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RESEARCH ARTICLE

EVALUATION OF THE PERFORMANCE OF HRCT IN THE DIAGNOSTIC AND MANAGEMENT OF COVID-19

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Abstract

In today's global health pandemic, high resolution computed tomography (HRCT) of chest became an important tool for early diagnosis, evaluation of disease progression and prompt management of COVID-19 patient. HRCT of Chest is also an important complement to the reverse-transcription polymerase chain reaction (RT-PCR) tests. The aim of this study was to assess different patterns of appearance in HRCT chest in COVID-19 infection & to grade the severity by observing a sample of 50 after the symptoms began. In this study, 50 patients had been selected from a private hospital of Dhaka, Bangladesh who came for HRCT chest to diagnose COVID-19. The data were collected from 11 April 2020 to 27 May 2020. Distribution and patterns of pulmonary lesions like ground glass opacity (GGO), consolidation, reverse halo sign, crazy paving, thickened vascular marking, lymphadenopathy and pleural effusion were evaluated. It was also assessed the involvement of lung lobe, percentage of lung involvement and total severity score. Among 50 patients diagnosed with COVID-19, most of patients had fever (64%) and dry cough (50%). 30% patients had come with shortness of breath. There were 28 (56%) males and 22 (44%) females aged 20 to 85 years. The highest number of patients were in the age range 40 to 49 years. The CT abnormality of ground glass opacity (GGO) was shown in all 50(100%) cases. Moreover 22(44%) cases had GGO plus consolidation. Crazy-paving pattern was in 16(32%) cases. In case of lobe involvement, most patients, 43 (86%) had involvement of all the 5 lobes and right lobe involvement were the most. The lesions were mostly peripheral (17, 34%) and in 5(10%) cases the distribution were diffuse but predominantly peripheral. Total severity score was categorized into 5 groups (0, 1-5, 6-10, 11-15, 16-20). Most of the patients (19, 38%) were in total severity score ranging from 16-20. In case of total percentage of lung involvement maximum patients (32, 64%) were in the range of 1- 25% and maximum lung involvement (76-100%) was seen in only 1 case. HRCT of chest may be useful for the rapid diagnosis of COVID-19 to optimize the management of patients.

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However, CT has still limitation for identifying specific viruses and distinguishing between viruses.

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Introduction:-

Coronavirus disease 2019 (COVID-19), also known as the coronavirus or COVID, is a contagious disease caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). The first known case was identified in Wuhan, China, in December 2019.¹ The disease has since spread worldwide, leading to an ongoing pandemic.

Six coronaviruses are known to cause human disease. Two are zoonosis: the severe acute respiratory syndrome coronavirus (SARS-CoV) and Middle East respiratory syndrome coronavirus (MERS-CoV), both of which may sometimes be fatal. The remaining four viruses cause the common cold.²

Several testing methods have been developed to diagnose the disease. The standard diagnostic method is by detection of the virus' nucleic acid by real-time reverse transcription polymerase chain reaction (rRT-PCR), transcription-mediated amplification (TMA), or by reverse transcription loop-mediated isothermal amplification (RT-LAMP) from a nasopharyngeal swab.³

As the corona virus outbreak quickly surges worldwide, many countries are adopting non-therapeutic preventive measures, which include travel bans, remote office activities, country lockdown, and most importantly, social distancing.

However, these measures face challenges in Bangladesh, a lower-middle-income economy with one of the world' s densest populations. Social distancing is difficult in many areas of the country, and with the minimal.

High resolution Computed tomography (HRCT) of the chest is increasingly recognized as strong evidence for early diagnosis, 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-19¹³. Recent studies have demonstrated that HRCT 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-19.¹⁴ At present, the diagnosis of COVID-19 pneumonia is based on clinical symptoms, contact history of epidemic area, imaging diagnosis and nucleic acid detection. Definitive diagnosis of COVID-19 requires a positive RT-PCR test which is highly specific and less sensitive. Sensitivity is reported as low as 60-70% and as high as 95-97%. Thus, false negatives are a real clinical problem.¹⁵

To the best of our knowledge, little literature focuses on the change of CT appearances among different clinical types during the course of medical treatment. Therefore, the purpose of this study was to evaluate the discrepancy of series CT manifestations in COVID-19 among different clinical types within the short-term follow-up periods, aiming to help clinicians monitor and predict outcome and to make more accurate and effective clinical decisions.³



Figure1:- Ground glass opacity in lung field axial CT Scan Image.

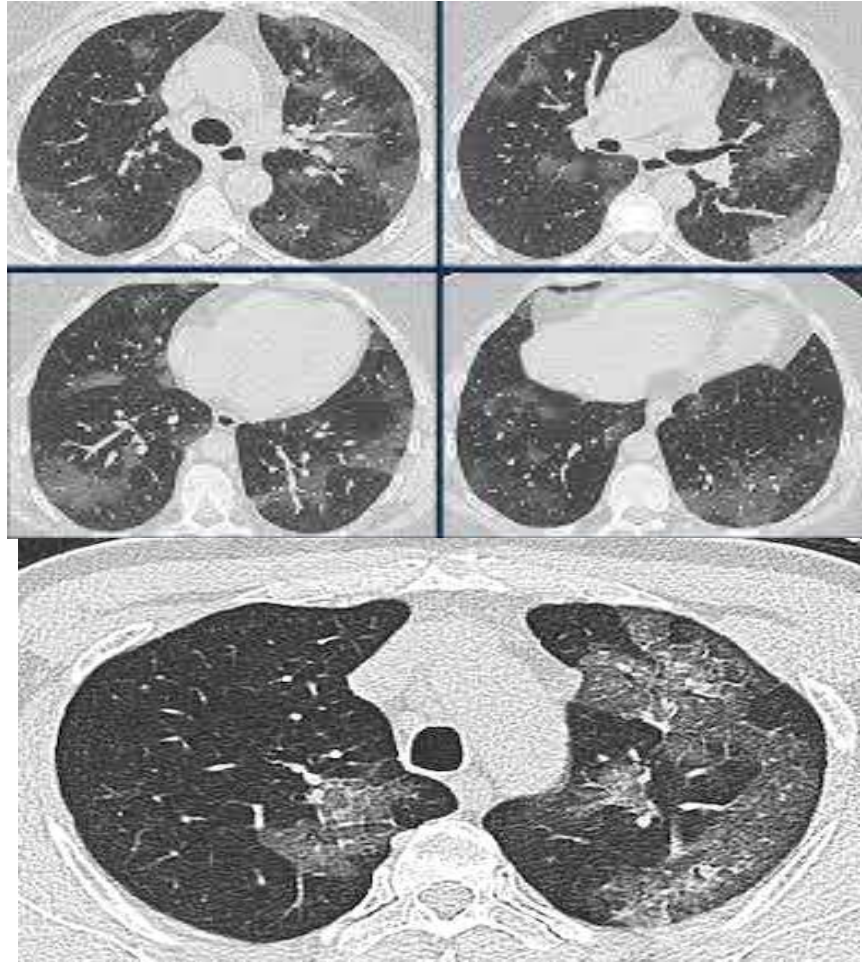


Figure2:- Ground glass opacity in lung field axial CT Scan Image.

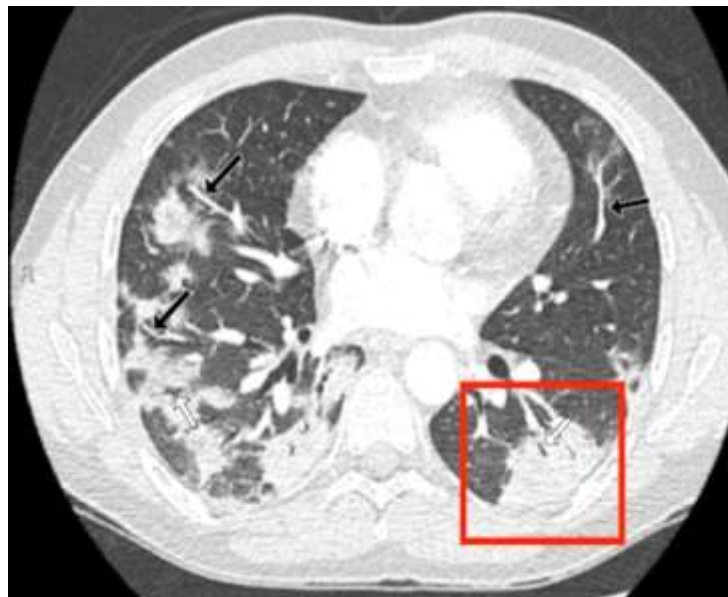


Figure 3:- Ground glass opacity in lung field axial CT Scan Image.

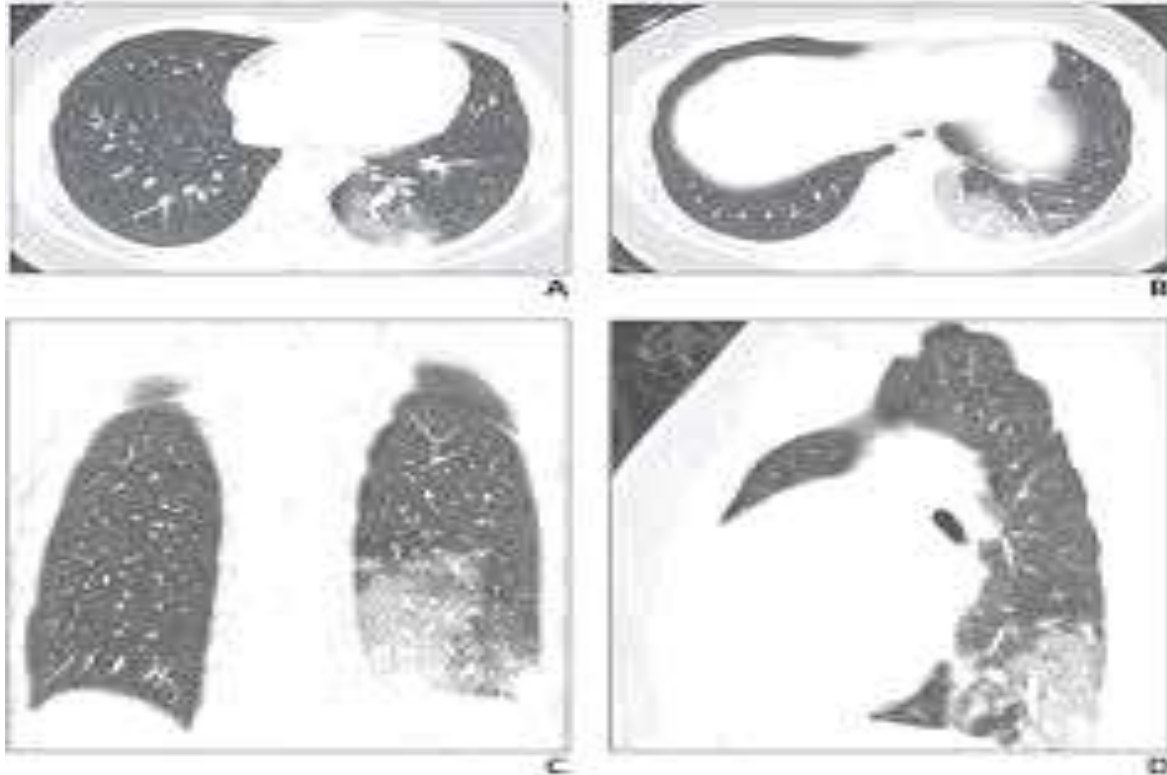


Figure 4:- Ground glass opacity in lung field axial, coronal and sagittal CT Scan Image.

Aim of the work:

The purpose of this study is to assess different patterns of manifestation in HRCT chest in COVID-19 infection & to grade the severity.

Materials and Methods:-

A descriptive, cross sectional study design was used to examine RT-PCR positive, negative and checkup of COVID-19 patients. This study was done in Radiology & Imaging Department of a Private Hospital in Dhaka, Bangladesh. Data were collected in the period spanned from 01 June 2020 to 30 July 2020. Verbal consent was obtained from all potential participants/guardians. Before going to collect data, all of the participants were explained in details about the aims and benefits of the present study. Medical history of all study subjects were thoroughly reviewed directly from participants themselves and from case sheet. A sample of fifty (50) patients was collected. Inclusion criteria were as follows: Any patient positive, negative or suspected of COVID-19 pneumonia performed a HRCT chest. All HRCT chest images that done in a time series were evaluated by radiologists and technologists, and all patients were evaluated to identify any changes occurred within lungs tissue. The data were collected from CT reports and then stored in data sheet which prepared specially for this task. Data had been analyzed by using Microsoft excel.

For all scanning techniques (axial, coronal and/or sagittal), SIEMENS SOMATOM Force CT scanner was used to obtain the non-contrast HRCT chest. The scanning parameter was 100 kVp, 73 mAs; matrix was 512×512; collimator was 0.625 m; pitch was 0.89, FOV 360 mm; scanning thickness was 1 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.

Results and Discussion:-

Table1:- Distribution of patient according to gender:

Sex	No	%
Male	28	56
Female	22	44

In this study randomly selected 50 patients had been diagnosed covid-19, in which total number of male 28 (56%), and female 22(44%). From this it may be said that males are affected more than female.

Table 2:- Distribution of patient according to age:

Age	No	%
20-29	3	6
30-39	7	14
40-49	13	26
50-59	9	18
60-69	8	16
70-79	8	16
>80	2	4

From table 2 it has been concluded that the persons of age range 40-49 years are affected more by covid-19 and the number is 13 which is 26% of total population. The second highest number is 9 (18%) which has come from age range is 50-59 years.

Table 3:- Distribution of symptoms of covid-19 positive patients and number of patients.

Symptoms	Number of patients	%
Fever	32	64
Sore throat	1	2
Dry cough	25	50
Headache	0	0
Runny nose	1	2
Fatigue	0	0
Shortness of breath	15	30

From table 3 it can be seen that fever (64%) and Dry cough (50%) were the common clinical symptom of Covid-19.

Table 4:- Distribution on the basis of total severity score (No. = 50).

Distribution on the basis of total severity score	No of patients	%
1-5	7	14
6-10	7	14
11-15	17	34
16-20	19	38

In this study scenario more than 38% of total study population of this study has high severity score 16-20.

Table 5:- Distribution of total percentage of lung involvement.

Total percentage of lung involvement	No of pt.	%
0%	0	0
1-25%	33	66
26-50%	7	14
51-75%	10	20
76-100%	1	2

From table 5 it has been observed that 33 (66%) patients, the highest number of total study population had 1-25% lung involvement diagnosed with covid-19.

Table 6:- Distribution of HRCT Patterns.

HRCT patterns	Total pt.	Total presentence%
Ground glass opacity(GGO)	50	100
GGO with Consolidation	22	44
Crazy paving pattern	16	32

Reverse halo sign	0	0
Thickened vessels	0	0
Sub-pleural band	2	4
Pleural effusion	2	4
Enlarged mediastinal nodes	0	0

All patients, 50 (100%) are diagnosed confirm in HRCT patterns presenting Ground glass opacity within the lung field. 22 (44%) patients had findings involvement Ground glass opacity with consolidation.

Table 7:- Sensitivity, specificity and predictive values of findings on HRCT compatible with COVID 19 Pneumonia in both asymptomatic and symptomatic individuals [17].

	Asymptomatic (in %)	Symptomatic (in %)
Sensitivity	73.1	71.2
Specificity	50	57
Positive predictive value	84.4	85.5
Negative predictive value	33.3	35.2
Accuracy	68.2	68.1

Conclusion:-

From above results and discussion, it can be concluded that males are affected more than female at the age range 40 to 59 years. From a previous study it was observed that in middle-aged patient's hypertension was the most common ailment in all patients, diabetes was the second most prevalent ailment.¹⁸ In this study though percentage of lung involvement was low for maximum responders but severity score was very high (16-20). The reason of high severity score may be correlate with a previous study which found that comorbid health conditions such as heart disease, pulmonary disease, diabetes, and arthritis are commonly present in elderly patients¹⁹⁻²¹. For the patients who have little or no symptoms of COVID-19, early and accurate diagnosis of patients is essential. This is especially because nearly 80% of all infections have little or no symptoms and yet, these individuals are equally infective and thus play a major role in spreading the pandemic. For the rapid diagnosis of COVID-19 and to optimize the management of patients, HRCT of chest may be useful. However, CT has still limitation for identifying specific viruses and distinguishing between viruses. It had been proven that HRCT is a very useful tool for the initial diagnosis of patients suspected to have COVID-19 irrespective of symptoms or day of onset of CT. Considering the many overall advantages, HRCT for the chest deserves to be included in the official diagnostic guidelines for diagnosis.¹⁷ Especially in places where prevalence is high, a fast, non-invasive, accurate, and inexpensive test for screening and diagnosis is essential.

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