

# A study of association between peripheral saturation and CT severity score among COVID-19 positive patients

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## Abstract

**Background:** SARS-CoV2 was initially reported in Wuhan, China. Later it spread to more than 180 countries. Its presentation varies from asymptomatic to symptomatic. It starts from mild fever to severe respiratory distress syndrome and multi-organ failure. As this is a respiratory disease peripheral saturation plays a vital parameter. We generally use CT severity scoring and peripheral saturation for COVID19. **Objective:** The aim of our study is to find any association between CT severity scoring and Peripheral saturation. **Methodology:** This observational study was done in a tertiary care hospital, Salem, Tamil Nadu in Internal Medicine Department, from the period of August 2020 to September 2020. All the Covid positive patients of all age groups of both sexes with or without comorbidity were included. Patients having Non-COVID Pneumonitis were excluded. After getting ethical committee clearance data was collected using Patients information sheet. **Results:** Male preponderance 132(75%) is noticed and the saturation decreases as the age increases. There is a statistically significant association noticed between peripheral saturation and CT severity scoring. **Conclusion:** There is a significant correlation between CT scoring and peripheral oxygen saturation. Patients who comes with hypoxemia needs immediate medical treatment depending on the parameters like comorbidity, lung parenchymal involvement etc., **Keywords:** COVID19, Computed Tomography, Peripheral saturation.

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## INTRODUCTION

In 2019 December 8, several cases of unknown etiology reported in Wuhan, in Hubei Province, China. It spread to more than 143 other countries by March 2020.<sup>1-5</sup> The disease was termed later as COVID 19. It presented from Mild to Severe disease starting from common cold and

cough to Severe Acute respiratory Distress syndrome (ARDS) which may also lead to Acute Respiratory failure and other complications.<sup>6</sup> Most of the patients have mild symptoms with good prognosis. But some may develop severe pneumonia, pulmonary oedema, multiple organ failure and death.<sup>7-9</sup> The World Health Organization (WHO) consensus guidelines recommend the use of reverse-transcription polymerase chain reaction (RT-PCR) over chest imaging for the diagnosis of COVID-19.<sup>10</sup> In high prevalence setting CORADS classification has become the standardized reporting system. Computed tomography (CT) has been used for detecting, diagnosing and for monitoring the COVID 19 disease progress. The common findings noted in COVID 19 disease are bilateral, peripheral, multifocal Ground glass opacities (GGOs) and with subsegmental patchy consolidation mostly in lower lobes and posterior segment.<sup>11-13</sup> With the increasing number of cases, formulating a simple risk stratification

strategy would not only be valuable for high-risk patients but will also help to ease the burden on the healthcare system. This will also reduce emergency room overcrowding, and avoid the late hospitalisation of some patients. Moreover, acute respiratory failure has been shown to be very rapid and fatal, with dissociation between the severity of hypoxemia and the maintenance of a relatively good clinical presentation before acute respiratory distress syndrome (ARDS) occurs.<sup>14</sup> Oxygen saturation has been defined as the fraction of oxygen saturated haemoglobin to that of total haemoglobin. Peripheral saturation is measured with a device called Pulse oximeter. The normal SPO2 level for human beings ranges from 96-99% in room air. Patients with lung involvement has low saturation.<sup>15</sup> Although SpO2 is a precise tool for measuring tissue oxygenation, it neither reflects ventilatory drive nor oxygen uptake efficacy.<sup>16</sup> According to World Health Organization (WHO) guidelines in COVID 19 pneumonia, breathing frequency and saturation are important indicators of disease severity. Hospitalisation in these patients is advised if respiratory frequency is >30 breaths·min<sup>-1</sup> or periphery oxygen saturation measured by pulse oximetry (SpO2) is less than 93%.<sup>16</sup> The current ICMR guide lines also suggest utilising spo2 level as a tool for triage and patients with saturation less than 90% for hospital admission and others for home quarantine. Rapid clinical triage is of foremost importance not only to decide whether hospitalisation is indicated or not but also, whether a patient can be discharged home safely with a low chance of subsequent deterioration. Yet, at present, clinical guidelines are still deficient, and this decision-making process is merely based upon clinical judgement.<sup>16</sup> In this context, our study aims to determine the association of peripheral saturation to the computer tomography grading so that it can help us to assess the severity of lung damage and start treatment early as possible.

## RESULTS

## METHODOLOGY

A cross sectional study was done in a tertiary care teaching hospital, Salem, Tamil Nadu by the Internal Medicine department. The study was conducted during August 2020 – September 2020. All the patients who were tested positive through Reverse transcriptase polymerase chain reaction (RTPCR) during this period were included in this study and those patients with history of cancer, malignancy, non- COVID pneumonitis, paediatric patients and pregnancy were excluded from the study. Investigations like complete blood count, renal parameters, liver function test, LDH, Serum Ferritin and D-dimer level, ECG and Chest CT scan was done to all patients. The measurement was taken in pulse oximeter with the middle finger of right hand kept for a minute. The CT scan was taken in supine position. Two radiologist of more than 5 years of experience gives the CT values. The scoring was given out of 25. Data was collected after obtaining written consent from the participants or their attenders in case of severely morbid patient. A pre designed and pre tested schedule containing details about socio-demographic details like name, age, sex, comorbid status, presentation at the time of admission, symptoms, saturation and pulse rate were collected. Institutional ethical committee clearance was obtained before the start of the study.

### Statistical Analysis:

After collecting the data, it was entered in MS excel. Statistical analysis was done in SPSS 23. Continuous data with normal distribution were expressed in terms of Mean ± Standard deviation and Compared by independent sample t test. Categorical variable were expressed in terms of numbers (percentages) and compared by the chi-square test. Association between categorical variables was done by spearman test.

**Table 1:** Baseline characteristics of the Study participants (n=176)

Baseline characteristics	Number (n)	Percentages (%)
<b>Age</b>		
<20	2	1.1
21-40	35	19.9
41-60	87	49.4
61-80	47	26.7
>80	5	2.8
<b>Sex</b>		
Male	132	75
Female	44	25
<b>Symptoms</b>		
Fever	111	63.1
Throat pain	7	4
Cough and Cold	105	59.7

Myalgia	66	37.5
Breathlessness	75	42.6
Diarrhoea	15	8.5
Headache	23	13.1
Loss of taste	13	7.4
Loss of smell	6	3.4
Loss of appetite	1	0.6
<b>Comorbidity</b>		
Diabetes Mellitus	60	34.1
Hypertension	47	26.7
Asthma	6	3.4
Hypothyroidism	6	3.4
Cardiovascular diseases	7	4

The mean age of the study participants was found to be  $52 \pm 14.4$  years with a minimum age of 18 years and a maximum age of 87 years. Around 132 (75%) of the study participants were male. 111(63.1%) reported fever followed by Cough and cold 105 (59.7%) which in turn followed by Breathlessness. The most common comorbidity presented among the study participants were Diabetes 60(34.1%) followed by Hypertension (26.7%). (Table.1)

**Table 2:** Oxygen saturation in accordance with the age and gender of the study participants (n=176)

Age	Mean SPO2 in percentages	Range of SPO2 in percentages
<20	98	96-99
21-40	94	79-99
41-60	93	76-99
61-80	90	65-98
>80	88	86-98
Gender		
Male	92	65-99
Female	93	75-99

The peripheral oxygen saturation decreases with increasing age. It is less in participants with more than 80 years of age. (Table.2)

**Table 3. Correlation between CT scoring and SPO2 levels among the study participants**

Spearman's rho		CT severity	SPO2 level
CT severity	Correlation coefficient	1.000	-.701
	Sig(2 tailed)		.000
	N	176	176
SPO2 level	Correlation coefficient	-.701	.000
	Sig(2 tailed)	.000	
	N	176	176

When association between CT scoring or severity is taken with Peripheral saturation it was found to be statistically significant and they have good correlation. (Table.3)

## DISCUSSION

In our study most of the study participants were male 132 (75%) which is similar to a study done by Ahmed *et al.*,<sup>17</sup> where 64.8% of the participants were male. Similar observations are seen by Francone M *et al.*<sup>18</sup> and Xiong *et al.* where male patients represented 60% of the study population. This observation is contrary to Salvati L *et al.* who studied the relation of gender and different characteristics of COVID-19. She concluded that almost equal distribution of the disease is seen among the genders. But the study significance difference was observed regarding the severity and mortality of the disease being more common in males.<sup>19</sup> Fever was found to be the most

common symptom in our study 111(63.1%). Xiong Y *et al.* and Fu l *et al.* also stated similar finding in their studies. Dyspnoea and fever were found to be the commonest presenting symptoms in a study done by Ahmed *et al.*,<sup>17</sup> the incidences being 66.4% and 55.2% respectively. The present study showed that oxygen saturation decreases with increase in age. It decreases gradually over 60 years of age which is similar to a study done by N. Anupama *et al.* In their study, Fatemeh Homayounieh *et al.* found that younger age, higher oxygen saturation, lower WBC count, increased lymphocyte fraction, lower CT severity score on follow-up CT correlated with survival. Precisely factors like age and oxygen saturation were independent markers

of survival and can also be used to make an estimate high risk cases and can be used for triage.<sup>10</sup> According to Tan L *et al.*<sup>18</sup> and Zhou F *et al.*,<sup>19</sup> among various vital signs and laboratory parameters, the lower oxygen saturation (pO<sub>2</sub>) and lower lymphocyte fraction is found to be more in the deceased group in their study. In their study, Huanyuan Luo *et al.*<sup>20</sup> studied the associations between CT pulmonary opacity score on admission and clinical characteristics and outcomes in patients with COVID-19. They found that the pulmonary opacity score on admission was independently associated with demographic data, various clinical symptoms and their onset, vital signs including temperature and Saturation findings. Studies done by Zhang X *et al.*<sup>21</sup> Paul NS *et al.*<sup>22</sup> and Chen Z<sup>23</sup> *et al.* also showed similar results. Similarly, Ali sabri *et al.*<sup>24</sup> stated that the mortality in the hospital was found to higher in patients with diffuse parenchymal involvement and low peripheral saturation. In our study we found an inverse relationship between CT severity and peripheral saturation, as lung involvement increases peripheral saturation drops. In a study done by Ahmed *et al.* oxygen saturation was considered as an important parameter predicting the disease severity and progression. Similar to our study they too recorded an inverse relationship between the CT severity and the level of oxygen saturation. The lowest level of oxygen saturation noticed in their study was at an advanced stage of COVID and this could be explained by the highest incidence of mixed reduction pattern with predominant consolidation at this stage. Additionally, the study suggested that the progressive development of fibrosis also parallels with disease extension, increased numbers of lobar involvement, and higher CT severity score. Wang *et al.*<sup>25</sup> in his study with 114 Covid 19 confirmed cases provided the similar results. D'Á H *et al.*<sup>26</sup> also stated that with progression of disease like diffuse parenchymal involvement and consolidation peripheral saturation drops. Henceforth, in their study Fatemeh Homayounieh *et al.* observed that adding clinical variables like peripheral oxygen saturation to the whole lung radiomics not only improved diagnosis but also prediction of patient outcome and mortality. One of the limitations of the study is the sample size; a multi- centric study involving many patients will increase the validity of the finding.

## CONCLUSION

There is a significant correlation between CT scoring and peripheral oxygen saturation. Patients who comes with hypoxemia needs immediate medical treatment depending on the parameters like comorbidity, lung parenchymal involvement etc.,

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