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To Analyze Pulmonary CT Manifestations of Covid 19, Changes Within 2 Weeks Duration from Presentation: A Teaching Hospital Based Study

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Abstract

Background: Coronavirus disease 2019 (COVID-19) is an infectious disease brought on by the SARS-CoV-2 coronavirus, which is responsible for severe acute respiratory syndrome. Performing a chest computed tomography (CT) is crucial for assessing COVID-19. Using a computed tomography (CT) scan, this retrospective study seeks to identify and assess the pulmonary alterations that occurred in Indian patients with COVID-19 disease within the first two weeks following the beginning of symptoms. In this study, 66 COVID-19 disease patients were included. According to the length of the symptoms, patients were split into two groups. The first group was scanned during the first week after symptom onset, while the second group was scanned during the second week.**Material and Methods:**This present study is a retrospective cross-sectional study carried out in the Department of Radiodiagnosis, Kanti Devi Medical College, Hospital and Research Centre, Mathura. Sixty-six (46 males and 20 females) with proven COVID-19 infection were enrolled in this study; aged 18–76 years, with a mean age of 38.4 ± 12.04 years. All of the patients had symptoms, including varying degrees of fever, coughing, and dyspnea. According to the length of the symptoms, the patients were split into two groups.**Results:**In the present investigation, two groups of patients who obtained chest CT scans at various times following initial clinical presentations were compared for the pulmonary radiological characteristics associated with COVID-19 infection. The bilateral, peripheral, and multilobar areas of GGO, as well as consolidation to a lesser extent in a patchy form, were the most often seen changes in both groups and are consistent with findings in nearly all publications that have been published to date. The ratio of GGO and consolidation was significantly different between individuals who underwent CT scans within the first week (group 1) and second week (group 2), though. Early CT scans performed within the first week revealed greater GGO (92.0% vs. 81.3%) and less consolidation (26.0% vs. 31.3%) than later CT scans.**Conclusion:**The two groups, who were scanned at various phases of the disease, show markedly distinct types, extents, and distributions of pulmonary symptoms linked to COVID-19 infection.

Keywords: Computerized tomography, ground glass opacity, consolidation and COVID-19.

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INTRODUCTION

Late in December 2019, Wuhan City, China, experienced an increase in pneumonia cases, which were then reported to the World Health Organization (WHO). A few months prior to the WHO declaring the pandemic, the new cases had respiratory symptoms that were similar

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to viral pneumonia.[1] Those cases were brought on by a virus known as the 2019 corona virus disease (COVID-19), which is also known as the severe acute respiratory syndrome corona virus 2 (SARS-CoV-2). A single-stranded RNA virus called SARS-CoV-2 is a member of the family Coronaviridae, which also includes other viruses linked to respiratory disorders such Middle Eastern respiratory syndrome (MERS) and severe acute respiratory syndrome (SARS).[2] The first instance in India was noted in students returning from Wuhan, China on January 30, 2020 at Thrissur, Kerala.[3] The following day, March 24, 2020, saw a total of 9 deaths and 519 confirmed cases. On March 25, 2020, the government declared a rigorous 21-day nationwide lockdown because to the impending threat.[4]The National Disaster Management Authority subsequently prolonged the closure to May 31 due to the gravity of the situation.[5]The exact viral genetic material must be found in samples taken from the nose, blood, feces, or respiratory secretions in order to diagnose COVID-19; however, the varying sensitivity of this test poses a threat to its validity.[6]In around 30% of cases, the COVID-19 infection results in lung damage manifested as acute respiratory distress.[7] Even before the clinical symptoms manifest, chest computed tomography (CT) is crucial for the evaluation of COVID-19.[8] Only 25% of individuals with specimens that are positive or negative may be accurately diagnosed with a chest CT scan, while having 97% and 75% sensitivity, respectively.[9] In few earlier investigations,[11,12] the changes in the lung characteristics on CT follow-up were mentioned. As no previous studies in India have been undertaken that could assess the development of the disease on CT scan follow-up, we have performed our study to improve the accuracy of the diagnosis of the disease and to have a better understanding of the chronological changes of the lung disease in COVID-19.

METHODOLOGY

This present study is a retrospective cross-sectional study was carried out in the Department of Radiodiagnosis, Kanti Devi Medical College, Hospital and Research Centre, Mathura. Sixty-six (46 males and 20 females) with proven COVID-19 infection were enrolled in this study; aged 18–76 years, with a mean age of 38.4 ± 12.04 years. All of the patients had symptoms, including varying degrees of fever, coughing, and dyspnea. According to the length of the symptoms, the patients were split into two groups. The first group (50 patients) had their scans done within the first week of presentation, while the second group (16 patients) had their scans done in the second week. The RT-PCR assay was used to establish the COVID-19 infection. Patients having positive PCR results: infection with COVID-19 proven. Patients who were symptomatic and included in this study had varying degrees of fever, coughing, and dyspnea. Patients having lung disease prior to the research were not included. Acceptance of participation and ethical clearance The research did not include any individual data. This study was approved by the medical school's research ethics committee at Kanti Devi Medical College, Hospital, and Research Center. All of the study's participants verbally agreed to take part in the research after receiving full disclosure. The patient's next of kin must have provided written informed permission if the patient was not conscious during the trial. Our medical study ethics committee advises verbal agreement, especially in such an unusually risky condition to lower the risk of disease transmission by avoiding any unnecessary interaction with the positive patients.

Procedure for CT scanning: With 16-sauce multi-detector row CT scanners (Siemens Sensation-64, Philips Brilliance-64, and GE Light Speed-64), a high-resolution CT (HRCT) scan was completed on all patients. During the breath-hold, patients were scanned while lying on their backs, head first. The following scanning settings were used: pitch 1.375, FOV 350–400 mm, tube voltage 100–120 kV, and tube current 110–280 mA. The images that were 1.25 or 2.5 mm thick were rebuilt using a high-frequency reconstruction method. There were no enhanced exams performed, and no intravenous contrast agent was given.

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Image analysis of HRCT: To detect the pulmonary alterations, two experienced radiologists (each with more than five years of experience) independently reviewed the CT scans. Ground-glass opacity (GGO), consolidation, crazy paving, tree-in-bud, broncho-vascular thickening, bronchiectasis, lung nodules, cavitation, and pleural effusion were among the pulmonary abnormalities that were discovered after a thorough analysis of the pictures. Additionally, the distribution of pulmonary alterations was classified as central vs. peripheral and unilateral vs. bilateral. Lower, middle/lingular, upper, and multi-lobar distribution (two or more lobes) were the reported lobe distributions. Lung alterations were classified as peripheral if they only affected the outside one-third of the lung and central if they only affected the interior two-thirds. diffuse adjustments when the central and periphery zones are concurrently impacted. A third radiologist was consulted if there was a dispute over the CT analysis.

Statistical Analysis: Using SPSS 20.0, a statistical analysis was carried out. Numerical data was given as frequency, whereas measurement data were expressed as mean standard deviation. Patients were split into two groups based on how long their symptoms had been present. The significance of the data of the CT findings across the groups was tested statistically using ANOVA for chi-square calculation, and the difference was statistically significant with a p value 0.05.

RESULTS

In this study, 66 symptomatic individuals with confirmed COVID-19 were included; there were 50 men and 16 women, ages 18 to 76, with a mean age of 38.4 12.04 years. According to the length of the symptoms, patients were split into two groups: the first group included patients who underwent scanning during the first week following the onset of symptoms, and the second group included patients during the second week following the onset of symptoms.

Manifestations on a pulmonary CT: GGO was detected in 13 patients (81.3%) and 46 patients (92.0%) of the second group, respectively (p=0.04). 13 patients (26.0%) in the first group and 05 individuals (31.3%) in the second group both had consolidation (P=0.01). 09 patients (18.0%) in the first group and 02 patients (12.5%) in the second group both had bronchovascular thickening (P=0.001). 08 patients (16.0%) in the first group and 1 patient (6.3%) in the second group both had the crazy paving appearance (P=0.02). In the first group, there were two patients (4%) who had a tree-in-bud appearance, and three patients (18.8%) in the second group (P = 12). 02 patients (4.0%) in the first group and 1 patient (6.3%) in the second group both had pulmonary nodules (P = 16). In the first group, there were 3 patients (6.0%) and in the second group, there were 2 patients (12.5%) with bronchiectasis (P = 21). In the first group, there were 1 individual (2.0%) with pleural effusion. Only one patient (2.0%) in the first group of patients had cavitation detected. Both the first and second groups did not exhibit halo signs, reversed halo signs, pneumothorax, or lymphadenopathy [Table-1].

Table 1: Shows the individuals with COVID-19 who had pulmonary CT abnormalities

CT characteristics	Subject Groups		P value
	Group A (n=50)	Group B (n=16)	
Ground glass opacity	46 (92.0%)	13 (81.3%)	0.04
Consolidation	13 (26.0%)	05 (31.3%)	0.01
Broncho vascular thickening	09 (18.0%)	02 (12.5%)	0.001
Crazy paving	08 (16.0%)	01 (6.3%)	0.02
Tree bin bud	02 (4.0%)	03 (18.75%)	0.12*
Bronchiectasis	03 (6.0%)	02 (12.5%)	0.16*
Nodule	02 (4.0%)	01 (6.3%)	0.21*
Pleural effusion	01 (2.0%)	00 (0.0%)	0.01

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Cavitation	01 (2.0%)	00 (0.0%)	0.01

Distribution of lung-related CT symptoms: Just one patient in the first group (07 individuals, 14.0%) had unilateral lung abnormalities. In the first group, 43 patients (86.0%) showed bilateral lung abnormalities, compared to 16 patients (100.0%) in the second group (P = 02). In the first group, 06 patients (12.0%) and 02 patients (12.5%) primarily had central lung alterations, respectively (P = 0.04). 32 patients (64.0%) in the first group and 7 patients (42.3%) in the second group both had predominantly peripheral lung alterations (significant relationship at p = 0.05). In the first group, 17 patients (24.3%) and the second group, 12 patients (43.8%) respectively, had diffuse (central and peripheral) lung abnormalities. Only in the first group were isolated upper lobar alterations identified, which involved 02 patients (4.0%). Only in the first group were isolated middle lobe/lingular alterations detected, occurring in 4 patients (8.0%). 09 patients (18.0%) in the first group and 03 patients (18.0%) in the second group both had lower lobar lung alterations (P = 0.01). Thirteen patients (81.3%) and 35 patients (70.0%), respectively, in the second group had multilobar lung alterations (P = 0.001) [Table-2].

Table 2: Shows the among COVID19 patients, the distribution of pulmonary CT alterations

CT characteristics (1st and 2nd week)	Subject Groups		P value
	Group A (n=50)	Group B (n=16)	
Unilateral	07 (14.0%)	00 (0.0%)	0.02
Bilateral	43 (86.0%)	16 (100.0%)	0.04
Central	06 (12.0%)	02 (12.5%)	0.03
Peripheral	32 (64.0%)	07 (43.8%)	0.05
Diffuse	12 (24.0%)	08 (50.0%)	0.01
Upper	02 (4.0%)	00 (0.0%)	0.01
Middle	04 (8.0%)	00 (0.0%)	0.01
Lower	09 (18.0%)	03 (18.8%)	0.01
Multilobar	35 (70.0%)	13 (81.3%)	0.04

DISCUSSION

Because imaging plays such an important element in the workup process, particularly chest CT scans, radiologists are dealing with an increasing number of cases due to the ongoing COVID-19 pandemic and the rising number of patients suspected or proven to have the disease. Although a number of articles describing various clinical and radiological aspects of the pulmonary manifestations of the infection have been published in the medical literature, there are still few studies that address the range of pulmonary changes in relation to the timing of the scan throughout the clinical course,[13,14,15] or were simply isolated case reports.[16,17] In the present investigation, two groups of patients who obtained chest CT scans at various times following initial clinical presentations were compared for the pulmonary radiological characteristics associated with COVID-19 infection. The bilateral, peripheral, and multilobar areas of GGO, as well as consolidation to a lesser extent in a patchy form, were the most often seen changes in both groups and are consistent with findings in nearly all publications that have been published to date.[18,19] The ratio of GGO and consolidation was significantly different between individuals who underwent CT scans within the first week (group 1) and second week (group 2), though. Early CT scans performed within the first week revealed greater GGO (92.0% vs. 81.3%) and less consolidation (26.0% vs. 31.3%) than later CT scans. This reflects the progression of the disease's pathology from early-stage interstitial edema or hyaline membrane injury [20] to later-stage exudate infiltration and overt

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alveolar involvement, which is consistent with the findings of earlier studies,[13,14]which also discovered similar changes over time after the initial presentation. In order to avoid missing the diagnosis when patients are photographed later for different reasons, radiologists should take into account this discrepancy while reading suspected instances. Bronchiectasis, cavitation, and nodules may indicate a more virulent or overlaid infection. They were also first thought to be rare observations and were less frequent or absent in the second group, presumably as a result of the lesser number. The groups' pulmonary alterations varied in terms of distribution as well. As all patients tested afterwards had bilateral distribution (100% vs. 86.0% in the first week), the growing bilateral pulmonary alterations were visible in the second week,[13,14,15]More axial distribution (less peripheral predominance and more diffuse involvement coincided with the results of the two most recent investigations,[13,14,15] providing additional support for the notion that the main conduit for these viral-related pulmonary lesions is through the airways. Additionally, multilobar involvement rose from 70% early in the second week to 81.3% later on, indicating more pathological advancement and concurring with earlier research,[13,14] According to one study,[13] and another study,[15] the crazy-paving pattern, which is caused by interlobular and intralobular septal thickening superimposed over a backdrop of GGO/consolidation, peaks at the end of the first week. Due to the prevalence of the interstitial phase, our results are more in line with the first one (16.0% in the first week vs. 6.3% in the second). This heterogeneity in the timing of crazy-paving alterations could be the result of various factors, including the size of the sample, the severity of the patients at presentation, or the condition of the underlying lung parenchyma. This problem might be solved with more effort, a larger multi-centric, and a longer followup. There doesn't appear to be a strong global consensus regarding the precise function of a CT scan in an initial diagnosis or the optimum method for monitoring. While other authorities have advised using a CT scan for an initial diagnosis,[9,21] this may be because RT-PCR is scarce in some places and has a lower sensitivity. Imaging, particularly a CT scan, should not be used for the initial diagnosis of individuals who are suspected (unless there is a danger of progression) and should only be used for confirmed cases with moderately severe clinical characteristics,[22] Because CT scans are performed at various times in various institutions around the world, special care must be given to the observed variations in how the CT pulmonary findings appear depending on the time of the scans.

CONCLUSION

There is a significant difference in the pulmonary manifestations of COVID-19 infection depending on whether the CT scan is performed sooner or later after the clinical presentation. On the one hand, the proportion and combination of GGO (becoming less) and consolidation (becoming more) change, and on the other hand, the second-week distribution becomes more diffuse and multilobar. These results can help shed additional light on the disease's typical course over the first two weeks so that necessary actions can be taken when changes can be foreseen. To further help the radiologist narrow the differential diagnosis and lessen confusion with other disorders that can resemble such appearances, the constellation of changes in connection to the scan time may be useful.

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