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## Pulmonary sequelae of moderate-to-severe COVID pneumonia, a 3-month follow-up study

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Sir,

While the entire world continues to fight the long battle with COVID-19 disease, the resources are still predominantly utilized in understanding the pathophysiology, management, and prevention of acute COVID-19 illness. There are insufficient data about the prevalence of post-COVID-19 pulmonary complications. Hence, we conducted an observational study in the Department of Pulmonary Medicine, Kokilaben Dhirubhai Ambani Hospital and Medical Research Institute, Mumbai, to assess the prevalence and severity of post-COVID-19 pulmonary sequel.

Patients with COVID-19 pneumonia requiring oxygen therapy who were admitted in the hospital and had positive severe acute respiratory syndrome coronavirus 2 (SARS-CoV 2) polymerase chain reaction test were enrolled in the study. This population of patients

was further classified into moderate if their oxygen requirement was  $<4$  L/min and severe if their oxygen requirement was more than 4 L/min. The study was approved by the Institutional Ethics Committee. The patients were followed up with lung function test at 6–8 weeks from the onset of symptoms and then again at 12–16 weeks following the onset of symptoms and had a computed tomography (CT) scan of chest at 3 months.

We collected data on 42 patients over a 5-month period with two sets of lung function tests and a follow-up CT scan. 11 (26.2%) patients had moderate and 31 (73.8%) patients had severe pneumonia. The mean age was 58 years. 35 (83.33%) patients had DLCO level of  $<80\%$  at 6 weeks, while 20 (47.61%) patients had restriction on lung function test, i.e., FVC  $<80\%$ . 13 (30.95%) patients achieved normal DLCO at their second follow-up visit, while 32 (76.19%) patients had a normal FVC. There

**Table 1: Comparison of lung function at 1st and 2nd visit**

	1 <sup>st</sup> visit	2 <sup>nd</sup> visit	P
FVC (L)	2.48±0.67	2.84±0.58	0.001
FVC (%)	80.38±17.74	91.24±13.02	0.001
DLCO (%)	61.52±16.89	71.47±15.04	0.001

Data presented as mean±SD. SD: Standard deviation, FVC: Forced vital capacity, DLCO: Diffusing capacity of the lungs for carbon monoxide

was a significant improvement in serial lung function in both FVC and DLCO, with  $P = 0.001$  [Table 1]. The improvement was much more significant in severe category as compared to moderate category in FVC (19.9% vs. 6.5%,  $P = 0.02$ ) and in DLCO (3.4% vs. 26.8%,  $P = 0.002$ ). The baseline high-resolution CT chest showed mean lung involvement of  $47.8\% \pm 18.8\%$ . Ground-glass opacities and septal thickening were seen in all patients, while crazy paving and organizing pattern in 50% of the patients. On CT follow-up at the interval of 12 weeks, significant regression of abnormalities was seen in all patients, and no diagnostic abnormality was detected in 10 (23.8%) patients. Septal bands and septal thickening were the predominant features and were observed among 28 (66.7%) and 18 (42.9%) patients, respectively. Linear atelectasis, traction bronchiectasis, residual ground-glass opacities, and air trapping were seen in 9 (21.4%), 20 (47.6%), 17 (40.4%), and 11 (26.2%) patients, respectively.

Heyland *et al.* and Orme *et al.* have demonstrated significant correlation of pulmonary function test (PFT) with health-related quality of life based on respiratory specific questionnaire, namely the St. George's Respiratory Questionnaire in post-acute respiratory distress syndrome (ARDS) patients.<sup>[1,2]</sup> We currently do not know whether the acute lung injury in COVID-19 disease is pathophysiologically different to other causes of ARDS. Most studies on long-term follow-up of ARDS patients including SARS-CoV patients showed significant improvement in the lung function by the end of 1 year, and residual changes were in the form of mild restriction and diffusion capacity defect.<sup>[3-5]</sup> Our 3-month follow-up results are in line with these results. Similarly, very few short-term follow-up series of COVID-19 patients showed interval resolution, indicating recovery of CT findings among these patients.<sup>[6,7]</sup> Similar imaging features were identified among the follow-up SARS and H1N1 pneumonia patients, and extent of CT abnormality in long run did not appear significant.<sup>[8-11]</sup> In light of good PFT and CT recovery, persistent post-COVID symptoms are partially attributable to neuromuscular weakness, mental health, and physiological deconditioning.

All our patients were treated with remdesivir and steroids with the average duration of steroids of about 2 weeks, and none of these patients were offered antifibrotics.

The study reveals that COVID-19 pneumonia does not induce a progressive fibrotic pathway in the lungs, at least at 3 months of follow-up. The antifibrotic drugs can slow down the process of fibrosis and not reverse it, and their role has been proven in chronic lung disease and not acute pneumonia or ARDS. We believe that randomized trials is essential to see an added benefit of these drugs as, in our study, the lung functions are getting better without any antifibrotic therapy.

Our study will help planning the follow-up and counseling of the patients and choosing a proper population of patients for the enrolment in antifibrotic drug studies.

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#### Conflicts of interest

There are no conflicts of interest.

**Sumeet Vimal Kishor Singhania<sup>1</sup>, Caroline Simon<sup>1</sup>,  
Abhijit Raut<sup>2</sup>, Nikhil Parvatkar<sup>2</sup>**

<sup>1</sup>Department of Pulmonary Medicine, Kokilaben Dhirubhai Ambani Hospital and Research Institute, Mumbai, Maharashtra, India, <sup>2</sup>Department of Radiology, Kokilaben Dhirubhai Ambani Hospital and Research Institute, Mumbai, Maharashtra, India.

E-mail: drsinghania@hotmail.com

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