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Research Article

STUDY OF HRCT CHEST FINDINGS AND SEVERITY SCORE IN COVID-19 PATIENTS AND ITS CORRELATION WITH CLINICAL AND LABORATORY PARAMETERS

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ABSTRACT

Objectives: High-resolution computed tomography (HRCT) refers to a CT scan that gives a more precise cross-section image of the lungs than a regular chest CT and chest X-ray. HRCT chest uses specific technologies for better image resolution with exquisite lung details ideal for assessment. This modality can be applied in diagnosing and grading severity in coronavirus disease 2019 (COVID-19) infection. HRCT is more sensitive and accurate in diagnosing diffuse lung disease. Since HRCT can detect even small nodules in the lungs, it can detect severe abnormalities at an early stage of the infection and help to plan appropriate treatment.

The aim of the study was to study HRCT chest findings in patients with COVID-19 infection and correlation with clinical and laboratory parameters.

Methods: This was a prospective and retrospective observational study done for duration of 1 year, that is, from June 2020 to May 2021 in the Department of Radio-diagnosis at Shri Sathya Sai Medical College and Research Institute, Tiruporur-Guduvancherry, Main Road, Ammapettai, Nellikuppam, Kancheepuram district on 235 COVID-19 positive patients.

Results: The typical findings were ground glass opacity + reticular pattern (GGO +crazy paving) noted 50.2% moderate cases and 13.2% severe cases. The mild group (CT-SS of 1–8) consisted of 56 patients (23.83%), moderate group (CT-SS of 9–12) consisted of 143 (60.85%) patients where as severe group (CT-SS of >13) was composed of 36 (15.32%).

Conclusion: HRCT chest plays an important role in early identification of the COVID-19 infection. HRCT severity score helps to the patients in guiding the treatment and monitor disease progression.

Keywords: High-resolution computed tomography, Coronavirus disease 2019 infection, Laboratory parameters, disease progression.

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INTRODUCTION

Coronavirus, named after their crown-like appearance, is a large family of viruses that was first discovered by researchers in Chicago in 1965 [1]. The virus was not investigated again till 2003, when the severe acute respiratory distress syndrome (SARS) outbreak started in China and rapidly spread to 29 countries. The SARS outbreak infected a total of 8089 patients with high mortality rate (774 deaths in 17 countries). Ten years later, Middle East respiratory distress syndrome outbreak started in Saudi Arabia, infected totally 2506, with total deaths of 862 [2,3].

Coronavirus disease 2019 (COVID-19) is a highly infectious disease causing severe respiratory distress syndrome that was first discovered by the end of 2019 in Wuhan, China, and spread globally. On March 11, 2020, the pandemic of COVID-19 has been declared by the World Health Organization as an international public health emergency. More than 5.3 million cases and 342,000 deaths were reported all over the world by May 24, 2020, and the disease was reported in 188 countries [4-6]. In the literature, the mortality rate ranges from 4.3 to 15% [7-9].

The disease is transmitted by person to person (direct contact by exposure to expired air from infected person) and touching a surface contaminated from infected person (indirect contact) [10]. The disease affects males more than females probably due to immune-linked chromosomes or occupational exposure. The incubation period is 2–14 days, average period 5.2 days. The clinical picture ranges from simple lung infection to severe respiratory distress syndrome, metabolic acidosis, diarrhea, intestinal symptoms, coagulation dysfunction, and septic shock [11].

Rapid detection of COVID-19 is vital for early treatment of patients and more importantly for quick isolation of the patient to stop the chain of contamination, the standard technique for confirming COVID-19 is the real-time reverse transcriptase polymerase chain reaction (RT-PCR). Other laboratory findings include low white blood cells, lymphopenia, thrombocytopenia, high serum C reactive protein, and elevated serum ferritin [12,13].

Todo *et al*., in 1982, initially described technique of high-resolution computed tomography (HRCT) for diffuse lung disease and described the potential benefits of the technique in assessment of various lung diseases [14].

HRCT brought revolution in pulmonary imaging where resolution reached the secondary pulmonary lobule or the functional unit of lung. HRCT allows delineation of the lung parenchyma down to the level of secondary pulmonary lobule. Due to these features, HRCT has become an important diagnostic tool in pulmonary medicine and provides valuable information about various focal and diffuse lung diseases [15].

High-resolution chest CT has 97% sensitivity for the diagnosis of COVID-19 pneumonia after a mean interval of 5 days. The typical chest CT findings in COVID-19 pneumonia are bilateral, peripheral, and basal predominant ground-glass opacity (GGOs) with or without consolidation and bronchovascular thickening. In addition, atypical chest CT findings include central upper lobe predominance, masses, nodules, cavitations, tree-in-bud sign, lymphadenopathy, and pleural effusion [16].

Chest computed tomography severity score was proposed by Yang *et al*. and Pan *et al*. and was published in *Radiology* in 2020 [16,17]. It was created to help assess COVID-19 effect on the initial scan obtained at admission and provides an objective approach to identify patients in need of admission to hospital.

CT scan examination and blood tests need indeed to participate in the screening and diagnosis of COVID-19 infection in addition to the PCR test examination [18].

The initial concern about using CT scan in patients with COVID-19 infection was to assess the spectrum of imaging findings and recognizing which pattern being typical or atypical for the disease, and hence, many classifications had been emerging to standardize reporting into typical, indeterminate, and atypical CT patterns for COVID-19 [19].

The CT severity score index is a scoring system used to assess the lung changes and involvement by COVID-19 based on approximate estimation of pulmonary involved areas. Each of the five lung lobes has been visually scored and given a score from 1 to 5:

1. Representing <5% lobar involvement.
2. 5–25% lobar involvement.
3. 26–50% lobar involvement.
4. 51–75% lobar involvement.
5. >75% lobar involvement.

Then, the final score will be the summation of individual lobar scores and will be out of 25 (total score); the total lung involvement is then obtained by multiplying the total score times 4 [20].

Aim of the study

The aim of the study was to study HRCT chest findings in patients with COVID-19 infection and correlation with clinical and laboratory parameters.

METHODS

The study was approved by the Institutional Ethics Committee.

Written informed consent was obtained from the all the cases included in the study.

Study design

This was a prospective and retrospective observational study.

Study period

The duration of the study was 1 year, that is, from June 2020 to May 2021.

Place of study

The study was conducted at Department of Radio-diagnosis, Shri Sathya Sai Medical College and Research Institute**,** Tiruporur-Guduvancherry, Main road Ammapettai, Nellikuppam, Kancheepuram district**.**

Sample size

The sample size was 235 COVID-19-positive patients.

Inclusion criteria

The following criteria were included in the study:

- Patients willing to participate in the study
- Age 20–80 years
- Patients with RT-PCR positive
- Patients with chest CT findings suspicious of COVID-19 pneumonia
- Presence of diabetes
- Hypertension.
- COPD
- Asthma

Exclusion criteria

The following criteria were excluded from the study:

- Patients not willing to participate in the study
- Patients <20 years old,
- Patients with negative RT-PCR results,
- Suboptimal HRCT scan due to significant motion artifacts
- Pulmonary edema and interstitial lung disease
- Patients with COVID-19 vaccination (1 or 2 doses)
- Females with pregnancy.

Methodology

All the cases (sample size 235) were selected according to the inclusion and exclusion criteria.

Demographic characteristics were collected and noted in proforma including age, gender, past history, present history, and any drug history.

COVID-19 infection was confirmed with RT-PCR test using nasopharyngeal swab. All patients underwent two consecutive RT-PCR tests.

The patient was subjected for certain investigations including complete blood count. The NLR was also calculated, CRP, serum ferritin, and coagulation profile.

Complete blood count was done in hematology laboratory. 2 ml of blood was collected in EDTA vacutainer and was processed in three part differential Siemens coulter. All the parameters noted (Hb, RBC, WBC, DLC (differential count), Platelets, and RBC indices).

CRP was done in microbiology laboratory by serial dilution methodology. Serum ferritin was done in biochemistry department by automated analyser.

HRCT chest

HRCT scan was done in all the patients who were clinically diagnosed with COVID-19 infection.

The procedure and objectives of performing the high resolution CT scan were explained to the patient and written consent of the patient was taken. The patient was explained and demonstrated the procedure of breath holding during the acquisition of HRCT scans.

The patient was kept supine on the gantry table and was scanned cephalocaudal in the axial axis. Scans obtained with patients supine were adequate in most instances. Prone scans were taken when needed. The scanogram or topogram was first taken and then the whole lung was scanned from apex to the base. The scans were performed on GE - REVOLUTION ACTs EX 16 Slice. Slice Multidetector scanner using the following protocol.

Collimation = 1 mm+
Feed = 10 mm
Scan time =2 s
KVp = 120–140
mA = 240
Matrix size = 512 × 512
Windows- window mean/width values = -600––700/1000–1500.

High spatial frequency algorithm was used. It reduces image smoothening and increases spatial resolution, making structures appear sharper. Thus, small vessels and bronchi are better seen in HRCT.

The following parameters were noted:

Location and distribution of disease

The location and distribution of the disease were unilateral or bilateral; peripheral, central, or both; and upper lobe predominance, lower lobe predominance, or both.

CT chest findings

The CT chest findings were the presence of ground glass opacification; consolidation; special signs such as crazy-paving, halo, and reversed

halo signs; spiderweb appearance; subpleural sparing; interlobular septal thickening; parenchymal, subpleural bands; cysts; nodules; vascular thickening; bronchial thickening; pleural thickening; pleural reaction; pleural effusion; and reactive lymph nodes (exceeding 1 cm in short-axis diameter).

CO-RADS based on the CT findings

The level of suspicion of COVID-19 infection is graded: CO-RADS score [21].

- CO-RADS 1: COVID-19 is highly unlikely, CT is normal, or there are findings indicating a non-infectious disease;
- CO-RADS 2: The level of suspicion of COVID-19 infection is low, and CT findings are consistent with other infections;
- CO-RADS 3: COVID-19 infection is unsure or indeterminate, and CT abnormalities indicate infection but are unsure whether COVID-19 is involved;
- CORADS 4: The level of suspicion is high, and most CT findings are suspicious but not extremely typical as unilateral ground glass, confluent, or multifocal consolidations without a typical location or any other typical findings
- CO-RADS 5: The level of suspicion is high with typical CT findings.

Semiquantitative scoring system

A semiquantitative scoring system was used to quantitatively estimate the pulmonary involvement of all these abnormalities based on the area involved.

The CT-SS was calculated based on the extent of lobar involvement. Each of the five lung lobes was visually scored on a scale of 0–5, with

- 0 indicating no involvement,
- 1 indicating <5% involvement,
- 2 indicating 5–25% involvement,
- 3 indicating 26–49% involvement,
- 4 indicating 50–75% involvement, and
- 5 indicating more than 75% involvement.

The total CT score was the sum of the individual lobar scores and ranged from 0 (no involvement) to 25 (maximum involvement) [22,23].

Statistical analysis

The data entered into a Ms excel sheet and collected data e analyzed in the Statistical Package for the Social Sciences (SPSS) Version 23.Categorical data were expressed as numbers and percentages, whereas numerical data were summarized as medians, The Chi-square correlation analysis was conducted(Mann Whitney test), p<0.05 was considered significant. Pearson's Correlation was considered significant at the 0.01 level (2-tailed).

RESULTS AND OBSERVATION

Demographic, severity, and clinical characteristics (Table 1)

This study involved 235 patients, including 132 males (56.17%) and 103 females (43.83%), with their ages ranging from 20 to 80 years (Mean age±SD, 43.97±12.71 years) (Figure 1). The mild group (CT-SS of 1–8) consisted of 56 patients, moderate group (CT-SS of 9–12) consisted of 143 patients whereas the severe group (CT-SS of ≥13) was composed of 36 patients.

The most presenting symptoms are displayed in Table 2. Disease severity was significantly correlated with lower respiratory symptoms, in particular dyspnea and chest pain and also the gastrointestinal symptom vomiting's. (p=0.0156, 0.0459, and 0.0005, respectively).

Mann–Whitney test, p<0.05, *=significant, ns=not significant.

The most common symptom was sore throat (19.1%), followed by only cough (15.75%) and dyspnea (14.8%), chest pain (8.5%), fever (15.3%), fatigue (12.8%), abdominal Pain+diarrhea (6.38%), and vomiting (7.23%).

According to risk factors, majority were having diabetes and hypertension each occupying 23.8% (56/235). Followed by both diabetes + hypertension constituting 19.1% (45/235), bronchial asthma occupied 14.8% (35/235), CAD 8.5% (20/235), COPD 6.3% (15/235), and CKD 3.4% (08/235).

In our study, the mild group (CT-SS of 1–8) consisted of 56 patients (23.83%), moderate group (CT-SS of 9–15) consisted of 143 (60.85%) patients where as severe group (CT-SS of >15) was composed of 36 (15.32%).

Chest CT findings were assessed and analyzed for all examined patients. Accordingly, the disease distribution was assessed; most of the cases presented with bilateral involvement with peripheral lobe predominance (Table 3). Both peripheral and central distributions did not show significance with disease severity (p=>0.99).

According to the CT findings, the most prominent features are GGO+Crazy paving, which is statistically significant with severity. There was predominant multilobar involvement of the lungs which was significant with severity score (p=0.0005).

The typical findings in mild disease were GGO noted in 23.4% cases, and one case showed GGO + reticular pattern (GGO+crazy paving).

In moderate disease, consolidation noted in 4.25% cases, GGO noted in 6.3% cases, and 50.2% cases showed GGO + reticular pattern (GGO +crazy paving).

In severe disease, consolidation noted in 2.1% cases, 13.2% cases showed GGO + reticular pattern (GGO +crazy paving).

Chest CT findings were assessed and analyzed for all examined patients. Accordingly, the disease distribution was assessed; most of the cases presented with bilateral involvement with peripheral lobe predominance (Table 3).

Lymphopenia was noted in all cases of 50.2% moderate and 14.9% severe cases and only 4.25% of mild cases.

Raised CRP was observed in in all cases of 60% moderate and 14.8% severe cases and only 19.14% of mild cases.

D-dimer increased in 50.2% of moderate cases and 14.8% severe cases and 2.5% mild cases.

Table 1: Age and gender distribution

S. No	Age (years)	Male (%)	Female (%)	No of patients
1	20–30 years	18 (7.6)	10 (4.2)	28 (11.9)
2	31–40 years	40 (17.2)	30 (12.7)	70 (29.7)
3	41–50 years	35 (14.8)	40 (17.2)	75 (31.9)
4	51–60 years	20 (7.9)	15 (6.3)	35 (14.8)
5	61–70 years	13 (5.5)	8 (3.4)	21 (8.9)
6	71–80 years	6 (2.5)	-	6 (2.5)
Mean Age±SD	43.97±12.7 years	44.36±13.97 years	43.47±10.93 years	235
Total		132 (56.1)	103 (43.8)	235 (99.7)

Serum ferritin increased in 59.5% cases of moderate, 14.8% cases of severe, and 2.5% cases of mild.

A significant positive correlation was found between disease severity and CRP, D-dimer, Serum ferritin, and age, whereas negatively significant correlation was seen with lymphocyte count.

There was a significant positive correlation between CRP with D-dimer and serum ferritin but non-significant with age and a negative significant correlation with lymphocyte count.

A significant negative correlation observed between ferritin with lymphocyte count and positive correlation with D-dimer and age.

The age also correlated significantly negative with lymphocyte count and positively but not significant with D-dimer.

DISCUSSION

Comparative studies related to age distribution

Our study involved 235 patients, the majority of the cases were among 41–50 years constituting 31.9% and next common age group was 31–40 years (29.7%). Least noted among 71–80 years (2.5%). Mean±SD = 43.97±12.7 years. Disease severity is significantly correlated with the 40–50 year age group. Our study findings were compared with other studies, respectively. In Saeed *et al*. study [22], the mean age was 44.2±11.9 years (range 19–87 years), The most common age group was that between 40 and 49 years old (53/202; 26.2%). Whereas Zhang *et al*. [23] observed 83 (77%) patients over 50-year-old, the median age was 66 years and similarly Mona *et al*. [15] noted the most affected age group as the 51–75-year age group (99 patients; 49.5%) followed by the 26–50-year age group (90 patients; 45%). Disease severity is significantly correlated with the 51–75-year age group [Graph 1].

Comparative studies related to Gender distribution

Our study noted predominant cases in males (56.17%) when compared to females (43.83%). Similar findings were observed in Saeed *et al*. study [22], Lei *et al*. [24], and Mona *et al*. [15], where they also observed males as predominantly affected.

Table 2: Distribution of clinical features

Clinical features	No. of cases	Percentage	p-value
Sore throat	45	19.15	0.9837 ns
Only cough	37	15.75	0.2104 ns
Dyspnea	35	14.89	0.0156*
Chest pain	20	8.51	0.0459*
Fever	36	15.32	0.8699 ns
Fatigue	30	12.8	0.0406 ns
abdominal Pain+diarrhea	15	6.38	0.3224 ns
Vomiting's	17	7.23	0.0005*
Total	235	100	

Mann–Whitney test, p<0.05, *=significant, ns=not significant

Comparative studies related to risk factors

In our study, according to risk factors, majority were having diabetes and hypertension each occupying 23.8% (56/235) followed by both diabetes + hypertension constituting 19.1% (45/235), bronchial asthma occupied 14.8% (35/235), CAD 8.5% (20/235), COPD 6.3% (15/235), and CKD 3.4% (08/235). In Saeed *et al*. study [26], the risk factors considered included hypertension, diabetes mellitus, asthma, COPD, coronary artery disease, and chronic kidney disease. Risk factors were found in 399/902 patients (44.2%) (one risk factor n=206 [22.8%], two risk factors n=114 [12.6%], and three or more risk factors n=79 [8.8%]).

Comparative studies related to clinical features

In our study, the most common symptoms were sore throat (19.1%), followed by only cough (15.75%) and dyspnea (14.8%). Chest pain (8.5%), fever (15.3%), fatigue (12.8%), abdominal Pain+diarrhea (6.38%), and vomiting (7.23%). In Zhang *et al*. [23], the most common symptoms at the onset of illness were fever (n=93, 86%), cough (n=78, 72.2%), and sputum production (n=44, 40.7%), followed by diarrhea, fatigue, abdominal pain, headache, and vomiting. Sixty patients (60.2%) had dyspnea. In Lei *et al*. [24], atients with hypertension were more likely to die than those without the previous history of hypertension. The most prevalent presenting symptoms include fever (22, 48.0%), cough (6, 13.0%), or both (18, 39.0%). These patients underwent initial CT scans from the symptom onset with a mean interval of 5 (3) days (range 1–15 days). In Li *et al*. study [25], a total of 32 (34%) patients had comorbidities, including diabetes (11 [12%]), hypertension (5 [5%]), cardiovascular disease (4 [4%]), chronic obstructive pulmonary disease (8 [9%]), and malignancy (4 [4%]). Fever (89 [96%]), dry cough (66 [71%]), and fatigue (63 [68%]) were the most common initial symptoms.

Comparative studies related to investigations

In our study, lymphopenia was noted in all cases of moderate and severe cases and only 4.25% (10) of mild cases. Raised CRP was observed in in all cases of moderate (143) and severe cases (36) and only 6.8 (16) of mild cases. Raised D-dimer (>1 mcg/mL) was in 50.2% (118) cases of moderate and 14.8% (35) cases of severe. Serum ferritin increased (>550 ng/mL) in 50.2% (118) cases of moderate, 15.3% (36) cases of severe, and 2.5% (06) cases of mild. A significant positive correlation was found between disease severity and CRP, D-dimer, serum ferritin, and age, whereas negatively significant correlation was seen with lymphocyte count. In a study conducted by Saeed *et al*. study [26], lymphopenia was in 203 patients (22.5%), elevated CRP (50 mg/L) in 236 patients (40.3%), high d-dimer (>1 mcg/mL) in 147 (16.2%), and elevated ferritin level (>600 ng/mL) in 301 (33.3%). Lymphopenia was detected in 55 patients (13.7%) of the mild group; 110 patients (35.6%) of the moderate group; and 31 patients (50.8%) of the severe group. In patients with severe CT scan, CRP levels were 100 mg/L in 39 patients (63.9%). These findings were found to have statistically significant correlation with the CT severity score (p 3mcg/mL in 7 patients (2.3%). In the severe category, the level was 3mcg/mL in

Table 3: Distribution of HRCT findings

HRCT findings	Mild (56)	Moderate (143)	Severe (36)	p-value
Consolidation	-	10	05	0.0365*[a]
Ground glass opacity	55	15	-	<0.0001****[a]
Ground glass opacity+reticular pattern (crazy pavin)	1	118	31	<0.0001****[a]
Anatomic sides involved				
Unilateral	10	20	05	0.7751 (ns)[b]
Bilateral (more common)	46	123	31	0.7751 (ns)[b]
Predominant distribution				
Peripheral (most common)	56	133	34	>0.9999(ns)[b]
Central	-	10	02	>0.9999(ns)[b]
Involved zone				
Unilobular	6	43	02	0.0005***[b]
Multilobar	50	100	34	0.0005***[b]

[a]Mann–Whitney test, [b]Chi-square test, p<0.05, *Significant, ns=not significant

15 patients (24.6%). Ferritin level was assessed in (888/902) patients. In patients with negative and mild CT scan findings, ferritin level was 2400ng/mL in 17 (5.5%). In patients with severe CT scan, ferritin level was 2400ng/mL in 12 (19.7%).

Comparative studies related to severity scoring on HRCT

In our study, the mild group (CT-SS of 1–8) consisted of 56/235 patients (23.83%) and moderate group (CT-SS of 9–15) consisted of 143/235 (60.85%) patients where as severe group (CT-SS of >15) was composed of 36/235 (15.32%). In Saeed *et al.* [22], mild disease was seen in 329/209 (36.5%) patients (84.5% males and 15.5% females); moderate in 309/902 (34.3%) (90.6 males and 9.4% females); and severe in 61/209 (6.8%) patients (93.4% males and 6.6% females) (Tables 5and 6).

In our study, the typical findings was GGO + reticular pattern (GGO+crazy paving) and noted in 63.8% (150/235) cases. About 129.7% (70/235) cases showed GGO and consolidation noted in 6.3% (15/235) cases. About 81.5% (200/235) had bilateral involvement of lung and 14.8% (35/235) had unilateral involvement of lung. Accordingly, the disease distribution was assessed; most of the cases presented with bilateral involvement with peripheral lobe predominance (Table 4, Figures 1 and 2). In a study conducted by Zhang *et al.* [23], the typical findings were bilateral frosted glass density, GGO, and consolidation chest CT images showed that the diffuse density of both lungs increased, and the transparency of the lung field weakened. The lighter ones were frosted glass with the lower attenuation than the ground glass GGO was present in 45 patients (53.6%), followed by frosted glass density (n=38, 45.2%), and consolidation (n=1, 0.93%). None of the patients had pleural effusion. Analysis of involved zones indicated that the base of the lung was most affected region (apex of diaphragm: n=79, 94.1%), most patients had central and peripheral distribution (n=81, 96.4%), and most patients had bilateral involvement (n=78, 92.9%). In Li *et al.* [25] chest CT demonstrations, a total of 175 chest CT scans were scored in this study. A total of 140 (80%) chest CT scans demonstrated bilateral infiltrates, and 31 (18%) chest CT scans showed unilateral infiltrates, whereas 4 (2%) chest CT scans had no abnormal findings. Pulmonary involvement identified from chest CT (including bilateral infiltrates, unilateral infiltrates, and no involvement) was not significantly different between survivors and non survivors (p>0.05 for all). The main chest CT demonstrations of COVID-19 included GGO, a crazy-paving pattern, consolidation, and a mixed pattern. In Mona *et al.* [15], chest CT findings were assessed and analyzed for all examined patients. Accordingly, the disease distribution was assessed; most of the cases presented with bilateral involvement with peripheral and lower lobe predominance. Both peripheral and central distributions showed significance with disease severity. According to the CT findings, the most prominent features are GGO with vascular pleural thickening and interlobular septations, and parenchymal and subpleural bands were the most constant imaging features. A significant correlation was found between disease severity and consolidation, interlobar septal thickening, bronchial thickening/dilatation, pulmonary nodule, and lymphadenopathy. Among several specific CT signs noted with COVID-19 pneumonia, the crazy-paving sign was the most encountered CT sign followed by the subpleural sparing sign. A significant correlation was found between disease severity and crazy-paving, halo, and reversed halo signs. In Lei *et al* [24], GGO, crazy-paving pattern (GGO with superimposed inter and intralobular septal thickening), and consolidation were the main CT findings in early-stage COVID-19 pneumonia. Of all patients examined, 27 (58.7%) had GGOs, 19 (41.3%) had ground glass and consolidation in combination, and 35 (76.1%) patients had crazy-paving pattern. Fibrosis was observed in six (6/40,

Table 4: Distribution of cases based on laboratory findings

Investigations	Mild (56)	Moderate (143)	Severe (36)
Lymphocyte percentage			
Normal lymphocyte count (%)	46 (19.5%)	25 (10.6%)	01 (0.4%)
Lymphopenia	10 (4.25%)	118 (50.2%)	35 (14.9%)
CRP			
CRP Normal	11 (4.68%)	2 (0.85%)	-
CRP increased	45 (19.14%)	141 (60%)	36 (14.8%)
D-dimer			
D-dimer Normal	55 (21.2%)	25 (10.63%)	01 (0.4%)
D-dimer increased	01 (2.5%)	118 (50.21%)	35 (14.8%)
Serum ferritin Normal	50 (21.2%)	3 (1.27)	3 (1.27)
Serum ferritin increased	06 (2.5%)	140 (59.57)	33 (14.8%)

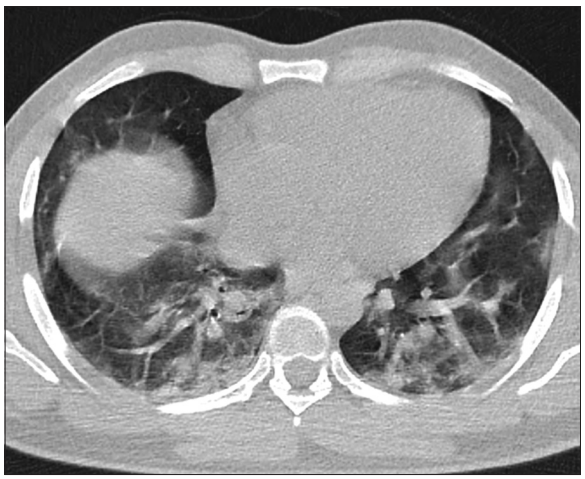


Figure 1: HRCT chest axial image at the level of lung bases in a 48-year-old male (with CTSS-15) shows multiple patchy ground glass opacities and consolidation

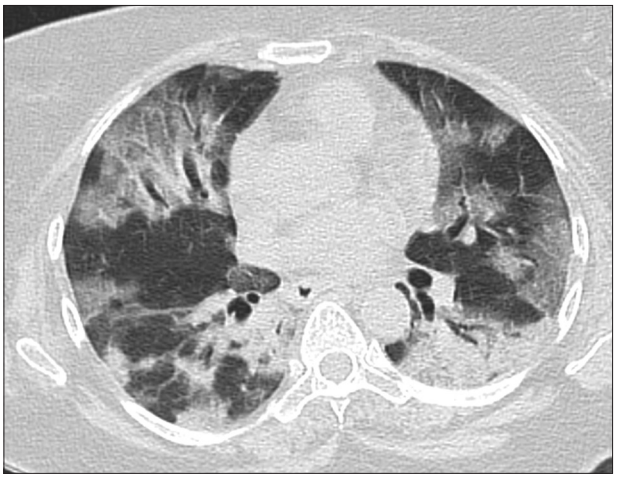
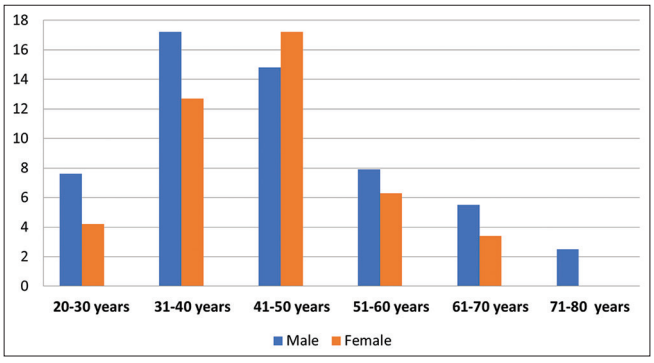


Figure 2: HRCT chest axial image at mid thoracic level in a 36-year-old female (with CTSS-15) shows multiple patchy ground glass opacities and consolidation



Graph 1: Bar diagram showing Age-sex distribution

Table 5: Pearsons correlation between CT severity score and all parameters

Pearson's correlation	Severity score	Lymphocytes	CRP	D Dimer	Serum ferritin	Age
SEVERITY SCORE						
r value	1	−0.572**	0.752**	0.814**	0.504**	0.231**
Sig. (2-tailed)	-	0.000	0.000	0.000	0.000	0.000
LYMPHOCYTES						
r value	−0.572**	1	−0.398**	−0.636**	−0.397**	−0.340**
Sig. (2-tailed)	0.000	-	0.000	0.000	0.000	0.000
CRP/mg/L						
r value	0.752**	−0.398**	1	0.751**	0.293**	0.088
Sig. (2-tailed)	0.000	0.000	-	0.000	0.000	0.181
D DIMER						
r value	0.814**	−0.636**	0.751**	1	0.517**	0.349**
Sig. (2-tailed)	0.000	0.000	0.000	-	0.000	0.000
SERUM FERRITIN						
r value	0.504**	−0.397**	0.293**	0.517**	1	0.395**
Sig. (2-tailed)	0.000	0.000	0.000	0.000		0.000
AGE						
r value	0.231**	−0.340**	0.088	0.349**	0.395**	1
Sig. (2-tailed)	0.000	0.000	0.181	0.000	0.000	-

**Correlation is significant at the 0.01 level (2-tailed).

Table 6: Comparative studies related to HRCT findings

HRCT findings	Hafez *et al.* [21]	Zhang *et al.* [23]	Present study
Frosted glass opacity	-	38 (45.2%)	-
Consolidation	60 (30%) (p=0.040*)	1 (1.2%)	15 (6.3%) (p=0.0365*)
Ground glass opacity	199 (99.5%) (p=0.738)	45 (53.6%)	70 (129.7%) p=<0.0001)
Ground glass opacity+reticular pattern (GGO + crazy paving)	Nil	Nil	150 (63.8%) p=<0.0001)
Unilateral involvement	13 (6.5%) (p=0.214)	6 (7.1%)	35 (14.8%) p=0.5008
Bilateral involvement	187 (93.5%) (p=0.214)	78 (92.9%)	200 (81.5) p=0.5008
Peripheral involvement	179 (89.5%) (p=0.026*	2 (2.3%)	223 (94.8%) p=0.0064
Central involvement	2 (1%) (p=0.636)	1 (1.2)	12 (5.1%) p=0.0064
Central and peripheral involvement	19 (9.5%) (p=0.013*)	81 (96.4%)	Nil

15.0%) patients who recovered, and none of the six patients died with COVID-19. Cavity, mediastinal lymphadenopathy, and pleural effusion were not observed.

CONCLUSION

HRCT chest in COVID 19 infection plays an important role in early identification of the disease. In our study, according to the CT findings, the most prominent features are GGO + Crazy paving, which is statistically significant with severity. There was predominant multilobar involvement of the lungs which was significant with severity score. A significant positive correlation was found between disease severity and CRP, D-dimer, serum ferritin, and age, whereas negatively significant correlation was seen with lymphocyte count.

Hence, HRCT severity score helps in assessing severity of disease and guiding the treatment.

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