

# A study of Inflammatory and biochemical markers correlated with CT Chest severiority score in Covid 19 patients in tertiary care Hospital, Kanchipuram

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## Abstract

**Aim:** To study of inflammatory (IL-6) and biochemical markers (Ferritin, CRP and D-Dimer) correlated with CT chest severity score [SpO<sub>2</sub>, RR, PaO<sub>2</sub>/FiO<sub>2</sub>] in COVID 19 patients. **Methods:** A Retrospective, observational study was conducted in Meenakshi Medical College Hospital and Research Institute, Kanchipuram, Tamil Nadu. Totally 100 Covid 19 patients were admitted in the Covid ward [IL-6, CRP, D-Dimer and RT PCR swab for COVID 19 positive and radiologically positive] between February 2021 to June 2021. The patient was clinically, radiologically, and biochemically evaluated. Based on the inflammatory, biochemical markers and CT chest severity score was used to differentiate the patients into mild, moderate, and severe groups. The relationship between CT Severity score and Clinical parameters such as SpO<sub>2</sub>, RR, PaO<sub>2</sub>/FiO<sub>2</sub> and Biochemical markers [Ferritin, CRP, D-Dimer] were studied. **Results:** IL-6, Biochemical markers like CRP, Ferritin and D-dimer and CT chest severity score was found to be positively correlated with decreased SpO<sub>2</sub> levels, decreased PaO<sub>2</sub>/FiO<sub>2</sub>, increased RR level. IL-6, D-Dimer and CRP levels were significantly increased ( $P < 0.001$ ) in moderate, severe Covid 19 patients when compared with mild and control patients. **Conclusion:** The 25 CT Severity score scores well with the Clinical parameters and biochemical markers. Our data suggest that inflammatory and biochemical markers significantly correlated with CT Chest Severity Score based on the severity of COVID 19 Patients.

**Keywords:** Covid 19, C Reactive Protein, Ferritin, D-dimer.

## INTRODUCTION

In December 2019, an ongoing outbreak of unexplained pneumonia in wuhan, China gained global attention. On 11 February 2020, the World Health Organization (WHO) announced a new name for the disease caused by SARS-CoV-2.

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The name is coined as COVID-19 Virus disease. In June 2021, 17.2 crores people worldwide have been affected by COVID 19 and 37 lakh people have died due to COVID 19. Coronaviruses belong to the order Nidovirales in the family Coronaviridae. [1] The incubation period of the virus is from 5-11 days.[2] The symptoms of the patients present with fever, cough with or without expectoration, myalgia, dyspnoea, diarrhoea, anosmia, ageusia, abdominal pain, and vomiting based on the severity. Patients developed complications such as Septic shock, ARDS, Respiratory failure, Pulmonary embolism, Mucormycosis. A new Vaccine, antiviral drugs and treatment methods were developed but there is still no standard treatment for COVID-19. In present also continuous to spread worldwide with its increasing infectiousness and new variants.

COVID 19 is diagnosed by using the following methods of Clinical such as Respiratory rate, Temperature, SpO2 levels, PaO2/FiO2 levels; Microbiological investigations such as RT-PCR [COVID 19 Swab], Rapid Antigen test; Blood investigations such as Complete Blood Profile including NLR ratio, Inflammatory and biochemical Markers such as CRP, D DIMER, Serum Ferritin, IL-6, LDH; Radiological Investigations such as CXR PA view and CT CHEST help in diagnosing the patient. Patients diagnosed with COVID 19 are undergone antimicrobial therapy, Multivitamin, and Antipyretics. Based on the patient diseases status, oxygen therapy and ventilatory support are given to the patient. In our study we aim to correlate between the CT chest severity score and clinical parameters and biochemical markers.

### Materials and Methods

Several notable limitations were noted in this paper. The present study was focused on retrospective study conducted in Meenakshi Medical College Hospital. 100 patients were admitted to the hospital with COVID 19 [RT PCR swab for COVID 19 positive and radiologically positive] between February 2021 to June 2021. The patient was clinically, radiologically, biochemically, and microbiologically evaluated. All the patients were selected from based on the inclusion and exclusion criteria. Covid 19 on CT Chest was interpreted using a standard scoring system compared with severity of Patients. This scoring system is defined by the RSNA Consensus statement. [3] Based on the CT Chest Severity Score patient was categorised into mild, moderate, severe.[3]

Percentage of Lobar Involvement in covid patient	Score
5% or Less	1
6% - 25%	2
26% - 49%	3
50% - 75%	4
>75%	5

Total score [	Severity [category]
7 or less	Mild
8-16	Moderate
17-25	Severe

Clinically patients were assessed using Respiratory Rate, O2 Saturation, PaO2/FiO2. Respiratory rate was measured manually and patients with respiratory rate more than 20cpm were tachypneic. Oxygen saturation was measured using Saturation probe and saturation levels less than 93% in room air was considered as Hypoxia. PaO2/FiO2 ratio was calculated using Arterial Blood Gas and PaO2/FiO2 ratio less than 300mmHg considered as hypoxemia. Routine Blood tests were done for all patients and following parameters were evaluated: CRP, D- Dimer, NLR ratio. Neutrophil – lymphocyte ratio is calculated by dividing the number of neutrophils by lymphocytes. A value of > 3.3 was selected as the optimal cut off value of the normal range for NLR Ratio with a sensitivity of 60% and specificity of 70% [3]. D- Dimer was measured using the ELISA method. A value of more than 500ng/ml was selected as the optimal cutoff value of the normal range with a sensitivity of > 98% [4]. CRP was measured using ELISA value of more than 7 mg/L was selected as the optimal cutoff value of the normal range.

### Statistical Analysis

The data was collected from the hospitalized patients and entered in Microsoft excel and analyzed using SPSS22 version software. Frequencies of CT Scores were calculated and compared with clinical parameters and biochemical markers.

### Results

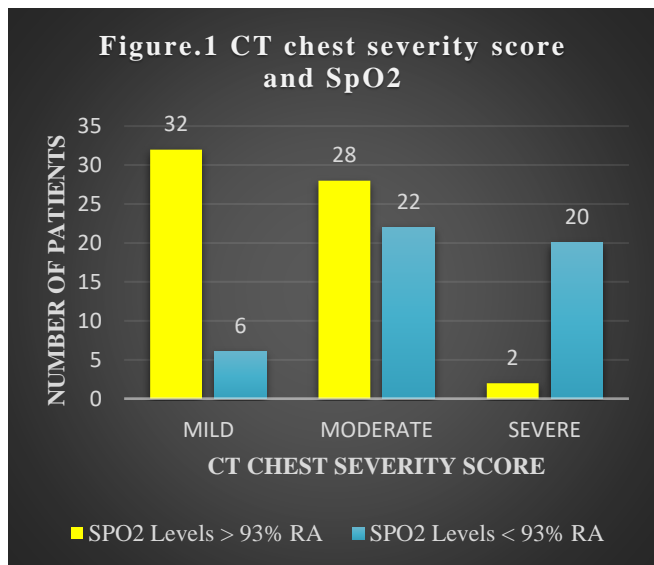
100 patients who were COVID 19 Positive [RT PCR swab positive] between February 2021 to June 2021 who were above the age of 18 years and with comorbidities such as T2DM, HTN, IHD, CKD, Thyroid disorders were evaluated clinically, radiologically, and biochemically.

CT chest severity score of 100 patients was separately correlated with NLR ratio, CRP, and D- Dimer. Out of 110 patients 30 patients had a CT severity score between 0- 8/25 and were classified as having mild disease. 50 patients had a CT Severity score between 9-16/25 and were classified as moderate disease. 20 patients had a CT Severity score between 17-25/25 and were classified as severe disease.

#### a. CT Chest severity Score and Clinical Parameters

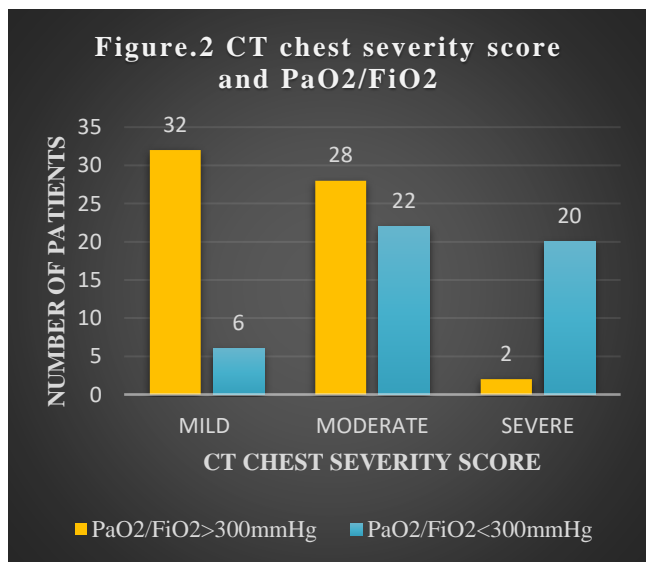
##### i. CT chest severity score and SpO2 levels

Decreased O2 saturation was seen in 12/30 patients with mild CT scan, 30/50 patients with moderate CT scans, 19/20 patients with Severe CT scans. CT Severity score was significantly associated with decreased SpO2 levels. [p value < 0.001]. Figure 1



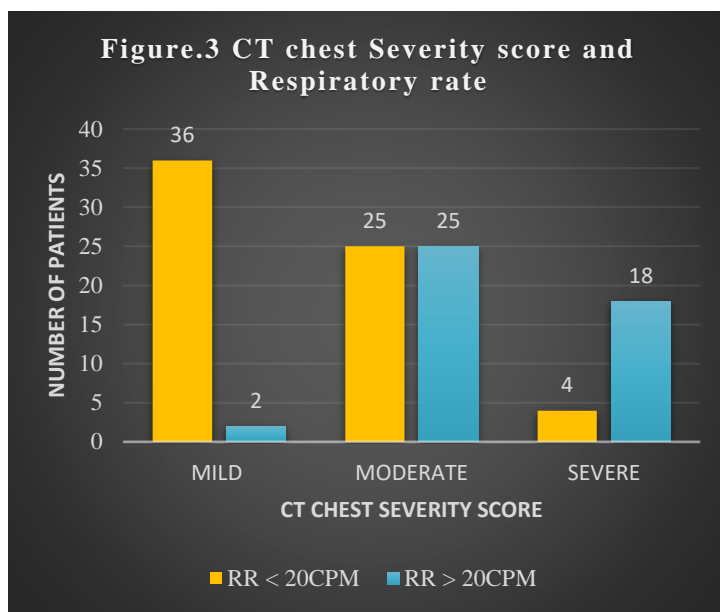
ii. CT Chest Severity Score and PaO2/FiO2 levels

PaO2/FiO2 less than 300mmHg in 6/30 patients with mild CT scans, 22/50 patients with moderate CT scans, 20/20 patients with Severe CT scans. CT Severity score was significantly associated with decreased PaO2/FiO2 levels. [ p value < 0.001]. Figure 2



iii. CT chest severity score and Respiratory Rate

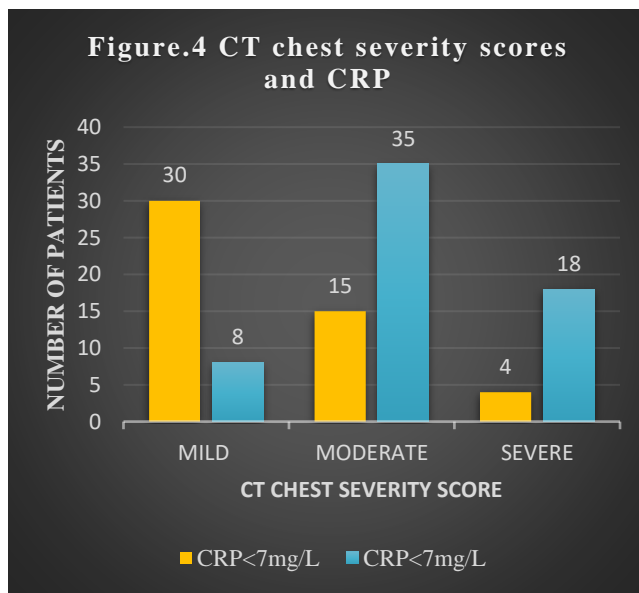
Tachypnoea [RR>20] was seen in 18/30 patients with Severe CT scans, 25/50 patients with moderate CT scan, 2/30 patients with mild CT scans. CT Severity score was significantly associated with increased respiratory rate.[ p value < 0.001]. Figure 3



b. CT chest Severity Score and Biochemical Parameters

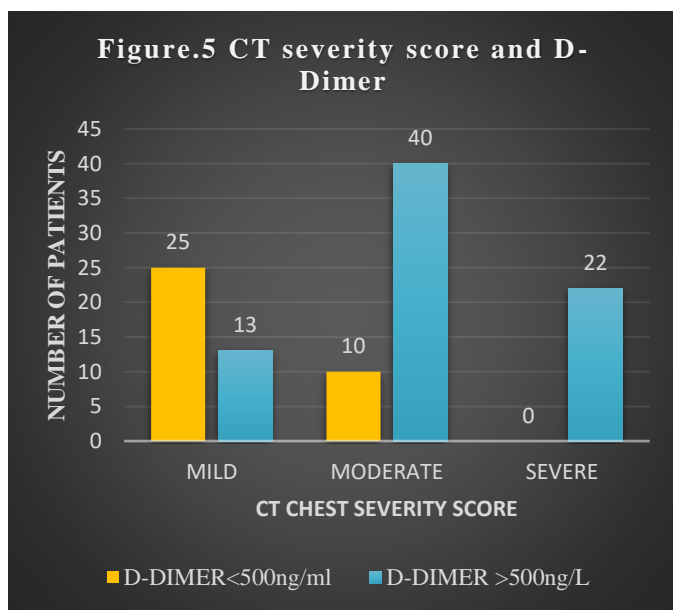
i. CT chest Severity Score and CRP

CRP ratio of more than 7mg/L was seen in 8/30 patients of mild CT scan group, 35/50 patients of the moderate CT scan group and 18/20 patients of the severe CT scan group. CT Severity score was significantly associated with increased CRP values.[ p value < 0.001]. Figure 4



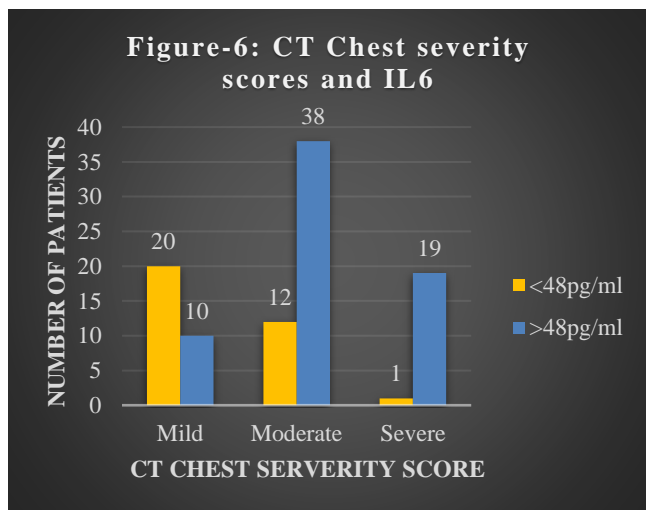
ii. CT chest severity score and D-Dimer

D- Dimer values of more than 500ng/ml was seen in 13/30 patients of the mild CT scan group, 40/50 patients of the moderate CT scan group and 22/20 patients of the severe CT scan group. CT Severity score was significantly associated with increased D-Dimer values.[ p value < 0.001]. Figure 5.



iii. CT chest severity score and IL-6

IL6 value of more than 48pg/ml was seen in 10/30 patients of mild CT scan group, 38/50 patients of the moderate CT scan group and 19/20 patients of the severe CT scan group. CT Severity score was significantly associated with increased IL-6 values. [ p value < 0.001]. Figure.6



Discussion

In December 2019, some cases with pneumonia were reported in Wuhan, China which came to be caused by a virus named COVID-19. On March 11,2020 WHO declared COVID -19 as a pandemic. A year later we are still grappling with this pandemic and research is still ongoing. In our study we have used few clinical parameters and biochemical markers to correlate with CT Chest severity score[5]. The study demonstrates a correlation between the ct severity score and clinical parameters and biochemical markers. As the CT chest severity score increases the clinical parameters like RR, PaO2, FiO2/SpO2 Levels of the patients worsened,

and the values of the biochemical markers increased.

Patients Based on CT Chest severity score were divided into mild, moderate, severe. CT prediction of disease progression and its correlation with clinical-laboratory findings may be helpful to assist medical staff in triaging patients and to timely establish symptomatic treatment.[6] CT parenchymal assessment may more accurately reflect short-term outcome, providing a direct visualization of anatomic injury compared with non-specific inflammatory biomarkers.[7]

CT Severity Score and Clinical Parameters

Low blood oxygen—technically, hypoxaemia but usually referred to as hypoxia—can be defined as a measured oxygen saturation below 94% in the absence (or below 88% in the presence) of chronic lung disease. [3] Hypoxia indicates higher severity of disease and greater need for Intensive care. The underlying pathology in covid-19 related hypoxia is probably a ventilation-perfusion mismatch, caused by a combination of intrapulmonary shunting, loss of lung perfusion regulation, intravascular microthrombi, and reduced lung compliance leading to alveolar collapse.[4]

The results suggest that patients with SpO2 < 93 % had significantly higher CT severity score. Aalinezhadet al [5] correlated between CT severity score and SpO2 and showed similar results. Among 270 patients this study showed that patients with hypoxia had higher CT severity score and there was negative correlation between CT severity score and SpO2 levels.

Respiratory rate is a non-invasive, common screening tool to identify lower respiratory tract infections [8]. Increased respiratory rate more than 20cpm indicates tachypnoea. It’s an early indicator to assess the severity of the condition clinically. Increased respiratory rate indicates more tissue damage. Our study shows that as the CT severity score increases the number of patients with increased respiratory rate also increases. Previous studies have not discussed the relationship between Ct Severity score and Respiratory Rate.

CT Severity and Biochemical Parameters

CRP is a type of protein that is produced by the liver that serves as early marker of infection and inflammation.[8] CRP values been used as an early predictor for severe COVID 19. From our study the data suggests that few patients with mild CT severity score had elevated .As the CT severity score increased more number of patient showed elevated CRP.Higher CRP values indicate that the patients need higher antibiotics and early intervention. Liu et al. reported that C-reactive protein might be predictive of disease severity in COVID-19 patients.[5]

D – Dimer may reflect the effects of infection on coagulation in infectious diseases [2]. High D-Dimer is likely to be associated with persistent clotting disorders, micro thrombotic formation, pulmonary embolism and acute myocardial infarction in long-stay or death patients, which may cause refractory hypoxemia, respiratory failure, disseminated intravascular coagulation or death.[2] Various

studies have proved that D-Dimer can be used as a prognostic indicator in Covid-19 pneumonia. The Present study was showed the correlation between CT score and D-dimer. As the CT Chest Severity score increases a greater number of patients have increased D-Dimer levels. Higher D-dimer levels along with High Ct chest severity score indicates worse prognosis [4] Such Patients require early intervention and prompt management. Wang et al have shown similar results [2][4]

IL-6 is an inflammatory type of cytokine which is associated with more rapid disease progression and a higher complication rate in COVID-19 cases. Based on these observations to investigate the relationship between IL-6 levels and CT Chest Severity score presence of COVID-19.

## Conclusion

From our study we have correlated between CT chest severity and Clinical and biochemical parameters and showed that there is a statistical significance [ $p < 0.001$ ] between them. This data is in line with some previous other studies.

## REFERENCES

1. Francone M, Iafrate F, Masci GM, Coco S, Cilia F, Manganaro L et al. Chest CT score in COVID-19 patients: correlation with disease severity and short-term prognosis. *EurRadiol.* 2020 Dec;30(12):6808-6817. doi: 10.1007/s00330-020-07033-y. Epub 2020 Jul 4. PMID: 32623505; PMCID: PMC7334627.
2. Ye, W., Chen, G., Li, X. et al. Dynamic changes of D-dimer and neutrophil-lymphocyte count ratio as prognostic biomarkers in COVID-19. *Respir Res* 21, 169 (2020). <https://doi.org/10.1186/s12931-020-01428-7>
3. GhufraanAref Saeed, Waqar Gaba, Asad Shah, Abeer Ahmed Al Helali, EmadullahRaidullah, Ameirah Bader Al Ali, et al."Correlation between Chest CT Severity Scores and the Clinical Parameters of Adult Patients with COVID-19 Pneumonia", *Radiology Research and Practice*, vol. 2021, Article ID 6697677, 7 pages, 2021. <https://doi.org/10.1155/2021/6697677>
4. Mehrdad Rostami & Hassan Mansouritorghabeh (2020) D-dimer level in COVID-19 infection: a systematic review, *Expert Review of Hematology*, 13:11, 1265-1275, DOI: 10.1080/17474086.2020.1831383
5. Pathak A and Agrawal A (2019) Evolution of C-Reactive Protein. *Front. Immunol.* 10:943. doi: 10.3389/fimmu.2019.00943
6. Ponti, G., Maccaferri, M., Ruini, C., Tomasi, A., & Ozben, T. (2020). Biomarkers associated with COVID-19 disease progression. *Critical reviews in clinical laboratory sciences*, 57(6), 389–399. <https://doi.org/10.1080/10408363.2020.1770685>
7. Mohamadian M, Chiti H, Shoghli A, Biglari S, Parsamanesh N, Esmaeilxadeh A. Covid-19 : Virology, biology and novel laboratory diagnosis. *J Gene Med.* 2021; 23: e3303. <https://doi.org/10.1002/jgm.3303>
8. Ali N. Elevated level of C-reactive protein may be an early marker to predict risk for severity of COVID-19. *J Med Virol.* 2020 Nov;92(11):2409-2411. doi: 10.1002/jmv.26097. Epub 2020 Jun 9. PMID: 32516845; PMCID: PMC7301027.