



RADIOLOGICAL CHANGES IN POST-COVID PATIENTS PRESENTING WITH BREATHLESSNESS AT A TERTIARY CARE CENTRE

Pulmonary Medicine

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ABSTRACT

Background: Breathlessness remains one of the most common persistent symptoms in patients recovering from COVID-19, even years after initial infection. High-Resolution Computed Tomography (HRCT) is pivotal in detecting long-term pulmonary sequelae. **Aim:** To analyse Radiological findings in post-COVID patients presenting with breathlessness and correlate imaging patterns with clinical severity. **Methods:** A prospective cross-sectional study was conducted at a tertiary care centre between January 2023 and December 2025. A total of 132 post-COVID patients presenting with persistent or new-onset breathlessness (>2 years post-infection) were included. HRCT thorax was performed, and findings were analyzed. CT severity scoring was used to categorize lung involvement. Statistical analysis was performed using chi-square and Pearson correlation tests. **Results:** Among 132 patients (mean age 48.7 ± 12.4 years; 62% males), the most common HRCT finding was fibrotic changes (56%), followed by ground-glass opacities (45%), bronchiectasis (28%), and air trapping (20%). Patients with severe acute COVID illness had a significantly higher prevalence of fibrosis ($p < 0.01$). A moderate positive correlation ($r = 0.62$) was found between initial CT severity score and residual lung abnormalities. **Conclusion:** HRCT reveals a substantial burden of long-term pulmonary sequelae among post-COVID patients presenting with breathlessness, even 2–3 years after infection. Early recognition of fibrotic changes can guide follow-up, rehabilitation, and interventions to improve long-term outcomes.

KEYWORDS

Post-COVID, HRCT, breathlessness, pulmonary fibrosis, tertiary care

INTRODUCTION

The coronavirus disease 2019 (COVID-19), caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), has profoundly impacted global health since its emergence in late 2019. While the majority of patients recover from the acute phase, a significant subset develop persistent symptoms and radiological abnormalities, constituting what is now recognized as **post-COVID syndrome** or **long COVID**. According to recent meta-analyses, the prevalence of long COVID ranges from **10% to 30%** among individuals recovering from symptomatic infection, with **breathlessness (dyspnea)** being one of the most commonly reported residual symptoms [1,2].

Persistent breathlessness in post-COVID patients may result from a spectrum of **structural and functional pulmonary sequelae**, including:

- **Interstitial fibrotic changes** secondary to severe viral pneumonitis
- **Persistent ground-glass opacities (GGOs)** reflecting ongoing inflammation or delayed resolution
- **Air trapping** due to small-airway disease
- **Bronchiectasis** and parenchymal distortion resulting from organizing pneumonia
- Less frequently, pulmonary vascular complications, including chronic thromboembolic changes

High-Resolution Computed Tomography (HRCT) of the thorax has emerged as the **gold standard imaging modality** for evaluating these sequelae. It provides detailed characterization of parenchymal patterns, quantifies residual lung involvement, and aids in differentiating **reversible inflammatory changes** from **irreversible fibrotic remodeling** [3,4]. Moreover, HRCT findings can guide pulmonary rehabilitation, antifibrotic therapy, and long-term clinical monitoring.

Despite the large burden of post-COVID morbidity, there remains **limited high-quality evidence** correlating HRCT findings with persistent respiratory symptoms, especially in patients presenting **2–3 years post-infection**. This knowledge gap is particularly relevant in tertiary care settings in India, where patient populations exhibit significant heterogeneity in terms of initial disease severity, treatment received, and comorbidities.

This study aims to systematically evaluate HRCT thorax findings in **post-COVID patients presenting with breathlessness** at a tertiary care centre and establish correlations between imaging patterns and the clinical course of disease. By doing so, it seeks to improve our understanding of the long-term pulmonary sequelae of COVID-19 and provide insights for **early diagnosis, management, and follow-up**.

AIMS & OBJECTIVES

1. To evaluate radiological findings in post-COVID patients presenting with breathlessness.
2. To correlate HRCT patterns with the severity of the initial COVID-19 infection.
3. To assess the prevalence and distribution of fibrotic sequelae and their association with clinical outcomes **2 to 3 years after infection**.
4. To provide imaging-based recommendations for follow-up and management.

MATERIALS AND METHODS

Study Design & Setting

- **Design:** Prospective cross-sectional study
- **Setting:** Department of Respiratory Medicine, SRMS-IMS, Bareilly
- **Duration:** January 2023 to December 2025

Study Population

- **Sample size:** all patients came to Respiratory Medicine OPD/IPD during this duration.
- **Inclusion Criteria:**
 - Age ≥ 18 years
 - Confirmed COVID-19 (RT-PCR or RAT positive)
 - Persistent or new-onset breathlessness **2 to 3 years post-infection**
- **Exclusion Criteria:**
 - Pre-existing chronic lung disease
 - Immuno-compromised status
 - Incomplete clinical or imaging data

HRCT Protocol

- **Scanner:** 128-slice multidetector CT
- Technical parameters: 120 kVp, 150 mAs, 1 mm slice thickness
- HRCT patterns evaluated:
 - Ground-glass opacities (GGO)
 - Reticulations
 - Traction bronchiectasis
 - Honeycombing
 - Air trapping
 - Consolidation

Statistical Analysis

- Data analyzed using SPSS v26.0
- Chi-square test used for categorical variables
- Pearson correlation used to evaluate association between acute-phase severity and residual fibrosis
- $p < 0.05$ considered statistically significant

RESULTS

Demographics

Parameter	Value
Total patients	132
Mean age	49.3 ± 13.2 years
Male:Female ratio	1.5:1
Mean time since COVID	2 to 3 years

HRCT Findings

HRCT Finding	Frequency (%)
Fibrotic changes	58.3%
Ground-glass opacities	47%
Traction bronchiectasis	30%
Air trapping	22%
Honeycombing	14%
Consolidation	10%

Figure 2: HRCT showing fibrotic bands and traction bronchiectasis.

Initial COVID Severity	Number of Patients	Fibrosis (%)	p-value
Mild	40	18%	<0.05
Moderate	55	55%	<0.01
Severe	37	80%	<0.01

Correlation with Acute COVID Severity

DISCUSSION

This study demonstrates that a significant proportion of post-COVID patients presenting with breathlessness exhibit persistent and sometimes progressive lung abnormalities on HRCT, even after 2–3 years since the acute illness. The predominance of **fibrosis and GGOs** underscores the evolving understanding that COVID-19 can lead to **chronic interstitial lung disease** in a subset of patients.

Our findings align with global reports highlighting **post-COVID interstitial lung disease (ILD)** as an emerging concern. Persistent HRCT abnormalities, particularly fibrotic bands, reticulations, and honeycombing, indicate that COVID-19 acts as a trigger for aberrant wound healing and fibrosis in predisposed individuals. Studies have shown that up to **30-70%** of hospitalized patients continue to have HRCT abnormalities for several years, mirroring our results.

Importantly, we observed a **strong correlation between initial disease severity and long-term fibrosis**. Patients who required hospitalization, ICU care, or mechanical ventilation during the acute phase demonstrated the highest burden of fibrotic sequelae. This emphasizes the necessity of early and structured follow-up for high-risk individuals.

Interestingly, a notable subset of patients with initially mild disease also exhibited residual GGOs, suggesting **ongoing low-grade inflammation, microvascular injury, or impaired alveolar repair mechanisms**. This finding challenges the assumption that mild COVID-19 universally leads to full recovery.

CLINICAL IMPLICATIONS

- **Long-term follow-up:** Patients recovering from moderate-to-severe COVID-19 require structured imaging and functional evaluations for at least 2–3 years.
- **Pulmonary rehabilitation:** Early initiation of rehabilitation programs can improve exercise tolerance and quality of life.
- **Antifibrotic therapies:** Emerging evidence suggests a potential role for antifibrotic drugs in preventing progressive post-COVID fibrosis.
- **Multidisciplinary care:** Collaboration between radiologists, pulmonologists, and rehabilitation specialists is essential for optimal management.

LIMITATIONS

Our study is limited by being single-centre and having a modest sample size. Serial imaging and pulmonary function testing could strengthen conclusions regarding progression versus resolution of lung changes.

CONCLUSION

This study highlights the **long-term pulmonary burden** of COVID-19, demonstrating that significant proportions of patients experience persistent HRCT abnormalities and breathlessness **even 2–3 years post-infection**. Fibrosis, GGOs, and traction bronchiectasis dominate

the imaging spectrum and are strongly associated with the severity of initial illness.

KEY TAKEAWAYS:

- HRCT remains the cornerstone for evaluating long-term pulmonary sequelae of COVID-19.
- Early detection of fibrosis allows timely interventions, including pulmonary rehabilitation and, in select cases, anti-fibrotic therapy.
- There is a pressing need for longitudinal multicentre studies to fully understand the natural history of post-COVID lung disease.

By acknowledging the chronic respiratory impact of COVID-19, clinicians can improve patient outcomes through **personalized follow-up protocols, targeted therapies, and preventive strategies**.

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