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Evaluation of severity of Covid-19 inpatient by Computed tomography in tertiary centre of Bihar

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Abstracts-

Introduction- COVID -19 now become pandemic disease and Chest computed tomography (CT) has very important role in diagnosis and characterizing the Covid patient severity by CT severity score.

Objectives: The main purpose of this study was to evaluate the performance of MDCT in identifying & categorising the severity of COVID-19 inpatients.

Methods: This is retrospective cohort study and is performed on about 512 hospitalized COVID-19 patients in IGIMS from 15 April to July 2021. The CT severity score was assessed by two independent radiologists by involvement of percentage of area of each lobe of both lung parenchyma on HRCT lung. All admitted RT-PCR positive patient whose HRCT chest done in IGIMS were included in this study and OPD RT-PCR positive patient (COVID positive) & RT-PCR positive (COVID positive) patient with previous history of chronic lung disease, Tuberculosis, Lung mass, bronchiectasis etc were excluded in this study.

Results- In our study, Male (72.5%) are more affected in comparison to female (27.5%) and most of the patient are above the forth decade (69.5 %). Most patients are presented with severe CT severity score, i.e. > 15 CT severity score (about 41 percent) and about 20 percent & 22 percent present with mild & moderate CT severity score. Males are present with more CT severity than female.

Conclusion- Our studies show that older age group male patient (> 40 year) more affected in second peak of covid-19 and patient with chest involvement presented with severe CT severity score, so more mortality was noted , however this study is retrospective, needs prospective study for better correlation.

Key word- HRCT Chest, COVID-19, CT Severity score.

Introduction-

COVID-19 is a viral infectious disease caused by a strain of corona virus (SARS-CoV-2). First recorded cases were in Wuhan, China, in the December 2019 then spread globally all over the world. The disease was announced as pandemic by the World Health Organization in 11 March2020[1]. Regarding the diagnosis of COVID 19 infection, the reverse transcription-polymerase chain reaction (RT-PCR) test is the gold standard for the diagnosis of COVID-19, chest x-ray and computed tomography (CT) have an essential role in the diagnosis, follow-up, and staging of COVID-19 pneumonia [2,3,4]. The aim of this study was to describe the relationship between COVID-19 mortality and chest CT scan findings. The main purpose of this study was to evaluate the performance of a MDCT in identifying & categorising the severity of COVID-19 inpatient.

Methods & Materials-

Patients- This retrospective study was approved by ethic committee board of our institute. This study was performed on about 512 COVID-19 inpatients in IGIMS (dedicated COVID hospital on that epidemic era) from 15 April to July 2021., All admitted RT-PCR positive patient whose HRCT chest done in IGIMS were included in this study and OPD RT-PCR positive patient (COVID positive) & RT-PCR positive patient with previous history of chronic lung disease, Tuberculosis, Lung mass, Bronchiectasis etc were excluded in this study.

CT technique- All patient are underwent HRCT chest by multislice (128 slice) Toshiba CT scan (Aquilion) or 16 slice Toshiba CT scan . The following CT parameters were used: collimation 5mm; slice thickness, 0.5- 2.5 mm; reconstruction interval, 2.5 mm; table speed 13.5 mm per rotation; 150 -250 mA effective current; tube potential 120kVp; and matrix size, 512 x 512. the patient were examined in supine position with both arms extended above the head. All CT chest were taken in caudocranial direction, covering entire chest from diaphragmatic dome up to lung apex, without intravenous contrast administration. The image finally send to PACS for reporting.

CT Image Analysis- CT Images were analyzed retrospectively by experienced radiologists and assess the pattern of lung involvement and severity of lung by involvement of percentage of area of each lobe of both lung parenchyma, .

Chest CT score method- This method was presented by Li *et al*. and was published in Investigative Radiology in March 2020[5]. In this method, both lungs were divided into five lobes, and each lobe was assessed individually. The abnormalities that were considered significant for the disease included the following: ground-glass opacity, consolidation, nodule, reticulation, interlobular septal thickening, crazy-paving pattern, linear opacities, subpleural curvilinear line, bronchial wall thickening.

Each lobe could be awarded a CT score from 0 to 5, depending on the percentage of the involved lobe: score 0 – 0% involvement; score 1 – less than 5% involvement; score 2 – 5% to 25%

involvement; score 3 – 26% to 49% involvement; score 4 – 50% to 75% involvement; score 5 – greater than 75% involvement.
The overall CT score was the sum of the points from each lobe and ranges from 0 to 25 pints. The cut-off value for identifying severe cases of COCID-19 of CT score was 7 (mild = 1-7), moderate = 8-15 and severe = 16-25.
Statistical analysis was performed using statistical package for social science (SPSS) software, version 21 and frequency & percentage were used as descriptive statistics for categorical & ordinal variables

Results-
All admitted COVID positive patient underwent HRCT chest and their demographic profile and CT severity patterns were assessed by radiologist. Male (72.5%) are more affected in comparison to female (27.5%) and most of the patient are above the forth decade (69.5 %)(mean age- 55 year) (Table-1). Most patients are presented with severe CT severity score, i.e. > 15 CT severity score (about 41 percent) and about 20 percent & 22 percent present with mild & moderate CT severity score. Males are present with more CT severity than female (Table-2). Eighty two patients (16 %) present with normal CT chest finding.

Parameter		
Age	Number	Percentage (%)
<20 year	15	3 %
20-40 year	141	27.5 %
> 40 year	356	69.5 %
Sex		
Males	371	72.5 %
Females	141	27.5 %

Table-1 Age and Sex distribution of the Covid-19 Patients.

Parameters			Male %	Female %
CT Severity score	Total Number	Percentage (%)		
Normal	82	16 %	30 (36.5%)	52 (63.5%)
Mild (1-7)	104	20.3 %	65 (62.5%)	39 (37.5%)
Moderate (8-15)	115	22.5 %	83 (72%)	32 (28%)
Severe (16-25)	211	41.2 %	163 (77%)	48 (23%)

Table-2 CT Severity score of Covid-19 Patients

Discussions-

COVID-19 disease (a viral infectious disease caused by a strain of corona virus (SARS-CoV-2), was announced as pandemic by the World Health Organization in 11 March20201. Chest computed tomography (CT) has rapidly emerged as a rapid and effective diagnostic tool and given the often quite characteristic pattern of COVID-19 pneumonia[6.7]

Due to pandemic nature of COVID-19, Radiologist & Clinician should be familiar with Covid-pneumonia. In typical finding of COVID-pneumonia, Bilateral Ground glass opacity is most common finding with peripheral and multilobular distribution[8].(Figure-1) Medial & lower lobes , predominantly posterior segments are more affected. Consolidation, crazy paving patterns & reticular / linear opacity are another common finding in COVID patients (Figure-2 & 3). Some atypical findings are also noted such as pleural thickening/ effusion, reverse halo sign, pulmonary nodules, pericardial effusion & pulmonary fibrosis[9] and Pneumomediastinum[10].

In our study, CT severity is measured by a method which was presented by Li *et al*. and was published in Investigative Radiology in March 2020[5]. In this method, both lungs were divided into five lobes, and each lobe was assessed individually. Each lobe could be awarded a CT score from 0 to 5, depending on the percentage of the involved lobe: score 0= 0% involvement of lobe; score 1= less than 5% involvement of the lobe; score 2 = 5% to 25% involvement of lobe; score 3 = 26% to 49% involvement of lobe; score 4= 50% to 75% involvement of lobe; score 5 = greater than 75% involvement of lobe.

The overall CT score was the sum of the points from each lobe and ranges from 0 to 25 pints. The cut-off value for identifying severe cases of COCID-19 of CT score was 7 (mild = 1-7), moderate = 8-15 and severe = 16-25.

In our study, Males are more affected and present with more severe CT severity score than female, which is same as George M. Bwire et al study which also show higher morbidity & mortality in male than females due to COVID-19[11]. Amber L Mueller et. al study show adults over 65 years of age represent 80% of hospitalizations due to COVID-19 and have a 23-fold greater risk of death than those under 65 year[12].Comorbidities such as cardiovascular disease, diabetes and obesity increase the chances of fatal disease. In our study with hospitalised patients, older patients are more in number and they present with more severe CT severity score than younger.

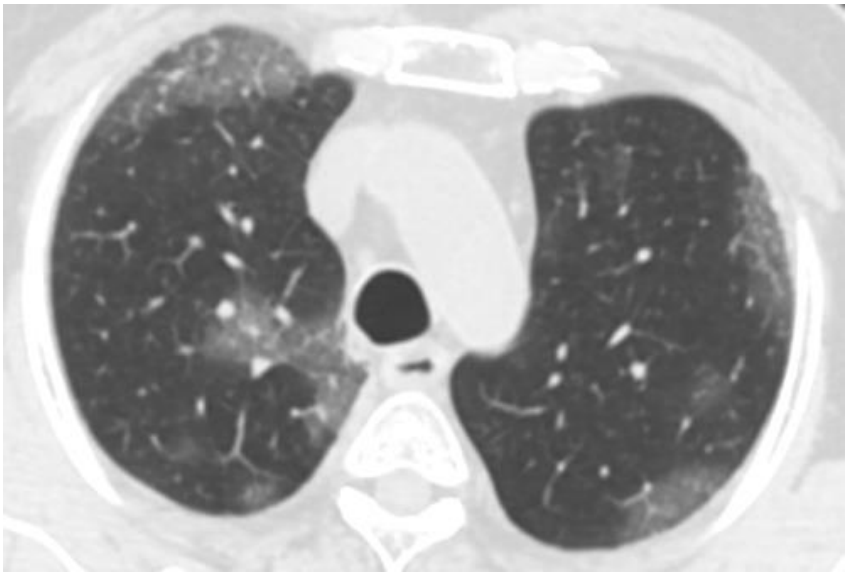

Figure-1 HRCT Chest of Covid patient with mild category show bilateral peripherallly distributed patchy ground glass opacity (< 5 % involvement of lobes of lung parenchyma). CT severity score- 6/25

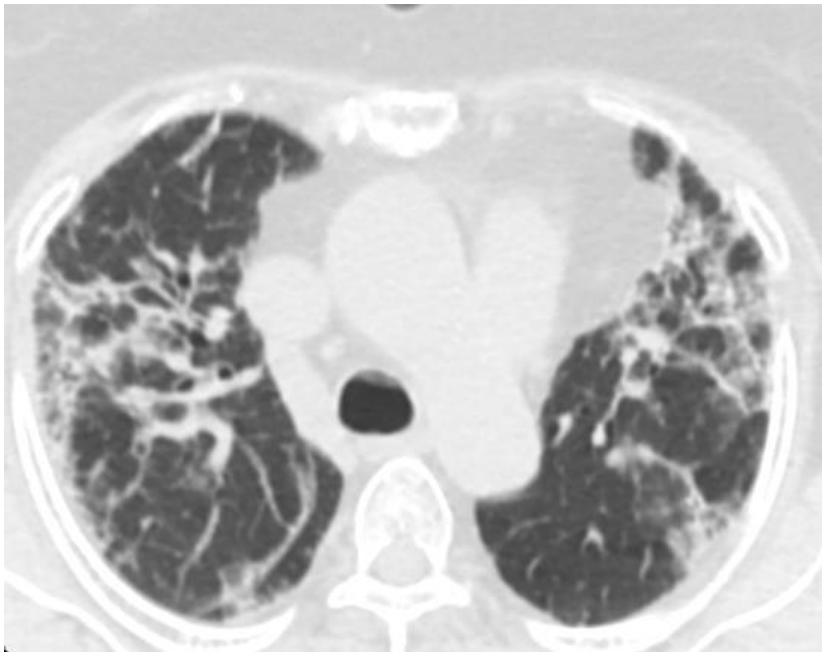

Figure- 2 HRCT Chest of Covid patient with moderate category (CT severity score- 13/25) show patchy ground glass opacity with interlobular septal thickening in both lung parenchyma (25-49 % involvement).

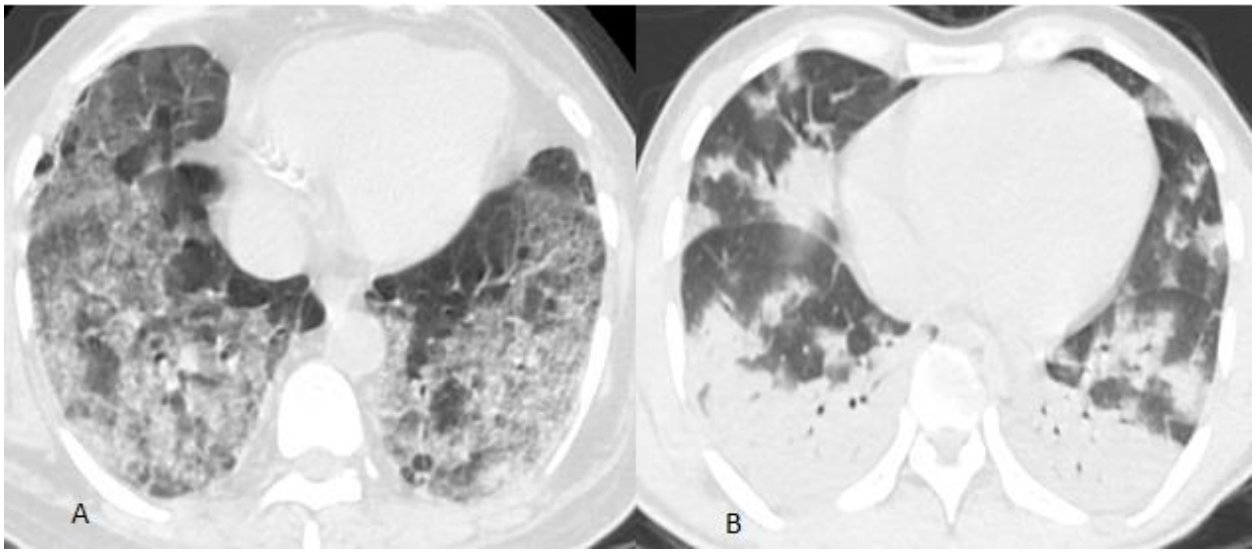

Figure-3A & 3B HRCT Chest of Covid patient with Severe category (CT severity score- 20/25) show multifocal ground glass opacity with interlobular septal thickening and consolidation in both lung parenchyma (50-75 % involvement).

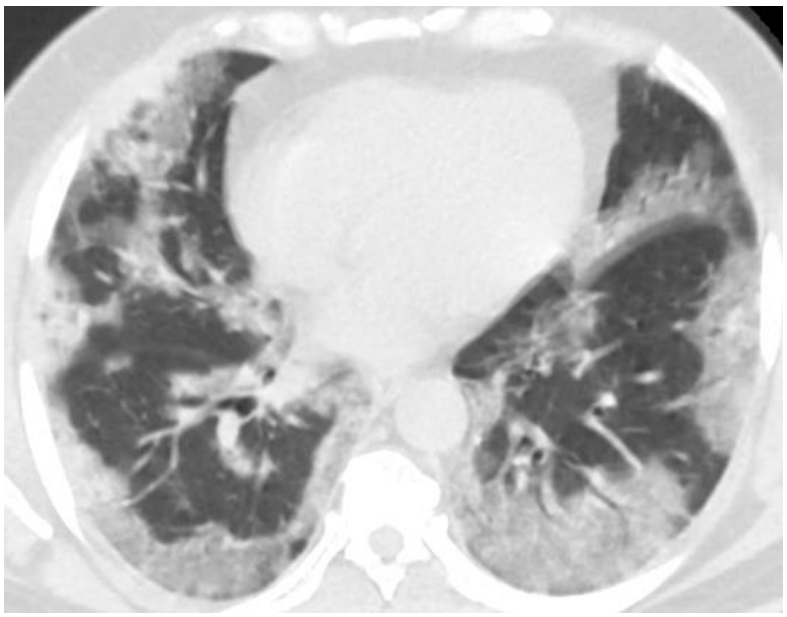

Figure- 4 Another HRCT Chest image with Severe category (CT severity score- 22/25) of different Covid patient show multifocal confluent ground glass opacity with evolving consolidation in both lung parenchyma (50-75 % involvement).

Conclusion- Our studies show that older age group male patient (> 40 year) more affected in second peak of covid-19 and more patient present with chest involvement by severe CT severity

score, so more mortality was noted with higher CT severity score, however this study is retrospective, needs prospective study for better correlation.

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