ASIAN JOURNAL OF PHARMACEUTICAL AND CLINICAL RESEARCH

INNOVARE ACADEMIC SCIENCES
Knowledge to Innovation

Vol 16, Issue 8, 2023

Online - 2455-3891
Print - 0974-2441

Research Article

ROLE OF CT CHEST IN EVALUATION OF PULMONARY MANIFESTATIONS OF COVID-19 RECOVERED CASES

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Received: 16 February 2023, Revised and Accepted: 29 March 2023

ABSTRACT

Objective: Pulmonary manifestations may be seen in a number of coronavirus disease 2019 (COVID-19)-recovered the evidence on post-COVID pulmonary sequelae is still limited. Herein, we aim to assess the role of computed tomography (CT) chest in the evaluation of pulmonary manifestations of COVID-19 recovered cases.

Methods: We conducted a hospital-based study in the Department of Radiodiagnosis at Government Medical College and Rajindra Hospital Patiala. It included 182 reverse transcriptase-polymerase chain reaction (RT-PCR)-proven COVID-19 patients after they recovered from the disease with at least one negative RT-PCR test and/or clinical recovery. Clinical data and CT findings in the recovery phase were summarized, and the relationship of different clinical parameters with CT severity scores was analyzed.

Results: The mean (±standard deviation [SD]) age of patients was 50.2±14.7 years, and 62.6% of them were males. The mean (±SD) symptomatic-scan interval was 33.05±22.27 days. Pulmonary abnormalities were found in the majority of the cases in the recovery phase, that is, 176 patients accounting for 96.7%, while six patients had normal scans. Bilateral involvement was seen in 169 out of 176 patients. Common CT patterns observed were ground glass opacities (90.34%), reticular pattern (81.82%), interlobular septal thickening (70.45%), linear opacities (90.34% cases), fibrous stripes (78.41% cases), and consolidation (36.93%). The mean (±SD) CT severity score of our study subjects was 16.10±7.95. Patients were also categorized into four groups according to symptomatic scan interval <1 month, 1–2 month, 2–3 month, and >3 months. We found that residual changes were more severe in patients with shorter symptomatic scan interval.

Conclusion: COVID-19 patients demonstrate persistent pulmonary abnormalities even after clinical recovery. Hence, follow-up in patients with moderate and severe disease is strongly recommended.

Keywords: Coronavirus disease 2019, Chest computed tomography, Symptomatic-scan interval, Acute respiratory distress syndrome, Pulmonary sequelae.

 DOI: http://dx.doi.org/10.22159/ajpcr.2023v16i8.47600. Journal homepage: https://innovareacademics.in/journals/index.php/ajpcr

INTRODUCTION

Coronavirus disease 2019 (COVID-19) is a highly infectious disease caused by a novel coronavirus, severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) [1,2]. COVID-19 outbreak started through a zoonotic spread from the seafood markets in Wuhan, China. After then, human-to-human transmission is considered to be responsible for the community spread of the disease worldwide [3]. The World Health Organization announced that COVID-19 reached pandemic status on January 30, 2020, and declared a global pandemic in March 2020 [1].

Clinically, COVID-19 infection may be asymptomatic or it can cause a wide spectrum of symptoms, such as mild symptoms of upper respiratory tract infection and life-threatening sepsis, acute respiratory distress syndrome (ARDS), and multisystem organ failure [4].

The method of reference for the identification of SARS-CoV-2 is laboratory testing by reverse transcriptase-polymerase chain reaction (RT-PCR) in nasopharyngeal aspirates [5].

Radiological imaging, especially computed tomography (CT), has an important role in the screening, diagnosis, management and follow-up of patients with SARS-CoV-2 pneumonia [6]. Bilateral ground glass opacities (GGOs) and consolidation in peripheral and posterior predominance are the CT hallmarks of COVID-19 pneumonia [7]. The status of lung involvement during the first chest CT scan has a predictive effect on the prognosis and outcome of the patient [8]. The epidemiological characteristics, pathogenetic mechanisms, clinical features, and complications of COVID-19 at acute phase have been explicitly evaluated, but the Post COVID sequelae after hospital discharge remain largely unclear [9]. Pulmonary manifestations being the most common expression of the "active" disease, hence need to be evaluated in recovered cases to assess the burden of residual disease and temporal sequelae, to guide further follow-up and for overall patient prognostication. Herein, we aim to describe the spectrum of pulmonary abnormalities in COVID-19-recovered patients after discharge.

METHODS

The study was conducted in the Department of Radiodiagnosis in collaboration with the Departments of Medicine and Community Medicine at Government Medical College and Rajindra Hospital Patiala.

Study design

This was a hospital-based, cross-sectional, prospective, and observational study.

Sample size and study population

The study was conducted on 182 RT-PCR proven COVID-19 patients after they recovered from disease with at least one negative RT-PCR test and/or Clinical recovery.

Patient preparation

Before subjecting a patient to CT scan, informed consent was obtained from the patient/caregiver and detailed clinical profile was recorded for each patient on a pre-validated proforma.

Inclusion criteria
Patient with at least one positive real-time RT-PCR for SARS-CoV-2 infection and now recovered from disease with at least one negative RT-PCR test and/or clinical recovery was included in the study.

Exclusion criteria
Patients who decline to participate in the study/refuse to give consent were excluded from the study.

Study equipment and chest CT protocol
GE Medical systems Revolution EVO 128 Slice multi-detector CT machine was used for image acquisition. Non-contrast CT was performed with standard dose scanning protocol and following parameters were used: Patient position: Supine; End inspiratory acquisition; Tube potential: 140 kVp; Tube current: 450 mAs; Slice thickness: 1 mm; slice interval: 1 mm; Reconstructions done with slice thickness of 0.625 mm with 0.625 mm interval. Both lung and mediastinal windows were acquired for each subject.

Image analysis and interpretation
CT images were evaluated for the presence of pulmonary manifestations as defined by the glossary of terms of the Fleischer Society. The main analysis criteria included the presence or absence of pulmonary involvement, unilateral/bilateral involvement, number of affected lobes, distribution of pathology (Central/peripheral/both and Anterior/posterior/both), presence of GGOs, patchy consolidation, vascular dilatation, fibrous stripes, linear opacities, subpleural curvilinear lines, and bronchial distortion. Other atypical findings were also noted. A semi-quantitative CT score was calculated on the basis of extent of lobar involvement (0, no involvement; 1, <5% involvement; 2, 5–25% involvement; 3, 26–50% involvement; 4, 51–75% involvement; and 5, >75% involvements; ranging from 0 to 5) for each of the five lobes with a total score of 0–25, similar to that in active COVID-19 cases. On the basis of CT severity score, we categorized patients into mild moderate and severe categories. We also categorized the patients according to symptomatic-scan intervals: <1 month, 1–2 months, 2–3 months, and >3 months.

Statistical analysis
The data were compiled, tabulated, and statistically analyzed using Microsoft Office Excel version 2021, Epi Info (CDC Atlanta) software version 7.2.5.0 and MedCalc® Statistical Software version 20.218. Categorical variables were presented as frequencies or percentages. Continuous variables were expressed as mean value ± standard deviation (SD) or median (interquartile range, [IQR]). The Mann–Whitney test was used for single comparisons, while the Kruskal–Wallis test was used for multiple comparisons. Fisher's exact test was used for categorical variables. $p<0.05$ was considered statistically significant.

Ethical statement
The study was reviewed and approved by Ethics and Research Committee, Govt. Medical College and Rajindra Hospital, Patiala. The patients/participants provided their written informed consent to participate in this study.

RESULTS

Participant characteristics
We included a total number of 182 patients between 15 and 82 years of age. Mean (±SD) age of the participants was 50.2±14.7 years and maximum number of patients was above 60 years of age accounting for 30.2%. Majority of the patients enrolled were males, that is, 62.6%. The mean (±SD) body mass index calculated was found to be 25.22±3.42 (Table 1).

A significant percentage of our study population, that is, 111 patients, 60.99% had other known comorbid conditions. Diabetes mellitus (39.56%) was most commonly encountered comorbidity followed by hypertension (26.37%). Other comorbidities found were obesity (7.14%), coronary artery disease (5.49%), bronchial asthma (3.30%), rheumatoid arthritis (2.20%), tuberculosis (1.65%), and chronic obstructive pulmonary disease (1.10%) (Fig. 1).

In our study, 13 patients (7.14%) had present or past history of tuberculosis. Out of them, three patients were suffering from pulmonary Koch's at the time of chest CT and were on anti-tubercular treatment. Majority of the patients in our study population were non-smokers accounting for 96.15% and only 7 (3.85%) patients had history of smoking. The mean (±SD) duration of smoking was 11.86±7.58 years.

Fever was the most common symptom observed during the acute phase of COVID-19 disease which was seen in 93.41% patients, followed by cough, dyspnea, fatigue, myalgia, arthralgia, and sore throat. Other less commonly observed symptoms include pleuritic chest pain, anosmia, loss of appetite, headache, pain abdomen, and diarrhea (Table 2).

The mean (±SD) symptomatic-testing interval calculated in our study was 4.97±5.52 days. The mean (±SD) symptomatic-scan interval was 33.05±22.27 days and median (IQR) symptomatic-scan interval was 26 days (21–36).

In our study, out of 182 patients, 82.97% of patients were admitted at the time of acute illness and 10.44% of patients were under home isolation with SpO_2 >94% at room air. About 6.59% of patients were

Table 1: Demographic characteristics of study population

Characteristics	Frequency (percentage)
Age	
Mean±SD	50.2±14.7 years
<30 years	19 (10.44)
30–40 years	23 (12.64)
40–50 years	40 (21.98)
50–60 years	45 (24.73)
60 years and above	55 (30.22)
Gender	
Males	114 (62.6)
Females	68 (37.4)
BMI	
Mean±SD	25.22±3.42
Underweight	5 (2.7)
Normal	85 (46.7)
Overweight and obese	92 (50.6)
Smoking history	7 (3.8)

BMI: Body mass index

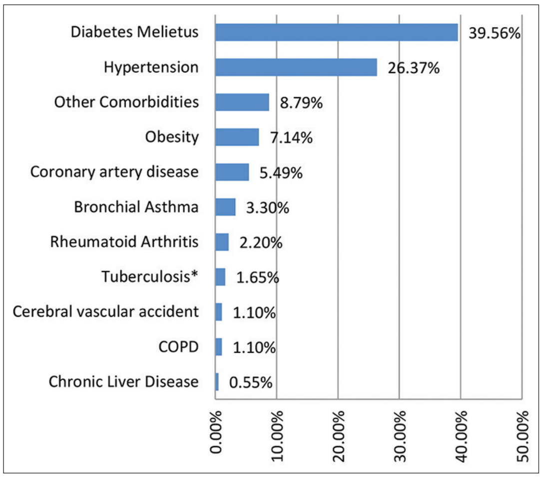

Fig. 1: Graph showing the occurrence of comorbidities among study subjects. *Out of 13 cases of tuberculosis among the study subjects, ten were treated in the past, while three are currently on treatment

under home isolation initially, but subsequently required hospital admission due to increased severity of illness (Fig. 2).

On the basis of mode of oxygen supplementation, 44.51% of patients required non-rebreather mask (NRM) during their hospital stay, 10.43% of patients were on high-flow nasal canula (HFNC), and 3.30% of patients were on mechanical non-invasive BIPAP. Only one patient required mechanical invasive ventilator as oxygen support. A significant number of cases, that is, 19.23% did not required any mode of oxygen supplementation with SpO_2 more than equal to 94% at room air (Fig. 3).

CT imaging characteristics

In our study, pulmonary abnormalities were found in majority of the cases in the recovery phase, that is, 176 patients accounting for 96.7%, while 6 patients had normal scans accounting for 3.30%. Most of our patients showed bilateral involvement, that is, 169 out of 176 patients (Fig. 4a). Majority of the cases revealed involvement of all the five lobes, that is, 142 patients (78.02%) followed by four-lobe involvement in 10 patients, that is, 5.49%. Out of the total number of lung lobes involved, the right lower lobe was the most commonly affected lobe which was involved in 79 patients accounting for 44.89% followed by left lower lobe in 68 patients accounting for 38.64% (Fig. 4b).

Among 176 patients with pulmonary involvement, GGOs were the predominant parenchymal finding observed which were seen in 90.34% of the patients. Crazy paving pattern was seen in 21.59% and consolidation in 65 patients of our study comprising of 36.93%. A significant number of our cases also showed linear opacities (90.34% cases) and fibrous stripes (78.41% cases) in the post-COVID phase (Table 3 and Figs. 5-7).

Other parenchymal findings observed on CT chest in recovery phase were peripheral subpleural curvilinear lines (38.64%), vascular dilatation (47.16%), nodules (34.66%), and tree-in-bud opacities (8.52%). Less commonly observed findings in our study subjects were halo sign (12.50%), Reverse halo sign/Atoll sign (3.98%), cavitatory lesions (5.68%), air bubble sign (5.68%), and interstitial pulmonary edema septal lines (2.27%) (Table 3 and Figs. 5-7).

In our study, a significant number of patients showed pleural involvement with pleural thickening, that is, 56.25% of patients and pleural effusion in 19.32% of patients. Airway involvement was also observed with Bronchial wall thickening (56.82%) and bronchiectasis/bronchial distortion (60.80%).

Very few of our patients revealed cardiomegaly (14.29%), pericardial effusion (7.14%), pneumothorax (2.20%), and spontaneous pneumomediastinum in some of the patients.

The mean (±SD) CT severity score in our study population was 16.10±7.95. The median (IQR) CT severity score was 19 (10–23). Patients were categorized according to the CT severity score into mild (37 patients), moderate (52 patients), and severe (93 patients) groups.

We found that CT severity score was directly proportional to the age group with highest mean CT severity score in patients above 60 years of age. Younger patients were less likely to suffer from severe disease as compared to older patients. No significant correlation was found between gender and CT severity in our study (Fig. 8).

Mean CT severity score was higher for patients with comorbidities, that is, 16.94±7.26 as compared to patients without comorbidities which

Table 2: The initial (first) presenting symptom among the study subjects

Initial (first) symptom	Frequency	Percent	Exact 95% LCL (%)	Exact 95% UCL (%)
Fever	118	64.84	57.43	71.75
Cough	23	12.64	8.18	18.36
Dyspnea	18	9.89	5.97	15.18
Sore throat	8	4.40	1.92	8.48
Myalgia	6	3.30	1.22	7.04
Fatigue	5	2.75	0.90	6.29
Abdominal pain	1	0.55	0.01	3.02
Headache	1	0.55	0.01	3.02
Pain abdomen	1	0.55	0.01	3.02
Vertigo	1	0.55	0.01	3.02
Total	182	100.00		

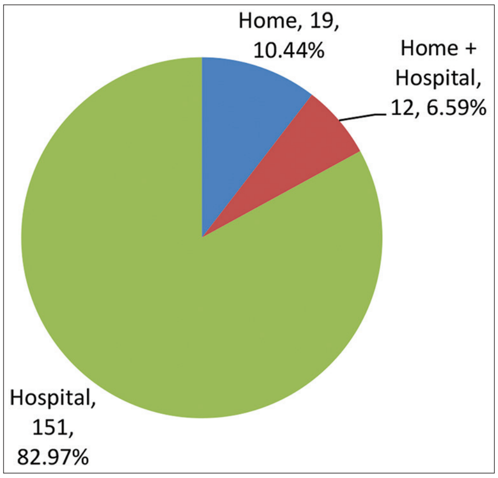

Fig. 2: The distribution of isolation and treatment facilities among study subjects

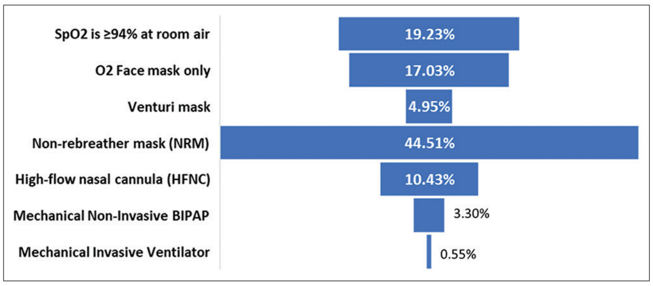

Fig. 3: Funnel chart regarding severity of illness based on treatment

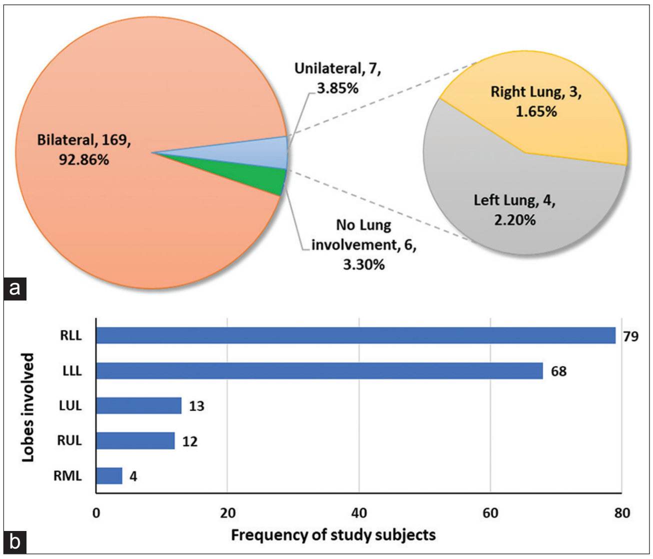

Fig. 4: (a and b) Lung/predominant lobe involvement among study subjects, respectively

Table 3: Parenchymal involvement among study subjects

Parenchymal involvement	Frequency	Percent	Exact 95% LCL (%)	Exact 95% UCL (%)
GGOs	159	90.34	84.99	94.27
Consolidation	65	36.93	29.79	44.52
Interlobular Septal thickening	124	70.45	63.12	77.08
Reticular pattern	144	81.82	75.31	87.22
Crazy paving pattern	42	23.86	17.77	30.86
Linear opacities	159	90.34	84.99	94.27
White lung pattern	1	0.57	0.01	3.12
Air bronchogram	62	35.23	28.19	42.77
Subpleural curvilinear line	68	38.64	31.41	46.26
Fibrosis/fibrous strips	138	78.41	71.59	84.24
Vascular dilatation	83	47.16	39.60	54.81
Air bubble sign	10	5.68	2.76	10.20
Vacuolar sign	10	5.68	2.76	10.20
Tree in bud opacities	15	8.52	4.85	13.67
Nodules<3 cm	61	34.66	27.66	42.19
Halo sign	22	12.50	8.00	18.31
Reversed halo atoll sign	7	3.98	1.61	8.02
Cavitation	10	5.68	2.76	10.20
Interstitial pulmonary edema septal lines (myocarditis)	4	2.27	0.62	5.72
Any other	89	50.57	42.94	58.17

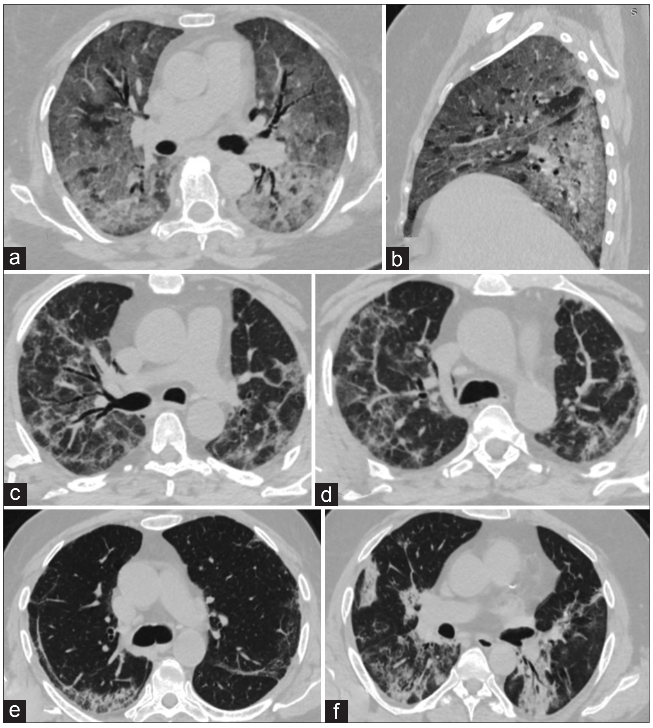

Fig. 5: Axial and sagittal computed tomography (CT) images showing ground glass opacities (GGOs) with ILST giving a Crazy paving pattern (a and b). CT images of a patient showing bronchial distortion, vascular dilatation, linear opacities, fibrous stripes, and spontaneous pneumomediastinum (c and d). Axial chest CT image (e) showing subpleural curvilinear lines and linear opacities. Image (f) shows GGOs with patchy consolidation with air bronchogram in the left lower lobe

was 14.79±8.83. However, no statistically significant correlation was found between both the variables.

The mean CT severity score was highest for patients having contact with symptomatic laboratory confirmed case, that is, 18.9±6.87 followed by patients with unknown mode of contact which was 17.5±6.96. This relationship between the probable mode of contact and CT severity score was found to be statistically significant.

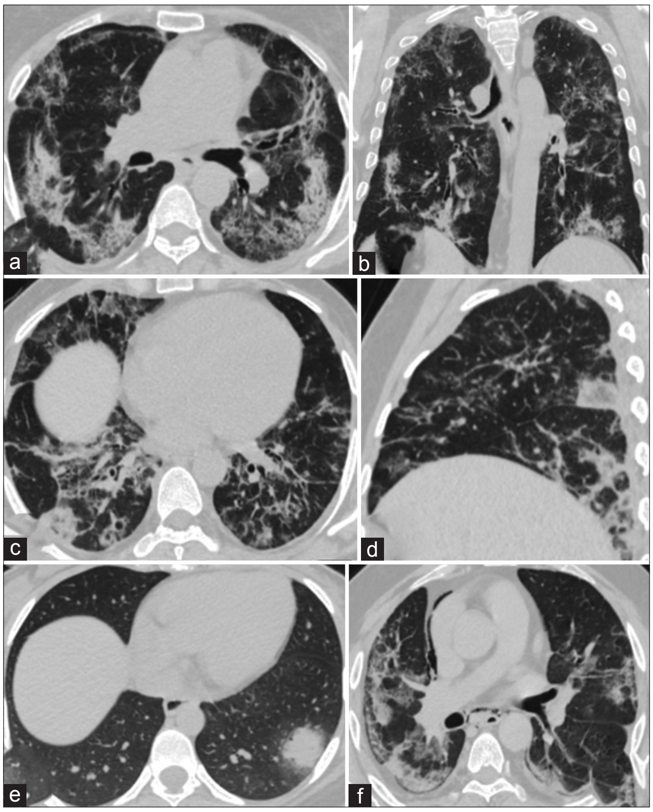

Fig. 6: Axial computed tomography (CT) images showing ground glass opacities (GGOs), linear opacities, fibrous stripes, and bronchial distortion with bronchial wall thickening (a and b). Axial and sagittal images of a patient showing the patchy area of GGOs with surrounding consolidation giving a "Reverse Halo" sign (c and d). Another axial CT image showing pulmonary nodule with surrounding GGOs giving a "Halo" sign in image (e). Image (f) shows GGOs with linear opacities and spontaneous pneumomediastinum

The mean CT severity score was higher for patients who required hospital admission, that is, 17.5±7.1 as compared to patients who underwent home isolation which was 4.3±3.6. The median (IQR) CT severity score for patients with hospital admission was 20 (15–23) and for patients with home isolation was 3 (2–8). Statistical significance was observed using Mann–Whitney U test with p<0.0001.

The mean CT severity score (±SD) was highest for patients with HFNC, that is, 21.6±4.7 followed by patients on non-invasive BIPAP which was 20.7±7.7 and patients on NRM, that is, 19.0±5.8. Patients on Venturi-mask on oxygen face mask had relatively lower mean CT severity scores (±SD) of 16.8±6.6 and 15.8±6.9, respectively. While patients who maintained SpO_2 >94% at room air had lowest mean CT severity score (±SD) ~5.8±5.8. This relationship between the mode of oxygen supplementation and CT severity score was found to be statistically significant.

Relationship of CT severity score with symptomatic-scan interval

Patients were categorized into four groups on the basis of symptomatic-scan interval, that is, <1 month (116 patients), 1–2 months (51 patients), 2–3 months (eight patients), and >3 months (seven patients). Relationship between symptomatic scan interval and CT severity score was established. The mean CT severity score was highest for patients having <1 month symptomatic-scan interval and after that as the interval increased, CT severity score decreased in our study population (Fig. 9). This inversely proportional relationship between the symptomatic-scan interval and CT severity score was found to be statistically significant.

In patients with <1 month and 1–2 months symptomatic-scan intervals, majority were found to have severe disease (57.76% and 49.02% respectively), followed by moderate disease (29.31% and 29.41%, respectively) and mild disease (12.93% and 21.57%, respectively). However, in patients with symptomatic-scan intervals between 2 and 3 months and >3 months, opposite pattern was observed. Majority were found to have mild disease (75% and 71.43%, respectively) followed by moderate disease (12.5% and 28.5%, respectively). Severe CT severity was encountered in 12.5% of the patients with symptomatic-scan interval between 2 and 3 months, while none of the patients who underwent CT after 3 months of symptom onset had severe CT score.

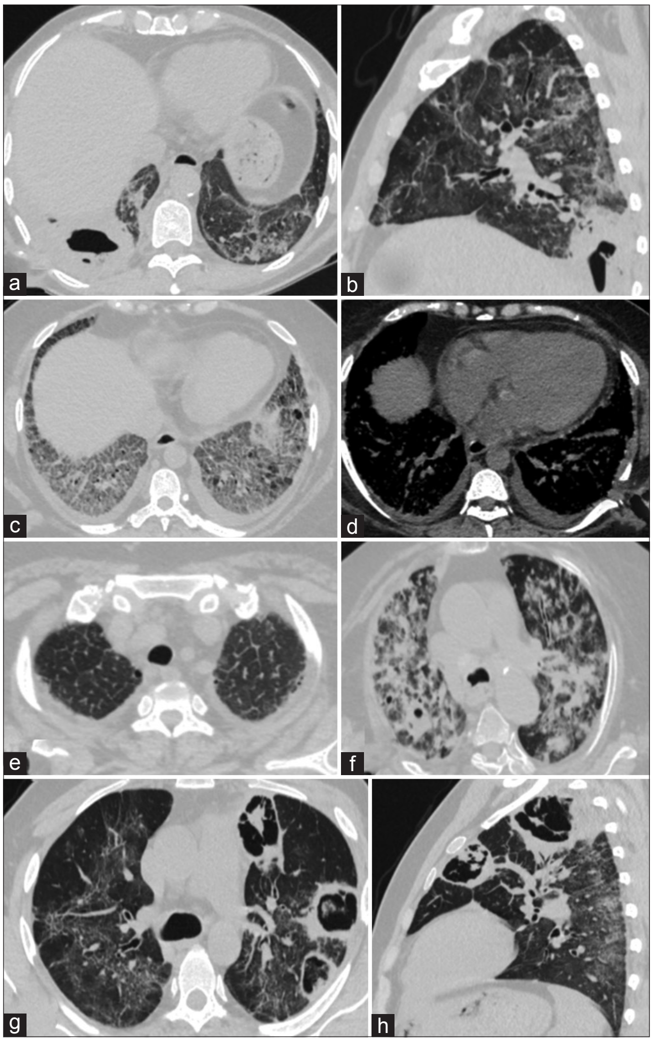

Fig. 7: Axial and sagittal computed tomography (CT) images showing a patch of consolidation and the internal breakdown and cavity formation in the right lower lobe may be due to superimposed bacterial infection (a and b). Axial CT images of a patient showing ground glass opacities, interstitial edema septal lines, bilateral pleural effusion, and cardiomegaly indicating pulmonary edema (c-e). Axial CT image showing multiple nodules in bilateral lungs with cavitatory nodule in the right lower lobe. Bronchial wall thickening is also noted (f). Multiple cavitatory lesions with surrounding consolidation give a "Bird's Nest sign" in the left lung highly suggestive of superimposed fungal infection (g and h)

DISCUSSION

The clinical spectrum, epidemiological characteristics, and pathogenesis of COVID-19 have been studied extensively with aim for early diagnosis, timely management of the disease, and to reduce mortality associated

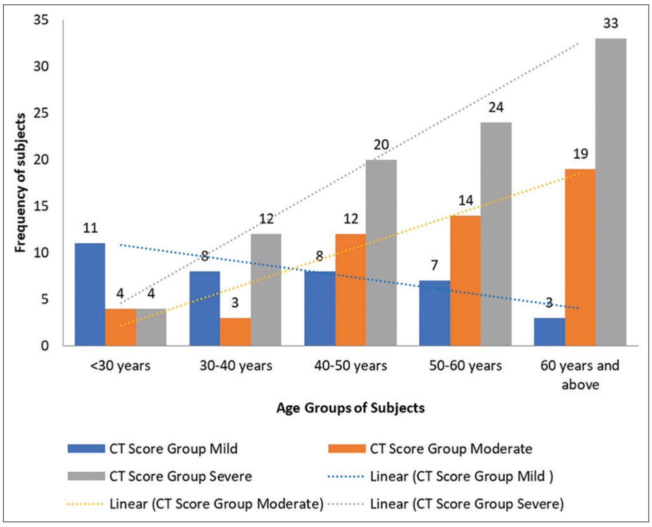

Fig. 8: Bar chart showing relationship between age groups and computed tomography severity groups

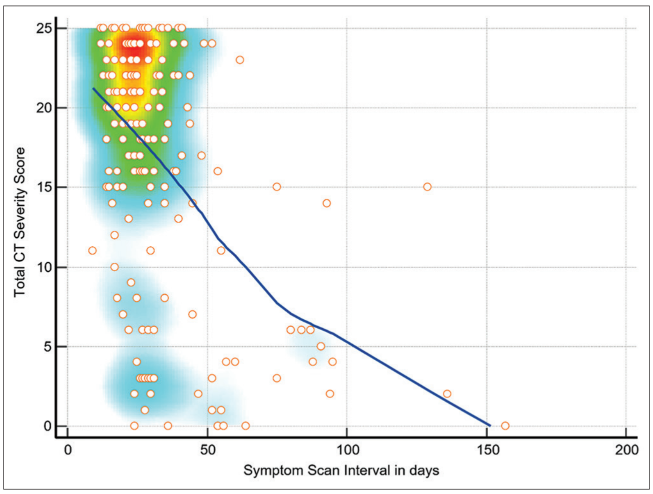

Fig. 9: Scatter diagram showing relationship between total computed tomography severity score and symptomatic-scan interval

with COVID-19 disease. In the recent scenario, there is a significant increase in population who recovered from COVID-19 disease and many of these patients experience persistent pulmonary symptoms.

We found that CT severity score was directly proportional to the age group with increasing severity as the age group increased. Older patients were more likely to suffer from severe disease and residual abnormalities which is in consistent with the previous studies [10,11]. In our study, the mean (±SD) symptomatic-Testing interval calculated in our study was 4.97±5.52 days. The mean (±SD) symptomatic-scan interval was 33.05±22.27 days. Patients were further categorized on the basis of symptomatic-scan intervals as 1 month group, 1–2 months, 2–3 months, and >3–month group.

In our study, out of 182 patients, 96.7% of patients had persistent pulmonary abnormalities in post-COVID phase. Out of these, majority of the patients had bilateral involvement and few of the cases showed atypical presentation with unilateral involvement. Majority of the cases revealed involvement of all the five lobes, that is, 142 patients (78.02%) followed by four-lobe involvement in 10 patients, that is, 5.49%.

Out of the total number of lung lobes involved, the right lower lobe was the most commonly affected lobe. These findings are in line with the study published by Bernheim *et al*. which included 121 COVID patients for initial CT, 27 patients showed normal chest CT. Out of 94 patients, 73 (60%) showed bilateral involvement. Majority of the patients showed opacity in all the five lobes, that is, 33 patients, 18 patients had four affected lobes. The right lower lobe was the most frequently affected lobe in their study [12].

Our study also correlates with the study published by Wang *et al*. in which initial CT features and dynamic evolution characteristics of the lung changes in COVID-19 patients were analyzed. It included a total number of 126 COVID-19 cases and initial chest CT features observed were bilateral (88.9%) and diffuse distribution (84.1%) of the pulmonary opacities [13].

Our study has shown that pulmonary abnormalities in COVID-19 patients persist even after negative RT-PCR test or after clinical recovery. Spectrum of pulmonary findings observed were GGO's, interlobular thickening, consolidations, reticular pattern, linear opacities, subpleural curvilinear lines, vascular dilatation, nodules, pleural effusion, and thickening along with bronchial distortion and bronchial wall thickening. GGOs (90%) were the most commonly observed findings in the recovery phase followed by reticular pattern (82%), linear opacities (90%), and fibrotic stripes (78%). Our findings are similar to the study conducted by Kumar *et al*. which is a short-term follow-up study on 40 COVID-19 recovered patients. In their study, GGO's (85%) and reticular pattern (80%) were the most commonly observed findings [14]. Another study published by Liu *et al*. included 149 patients in their study and predominant pulmonary abnormalities at discharge were GGO's (83.9%), fibrous stripe (54.4%), and pleural thickening (33 patients, 22.1%) [15].

Atypical findings that were observed in our study include tree in bud opacities, "halo" sign, "Reverse halo" sign, and cavitation. These findings are in concordance with the previous studies published by Garg *et al*. describing the pulmonary sequelae in COVID-19 patients in which they concluded that COVID-19 patients are more prone to develop superadded bacterial and fungal infections secondary to immunosuppression [16]. Similar to their results, two of our patients were found to have COVID Associated Pulmonary Mucormycosis and one patients had COVID associated Pulmonary Aspergillosis; while another two patients found to have spontaneous pneumomediastinum and four patients had pneumothorax which is in agreement with the previous reports published by Brogna *et al*. [17].

A semiquantitative score was used to assess the severity of residual pulmonary abnormalities on high-resolution CT (HRCT) chest. Patients were divided into mild, moderate, and severe groups. Relationship of CT severity with different variables was analyzed.

We found that the patients having contact with symptomatic laboratory confirmed case suffered from more severe disease as compared to the patients with unknown mode of contact. Symptomatic healthcare workers were also found to have mild disease. Strong statistical significance was observed in the relationship between CT severity score and requirement for hospital admission with more severe disease in patients who required hospital admission. These findings correlate with the previous study published by Frija-Masson *et al*. in which majority of their patients in moderate and severe categories required hospital admission at the time of illness [18].

We observed that mean CT severity scores (±SD) were higher in patients who required HFNC, non-invasive BIPAP, and NRM as modes of oxygen supplementation as compared to those on Venturi-mask and oxygen face mask. While patients who maintained SpO_2 >94% at room air suffered from milder disease.

In our study, symptomatic-scan interval and CT severity score were found to have inverse relationship with each other. Residual pulmonary abnormalities were more severe in patients with shorter symptomatic scan interval with gradual decline in the pulmonary abnormalities as symptomatic-scan interval increased. None of the patients who underwent CT after 3 months of symptom onset had severe CT score. However, residual abnormalities still persisted and few of our patients showed fibrotic like changes for which further follow-up is recommended. According to the previous reports by Zhao *et al*., residual pulmonary abnormalities were observed in a quarter of the patients even at 3-months after discharge [19].

Lee *et al*. in a systematic review stated that residual pulmonary findings may persist even after 6–12 months after discharge [20]. In another study by Darcis *et al*., improvement in chest CT findings was noted over time with significant residual abnormalities at 3 months after discharge (69%) [21]. Persistent abnormalities were also found at 3-month follow-up in a study published by Vijayakumar *et al*.; however, progressive improvement was noted at 1 year follow-up in a majority of patients with residual functional impairment and persistent radiologic abnormalities in few of the patients [22].

CONCLUSION

Pulmonary abnormalities in COVID-19 patients persist even after negative RT-PCR test or after clinical recovery. Some of these patients may present with complications due to ARDS, immunosuppression, and ventilator associated lung injury that need to be strictly monitored. The quantitative CT parameters such as CT severity score are reliable indicators of disease severity. Due to high prevalence of ARDS among COVID-19 pneumonia patients, there is high risk of development of pulmonary fibrosis in this patient population. Therefore, follow-up in patients with moderate and severe disease is strongly recommended. Radiologists and clinicians should be aware of the post COVID pulmonary sequelae and pulmonary complications for appropriate clinical decisions and timely management.

AUTHORS CONTRIBUTION

Dr. Aarti had contributed in planning, collection of data, analysis of research, and write up of research article. Dr. Saryu Gupta had conceptualized, planned, supervised, collection of data and interpretation, analyzed research, and edited the write up of research article. Dr. Raminder Pal Singh Sibia assisted in planning, supervision, collection, and interpretation of data. Dr. Puneet Gambhir had contributed in conceptualization, planning, analysis, interpretation of research, and editing of the research article.

CONFLICTS OF INTEREST

Nil.

FUNDING OF RESEARCH

Nil.

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