Original Research Article

A study on evaluation of the Post covid-19 pulmonary fibrosis and its predictive factors

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Abstract

Aim: the aim of this study to evaluate the Post covid-19 pulmonary fibrosis and its predective factors. **Methods:** This cross sectional study was done in the department of Pulmonary Medicine after ethical permission, patients with average or severe covid 19 pneumonia were included in this study. The covid infection was confirmed by RTPCR on nasopharyngeal swab samples collected from the patients with symptoms of fever cough and sputum discharge. Chest CT was also done for all the patients. **Results:** Logistic regression results of the parameter related with post covid 19 lungs fibrosis were. Severe disease was related with high risk of pulmonary fibrosis at follow-up (OR 3.01, 95% CI 1.51–4.99). Also, patients who had consolidation in their initial CT scan were at a bigger risk of post-COVID-19 lung fibrosis (OR 3.52, 95% CI 1.55–8.12). Moreover, patients with pulmonary fibrosis had a higher CSS than those without (OR 1.21, 95% CI 1.12–1.21). The median number of CSS was 19 (interquartile range: 13–22), and we used it as a threshold for the relevant study. CSS ≥ 19 could predict post-COVID-19 lung fibrosis in patients 2.22 (1.26–4.02). In multivariable analysis, consolidation (OR 2.91, 95% CI 1.21–6.82, p = 0.016) and severe disease (OR 2.42, 95% CI 1.31–4.49, p = 0.006) were related with expand risk of fibrotic abnormalities, with AUC = 60% and AUC = 64%, respectively.14% patients had sever fibrosis and 86% patients average fibrosis present in this study. In term of severity there is no significant differences were found at the 3 months observations. **Conclusion:** we concluded that 50% of patients had post covid 19 lungs fibrosis, patients with severe COVID-19 pneumonia were at a bigger risk of pulmonary fibrosis.

Keywords: Post covid-19 pulmonary fibrosis, predective factors

Introduction

The novel coronavirus is an enveloped single positive-stranded virus with spikes of glycoproteins on the outer layer[1]. the spread of virus begins from the china[2,3]. COVID-19 was declared a global pandemic on March 11, 2020[4]. As of February 15, 2022, the coronavirus cases transcended 77,025,050 confirmed cases in the United States (US)[5].

the vaccine development is very important for human history[6]. However, evidence shows that the long-term adverse consequences of COVID-19 patients can be a considerable health problems for the people who have recovered[7]. large studies now indicate that increased danger of pulmonary fibrosis followed a severe COVID-19 infection and is mainly found in patients with co morbidities such as hypertension, diabetes, or CVD[8]. In addition, many studies explained that the inflammatory response generated could lead to lasting structural changes in the lungs, such as fibrosis[9]. Pulmonary fibrosis can present as a serious problems of viral pneumonia, which often leads to dyspnea and impaired lung function. It significantly affects quality of life and is associated with increased mortality in severe cases[10,11]. Patients with confirmed severe acute respiratory syndrome coronavirus (SARS-CoV) or MERS-CoV infections were found to have different levels of pulmonary fibrosis after hospital discharge, and some still had residual pulmonary fibrosis and impaired lung function two years later. In addition, wheezing and dyspnea have also been reported in critically ill patients[12-14]. It's a novel Betacorona virus that is responsible for an outbreak of acute respiratory diseases known as COVID-19.

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SARS-CoV-2 shares 85% of its genome with the bat coronavirus bat-SL-CoVZC45[15]. However, there are still some considerable differences between SARS-CoV- 2 and SARS-CoV or MERS-CoV. Whether COVID-19 can trigger irreversible pulmonary fibrosis deserves more investigation. George reported that COVID-19 was associated with extensive respiratory deterioration, especially acute respiratory distress syndrome (ARDS), which suggested that there could be substantial fibrotic consequences of infection with SARS--CoV-2[8].

Material and methods

This cross sectional study was done in the department of Pulmonary Medicine after ethical permission, patients with average or severe covid 19 pneumonia were included in this study. The covid infection was confirmed by RTPCR on nasopharyngeal swab samples collected from the patients with symptoms of fever cough and sputumdischarge. Chest CT were also done for all the patients.

The severity of patients was classified as average (evidence of lower respiratory disease with oxygen saturation ≥ 94%) and severe (oxygen saturation < 94%, a ratio of arterial partial pressure of oxygen to fraction of inspired oxygen < 300, respiratory rate > 30, or lung infiltrates > 50%) as per WHO[16][8]. All the demographic profile and co morbidity were noted. Within the three months of follow-up, the next chest CT scan was done for study of changes of their CT images. Patients had co morbidity or not willing to participate in this study were excluded from this study. For secondary outcome, the patients with fibrotic abnormalities in their 2nd CT scan were followed up in the next three months for observation of imaging changes.

Methodology

Non-enhanced 16-detector-row CT scans were done on the patients in the supine position during deep inspiration breath-hold from the thoracic inlet to the diaphragm. for study of patients CT scan were done before or follow up the time periods. CT imaging features, such

as traction bronchiectasis, parenchymal bands honeycombing, and interlobar septal thickening (IST), were considered as the fibrotic-like changes. Also, parenchymal bands and IST were used as mild/moderate fibrosis, and traction bronchiectasis and honeycombing were used as severe fibrosis.

CT score were determined for all the patients ranging from 0-25. All the data analysis were studied by SPSS version 25.0

Results

Table 1 show that the general information of all the patients. Total 100 patients were included in this study, 50 had lungs fibrosis and 50 without fibrosis. 57% patients were male and remaining female. The mean age of the patients were 54.88±6.97.fever was the most common symptoms in all the patients followed by dry caogh, chills, dyspnea, sore throat and headache. Co morbidity shown in table 1.

3 months observation

Pulmonary fibrosis was found in 50% patients, 62% parenchymal bands, 82% IST, 10%bronchiectasis and 4% honeycombing present in patients. No remarkable differences were present between the fibrosis or without fibrosis groups in terms of age, gender, and co morbidity.

Logistic regression results of the parameter related with post covid 19 lungs fibrosis were show in table 2.

Severe disease was related with high risk of pulmonary fibrosis at follow-up (OR 3.01, 95% CI 1.51–4.99).

Also, patients who had consolidation in their initial CT scan were at a bigger risk of post-COVID-19 lung fibrosis (OR 3.52, 95% CI 1.55–8.12). Moreover, patients with pulmonary fibrosis had a higher CSS than those without (OR 1.21, 95% CI 1.12–1.21). The median number of CSS was 19 (interquartile range: 13–22), and we used it as a threshold for the relevant study. CSS ≥ 19 could predict post-COVID-19 lung fibrosis in patients 2.22 (1.26–4.02). In multivariable analysis, consolidation (OR 2.91, 95% CI 1.21–6.82, p = 0.016) and severe disease (OR 2.42, 95% CI 1.31– 4.49, p = 0.006) were related with expand risk of fibrotic abnormalities, with AUC = 60% and AUC = 64%, respectively.

14% patients had sever fibrosis and 86% patients average fibrosis present in this study.

In term of severity there is no significant differences were found at the 3 months observations.

6 months observations findings

Out of 50 patients with pulmonary fibrosis in the first three months of follow-up, 40 patients (80%) underwent chest CT scan again at six months of follow-up for recheck previous CT findings. we studied that fibrotic findings were not greatly changed in 67.5% patients. On the other side, lung fibrosis was relatively diminished in 32.5% patients who all had average lung fibrosis.

Table 1 Basic character of the patients

	With lung fibrosis=50		Without lung fibrosis=50		P-value
Age	55.02±7.22		54.36±6.68		0.44
Gender	Number	%	Number	%	
Male	30	60	27	54	
Female	20	40	23	46	0.36
Co morbidity					
Diabetes	8	16	10	20	0.54
CVD	7	14	8	16	0.29
COPD	8	16	9	18	0.39

Table 2. Parameter related with post covid lungs fibrosis (logistic regression)

Severity	Odds ratio (95% confidence interval)	*p* value
Severity of diseases		
Moderate	1.01	
Severe	3.01 (1.51–4.99)	0.001
Consolidation		
No	1.02	
Yes	3.52 (1.55–8.12)	0.002
CT severity score (continuous)	1.21 (1.12–1.21)	0.007
CT severity score ≥ 19	2.22 (1.26–4.02)	0.0.12

Table 3 Lung fibrotic-like changes in chest CT scan at three- and six-month follow-ups

Imaging findings	3-month follow-up		6 -month follow	
Parenchymal bands				
Absent	19	38	27	67.5
Present	31	62	13	32.5
IST				
Absent	9	18	24	60
Present	41	82	16	40
Bronchiectasis				
Absent	45	90	34	85
Present	5	10	6	15
Honeycombing,				
Absent	48	96	38	95
Present	2	4	2	5

Discussion

We determined the fibrotic changes in 50 patients who recovered from the average or severe COVID-19 pneumonia within 3 to 6 months periods. 50% of the patients showed an evidence of fibrotic abnormalities on the three months follow-up, of whom 14% had severe fibrosis. We also observed that lung fibrosis was not considerably changed in we studied that fibrotic findings were not greatly changed in 67.5% patients. To the best of our knowledge, the present survey was the first report of post-COVID-19 lung fibrosis in

our area. others studies alluded to the manifestations of COVID- 19 during follow-up; However, less number of studies focused on the lung fibrosis as the main outcome, which can lead to permanent side effect outcomes in the survivors, such as irreversible pulmonary dysfunction[17].In the study by Han et al[18]. fibrotic abnormalities were seen in 35% of the patients over the 6 months of follow-up, which was lower than the results obtained by us. Also, other study by Ali et al[19]. showed a rate of 32% for pulmonary fibrosis in the COVID-19 patients within three month follow-up, which was less than that we observed in this study. We also observed that patients who had consolidation, as well as a higher CSS, in their initial chest CT scan, were at a higher risk of post-COVID-19 pulmonary fibrosis compared with those without. Furthermore, it was demonstrated that severe COVID-19 pneumonia increased risk of fibrotic lung damages in the patients. In the study by Ali et al[19]. it was declared that older age, cigarette smoking, higher CSS, and long-term mechanical ventilation were associated with increased risk of lung fibrosis. The same results for age, CSS, and mechanical ventilation were seen in the study by Han et al[18]. as well. Therefore, identifying and controlling these predictors in clinical practice can help in pre- venting the development of and/or reducing the pro- gression of the lung fibrosis as a considerable adverse outcome of COVID-19 pneumonia.The main cause of post-COVID-19 pulmonary fibrosis still remains unclear; However, some theories allude to the abnormal immune mechanisms and the result- ant cytokine storm[20]. Also, more studies need to be done to clarify why some patients develop lung fibrosis, while some others not.It should be stated that there is not a consensus on the use of anti-fibrotic drugs in the prevention and treatment of lung fibrosis in the COVID-19 survivors yet. These drugs can decrease pulmonary damage in the high-risk patients and are presently used for inter- stitial lung diseases[20]. Considering that lung fibrosis is accepting as an important adverse outcome in the survivors of COVID-19, it is suggested to reach a con- sensus on putting anti-fibrotic drugs into the COVID 19 treatment guidelines, specifically concerning the high-risk patients.

Conclusion

We concluded that 50% of patients had post covid 19 lungs fibrosis,patients with severe COVID-19 pneumonia were at a bigger risk of pulmonary fibrosis.

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