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CT SCAN FINDINGS IN CRITICALLY ILL ICU PATIENTS WITH COVID-19 IN BANGLADESH

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ABSTRACT

Background: The COVID-19 pandemic, also known as the coronavirus pandemic, is spreading across the world at an alarming rate. Many of the patients infected with the coronavirus have become critical ill requiring ICU support. Critical care triage will allow the rationing of scarce ICU resources that might be needed. The CT scan of chest can assist in identifying the patients who are most likely to be critically affected by the disease and will require ICU support. The study describes the radiological findings of critically ill COVID-19 patients in ICU with the hope that this will provide information and offer the best chance of survival for the critically ill by identifying them in due time. **Methods:** This cross-sectional study has been carried out among the critically ill patients of COVID-19 pneumonia (confirmed by RT-PCR) admitted in ICU aged 30-70 years. The data were collected by a checklist, where the particulars of the patient, history of the illness, biochemical investigation profile and radiological findings of chest were recorded. Quality of data is strictly maintained and ethical issues are properly maintained in all the steps of this study. **Results:** 125 patients admitted in ICU of Kuwait Bangladesh Friendship Government Hospital between March 15, 2020, and August 31, 2020, were included in this study. The cohort included 80 (64.0%) men and 45 (36.0%) women, and the mean age was 58· 6 years (SD 7.2). In the CT chest findings, 114 (91.2%) patients had abnormal findings and the remaining 11 (8.8%) were normal. Among the abnormal CT findings, the predominant pattern of abnormality observed in 90 (72.0%) patients was extensive ground-glass opacity followed by crazy paving in 66 (52.8%) patients. **Conclusion:** The CT scan findings of critically ill patients admitted in ICU study provides essential information which will assist in critical care triage and uplift the chances of survival in life-and-death scenarios.

KEYWORDS:

INTRODUCTION

The emergence of COVID-19 was first identified in the capital of the Hubei Province, Wuhan, China on December 2019.[1] Since its initial detection, infections have spread across China and in other countries across the globe resulting in a pandemic. The causative organism for the disease was found out to be a novel coronavirus, severe acute respiratory syndrome coronavirus 2 (SARS- CoV-2; previously known as 2019-nCoV). The virus has been shown to infect human respiratory epithelial cells through an interaction between the viral S protein and the angiotensin converting enzyme 2 receptor on human cells allowing it to have a strong capability to infect humans.[2]

Bangladesh reported its first confirmed COVID-19 case on 08 March 2020. Initially there was scarcity of testing kits for RT PCR (Reverse Transcription Polymerase Chain Reaction) and initially only one testing lab for COVID 19 was available. Therefore, only people who had travel history and travelers arriving at the airport were tested. At the onset of the disease, the number of positive cases were surprisingly low compared to our potentially exposed population. Bangladesh witnessed gradual increase in positive cases as number of testing centers were established in different parts the country with plenty of testing kits received from abroad. The number of positive cases and number of COVID related deaths have been slowly and steadily rising at an arithmetic progression.[3]

Fever is the most common symptom, although some older people and those with other health problems may experience fever later in the disease. However, a lack of fever does not verify someone is disease free. In addition, other common symptoms include cough, loss of appetite, fatigue, shortness of breath, sputum production, and muscle and joint pains. Symptoms related with gastrointestinal disorders such as nausea, vomiting, and diarrhea have also been observed in varying percentages. Less common symptoms include sneezing, runny nose, anosmia, ageusia, sore throat and skin lesions may also occur.[4]

Chest imaging is of great importance for the diagnosis and management of patients with COVID- 19 infection. However, it is easy to miss the diagnosis of early ground glass opacity (GGO) with plain chest radiography. Thus, computed tomography (CT), especially high-resolution CT (HRCT), is used for the early diagnosis of COVID-19 disease infection.[5,6,7] High-resolution CT allows objective evaluation of the lung lesions, thus enabling us to better understand the pathogenesis of the disease. With serial CT examinations, the occurrence, development, and prognosis of the disease can be comprehensively understood. The advantage of CT over RT-PCR is that CT requires less time and is more sensitive in the identification of COVID-19.

MATERIALS AND METHODS

The nature of this research was a cross-sectional study conducted in Kuwait Bangladesh Friendship Government Hospital, Uttara, Dhaka. The duration of this study was from March 15, 2020 to August 31, 2020.

The CT scans of 125 positive COVID-19 patients were completed during this time along with a few laboratory investigations. The patients were confirmed positive by RT-PCR of nasal swab specimen. The collection of the specimen was carried out according to the guidelines published by Centers for Disease Control and Prevention (CDC)[8]. The diagnosis of the cases in this study were based on the criteria posted by WHO.[9]

Data were collected by a checklist, where the particulars of the patient, history of the illness, biochemical investigation profile and CT scan findings of chest detecting any changes in the lung parenchyma were recorded. The data was collected by skilled data enumerators, blood samples were collected by skilled medical technologist using all aseptic precautions and CT scans were done diligently where safety of personnel were ensured and environmental decontamination of CT scan rooms.

The images of the CT scans were analyzed by the radiologists working in Kuwait Bangladesh Friendship Government Hospital. The evaluators independently and freely assessed the CT features using both axial CT images and multiplanar reconstruction images. In the event of a differing verdict, a conclusion was reached after discussion on the subject matter among the evaluators.

Data analysis was done with the assistance of Statistical Package for the Social Sciences (SPSS) software. Quality was assured in every steps of the research including protocol development, data collection, data processing, and data entry and analysis.

RESULTS

The 104 patients admitted in the ICU of the hospital who were confirmed positive of having COVID-19 were included in this study. In this study, 80 (64.0%) were males and 45 (36.0%) were females. The mean age was 58.6 years (SD 7.2; range 30–70). (Table -1)

Table-1: Socio-demographic profile of the patients.

Attributes		Frequency (%) (n = 125)
Sex	Male	80 (64.0)
	Female	45 (36.0)
Age	30-40	27 (21.6)
	41-50	34 (27.2)
	51-60	48 (38.4)
	61-70	16 (12.8)
Monthly family income (BDT)	20,000 - 40,000	21 (16.8)
	40,001 - 60,000	47 (37.6)
	61,000 - 80,000	32 (25.6)
	80,001 - 1,00,000	16 (12.8)
	> 1,00,000	9 (7.2)

Among the patients, majority i.e. 47 (37.6%) were admitted in the ICU with COVID-19 came from families with a monthly income in between 40,001 – 60,000 takas. On the other hand, only 9 (7.2%) individuals coming from families with an income of more than 1 lac takas were admitted in the ICU. (Table -1)

Table-2: Clinical characteristics of the patients.

Attributes		Frequency (%) (n = 125)
Comorbidities	Any	103 (82.5)
	Diabetes mellitus	65 (52.0)
	Hypertension	45 (36.0)
	Asthma	27 (21.6)
	IHD	9 (7.2)
	Hypothyroidism	4 (3.2)
	CKD	3 (2.4)
Symptoms	Fever	89 (71.2)
	Dry Cough	96 (76.8)
	Respiratory distress	73 (58.4)
	Sore Throat	25 (20.0)
	Diarrhea	11 (8.8)
	Anosmia	6 (4.8)

Majority of the patients i.e. 103 (82.5%) had an underlying disease. The most prevalent co- morbidities were diabetes mellitus and hypertension, present in 65

(52.0%) and 45 (36.0%) patients respectively. The most common symptoms at onset was dry cough present in 96 (76.8%) patients followed by fever which was present in 89 (71.2%) patients. (Table -2)

Table-3: Laboratory findings of the patients.

Attributes	Frequency (%) (n = 125)
Leukocytosis	46 (36.8)
Decreased Hb%	28 (22.4)
Raised C-reactive protein (CRP)	93 (74.4)
Positive finding in RT-PCR for COVID-19	125 (100.0)

The laboratory investigations revealed that 46 (36.8%) patients had leukocytosis, 28 (22.4%) displayed decreased level of haemoglobin and 93 (74.4%) had raised C-reactive protein (CRP) levels. All of the patients included in this study had tested positive for RT-PCR for COVID-19. (Table -3)

Table-4: CT chest findings of the patients.

Attributes	Frequency (%) (n = 125)
Normal CT	11 (8.8)
Ground-glass Opacity	97 (77.6)
Ground-glass Opacity with crazy paving	59 (47.2)
Pleural Thickening	31 (24.8)
Discrete Opacity	18 (14.4)

CT imaging revealed that considerably i.e. 114 (91.2%) had abnormal findings and the remaining 11 (8.8%) were normal. Among the abnormal CT findings, 97 (77.6%) had ground-glass opacity, 59 (47.2%) had ground-glass Opacity with crazy paving, 31 (24.8%) had pleural thickening and 18 (14.4%) showed discrete opacity in the lung fields. (Table -3)

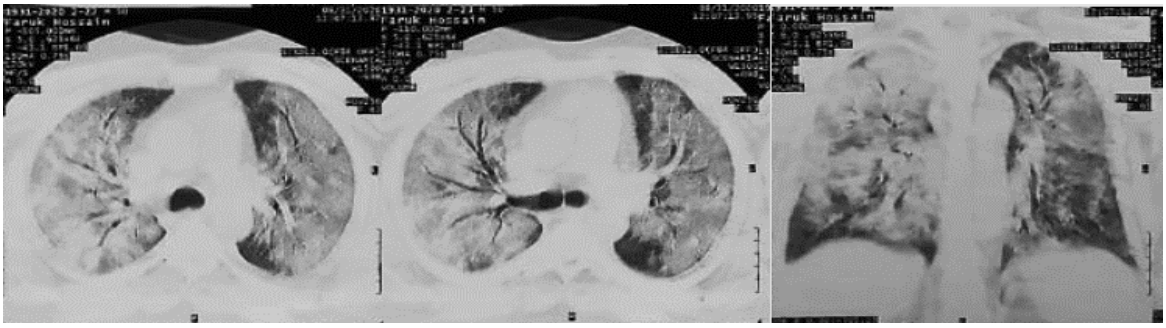

Figure 1: (a,b,c) 33 years old male ICU patient with extensive bilateral consolidation with air-bronchogram involving almost all lung segments.

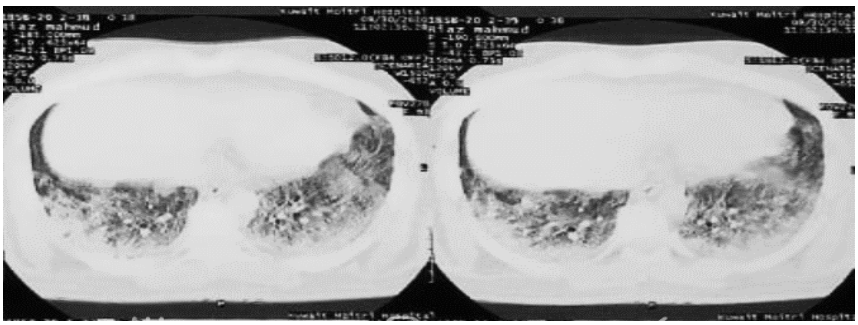

Figure : 2 (a,b) 38 years old male COVID-19 patient admitted in ICU, CT scan shows bilateral consolidation and GGO involving all basal lung segments.

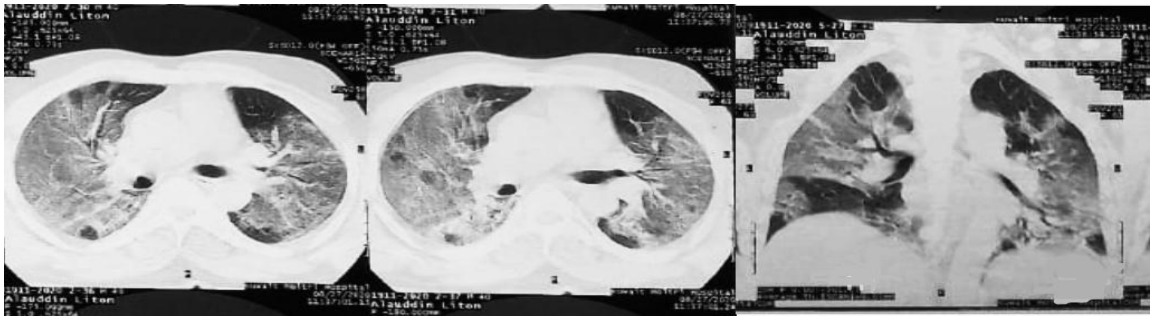

Figure : 3 (a,b,c) 22 years old male COVID-19, ICU patient CT scan shows bilateral consolidation with air bronchogram involving almost all lung segments.

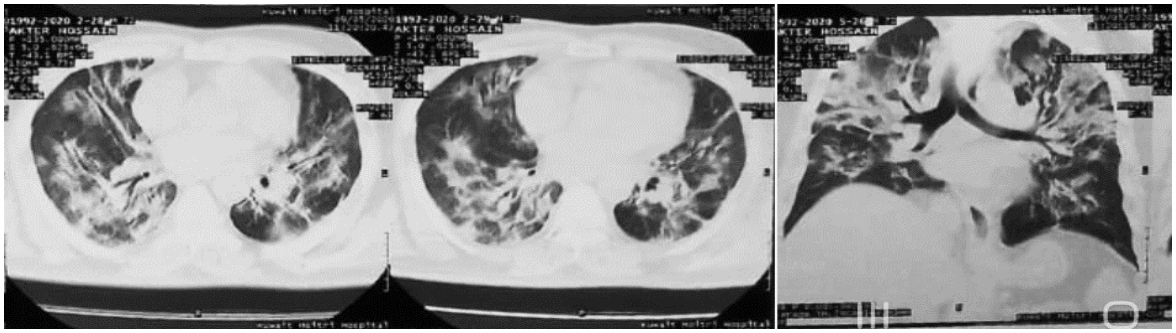

Figure : 4 (a,b,c) 58 years old male COVID-19 patient CT scan shows bilateral consolidation with air bronchogram in anterior, posterior, superior and basal lung segments.

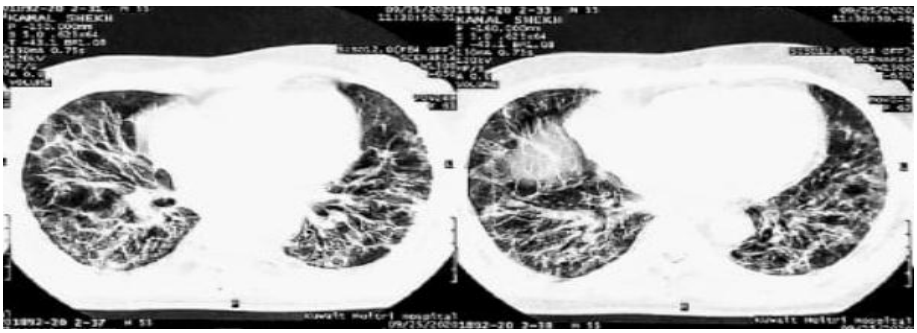

Figure 5: (a,b) 68 years old female ICU patient with extensive bilateral consolidation and septal thickening involving basal lung segments.

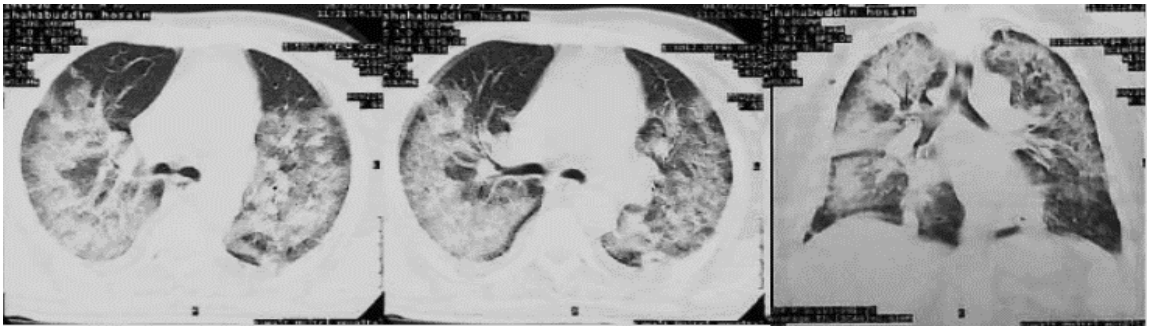

Figure 6: (a,b,c) 28 years old male COVID-19, ICU patient with extensive bilateral consolidation and vascular thickening involving predominantly anterior, posterior and superior lung segments.

DISCUSSION

The virus responsible for the COVID-19 pandemic comes from the Coronaviridae family. This group of microorganisms are RNA viruses which are enveloped, non-segmented and can be found infecting humans. The novel coronavirus SARSCoV2 is the seventh member of the Coronaviridae family known to infect humans.[10] Even though, the mortality rate of COVID19 is lower than that of SARS or MERS coronavirus diseases; it has proved to be a major public health concern as the number of people diagnosed with COVID-19 worldwide crossed the one million mark on April 2, 2020 in 204 countries and territories.[11]

Patients infected with COVID-19 requiring ICU support depends on the severity of the illness and the number of beds available in ICU in a particular health system. Reports from China and Italy have emphasized the requirement of ICU facilities as up to 12 percent of all positive cases require ventilation.[12]

In this study, there was a significant difference present in the number of male and female patients being admitted in the ICU. Around two-third males (64.0%) required ICU support compared to that of females (36.0%). This was similar to the study reported in Seattle, USA where 63% of the individuals admitted in the ICU infected were men.[13] The similar results in two different geographical locations suggest that males are more likely to be affected than woman.

Majority of the admitted patients had some sort of comorbidity i.e. 103 (82.5%) where the leading cause was diabetes (52.0%). The mean age of the patients was 58.6 ±7.2 years. These findings match with similar studies done in this regard where critically ill patients are generally older and have more comorbidities than non-critically ill patients.[13-15]

The most common symptoms in critically ill patients were dry cough (76.8%) and fever (71.2%). The other symptoms were respiratory distress, sore throat, diarrhea and anosmia which were present in a number of patients. In addition, leukocytosis was detected in 46 (36.8%) patients, 28 (22.4%) had decreased haemoglobin level and 93 (74.4%) had raised CRP levels. The findings are consistent with similar studies which have revealed that the most common symptoms are fever, cough, fatigue and dyspnea. In addition, laboratory results have showed in these studies raised CRP level and abnormal lymphocyte count.[15,16]

The predominant pattern found in CT scan of chest among critically ill patients was that 97 (77.6%) had ground-glass opacity and 59 (47.2%) had ground-glass Opacity with crazy paving. This is compatible with other studies done in regard to CT scan findings of COVID patient.[17,18] However, some of the CT features i.e. of 11 (8.8%) COVID19 patients seemed to be normal and showed no change. This was also seen in another study where 20 of the 36 patients (56%) imaged 0–2 days after symptom onset had a normal CT scan with complete absence of ground-glass opacities and consolidation.[19] The findings in these two studies could be due to the manifestation caused by the virus in the lungs take some time to appear.

CONCLUSION

Critically ill patients of the coronavirus are the ones who are at greatest threat that require ICU support. ICUs may become overwhelmed by the sheer volume of patients and therefore must adapt a triage system as resources are limited. The critical care has its own challenges and is a complex healthcare system with its own protocol and guidelines.

A chest scan of CT can help in the distribution of critical care resources as it is a essential component in diagnosing COVID-19 infection. In many cases chest CT has allowed proper identification of the disease where RT-PCR has revealed false negative. The aim of this study is to aid in the formation of triage system for the proper usage of resources available in critical care.

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