

Pulmonary Complications among Discharged COVID-19 Patients – A Prospective Study

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ABSTRACT

Background: There is a need for a unified pathway and structure for the respiratory follow-up of patients with COVID-19 pneumonia. **Introduction:** The long-term complications of COVID-19 pneumonia-pulmonary fibrosis, pulmonary vascular disease, bronchial hyper-reactivity, and pleural effusion are real and need evaluation. **Methodology:** A prospective study was conducted in November 2020–January 2021 among the patients discharged from MES COVID hospital. **Aim:** The aims of this study were to estimate the prevalence of pulmonary complications among discharged COVID-19 patients and to study the risk factors and long-term outcome of pulmonary fibrosis in COVID. **Results:** Out of the 300 patients studied, most common outcome was pulmonary fibrosis – 10.7%; followed by death (9%), pleural effusion (2%), bronchial hyper-reactivity (1.3%), pulmonary embolism (0.3%), anosmia (0.3%), pneumothorax (0.3%), and organizing pneumonia (0.3%). **Conclusion:** Most of the complications were seen among Cat-C patients, the most common being pulmonary fibrosis which showed a serial decrement in the chest X-ray scores suggesting favorable outcome.

Key words: COVID-19, complications, post COVID, pulmonary fibrosis

INTRODUCTION

An outbreak of the novel corona virus nCoV-19 (SARS-CoV2), responsible for the coronavirus disease 19 (COVID-19), was first reported in Hubei province, China, on December 31, 2019. It has rapidly spread globally with approximately 3 million confirmed infections and 200,000 deaths within the first 4 months. The overwhelming majority of patients admitted to hospital have respiratory failure and while most are managed on general wards, a sizeable proportion requires intensive care support. The long-term complications of COVID-19 pneumonia (pulmonary fibrosis,^[1,2] pulmonary vascular disease,^[3] post viral bronchial hyper-reactivity, pleural thickening,^[4]

bronchiectasis,^[5] pneumatocele, and pneumothorax^[6]) are starting to emerge. There is a need for a unified pathway for the respiratory follow-up of patients with COVID-19.^[7] We provide a suggested structure for the respiratory follow-up of patients with clinic-radiological confirmation of COVID-19 pneumonia by defining an algorithm integrating disease severity, likelihood of long-term respiratory complications, and functional capacity on discharge.^[8] The study under consideration aims to look into the various pulmonary complications faced by the survivors who recovered from COVID-19 illness. As the number of confirmed COVID-19 cases is rising globally, the share of patients who have survived the disease is also scaling up. Thus, beating the initial sickness may be just the first of many battles for those who have survived.

Aim

The aims of this study were to estimate the prevalence of pulmonary complications among discharged COVID-19 patients and to study the risk factors and long-term outcome of pulmonary fibrosis in the same.

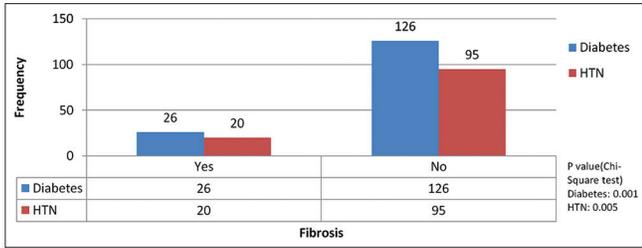
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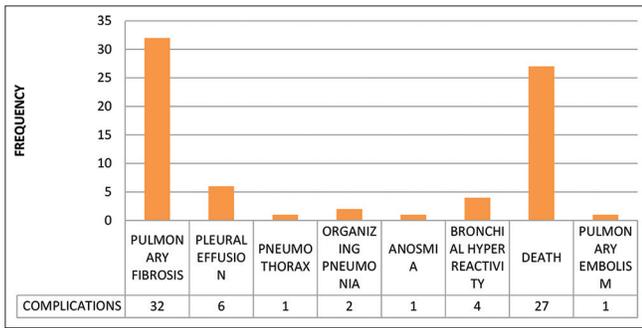
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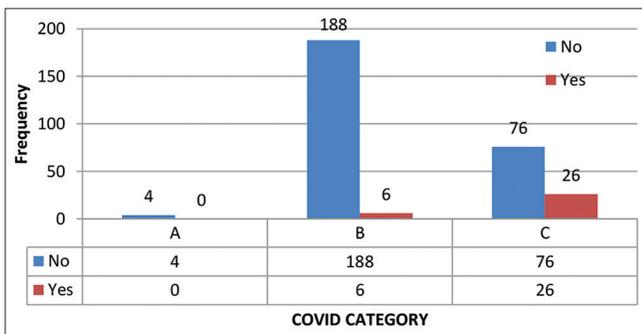
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Graph 1: Number of diabetic and hypertensive patients who developed fibrosis



Graph 2: Pulmonary complications in follow up of discharged COVID 19 patients



Graph 3: Pulmonary Fibrosis in each category

MATERIALS AND METHODS

Study Design

The study design was prospective study.

Study Period

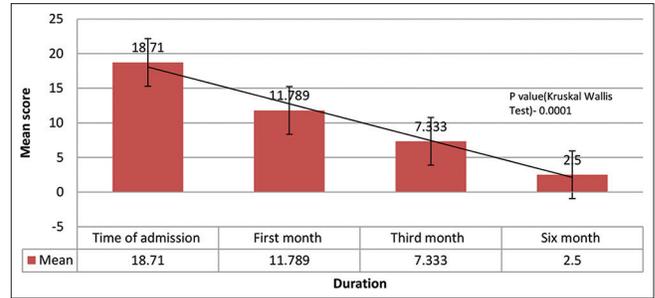
The study period was from November 2020 to October 2022.

Study Population

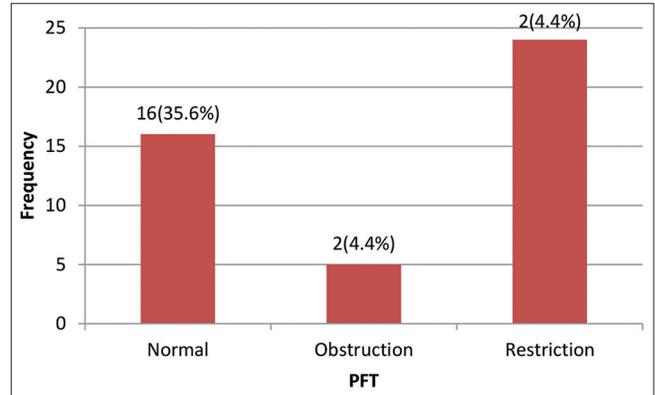
All patients with history of COVID-19 attending the post-COVID clinic of MES Medical College during the period of study satisfying the inclusion criteria.

Working Definition

Diagnosis of COVID-19 is made by Rapid Antigen or RT-PCR or TrueNat COVID-19 positivity. Pulmonary complications



Graph 4: Chest X-ray scores at the time of admission, 1st month, 3rd month and 6th month



Graph 5: PFT of discharged covid-19 patients

will be assessed by history, physical examination, and relevant investigations.

Inclusion Criteria

Adults aged 15 years or more with history of confirmed COVID-19 positivity, attending post-COVID clinic, who are willing to participate in the follow-up study within the time frame of 2 weeks–6 months after discharge from MES COVID hospital, are included in the study.

Exclusion Criteria

Patients who are known case of interstitial lung disease, bronchiectasis, and post-tubercular fibrosis were excluded from the study.

Sampling Technique

This study was convenient sampling.

Data Collection

All those adults aged 15 years and above who were diagnosed with COVID-19, followed up in the post-COVID clinic 2 weeks–6 months after discharge from the hospital will be enrolled after taking written informed consent. A detailed clinical assessment, pulmonary function test, and 6-min walk

Table 1a: Distribution pattern of infiltrates seen in chest X-ray of post-COVID-19 patients

Basal/Peripheral/Perihilar/Diffuse	Frequency	Percent
Basal	21	25.6
Diffuse	38	46.3
Perihilar	1	1.2
Peripheral	21	25.6
Peripheral and Basal	1	1.2
Total	82	100

Table 1b: Zonal predominance in chest X-ray of COVID-19 patients

Zonal predominance	Frequency	Percent (%)
Diffuse	31	37.8
Lower Zone	31	37.8
Middle Lower Zone	14	17.1
Middle Zone	4	4.9
Upper Zone Lower Zone	2	2.4
Total	82	100

Table 2: Levels of restriction among discharged COVID-19 patients category wise

Level of restriction	COVID Category		Total
	B	C	
Mild restriction	2	0	2
Moderate restriction	5	10	15
Moderately severe restriction	1	4	5
Severe restriction	0	2	2
Total	8	16	24

Table 3: Grading of DLCO among discharged COVID-19 patients COVID category wise

DLCO	COVID Category		Total
	B	C	
Mild	13.6%	13.6%	27%
Moderate	4.5%	31.8%	36.36%
Normal	9%	27%	36.36%

test of the patient will be carried out and chest X-ray and HRCT [if indicated according to the protocol in Figure 1] will be taken. The chest radiographic score of COVID-19 infection can be obtained by first dividing each lung into three zones and evaluating the levels of involvement in each zone. The development of COVID-19 lesions within each lung zone is then scored as follows: 0 = normal; 4 = complete involvement of one zone; or 24 = complete involvement of all six zones. The scores for all six zones per chest radiograph are added together to yield a cumulative chest radiographic score ranging from 0 to 24, depending on the involvement of the lung parenchyma.^[9] Those patients who are having a high index of clinical suspicion or abnormal spirometry and chest radiograph findings will undergo specific investigations for diagnosing lung complications and are followed up at 1st, 3rd, and 6th month to know the pattern of disease progression. The period of data collection is from November 2020 to April 2021 and the period of follow-up will be up to October 20.

Statistical Analysis

The data were collected into Microsoft Excel and analyzed at the end of the study using statistical. Results on categorical measurements were expressed in number (%) and results on continuous measurements were presented in mean (+ standard deviation). Analysis of contingency tables were done using Fisher’s exact test. Comparison between quantitative variables was assessed using the Kruskal–Wallis test as appropriate. $P < 0.05$ was considered to be statistically significant.

RESULTS

Spirometry

Post-COVID pulmonary evaluation was done in 300 patients and the overall mean age was 55.57 (± 18 SD), with mean age increasing from Category A (36.25 ± 9.465 SD) to Category B (52.93 ± 19.160 SD) to Category C (61.34 ± 14.166 SD). Among 300 patients studied males constituted about 58.6% and majority of CAT C patients were males 72.54%.

Among the risk factors (Graph 1), there was a significant association between pulmonary fibrosis and diabetes mellitus ($P < 0.001$) and hypertension ($P < 0.005$). Smoking history in CAT B and CAT C COVID-19 patients was not significantly different.

Pulmonary Function

Overall, average pulmonary function test was restrictive in patients after COVID-19, with 60.9% showing moderate restriction (Graph 5, Table 2). DLCO was significantly lower in patients after severe/critical COVID-19 compared to patients after mild/moderate disease. DLCO was normal in 37% cases and moderately reduced in 36% cases (Table 3).

Radiological Features

In this follow-up study, the zonal predominance was diffuse in 37.8% cases, lower zone predominant in 37.8% cases, and middle and lower zone involvement in 17.1% cases (Table 1b). Peripheral and basal involvement was seen in 21% cases each (Table 1a). The serial chest X-ray study of pulmonary fibrosis patients showed a decrement in the value of chest X-ray score, with a mean of 18.7 (± 6.6443) at the time of COVID-19 infection, to 11.789 (± 5.4117) in the 1st month and finally 7.333 (± 5.6138) in the 3rd month follow-up with $P < 0.0001$ (Kruskal–Wallis test) (Graph 4).

Outcomes

Out of the 300 patients studied, 10.7% had pulmonary fibrosis which was the most common outcome followed by death 9% and pleural effusion was seen in 2% (6) of the cases

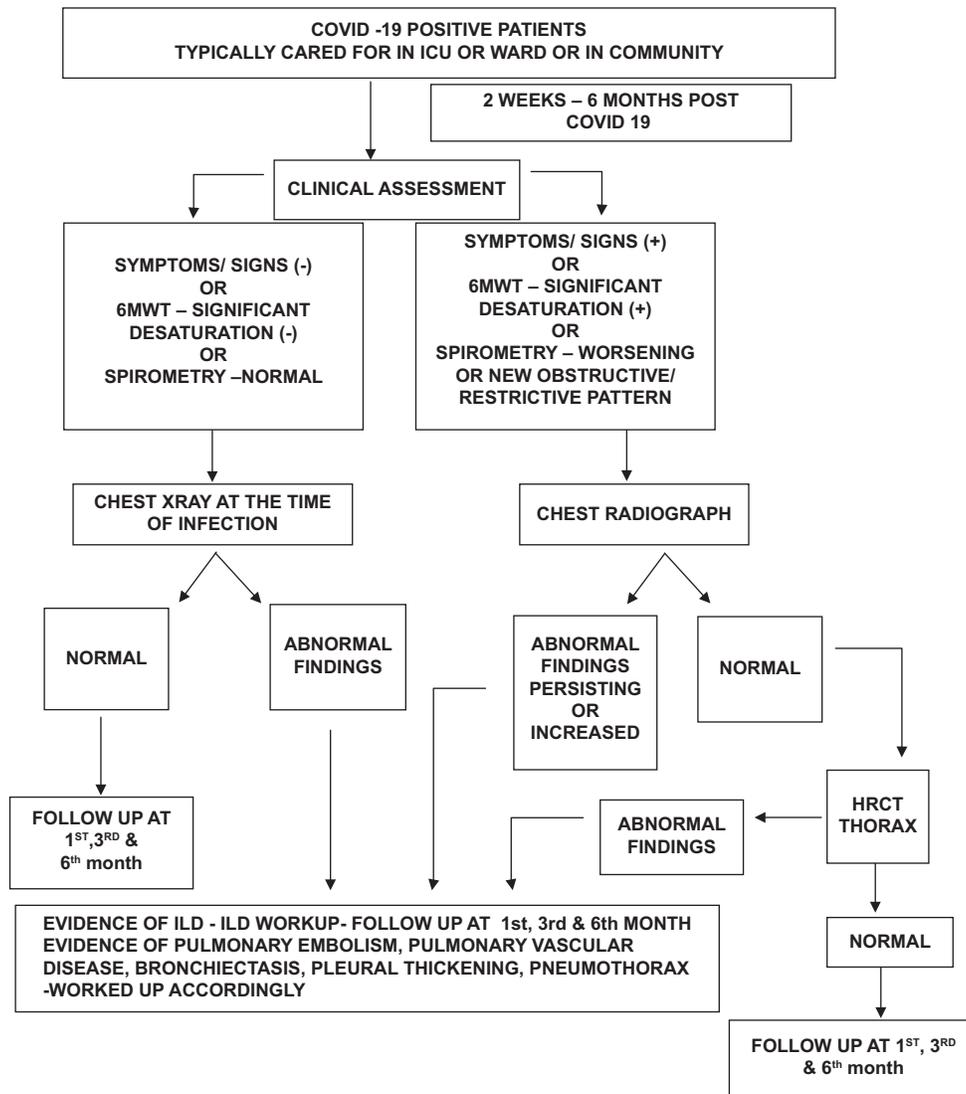


Figure 1: Algorithm for evaluation and management of patients following COVID-19 infection

(Graph 3). Other outcomes include pulmonary embolism (0.3%), anosmia (0.3%), bronchial hyper-reactivity (1.3%), pneumothorax (0.3%), and organizing pneumonia (0.3%) (Graph 2). In the follow-up study of patients with pulmonary fibrosis, clearance was present in the 1st month and 3rd month serial chest X-ray studies. Mean chest X-ray score was 18.71 (± 6.6443 SD) at the time of admission, there after showing a decreasing trend in the 1st month 11.789 (± 5.4117 SD), in the 3rd month 7.333 (± 5.6138 SD), and in the 6th month 2.5 (± 3.5) suggesting a favorable prognosis in this subset of patients (Graph 4).

Clinical Associations with CAT C

Out of 32 cases of pulmonary fibrosis, majority belonged to the CAT C (26, 81.25%). Among the risk factors, diabetes and hypertension did not vary much between CAT B and CAT C patients but were much lower among CAT A. Out of the 16 CAT C patients, who had taken the DLCO test in the

post-COVID visit, 43% (7) had moderate reduction, 18% (3) had mild reduction, and 37.5% (6) had normal DLCO. Out of the 45 patients who had taken the PFT, 53.3% (24) patients had restriction, with 35.5% (16) of them being the CAT C.

CONCLUSION

Most of the clinical implications were seen in Cat C patients, with the most common being pulmonary fibrosis which showed a serial decrement in the chest X-ray scores suggesting a favorable outcome.

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