



“ROLE OF MDCT THORAX IN EVALUATION OF PULMONARY FINDINGS IN COVID-19 PATIENTS.

Radiology

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ABSTRACT

AIMS & OBJECTIVES:

- The study aims at early detection and extent of the pulmonary involvement in patients who were suspected of COVID-19 and those who were RT-PCR test positive.
- To evaluate the pulmonary findings in patients with COVID-19 disease.

METHODS: MDCT was performed on 128 slice Philips CT Scanner machine on 105 patients with the age group varying from 6 years to 60 years (56 males and 49 females) from March 2020 to May 2020 in our SVP hospital, NHL MMC, Ahmedabad. No gender and age bias was followed.

Chest X-rays of all patients were also evaluated. **RESULT:** Our study shows that out of 105 patients, with age group varying from 6-60 years, including 56 males and 49 females; 86 patients had typical CT features of COVID-19, 06 patients had indeterminate features, 03 patients had atypical features of COVID-19 and 10 were normal. The commonest finding was ground glass opacities/ consolidation with interstitial septal thickening. Few of them showed associated findings like cardiomegaly, pleural effusion, lung nodules etc **CONCLUSION:** CT Thorax plays an important role in assessment of extent of disease and follow up of COVID-19 patients. It aids in early detection of pulmonary features in suspected patients.

KEYWORDS

MDCT Thorax, Typical, Indeterminate And Atypical Features, RT-PCR

INTRODUCTION:

The corona virus infection outbreak initially began in December 2019, in wuhan, Capital of China. The patients were admitted in our SVP hospital since mid march 2020. Mortality is extremely high in critically ill patients with COVID-19 and elder patients with comorbidities are at increased risk of developing critical illness and death.

The RT-PCR test for COVID-19 is believed to have high specificity, but the sensitivity has been reported to be as low as 60-70%(10,11). Cases were reported in RT-PCR test can give false negative results in the early stages of the disease. CT findings have confirmed the diagnosis in the number of the patients with an initial false negative RT-PCR result(16). In this light, the role of chest computed tomography(CT) in COVID-19 has evolved.

COVID-19 presents with CT findings that partially overlap with other diseases, like viral infections, but also shows characteristic features seen less frequently in other settings.

The *RSNA consensus statement on reporting*, proposes standardized nomenclature and an imaging classification for COVID-19 pneumonia that involves four categories:(i.e. typical appearance, indeterminate appearance, atypical appearance and negative for pneumonia(18).

We present a study of the MDCT thorax and Chest X-ray findings in 105 patients (either suspected or positive RT-PCR) with COVID-19 disease.

MATERIALS AND METHODS:

Study Population

105 patients

Study Site

SVP Hospital
NHL MMC Ahmedabad

Study Period

- 2 months from March 2020 to May 2020
- Age group from 6-60 years.

Inclusion Criteria:

- All patients undergoing a chest CT scan who were RT-PCR test positive or suspected of COVID-19 infection, based on symptoms of lower respiratory tract infections including cough, sore throat and clinically relevant dyspnoea with or without fever.
- Patients with first negative RT-PCR test result; but a clinical diagnosis of COVID-19 according to clinical records(PCR-/Clinical+).
- No age group and gender bias was followed.

Methodology:

- A Retrospective study of the role of MDCT in diagnosing COVID-19 pneumonia on the basis of radiological findings.
- 105 patients were evaluated who were admitted to the hospital with clinical suspicion of COVID-19 and in whom RT-PCR test was performed.
- All scans were performed on 128 slice Philips CT Scanner.
- As per the CT protocol of the department; the protocol which was followed is as follow:
- Written consents were signed by the patients and/ or relatives for getting CT scan study done.
- Patient were asked to remain Nil by mouth and for serum creatinine needed for the contrast study.
- History of allergy were asked to the patient.
- Breath holding technique was explained to the patient whenever it was feasible.
- Scanning options

1. Plain High resolution computed tomography thorax scan.
- CT scan were done on multidetector scanner from the philips company which is installed in our department.
- Plain High resolution CT scan was reconstructed in lung window and soft tissue window.
- Volumetric data was reconstructed in the multiple planes.

Scan Parameters:

1. Slice thickness- 1.00 mm
2. Collimation- 128 x 1.00
3. Pitch-0.95
4. mAS-160
5. Kvp-120

Patient characteristics(age),clinical diagnosis and RT-PCR results were extracted from the patient records. These data allowed stratification of all patients into one of the following two groups: patients with positive RT-PCR result for SARS-CoV-2, patients with one negative RT-PCR result but a clinical diagnosis of COVID-19 according to clinical records(PCR-/Clinical+).

- All CXRs were acquired as computed or digital radiographs following usual protocols.
- CXRs were acquired in the posteroanterior (PA) or antero-posterior(AP) projections.

Assessment Standards:

- Typical, indeterminate and atypical features of COVID-19 pneumonia.

Statistical Analysis

- All data was analysed using the Microsoft Excel software. Statistical analysis of data was done after compiling and tabulation of data.

RESULTS:

The study includes 56 males and 49 females with age group varying from 6-60 years.

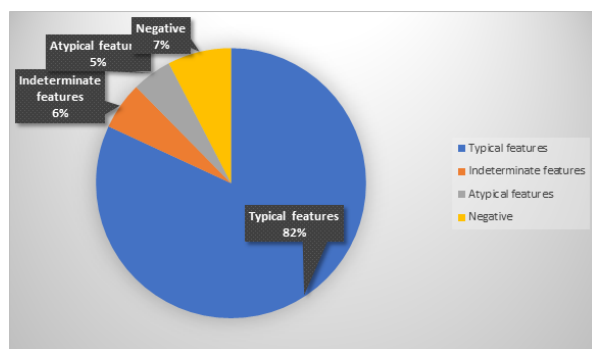


CHART 1- HRCT FINDINGS IN STUDY OF 105 COVID-19 PATIENTS

TABLE 1- TYPICAL FEATURES OF COVID-19 ON HRCT SCAN:

FINDINGS	NO. OF PATIENTS (%)
Bilateral ground glass opacities	13(12.38)
Bilateral ground glass opacities with interstitial septal thickening	41(39.04)
Bilateral consolidation with ground glass opacities	32(30.47)

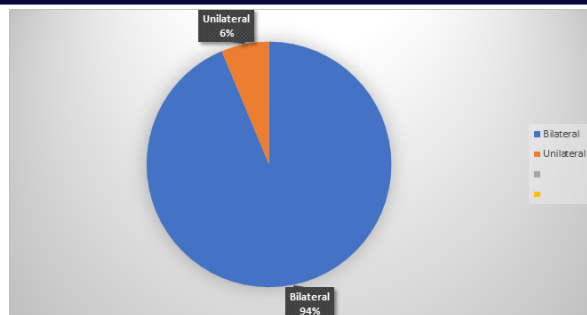
Among typical features of COVID-19 on CT scan ; ground glass opacities with interstitial septal thickening were the commonest finding followed by consolidation with ground glass opacities.

TABLE 2- INDETERMINATE FEATURES ON HRCT SCAN:

FINDINGS	NO. OF PATIENTS (%)
Multifocal unilateral ground glass opacities	4 (3.8)
Multifocal unilateral ground glass opacities with consolidation	2 (2)

TABLE 3- ATYPICAL FEATURES ON HRCT SCAN:

FINDINGS	NO. OF PATIENTS (%)
Lobar and segmental consolidation	05 (4.7)
Pulmonary nodules	03 (2.9)
Pleural effusion	04 (3.8)



PERCENTAGE OF UNILATERAL AND BILATERAL LUNG FIELD INVOLVEMENT:

TABLE 4-DISTRIBUTION AND PATTERN OF FINDINGS :

Peripheral subpleural distribution	25
Subpleural and peri-bronchovascular distribution	67
Crazy paving pattern	32
Traction bronchiectasis	48
Subpleural fibrotic changes	34

Most common pattern of lung field involvement was bilateral involvement with pre-dominant sub-pleural and peri-bronchovascular distribution

TABLE 5-OTHER ASSOCIATED FINDINGS:

FINDINGS	NO. OF PATIENTS
Cardiomegaly	23
Cavitation	01
Pleural effusion	04
Pulmonary emphysema	15
Pulmonary nodules	03

TABLE 6-FREQUENCY OF LOBE INVOLVEMENT:

Right upper lobe	81
Right middle lobe	74
Right lower lobe	91
Left upper lobe	85
Left lower lobe	89

Predominant involved lobes were bilateral lower lobes

TABLE 7-Radiographic findings in COVID-19 PNEUMONIA in Chest Radiography

Findings	Number of patients
No. of normal chest radiographs	18
No. of abnormal chest radiographs	87
Parenchymal opacities :	
Consolidation	39
Ground glass opacities	48
Distribution:	
Peripheral predominance	79
Upper zone predominant	82
Lower zone predominant	85
Bilateral lungs	79
Other findings:	
Cardiomegaly	20
Blunting of costophrenic angle-Pleural effusion	04

DISCUSSION:

- RT-PCR test is the standard test for diagnosis of COVID-19; but sensitivity is only 60-70%. HRCT plays an important role in the diagnosis of the disease.
- COVID-19 Pneumonia has a high mortality rate in patients with diabetes, hypertension and other co-morbidities and elderly patients(14)
- The *RSNA expert consensus statement on reporting*, proposes standardized nomenclature and an imaging classification for COVID-19 pneumonia that involves four categories: (i.e. typical appearance, indeterminate appearance, atypical appearance and negative for pneumonia(18).

Typical features are:

1. Peripheral , bilateral(multi-lobar), GGO w/ or w/o consolidation or visible intralobular lines('crazy paving").
2. Multifocal GGO of rounded morphology w/ or w/o consolidation or visible intralobular lines('crazy paving")
3. Reverse halo sign or other findings of organizing pneumonia.

Indeterminate features are:

Absence of typical features AND the presence of:

1. Multifocal, diffuse, perihilar or unilateral GGO w/ or w/o consolidation, lacking a specific distribution, & are non-rounded or non-peripheral
2. Few very small GGO with a non-rounded & non-peripheral distribution.

Atypical features are:

Absence of typical or indeterminate features and the presence of:

1. Isolated lobar or segmental consolidation w/o GGO.
2. Discrete small nodules (centrilobular, tree in bud).
3. Lung cavitation.
4. Smooth interlobular septal thickening w/without pleural effusion.

Negative:

No CT features to suggest pneumonia.

The predominant CT findings of COVID-19 infection are bilateral, peripheral, and basal predominant ground glass opacities, consolidation or both.(12,13). Ground glass opacities has also been frequently reported to have round morphology or a "crazy paving" pattern. (15,12). Song Fengxiang et al (17) included 51 patients and found that 30% of the lesions were pure ground glass opacities, 39% were ground glass opacities with interstitial septal thickening, 18% were ground glass opacities with consolidation , 13% were consolidation lesions. In our study we found that most common findings were bilateral ground glass opacities with interstitial septal thickening(39.04%) followed by bilateral consolidation with ground glass opacities(30.4%) and bilateral pure ground glass opacities(12.3%) with predominant bilateral involvement in subpleural and peri-bronchovascular distribution. Bilateral and multifocal involvement is more than unilateral involvement in our study.

As in some cases ; RT-PCR test can give false negative results in the early stages of the disease. CT findings have confirmed the diagnosis in the number of the patients with an initial false negative RT-PCR result(16). In our study about 18 patients who initially had negative results from a RT-PCR test showed the typical CT findings for diagnosis of the disease and were tested positive on retesting. This report showed that MDCT Thorax has high sensitivity and the presence of typical CT findings could be helpful for the initial screening in the individuals who are false-negative for RT-PCR test.

Of the 105 patients in our study group; positive CT findings diagnostic of COVID-19 pneumonia were available before a positive laboratory test result in 57(54.2%) patients.

In our study other findings seen were sub-pleural fibrosis and traction bronchiectasis in lung fields, pleural effusion, lung parenchymal nodules, cardiomegaly, cavitation.

Chest X-ray is insensitive in the detection of early disease but it can be useful for the follow up imaging of the disease progression. 18 patients had normal chest Xray but CT showed typical features of COVID-19 Pneumonia in 10 patients out of those 18 patients.

Chest CT is superior to the chest X-ray in the evaluation of extent of the pulmonary involvement. In our study 87 patient had abnormal findings on chest Xray but exact distribution and pattern could be well-established on chest CT scan.

To summarize the commonest CT chest findings in COVID-19 disease were subpleural and peri-bronchovascular ground glass opacities/consolidation with or without interstitial septal thickening and bronchiectasis with bilateral involvement being more common.

CONCLUSION:

CT plays an important role in the diagnosis and extent of pulmonary involvement of COVID-19 pneumonia.

It helps to diagnose the disease even if RT-PCR test is negative so that patient can be treated accordingly.

The use of CT for diagnosis of the COVID-19 pneumonia allows the patients with suspected COVID-19 infection to be isolated and treated in time for recovery, thus optimizing patient management.

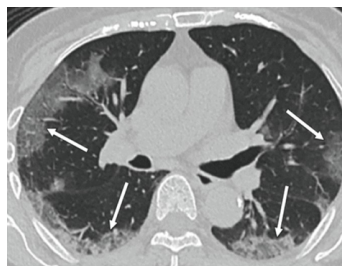


Figure 1 : Axial and Sagittal CT images shows subpleural and peri-bronchovascular ground glass opacities and consolidation.

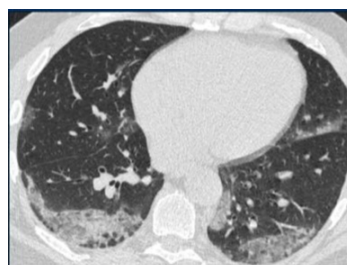


Figure 2 : Axial and Sagittal CT images shows subpleural and peri-bronchovascular ground glass opacities and consolidation.

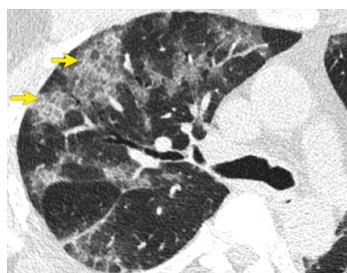


Figure 3: Axial CT image shows subpleural and peri-bronchovascular ground glass opacities with interstitial septal thickening(crazy paving appearance).



Figure 4: Axial CT images shows bilateral subpleural and peri-bronchovascular ground glass opacities.



Figure 5: Axial CT images shows bilateral subpleural and peri-bronchovascular ground glass opacities with interstitial septal thickening and traction bronchiectasis.



Figure 6: Axial CT images shows subpleural bands (fibrosis) with ground glass opacities.



Figure 7: Axial CT images shows bilateral diffuse subpleural and peri-bronchovascular ground glass opacities.

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