## Original Articles

# "MDCT findings in Novel Covid-19 disease in survivors and non-survivors"

**Dr. Rushabh H. Shah*, Dr. Chhaya J. Bhatt**

*2nd year resident; Department of Radio-diagnosis, **Department of Radio-diagnosis; SVP Hospital; Smt. NHL Municipal Medical College; Ahmedabad.

**ABSTRACT**

**AIMS AND OBJECTIVES:**

1. To compare the CT findings between survivors and non survivors diagnosed with COVID-19 infection.

2. To correlate the severity of CT scan findings by CT Severity Score in COVID - 19 pneumonia helping to predict prognosis of patients diagnosed with COVID-19 infection.

**METHODS:** MDCT was performed on 128 slice PHILIPS CT Scanner machine on 80 patients from APRIL 2020 to OCTOBER 2020 in our SVP Hospital, NHLMMC, Ahmedabad. No age and gender bias was followed.

**RESULT:** Our study shows that out of 80 patients(40 survivors and 40 non-survivors) studied, 37 patients showed ground glass opacities as the commonest finding. Out of 40 non survivors studied, 25 patients had CT Severity Index of > 18 and 15 patients showed crazy pavement appearance. Out of 40 survivors studied, 37 patients had CT Severity index of ≤18 and only 6 patients showed crazy pavement appearance.

**CONCLUSION :** From comparison between survivors and non survivors, the study concluded that non survivors had crazy paving pattern with increased CT severity index as compared to survivors. Thus, we concluded that CT Severity index helps us in predicting the prognosis of the patients. Higher the CT Severity index , higher the chances of mortality and morbidity. Parenchymal pattern that can help in predicting the prognosis is appearance of the crazy paving pattern which may increase the rate of mortality.

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## INTRODUCTION

The corona virus infection outbreak initially began in December 2019, in Wuhan, Capital of China.

Since the outbreak of COVID-19 started in India, HRCT of the patients who were suspicious and those with RT-PCR positive are being done at our institution in SVP Hospital. We have our own institutional experience of COVID-19 pneumonia. Number of HRCT findings are considered classic for COVID 19 infection with severity of these findings can help in predicting the prognosis of the patient.

## MATERIALS AND METHODS

Retrospective observational study

## DURATION OF THE STUDY

From APRIL 2020 to OCTOBER 2020

## STUDY SITE

Department of Radio-Diagnosis; SVPIMSR

Smt. NHL MMC; Ahmedabad.

## INCLUSION CRITERIA

- All patients with positive RT-PCR result forSARS-CoV-2/Suspected for COVID during the specified period
- 40 survivors and 40 non survivors with no age group and gender bias followed.
- HRCT Scan and Pulmonary Angiography with contrast study was being done (if required) as per protocol of the department.

**Imaging Parameters:**

All scans were performed on 128 slice PHILIPS CT Scanner. Scan Parameters:

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

**Exclusion criteria : None**

Clinical and Laboratorical data was extracted from HIS and noted. This included CRP, IL-6 and Serum Ferritin levels.

**Correspondence Address** : **Dr. Rushabh H. Shah**
A-804, Sagar Samrat Flats, Near Jalaram Temple, Ellisbridge, Ahmedabad-380006
Email : rhshah19951995@gmail.com

## METHOD

- Volumetric data was reconstructed in the multiple planes.
- A semi-quantitative CT score was calculated based on the extent of each lobar involvement.
    - <5% lung parenchyma involved =1
    - 5-25% lung parenchyma involved =2
    - 25-50% lung parenchyma involved =3
    - 50-75% lung parenchyma involved =4
    - >75% lung parenchyma involved =5

The total CT score would be the sum of the individual lobar scores and can range from 0(No involvement) to 25(Maximum involvement), when all the five lobes show more than 75% involvement.

CT Severity index <10 is considered to be **MILD** involvement.

CT Severity index 10-18 is considered to be **MODERATE** involvement.

CT Severity index >18 is considered to be **SEVERE** involvement.

Pattern of parenchymal involvement was compared between 2 groups.

Parenchymal patterns were grouped in four categories:

It included:

1. Types of parenchymal involvement:
    a. Presence of ground glass opacities
    b. Presence of ground glass opacity and dense consolidation
    c. Crazy paving pattern(Ground glass opacity with interstitial septal thickening) d.Presence of crazy paving pattern and dense consolidation
2. Site:
    a. Subpleural
    b. Peribronchovascular
3. Lobes involved:
    a. Unilateral/ Bilateral
    b. Upper/ Middle/Lower lobes

Patients survival status was extracted from the patient records. These data allowed stratification of all patients into following two groups:

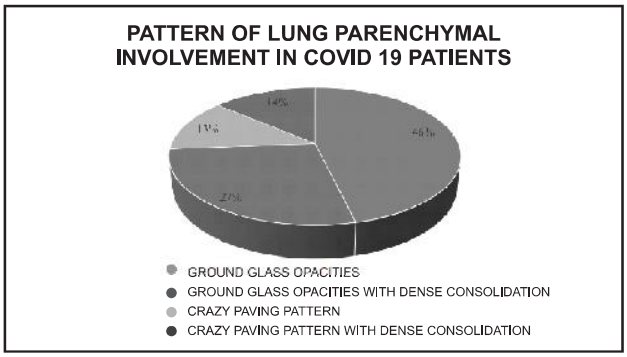
- Patients who survived COVID -19 infection
- Patients who did not survive COVID -19 infection

## RESULTS

The study includes 40 survivors and 40 non-survivor patients with confirmed COVID -19 infection. Mean Age Group : 15-85 years

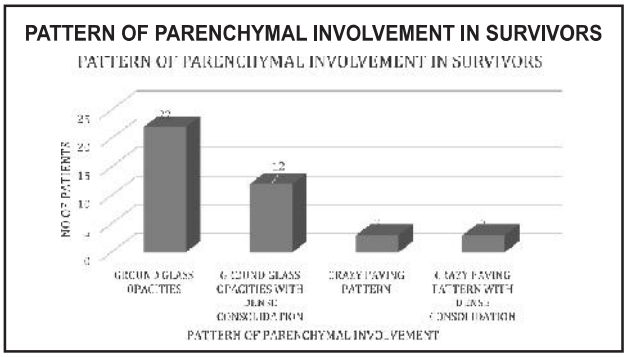
Clinical Symptoms : Fever (83%), Cough (68%) and Dyspnoea (40%)

**CHART 1: VARIOUS PATTERNS OF COVID 19 PNEUMONIA PATIENTS ON HRCT THORAX**



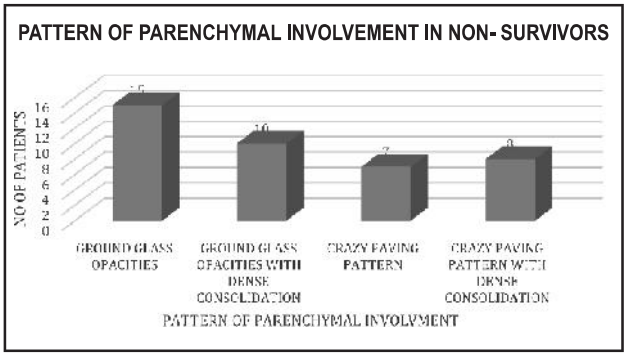

**Most common pattern of lung involvement in COVID19 pneumonia was ground glass opacities.**

**CHART 2: CT PATTERN IN COVID 19 SURVIVORS**



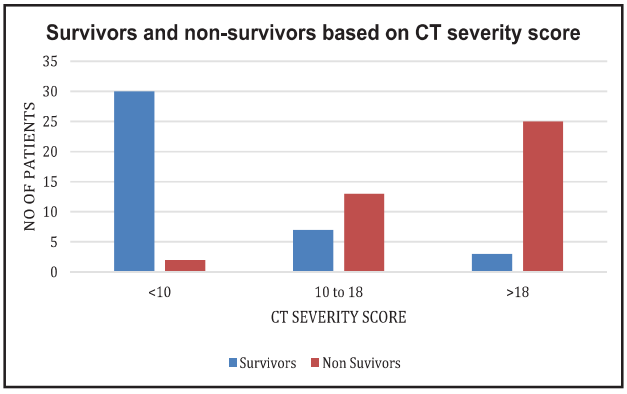

**Crazy paving pattern was less commonly seen in COVID 19 survivors.**

**CHART 3 : CT PATTERN IN COVID 19 NON SURVIVORS**



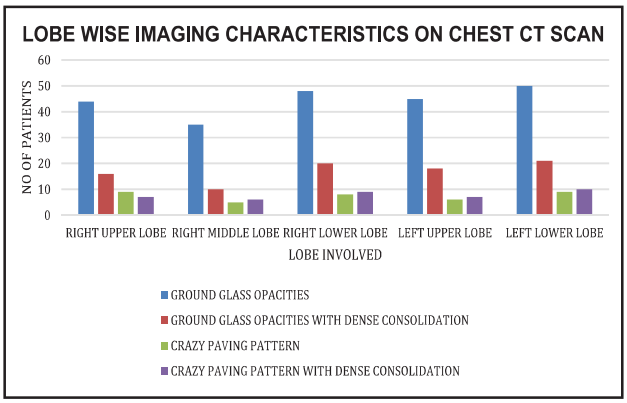

**Crazy paving pattern was more commonly seen in COVID 19 non-survivors.**

**CHART 4 : CT SEVERITY SCORE IN COVID 19 SURVIVORS AND NON SURVIVORS**



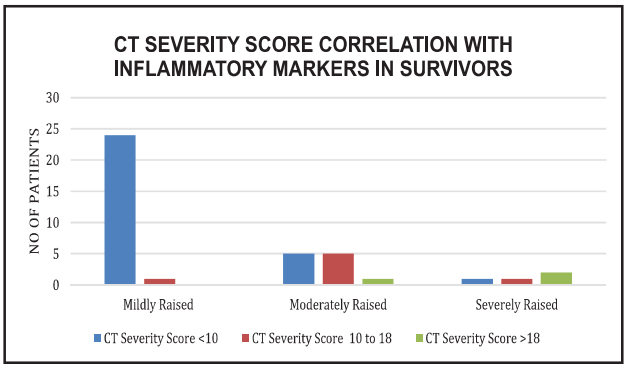

**CT severity score >18 was associated with increased mortality in COVID 19 pneumonia patients.**

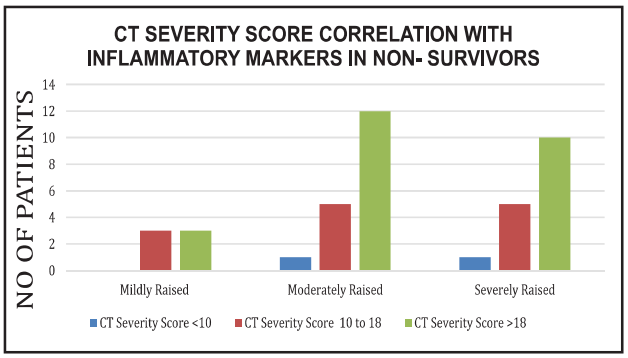
**CHART 5: LOBE WISE IMAGING CHARACTERISTICS ON CHEST CT SCAN**




**All 4 patterns of lung parenchymal involvement was more commonly seen in bilateral lower lobes as compared to other lobes.**

**CHART 6: CT SEVERITY SCORE CORRELATION WITH INFLAMMATORY MARKERS IN SURVIVORS AND NON SURVIVORS**




**Significant correlation is seen between CT Severity Index and Inflammatory markers.**

**Increased CT Severity Index was associated with increased inflammatory markers in both survivors and non survivors.**

## DISCUSSION

On January 30th, 2020 WHO declared COVID 19 as a sixth health emergency deserving international attention. COVID-19 is highly contagious and has spread world wide. HRCT Thorax can be considered as standard test for prognosis of COVID-19 pneumonitis.

The outbreak of COVID-19 has had a strong impact worldwide. Almost all countries have suffered huge losses in health, society and economy. Our results may be potential risk factors to identify patients with poor prognosis, help clinicians to provide earlier interventions for these patients, and improve their survival rate.

Currently RT-PCR has been identified as the most effective and accurate way to diagnose COVID 19 infection; but imaging - specifically CT scans can be helpful in assessing the extent and outcome of the disease. Pin-pointing measurable features of CT scans could go even further in augmenting evaluation and triage of patients.

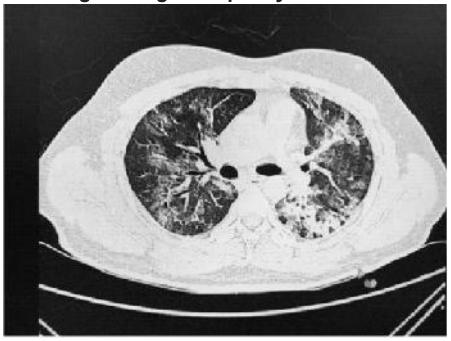
Chest CT imaging plays an important role in the diagnosis and dynamic evaluation of COVID-19. Typical imaging features of multiple ground-glass opacities and/or consolidations in patients with COVID-19 pneumonia have been detailedly described in previous reports. From the current study, we found that GGO and GGO with consolidation were the most predominant imaging features in patients who died from COVID-19, which is correlated with the pathological findings of COVID-19 that severe inflammatory exudation in intra-alveolar spaces and hyaline membrane formation. The severity score of

lung involvement in patients who died from COVID-19 was also significantly greater than that in patients with mild to moderate COVID-19. What is more, the mild-moderate correlation between chest CT severity scores and systemic inflammation activation was also preliminarily demonstrated in this study. Therefore, the imaging features and dynamic changes could provide the most direct evidence for assessing the severity of the disease and the prognosis.

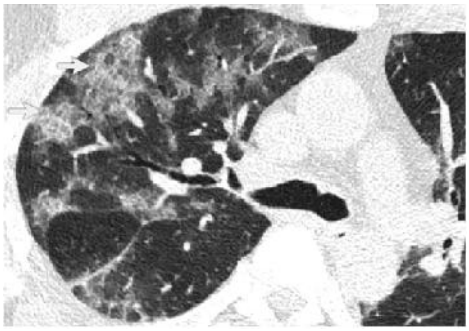
The predominant CT findings of COVID-19 infection are bilateral, peripheral, and basal predominant ground glass opacities, consolidation or both. Ground glass opacities has also been frequently reported to have round morphology or a "crazy paving" pattern. Song Fengxiang et al included 51 patients and 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. [12] In our study we found that most common findings were bilateral ground glass opacities (46 %) followed by crazy paving pattern (27%) and bilateral ground glass opacities with consolidation (27%) with predominant bilateral involvement in subpleural and peri-broncho-vascular distribution. Bilateral and multifocal involvement is more than unilateral involvement in our study.

**(A) Presence of ground glass opacities**

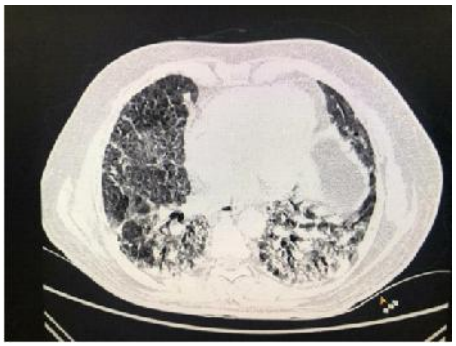
**(B) Presence of ground glass opacity and dense consolidation**



**( C ) Crazy paving pattern(Ground glass opacity with interstitial septal thickening)**



**( D ) Presence of crazy paving pattern and dense consolidation**



## CT INVOLVEMENT SCORE

The severity of the lung involvement on the CT correlates with the severity of the disease. There are 2 methods for the assessment of CT severity score:

1) By scoring the percentages of each of the five lobes that is involved:

1. < 5% involvement
2. 5%-25% involvement
3. 26%-49% involvement
4. 50%-75% involvement
5. > 75% involvement.

The total CT score is the sum of the individual lobar scores and can range from 0 (no involvement) to 25 (maximum involvement), when all the five lobes show more than 75% involvement.

Some say that the percentage of lung involvement can be calculated by multiplying the total score times 4.

This however is not true. Suppose that all lobes have a 10% involvement, then this would lead to an overall score of 10, which could lead to the impression that 40% of the lungs are involved.[9]

On reviewing this retrospective study, a CT score of ≥ 18/25 was associated with increased mortality risk and was found to be associated with increased risk of mortality. Similar findings were concluded in a study performed by Marco Francone, Franco Lafrate and Carlo Catalano.[3,1]

## CONCLUSION

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

The CT severity score and certain pattern of parenchymal involvement like crazy paving pattern demonstrated a significant correlation with the patients' mortality and severity of illness in COVID-19 pneumonia.

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