total of 58 patients (24 males and 34 females), aged between 2 to 67 years, were enrolled between January 2020 and June 2021. They were referred from the Pulmonology department to the Thoracic Imaging Unit of the Department of Diagnostic and Interventional Radiology for HRCT of the lungs. Patients meeting the following criteria were included:

INCLUSION CRITERIA:

All patients with HRCT chest showing centri-lobular pulmonary nodules were included.

EXCLUSION CRITERIA:

HRCT scans without evidence of centri-lobular pulmonary nodules or scans with marked respiratory motion artifacts hindering nodule visualization were excluded.

All included cases underwent:

1. Full medical history, general, and chest clinical examination.
2. HRCT chest imaging.
3. Further laboratory investigations, with or without biopsy, based on suspected clinical conditions.

IMAGE ACQUISITION:

HRCT was performed using GE Revolution 16-slice MDCT machine. Non-contrast helical-volumetric axial cuts were performed in full inspiration in the supine position with 1.5 mm slice thickness, 1.5 mm pitch, 0 gantry tilt, and a field of view (FOV) of around 320 mm. The imaging parameters were standardized: KV 120, mAs 25, rotation time 0.5 s, total exposure time 8–10 s. HRCT window width (WW) was set to 1000 HU, window level (WL) to -700 HU, and mediastinal WW to 300 HU with WL at 30 HU. Reconstructed two-dimensional axial, coronal, and sagittal images, as well as minimum intensity projection (MinIP) images, were obtained.

IMAGE ANALYSIS:

The following parameters of the centri-lobular nodules were assessed:

1. Nodule distribution: diffuse, multiple, single, or segmental.
2. Nodule location: unilateral, bilateral, upper lobe, middle lobe/ lingula, or lower lobe.
3. Nodule margin: well-defined or ill-defined.
4. Nodule number: few (countable) or multiple.

Associated findings such as ground-glass densities, peri-lymphatic nodules, cavitation, septal thickening, bronchiectasis, bronchial wall thickening, atelectasis, air trapping, reticulation, pleural effusion, and lymphadenopathy were recorded.

Etiological diagnosis was suggested and guided by the clinical condition and laboratory findings.

STATISTICAL ANALYSIS:

Data were collected, reviewed, coded, and entered into the Statistical Package for Social Science (SPSS version 20). Qualitative data were presented as numbers and percentages, while quantitative data were presented as mean, standard deviations, and ranges when their distribution was found to be parametric.

A confidence interval of 95% was set, and the margin of error accepted was 5%. Therefore, the p-value was considered significant as follows:

- $P < 0.05$ = significant
- $P < 0.001$ = highly significant.

RESULTS:

Demographic Characteristics:

A total of 58 cases were included in this study, comprising 24 (41.4%) males and 34 (58.6%) females. The age of the patients ranged from 2 to 67 years, with a mean age of 25.69 ± 18.89 years.

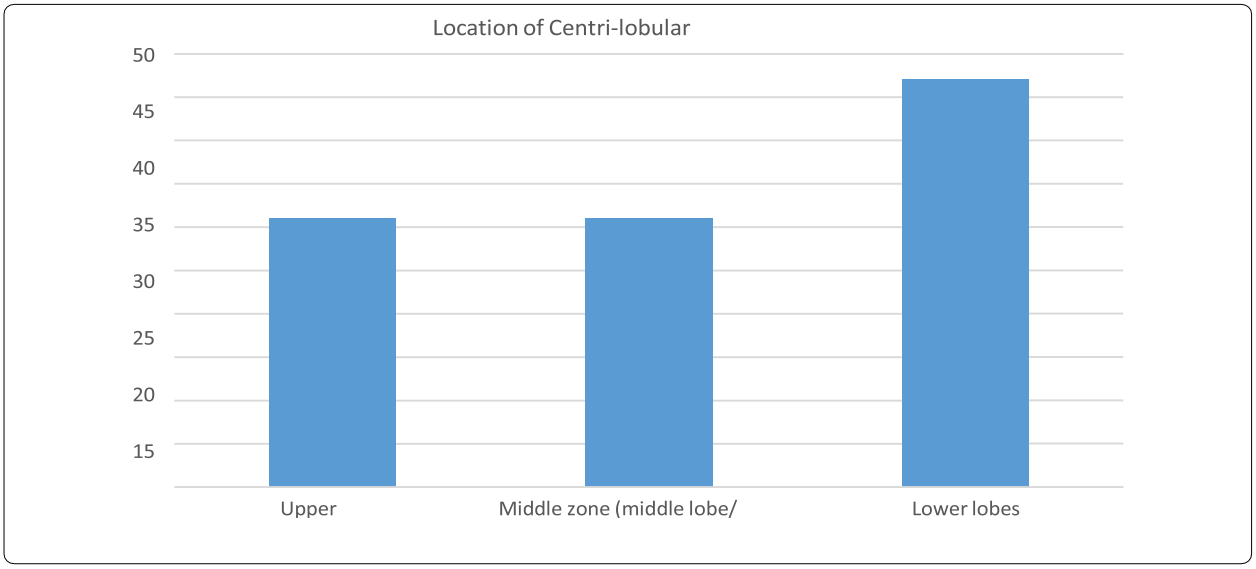
Centri-lobular Nodules Number:

Among the cases, centri-lobular pulmonary nodules were countable (few) in 19 (32.8%) cases and non-countable (multiple) in 39 (67.2%) cases.

Distribution of Centri-lobular Nodules:

Among the cases examined, nine (15.5%) exhibited unilateral nodules, while bilateral nodules were present in 45 (77.6%) cases. Nodules were observed to be diffuse throughout the lung in 10 (17.2%) cases, localized to a single segment in 11 (19%) cases, and distributed in multiple segments in 37 (63.8%) cases as shown in **Figure 1.**

Fig. 1 Column graph showing the lobar distribution of centri-lobular nodules



Shape of Centri-lobular Nodules:

Well-defined nodules were identified in 36 (62.1%) cases, while ill-defined nodules were observed in 22 (37.9%) cases. Additionally, a tree-in-bud pattern was detected in 13 (22.4%) cases.

Associated HRCT Chest Findings:

Several associated HRCT findings aided in the radiological diagnosis of each case as shown in **Table 1.**

Table 1 Number and percentages of the associated HRCT chest findings

HRCT Finding	Number of Cases	Percentage
Bronchial wall thickening	27	46.6%
Bronchiectasis	23	39.7%
Ground glass	22	37.9%
Reticulations	22	37.9%
Air trapping	19	32.8%
Lymphadenopathy	16	27.6%
Atelectasis	13	22.4%

HRCT Finding	Number of Cases	Percentage
Peri-lymphatic nodule	10	17.2%
Septal thickening	6	10.3%
Cavitation	4	6.9%
Pleural effusion	3	5.2%

Etiological Diagnosis of Centri-lobular Nodules: The etiological diagnoses of centri-lobular nodules, determined by combined radiological, clinical, laboratory data, and biopsy in selected cases **(Fig. 2),** are detailed below:

1. Inhalation Etiology: Out of 12 cases with inhalation lung disease:

    - Six cases (54.5%) were diagnosed with hypersensitivity pneumonitis (HP) **(Fig. 3),** characterized by bilateral diffuse ill-defined ground glass centri-lobular nodules primarily involving the upper and middle lobes, along with ground glass opacities and air trapping.
    - One case (9.09%) was diagnosed as respiratory bronchiolitis (RB) **(Fig. 4),** exhibiting bilateral multiple ill-defined centri-lobular nodules mainly involving the upper lobes.
    - Three cases (27.3%) were diagnosed with respiratory bronchiolitis interstitial lung disease (RB-ILD), showing diffuse bilateral ill-defined centri-lobular nodules associated with ground glass opacities and reticulations.
    - One case (9.09%) was diagnosed with bronchiolitis obliterans secondary to toxin inhalation, presenting bilateral diffuse well-defined centri-lobular nodules with a tree-in-bud pattern involving all lung lobes, in addition to bronchiectasis, oligemic lung, and air trapping.

Fig. 2 Column graph showing the etiological diagnosis of the studied cases

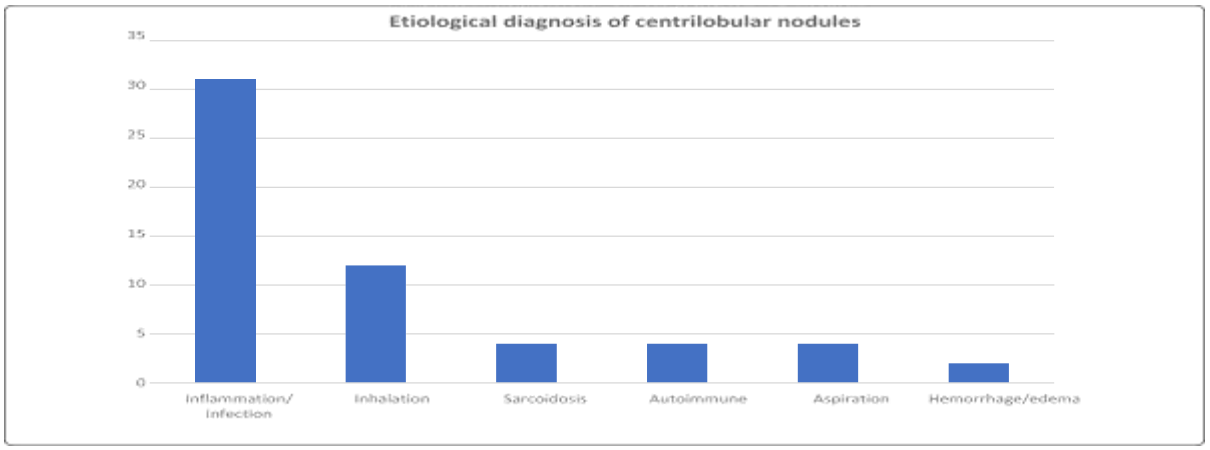
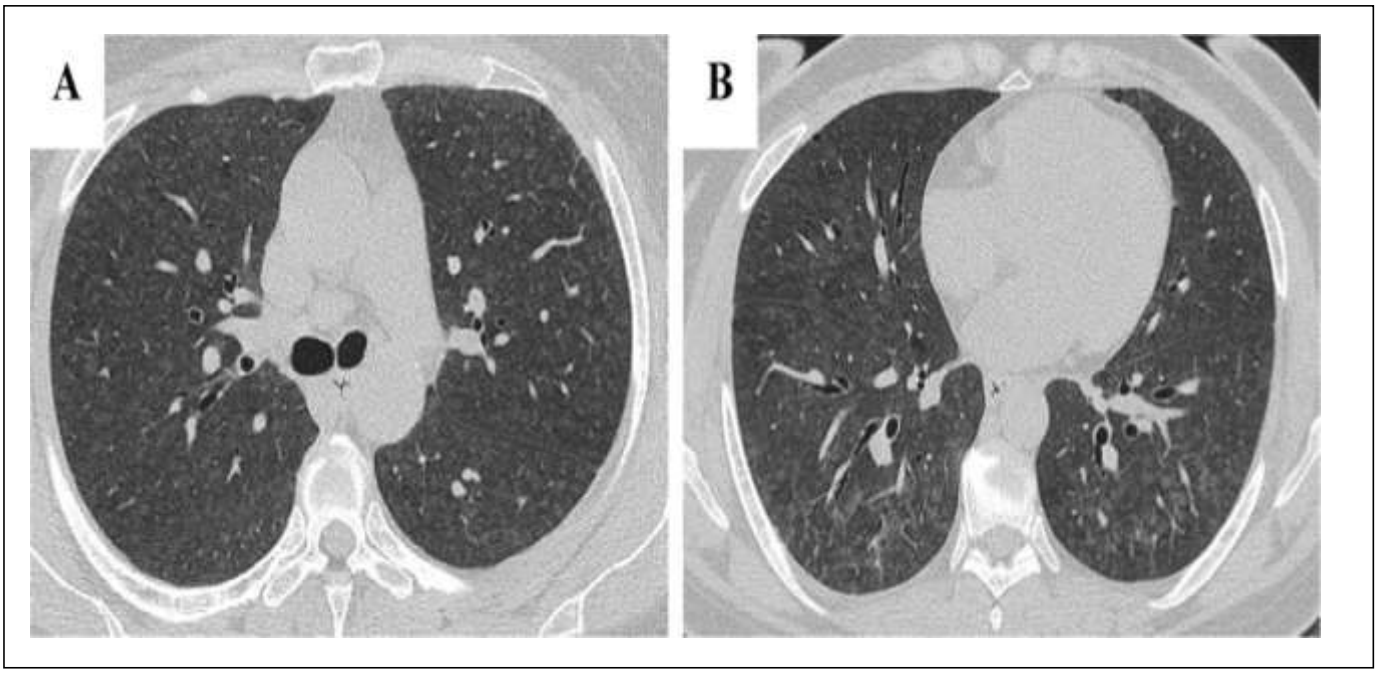


Fig. 3 A 44-year-old female complaining of progressive dyspnea and dry cough with history of raising birds. HRCT of the chest in a, b axial lung window images showing bilateral diffuse ill-defined ground glass centrilobular nodules. The diagnosis of subacute hypersensitivity pneumonitis was made



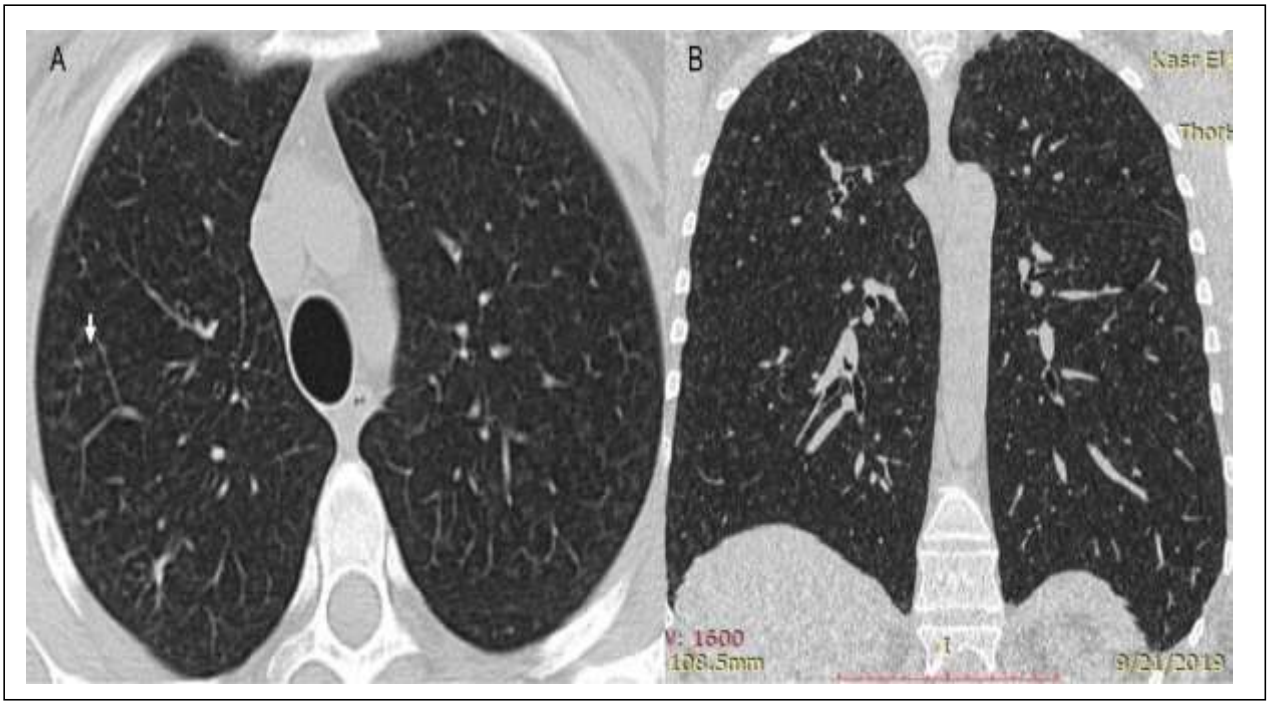


Fig. 4 A 43-year-old male, smoker over the last 20 years, HRCT lungs (a) axial, (b) coronal sections showed diffuse ill-defined faint ground glass centri-lobular nodules scattered all over the lung lobes bilaterally more prominent at upper lobes. Radiological and clinical diagnosis was made of inhalation lung disease as smoking related-respiratory bronchiolitis (RB)

Correlation with Other Etiological Diagnoses:

Comparing inhalation lung disease with other etiological diagnoses of centri-lobular nodules revealed statistically significant differences in terms of diffuse distribution, upper lobes predominance, and both well- and ill-defined nodules, as illustrated in **Table 2.**

Regarding associated HRCT lung findings, there was a high statistical significance concerning ground glass opacities and air trapping, as shown in **Table 3.**

Table 2 The significance of inhalation, inflammatory, autoimmune and edema/ hemorrhagic lung diseases regarding lesion distribution and shape

Lesion Characteristic	P Value	Inhalation	Inflammation	Autoimmune	Hemorrhage/EDEMA
Number					
- Few	0.102	0.773	0.067	0.516	0.516
- Multiple	0.207	0.279	0.113	0.430	0.430
Location					
- Unilateral	0.096	0.329	0.425	0.651	0.651

Lesion Characteristic	P Value	Inhalation	Inflammation	Autoimmune	Hemorrhage/EDEMA
- Bilateral					
- Upper lobe	0.006**	0.430	0.886	0.346	0.346
- Middle lobe and lingual	0.452	0.430	0.886	0.346	0.346
- Lower lobe	0.435	0.738	0.316	0.626	0.626
Shape					
- Well defined	0.004**	0.791	0.773	0.246	0.246
- Ill defined	0.001**	0.279	0.606	0.197	0.197

Note: Chi-square test, P value > 0.05: Non-significant (NS); P value < 0.05*: Significant (S); P value < 0.01**: Highly significant (HS)

Table 3 The significance of inhalation, inflammatory, autoimmune and edema/hemorrhagic lung diseases regarding the associated CT chest findings

HRCT Finding	P Value	Inhalation	Inflammation	Autoimmune	Hemorrhage/EDEMA
Tree-in-bud	0.239	0.115	0.898	0.588	0.588
Ground glass	0.008**	1.000	0.581	0.430	0.430
Peri-lymphatic nodule	0.093	0.180	0.000**	0.067	0.067
Cavitation	0.316	0.300	0.573	0.784	0.784
Septal thickening	0.211	0.085	0.481	0.732	0.732
Bronchiectasis	0.804	0.005**	0.661	0.414	0.414
Bronchial wall thickening	0.036*	0.004**	0.886	0.346	0.346
Atelectasis	0.708	0.753	0.265	0.588	0.588
Air trapping	0.002**	0.780	0.732	0.481	0.481
Reticulations	0.207	0.279	0.105	0.430	0.430

HRCT Finding	P Value	Inhalation	Inflammation	Autoimmune	Hemorrhage/EDEMA
Pleural effusion	0.390	0.553	0.628	0.814	0.814
Lymphadenopathy	0.979	0.557	0.905	0.534	0.534

Note: Chi-square test, P value > 0.05: Non-significant (NS); P value < 0.05*: Significant (S); P value < 0.01**: Highly significant (HS)

Inflammatory/Infectious Etiology:

Out of 31 cases with inflammation/infectious etiology:

- Sixteen (55.17%) cases were diagnosed as viral bronchiolitis.
- Nine cases (31.03%) were diagnosed with active granulomatous infection **(Fig. 5).**
- Four cases (13.9%) were diagnosed with fungal bronchiolitis.

The number, distribution and shape of infection/inflammatory centri-lobular nodules are listed in **Table 2.**

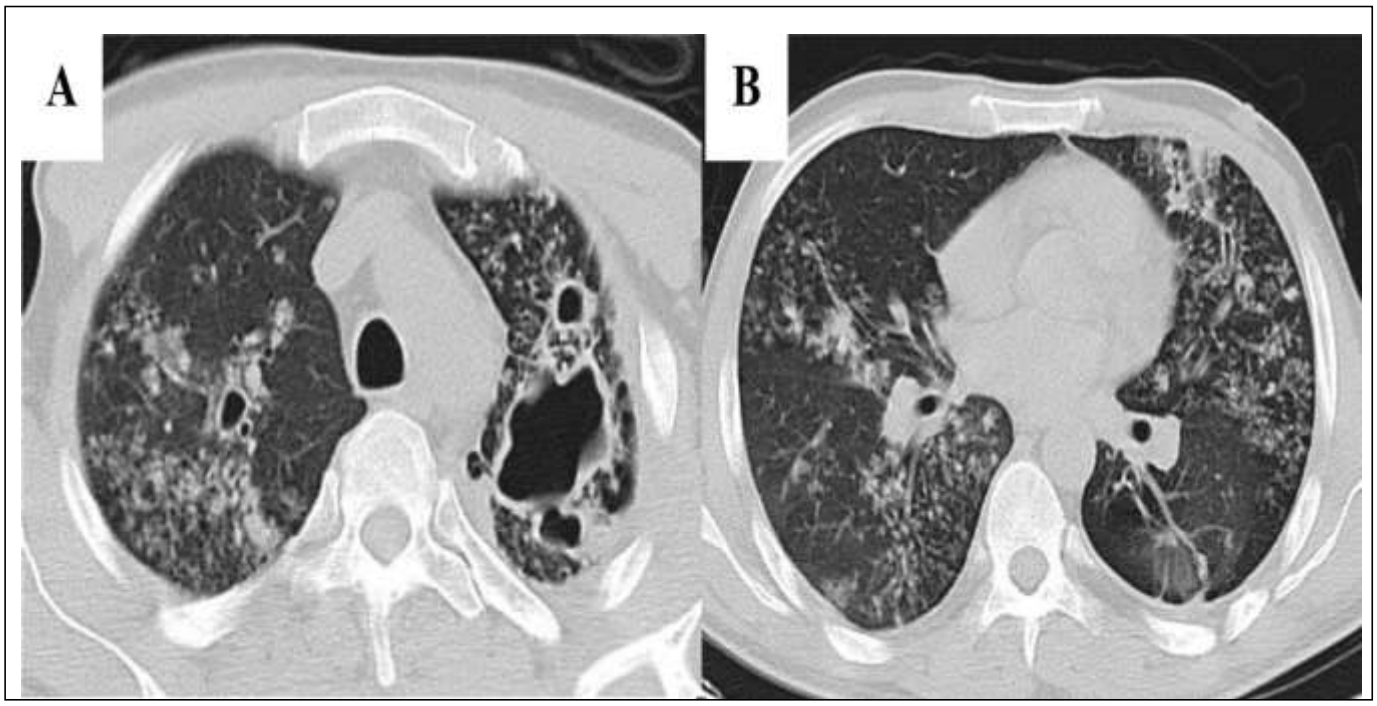


Fig. 5 A 39-year-old male complaining of fever, night sweats, productive cough with occasional blood streaking in the sputum and weight loss for about 6 months. HRCT of the chest in a, b axial lung window images showing bilateral multiple well-defined centri-lobular and tree-in-bud nodules with bronchiectatic changes and upper lobar cavitation. The diagnosis of active granulomatous infection (pulmonary tuberculosis) was made

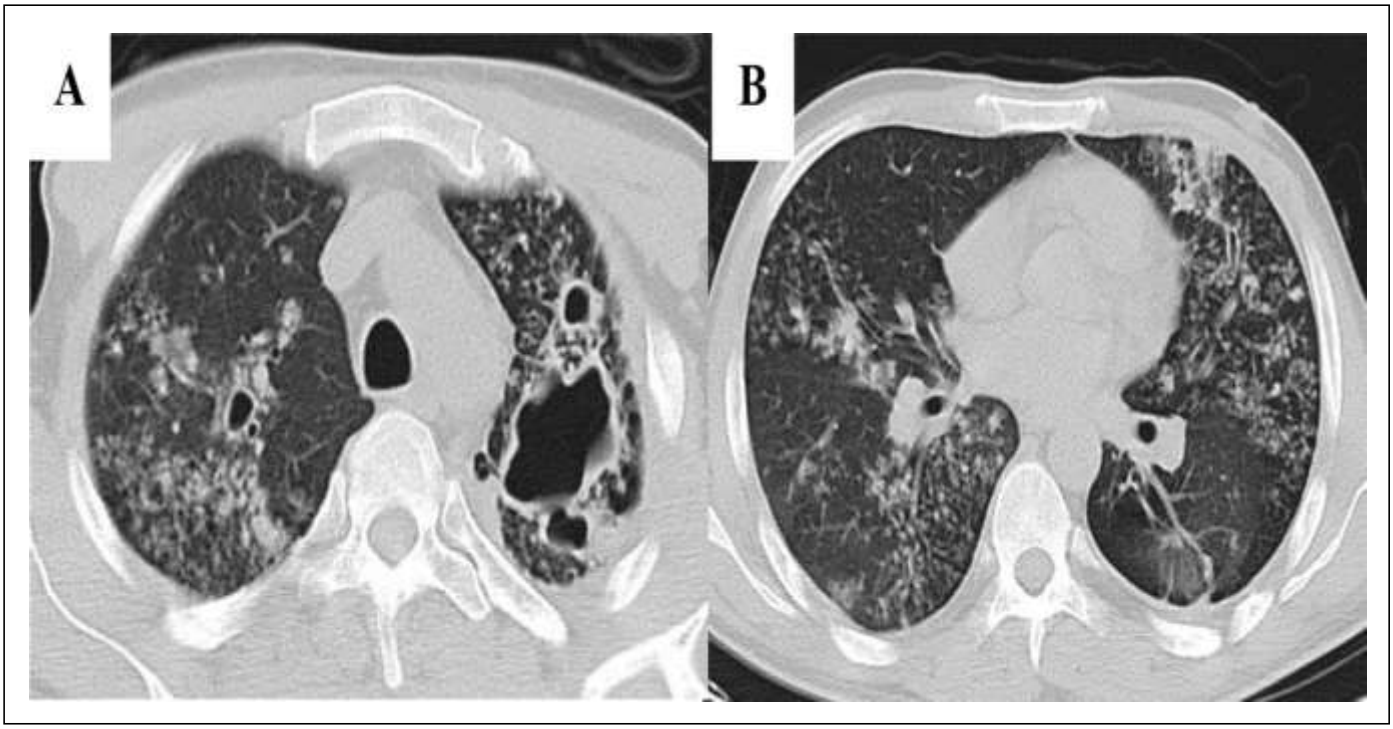


Fig. 6 A 31-year-old female presented with the chief complaints of cough with occasional blood in the sputum, shortness of breath and lethargy for 6 months and exacerbated since last 2 weeks. HRCT lungs sequential axial cuts showed bilateral mainly central bronchiectasis, with mucus blugging, multilobar well-defined centri-lobular nodules and tree-in-bud appearance. The laboratory, clinical and radiological diagnosis of fungal lung infection as ABPA was made

Correlation with Other Etiological Diagnoses:

High statistical significance was found regarding multi-segment distribution. Associated HRCT lung findings showed high statistical significance regarding bronchial wall thickening and bronchiectasis, as shown in **Table 3.**

Autoimmune Etiology:

Out of four cases diagnosed with autoimmune disease:

- Two cases (50%) had rheumatoid arthritis, characterized by few single segment lower lobar ill-defined centri-lobular and peri-lymphatic nodules.
- The other two cases (50%) had non-specific autoimmune disease; one exhibited bronchiolitis obliterans with bilateral multi-segment well-defined centri-lobular and peri-lymphatic nodules, bronchial wall thickening, bronchiectasis, and air trapping, while the other showed follicular bronchiolitis with bilateral diffuse well-defined centri-lobular nodules and tree-in-bud appearance, along with associated ground glass opacities, bronchial wall thickening, bronchiectasis, and pleural effusion.

Correlation with Other Etiological Diagnoses:

No statistical significance was observed in terms of centri-lobular nodules distribution, number, location, and shape, as seen in **Table 2.** However, statistically significant differences were noted concerning peri-lymphatic nodules in associated HRCT findings, as shown in **Table 3.**

Other Etiological Diagnoses:

- Four cases diagnosed with sarcoidosis exhibited bilateral well-defined centri-lobular and peri-lymphatic nodules involving multiple lobes, with nodular septal thickening and mediastinal lymphadenopathy **(Fig. 7).**
- Four cases diagnosed with aspiration pneumonitis displayed well-defined multi-segment centri-lobular nodules with a tree-in-bud pattern, along with associated ground glass opacity, bronchial wall thickening, and bronchiectasis **(Fig. 8).**

- One case diagnosed with pulmonary edema presented bilateral multiple ill-defined centri-lobular nodules associated with ground glass opacities, smooth septal thickening, bronchial wall thickening, and pleural effusion.
- One case diagnosed with alveolar hemochromatosis showed bilateral diffuse ill-defined centri-lobular and peri-lymphatic nodules **(Fig. 9).**
- One case diagnosed with Langerhans cell histiocytosis exhibited bilateral multiple well-defined centri-lobular nodules involving all lung lobes, along with irregular cysts and cavitary lesions.

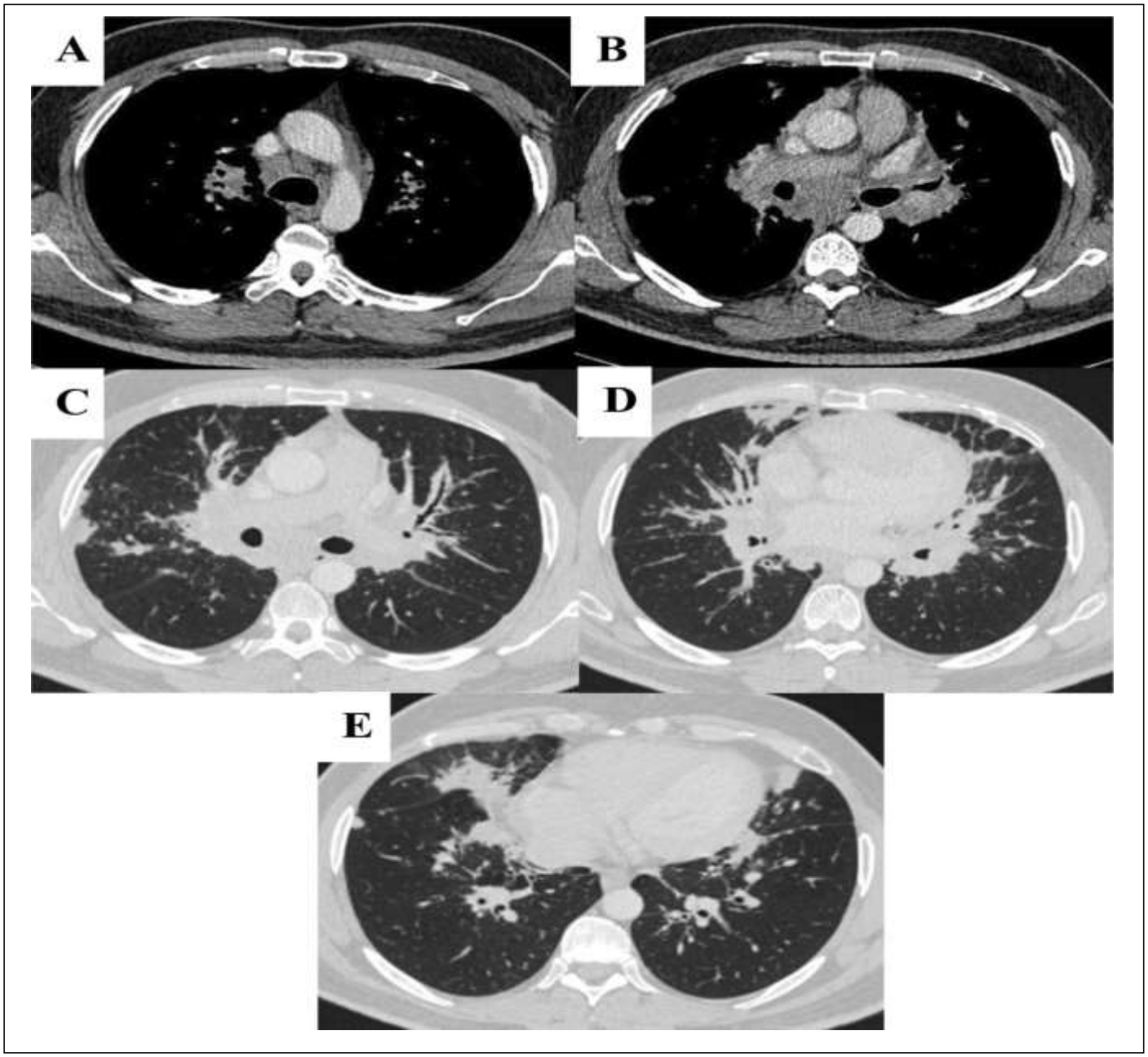


Fig. 7 A 33-year-old male complaining of persisted dry cough, wheezing and dyspnea. HRCT of the chest in A, B axial mediastinal window showing mediastinal and bilateral hilar lymphadenopathy, and c–e axial lung window images showing bilateral well-defined centri-lobular and peri-lymphatic nodules involving multiple lobes with nodular septal thickening and beaded fissures. The diagnosis of sarcoidosis was made.

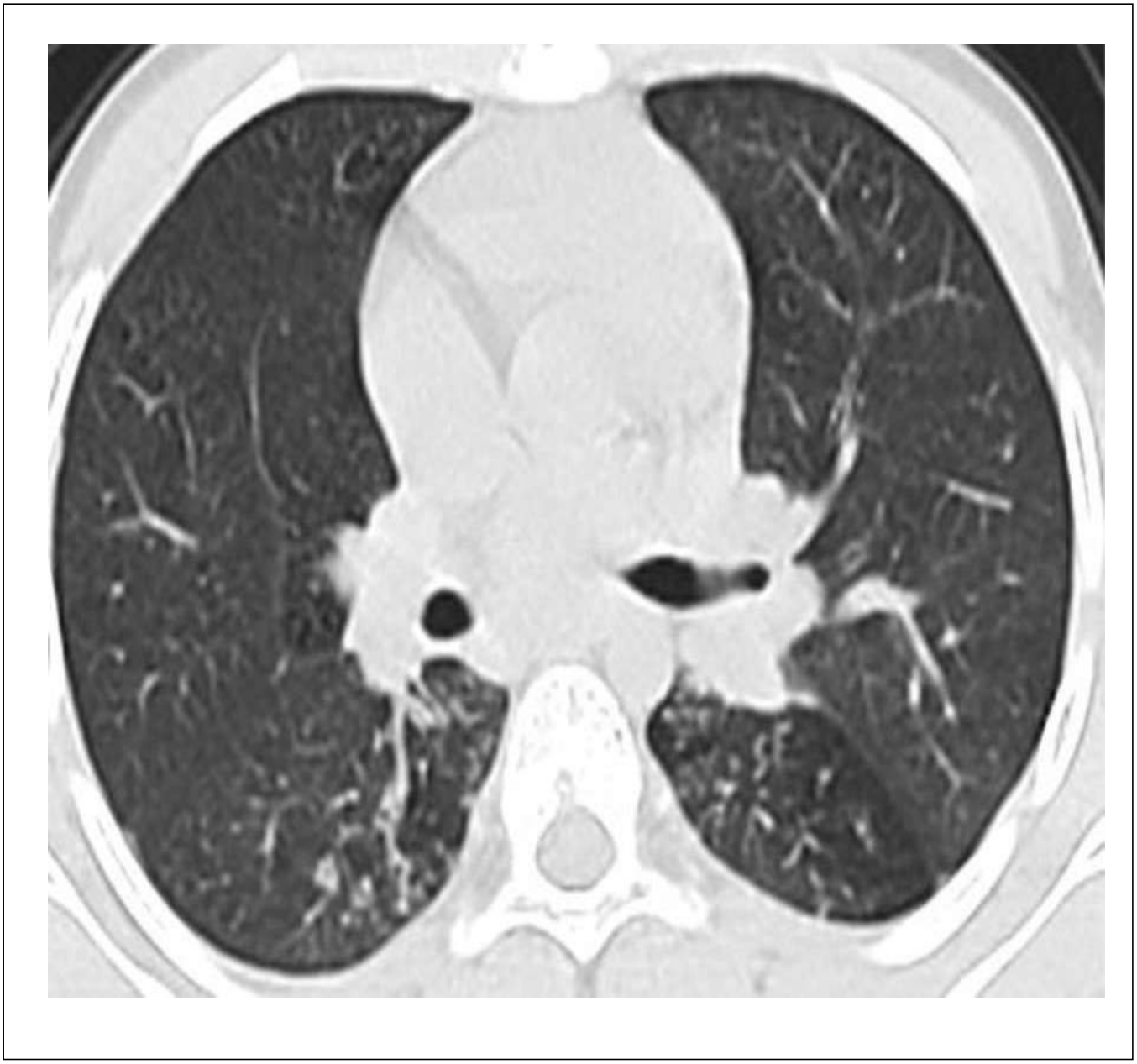


Fig. 8 A 56-year-old male with neuromuscular disorder complaining of dyspnea, cough and fever. HRCT of the chest in axial lung window image showing bilateral lower lobar apical segments centri-lobular and tree-in-bud nodules. The diagnosis of aspiration pneumonitis was made.

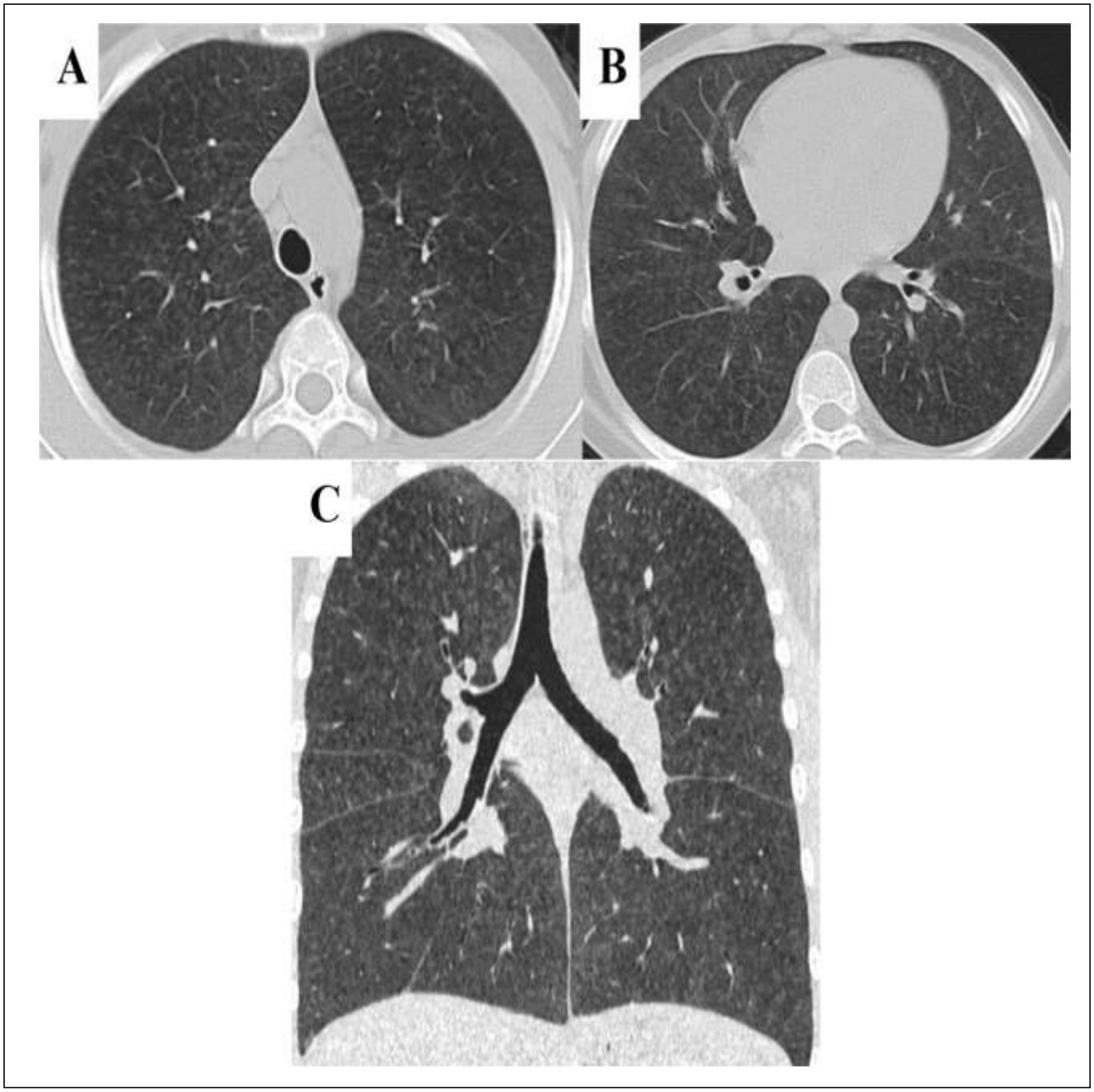


Fig. 9 A 25-year-old male complaining of hemoptysis. HRCT of the chest in a, b axial and c coronal lung window images showing bilateral diffuse ill-defined centri-lobular and peri-lymphatic nodules. Lung biopsy was taken and revealed alveolar hemochromatosis

The diagnostic approach used in the studied cases and an algorithm for the diagnostic approach of various etiologies of centri-lobular pulmonary nodules are illustrated in Tables 4 and Fig. 10, respectively.

Table 4 Summary for the diagnostic approach for the various etiologies of centri-lobular pulmonary nodules

Diagnosis	Age Group	Clinical Data	Lesion Distribution	Centri-lobular Nodule Shape	Associated CT Chest Findings	Need for Other Investigation
Hypersensitivity Pneumonitis (HP)	Young and middle age	History of allergen exposure, chronic cough, difficulty in breathing, chest tightness	Bilateral, diffuse, mainly upper and middle lobes	Ill defined	Ground glass opacities, air trapping (mosaic attenuation) in subacute type, mainly upper fibrosis in chronic type	Broncho-alveolar lavage
Respiratory Bronchiolitis (RB) / RB-ILD	Middle age	Smoker, chronic cough, exertional dyspnea	Bilateral, mainly upper lobar	Ill defined	Ground glass opacities, bronchial wall thickening, reticulations, and fibrosis in advanced RB-ILD	
Bronchiolitis Obliterans	Mostly young age	History of toxin inhalation, lung transplantation, or history of atypical infection, dry cough, progressive difficulty in breathing	Segmental or diffuse according to etiology	Well defined	Bronchiectasis, bronchial wall thickening, oligemic lung, and air trapping	
Viral Bronchiolitis	Any age	Fever, dry or productive cough, mild chest pain	Differ from bilateral, unilateral, and single lobe to multiple lobes	Mostly well defined, some ill-defined, tree-in-bud pattern	Bronchial wall thickening, ground glass opacities, atelectasis	Laboratory tests
Active Granulomatous Infection	Mostly middle age	Fever and night sweats, chest pain, occasional blood in sputum, weight loss, loss of appetite, generalized weakness	Bilateral, mostly multi-segmental	Mostly well defined, tree-in-bud pattern	Bi-apical reticulations, bronchial wall thickening, bronchiectasis, sometimes cavitation, ground glass, mediastinal lymphadenopathy	Tuberculin test
Fungal Bronchiolitis	Mostly young	Cough with sputum, difficulty in breathing, fever, blood in sputum, weakness	Mostly bilateral, multi-segment, could be single lobe	Mostly well defined, tree-in-bud pattern	Bronchial wall thickening, bronchiectasis, cavitation	CBC and sputum analysis
Autoimmune	Middle age	Dry cough, difficulty in breathing	Differ from few to diffuse, single segment to multiple segment, and unilateral to bilateral	Mostly well defined	Peri-lymphatic nodules, ground glass opacities, bronchial wall thickening, bronchiectasis, air trapping	Laboratory studies
Sarcoidosis	Middle age	Persistent dry cough, chest pain, difficulty in breathing, wheezing	Bilateral, few to multiple, multiple segments, and multiple lobes	Well defined	Peri-lymphatic nodules, mediastinal lymphadenopathy, upper lobe fibrosis in advanced cases	Kveim test and LN biopsy

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Respiratory Bronchiolitis (RB) / RB-ILD	Middle age	Smoker, chronic cough, exertional dyspnea	Bilateral, mainly upper lobar	Ill defined	Ground glass opacities, bronchial wall thickening, reticulations, and fibrosis in advanced RB-ILD	
Bronchiolitis Obliterans	Mostly young age	History of toxin inhalation, lung transplantation, or history of atypical infection, dry cough, progressive difficulty in breathing	Segmental or diffuse according to etiology	Well defined	Bronchiectasis, bronchial wall thickening, oligemic lung, and air trapping	
Viral Bronchiolitis	Any age	Fever, dry or productive cough, mild chest pain	Differ from bilateral, unilateral, and single lobe to multiple lobes	Mostly well defined, some ill-defined, tree-in-bud pattern	Bronchial wall thickening, ground glass opacities, atelectasis	Laboratory tests
Active Granulomatous Infection	Mostly middle age	Fever and night sweats, chest pain, occasional blood in sputum, weight loss, loss of appetite, generalized weakness	Bilateral, mostly multi-segmental	Mostly well defined, tree-in-bud pattern	Bi-apical reticulations, bronchial wall thickening, bronchiectasis, sometimes cavitation, ground glass, mediastinal lymphadenopathy	Tuberculin test
Fungal Bronchiolitis	Mostly young	Cough with sputum, difficulty in breathing, fever, blood in sputum, weakness	Mostly bilateral, multi-segment, could be single lobe	Mostly well defined, tree-in-bud pattern	Bronchial wall thickening, bronchiectasis, cavitation	CBC and sputum analysis
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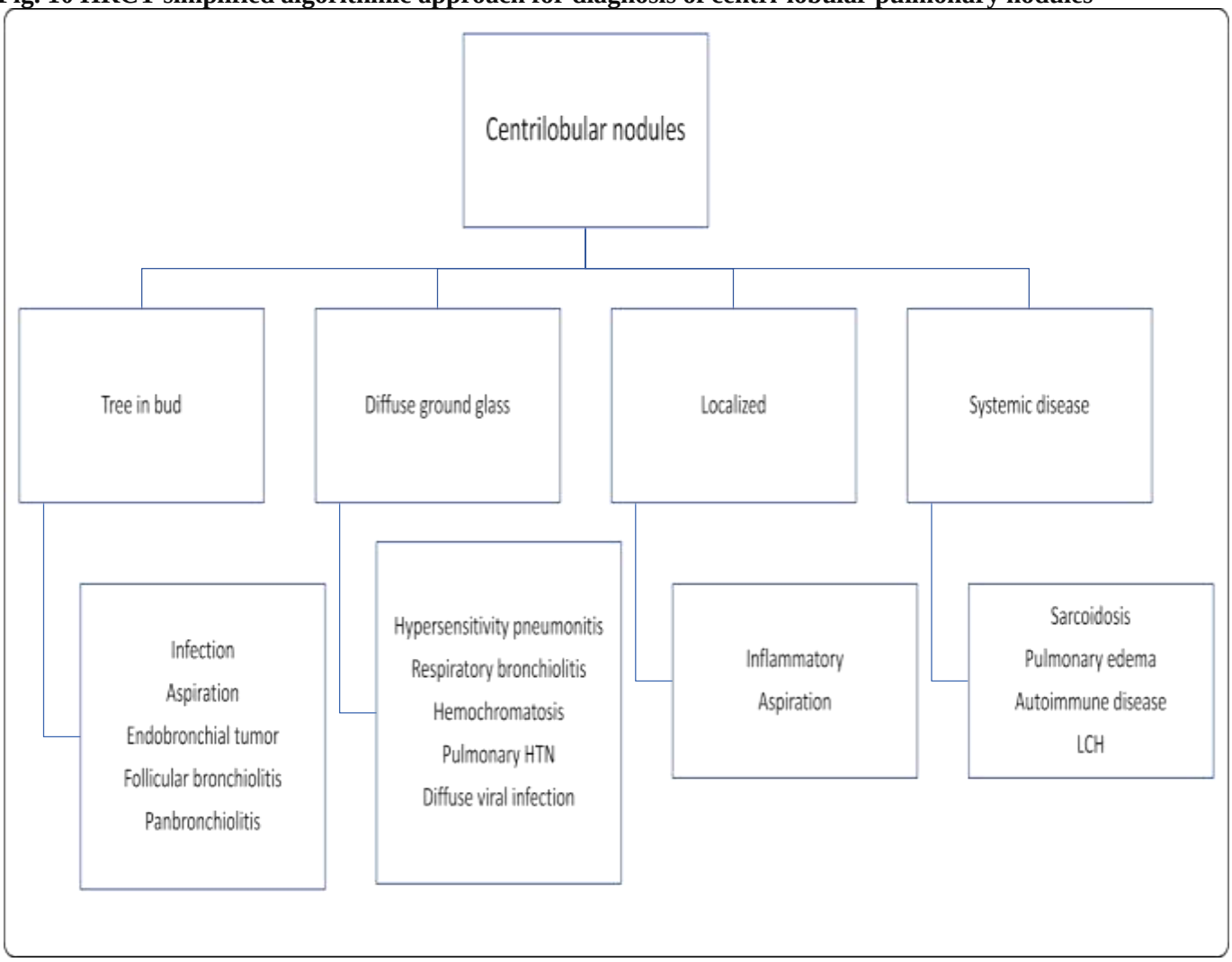
Sarcoidosis	Middle age	Persistent dry cough, chest pain, difficulty in breathing, wheezing	Bilateral, few to multiple, multiple segments, and multiple lobes	Well defined	Peri-lymphatic nodules, mediastinal lymphadenopathy, upper lobe fibrosis in advanced cases	Kveim test and LN biopsy
Aspiration Pneumonitis	Any age	History of esophageal or neurological disorder, cough with sputum, difficulty in breathing, fever, foul odor breath	Bilateral, multiple segments, mostly posterior segments of upper and lower lobes	Mostly well-defined, tree-in-bud pattern	Ground glass opacities, bronchial wall thickening, bronchiectasis, and atelectasis	
Pulmonary Edema	Any age	Cough with sputum, difficulty in breathing especially at night	Bilateral, multiple, multiple segments, middle and lower lobes	Ill defined	Ground glass opacities, smooth interlobular septal thickening, bronchial wall thickening, and pleural effusion	Echo-cardiography and laboratory tests
Alveolar Hemochromatosis	Young age	Fatigue, difficulty in breathing on exertion, joint pain, abdominal pain, failure to gain weight	Bilateral, diffuse, all lung lobes	Ill-defined and fluffy	Mild interstitial fibrosis, interlobular septal thickening with repeated hemorrhage	Laboratory tests
Langerhans Cell Histiocytosis	Young age	Male, dry cough, difficulty in breathing, chest pain, weight loss	Bilateral, multiple, upper and middle lobar predominance	Well defined	Irregular cysts and cavitary lesions	Biopsy

Fig. 10 HRCT simplified algorithmic approach for diagnosis of centri-lobular pulmonary nodules



DISCUSSION:

Centri-lobular nodules are a common finding on HRCT scans, but they present a broad range of potential diagnoses. This study aimed to document the prevalent HRCT findings associated with centri-lobular pulmonary nodules across various conditions and compare their different etiologies.

The study identified four main etiological categories for centri-lobular nodules: infection/inflammatory lung disease (including viral, granulomatous, fungal diseases, and aspiration pneumonitis), inhalation lung disease (such as hypersensitivity pneumonitis, RB, RB-ILD, and post-toxin-bronchiolitis obliterans), autoimmune diseases (like sarcoidosis, rheumatoid arthritis, and non-specific autoimmune diseases), and hemorrhage and lung edema.

Imaging findings play a crucial role in supporting the diagnosis of inhalation lung disease, alongside clinical criteria and exposure to allergens. Consistent with previous studies, this research found ground glass opacity and reticulations to be common HRCT findings in patients with inhalation lung diseases. Additionally, bronchial wall thickening was identified as a major HRCT feature in patients with RB-ILD, while centri-lobular nodules associated with ground glass opacities were considered inconsistent features in bronchiolitis obliterans.

Regarding infection and inflammatory lung diseases, centri-lobular nodules were identified as the main CT features in bronchiolitis cases. Additionally, bronchial wall thickening and ground glass opacities were common findings in these cases. Multi-segment distribution was prevalent across various conditions, with fungal infections often presenting nodularly.

In tuberculosis cases, centri-lobular nodules with segmental distribution were common on CT scans, while in sarcoidosis, nodules were typically observed in a miliary distribution, often bilaterally. Rheumatoid arthritis patients exhibited ground glass opacities as the most common finding, while centri-lobular nodules were present in a significant proportion of cases.

Aspiration pneumonitis was characterized by tree-in-bud nodularity on HRCT, along with features like bronchiectasis and ground glass opacities. Hemochromatosis often presented with patchy ground glass nodules, predominantly in the upper lobe, and Langerhans cell histiocytosis featured lung cysts and cavitation, alongside centri-lobular nodules.

A multidisciplinary approach involving history-taking, analysis of radiographic features, and auxiliary assessments such as laboratory or histopathological evaluations is crucial for reaching a proper diagnosis in cases of centri-lobular pulmonary nodules.

The study's main limitation was the relatively small number of cases within each disease category

CONCLUSIONS:

High-resolution computed tomography (HRCT) emerges as a valuable tool for both the detection and characterization of centri-lobular pulmonary nodules. Its utility lies in its ability to discern the varied etiologies associated with centri-lobular nodularity, enabling clinicians to make informed diagnostic and management decisions. However, HRCT findings should not be interpreted in isolation; they should be complemented by other associated features and a multidisciplinary approach for further refinement of the most relevant etiological diagnosis.

ABBREVIATIONS:

HP: Hypersensitivity pneumonitis; HRCT: High-resolution computed tomography; LCH: Langerhans cell histiocytosis; MinIP: Minimum intensity projection; MIP: Maximum intensity projection; RB: Respiratory bronchiolitis; RB-ILD: Respiratory bronchiolitis interstitial lung disease.

ACKNOWLEDGEMENTS:

We extend our gratitude to all individuals involved in the acquisition and interpretation of the patient data.

FUNDING:

The authors declare that this work did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

AVAILABILITY OF DATA AND MATERIALS:

The datasets analyzed during the current study are available from the corresponding author upon reasonable request.

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