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Original Research Paper

Correlation between High Resolution CT-Thorax severity score and Clinical Outcome among COVID 19 infected patients

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ABSTRACT:

Background: COVID 19 being a disease of varying clinical presentation and higher level of mortality required a highly sensitive investigation to be carried out during the time of admission to plan for appropriate management. **Objectives: 1)**To classify the COVID 19 patients based on HRCT scoring system. **2)**To correlate HRCT score with the Clinical outcome of COVID 19 among the study participants. **3)**To determine HRCT cutoff value for detecting mortality among COVID 19 patients . **Materials and methods:** A retrospective Observational study was done among 100 participants based on their case records using Purposive sampling method. HRCT scoring based classification was noted and was expressed in frequency and proportion, the correlation between HRCT and clinical outcome was determined by Pearson correlation, p value of < 0.05 considered significant. Cut off HRCT score was determined for predicting Mortality as clinical outcome using Receiver Operating Curve (ROC). **Results:** The mean age of the participants was 60.5 ± 13.4 years, most of them were aged above 60 years and are males belonging to Class II socio economic scale. The proportion of milder form of COVID 19 was higher than moderate and sever forms as classified by HRCT scoring. There was a positive correlation between HRCT score and death as clinical outcome with r=0.69, p value <0.05. The ROC curve yielded a cut-off HRCT score of 16 to predict mortality among COVID 19 admitted patients. **Conclusion:** HRCT scoring yields a high value in detecting COVID 19 mortality rates hence have to be emphasized as an initial investigation in admitted patients

Keywords: HRCT scoring, Cut-off value, COVID 19 severity

INTRODUCTION:

The life threatening COVID 19 disease was first identified at Wuhan China, in December 2019, where around 41 patients in the city reported unexplained pneumonia. World Health Organization on January 30, 2020 declared COVID-19 to be public health emergency , since the onset, COVID-19 infection had spread widely and quickly worldwide creating a deleterious effort to the global economy and health care system, with a marked strike to the developing and underdeveloped countries which are not only less than on par economically with the developed countries, but also densely populated hastening the spread and sequale.[1] Though there were majority of the patients who had mild respiratory symptoms with good prognosis, the disease was alarming threat because of the high mortality rate where many died due to complications like pulmonary oedema, acute respiratory distress syndrome (ARDS), or multiple organ failure [2,3,4.] It was an unforeseen challenge for most of the countries, because of its varying clinical presentations ranged from asymptomatic carriers to severe sequel which also requires varying management from home isolation to assisted ventilator support, and ICU stays [5] The mortality

rate is further increased in COVID 19 patients by the presence of co-morbidities such as chronic pulmonary disease, cardiovascular disease, hypertension, diabetes, and cancer[6]. All this has emphasized the need for more accurate and swift diagnosis was vital to accomplish rapid and ideal management[7]. The diagnosis of COVID 19 was done by RT-PCR testing, however with the relatively long turnaround time (TAT) for viral testing together with the low sensitivity of a single real-time reverse-transcriptase polymerase-chain reaction(RT-PCR) assay of nasal and pharyngeal swab specimens implied indirectly that a large number of SARS-CoV-2 patients would not be quickly identified and hence may not be appropriately managed[8] and also there is a increasing evidence that sensitivity of combined nasal and pharyngeal swabs may be insufficient if obtained at a single time point, also depending on the technical characteristics of the test and method of specimen collection[9,10] HRCT has a reported high sensitivity in patients infected by SARS-CoV-2 , which not only helps in identifying the patients but also grade the severity based on degree of lung involvement.[11]Thus with the above background the study was planned with the below objectives

Objectives:

- To classify the COVID 19 patients based on HRCT scoring system
- To correlate HRCT score with the Clinical outcome of COVID 19 among the study participants
- To determine HRCT cutoff value for detecting mortality among COVID 19 patients

MATERIALS AND METHODS:

After the Institutional scientific ethical clearance the present case record based retrospective study was conducted at General Medicine department of Sri Venkateshwaraa Medical College and Hospital situated in Puducherry. The Hospital served as COVID 19 nodal centre during the pandemic and also during the study period between March to June, 2021. From the case records, patients admitted in COVID 19 isolation ward and Critical care unit, having diagnosed by RTPCR for confirming the COVID 19 diagnosis and have also taken HRCT chest during the admission were considered eligible for the study. Those patients who were discharged against medical advice/ referred during the course of treatment , incomplete medical records were excluded. Using Purposive sapling method, 100 such case records admitted during the study period was found to be adequate for the study purpose based on the formula, $4pq/d^2$, where p (proportion of mild COVID 19 based on HRCT Scoring) =55.4[12] , q=44.6, d=10; the minimum required sample size came as 98, however a higher sample size of 100 is considered for the study).Basic socio demographic parameters were noted. HRCT grading of severity, number of hospital admission days, need for ventilator support and occurrence of secondary infection and outcome of the disease was noted. The participants were classified based on the HRCT scoring as Mild/Moderate/Severe , if they have obtained the HRCT score based on sum of individual lobar scores $\leq$ 7/ 8-15/ $\geq$15 respectively. The data was entered in MS excel and analyzed in SPSS 21. Discrete variables were expressed in Frequency and proportion, continuous variables as mean ± SD. The association between selected parameters and the death outcome was determined by using chi square test, p value of < 0.05 was considered statistically significant. ROC was done to identify the HRCT cut off in determining the mortality outcome

RESULTS:

The mean age of the study participants was 60.5 ± 13.4 years.

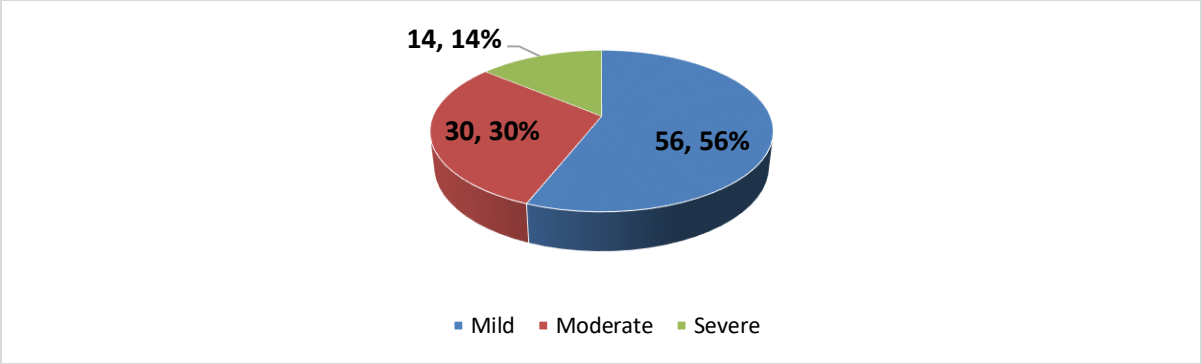
Table 1: Distribution of participants based on socio-demographic variables (n=100)

PARAMETERS	FREQUENCY n (%)
Age (in years)	
< 40 years	6 (6%)
40-60 years	37(37%)
>60 years	57(57%)
Age (mean ± SD) : 60.5 ± 13.4 years	
Sex	
Male	59(59%)
Female	41(41%)
Residence	
Urban	48(48%)

Rural	52(52%)
Socio economic status	
Class I	41(41%)
Class II	54(54%)
Class III	5(5%)

Among the 100 participants, majority of them re aged above 60 years, 57% and most of the participants are males (59%) and around 52% of the participants were rural residents , majority (54%) of them belonged of participants belonged to Class II socio economic class as classified by modified BG Prasad classification [Table 1]

Figure 1: Distribution of participants based on HRCT severity scoring (n=100)



Based on HRCT severity scoring, it was noted that, most of them were classified to have mild severity (56%) followed by moderate (30%) and severe(14%) forms respectively [Figure 1].The Mean HRCT scoring=10 ± 5 score

Table 2: Distribution of participants based on association between days of admission days, ventilator support, and secondary infection with mortality of the disease (n=100)

Parameters	**Mortality/Death**	**Significance** (p value)
Days of Hospital admission		
<7 days (n=60)	2 (3%)	0.0001
≥7 days(n=40)	10 (25%)	
On Ventilator support		0.001
Yes(n=22)	4 (18%)	
No(n=78)	8(10%)	
Occurrence of Secondary infection		0.067
Present(n=80)	10(12%)	
Absent(n=20)	2(10%)	

From the Table 2, it was observed that, proportion of participants admitted for ≥7 days and on ventilator support had higher mortality rates as compared to < 7 days of hospital admission and without the ventilator support respectively and this difference was found to be statistically significant having a p value of < 0.05.On the other hand, though the proportion of participants with death as outcome was higher among those who had secondary infections compared to those who didn't have, the association was not statistically significant, since the p value was 0.067 (p value> 0.05)

Table 3: Correlation between HRCT score and Mortality as clinical outcome (n=100)

Pearson correlation	Significance
r = 0.691	p value, 0.0001

On assessing the correlation between the HRCT score and the mortality rate, it was noted that, there is a positive relationship between HRCT score and death as clinical outcome, with the r value of 0.691 and it was found statistically significant, having a p value of 0.0001

Figure 2: ROC to identify HRCT cut off for determining mortality as clinical outcome (n=100)

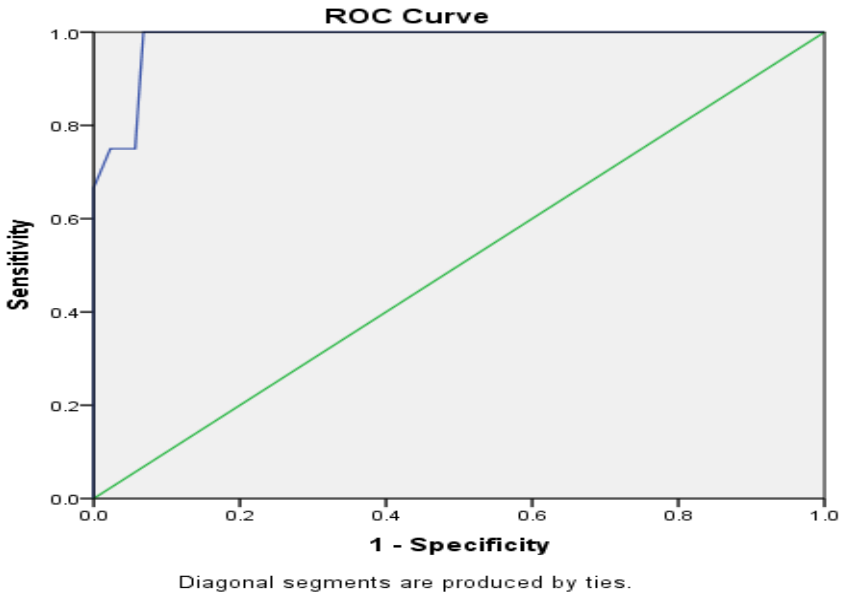


Figure 2, tells, Receiver operating curve (ROC), comparing various HRCT scores cut-offs; the best performance was that of that of 16 .The total area under ROC curve is 0.983 , p value 0.0001, hence the cutoff predicts short term mortality rate more.

DISCUSSION:

In the present study conducted with 100 participants based on case records, the proportion of participants with mild (56%) severity was higher than moderate (30%) and severe (14%) forms, where as in a study conducted by Agarwal N et al [13] it was found that, the proportion of moderate (41.6%) forms were higher followed by severe (30.5%) and mild (5.7%) forms respectively. This contrary findings could be different geographical setting and different level of awareness on COVID 19 symptoms and signs, variation in number of beds availability and nearby health facility The median total HRCT severity score was 8 having a cumulative range from 3 to 22, whereas, Sahu G etal reported, the median total HRCT severity score to be 14 with a cumulative range of 1 to 25[14] The current study showed a mortality rate of 12 %, however the study conducted by Saeed et al[15], showed a decreased mortality rate of 3.7%. The higher mortality rate in the present study could be due to higher proportion of elderly age group, who are often associated with multiple co morbidities and diminished immunity. However both the current study and the study by Saeed et al[15] it was noted that higher the HRCT scores more is the mortality rate. The present study showed a positive correlation between extent of CT lung involvement and the death as clinical outcome, this finding was supported by the study did by Colombi et al[16], who also found a positive correlation between the extent of CT lung involvement and death[16] Cut off value of 16 is highly predictive of short term mortality in our study whereas in other study by Sahu G Cut-off value of 18 is highly predictive of short-term mortality.[14]

CONCLUSION:

The HRCT should be sole the diagnostic test in every health setting, as it has a greater influence on mortality rates. Having obtained a cut off value of 16 for HRCT score to predict mortality, it could be kept in mind before initiation of routine COVID 19 management and also to make the necessary medical facility to tackle the expected severe sequel well ahead.

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