

Post Acute Sequelae of COVID 19: A Prospective Observational Study

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Abstract: *The aim was to evaluate sequelae of COVID-19 on CXR and HRCT thorax in young and middle-aged patients. This was a prospective observational study comprising a total number of 58 COVID cases from November 2020 to October 2022. The baseline scan during the active phase of the disease was collected followed by CT scan done 3 to 24 months later. 30 patients had mild disease, 15 had moderate and 13 had severe disease during the active phase of the disease (based on CT severity score - out of 25). 39.66% patients showed post-acute-infection sequelae of COVID. Fibrosis was the predominant sequelae observed in 21 patients- mild in 10, moderate in 9 and severe in 2. Fibrosis was more common with advancing age in the age group of 41-50 years (61% had fibrosis). The majority of the patients (60%) showed complete clearance of the acute changes in the lung. Post COVID lung fibrosis was found approximately in 36 % of patients, predominantly in patients with moderate to severe disease.*

Keywords: long COVID, lung sequelae in COVID, lung fibrosis in COVID, post - COVID ILD

1. Aim

Evaluation of sequelae of COVID-19 on CXR and HRCT thorax in young and middle-aged patients.

2. Materials & Method

This was a prospective observational study consisting of an initial 110 COVID cases (RT-PCR positive or negative with typical HRCT pattern (CORADS- 5/6) patients between the age group of 20-50 years, anytime between 3 months to 24 months of their infection with no previous respiratory illness. Pregnant patients with prior history of COVID-19 excluded. Due to mortality (28) and lost-to follow-up (24), only 58 patients had follow-up scanning. To avoid unnecessary radiation exposure, all of them were followed with a single-time chest radiograph (CXR) and HRCT thorax anytime between 3 months to 24 months of their infection, irrespective of their complaints. In follow-up scans we looked for any resolution or persistence of the disease or if there was development of any sequelae/ fibrosis. CXR was performed in all patients in PA-view (erect position) with full inspiration. HRCT was performed using 128-slice or 16-slice multidetector row CT scanners. Scans were obtained in the craniocaudal direction, supine position and during end-inspiration.

The final analysis was done with the use of Statistical Package for Social Sciences (SPSS) software, IBM manufacturer, Chicago, USA, Ver 25.0. For statistical significance, p value of less than 0.05 was considered statistically significant.

3. Results

On CXR (performed on all 58 patients), post - acute sequelae of COVID 19 (PASC) were in the form of fibrotic streaks, interstitial thickening and pleural thickening in 13, 11 and 4 respectively. Rare findings noted were pleural effusion & lymphadenopathy in 1 each.

On HRCT, 39.66% of patients showed (Post acute sequelae of COVID 19) PASC in the form of fibrotic and non-fibrotic changes. Fibrosis was more common in the age group of 41-50 years accounting for 61% of the patients.

On follow up scans, 2 of mild disease showed fibrosis, while 6 of moderate and all 13 severe cases had fibrotic changes (p value <0.0001). In addition, fibrosis was graded into mild, moderate and severe on the basis of fibrosis score similar to the CT severity score during the active phase of the disease. Proportion of mild, moderate and severe fibrosis was significantly (p value=0.005) more in the older age group.

On comparing severity of fibrosis with disease severity during active infection, we found that mild fibrosis was seen in 2 patients with mild disease, 5 of moderate disease and 3 of severe cases. Moderate degree of fibrosis was seen in 8 of severe cases and 1 of moderate cases. Severe fibrosis grading was seen in only 2 severe cases. None of mild or moderate cases showed severe fibrosis (p value=0.062).

When fibrosis grading was compared between male and female, male gender found to have more fibrosis as compared to female. It was found that 70% male showed mild fibrosis as compared to 30% of female patients. Moderate fibrosis was seen in 88.89% of male patients as compared to only

11.11% of female patients. Most of the females showed clear lungs. However, due to a smaller number of severe fibrosis cases (two) we did not find a significant difference between male and female (male: female - 1:1). In the age group of 20-40 years majority of patients had no fibrosis (86.7%), only 13.3% patients showed fibrosis. In the age group of 41-50 years 61% patients had fibrosis whereas clear lung was seen in 39% of patients (p value=0.0002).

The proportion of patients in the age group 20-30 years had shown one severe fibrosis (20-30 years: 50%). The proportion of patients in the age group 31-40 years, was significantly

higher in moderate as against mild and severe. In the age group 41-50 years, moderate was significantly higher as compared to mild and severe. (p value=0.005).

Age (years)	20-30	30-40	40-50
	17(29.31%)	13(22.41%)	28(48.24%)
Disease severity	Mild	Moderate	Severe
	30 fibrosis seen in 2	15 fibrosis seen in 6	13 fibrosis seen in 13
Fibrosis	Mild	Moderate	Severe
	10	9	2

Post acute covid sequelae (on HRCT)	Fibrotic streaks	Septal thickening	Pleural thickening	Bronchiectasis	Nodule	Pleural effusion, LAP, Cystic changes, Mosaic	GGO, Honeycombing
	21	12	9	4	3	2 each	1 each
IMV	Given	Not given					
	4 -100% had fibrosis on follow up	54-31.4% had fibrosis on follow up					

4. Discussion

Sequelae of COVID: PASC were present in 23 out of 58 patients on HRCT. In some, non-fibrotic patterns such as nodule, pleural effusion, lymphadenopathy, cystic changes, mosaic, GGO and honeycombing were seen. In the rest of the patients, there was complete resolution of the radiological findings. There was a higher percentage of chest clearance compared to previous studies in literature because of less mean age, viz, 39 years as in younger population post- acute sequelae are less and also because there was long term follow up. 28 patients showed complete resolution with no residual findings on chest radiographs. The remaining patients showed fibrotic streaks in 13, interstitial thickening in 11 and pleural thickening in 4. Rare findings include pleural effusion. None of the patients on follow up had consolidation on CXR.

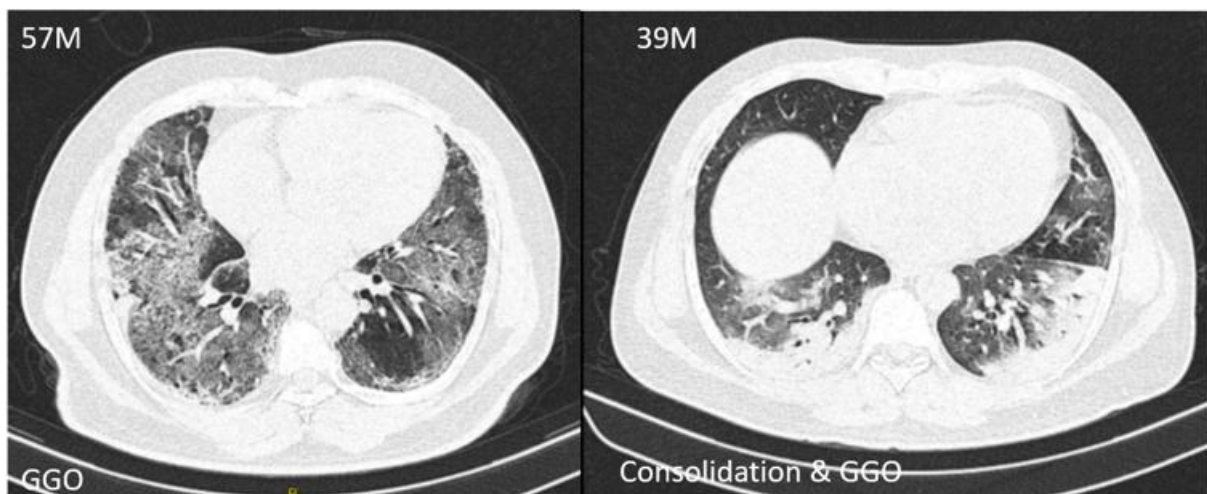
Severity: On CXR, the majority of the patients with severe disease had fibrotic streaks, interstitial thickening, pleural thickening as compared to patients with moderate and mild disease. On HRCT, the majority of the patients with severe disease had fibrotic streaks, septal thickening, pleural thickening, pleural effusion, LAP, bronchiectasis, mosaic

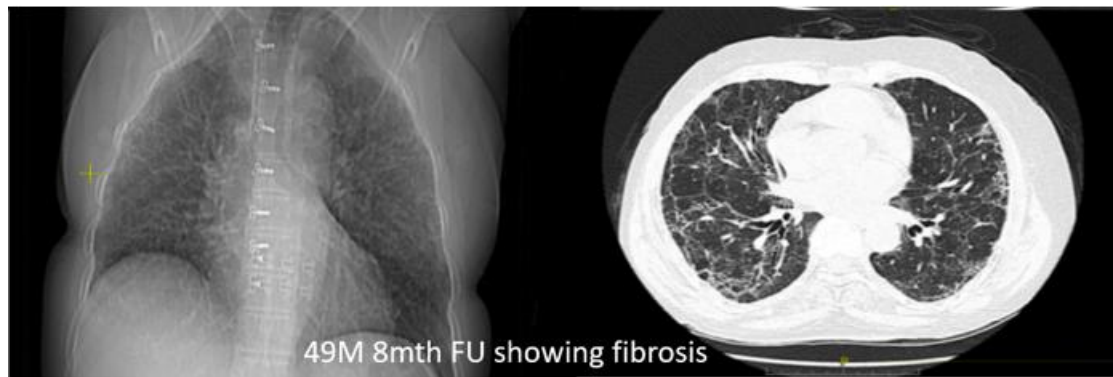
pattern compared to mild and moderate cases. Patients with severe disease also showed radiographic changes like pleural effusion, lymphadenopathy, GGO, honeycombing while none of the mild to moderate cases showed any of these findings.

Role of steroids on fibrosis: There was no significant difference in presence of fibrosis between the patients who took steroids and those who did not take steroids.

Fibrosis in patients with invasive mechanical ventilation (IMV): In majority of patients, IMV was not required. IMV was required in only severe cases, who developed ARDS during the active infection. All the patients who needed IMV were among severe cases. None of the patients from mild and moderate severity needed IMV. (p value=0.002). Fibrosis was significantly higher in patients who needed IMV (100%) as compared to patients who did not need IMV (31.48%). (p value=0.014- severity can be a confounding factor.

Chest physiotherapy & fibrosis: Patients symptomatic for long duration during recovery had a longer hospital stay. Therefore, it could not be concluded that chest physiotherapy is a risk factor for post COVID sequelae.





5. Conclusion

The majority of patients suffering from COVID 19 recovered completely without any sequelae. Sequelae were found in 40 % of patients, majority with moderate to severe acute infection. Among all patients with sequelae, significant fibrosis, that is, moderate fibrosis is seen in 9 and severe fibrosis was seen in 2, mainly affecting the male gender & older age group patients. We observed PASC were predominantly in the form of fibrotic streaks followed by septal thickening. We also found out that short-term steroid therapy given at the time of the acute phase, had no significant role in the prevention of sequelae or fibrosis.

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