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Radiodiagnosis

Study of Utility of High Resolution Computed Tomography in Assesing Severity of COVID 19

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Abstract **Original Research Article**

Aim: Utility of Multidetector Computed Tomography in assessing severity of COVID 19. ***Objectives:*** 1. To study the spectrum of imaging findings in patients presenting with COVID 19 disease. 2. To associate the CT severity in COVID-19 with the spo2 and co-morbidity. ***Result:*** Patient between 31 to 40 years is the most common age group affected by COVID 19 and most of the patients were having moderate severity of disease. ***Conclusion:*** Multidetector computed tomography is a very useful modality in assessing various patterns and severity of the COVID 19 disease.
Keywords: COVID 19, MDCT - Multi Detector Computed Tomography.

INTRODUCTION

Coronavirus disease 2019 (COVID-19) is highly contagious viral illness caused by severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) and had a catastrophic effect on the world's demographics, resulting in more than 6 million deaths worldwide as of March 2022, emerging as the most consequential global health crisis since the era of the influenza pandemic of 1918. The first few cases of this predominantly respiratory viral illness were first reported in Wuhan, Hubei Province, China, in late December 2019 [1]. After this, SARS-CoV-2 rapidly disseminated across the world in a short span of time and on 30 January 2020, first case was reported in India. World Health Organization (WHO) declared it as a global pandemic on March 11, 2020. Since being declared a global pandemic, COVID-19 has ravaged many countries worldwide and has overwhelmed many healthcare systems. The primary mode of transmission of SARS-CoV-2 is via exposure to respiratory droplets. Infection can be transmitted through respiratory air droplets or via direct contact with contaminated surfaces. Early and accurate diagnosis of patients, including those with little or no symptoms is crucial, since 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. Common symptoms include fever, cough, and dyspnea, while the disease has potential to cause a host severe fatal cardio-respiratory complications in vulnerable population, particularly the elder with co-morbid conditions [2].

Medical imaging such as chest X-ray has been conventionally used in the global fight against COVID-19. Chest X-ray being portable and having lower dose of radiation exposure, acts as a feasible tool for ICU admitted patients and their follow up. HRCT is an 3D imaging modality with excellent spatial resolution, providing fine anatomic details. In early stages of COVID-19 disease, HRCT findings could be present even before the onset of symptoms when chest x ray is usually normal. Thus making it crucial in patients' prompt diagnosis and early treatment [3].

Serological test like real-time reverse transcriptase-polymerase chain reaction (RT-PCR) assay is considered gold standard test for the diagnosis of SARS-CoV- 2 infection. But it also comes with flaws like limited availability, long turn- around times and high false negative rates. HRCT being a highly sensitive and time-effective imaging modality is a better alternative to RT-PCR as it can detect the subtle changes in lung parenchyma that were otherwise difficult to assess on conventional chest imaging [4]. Wide spectrum of HRCT patterns are observed in COVID-19 patients. It has been observed that while some patterns are associated with good prognosis, some may be refractive to the conventional therapies and show a protracted clinical course. A pattern categorization of COVID-19 pneumonia may help the

prognostic stratification e.g., adverse outcome, clinical course with recovery. As health care system in India are overwhelmed with COVID-19 patients, improved prediction of the course of the disease based on early findings can assist with improved utilization of limited resource.

The chest CT severity score has great significance in assessing the pulmonary involvement with differentiation of mild, critical and severe types. These scores help in evaluating the extent of disease which could be used as an imaging surrogate for disease burden and in turn, appropriate management. It can also be used to provide additional prognostic information and in triage purpose of patients in need of hospital, especially during the peak of the pandemic wave. In our study we aim to evaluate the spectrum of HRCT patterns and to assess the CT severity score in COVID-19 positive patients which will help early prognostic stratification of COVID-19 and facilitate the decision making for treatment strategy and optimal use of healthcare resources [5].

MATERIALS AND METHOD

Prospective observational study was carried out from 1st April 2021 to 30th September 2022 in the department of Radiodiagnosis, SAMC & PG Institute, Indore. Patients with confirmed covid 19 referred to the department of Radio diagnosis, will be subjected to HRCT chest for evaluation of the covid 19 and its severity on the basis of their CT characteristics and data will be recorded, the final study population of our study was 300.

Inclusion criteria

1) Patients of irrespective of age and sex presenting with positive report of covid 19.

Exclusion criteria

The following patients will be excluded from the study -

1) Patients not willing to be part of study.
2) Patients in which CT scan is contraindicated.
3) Patients who came negative for covid 19 but presenting with symptoms of covid 19.

Data collection procedure

Each patient underwent a thorough clinical evaluation including a detailed history and spO2 measurement. The duration of the complaints were noted in each patient.

All the patients were made to undergo MDCT scan as the radiological examination after taking an informed consent for the same

Observation

The present study "Role of Multi detector Computed Tomography in evaluation of severity of COVID 19" was carried out in the department of Radiodiagnosis, SAMC & PG Institute, Indore for a period of 18 months. Our study population comprised of 300 patients fulfilling our inclusion and exclusion criteria which were included in the study after taking written informed consent. All the patients referred to our department with positive COVID 19 status formed our study population. All patients were subjected to MDCT chest and the data collected was meticulously analyzed to characterize patients into one of the various reasons. Following observations were made in our study.

Table-1: Age and sex distribution

Age Group	Gender		Total
	Female	Male	
Upto 30	11	30	41
31-40	26	54	80
41-50	16	46	62
51-60	21	36	57
>60	18	42	60
Total	92	208	300

Table-2: SPo2

	Number	Percentage %
91-100%	52	17.3
81-90%	152	50.6
71-80%	65	21.6
</= 70%	31	10.3

Table-3: HRCT findings

Compartment	Numbers	Percentage %
GROUND GLASS OPACITY	269	89.6
INTERLOBULAR SEPT. THICKENING	163	54.3
CRAZY PAVING	90	30
FIBROSIS	50	16.6
CONSOLIDATION	199	66.3
EFFUSION	12	4
COLLAPSE	7	2.3

Table-4: Co-morbidities

COMORBIDITY	Numbers	Percentage %
DIABETES	168	56
HYPERTENSION	108	36
NONE	63	21

Table-5: Distribution according to presence of HRCT findings

	Number of Cases	Percentage
Present	288	96
Absent	12	4

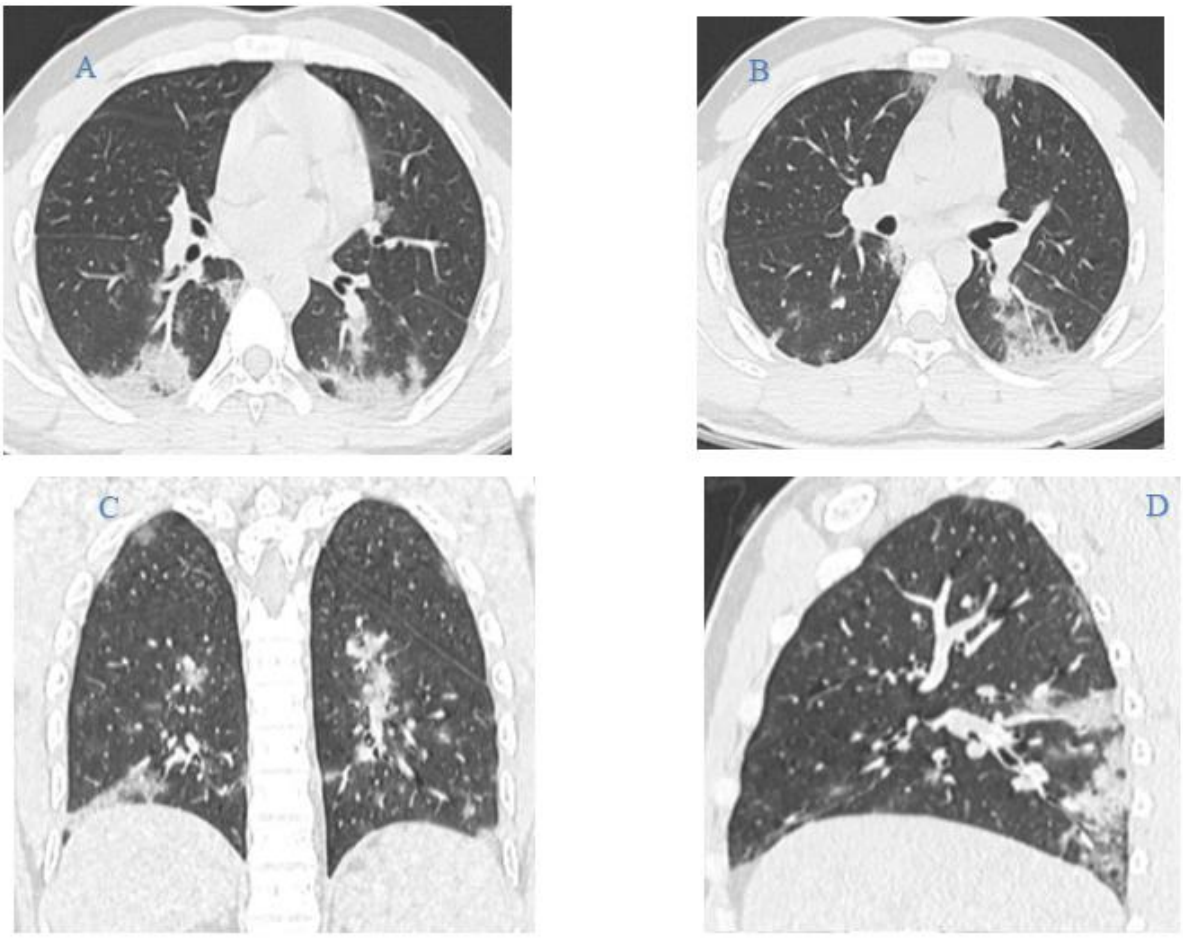
Table-6: Distribution according to lung involvement

	Number of Cases	Percentage
Bilateral	236	81.9
Unilateral	52	18.1

Table-7: Distribution of patients according CT severity score

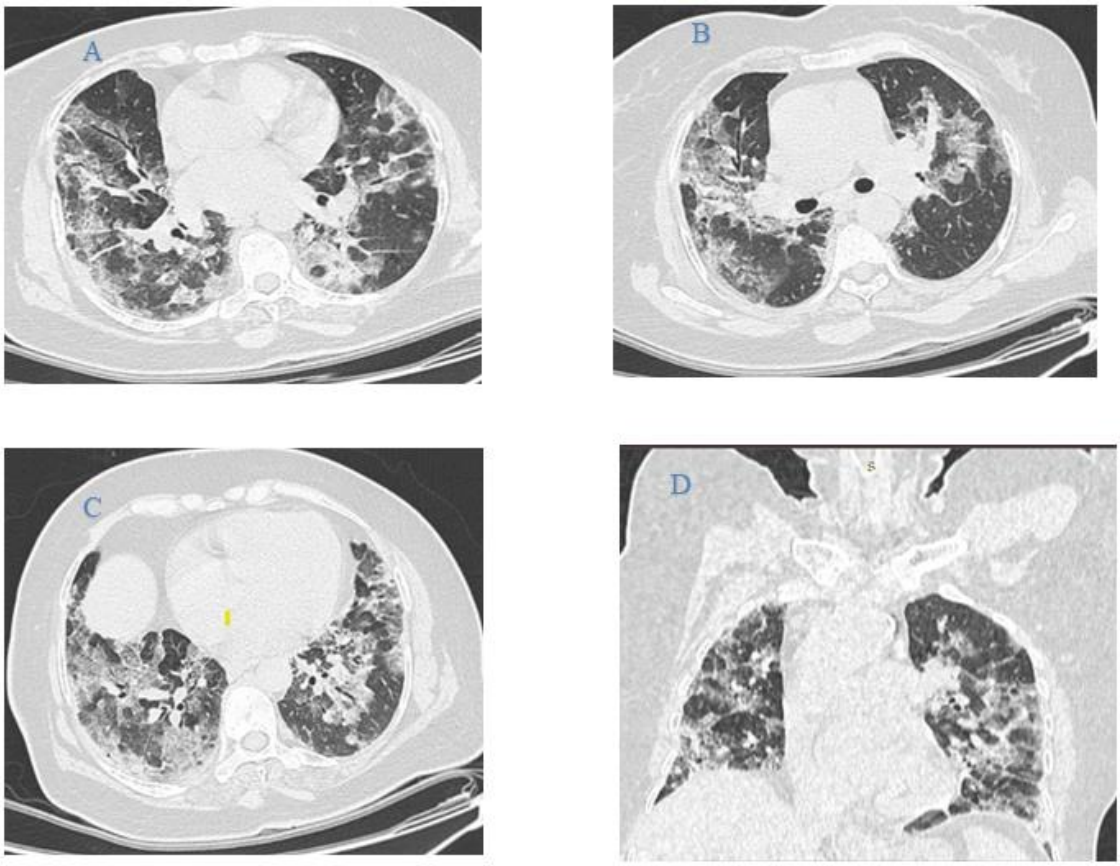
	No. of Cases	Percentage %
MILD (1-7)	78	27.1
MODERATE(8-15)	167	58
SEVERE (16-25)	43	14.9

Case 1: 42 year old male, complaints of fever and cough since 5 days.



HRCT Axial (a,b), Coronal (c) and Sagittal (d) sections show peripheral basal predominant consolidation CT Severity score 6/25 (Mild)

Case 2: 55year old diabetic COVID positive male.



HRCT Axial (a, b, c) and coronal (d) sections shows diffuse multiple ground glass opacities with few patchy areas of consolidation and intralobular septal thickening CT severity score 11/25 (Moderate category)

DISCUSSION

The chest CT severity score has great significance in assessing the pulmonary involvement with differentiation of mild, critical and severe types. These scores help in evaluating the extent of disease which could be used as an imaging surrogate for disease burden and in turn, appropriate management. It also helps in detection of wide spectrum of patterns observed in COVID-19 patients. It can also be used to provide additional prognostic information and in triage purpose of patients in need of hospital, especially during the peak of the pandemic wave.

In this present study, 300 patients were subjected to CT of thorax. Patients with COVID 19 were grouped under age, gender, spo2, laterality, co-morbidities, CT severity score and MDCT patterns. In present study most were in the age group of 31-40 yrs. Male preponderance was observed in our study 70% being male and 30 % being females, with male to female ratio of 2.3:1. This was in concordance with study done by Atre *et al*., 2022 [6] where 64% were male and 36% were female. Similar findings were seen in the study conducted by Mannan *et al*., 2021 [7], Mosawe *et al*., 2021 [8], Francone *et al*., 2020 [9] and Cao *et al*., 2020 [10].

In our study of 300 patients, most of the patients had Spo2 of 81-90 % which were similar to study conducted by Mannan *et al*., 2021 [7].

We found that patients infected with COVID-19 also had co-morbidities. Diabetes was found to be the most common comorbidity seen in 56% patients followed by hypertension in 36%. Mithal *et al*., 2021 [11] observed similar results where diabetes was seen in 47% patients, hypertension in 40% patients.

In our study, 96% patients had positive HRCT findings. These results were in accordance with the results found in the study done by Zarifian *et al*., 2021 [12] who found 91.8% patients with positive findings.

In our study, ground-glass opacities (GGO) were the main finding, present in 89.6 % of patients. GGOs are related to a partial airspace filling or to interstitial thickening resulting in hazy lung opacities which do not obscure the underlying vascular or bronchial margins. These results correlated well with study of Cao *et al*., 2020 (10) who found that GGO in 90% of patients. However, study done by Khaliq *et al*., 2021[13], Mannan *et al*., 2021, [7] Bao *et al*., 2020 [14], Ng *et al*., 2020 [15], Hafeda *et al*., 2020 [16], Mosawe et al 2021 [8], and Ishfaq *et al*., 2021 [17]

found that GGO were present in 88%, 84%, 83%, 86%,83.3%, 71%, and 71.6%in their studies respectively.

The GGO findings was followed by consolidation seen in 66.3% patients, respectively. Consolidation occurs as a result of filling of alveolar airspaces with pathological fluids or cells which in turn increases the parenchymal density, obscuring the underlying vessels and bronchial walls. Khaliq *et al*., 2021 [13], found consolidation in 52.8% of patients. While study done by Mannan *et al*., 2021 [7], Mosawe *et al*., 2021 [8], Mona *et al*., (2020) [18] and Francone *et al*., 2020 [9] found it to be present in 41, 33%, 30% and 20% patients only, respectively.

The prevalence of interlobular septal thickening observed in our study was 54.3%. Due to infection, infiltration of interlobular septa with fluid and inflammatory cells occur resulting in thickening of septa. Study done by Ishfaq *et al*., 2021 [17] found interlobular septal thickening in 43.2% of patients. However, our findings were lower as compared to the results obtained by Cao *et al*., 2020 [10] who found that it was present in 72%.

In present study, 30% patients showed crazy paving pattern. When GGOs are superimposed on interlobular septal thickening it gives the appearance of irregularly paved stones hence the name crazy paving pattern. This is in concordance with study of Mona A *et al*., 2020 [18] who found that crazy paving was present in 36.5% of patients. Similarly, study done by Khaliq *et al*., 2021 [13] and Francone *et al*., 2020 [9], found that it to be present in 33.4% and 31% patients.

In our study, we found pleural effusion to be present in 4% of patients. Presence of pleural effusion is a sign of poor prognosis as this depicts the spread of inflammation from lung parenchyma to the pleural surface. This was agreed with results of study conducted by Gurumurty *et al*., 2021 [19], Ojha *et al*., 2020 [20], Carotti *et al*., 2021 [21] who showed similar finding of pleural effusion in 5.7%, 5% and 10% of patients respectively.

Our study showed that bilateral involvement of lung was in 81.9 % patients this was agreed with results of study conducted by Farghaly *et al*., 2021 [22] who showed bilateral involvement in 80% of patients and similarly, the finding observed in the study conducted by Hafez *et al*., 2020 [19] where bilateral involvement was seen in 93.2% of patients.

In our study, we found majority of patients were present in moderate category (58%) of CT severity score followed by in mild category (27.1%) and in severe category (14.9%). This could be possibly explained by a greater number of patients in our study were from older age group (>50yrs) and having associated comorbidities. While study conducted by Atre *et al*., 2022 [6] who found 31.4% in moderate category and study conducted by Sheed *et al*., 2021 [23] who found 34.3% in moderate category.

CONCLUSION

This prospective observational study comprised of 300 patients who were positive for COVID 19, all the patients were subjected to MDCT of chest to assess severity and patterns of disease.

The results were summarized as below

- There were a total of 300 patients in the age group ranging from less than 20 years to more than 60 years, most were in the age group 31 – 40 years.
- A male preponderance was observed in our study with 70% being male and 30 % being female, with male to female ratio of 2.3:1.
- In our study of 300 patients, most of the patients had Spo2 of 81-90 %.
- We found that patients infected with COVID-19 also had co-morbidities. Diabetes was found to be the most common comorbidity seen in 56 % patients followed by hypertension in 36%.
- In our study, 96% patients had positive HRCT findings.
- In our study, ground-glass opacities (GGO) were the main finding, present in 89.6 % of patients, followed by consolidation (66.3%) and interlobular septal thickening (54.3%).
- Our study showed that bilateral involvement of lung was in 81.9% patients.
- In our study, we found majority of patients were present in moderate category (58%) of CT severity score followed by in mild category (27.1%) and in severe category (14.9%).
- In our study, we found patients with co-morbidities had more severe CT scores as compared to patients without co-morbidities.
- Most of the patients (90%) with severe CT scores (16-25) had Spo2 <80%.

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