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Pulmonary Function Among Patients Surviving Covid-19 Pneumonia In Govt Dharmapuri Medical College & Hospital

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Abstract

Aim: The aim of our study was to assess respiratory function at the time of clinical recovery in patients surviving to COVID-19 pneumonia.

Methods: Our case series consisted of 20 patients with COVID-19 pneumonia.

Results: At the time of clinical recovery, FEV1 (2.07 ± 0.72 L) and FVC (2.25 ± 0.86 L) were lower compared to lower limit of normality (LLN) values (2.56 ± 0.53 L, $p = 0.004$, and 3.31 ± 0.65 L, $p < 0.001$, respectively), while FEV1/FVC (0.94 ± 0.07) was higher compared to upper limit of normality (ULN) values (0.89 ± 0.01, $p = 0.029$). After 6 weeks pulmonary function improved but FVC was still lower than ULN (2.87 ± 0.81, $p = 0.014$).

Conclusion: These findings suggest that COVID-19 pneumonia may result in clinically relevant alterations in pulmonary function tests, with a mainly restrictive pattern.

Keywords: COVID-19 · Pneumonia · Spirometry

Introduction

Coronavirus disease 2019 (COVID-19) is an emerging zoonosis caused by Severe Acute RespiratorySyndrome Coronavirus 2 (SARS-CoV-2) [1, 2]. Phylogenetically, SARS-CoV-2 sufficientlydiffers from other zoonotic coronaviruses, such as Severe Acute Respiratory SyndromeCoronavirus (SARS-CoV) and Middle East Respiratory Syndrome Coronavirus (MERS-CoV)introduced to humans in the past two decades [1, 3]. Disease resulting from infection withSARS-CoV-2 was first reported in Wuhan, China in December 2019, and the virus rapidlyspread to other regions of the world thereafter [4, 5]. Given the scale of the outbreak, COVID-19 was declared a pandemic on March 12 2020 by the World Health Organization [6].To date, several clinical laboratory parameters associated with Coronavirus disease 2019 (COVID-19) severity have been reported. However, these parameters have not been observed consistently across studies. Though coronavirus is a respiratory virus that replicates in the nose, throat, and lungs, moderate or severe disease can cause hyperinflammation in the body. This dysregulated immune response can be lethal. In symptomatic patients, the clinical manifestations of the disease usually start after less than a week, consisting of fever (body temperature 37 to 38±C), cough, nasal congestion, and fatigue (8).

The majority of patients developing COVID-19 pneumonia had bilateral lung lesions(75.7%, 95% CI = 65.7–84.5%) and respiratory failure oracute respiratory distress syndrome (ARDS) occurred in9.5% (95% CI = 5.0%, 40.3%) of patients [9].As a

new infectious disease carrying a high risk of severecourse and intensive care unit admission, it is particularlyimportant to explore COVID-19 clinical characteristics,which may help to manage properly its sequelae in the postacute phase. It is worth noting that evidence about pulmonary function tests among COVID-19 patients is currently limited to a trial showing that 6-week respiratory rehabilitation can improve respiratory function, quality of life and anxiety of older patients [10]. Therefore, we aimed at assessing respiratory function at the time of clinical recovery and 6 weeks after discharge in patients surviving to COVID-19 pneumonia.

Material and Methods

The study was conducted on 20 adult patients with COVID-19 bilateralpneumonia admitted Government Dharmapuri Medical College & Hospital, Tamilnadu, India from 01 May 2021 to 14 March, 2022.

Inclusion criteria: availability of written informed consent to participate in the study and ability to perform pulmonary function tests correctly.

Exclusion criteria: patients with bacterial infection, smokers, other pre-existing lung illness, patients with onset more than 7 days before, and patients with incomplete data were excluded.

The study protocol was approved by the Institute Ethical Committee.

COVID-19 bilateral pneumonia was diagnosed by positive polymerase chain reaction (PCR) testing on nasopharyngeal swab and presence of bilateral lung infiltrates on chest computed tomography (CT) upon admission.Spirometry was done at the time of clinical recovery (i.e. the day before discharge).

Clinical recovery was defined by the presence of all of the following: absence of fever for at least 48 h, PaO2greater than 60 mmHg on arterial blood gas testing on room air, and negative C-reactive protein (CRP) on two consecutive blood samples performed at least 48 h apart.

Pulmonary function tests were performed using Medspiro portable spirometer.

Forced expiratory volume in the first second (FEV1), forced vital capacity (FVC) and FEV1/FVC ratio were included in the analysis. For each patient lower limit of normality (LLN) values for FEV1,FVC, and upper limit of normality (ULN) values for FEV1/FVC were also calculated by Global Lung Function 2012 equations [11]. Correct performance of forced expiration was ensured by medical personnel who observed the patients at security distance to minimize the risk of infection due to droplet spreading.

Statistical analysis:

Descriptive data were presented as mean ± SD for continuous variables or number (percentage) for categorical ones. Paired data *t* test was used when appropriate. Statistical analysis was carried out by SPSS V.24 statistical software package (SPSS for Windows V24, SPSS Inc., Chicago,IL, USA).

Results:

Overall, patients enrolled in the study were aged 58.8 ± 10.0 years (range 30–78 years) and almost exclusivelymale (18 patients, 90%). Fever (*N* = 18), dyspnea (*N* = 15) andcough (*N* = 13) were the most frequently observed symptoms at presentation. Pre-existing comorbidities are reported in Table 1.

14 out of 20 patients had BMI > 30 kg/m2. The average length of hospital stay was 14.5 ± 7.8 days.

TABLE-1: Demographic parameters of COVID-19 patients

	All patients (*N* = 20)	Patient ID																			
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Age		30	56	64	53	47	72	69	54	42	39	56	78	64	69	72	49	59	63	54	59
Sex		M	M	M	M	M	M	M	M	F	M	M	M	F	M	M	M	M	M	M	M
BMI		30.5	31	33.5	34	26.5	24	35.5	36.5	40	22.5	26.5	28	29.2	34.2	33.3	36.5	33.7	31	32.3	33.8

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Comorbidities																					
DM				+					+		+	+		+		+	+			+	+
HT				+		+			+			+			+		+				
OTHERS																CAD					

CT scan at the time of clinical recovery showed persistent multifocal ground glass opacities in 18 patients, crazy pavingin 10 patients, linear opacities in 9 patients and consolidation pattern associated to multifocal ground glass opacities in 8 patients.

Table 2shows pulmonary function variables of patientsstudied. At the baseline, the average FEV1/FVC was higher compared to ULN values ($p = 0.029$), while FVC ($p < 0.001$)and FEV1($p = 0.004$) were lower compared to respective LLN values in enrolled patients.

TABLE-2: Pulmonary Function tests of COVID-19 patients in our study

S.NO	FVC(% PREDICTED)	FEV1(% PREDICTED)	FEV1/FVC(% PREDICTED)
1	65	75	115
2	60	79	131
3	63	74	117
4	77	80	103
5	62	74	119
6	80	81	101
7	81	86	107
8	72	78	108
9	74	80	108
10	64	86	134
11	80	86	107
12	80	86	107
13	75	78	104
14	78	80	102
15	74	76	102
16	72	78	108
17	70	77	110
18	76	82	107
19	82	84	102
20	79	82	103

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Discussion:

Results of the present case series suggest that COVID-19pneumonia may result in clinically relevant alterations in pulmonary function tests, with a restrictive pattern in 18 out of 20 patients at the time of hospital discharge.

Patients surviving to COVID-19 pneumonia may presentwith a restrictive pulmonary pattern, which is known to beassociated with increased risk of life-threatening comorbidities[12, 13]. While the need of further data with DLCOand plethysmography deserves to be recognized, our results suggest that survivors to COVID-19 pneumonia should becarefully screened for pulmonary function and rehabilitationneeds at the end of acute phase, and eventually referred to specific care pathways to monitor and manage clinically relevant sequelae during follow-up.

Our data suggest that pulmonary function needs to becarefully investigated in COVID-19 patients, as it was already done for other atypical pneumonia.

If our data will be confirmed by a more comprehensive diagnostic assessment, it will likely be necessary to rethink the pneumology services with an increase in the availability of respiratory rehabilitation units in the areas most violently affected by the pandemic. The recent demonstration that sixweeks respiratory rehabilitation can effectively improve respiratoryf unction in older patients with COVID-19 [10] is in keeping with this view.

The small sample size and the simple spirometric approach are main limitations of the present study. Additionally, pulmonary function tests before COVID-19 infectionare not available for our patients. Nevertheless, our results may represent an important first step in the knowledge of COVID-19 consequences in terms of pulmonary function.

Conclusion:

COVID-19 pneumonia may result in significant alterations in lung function, with a mainly restrictivepattern. Further studies are needed to confirm this observation on wider populations and with a more detailed diagnostic work-up. However, given the potential implications of spirometric restrictive patterns in terms of quality of life and independency ofpatients [14], it will be necessary to prevent the tsunami of post-COVID-19 patients from catching healthcare systems unprepared again after the pandemic.

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