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Role of ultra-low dose computed tomography (CT) in COVID-19 suspected patients: A cross sectional study

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Abstract
Background: This study aims to evaluate the accuracy of ultra-low-dose CT in detecting COVID 19 related chest findings in COVID 19 suspected patients.
Materials and Methods: 106 COVID 19 infection suspected patients who are referred for HRCT chest screening, were evaluated by CT using 128 slice CT scanner (Wipro GE Optima 660). Ultra low dose CT with kv 120 & mA 10 was used. The Ground glass opacities and consolidations will be assessed in every lobe and the severity and grading will be done.
CT severity score - in this both lungs are 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. All the values of each lobe is added and graded as mild (0-8), moderate (8-15) and severe (15-25). Then we will correlate the ultra low dose CT findings with RT-PCR results.
Results: Among the study population with RT-PCR positive, 67 (85.9%) of them ground glass opacity was present and 11 (14.1%) of them absent. The difference in proportion of Ground glass opacity between RT-PCR was statistically significant (p value <0.001).
Conclusion: It was observed that the ULD-CT images could detect Covid 19 related lung lesions in patients with suspected Covid 19 infection. Routine chest CT protocol can be replaced by ULD-CT with significant dose reduction, to detect lung lesions for COVID-19 diagnosis and follow-up.
ULD-CT plays a pivotal role in assisting physicians in the management plan & works as an indicator for disease severity & possible outcome.

Keywords: Ultra low dose CT (ULD-CT), COVID 19, Ground glass opacity (GGO), CT severity score, RT-PCR

Introduction
COVID-19 is an infectious disease caused by severe acute respiratory syndrome corona virus 2 (SARS-CoV-2), a strain of corona virus. As a result of the virus's global dissemination, COVID-19 has evolved into a significant source of concern within the medical community [1].
Nucleic acid amplification test (NAATs) such as RT-PCR for SARS-CoV-2 are designed to detect viral RNA. It is only possible to make a positive diagnosis, but the severity of COVID-19 and how it will progress cannot be determined by these tests.
Chest computed tomography (CT) findings have the potential to be used as both a diagnostic aid and a screening tool in individuals who are suspected of having the disease.
When a patient is clinically suspected of having COVID-19 but the NAAT results come back negative but the imaging results come back positive, the patient needs to be separated and treated as soon as feasible. When it comes to making a diagnosis of COVID-19, it should come as no surprise that a CT scan is superior [2].
CT scans are also helpful to assess the severity and progression of the disease.
When it comes to making a diagnosis of COVID-19, it should come as no surprise that a CT scan is superior [3].
This study aims to evaluate the accuracy of ultra-low-dose CT in detecting COVID 19 related chest findings in COVID 19 suspected patients.

Materials and Methods
This is a hospital based cross section study that was conducted from January 2021 to May 2022 in the department of Radio diagnosis, Mahatma Gandhi Medical College and Research

Hospital. All patients suspected to have COVID19 are referred to department of radio diagnosis for HRCT thorax will form the study population.

Inclusion criteria

All patients suspected to have COVID19 infection and referred to department of Radio -diagnosis for HRCT thorax and who would undergo throat swab.

Exclusion criteria

- Very sick patients, due to poor breath holding.
- Pregnant women.

Procedure

All COVID infection suspected patients who are referred to radiology department for HRCT chest screening were evaluated by CT using 128 slice CT scanner (Wipro GE Optima 660). Ultra low dose CT with kv 120 & mA 10 be used. Multiplanar 2D and 3D reformatted images will be generated on workstations from axial source images. The Ground glass opacities and consolidations will be assessed in every lobe and the severity and grading will be done.

CT severity score

In this both lungs are divided into five lobes, and each lobe was assessed individually. The abnormalities that were considered significant for the disease include the following: ground-glass opacity, consolidation, nodule, reticulation, interlobular septal thickening, crazy-paving pattern, linear opacities, sub pleural curvilinear line, bronchial wall thickening, lymph node enlargement, pleural effusion, and pericardial effusion.

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. All the valves of each lobe is added and graded as mild (0-8), moderate (8-15) and severe (15-25). Then we will assess whether ultra low dose CT is able to find the COVID chest findings in RT-PCR positive patients.

Data collection

All data was entered into a Data Collection Proforma Sheet (Appendix 1) and was entered into Excel (MS Excel 2019). Other biographical details were also collected including age.

Statistical methods

Statistical analysis was carried out using SPSS I. IBM SPSS Statistics Version 22 Statistical Software: Core System Users' Guide. SPSS Inc. 2014.

Results

A total of 106 cases were investigated, among the study population, the mean age was 47.05 ± 12.76. (Table 1).

Among the study population, 65.09% of them were male and 34.91% of them were female.

Among the study population, in 77.36% of them Ground Glass Opacity and 31.13% of them Consolidation were present.

Among the study population, 73.58%of them RT-PCR were positive.

Among the study population with RT-PCR positive, 67 (85.9%) of them Ground Glass Opacity was present, 11 (14.1%) of them were absent. The difference in proportion of Ground Glass Opacity between RT-PCR was statistically significant. (p value <0.001)

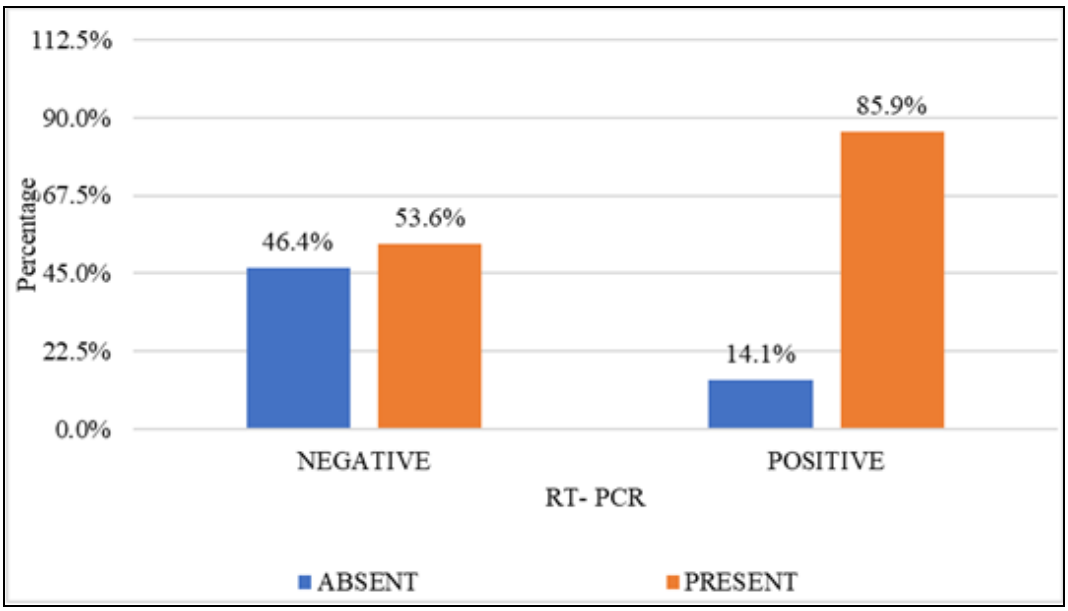

Fig 1: Cluster bar chart of comparison of Ground Glass Opacity between RT-PCR (N=106)

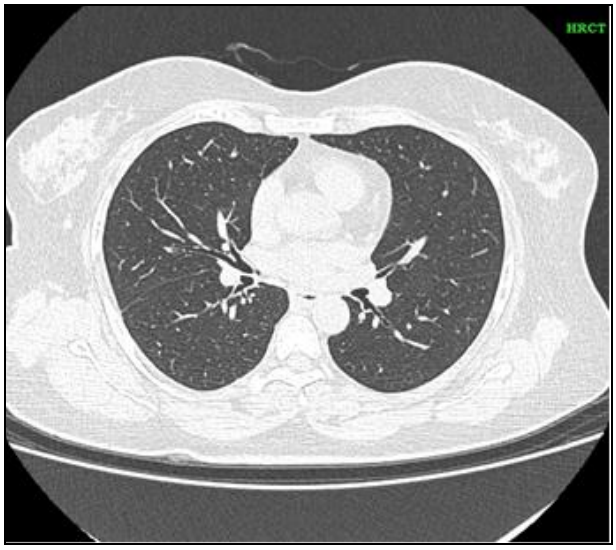

Fig 2: HRCT Axial thin section showing no evidence of any GGO and consolidation -- CO-RADS -1

Fig 3: HRCT Axial thin section showing bilateral pleural effusion and passive atelectasis of underlying segemnts with no evidence of any GGO – CO-RADS - 2

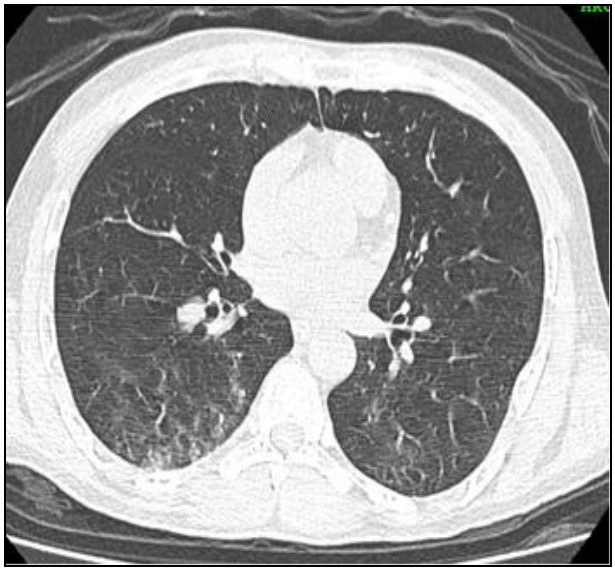

Fig 4: HRCT Axial thin section showing non rounded GGO in the right lower lobe basal segments with few areas of fibrotic bands in bilateral lungs – CO-RADS - 3

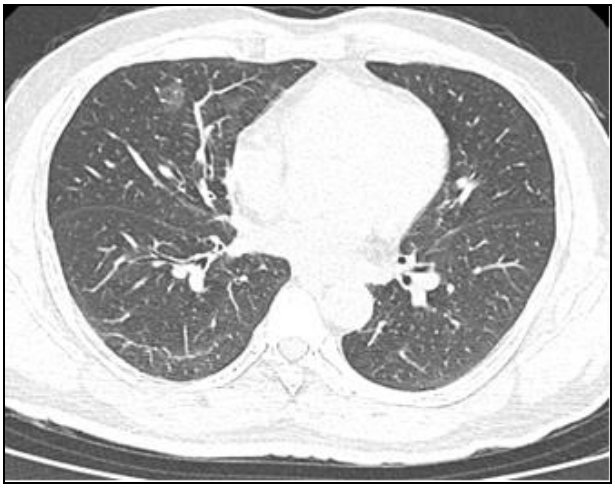

Fig 5: HRCT Axial thin section showing a focal GGO in the right upper lobe with no evidence of any consolidation – CO-RADS – 4

Fig 6: HRCT Axial thin section showing multifocal GGO and few consolidations in bilateral lung fields predominantly in the lower lobe segments with peripheral and subpleural predominance – CO-RADS - 5

Fig 7: HRCT Axial thin section of a RT-PCR positive patient showing multifocal GGO and few consolidations in bilateral lung fields predominantly in the lower lobe segments with peripheral and subpleural predominance – CO-RADS - 6

Discussion

The primary objective of the study was to assess the presence of ground glass appearance and consolidation in ultra-low dose CT imaging and calculate the CT severity index and to correlate ultra-low dose CT findings with RT-PCR results. Lung CT scan was crucial for COVID-19 screening and diagnosis because RT-PCR was unavailable, especially early in the pandemic. Chest CT imaging was performed for the triage of suspected patients in many medical facilities. This results is an increase in the frequency of chest CT scans and, as a result, a higher radiation exposure [4]. Patients are exposed to high levels of radiation when this high number of CT acquisitions is combined with repeated imaging for tracking the progression or absorption of the lesions. Therefore, for the sake of patient safety, minimizing the radiation dose became a top concern.

Since persistent GGO are frequently a marker of poor medical treatment progression, detection and management of GGO are key imaging characteristics in SARS-CoV-2 screening [5]. A hazy area of increased lung density known as a GGO preserves the underlying Broncho vascular borders, which when obscure, develop into consolidation. Among the study population, 77.36% of them Ground Glass Opacity were present and from that about 31.13% were presented with Consolidation. This becomes comparable with Hooman *et al*. study in which among 167 patient, only 22% had the Ground Glass Opacity among which 13% were presented with Consolidation and only 44 people were detected positive with RT PCR [7], and in our study we can observe that 74% of them were positive which is slightly greater from the above mentioned study. With the outbreak, a significant amount of research containing SARS-CoV-2 imaging patterns has entered the scientific community. Initial chest CT results for GGO initially showed bilateral lung involvement, however, over time this description altered to become a consolidative pattern [6].

In our study, ultra-low dose CT was found to be a minimally invasive imaging technique that had a significantly greater radiation dosage but significantly higher accuracy and inter-reader agreement than chest radiography. The CO-RADS median in our study was 5 which comes in concordance with another study in which the CO-RADS median value appears to be 5. They also concluded that when comparing with the PCR, the false-negative rate of 27.3%, CO-RADS has a sensitivity of 72.7% [8]. Therefore the CORADS system is not very sensitive, we cannot rely solely on it to rule out COVID-19 infection. Although the RT-PCR test is widely regarded as the gold standard for the diagnosis of COVID-19, it occasionally produces false-negative results in the early stages of the illness. Several patients with an initial false-negative RT-PCR result have had their diagnoses supported by CT results [7]. Chest CT may be used in these situations as the primary method for identifying COVID-19 in places where the disease is rife.

Hence, we compared the RT-PCR with Ground Glass Opacity and consolidation and the results revealed statistical significance (p<0.05). These results has been proven by various researchers with explanations. The area of consolidation lesions in the patients with negative initial RT-PCR results was smaller than the findings in those with positive initial RT-PCR results, according to their research. Similar findings were found in a recent study [9], where only two of the five patients exhibited mixed consolidation and all five showed ground glass opacification. According to a publication [3], consolidation lesions point to a pattern of organising pneumonia-related lung damage. In contrast to Conventional CT scan, our findings indicated that ultra-low-dose chest CT scan showed a very strong diagnostic performance for the diagnosis of lung infiltrates suggestive of viral pneumonia during the COVID-19 pandemic. In most anomalies, consolidation and GGO were present.

The lung tissue is where the illness first manifests itself. Patients who have been infected with Corona virus typically have bilateral ground-glass opacity lesions in the posterior and peripheral lungs, which is cited as a hallmark of Corona virus.

Because there are so many people infected with COVID-19 infection, there is increase in the number of people who require CT scans. In addition, individuals who are experiencing severe symptoms are frequently subjected to multiple imaging studies over the course of their disease.

Although it has been demonstrated that CT imaging is helpful, it is impossible to dismiss the possibility that a huge number of patients are subjected to higher radiation exposure.

It has been suggested that these patients could benefit from having ultra-low-dose computed tomography (ULDCT) performed instead of conventional computed tomography (CCT) with high accuracy because ground glass opacities (GGO) and consolidation are the predominant CT manifestations of COVID-19 that have been demonstrated to be adequately detected in ULDCT.

Table 1: Descriptive analysis of age in study population (N=106)

Parameter	Mean ± SD	Median	Minimum	Maximum
Age	47.05 ± 12.76	46.00	18.00	77.00

Table 2: Descriptive analysis of sex in the study population (N=106)

	Frequency	Percentages
Female	37	34.91%
Male	69	65.09%

Table 3: Descriptive analysis of Ground Glass Opacity in the study population (N=106)

Ground Glass Opacity	Frequency	Percentages
Absent	24	22.64%
Present	82	77.36%

Table 4: Descriptive analysis of consolidation in the study population (N=106)

Consolidation	Frequency	Percentages
Present	33	31.13%
Absent	73	68.87%

Table 5: Descriptive analysis of RT-PCR in the study population (N=106)

RT-PCR	Frequency	Percentages
Negative	28	26.42%
Positive	78	73.58%

Table 6: Comparison of Ground Glass Opacity between RT-PCR (N=106)

Ground Glass Opacity	RT-PCR		Chi square	P value
	Negative (N=28)	Positive (N=78)		
Absent	13 (46.43%)	11 (14.1%)	12.292	<0.001
Present	15 (53.57%)	67 (85.9%)		

Conclusion

It was observed that the ULD-CT images could detect Covid 19 related lung lesions in patients with suspected Covid 19 infection. Routine chest CT protocol can be replaced by ULD-CT with significant dose reduction, to detect lung lesions for COVID-19 diagnosis and follow-up.

ULD-CT plays a pivotal role in assisting physicians in the management plan & works as an indicator for disease severity & possible outcome. Combating COVID-19's recurrent waves is a difficult task, and minimally invasive techniques are crucial for a rapid and precise diagnosis. This problem might be overcome through ULD-CT imaging. Additionally, the presence of consolidation, GGO, the atoll sign, and the crazy-paving pattern in the pictures of COVID-19 patients demonstrates that the ULD-CT imaging modality is a feasible diagnostic tool for both the early detection and follow-up of COVID-19.

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Conflict of Interest

Not available

Financial Support

Not available

References

1. Bhandari S, Bhargava A, Sharma S, Keshwani P, Sharma R, Banerjee S. Clinical profile of COVID-19 infected patients admitted in a tertiary care hospital in north India. J Assoc Physicians India. 2020;68:13-17.
2. Shahriarirad R, Khodamoradi Z, Erfani A, *et al*. Epidemiological and clinical features of 2019 novel coronavirus diseases (COVID-19) in the South of Iran. BMC infectious diseases. 2020;20(1):1-2.
3. Shahriarirad R, Khodamoradi Z, Erfani A, *et al*. Epidemiological and clinical features of 2019 novel coronavirus diseases (COVID-19) in the South of Iran. BMC infectious diseases. 2020;20(1):1-2.
4. Radmard AR, Gholamrezanezhad A, Montazeri SA, Kasaeian A, Nematol Lahy N, Molaee Langrudi R, *et al*. A multicenter survey on the trend of chest CT scan utilization: tracing the first footsteps of COVID-19 in Iran. Arch Iran Med. 2020;23:787-793.
5. Pan F, *et al*. Time course of lung changes on chest CT during recovery from, novel coronavirus (COVID-19) pneumonia. Radiology; c2020. p. 200370.
6. Huang C, *et al*. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. Lancet. 2020;395(10223):497-506.
7. Bahrami-Motlagh H, Moharamzad Y, Izadi Amoli G, *et al*. Agreement between low-dose and ultra-low-dose chest CT for the diagnosis of viral pneumonia imaging patterns during the COVID-19 pandemic. Egypt J Radiol Nucl Med. 2022;53:14.
8. Mohammed R, Hosny M, Samy T. Description of the CT chest findings in COVID-19 infection and validation of CORADS criteria in establishing diagnosis. Benha Medical Journal. 2022;39:349-357. Doi: 10.21608/bmfj.2022.113050.1522
9. Xie X, Zhong Z, Zhao W, Zheng C, Wang F, Liu J. Chest CT for typical 2019-nCoV pneumonia: relationship to negative RT-PCR testing. Radiology; c2020 Feb 12. [Epub ahead of print]
10. Kanne JP. Chest CT findings in 2019 novel coronavirus (2019-nCoV) infections from Wuhan, China: Key points for the radiologist. Radiology. 2020; 295:16–17.

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