

## A STUDY OF CORRELATION OF HRCT THORAX AND RTPCR TESTING IN ATYPICAL PNEUMONIA PATIENTS

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### ABSTRACT:

**Introduction:** Our aim is to correlate the outcome of patients, RTPCR testing with COVID-19 infection with the 25-point CT severity score by Chang et al. (devised for assessment of ARDS in patients with SARS in 2005). **Materials and Methods:** Data of 200 consecutive symptomatic patients who were suspected to have COVID-19 infection and presented to Internal Medicine wards, dedicated ICU were collected. All patients underwent two consecutive RT-PCR tests and had a HRCT scan done at presentation. **Results:** In the present study, from total number of participants (n=200) there are 55.50% male participants and 44.50% female participants. Age ranges of the patients from 35 year to 84year. The mean age of study participants was found to be  $60.37 \pm 11.30$  years. In our study majority of patients belonged to moderate and severe CT category (45% and 44.5% respectively) and a small portion of mild category (10.5%). Our study showed significant association between CT severity grading and biomarkers level. Less severe CT results were connected with better outcomes, while more severe scan results were associated with a higher death rate. In our study, 56 patients (28%) out of 200 died. Death rates range from 4.76% (1/21) for the light group to 23.33% (21/90) and 28% (34/89) for the moderate and severe categories, respectively. ( $p = 0.003$ ). **Conclusion:** The COVID-19 severity and the 25-point CT severity score are highly correlated. Our findings indicate that the COVID-19 illness prognosis can be predicted with the help of the chest CT scoring system, which has a strong relationship with laboratory results and oxygen consumption.

**Keywords:** Atypical pneumonia, COVID'19, CT, severity score, HRCT thorax

### INTRODUCTION:

A pandemic with substantial effects on the sociopolitical environment and healthcare delivery systems, COVID-19 is an infection that spread widely and quickly throughout the world [1]. It was an unexpected and unprecedented difficulty because the clinical manifestations ranged from asymptomatic carriers to patients needing assisted ventilatory support, and ICU stays with higher mortality [2, 3]. The diagnostic test chosen as the benchmark for confirming illness is the nasopharyngeal swab RT-PCR test [4]. The test is an effective tool, but a tiny but considerable percentage of false-negative results have been recorded [5]. A HRCT chest imaging is crucial and vital in controlling and detecting early illness, especially in patients with false-negative RT-PCR results. As well as in controlling and observing the progression of the illness [6]. Additionally, it is possible to determine the severity of the disease from the imaging results, which considerably aids physicians in using their clinical judgment and

guarantees appropriate and prompt care [7]. The severity of the disease in critically sick patients can also have an impact on prognosis, allowing for the proper choice of early intensive care participation [8, 9]. Several research have investigated the pulmonary involvement on the chest computed tomography images using both quantitative software analysis and ocular evaluations [10, 11]. Ours is the first in-depth study that we are aware of that describes the relationship between the severity ratings on a chest CT and the clinical profile of COVID-19 illness patients in the Gulf and Arab region. Our study compares the clinical severity of the patients whose COVID-19 condition was confirmed by the 25-point visual quantitative assessment to the CT severity score.

### MATERIAL AND METHODS:

The Institutional Review Board gave its ethical approval. As recommended by the ethics committee, informed permission was not required. We collected clinical and laboratory data for analysis from 200

patients who presented with atypical pneumonia in RNT medical and associated group of hospitals and underwent a chest HRCT scan in a cross-sectional study at Internal Medicine wards, dedicated ICU of RNT Medical College and Attached Group of Hospitals. The Picture Archiving and Communication Systems (PACS) were used to gather and assess the data for the chest HRCT images.

**INCLUSION CRITERIA:**

- Patients giving consent and willing to participate in the study.
- Patients presenting with atypical pneumonia and both COVID 19 RTPCR positive and negative.
- Patients giving consent for HRCT thorax

**EXCLUSION CRITERIA:**

- Patients with serious mental illness.
- Patients with H<sub>1</sub>N<sub>1</sub> status positive.

**HRCT Inspection:**

On the day of the patient's presentation, a VCT GE 64 scanner was used to complete each patient's initial chest HRCT scan. Patients were positioned supine and instructed to hold one breath. These were the scanning parameters: scan direction (craniocaudally), tube voltage (120 kV), tube current (100-600 mA)-smart mA dose modulation, slice collimation (64 0.625 mm), width (0.625 0.625 mm), pitch [1], rotation time (0.5 s), and scan length (60.00-1300.00 s).

**HRCT Image Analysis:**

Radiologists assessed the photos to determine the patient's disease severity score. First, the scans were evaluated to see if they showed the typical COVID-19 pneumonia symptoms (bilateral, multilobe, posterior peripheral ground-glass opacities), which can be either positive or negative. The following rating system, which is based on a visual evaluation of each affected lobe, was subsequently used to determine the severity [12–15].

**OBSERVATIONS & RESULTS:**

**Table 1: Age Distribution**

AGE GROUP	Total		RTPCR Negative		RTPCR Positive	
	No.(n=200)	%	No.	%	No.	%
25-44	17	8.50%	10	8.00%	7	9.33%
45-65	110	55.00%	68	54.40%	42	56.00%
>65	73	36.50%	47	37.60%	26	34.67%
<b>TOTAL</b>	200	100%	125	100%	75	100%
<b>MEAN AGE</b>	60.37±11.30		60.29 ± 11.38		60.34 ± 11.30	

**P VALUE= 0.891**

The mean age of study participants was 60.37±11.30years. Age ranges from 35 to 84 year. In this study I have total 200 patients, out of which 125 patients were RTPCR negative and 75 were RTPCR positive. Age distribution of patient states that majority of covid 19 patients (RTPCR Negative,68 and RTPCR positive,42) belonged to 45–65year age group, followed by 47 and 26 patients of >65 year age group in RTPCR Negative and RTPCR positive respectively. Minimum patients belonged to 25 -44year age group.

**Table 2: Sex Distribution of Study Participants**

SEX	Total		RTPCR Negative		RTPCR Positive	
	No. (n=200)	%	No.	%	No.	%
Male	111	55.50%	60	48.00%	51	68.00%
Female	89	44.50%	65	52.00%	24	32.00%
<b>TOTAL</b>	200	100%	125	100%	75	100%

**P VALUE=0.005**

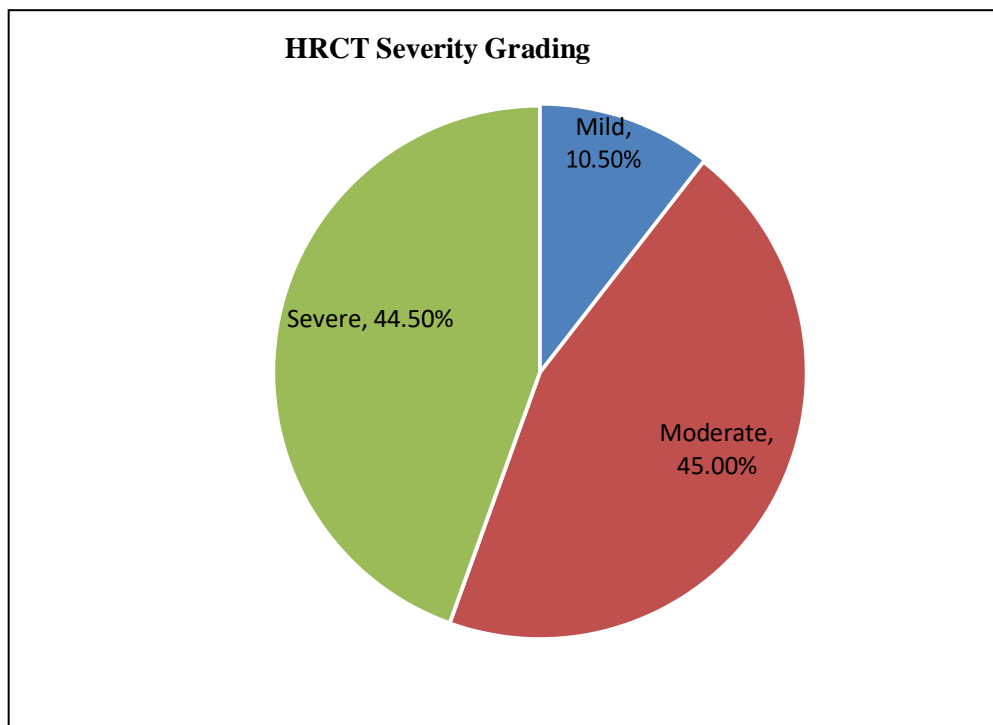
Sex distribution among patients stated that there is highly significant difference between males and females. 65(52%) females and 60(48%) males had RTPCR negative test results, while 51 males(68%) and 24(32%) females had RTPCR positive.

**Table 3: HRCT Grading**

HRCT CTSS	RTPCR Negative(n=125)		RTPCR Positive(n=75)		Total (n=200)	
	No.	%	No.	%	No.	%
Mild	14	11.20%	7	9.33%	21	10.50%
Moderate	56	44.80%	34	45.33%	90	45.00%
Severe	55	44.00%	34	45.33%	89	44.50%

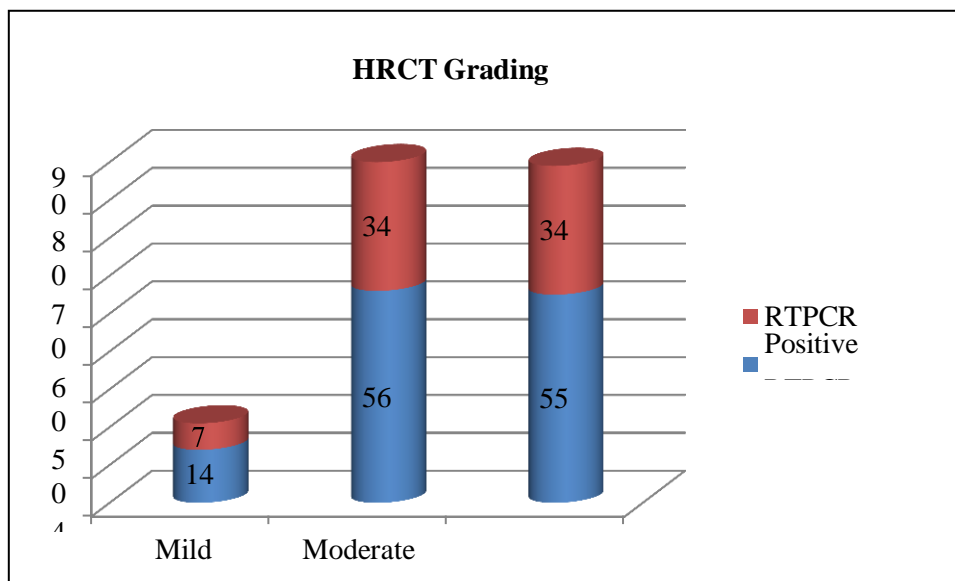
**P VALUE=0.91**

**GRAPH 3(A)**



In present study majority of patients belonged to moderate and severe category based on CT severity score (CTSS) (45% and 44.5% respectively) and small proportion made mild group (10.5%)

**GRAPH 3(B)**

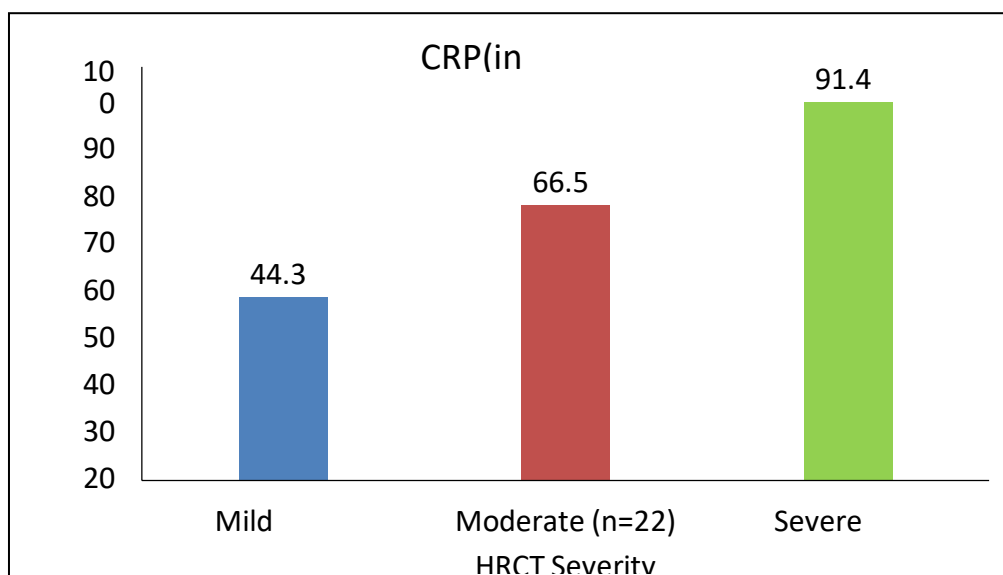


There was non-significant difference between RT-PCR test and HRCT CT severity score (CTSS). But proportional distribution states that majority of patients had severe HRCT CT severity score (CTSS) and 45% were RT-PCR positive. Same was found with moderate changes in HRCT CT severity score (CTSS).

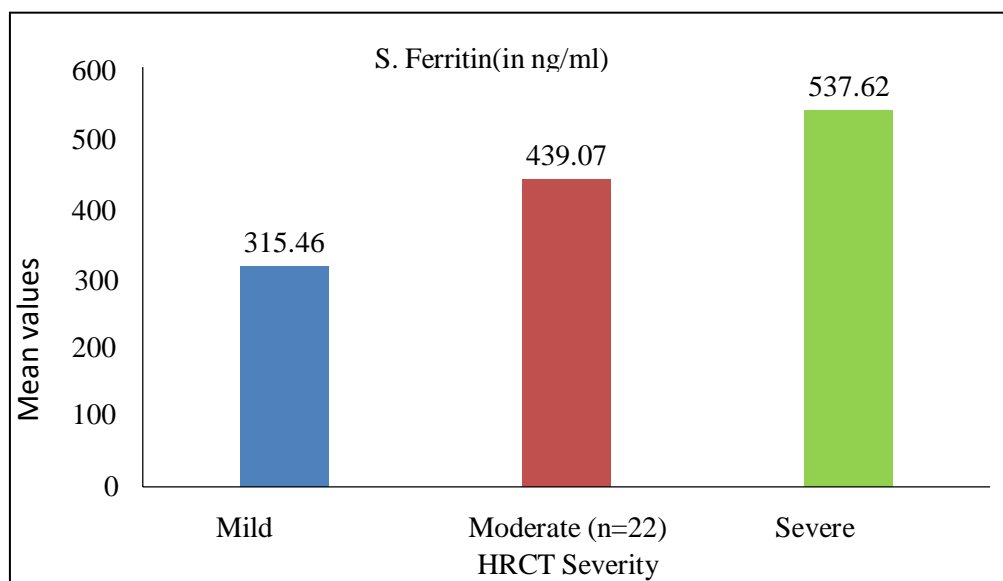
**Table 4: HRCT CTSS and Outcome**

Biomarkers	HRCT Score						P value
	Mild (n=17)		Moderate (n=22)		Severe (n=6)		
	Mean	SD	Mean	SD	Mean	SD	
CRP (in mg/L)	44.36	29.12	66.53	42.33	91.46	58.44	0.04
S. Ferritin (in ng/ml)	315.46	212.44	439.07	254.08	537.62	294.80	0.05
D. Dimer (in mcg/ml)	1.20	0.60	3.74	5.47	4.87	4.74	0.04

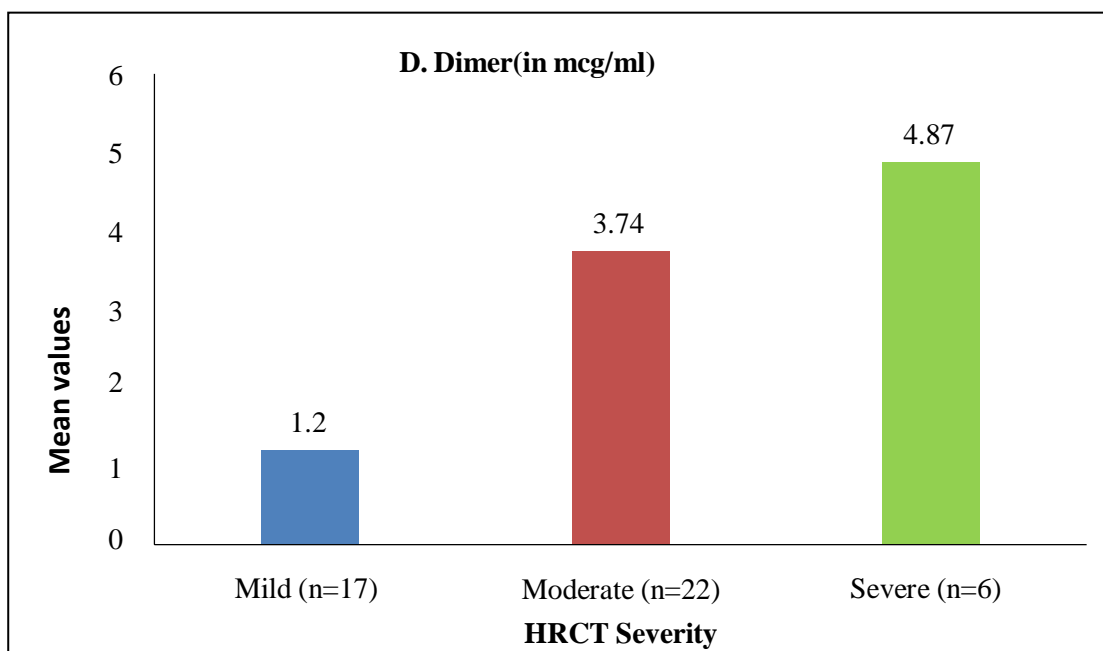
**Graph 4 (a)**



**Graph 4(B)**



**Graph 4 (C)**



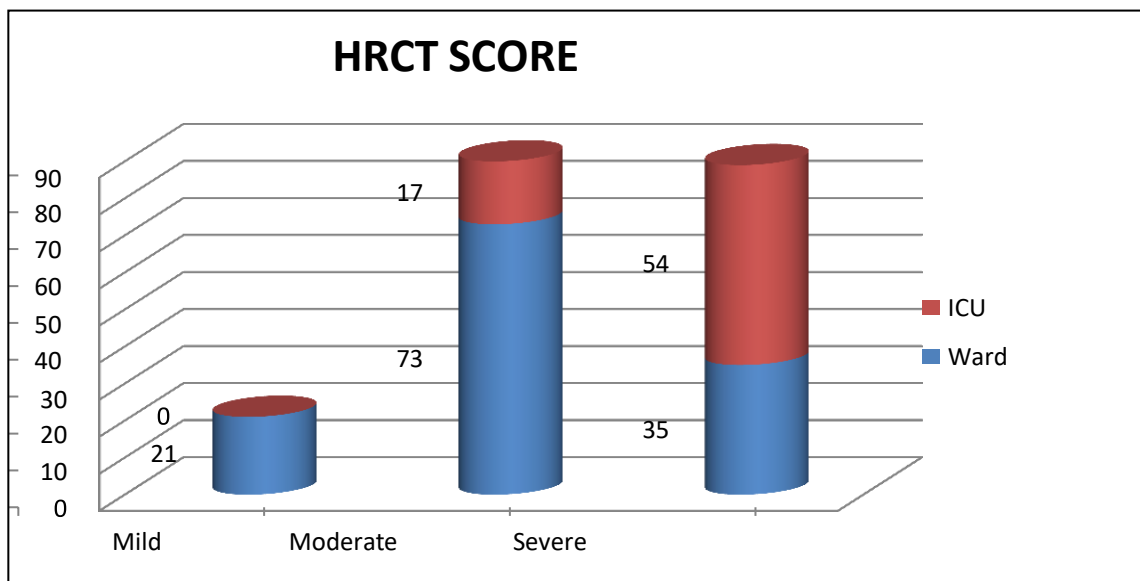
There is significant association between CT severity score (CTSS) and biomarkers. The mean value of CRP is 44.36 mg/L, 66.5 mg/L and 91 mg/L in mild, moderate and severe category respectively in an increasing trend. Similar trend also seen in ferritin and d-dimers.

**Table 5 : CT severity score (CTSS) and ICU Requirement**

Oxygen Supplementation	HRCT Score								Mean CTSS
	Mild		Moderate		Severe		Total		
	No.	%	No.	%	No.	%	No.	%	
Ward	21	100%	73	81.11%	35	39.33%	129	64.50%	13.43
ICU	0	0%	17	18.89%	54	60.67%	71	35.50%	17.83

**P value=0.002**

**GRAPH 5**



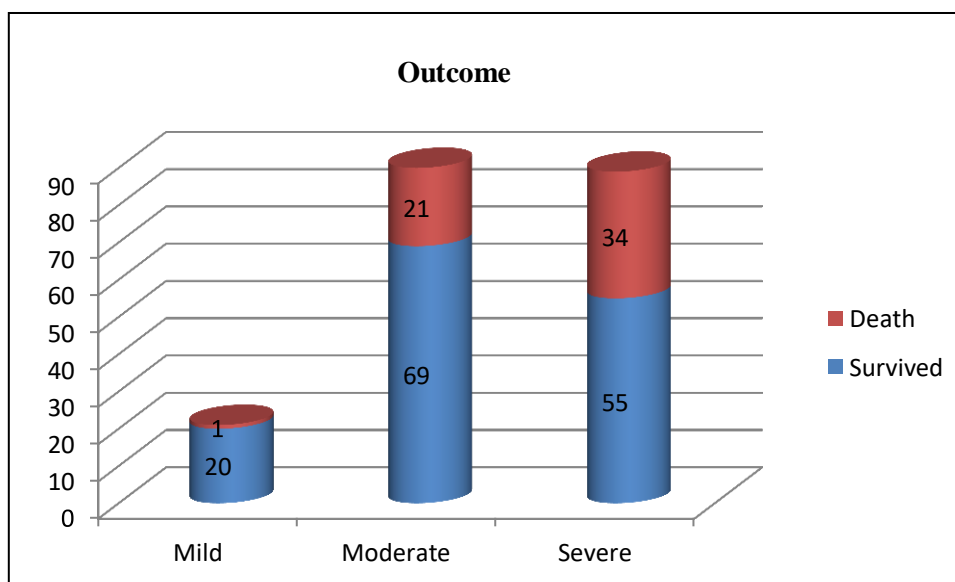
There is significant association of CT severity score (CTSS) and ICU Requirement.(p value=0.002) All the patients with moderate and severe changes were admitted in ICU.

**Table 6: HRCT CTSS and Outcome**

Outcome	HRCT Score								Mean CTSS
	Mild		Moderate		Severe		Total		
	No.	%	No.	%	No.	%	No.	%	
Survived	20	95.24%	69	76.67%	55	61.80%	144	72.00%	14.37
Death	1	4.76%	21	23.33%	34	38.20%	56	28.00%	16.59

**P value=0.003**

**GRAPH 6**



There is significant association of HRCT CT severity score (CTSS) and Outcome.

## **DISCUSSION:**

In the present study, an attempt was made to outline distribution of age, gender, clinical, and laboratory features at presentation, severity of patients on the basis of CT imaging, and their correlation with clinical and laboratory parameters of patients to put diagnostic, and prognostic tools for COVID-19 disease. In the present study from total number of participants (n=200) there are 55.5% male participants and 44.5% female participants. Almost half of them are males and half of them are females. But in RTPCR positive group 68% of them are male and 32% are females. Which is similar to studies done by Bhandari S. et al<sup>[16]</sup> and Sharma et al<sup>[17]</sup>. This is may be due to gender bias or due to the reduced susceptibility of females to viral infections which might be attributable to protection from X chromosomes and sex hormones, which play an important role in innate and adaptive immunity.<sup>[18-19]</sup> Also, the severity of disease was not significantly associated with sex of the patient. The proportion of male patients in moderate and severe group is higher 53.3% and 59.5% respectively but this difference is not statistically significant. Which is similar to study done by Sharma et al<sup>[17]</sup>.

In our study Age distribution of patient states that majority of atypical pneumonia patients (RTPCR Negative, 68 and RTPCR positive, 42) belonged to 45-65 year age group, followed by 47 and 26 patients of >65- year age group in RTPCR Negative and RTPCR positive respectively. Minimum patients belonged to 25 – 44 year age group. youngest participant was 31 and eldest being 84 years old, mean age 60.3 years. Participants in study done by Mardani R et al mimic our cases in sex and age composition. The result of RT-PCR for COVID-19 was positive in 70 (35%) cases and negative in 130 (65%). Groups of patients with positive and negative RT-PCR were similar regarding gender (p = 0.17) and age (p = 0.35) distribution.<sup>[20]</sup> In patients with negative CT scan, mean CRP levels were <50 mg/L in patients with mild scan results. In patients with moderate and severe CT scan, mean CRP levels were >50 mg/L this finding is found to have statistically significant correlation with the CT severity score (p = 0.04). Similarly, mean values of ferritin and d-dimer levels doubled and tripled from mild category to severe category. Studies have also suggested that early treatment at early disease stage can be considered using CRP as a predictive marker for likelihood of disease progression<sup>[21]</sup> Similarly, serum ferritin is a vital mediator of immune dysregulation, and its level was closely linked to the severity of the disease<sup>[22]</sup> D-dimer likewise can be used as a prognostic indicator, where higher levels are seen in more critical conditions. However, there is lack of evidence regarding the causal effect. It is not yet clear whether this increase is related to the direct

effect of the virus or the systemic inflammatory response.<sup>[23,24]</sup> The findings of our present study show that CT scan can help prognosticate patients and identify those at higher risk of severe outcomes, including mortality, ICU requirement. Death rate increased from mere 4.7% (one death) in mild category to 23.3% and 38.2% in moderate and severe category respectively. Proving significant association between HRCT CTSS and outcome and ICU admissions. Mean CTSS of those patients who required ICU was significantly (p value=0.002) higher (17.83) than those who did not require ICU (13.43). Mortality rate of COVID-19 patients in this study was associated with higher CT severity grade. In our study 72% patients survived and 28% patients died. The mean CT severity score among patients who died was significantly higher (16.5) than patients who survived (14.37). Y.Li.Z .Yang et al in their study confirmed increased death rate among patients with severe CT findings.<sup>[25]</sup> It is also known that CTSS determined by the percentage of disease involvement in each lobe of the lung is associated with the need for ICU and mortality<sup>[26]</sup> Similar results were seen in study by Sharma et al.<sup>[17]</sup>

## **CONCLUSION:**

In the present study, from total number of participants (n=200) there are 55.50% male participants and 44.50% female participants. Age ranges of the patients from 35 year to 84 year. The mean age of study participants was found to be 60.37± 11.30 years. In our study majority of patients belonged to moderate and severe CT category (45% and 44.5% respectively) and a small portion of mild category (10.5%). Our study showed significant association between CT severity grading and biomarkers level. The best outcomes were associated with milder CT findings, while death rate was increased among those with more severe scan results. 56(28%) patients out of 200 died in our study. In mild category death percent is 4.76% (1/21), in moderate and severe category its 23.33% (21/90) and 28% (34/89) respectively. (p value=0.003).

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