



PULMONARY FUNCTION CHANGES IN POST COVID-19 PATIENTS

General Medicine

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ABSTRACT

Introduction: The covid 19 pandemic has exploded since cases were first reported in China on December 2019. As of July 9 2020, more than 12 million cases of Covid 19 caused by Severe Acute Respiratory Syndrome Corona Virus-2(SARS-CoV-2) have been reported, and cases have been reported in more than 180 countries. **Aim and Objectives:** To study the common abnormality in pulmonary function tests in post Covid 19 discharged patients and to correlate with the severity of the disease. **Material and Method:** A single centre, hospital based, observational, cross-sectional study was conducted in the Department of General Medicine, KPC Medical College and Hospital, Jadavpur, Kolkata, both indoor and OPD patients from 25th of August 2020 to 25th Of June 2021. **Result:** In our study, 16(20.0%) patients had Mild restriction at PFT Spirometry Finding-x, 34(42.5%) patients had Moderate Restriction at PFT Spirometry Finding-x, 23(28.8%) patients had moderately severe Restriction at PFT Spirometry Finding-x and 7(8.8%) patients had severe restriction at PFT Spirometry Finding-x. **Conclusion:** DLCO/Va-x was less in severe disease followed by mild and moderate disease which was statistically significant. DLCO/Va-y was less in severe disease followed by mild and moderate disease which was statistically significant.

KEYWORDS

COVID-19, Pulmonary Function, SARS-CoV-2 and Symptoms.

INTRODUCTION

The covid 19 pandemic has exploded since cases were first reported in China on December 2019. As of July 9 2020, more than 12 million cases of Covid 19 caused by Severe Acute Respiratory Syndrome Corona Virus-2(SARS-CoV-2) have been reported, and cases have been reported in more than 180 countries.

Coronavirus disease 2019 (COVID-19), which is caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), was first reported in December 2019 in China, quickly spread to countries across five continents, and was declared a pandemic by the World Health Organization (WHO) on March 11, 2020. By the end of January 2021, more than 90 million cases have been registered across more than 100 countries, and more than 2 million deaths have occurred¹.

The symptoms of COVID-19 range from mild flu-like symptoms to respiratory system failure. The epidemiology of the infection indicates that the majority of patients develop milder forms of the disease, while 14% of those infected have a severe form, and a smaller percentage (5%) become critically ill². Among patients who have required hospitalization, 14.2% required care in the intensive care unit and 12.2% received mechanical ventilation, and the mortality in this group was approximately 24.5%³. Pulmonary manifestations are the most common due to the route of entry of the virus, which uses angiotensin-converting enzyme 2 receptors present in type 2 pneumocytes, leading to a subsequent inflammatory response⁴.

The demographic profile and risk factors for COVID-19 show a wide spectrum around the world, and the factors responsible for the occurrence of different clinical forms and variability of symptoms are not yet understood. Moreover, health issues that persist for more than four weeks after COVID-19 infection, known as post-COVID conditions, are still not well understood, and present a major challenge to health systems worldwide given the high number of individuals affected by the disease and who recover after varying periods of hospitalization⁵.

To date, few studies have evaluated the clinical evolution and the occurrence of structural and functional post-COVID conditions in the lungs of individuals who survive the severe form of the disease, mainly because it is a new and recent disease. Initial studies described possible long-term complications of COVID-19 including cardiovascular, pulmonary, metabolic, and neuropsychiatric sequelae based on data from the severe acute respiratory syndrome (SARS) and Middle East respiratory syndrome (MERS) epidemics⁶. Recent publications have described the persistence of symptoms, especially fatigue and

dyspnea, approximately two months after the onset of symptoms, associated with a decrease in patients' quality of life^{7,8}, as well as altered respiratory function after discharge^{9,10}.

AIM AND OBJECTIVES

Aim

To study the common abnormality in pulmonary function tests in post Covid 19 discharged patients and to correlate with the severity of the disease.

MATERIALS AND METHODS

Study Design:

A single centre, hospital based, observational, cross-sectional study.

Study site: Department of General Medicine, KPC Medical College and Hospital, Jadavpur, Kolkata, both indoor and OPD patients

Inclusion criteria

1. Patients with ICMR laboratory confirmed RT-PCR/ Geneexpert positive non critical COVID 19 cases.
2. Patients Guardians given informed written consent for the same.

Exclusion criteria

1. Critical cases
2. Patient unable to perform breathe holding or diffusion capacity testing
3. Patients/ guardians refusing consent
4. Patients who had previous history of chronic lung diseases like - Asthma/COPD, any restrictive lung diseases like lung fibrosis.

RESULT AND DISCUSSION

A single centre, hospital based, observational, cross-sectional study was conducted in the Department of General Medicine, KPC Medical College and Hospital, Jadavpur, Kolkata, both indoor and OPD patients from 25th of August 2020 to 25th Of June 2021.

We found that, 16(20.0%) patients had Mild restriction at PFT Spirometry Finding-x, 34(42.5%) patients had Moderate Restriction at PFT Spirometry Finding-x, 23(28.8%) patients had Moderately severe Restriction at PFT Spirometry Finding-x and 7(8.8%) patients had Severe restriction at PFT Spirometry Finding-x.

In our study, most of the patients had Restrictive lung disorder with moderate diffusion restriction [34(68.0%)] in Moderate compared to Severe [7(50.0%)] and [7(43.8%)] Mild which was statistically significant ($p < 0.0001$). In our study, 43(53.8%) patients were

improved in Outcome and 37(46.3%) patients had No significant change in Outcome.

We found that, 16(20.0%) patients were Mild Clinical Types, 50(62.5%) patients were Moderate Clinical Types and 14(17.5%) patients were Severe Clinical Types.

Our study showed that, 80(100.0%) patients were discharged. Our study showed that in Mild Clinical Types, 14(87.5%) patients were 41-50years old, 1(6.3%) patient were 51-60years old and 1(6.3%) patient were >60 years old. In Moderate Clinical Types, 4(8.0%) patients were ≤30years old, 10(20.0%) patients were 31-40years old, 8(16.0%) patients were 41-50years old, 15(30.0%) patients were 51-60years old and 13(26.0%) patient were >60 years old. In Severe Clinical Types, 3(21.4%) patients were 31-40years old, 4(28.6%) patients were 41-50years old, 6(42.9%) patients were 51-60years old and 1(7.1%) patient were >60 years old. It was statistically significant ($p < 0.0001$).

It was found that in Mild Clinical Types, 9(56.3%) patients were Female and 7(43.8%) patients were male. In Moderate Clinical Types, 9(18.0%) patients were Female and 41(82.0%) patients were male. In Severe Clinical Types, 7(50.0%) patients were Female and 7(50.0%) patients were male. This was statistically significant ($p = 0.0040$).

We found that in Mild Clinical Types, 7(43.8%) patients had Non-obese BMI and 9(56.3%) patients had Obese BMI. In Moderate Clinical Types, 34(68.0%) patients had Non-obese BMI and 16(32.0%) patients had Overweight BMI. In Severe Clinical Types, 14(100.0%) patients had Overweight BMI. It was statistically significant ($p < 0.0001$).

It was found that in Mild Clinical Types, 9(56.3%) patients had improved in Outcome and 7(43.8%) patients had No significant change in Outcome. In Moderate Clinical Types, 34(68.0%) patients had improved in Outcome and 16(32.0%) patients had No significant change in Outcome. In Severe Clinical Types, 14(100.0%) patients had No significant change in Outcome which was statistically significant ($p < 0.0001$).

Zhao YM et al¹¹(2020) found that radiological and physiological abnormalities were still found in a considerable proportion of COVID-19 survivors without critical cases 3 months after discharge. Higher level of D-dimer on admission could effectively predict impaired DLCO after 3 months discharge. It is necessary to follow up the COVID-19 patients to appropriately manage any persistent or emerging long-term sequelae.

We found that In Mild Clinical Types, 16(100.0%) patients were discharged. In Moderate Clinical Types, 50(100.0%) patients were discharged. In Severe Clinical Types, 14(100.0%) patients were discharged.

Our study showed that In Mild Clinical Types, the mean Age(yrs) (mean± s.d.) of patients was 47.3125± 6.1830. In Moderate Clinical Types, the mean Age(yrs) (mean± s.d.) of patients was 52.7600± 15.7837. In Severe Clinical Types, the mean Age(yrs) (mean± s.d.) of patients was 49.7143± 8.8268. This was not statistically significant ($p = 0.3381$).

Present study showed that, the mean DLCO-x was higher [56.4000 ± 10.2877] in Moderate compared to [53.2500 ± 2.0494] Mild and Severe [26.0000 ± 4.1510] this was statistically significant ($p < 0.0001$).

We observed that in Mild Clinical Types, the mean DLCO/Va-x (mean± s.d.) of patients was 79.0625 ± 19.9816. In Moderate Clinical Types, the mean DLCO/Va-x (mean± s.d.) of patients was 95.3600 ± 11.8058. In Severe Clinical Types, the mean DLCO/Va-x (mean± s.d.) of patients was 74.5000 ± 29.5758. This was statistically significant ($p < 0.0001$). It was found that in Mild Clinical Types, the mean TLC-x (mean± s.d.) of patients was 70.7500 ± 14.3457. In Moderate Clinical Types, the mean TLC-x (mean± s.d.) of patients was 70.6400 ± 14.2195. In Severe Clinical Types, the mean TLC-x (mean± s.d.) of patients was 38.0000 ± 9.3397 which was statistically significant ($p < 0.0001$).

Liang L et al¹²(2020) found that the mean values of forced expiratory volume in 1 second (FEV1), forced vital capacity (FVC), FEV1/FVC,

total lung capacity and diffusion capacity were all normal (> 80% predicted) and lung HRCTs returned to normal in most of the patients (82%).

In our study in Mild Clinical Types, the mean FVC(% of predicted)-x (mean± s.d.) of patients was 58.2500 ± 2.0494. In Moderate Clinical Types, the mean FVC(% of predicted)-x (mean± s.d.) of patients was 67.4200 ± 9.6110. In Severe Clinical Types, the mean FVC(% of predicted)-x (mean± s.d.) of patients was 47.0000 ± 6.2265. This was statistically significant ($p < 0.0001$).

Our study showed that in Mild Clinical Types, the mean FEV1/FVC-x (mean± s.d.) of patients was 83.9313 ± 4.7648. In Moderate Clinical Types, the mean FEV1/FVC-x (mean± s.d.) of patients was 102.4200 ± 10.9621. In Severe Clinical Types, the mean FEV1/FVC-x (mean± s.d.) of patients was 104.3500 ± 12.0898. It was statistically significant ($p < 0.0001$).

Xie L et al¹³(2005) showed that Positive SARS-Co virus IgG antibody results were seen in 208 of 258 patients, with 21.3% (55 of 258 patients) still having a pulmonary diffusion abnormality (Dlco < 80% of predicted).

We found that In Mild Clinical Types, the mean DLCO-y (mean± s.d.) of patients was 56.3750 ± 3.0741. In Moderate Clinical Types, the mean DLCO-y (mean± s.d.) of patients was 61.0400 ± 11.7716. In Severe Clinical Types, the mean DLCO-y (mean± s.d.) of patients was 33.5000 ± 2.5944. It was statistically significant ($p < 0.0001$).

Zhou M et al¹⁴(2021) showed that pulmonary function showed that the frequency of lung diffusion capacity for carbon monoxide abnormalities were comparable in SPs and MPs (47.1 vs. 41.7%), while abnormal total lung capacity (TLC) and residual volume (RV) were more frequent in SPs than in MPs (TLC, 18.8 vs. 8.3%; RV, 11.8 vs. 0%).

It was found that in Mild Clinical Types, the mean TLC-y (mean± s.d.) of patients was 77.1875 ± 30.2285. In Moderate Clinical Types, the mean TLC-y (mean± s.d.) of patients was 75.2800 ± 14.7787. In Severe Clinical Types, the mean TLC-y (mean± s.d.) of patients was 49.5000 ± 11.9341. This was statistically significant ($p < 0.0001$).

We examined that In Mild Clinical Types, the mean RV/TLC-y (mean± s.d.) of patients was 69.5625 ± 16.9075. In Moderate Clinical Types, the mean RV/TLC-y (mean± s.d.) of patients was 103.0200 ± 21.9540. In Severe Clinical Types, the mean RV/TLC-y (mean± s.d.) of patients was 79.0000 ± 5.1887. This was statistically significant ($p < 0.0001$).

We found that in Mild Clinical Types, the mean FVC(% of predicted)-y (mean± s.d.) of patients was 80.7500 ± 22.5433. In Moderate Clinical Types, the mean FVC(% of predicted)-y (mean± s.d.) of patients was 74.2400 ± 7.3694. In Severe Clinical Types, the mean FVC(% of predicted)-y (mean± s.d.) of patients was 56.5000 ± 11.9341. It was statistically significant ($p < 0.0001$).

CONCLUSION

- In our study, 16(20.0%) patients had Mild restriction at PFT Spirometry Finding-x, 34(42.5%) patients had Moderate Restriction at PFT Spirometry Finding-x, 23(28.8%) patients had Moderately severe Restriction at PFT Spirometry Finding-x and 7(8.8%) patients had Severe restriction at PFT Spirometry Finding-x.
- In our study, 43(53.8%) patients had Improved in Outcome and 37(46.3%) patients had No significant change in Outcome.
- In our study, 16(20.0%) patients were Mild Clinical Types, 50(62.5%) patients were Moderate Clinical Types and 14(17.5%) patients were Severe Clinical Types.
- Male was more affected in moderate and severe disease which was statistically significant.
- Overweight was significantly associated with severe disease and this was statistically significant.
- In PFT Spirometry Finding-x, Severe restriction was more in moderate and severe disease. PFT Spirometry Finding-x was significantly associated with severity of the disease.
- We also found that PFT Spirometry Finding-y was significantly associated with severity of the disease and Poor outcome was observed in severe disease followed by mild and moderate disease which was statistically significant, DLCO/Va-x was less in severe

- disease followed by mild and moderate disease which was statistically significant. DLCO/Va-y was less in severe disease followed by mild and moderate disease which was statistically significant and Both TLC-x and TLC-y were less in severe disease compared to mild and moderate disease which was statistically significant.
- FEV1 (% of predicted)-x was less in severe disease followed by mild and moderate disease which was statistically significant.
- FEV1 (% of predicted)-y was less in severe disease followed by moderate and mild disease which was statistically significant.
- FVC (% of predicted)-x was less in severe disease followed by mild and moderate disease which was statistically significant.
- FVC (% of predicted)-y was less in severe disease followed by moderate and mild disease which was statistically significant, FEV1/FVC-x was higher in severe disease compared to mild and moderate disease which was statistically significant and Influence of corona virus disease 2019 on pulmonary function was changed in post covid-19 discharged patients
- The progression respiratory function changes were associated with COVID-19, whether changes persisting or improving.
- In our study, most of the patients had Restrictive lung disorder with moderate diffusion restriction in Moderate compared to Severe and Mild which was statistically significant.
- Present study showed that, the mean DLCO-x was higher in Moderate compared to Mild and severe this was statistically significant..

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Table: Association between PFT Interpretation -x: Clinical Types

CLINICAL TYPES				
PFT Interpretation -x	Mild	Moderate	Severe	TOTAL
Restrictive lung disorder with mild diffusion restriction	9	16	0	25
Row %	36.0	64.0	0.0	100.0
Col %	56.3	32.0	0.0	31.3
Restrictive lung disorder with moderate diffusion restriction	7	34	7	48
Row %	14.6	70.8	14.6	100.0
Col %	43.8	68.0	50.0	60.0
Restrictive lung disorder with severe diffusion restriction	0	0	7	7
Row %	0.0	0.0	100.0	100.0
Col %	0.0	0.0	50.0	8.8
TOTAL	16	50	14	80
Row %	20.0	62.5	17.5	100.0
Col %	100.0	100.0	100.0	100.0

Chi-square value: 42.0548; p-value:<0.0001;

		Numb er	Mean	SD	Minim um	Maxi mum	Media n	P -value
DLCO-x	Mild	16	53.2500	2.0494	51.0000	55.0000	55.0000	<0.0001
	Mode rate	50	56.4000	10.2877	41.0000	71.0000	56.0000	
	Sever e	14	26.0000	4.1510	22.0000	30.0000	26.0000	

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