Chest HRCT pattern in SARS COV 2 pneumonia: correlations of imaging findings in clinically suspected RT-PCR negative and positive patients.

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Abstract

The objective was to study the spectrum of lungs involvement as concluded by HRCT scan chest finding and to compare HRCT findings with RT-PCR in COVID 19 suspected patients who are hospitalized Chest HRCT pattern in SARS COV 2 pneumonia: correlations of imaging findings in clinically suspected RT-PCR negative and positive patients along with the prognosis determination through CT severity score**.**

This study was performed in a tertiary care hospital cum Medical College in Eastern India This retrospective cross-sectional study was conducted by department of Microbiology and Radiology on patients with high clinical suspicion for COVID-19 presented to the Diagnostic Radiology Department from January 2021 to June 2021.Along with Covid RT PCR High-resolution computed tomography(HRCT) chest were done for all suspected patients.

Total 90 cases were included in study for further assessments with severe disease undergoing HRCT Chest, of whom 57 (63.3%) were males and 33 (36.7%) were females. The mean age was 54.49 ± 13.9 years old, ranging from 18 to 86 years old. Out of 90 patients 64(71.1%) were RT-PCR-positive on initial testing. Analyses demonstrated that ground glass opacity and consolidation were significantly higher in COVID-19-positive patients than in COVID-19 negative patients and statistically significant association (p value 0.0002 and 0.0019 respectively). In imaging findings, ground glass opacity was directly associated with COVID-19 infection.RT PCR positive cases had considerably higher CSS than RT PCR negative cases.In patients with established Covid 19 infection ground glass opacity,peri bronchovascular distribution of lesion,consolidation and CSS were associated with increased disease severity and mortality.

Initial HRCT can predict Covid 19 positivity ,disease severity through CSS.

Key Words: COVID-19, RT-PCR, HRCT chest, Sensitivity, Specificity

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Introduction

On December 31, 2019, the World Health Organization China Country Office reported cases of pneumonia of unknown etiology detected in Wuhan, China's Hubei province. The World Health Organization (WHO) on March 11, 2020, has declared the novel coronavirus (COVID-19) outbreak a global pandemic.(1)

To emphasize the importance of HRCT in the diagnosis of COVID-19 disease by comparing the thoracic CT findings of COVID-19 patients with positive RT-PCR results and patients with clinical suspicion of COVID-19 but with negative RT-PCR results. : The study will be conducted with the objective of describing High-resolution computed tomography (HRCT) chest findings of clinically

suspected COVID-19 patients and also the distribution of the HRCT chest manifestations consistent with the diagnosis of COVID-19 pneumonia.(2–4)

In diagnosis of COVID -19 RT-PCR of viral nucleic acid is regarded as the reference standard. However recent studies evaluated the significance of CT chest specially HRCT in suspected and false negative COVID patients. According to many studies the sensitivity is about 98% compared to RT-PCR sensitivity of 71%.(5,6)

Real-time polymerase chain reaction (RT-PCR) remains the standard test of COVID-19 pneumonia but standby time for viral detection with RT-PCR tests, incomplete sampling techniques, variations in viral load, and false-negative rates of a test depending on the kit sensitivity can delay the diagnosis.(7) HRCT is the most sensitive modality to detect severity of COVID-19 pneumonia. (8)

Aims and objective

1. The spectrum of HRCT findings consistent with the diagnosis of COVID-19 pneumonia.
2. To compare HRCT findings with RT-PCR in COVID 19 suspected patients

Materials & Methods:This retrospective cross-sectional study will be conducted on a patients with high clinical suspicion for COVID-19 presented to the Diagnostic Radiology Department from January 2021 to June 2021.

Inclusion criteria : Adult patients who had clinically suspected symptoms of COVID-19 (fever, cough/sore throat or shortness of breath) and had their HRCT chest conducted from Radiology Department and RT-PCR performed at Viral Lab of Microbiology department were included.

Subjects included were those who had tested positive for the virus on RT-PCR, those with symptoms suspicious for COVID-19 infection awaiting results for the RT-PCR test or with negative result but strong clinical suspicion as well as those with exposure to proven patients based on contact tracing .

HRCT was performed in 164 slice SOMATOM CT Scan Machine .The following CT scanning parameters were used :1mm slice thickness,1mmdetector collimation0.6-0.9s tube rotation helical mode volumetric HRCT with 100-120kVp and 80-200mA according to weight of patient .Intravenous contrast was not used. Real Time multiplex PCR for SARS COV 2 done Qiagen Rotor gene Q using kit like Trivitron Covidsure following RNA extraction from sample by Thermo Scientific KingFisher Flex

These data were retrieved from electronic system of PACS. Results will be categorised into positive and negative findings for COVID-19. Diagnostic accuracies of HRCT chest and first RT-PCR along with 95% confidence interval were calculated

Exclusion Criteria: Patients with previous history of Lung malignancy- Primary & Secondary metastasis, Trauma,Interstitial lung disease

..HRCT images and PCR results will be retrospectively collected.

HRCT deemed to be "positive" for diagnosis of COVID-19 pneumonia if either one or a combination of several well-described signs were seen—including but not limited to ground-glass opacities in typical peripheral subpleural distribution, subpleural/interlobular interstitial thickening, atoll sign, halo and reverse halo signs.(5,6,8). Further, CT severity index was evaluated for the patients who had a "positive" HRCT to assess the severity in these patients

RT PCR will be taken as positive if both E & ORF 1B genes are positive with CT value ≤35.

The data was statistically analyzed with SPSS V 26 to identify any correlation between the mentioned factors with the lung findings.

Results

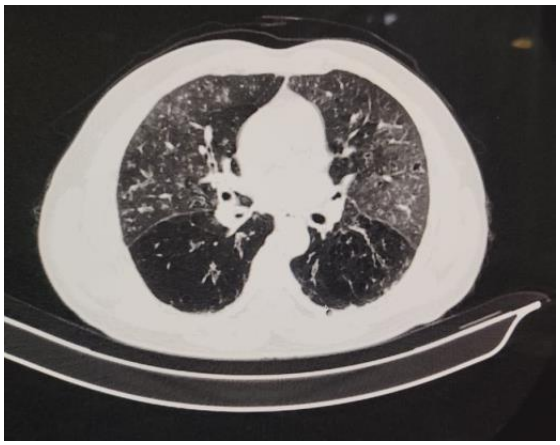
Basic information

In the study period, 229 patients were admitted to the hospitals, of whom 90 cases were included in study for further assessments with severe disease undergoing HRCT Chest, of whom 57 (63.3%) were

males and 33 (36.7%) were females. The mean age was 54.49 ± 13.9 years old, ranging from 18 to 86 years old. The patients' symptoms included fever (68.2%), chills (60.7%), myalgia (46.3%), headache (22.5%), dry cough (57.6%), sputum (21.9%), sore throat (15.2%), and nasal congestion (5.1%). Cardiovascular diseases were the most prevalent comorbidity observed in the patients (*n* = 32, 35.05%). Regarding COVID-19 status,out of 90 patients 64(71.1%) were RT-PCR-positive and others were RT-PCR-negative. Of 90 patients confirmed with COVID-19, 21 (23.3%) were admitted to the ICU and 69 (76.7%) were admitted to the regular ward. Also, 82 cases (91.2%) survived and were discharged, while 8 patients (8.8%) died..

Imaging findings and COVID-19 status(Fig 1-4

The findings of chest CT scan according to COVID-19 status are represented in Table 2. Analyses demonstrated that ground glass and consolidation were significantly higher in COVID-19-positive patients than in COVID-19 negative patients and statistically significant association (p value 0.0002 and 0.0019 respectively). After adjustment for imaging findings, ground glass was directly associated with COVID-19 infection . The sensitivity, specificity, and accuracy of ground glass opacity for the infection were 91.1%, 15.5%, and 70.9%, respectively. It has also been found that RT-PCR-positive cases had significantly a higher CSS than RT-PCR-negative cases with significant association (p value 0.0085). The median number of CSS was 18 (interquartile range 12.75–22) and we used it as a threshold for the relevant analyses. Based on the analyses, CSS ≥ 18 could predict COVID-19 infection in the study cases (OR = 1.39, AUC = 54.1%). No significant associations were identified between COVID-19 infection and other CT findings, such as reticular pattern, bilateral lung involvement, crazy paving, pleural effusion, lesions distribution, and number of zones involved.



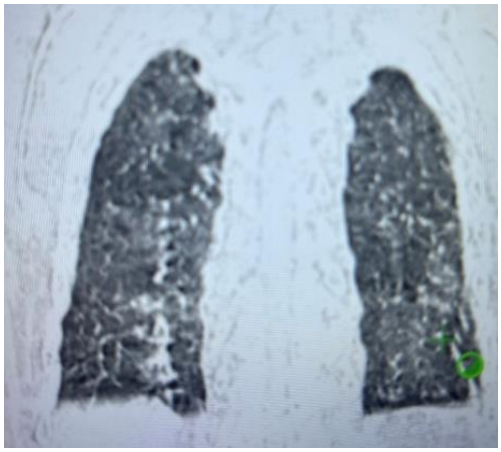
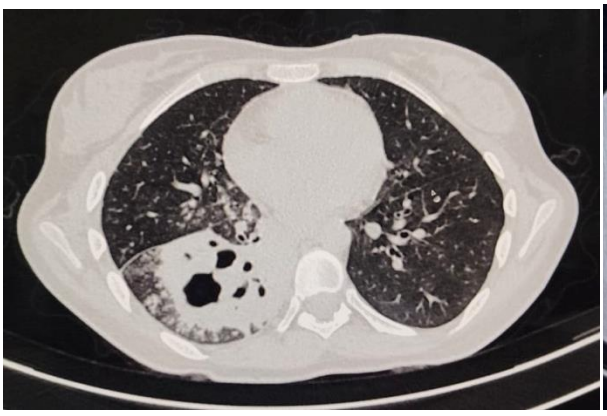


Fig 1 :CT showing ground glass opacities both UL
Fig 2 : air space opacities both lungs



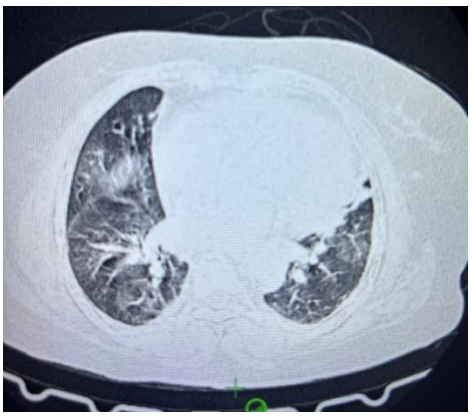


Fig 3:Consolidation with cavitary lesion seen at superior segment of right lower lobe
Fig 4 :ground glass opacities ,scattered nodular lesions with peri-bronchovasular lesion

Table 2 : Association between imaging findings and real-time polymerase chain reaction(RT-PCR)results

Imaging findings	RT-PCR-positive(*n*=64)	RT-PCR-negative(*n*=26)	*P* value
Ground glass,n(%)			
No	4	4	0.0002
Yes	60	22	
Consolidation,n(%)			
No	4	8	
Yes	60	18	0.0019
Bilateral lung involvement, n(%)			
No	3	5	0.419
Yes	61	21	
Crazy paving,n (%)			
No	50	24	0.110
Yes	14	2	
Pleural effusion,n(%)			
No	59	25	0.668
Yes	5	1	
Lesions distribution,n(%)			
Peribronchovascular			
No	22	18	0.0026
Yes	42	8	
Peripheral			
No			
Yes			
CSS≥18,n(%)			
No	16	14	0.0085
Yes	48	12	

Discussion

In the present study, we investigated the spectrum of HRCT findings consistent with diagnosis of COVID 19 pneumonia and comparison of HRCT findings with RTPCR in suspected COVID 19 patients and potential of the study to forecast future outcomes including negative health impact.

It was found that cases with ground glass opacity had greater probability of COVID-19 infection in comparison to those without .This CT finding had also acceptable level of sensitivity and accuracy.

In the study by Chenetal(9), consolidation was reported to be predictive for COVID-19 infection, which was inconsistent with our results. Concerning the diagnostic performance of CT scan, although it has good diagnostic sensitivity and specificity., It is advocated to use RT-PCR along with CT scan to reach precise result.

It was documented that CSS could be predictive for future outcome of COVID-19 infected patients, that is a higher total CSS is closely linked to unfavourable consequence of the disease. Similar to our results, thestudy by Al-Mosaweetal.(10) showed that the probability of RT-PCR positivity increases with increase in CT severity score.It has been observed that restricted number of studies have investigated the relationship between CSS and COVID- 19 status.

Our outcome shows that CSS can be used in collaboration with clinical findings for the Preliminary management of the suspected COVID-19 cases while waiting for RT-PCR results.It would be beneficial for clinicians and radiologists to arrive at a result for CSS to better identify the COVID-19 cases.

In relation to the negative outcomes of COVID-19, we evaluated whether the initial CT scan findings predicted mortality and disease severity.

In this respect we found that peribroncho- vascular distribution of lesions, number of lung zones involved, and total CSS were related with higher risk of negative outcome. Consolidation was

demonstrated to predict severe COVID-19 disease. Leietal.(11) showed that a higher CT severity score was associated with an increased mortality, which was in agreement with our results. On the other hand, number of lung zones involved did not predict mortality, which was not consistent with our findings.In the study by Liuet al.(12), which used the same criteria as the present study used for the disease severity(WHO),number of lung lobes involved and total CT score were directly correlated to disease severity. In other study, it was stated that the odds of adverse outcome(need for mechanical ventilation or mortality) is four times higher in patients with more than four lung zones involved than in those without. Auger et al. (13) reported that ground glass, crazy paving, and consolidation did not have a significant association either with invasive endotracheal ventilation or mortality. On the other hand, number of lung zones involved was associated with invasive endotracheal ventilation, but not with death.

As reported , there are contradictory results between studies on the predictive ability of CT scan findings for clinical outcomes of COVID-19. However, CSS is has the ability able to derive the future outcomes of the patients with COVID-19. It is suggested to endorse a boundary for CSS to differentiate high-risk from low-risk patients.

In the current study, we considered a limit for the negative outcomes and seen relatively higher connections between the study outcomes and CSS classification.A draw back of this study was that we only investigated the CT scan without repetition.Thus, it is suggested to perform longitudinal studies for prospective re-evaluation of the patient

Conclusion

Inconsistence with the outcome of our results it was found that CT scan findings had good diagnostic sensitivity and specificity. Patients with ground glass opacity had more possibility for having Covid 19 infection than those without and same with consolidation, peribronchovascular distribution of the lesions and number of lung zones involved predicted adverse outcomes of COVID-19 infection including mortality and disease severity. It was documented that CSS could be predictive for future outcome of COVID-19 infection,that is,a higher total CSS is closely linked to unfavourable consequence of the disease.CT scan findings in correlation with RTPCR reports can guide clinicians regarding management and predict b prognostic outcome of the disease.

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