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Original Article

Correlation between Chest Computed Tomography Severity Scores and Age of Adult Patients with Suspected Covid-19 Pneumonia Admitted in Intensive Care Unit of a Tertiary Care Hospital, Bangladesh

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Abstract:

In Bangladesh, the second wave of Covid-19 was devastating. Mostly RT-PCR is used to determine the Covid-19 infection. But when test results are delayed, or when there is a clinical suspicion of Covid-19 despite initial negative RT-PCR testing, CT scan of chest was used to detect Covid-19 and Covid-19 severity. This observational cross-sectional study was carried out at Corona dedicated ICU of Bangabandhu Sheikh Mujib Medical College Hospital, Faridpur during February to June, 2021 to observe the HRCT severity score of the patient and its correlation with different ages. A total of 50 patients with clinically suspected Covid-19 cases who were admitted to the Corona dedicated ICU were included in the study. The chest HRCT images of study participants was gathered, CT severity score was calculated by a particular assignment radiologist. Based on this score; Severe disease was mainly seen in the >60 year age group (50%). A significant moderate positive correlation was observed between age and CT chest severity score. With the increasing age the patients were suffering more and being male may increase the risk and put the patient to get admitted in the ICU, and as an alternative of the RT-PCR, CT scan of chest could be useful.

Keywords: Covid19, HRCT, Pneumonia.

Introduction:

The most recent outbreak of a worldwide health crisis is the coronavirus disease 2019 (Covid-19), which was detected for the first time at the tail end of 2019 in China (Wuhan). Coronavirus 2 is the beta-coronavirus that is responsible for this condition (SARS-CoV)[1,2]. The most common clinical signs of Covid-19 are a high temperature, a dry cough, a sore throat, and exhaustion. Nevertheless, other symptoms, such as a headache, nasal congestion, and myalgia, loss of smell and taste, and diarrhea may also develop[3]. It was a new and unprecedented problem because the clinical manifestations ranged from asymptomatic carriers to patients needing assisted ventilator support and ICU stays with higher mortality[4,5]. An early Covid-19 diagnosis is crucial for quick therapeutic interventions and patient seclusion[6].

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To promptly confirm the diagnosis of Covid-19, a unique viral test utilizing real time reverse transcription polymerase chain reaction (RT-PCR) was introduced. Despite the fact that it is the gold standard test for diagnosis, some patients may get false-negative results[7]. This could be as a result of inadequate cellular material for detection and incorrect nucleic acid extraction from clinical materials[8,9]. The inconsistent RT-PCR results highlight the need for a different diagnostic strategy6,8. According to the findings of several researches, chest computed tomography (CT) is crucial for screening, diagnosing, and monitoring the progression of the disease. Additionally, it has a 97% sensitivity rate, produces a characteristic pattern, and may detect abnormalities earlier than RT-PCR testing[10,11].

In order to manage and track the progression of the disease, non-contrast high-resolution CT chest imaging is crucial and vital in the early disease detection of patients with false-negative RT-PCR results in particular disease[12]. Additionally, the imaging results can be used to determine the severity of the condition, which greatly aids clinicians in using their clinical judgment and ensures effective and prompt care[13]. The severity of the disease in critically ill patients can also affect the prognosis, allowing for the proper choice of early engagement of the intensive care unit[14,15]. Several studies have examined the presence of pulmonary involvement on chest CT scans using quantitative and visual evaluations[16,17]. Several studies had been conducted to describe the clinical severity of the Covid-19 patients, but there was relatively less data on it in Bangladesh. In this study we observed the HRCT severity score of the patient and its correlation with different ages.

Materials and Methods:

In the year 2021 from February to June, an observational cross-sectional study was carried out at the Bangabandhu Sheikh Mujib Medical College (BSMMC) Hospital, Faridpur. A total of 50 patients who were admitted to the Corona dedicated ICU were included in the study. Suspected Covid-19 patient admitted to ICU were included in the study. Patients with positive RT-PCR test or those who were vaccinated against covid-19 were excluded from the study. Total 50 patients were included in this study. The study's goals and objectives were explained to all participants and family members, and their written informed consent was obtained. Results for the chest HRCT images were gathered, and a radiologist with a particular assignment examined and deciphered the scan report. Data were collected using a pretested data collecting form. Additionally, information was logged regarding the Covid-19 pneumonia presentation, associated history, comorbidities, results, and CT chest score. The BSMMC's institutional review board granted the study ethical permission.

The CT severity score was determined by dividing both lungs into five lung zones according to anatomical structures: right upper lobe, right middle lobe, right lower lobe, left upper lobe (including lingula), and left lower lobe. Score was given for each lung lobe based on the percentage of lobe involvement: Score 0: 0% involvement, Score 1: less than 5% involvement
Score 2: 5% to less than 25% involvement, Score 3: 25% to less than 50% involvement, Score 4: 50% to less than 75% involvement, Score 5: 75% or greater involvement[3].

Patients were grouped into mild (CT score $\leq$ 7), moderate (CT score 8-17) and severe (CT score $\geq$ 18) on the basis of the severity of the lung involvement by 25-point HRCT scan[18].

Data were collected, entered, evaluated for accuracy and completeness, and then analyzed using IBM SPSS version 23. Continuous data were presented as mean, standard deviation, or median (range), and categorical data were presented as frequency (percentage). The Shapiro test was used to determine whether the age and CT severity score were normally distributed. The Kruskal-Wallis test was used to compare the CT severity scores for different age groups (in case of more than two different groups). The age-CT-severity-score relationship was analyzed using the Spearman rank correlation. P value was considered significant if it was <0.05

Results:

Majority (44.0%) of the patients were from 40-60 years age group, followed by >60 years age group (34.0%) with mean age was 54.76 ± 15.19 years. Majority (78.0%) of the patient were Muslim. Majority (32.0%) of the patients were businessman and 28.0% of the patients were housewife. The monthly family income was between 10000-30000 BDT of most of the patients (Table I).

Table I: Distribution of the patients according to demographic characteristics (n=50)

Demographic characteristics		Frequency (%)
Age (years)	20-40 years	11 (22.0)
	40-60 years	22 (44.0)
	> 60 years	17 (34.0)

Data were as expressed frequency and percentage Majority of the study patients were male (58.0%), whereas only 42.0% were female.

Clinical presentation of the study patients was presented in Table II. About 65% patients presented with fever and 62% with cough. More than 60% patients complained about mild respiratory distress, whereas only 4.0% and 2.0% complained about moderate and severe respiratory distress, respectively. Generalized weakness was reported by 20% of the participants.

Table II: Distribution of patients according to clinical presentation (n=50)

Clinical Presentation	Frequency (%)
Fever	32 (64.0)
Cough	31 (62.0)
Chest pain	3 (6.0)
Generalized weakness	10 (20.0)
Anorexia	1 (2.0)
Burning micturition	1 (2.0)
Mild Respiratory distress	31 (62.0)
Moderate Respiratory distress	2 (4.0)
Severe Respiratory distress	1 (2.0)

Data were as expressed frequency and percentage

Figure 1 depicts that, there was a significant moderate positive correlation between age and CT severity score (Spearman co-relation coefficient, r=0.464, P value: 0.001).

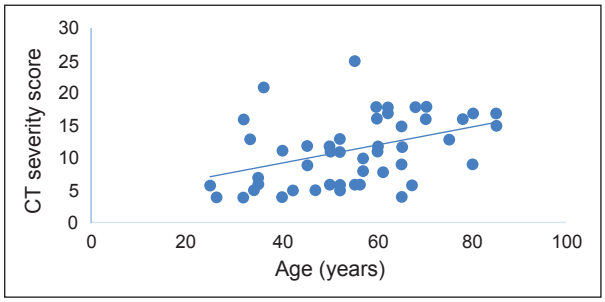

Figure 1: Distribution of patients according to correlation between age and CT severity score (n=50)

Figure 2 depicts that, there was a non-significant weak positive correlation between age and CT severity score in male (Spearman co-relation coefficient, r=0.330, P value:0.080).

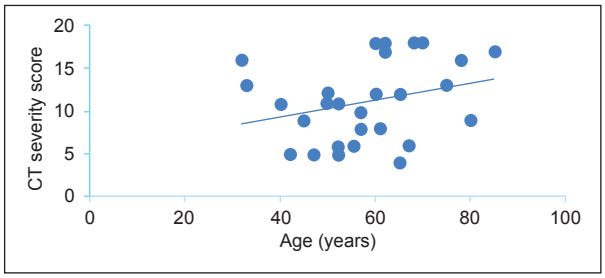

Figure 2: Distribution of patients according to correlation between age and CT severity score in male patients.

Figure 3 depicts that, there was a significant moderate positive correlation between age and CT severity score in female (Spearman co-relation coefficient, r=0.686, P value:0.001).

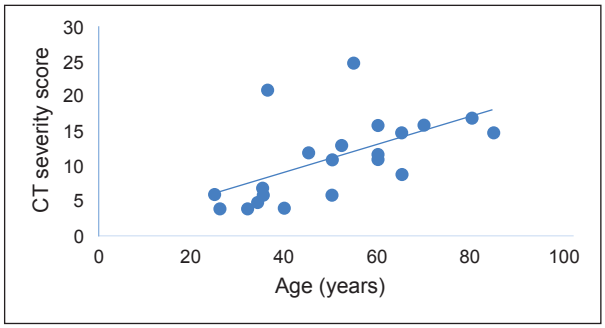

Figure 3: Distribution of patients according to correlation between age and CT severity score in female.

Mild diseases were more prevalent among 20-40 and 40-60 years age group patients. Moderate diseases were mainly seen in the 40-60 years age group (46.4%) and severe diseases were mainly seen in the >60-year age group (50%) (Figure 4).

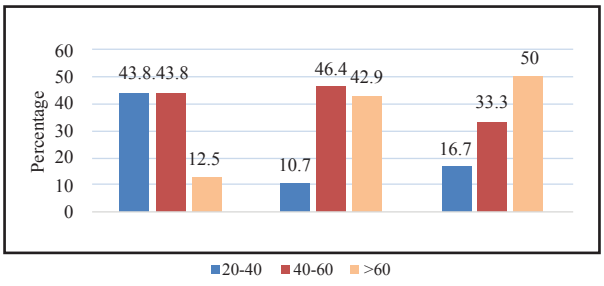

Figure 4: Distribution of patients according to CT severity score and different age group.

Figure 5 is showing that majority (56%) of the patients were with moderate CT severity, whereas 6 (12%) were in CT severity category.

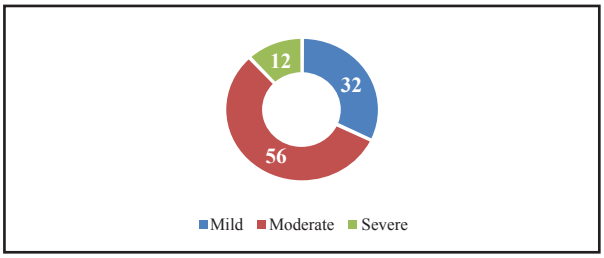

Figure 5: Distribution of patients according to CT severity category.

The mean ±SD CT chest severity score in >60 years age group participants was 13.41±4.57, which was significantly higher than the CT chest severity score of 40-60 years (10.46±4.85) and 20-40 years age group (8.82±5.71) (p value: 0.026) (Table III).

Table III: Distribution of patients according to CT chest severity score and different age groups (n=50)

Age (years)	20-40	>40-60	>60	Total	P value
CT chest severity score (Mean ±SD)	8.82±5.71	10.46±4.85	13.41±4.57	11.10±5.17	0.026
CT chest severity score (Median range)	6 (4-21)	11 (5-25)	15 (4-18)	11 (4-25)	

Kruskal Wallis test was done.

Discussion:

In 2020, Bangladesh had been able to successfully combat the initial wave of coronavirus infection. However, the country experienced the grimmest incident of the pandemic during the second wave at 2021. The Government of Bangladesh has allowed low-cost antigen testing at the district level and has established a few additional RT-PCR testing facilities in response to the need during that period[19]. Because testing was time-consuming, and unreliable, people were not that much interested in doing it for diagnostic purpose[20]. The World Health Organization recommended using chest imaging as part of the diagnostic workup for COVID-19 disease when test results are delayed or when there is a clinical suspicion of COVID-19 disease despite initial negative RT-PCR testing[21].

This study was conducted in Bangladesh during the second wave of COVID-19. Mean age of the patients was 54.76±15.19 years and majority (58%) of the participants were male. More than 80.83% of the deceased during that time period were over the age of 50 at the time of death[20], which is consistent with our findings that patients with a mean age more than 50 needed to be admitted to the ICU for support. According to Islam M et al[22] & Ali MR et al[23] male were more affected.

The most typical presentation of the study participants was fever, cough, and respiratory distress, which was consistent with the findings of Ali et al. a different study carried out in Bangladesh[19].

According to Farghaly & Makboul 91.8% of the participants had positive COVID-19 CT results, and both lungs were affected in 80.3% of the cases[3]. All of the patients in this study showed positive CT results, and both lungs were affected in all of them. The study's ICU setting and admission of predominantly very ill patients may be the sources of the discrepancy.

The study by Chung et al[24] developed a method to assess the degree of COVID inflammation on chest CT scans based on the summation of the degree of affection in both lung lobes to determine the total CT severity score for overall lung involvement. In this study we evaluated the CT severity score and correlate with the age of the participants. In this study we found a significant (Spearman co-relation coefficient, r=0.464, P value:0.001) moderate correlation between age and CT severity score of the patient. When we tried to evaluate the relation in different sex category, the correlation was found stronger and more significant in female (Spearman co-relation coefficient, r=0.686, P value: 0.001), whereas it was weak and insignificant in male (Spearman co-relation coefficient, r=0.330, P value:0.080). Farghaly S et al[3] on their study founded highly statistically significant correlation between age and CT severity score in both sexes (P value < 0.001).

Patients were grouped on the basis of the severity of the lung involvement by 25-point HRCT scan as showed by Sharma et al[18]. In this study majority (56%) of the patients were with moderate CT severity, whereas 6 (12%) were in CT severity category. And the CT severity score was found significantly higher among the patients > 60 years of age, which signifies that the older aged people were suffering at fatal lung pathology due to covid-19 and were admitted in the ICU with this suffering.

Conclusion:

Male people were affected more from COVID-19. A significant correlation of CT severity score and age was found. People with age >60 were having significantly higher CT severity score which signifies that with the increasing age the patients suffering were more. And also, as an alternative of the RT-PCR, when it delayed to confirm COVID-19 infection; CT scan could be useful.

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