

CT-Scan of Chest among Severe Covid-19 Patients: Experienced from Dedicated Hospital in Dhaka City

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Abstract

Background: High resolution Computed Tomography scan (HR CT-scan) of chest imaging among COVID-19 patients is very useful. **Objective:** The purpose of the present study was to see the high resolution computed tomography (CT) findings observed among the coronavirus disease 2019 (COVID-19) patients presented with severe pneumonia. **Methodology:** This retrospective study was performed in the Department of Radiology & Imaging at Kurmitola General Hospital, Dhaka, Bangladesh from April 2020 up to May 2020. As this was a retrospective study, verbal or written consent was not obtained from all potential participants or guardians. The available demographic data as well as the medical history of all data were collected and were thoroughly reviewed from the record book. These patients were RT-PCR confirmed severe cases of COVID-19 patients presented with pneumonia and were admitted in Kurmitola General Hospital, Dhaka, Bangladesh and all these patients underwent HRCT chest. **Result:** A total number of 155 covid19 patients HRCT scan were evaluated. The mean age with SD of the study population was 58.03±14.08 years. The involvement of both lung was found in 32(20.6%) cases. Fibrosis of lungs and thickening of pleura were found in 38(24.5%) cases and 33(21.3%) cases respectively. Presence of pneumonitis and bronchiectasis were detected in 77(49.7%) cases and 5(3.2%) cases respectively. The most common form was the presence of only ground glass opacities (40.6%). **Conclusion:** In conclusion the bilateral ground glass opacities and fibrosis of lungs with pneumonitis are most common findings of severe Covid-19 patients. [*Journal of National Institute of Neurosciences Bangladesh, January 2022;8(1): 33-37*]

Keywords: High Resolution CT-Scan; chest; Covid19 diseases; first wave of pandemic

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Introduction

Computed tomography (CT) scan is important in the diagnosis and follow-up of lung disease treatment among the COVID-19 patients¹. The imaging features of COVID-19 pneumonia are varied from their natural appearance to diffuse changes in the lungs². In addition, different radiological patterns are observed at different times over the course of the disease. The onset of

symptoms and acute respiratory distress syndrome are short-lived in the first wave of COVID-19 pneumonia and the early detection of the disease is essential for the management of these patients³.

Several studies have been performed regarding the findings of CT scans in COVID-19 patients and the results are inconsistent⁵⁻⁶. The lesions in patients with COVID-19 show ground-glass opacity or mixed patterns,

and are likely to have peripheral distribution, bilateral involvement, lower lobe dominance, and multi-lobe distribution⁷. The structured review of all documentation and their composition can provide a more comprehensive picture of all dimensions of the subject. One of the main goals of meta-analysis is to reduce the differences between parameters by increasing the number of studies involved in the analysis process.

The high resolution computed tomography (HRCT) scan of the chest is increasingly recognized as strong evidence for early diagnosis⁸, because the changes in chest imaging sometimes may be earlier than clinical symptoms and thus HRCT scan play an early warning role in the diagnosis of COVID-19. HRCT-scan can play a critical role in the early identification of pneumonia and help in accurate diagnosis as HRCT has high sensitivity of 97% in diagnosing COVID-19 cases⁹. Some previous studies^{4,7,9} reported the radiological features of CT-scan in hospitalized COVID-19 patients, showing clear destruction of the pulmonary parenchyma including interstitial inflammation and extensive consolidation. In a study¹⁰ it has been described the changes in chest CT-scan imaging on COVID-19 patients from initial diagnosis to recovery. This present study was undertaken to find out the high resolution CT-scan findings observed among severe Covid-19 patients.

Methodology

Study Settings & Population: This retrospective study was performed in the Department of Radiology & Imaging at Kurmitola General Hospital, Dhaka, Bangladesh. The recorded HR-CT scan data were collected in the period spanned from April 2020 up to May 2020 during the first wave of Covid19 in Bangladesh. This was a first dedicated Covid19 hospital with a bed capacity of 500 and well-equipped ICU facilities. As this was a retrospective study, verbal or written consent was not obtained from all potential participants or guardians.

Study Procedure: The available demographic data as well as the medical history of all data were collected and were thoroughly reviewed from the record book. These patients were RT-PCR confirmed cases of COVID-19 patients presented with pneumonia and were admitted in Kurmitola General Hospital, Dhaka, Bangladesh and all these patients underwent HRCT chest. All HR CT-scan of chest images were evaluated by two radiologists blindly with a minimum experience of 8 years and all patients were evaluated to identify any change occurred within lung parenchyma. Patterns and distributions of lung involvement were evaluated.

Visual quantitative evaluation for each of the five lung lobes were also assessed for degree of involvement and classified as none (0%), minimal (1-25%), mild (26-50%), moderate (51-75%) and severe (76-100%). The total severity score¹¹ was reached by summing the score of all five lobes with the range of total severity score was 0 to 20. For all scanning techniques (axial, coronal and/or sagittal), American, General Electric (GE) Hi- speed 128 slice multi-detector CT scanner was used to obtain the HRCT chest. The scanning parameter was 120 kV, 200mAs; matrix was 512×512; scanning time was 0.55 s/circuit; collimator was 0.625 m; pitch was 0.89, FOV 360 mm; scanning thickness was 0.625 mm; reconstruction algorithm: high spatial frequency, window: lung window. The scan ranged from the thoracic entrance to the angle plane of the bilateral rib. Level of inspiration: full inspiration. Proper protections of all the radiology staffs were taken.

Statistical Analysis: The Statistical Package for the Social Sciences (SPSS) version 23 (Statistical Package for the Social Sciences) for Windows, Version 23.0 (IBM Corporation, Armonk, New York) was used to perform the statistical analysis. Categorical data were presented as numbers and percentages. Numerical data were presented as mean and standard deviation. An unpaired t test was employed to assess quantitative variables, while the chi-square test was used to assess qualitative ones. Statistical significance was defined as $p < 0.05$.

Results

A total number of 155 covid19 patients HRCT scan were evaluated. Most of the study population were in the age group of 40 to 60 Years which was 73(47.1%) cases followed by 60 to 80 years, Less Than 40 Years and More Than 80 Years which were 57(36.8%) cases, 17(11.0%) and 8(5.2%) cases respectively. The mean age with SD of the study population was 58.03±14.08 years with the range of 22 to 97 years (Table 1).

Table 1: Age Distribution of the Study Population

Age Group	Frequency	Percent
Less Than 40 Years	17	11.0
40 to 60 Years	73	47.1
60 to 80 Years	57	36.8
More Than 80 Years	8	5.2
Total	155	100.0
Mean±SD (Range)	58.03±14.08(22 to 97)	

In this study male was predominant than female which were 104(67.1%) cases and 51(32.9%) cases

respectively. The male and female ratio was 2.04:1 (Figure I).

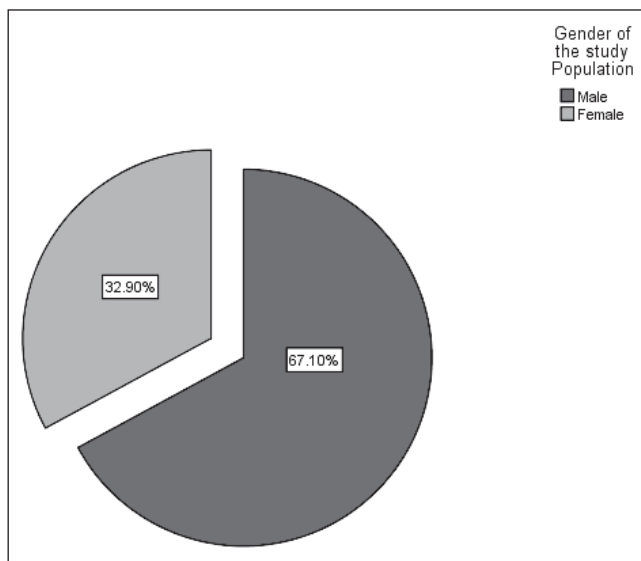


Figure I: Distribution of Gender of the study population

Table 2: Involvement of Different Lobes of Lungs among Study Population

Lobes of Lung	Mean± Std. Deviation	Range
Right Upper Lobe	30.61±25.528	0 to 95
Right Middle Lobe	25.63±24.940	0 to 100
Right Lower Lobe	45.10±30.186	0 to 95
Left Upper Lobe	29.37±24.403	0 to 90
Left Lower Lobe	41.19±30.064	0 to 95
TSS	9.35±4.940	1 to 20
Total Lung	34.39±24.827	1 to 95

Medistinal lymphadenopathy was the most common HR CT-scan findings of chest among the Covid19 patients which was found in 114(73.5%) cases followed by sub-centrimetric lymphadenopathy, consolidations and crazy paving which were 82(52.9%) cases, 78(50.3%) cases and 55(35.5%) cases respectively. Fibrosis of Lungs and Thickening of Pleura were found in 38(24.5%) cases and 33(21.3%) cases respectively. The involvement of Both Lung was found in 32(20.6%) cases. Presence of pneumonitis and bronchiactesis were detected in 77(49.7%) cases and 5(3.2%) cases respectively. Left sided mild pleural effusion was also noted in 6(3.9%) cases (Table 3).

Ground glass opacity was found in different forms. The most common form was the presence of only ground glass opacities which was 63(40.6%) cases. Bilateral ground glass opacities was detected in 63(40.6%) cases. Widespread and bilateral focal ground glass

opacities were reported in 18(11.6%) cases and 6(3.9%) cases respectively. Bilateral multifocal was found in 4(2.6%) cases. Only 1(0.6%) case was found with scattered ground glass opacities (Figure II).

Table 3: Different Findings of HRCT-scan of Chest among the Study Population

HR CT-scan findings	Frequency	Percent
Sub-segmental Collapse	5	3.2
Medistinal Lymphadenopathy	114	73.5
Sub-centrimetric Lymphadenopathy	82	52.9
Dilated Vessels	14	9.0
Consolidations	78	50.3
Reticulations Lymphadenopathy	11	7.1
Subtle	9	5.8
Diffuse	51	32.9
Crazy Paving	55	35.5
Fibrosis of Lungs	38	24.5
Thickening of Pleura	33	21.3
Bronchiactesis	5	3.2
Bullae	6	3.9
Involvement of Both Lung	32	20.6
Presence of Pneumonitis	77	49.7
Left sided mild pleural effusion	6	3.9
Minimal Fibrosis	1	0.6

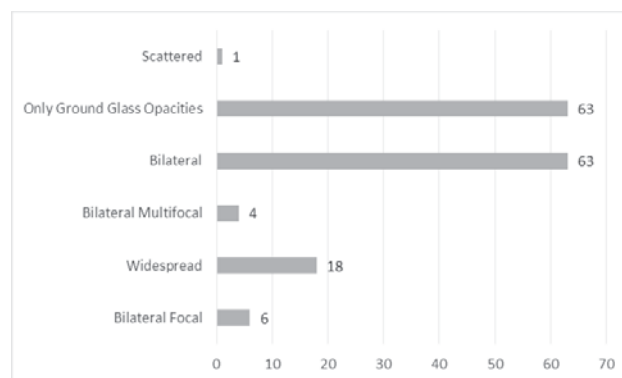


Figure II: Different Variations of Ground Glass Opacity in Lungs

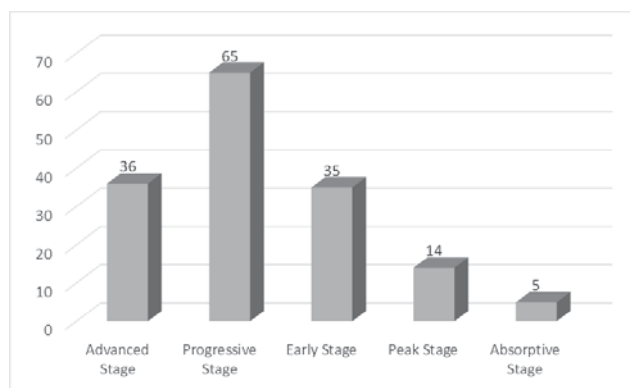


Figure III: Different Stages of Covid19 according to HR CT-scan of Chest

Imaging of lungs with HR CT-scan of chest was reported in different stages of Covid19. The most common was the progressive stage which was 65(41.9%) cases followed by Advanced Stage, Early Stage and Peak Stage which were 36(23.2%) cases, 35(22.6%) cases and 14(9.0%) cases respectively. However, only 5(3.2%) cases were reported as absorptive stage (Figure III).

Discussion

COVID-19 can disseminate rapidly and it is primarily through the respiratory tract by droplets, respiratory secretions, and direct contact¹⁰. It has been described that small particles containing the virus may diffuse in indoor environments covering distances up to 10 m from the emission source¹¹. Chest CT should be performed with strict precautions to minimize hazardous exposure of patients and health care professionals. When possible, chest CT is performed at sites with less traffic to avoid exposure of other patients and staff. Where more than one fixed CT scan is available, dedicated use of only one CT scan for patients with COVID-19 may be ideal. Another option is the use of a mobile CT scan¹².

In this study a total number of 155 covid19 patients HRCT scan were evaluated. Most of the study population were in the age group of 40 to 60 Years which was 73(47.1%) cases followed by 60 to 80 years, Less Than 40 Years and More Than 80 Years which were 57(36.8%) cases, 17(11.0%) and 8(5.2%) cases respectively. The mean age with SD of the study population was 58.03±14.08 years with the range of 22 to 97 years. Patients who are referred for chest CT should be screened for COVID-19 symptoms, and symptomatic patients should be provided with a surgical mask and placed in an isolation room¹³. The same applies to patients with proven COVID-19. A strong case can also be made for all patients to wear face masks, whether they are symptomatic or not. Distances between patients in waiting areas near the CT scanner should be maximized; maintaining an interpersonal distance of 2 m in combination with wearing a face mask has been reported to be effective protection¹⁴.

In this present study male was predominant than female which were 104(67.1%) cases and 51(32.9%) cases respectively. The male and female ratio was 2.04:1. Medistinal Lymphadenopathy was the most common HR CT-scan findings of chest among the Covid19 patients which was found in 114(73.5%) cases followed by sub-centrimetric lymphadenopathy,

consolidations and crazy paving which were 82(52.9%) cases, 78(50.3%) cases and 55(35.5%) cases. Fibrosis of Lungs and Thickening of Pleura were found in 38(24.5%) cases and 33(21.3%) cases respectively. The involvement of Both Lung was found in 32(20.6%) cases. Presence of Pneumonitis and Bronchiactesis were detected in 77(49.7%) cases and 5(3.2%) cases respectively. Left sided mild pleural effusion was also noted in 6(3.9%) cases. Several studies have been published reporting chest CT findings in COVID-19 cases¹⁵. However, many studies are limited by selection bias, potential blinding issues, and potential confounding of chest CT findings owing to the simultaneous presence of other lung diseases¹⁶. Nearly all authors of studies who investigated the chest CT-scan appearance of COVID-19 investigated CT performed in symptomatic patients. The pulmonary histologic findings of COVID-19, which are characterized by acute and organizing diffuse alveolar damage, resemble those observed in other coronavirus infections, including severe acute respiratory syndrome coronavirus 1 (SARS-CoV-1) and MERS-CoV cases¹⁷. Accordingly, the reported chest CT abnormalities in COVID-19 are similar to those seen in infections with SARS-CoV-1 and MERS-CoV cases. The prevalence of chest CT abnormalities in COVID-19 is dependent on the stage and severity of the disease. There is currently a lack of radiologic-pathologic correlation studies in the literature.

Ground glass opacity was found in different forms. The most common form is the presence of only ground glass opacities which was 63(40.6%) cases. Bilateral ground glass opacities was detected in 63(40.6%) cases. Widespread and bilateral focal ground glass opacities were reported in 18(11.6%) cases and 6(3.9%) cases respectively. Bilateral Multifocal was found in 4(2.6%) cases. Only 1(0.6%) case was found with scattered ground glass opacities. Several chest CT findings have been reported in 10% to 70% of RT-PCR test-proven COVID-19 cases, including consolidation (51.5%), linear opacity (40.7%), septal thickening and/or reticulation (49.6%), crazy-paving pattern (34.9%), air bronchogram (40.2%), pleural thickening (34.7%), halo sign (34.5%), bronchiectasis (24.2%), nodules (19.8%), bronchial wall thickening (14.3%), and reversed halo sign (11.1%)¹⁸. The lesion distributions have been reported in a study¹¹ as unilateral (15.0%), multifocal (63.2%), diffuse (26.4%), single and/or focal (10.5%), middle or upper lobe involvement (49.3%–55.4%), peripheral location (59.0%), and central and peripheral location (36.2%).

Imaging of lungs with HR CT-scan of chest was reported in different stages of Covid¹⁹. The most common was the progressive stage which was 65(41.9%) cases followed by advanced stage, early stage and peak stage which were 36(23.2%) cases, 35(22.6%) cases and 14(9.0%) cases respectively. However, only 5(3.2%) cases were reported as absorptive stage. Depending on local circumstances, such as the number of patients with proven or suspected COVID-19 who require chest CT, the number of patients who require CT for reasons other than COVID-19, and available CT scanners and radiology staff, this limited patient throughput may cause considerable planning and logistic challenges that need to be addressed.

Conclusion

In conclusion the bilateral ground glass opacities has been found in half of Covid19 cases. However, fibrosis of lungs is also reported among the patients. Imaging of lungs with HR CT-scan of chest has been reported in different stages of Covid19 and in this study the most common is the progressive stage followed by advanced stage.

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