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Clinical Spectrum Of COVID19 Patients Admitting To A Tertiary Care Hospital And Their Outcome Based On Ct Severity Score And Blood Sugar.

Padmanaban UB[1], Sathish Kumar G[2], Mohammed Ibrahim Chundeli[3], and Khizer Hussain Afroze M[4]*.

[1]Professor and HOD, Department of General Medicine, KAPV Government Medical College, Trichy, Tamilnadu, India
[2]Professor, Department of General Medicine, KAPV Government Medical College, Trichy, Tamilnadu, India
[3]Junior Resident, Department of General Medicine, KAPV Government Medical College, Trichy, Tamilnadu, India
[4]Assistant Professor, Department of Anatomy, MVJ Medical College and Research Hospital, Bangalore, Karnataka, India

ABSTRACT

COVID19 emerged in Wuhan, China in December 2019 spread all across the world. It affects mainly the lungs and produce typical findings in CT Chest. CT SEVERITY SCORE derived from CT chest can be used as a prognostic marker in COVID-19. As a result, we would like to observe whether there is a link between presenting blood sugar levels and CT findings, as well as disease severity, because past research have shown that diabetic patients have higher disease severity This retrospective study consist of 100 radiologically positive COVID 19 patients admitting to Mahathma Gandhi Memorial Government Hospital, Tiruchirapalli (Tamil Nadu, India) from September 2020 to October 2020. 75% were males; 25% females. Mean age was 58 years. 68% had comorbidities (58% DM, 28% Hypertension, 13% cardiovascular diseases and 2% bronchial asthma). All were symptomatic (Dyspnoea 70%, Cough 68%, Fever 63%, Sore throat 23%, Diarrhoea 6%, Myalgia 5%). Around half of the patients were in severe disease as per WHO criteria. More than 60% patients had 50% lung involvement (CT Severity score>20/40). Mortality rate was 17%. CT severity score had significant correlation with disease severity (P value- 0.028). While presenting random blood sugar (RBS) values had substantial significant correlation with diseases severity and CT severity score (P value 0.047 and 0.008 respectively). CT severity score can be used as risk stratifying tool assessing the disease severity and prognosis in COVID-19 patients. And presenting blood sugar values had significant correlation with disease severity and CT findings. So adequate glycemic control is paramount in preventing further COVID-19 complications.

Keywords: CT severity score, Blood Sugar Level, RBS, COVID-19.

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Corresponding author

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INTRODUCTION

Novel corona virus emerged in Wuhan, China is an infection that has spread widely and quickly over the world, then WHO named it as corona virus disease 2019 (COVID-19). It resulted in a pandemic that had significant ramifications for the socio-political climate and healthcare delivery systems [1].

The diagnostic test utilised as the standard of reference for disease confirmation has been the nasopharyngeal swab RT-PCR test [2]. Although COVID-19 instances are validated by an RTPCR swab test, which has a lower sensitivity (42-71%), it can miss certain cases, CT Chest has a higher sensitivity (60-98%) in diagnosing COVID-19. In identifying COVID-19 pneumonia, CT Chest has a positive predictive value of 92 % and a negative predictive value of 42% [3, 4].

Novel coronavirus (SARS CoV2) typically affects the lungs and producing classical bilateral peripheral ground glass opacities mostly involving the lower lobes and posterior parts so that COVID-19 pneumonia can be accurately diagnosed through CT chest [5, 6]. These CT findings can be quantitatively assessed by calculating CT Severity score (CTSS). Lungs are divided into 20 fields. Scores are given as 0, 1, and 2 for 0%, <50%, >50% involvement of each lung fields respectively and added collectively to get CTSS [7, 8].

CT scan can accurately assess the severity of COVID-19 disease and guide the treatment modality [6, 9]. Since there is delay in reporting the RTPCR reports, CT Chest can be used for early and accurate diagnosis of COVID19 pneumonia in the pandemic situation.

Previous research [10, 11] by Zhang Y et al and Wang S et al has revealed an increase in disease severity among diabetes individuals. However, contrary to above findings, research by Raoufi M et al and Yang J et al have found no link between diabetes and COVID-19 [12, 13]. As a result, we were curious about the relationship between presenting blood sugar levels and disease severity and CT severity score among COVID patients

MATERIAL AND METHODS

Study Design & Population

This retrospective study includes all the radiologically positive patients with classical COVID-19 changes defined as CO-RADS 5 in CT Chest admitting to Mahathma Gandhi Government memorial Hospital, Tiruchirapalli from September 2020 to October 2020 (irrespective of RTPCR swab status). We excluded the patients lesser than 18 years of age and those whose CT Chest was normal or not suggestive of classical COVID-19 (<CORADS 5).

Ethical Approval

The study protocol was presented to the Institutional Research Committee and the Ethical Committee. The Institutional Ethics Committee at KAPV Government Medical College, Tiruchirapalli, where the study was conducted, granted the ethical clearance for this study.

Data Collection

The data on socio-demographic details & history was collected using a pretested proforma followed by clinical history, laboratory and radiological data by the primary investigator through hospital record.

Study Variables And Definitions:

Covid Disease Severity: Based on WHO case definition for COVID19[1]

- MILD-symptomatic patients without evidence of pneumonia or hypoxia
- MODERATE-Pneumonia & SpO2>90% on RA
- SEVERE- severe pneumonia, respiratory rate>30/minute or SpO2 <90% on RA
- CRITICAL – ARDS as per Berlin criterion

Diabetes

- Based on past history and records
- New case diagnosed based on FBS>126 mg/dL & PPBS>200 mg/dl (AMERICAN DIABETES ASSOCIATION GUIDELINES).

Co-Rads Grading

Categorical radiological grading scheme in CT Chest for predicting COVID-19, in which CO-RADS 5 indicates very highly suspicion of COVID-19 [14].

CT Severity Score (CTSS)

Lungs are divided into 20 fields. Scores are given as 0, 1, 2 for 0%,<50 %, >50% involvement of each lung fields respectively and added collectively to get CTSS. Then we divided it into 3 subgroups <20, 20-30 and >30 [7, 8]**.**

Prognosis: Based on need of ventilators, duration of hospitalization and mortality.

Statistical Analysis

The Kolmogorov-Smirnov test was used to verify the normality of all research variables among the study population prior to data analysis. Normalcy was assumed and parametric tests were employed when the P-values were greater than 0.05. When variables did not follow normality, non-parametric tests were applied. The data was entered in excel spread sheet. All statistical calculation were performed with SPSS, Version-16 (SPSS Inc., Chicago, IL, USA). Comparisons between two groups was done using Student't' test. Chi-square test was applied to check for association between categorical variables.

RESULTS

This study consisted of 75 males and 25 females with the mean age of 58. 75 ± 12.77 and 55.80 ± 10.43 years respectively (p value = 0.099). Characteristics of study population based on gender and patients status i.e. Survivor and Non survivor patients was tabulated in Table 1 and 2 respectively.

Table 1: Characteristics of the COVID-19 patients based on gender

Variables	Male (n=75)	Female (n=25)	p Value
Age in years (Mean ± S.D)	58.75 ± 12.77	55.80 ± 10.43	0.099 (NS)
SYMPTOMS, n (%)			
Fever	47 (74.6%)	16 (25.4%)	0.552 (NS)
Cough	50 (73.5%)	18 (26.5%)	0.408 (NS)
Sore Throat	18 (69.2%)	08 (30.8%)	0.294 (NS)
Respiratory Disease	52 (74.3%)	18 (25.7%)	0.507(NS)
Diarrhoea	04 (80.0%)	01 (20.0%)	0.805 (NS)
Myalgia	04 (66.7%)	02 (33.3%)	0.439 (NS)
Pulse Rate (Mean ± S.D)	105.28 ± 18.35	102.88 ± 17.54	0.568 (NS)
SPO2 (Mean ± S.D)	80.73 ± 15.02	82.52 ± 15.41	0.610 (NS)
Co morbidities on admission, n (%)			
Hypertension	24 (63.2%)	14 (36.8%)	0.202 (NS)
Cardiovascular disease	12 (54.5%)	10 (45.5%)	0.109 (NS)
COPD	02 (50.0%)	02 (50.0%)	0.439 (NS)
RBS mg/dL (Mean ± S.D)	208.48 ± 95.85	175.96 ± 76.03	0.127 (NS)

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Table 2: Characteristics of the COVID-19 patients based on Survivor and Non-Survivor

Variables	Non-Survivor (n=20)	Survivor (n=80)	p Value
Age in years (Mean ± S.D)	58.50 ± 14.09	57.89 ± 11.82	0.842 (NS)
SYMPTOMS, n (%)			
Fever	14 (16.2%)	49 (77.8%)	0.325 (NS)
Cough	14 (20.6%)	54 (79.4%)	0.529 (NS)
Sore Throat	7 (26.9%)	19 (73.1%)	0.226(NS)
Respiratory Disease	11 (15.7%)	59 (84.9%)	0.088 (NS)
Diarrhoea	1 (20.0%)	04 (80.0%)	0.069 (NS)
Myalgia	01 (16.7%)	05 (83.3%)	0.548 (NS)
Pulse Rate (Mean ± S.D)	113.50 ± 23.76	102.48 ± 15.81	0.014 **(SIG)**
SPO2 (Mean ± S.D)	75.60 ± 16.82	82.58 ± 14.37	0.064 (NS)
Co morbidities on admission, n (%)			
Hypertension	04 (21.1%)	15 (78.9%)	0.622 (NS)
Cardiovascular disease	02 (18.2%)	09 (81.8%)	0.951 (NS)
COPD	0 (0.0%)	02 (100.0%)	0.507 (NS)
RBS mg/dL (Mean ± S.D)	247.15 ± 78.51	193.65 ± 94.35	0.015 (SIG)

68% had comorbidities (48% DM, 10% newly diagnosed T2DM, 28% Hypertension, 13% cardiovascular diseases and 2% bronchial asthma). All were symptomatic (Dyspnoea 70%, Cough 68%, Fever 63%, Sore throat 23%, Diarrhoea 6%, Myalgia 5%) since all were radiological positive. Around half of the patients were in severe disease as per WHO criteria

Table 3: Disease severity, CT Severity Score and Prognosis of COVID -19 Patients based on gender

Variables	Male (n=75)	Female (n=25)	p Value
Disease Severity, n (%)			
Critical	17 (81.0%)	04 (19.0%)	0.828 (NS)
Moderate	23 (76.7%)	07 (23.3%)	
Severe	35 (71.4%)	14 (28.6%)	
CT Severity Score, n (%)			
<20	26 (65.0%)	14 (35.0%)	0.260 (NS)
21-30	29 (80.6%)	07 (19.4%)	
>30	20 (83.3%)	04 (16.7%)	
Prognosis, n (%)			
Discharged	58 (72.5%)	22 (27.5%)	0.196 (NS)
Death	17 (85.0%)	03 (15.0%)	

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Table 4: Disease severity, CT Severity Score and Prognosis of COVID -19 Patients based on Survivor and Non-Survivor

Variables	Non-Survivor (n=10)	Survivor (n=47)	p Value
Disease Severity, n (%)			
Critical	13 (61.9%)	8 (38.1%)	0.000 **(SIG)**
Moderate	01 (3.3%)	29 (96.7%)	
Severe	06 (12.2%)	43 (87.8%)	
CT Severity Score, n (%)			
<20	03 (7.5%)	37 (92.5%)	0.028 **(SIG)**
21-30	09 (25.0%)	27 (75.0%)	
>30	08 (33.3%)	16 (66.7%)	

Table 2 revealed the there was no difference in the disease severity, CT severity score and patients status or prognosis of the patients among the gender. But in case of survivor and non-survivor, we observed that there was a substantial differences in the disease Severity and CT severity score. It also observed that survival rate is higher when CTSS <20 compared to CTSS >30. More than 60% patients had 50% lung involvement (CT Severity score>20/40).

Table 5: Distribution of CT severity score based on disease severity

DISEASE SEVERITY	CT SEVERITY SCORE			Total	P value
	<20	21-30	>30		
Critical	4	8	9	21	0.022 (SIG)
	19.0%	38.1%	42.9%	100.0%	
Moderate	17	11	2	30	
	56.7%	36.7%	6.7%	100.0%	
Severe	19	17	13	49	
	38.8%	34.7%	26.5%	100.0%	
Total	40	36	24	100	
	40.0%	36.0%	24.0%	100.0%	

Table 6: Distribution of RBS based on CT Severity score and disease severity

Variables	N	RBS mg/dL		p Value
		Mean	Std. Deviation	
CTSS				
<20	40	174.360	90.79	0.008 **(SIG)**
21-30	36	197.53	80.12	
>30	24	247.50	96.01	
Disease Severity				
Critical	21	237.95	98.98	0.047 **(SIG)**
Moderate	30	173.57	98.59	
Severe	49	200.63	80.26	

Table 6 shows the distribution of RBS based on CT severity score and disease severity. Our findings revealed that RBS value increases as the CT severity score increases. RBS value was more in CT severity

score >30 (247.50 mg/dL). Similarly, RBS value more in critical patients (237.95 mg/dL) followed by severe (200.63 mg/dL) and moderate cases (173.57 mg/dL).

DISCUSSION

Early detection of COVID-19, a new coronavirus disease that emerged in 2019, is critical for disease treatment and management. Chest CT imaging, as opposed to RT-PCR, may be a more reliable, feasible, and quick way of diagnosing and assessing COVID-19, particularly in epidemic areas [4]. The lack of sensitivity, poor stability, and relatively long processing time of RT-PCR were all unfavourable to disease control. Furthermore, a variety of extrinsic variables, such as sampling processes, specimen source (upper or lower respiratory tract), sampling period (various stages of illness progression) [15], and detection kit performance, may influence RT-PCR testing findings. As a result, RT-PCR test results must be interpreted with care.

The mean age of the study population is 58.01 ± 12.23 years. Out of 100 COVID-19 patients studied, 75 were male patients and 25 were female patients. Male preponderance is seen as seen in many studies [10, 16], since males have more contact with outer environment than females. 68% had comorbidities (48% DM, 10% newly diagnosed T2DM, 28% Hypertension, 13% Cardiovascular diseases and 2% bronchial asthma).

According to Ai T et al, based on positive RT-PCR data, the sensitivity of chest CT in indicating COVID-19 was 97 percent (95 percent CI, 95-98 percent, 580/601 patients). They also said that 75 percent (308/413) of patients with negative RT-PCR results had positive chest CT findings; among the 308, 48 percent were regarded extremely likely cases, and 33 percent as probable cases [4]. Similar findings were reported by Bandhari S [6], Yang R et al [7], and Li K [9] and suggested that CT Severity score can be used as better prognostic marker for COVID19 pneumonia for assessing disease severity and to manage treatment plans.

In the present study, we observed that there was a substantial differences in the disease severity and CT severity score among survivor and Non-survivor. More than 60% had 50% lung involvement (CT Severity score>20/40).

According to Laxminarayan R et al, diabetes is the most common comorbidity among the COVID19 patients [16]. Laxminarayan R et al found an increased risk of death in patients with COVID-19 who had a history of diabetes (adjusted hazard ratio 228; 95 percent CI 179–291); hypertension (208; 162–266); other circulatory disorders (389; 266–571); cancer (804; 347–1865); or respiratory disorders (457, 243–861). Male sex, advanced age, and chronic renal illness were also linked to a greater death rate in COVID-19 patients.

Lacobellis G et al conducted a study on 85 patients with laboratory-confirmed COVID-19 and reported that admission hyperglycemia is the best predictor of radiographic imaging of SARS-CoV2, regardless of the past medical history of diabetes [17].

Similar findings were reported in previous research by Zhang Y et al [10] and Wang S et al [11], which also demonstrated an increase in disease severity among diabetes individuals. However, when it related to disease severity and CT chest findings, Zhang Y et al and Wang S et al discovered that blood sugar levels showed no significant relationship with the aforementioned diseases [10, 11].

A comparable research by Raoufi M et al and Yang J et al revealed no link between diabetes and COVID-19, as well as no significant correlation between blood sugar levels, CT results, and disease severity [12, 13].

Our findings revealed that RBS value increases as the CT severity score increases. CT severity score >30 (247.50 mg/dL) resulted with a higher RBS value. Similarly, critical patients had a higher RBS value (237.95 mg/dL) than severe (200.63 mg/dL) or moderate (173.57 mg/dL) patients.

Even though CTSS can assess the disease severity, patients with lower CTSS can worsen further and can have more CTSS. So continuous monitoring of COVID-19 patients is essential till recovery.

CONCLUSION

CT severity score can be used as risk stratifying tool assessing the disease severity and prognosis in COVID19 patients. And presenting blood sugar values has significant correlation with disease severity and CT findings. So adequate glycemic control is paramount in preventing further COVID-19 complications.

Limitations

Studies should be done with a larger population for better comprehension and generalisation of the results, as we conducted our study with a small sample due to the urgent need for information in this pandemic crisis. Due to a lack of resources, HbA1C was not employed to diagnose and stratify diabetes individuals.

ABBREVIATIONS

ARDS	= Acute respiratory distress syndrome
COVID19	= Corona virus disease 2019
CO-RADS	= Categorical radiological grading scheme
CT	= Computed Tomography
CTSS	= CT severity score
RA	= Room air

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