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# AN OBSERVATIONAL STUDY ON SPIROMETRY FINDINGS IN POST COVID PATIENTS

Pulmonary Medicine

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## ABSTRACT

**Background and Objectives:** Information on effects of SARS-CoV-2 virus on patients 6 months post infection is still lacking. We aimed to evaluate the spirometry changes in 153 patients at least 6 months after covid infection to gain some insight into the effects of the viral infection on lung function. **Methods:** We studied 153 Post Covid patients presenting in our large tertiary care center in Northern India. Spirometry was done on all of them. The results were evaluated using Chi-Square test and Independent-t test to compare the difference in oxygen and non oxygen groups. **Results:** The results showed statistically significant difference between the two groups. Out of the 68 patients that were not put on any oxygen support during covid infection, 44 had a normal pulmonary function test (PFT) and 24 had abnormal ones with most (17) being of restrictive pattern. Out of the 85 patients requiring oxygen support, none had normal PFT. Restrictive changes were present in 62 of them with the rest being of obstructive or mixed pattern. **Interpretations and Conclusion:** Covid-19 infection has long term effects on lung function. Patients on oxygen support had a more severe effect on their lung function in terms of volume restriction in comparison to patients not on oxygen support, though they were not totally spared.

## KEYWORDS

Post Covid, Restrictive, SARS CoV-2, Spirometry

## INTRODUCTION

The spread of covid 19 has taken on pandemic proportions affecting more than 760 million people and causing almost 6.9 million deaths till March 2023[1]. The novel coronavirus disease (COVID-19) caused by SARS CoV-2 has spread rapidly around the world and has taken it by storm.[2],[3] The rapid progression of the disease led to a search for immediate measures for its treatment and control.[4,5,6,7] Then came the search for ways to combat the short term sequelae of the infection which were most frequently respiratory in nature,[8,9,10,11]specially in patients developing pneumonia and needing supplemental oxygen.

In the search of the above mentioned, the long term effects of the disease (which have also been termed as LONG COVID)[12,13,14] have been somewhat ignored. The potential burden of LONG COVID makes it critical that we know as much about it as fast as we can. Current evidence suggests that there are a large number of Pulmonary Sequelae after Covid-19 infection.[15,16]

Covid-19 patients may present with a spectrum of symptoms ranging from asymptomatic, mild upper respiratory tract symptoms to severe pneumonia and multi organ failure.[15] The lung is the most common organ affected in SARS CoV-2 infection.[16] More than half the patients with covid 19 pneumonia exhibit abnormal lung function 30 days after symptom onset. This warrants long term follow up of these patients.[16] The pathology of the lung in COVID-19 patients includes diffuse alveolar damage, bronchiolitis, alveolitis and interstitial fibrosis.[17] Extensive injury to alveolar epithelial cells and endothelial cells, with secondary fibroproliferative changes is a hallmark of covid infection.[17] It indicates a potential for chronic vascular and alveolar remodeling leading to lung fibrosis[18] and pulmonary hypertension[19]. Thus, patients who have history of infection may have a restrictive or obstructive defect on a spirometry during recovery.[20,21] Previous studies in SARS showed that patients had an abnormal pulmonary function test upto 20% after recovery from SARS.[22] There is insufficient data about the prevalence and severity of post covid pulmonary complications[23,24]. It is essential to assess the extent of these complications and there effect on lung function.[25] Spirometry is an important modality to investigate the pulmonary sequelae of Covid-19 infection.

In our study we aimed to investigate pulmonary function of all post covid 19 patients irrespective of severity at time of infection. We compared spirometric parameters between patients on oxygen support and those not on oxygen support.

## MATERIAL AND METHODS

This was an Observational study conducted in our large tertiary care centre in Northern India. A written informed consent was taken from all patients after a detailed description of the procedure. This study was approved by the Institutional ethical committee as it was done as a thesis for MD examination.

The sample size was calculated based on a previous study that reported that the prevalence of average restrictive pattern and obstructive pattern in COVID-19 patients was 11% (7%-15% (Torres-Castro et al., 2021), 95% level of confidence and Error rate, usually set at 0.05 level is 4. Total 153 patients were included in this study.

153 Post Covid patients who were diagnosed as Covid-19 positive through RT-PCR, TRUNAAT or RAT and subsequently tested negative or admitted to our hospital with the diagnosis Post Covid or Presenting to Pulmonary Medicine OPD with the same from February 2021- February 2022. They were classified into patients requiring oxygen support and not requiring oxygen support during covid 19 infection and spirometry findings in these patients were studied. Only patients who were covid positive and subsequently tested negative through RT-PCR at least six months before date of inclusion in the study were included. Patients who had preexisting chronic respiratory illness, were chronic smokers, had a BMI>35, were on mechanical ventilation or had a history of long term glucocorticoid use were excluded from the study. After obtaining written informed consent from patients and recording of demographic data, a detailed history of the patient was taken and they were divided into two groups on basis of oxygen requirement during covid infection. Spirometry was done on all of them. Spirometry was done using MIR SPIROBANK OXI spirometer. It was calibrated daily. Spirometry was done according to standard guidelines(Joint ICS-NCCP guidelines(India) for spirometry). Both Pre and Post bronchodilator (inhaled short acting beta agonist) readings were taken.

Patients who were on oxygen support at time of infection were put into severe group and those who were not on oxygen support were put into non- severe group. Spirometric findings of the two groups were compared.

**Statistical Analysis:** SPSS version 21.0 was used for statistical analysis. Data was presented as mean (standard deviation), number and percentage (%). The Chi-square test was used to compare the categorical variables and independent t test was used to compare discrete variables between groups. The p value 0.05 was considered significant.

## RESULTS:

We studied 153 patients of which maximum were in the age group of 41-50 and 61-70 years. 53% of our patients were male and 47% female.

Out of 153 patients, 85 ( 55.6%) gave history of supplemental oxygen use during covid infection and were put into severe group. The rest 68 (44.4%) patients gave no such history and were put into non severe group.

In our study the distribution of Covid 19 patients according to Spirometry Pattern was as follows:

The percentages of normal, obstructive, restrictive and mixed were 28.76%, 5.23%, 51.63%, an 14.38%, respectively.

**Table I: Distribution of Covid 19 patients according to spirometry Pattern**

| | Number | % |
|---|---|---|
| Normal | 44 | 28.76 |
| Obstructive | 8 | 5.23 |
| Restrictive | 79 | 51.63 |
| Mixed | 22 | 14.38 |

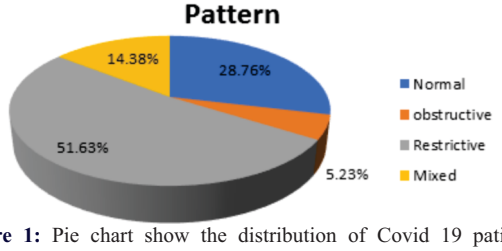


**Figure 1:** Pie chart show the distribution of Covid 19 patients according to Pattern

The frequencies of different patterns in between severe and non-severe group were studied. The percentage of normal, obstructive, restrictive, and mixed pattern were 64.71%, 5.88%, 25.00%, and 4.41% in non-severe group and 0.00%, 4.71%, 72.94%, and 22.35% in severe group, respectively. The frequencies of restrictive and mixed pattern were significantly more common in severe patients as compared to non-severe patients.

**Table II: Comparison of frequencies of different Pattern in between non-severe and severe group**

| | Non-severe (n=68) (oxygen not required) | | Severe (n=85) (oxygen required) | | Chi Sq. | 1p-Value |
|---|---|---|---|---|---|---|
| | Number | % | Number | % | | |
| Normal | 44 | 64.71 | 0 | 0.00 | 80.37 | <0.001 * |
| Obstructive | 4 | 5.88 | 4 | 4.71 | | |
| Restrictive | 17 | 25.00 | 62 | 72.94 | | |
| Mixed | 3 | 4.41 | 19 | 22.35 | | |

*=Significant ($p<0.05$), [1]=independent t test

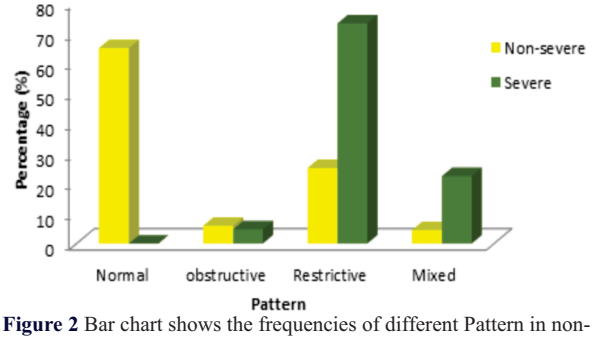


**Figure 2** Bar chart shows the frequencies of different Pattern in non-severe and severe group

## DISCUSSION:

On March 11, 2020, the World Health Organization (WHO) designated the coronavirus disease 2019 (COVID-19) to be a pandemic, with over 20% of infected people needing hospitalization and 6% in critical care and requiring invasive ventilatory support. Millions of deaths have been attributed to COVID-19 worldwide, and those who survive the severe type often experience major morbidity. Long after being released from the hospital, symptoms such as fatigue, breathlessness, joint discomfort, cognitive problems, chest pain and hair loss are frequently noticed.[8,9,12,13] Respiratory symptoms predominate both the acute phase and long-term consequences, despite encompassing several organs.[15,16]

Recent research indicates that COVID-19 is has most impact on the lungs, which show several pathophysiological processes such as widespread alveolar epithelium damage, hyaline membrane development, capillary injury and hemorrhage, alveolar septal fiber proliferation and pulmonary consolidation.[17,18] The severe damage to alveolar epithelial and endothelial cells, along with subsequent fibroproliferation, is a hallmark of COVID-19 and suggests a possibility for persistent vascular and alveolar remodeling that could result in lung fibrosis and/or pulmonary hypertension.[19] These findings raise questions about how patients who have been discharged should be assessed for lung injury.

The most often used objective functional respiratory assessments are pulmonary function tests (PFTs), which include spirometry, diffusion capacity and lung volumes. In our study we used spirometry to assess the lung function of patients.

In our study the percentage of normal, obstructive, restrictive, and mixed pattern were 64.71%, 5.88%, 25.00%, and 4.41% in non-severe group and 0.00%, 4.71%, 72.94%, and 22.35% in severe group, respectively. The frequencies of restrictive and mixed pattern were significantly more common in severe patients as compared to non-severe patients.

In our study, the mean Pre FVC, % Pred FVC, Post FVC, and % Pred FVC were significantly reduced in severe as compared non-severe Covid 19 patients. The mean Pre FEV1, % Pred FEV1, Post FEV1, and % Pred FEV1 were significantly lowered in severe as compared to non-severe Covid 19 patients. The mean Pre and Post FEV1/FVC and %pred FEV1/FVC were significantly lowered in severe as compared to non-severe Covid 19 patients.

This implies that Restrictive pattern on spirometry was more common in post covid patients as compared to obstructive or mixed patterns. Patients on oxygen support had a more severe effect on their lung function. Even in patients who were categorized as non severe in our study, almost 35% had abnormal spirometry reports indicating reduced pulmonary function.

## CONCLUSION

This study was carried out to evaluate the Spirometry findings in Post Covid Patients. Covid 19 patients were divided into two groups on the basis of oxygen support: Severe (Oxygen support required) and Non-severe (Oxygen support not required). The percentage of yes and no oxygen support were 55.56%, and 44.44%, respectively. The following findings from the study were drawn:The frequencies of restrictive and mixed pattern were significantly more common in severe patients as compared to non-severe patients. Pre and Post bronchodilator FEV1, FVC and FEV/FVC were significantly lower in severe group as compared to non severe group.

Covid-19 infection has long term effects on lung function. Patients on oxygen support had a more severe effect on their lung function in comparison to patients not on oxygen support, though they were not totally spared.

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**Conflicts of Interest:** None

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