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To Study the Correlation of CT Severity Score with Oxygen Saturation and Inflammatory Biomarkers in Patients with Covid -19 Infection

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Abstract:-

Introduction.

SARS- COV 2 is a viral infection which emerged in Wuhan in December 2019 and later on spread like a wild fire across the globe. CT scan turned out to be a corner stone in early identification and triaging of such patients and ensuring treatment at the earliest as well as in monitoring of disease progression. Biomarkers indicating rapid deterioration in COVID-19 patients are mostly represented by , CRP, D-dimer, and IL-6

Materials and Methods:

A study on 100 RT-PCR positive patients admitted in in GMC KOTA. All the data was collected along with their baseline sp02, CT severity score (CTSS) and the studied biomarkers (CRP, D-dimer, IL-6.

Results:

The severity of disease as per HRCT was correlated with the oxygen saturation which showed the lowest mean oxygen saturation in patients with CTSS > 14 (79.85 ±11.83, P =0.0001) and CTSS <8 showing an average SPO2 of 89.8%(p=0.0001). The Pearson's correlation coefficient was applied and was found to have a negative correlation with the oxygen saturation (r= -0.443, p, 0.00001).). IL-6 was observed to be 18.34 ± 9.55 in mild, 27.41±4.71 in moderate and 45.54± 9.50 in severe cases respectively. The findings were found to have statistically significant correlation with CTSS (r=0.69, p<0.00001).

Conclusion:

We concluded that HRCT can be used as an effective tool for screening patients and predicting disease severity. Both clinically and radiologically, the severity of disease increased with increasing age and there is inverse relation between oxygen saturation and the ct severity score as observed from the study. The CT severity score is related to inflammatory biochemical markers and the clinical severity of the disease. A large-scale study would be required to generalise the results and use these factors for prognostication in the final outcome.

Keywords:- *CTSS- CT severity score, Il-6- interleukin 6, Crp- c reactive protein.*

I. INTRODUCTION

SARS- COV 2 is a viral infection that first appeared in Wuhan in December 2019 and then spread like wildfire around the world. Although nasopharyngeal RT PCR was used as the initial diagnostic tool to screen the patient, false negative results posed a significant challenge because the patient later presented with radiological evidence of pneumonia in a worsened clinical state. CT scans have proven to be critical in the early identification and triaging of such patients, as well as in ensuring timely treatment and monitoring disease progression. Systemic inflammation has been implicated as a predictor of disease severitySARSCoV2 tissue injury causes an increase in the secretion of proinflammatory cytokines as well as the recruitment of other proinflammatory cells such as granulocytes and macrophages (1,2). To respond to virus infection, the innate and adaptive immune systems employ a variety of strategies. Covid 19 infects human epithelial cells, causing them to produce significant but delayed responses by IFN, pro-inflammatory cytokines (e.g., IL-1, IL-6) and chemokines (e.g., IL-8), resulting in a cytokine storm that causes multi-organ damage (1,3). The cytokine storm is distinguished by elevated levels of cytokines, most notably interleukins IL-6, IL-7, and IL-22.

The remaining biochemical markers Troponin I (TnI), CRP, erythrocyte sedimentation rate (ESR), D-dimer, progressive deterioration of lymphocyte counts, and elevated inflammatory markers (IL-6, TNF-alpha) are the most common biomarkers in COVID-19 patients (4)

CT manifestations resemble those seen in viral pneumonias, with multifocal ground-glass opacities and peripheral consolidation being the most common findings (5,6). The severity score was calculated for each patient based on the percentage of lung involvement by scoring the percentage of each lobe involvement individually and assigning a score from 1 to 5 where ;

Score 1 denotes a involvement of 5%.
Score 2: 5–25% involvement
Score 3:26–50% involvement
Score 4: 51–75% involvement
Score 5: More than 75% involvement

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The final score, which will be out of 25, will be the sum of individual lobar scores.

II. MATERIALS AND PROCEDURES:

A retrospective study was conducted on 100 RT-PCR positive patients admitted to GMC KOTA's covid wards and ICU from January 2021 to July 2021. All of the data was collected along with their baseline sp02, CT severity score (CTSS), and the biomarkers under investigation (CRP, D-dimer, IL-6). HRCT of the chest yielded a severity score of 25 points. On the basis of CT scan findings, the disease severity was classified as mild, moderate, or severe.

III. RESULTS

A total of 100 patients were enrolled in the study, with 25% suffering from mild disease (CTSS 1-8), 33% suffering from moderate disease (CTSS 9-13), and 42% suffering from severe disease (CTSS 14-25). In this age group, the mean CTSS was higher 13.32 (5.54), p=0.0001), but the mean baseline SPO2 was lower (81.23 (14.30), p=0.0001). The oxygen saturation was correlated with the severity of disease as determined by HRCT, with the lowest mean oxygen saturation in patients with CTSS > 14 {79.85 (11.83)} p =0.0001) and CTSS 14 {79.85 (11)}. As in previous studies, the biochemical markers investigated showed a significant positive relationship with disease severity. On CT scan, patients with mild disease had the lowest mean CRP levels of 59.9, compared to an average of 61.8 % and 78.7 % in moderate and severe disease, respectively. These findings had a statistically significant correlation with CTSS (r=0.45, p 0.00001).

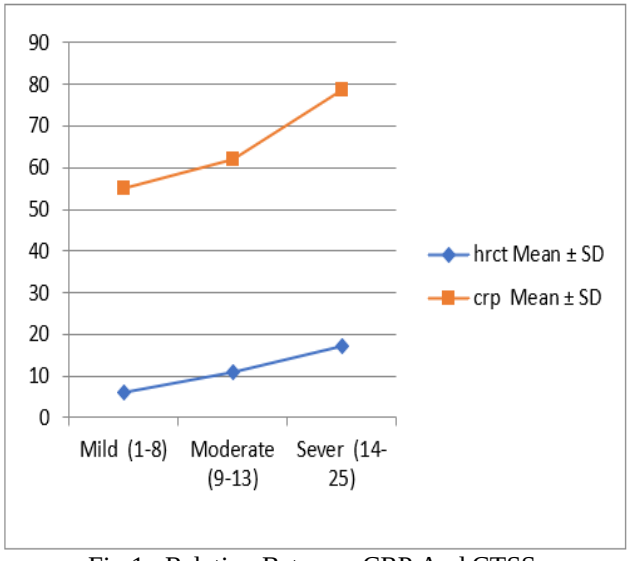

Fig 1 : Relation Between CRP And CTSS

Despite the fact that elevated D-dimer values were obtained for the severe disease category {2.43 (2.04)}, p=0.0001), even patients with mild scans had significantly elevated D-dimer values {1.09 (1.24)}, p=0.0001). CTSS was found to have a statistically significant correlation with D-dimer values (r=0.24, p 0.0001).

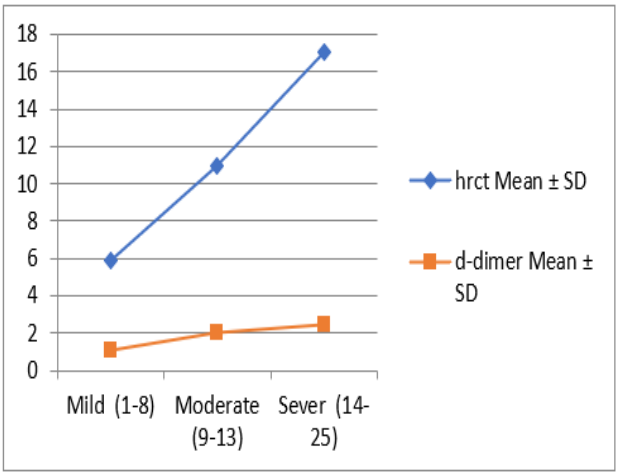

Fig 2: Relation Between D-Dimer And CTSS

IL-6, which is thought to be a biochemical marker of disease severity, clinical outcome, and cytokine storm, was found to be ten times higher in patients with severe disease. The average serum IL-6 level was found to be{ 18.34 (9.55)} in mild cases,{ 27.41(4.71)} in moderate cases, and {45.54 (9.50)} in severe cases. The results showed a statistically significant correlation with CTSS (r=0.69, p =0.00001).

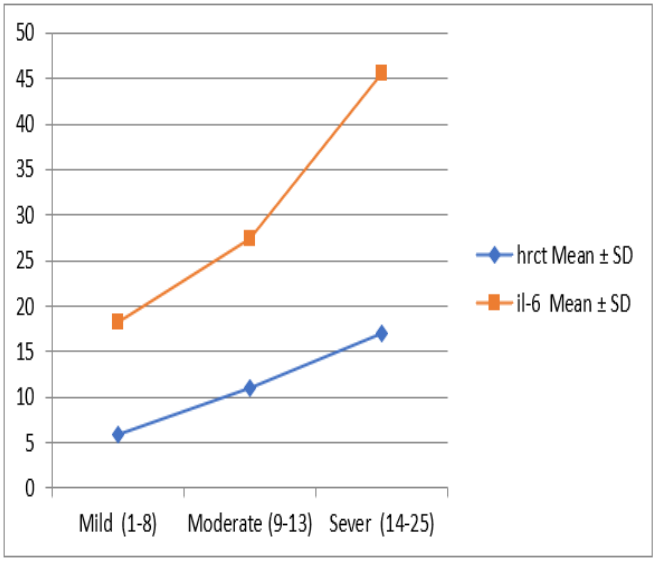

Fig 3: Relation Between Il-6 And CTSS

All of the findings are compiled in following table

Table Depicting Hrct Score with The Covid -19 Biomarkers and O2 Saturation

HRCT Score	CTSS Mean ± SD	SPO2 ±SD	IL-6 Mean ± SD	D-dimer ± SD	CRP ± SD
Mild (1-8)	5.92 ± 1.89	89.8 ± 9.61	18.34 ± 9.55	1.09 ± 0.24	54.91 ±41.11
Moderate (9-13)	10.96 ± 1.42	89.27 ± 7.63	27.41 ± 4.71	1.99 ± 0.60	61.86 ± 43.61
Severe (14-25)	17.09 ± 2.44	79.85 ±11.83	45.54 ± 9.50	2.43 ±2.04	78.72 ± 46.14
Over all Mean ± SD	12.28 ±4.96	85.45 ±11.05	32.91 ±7.63	1.95 ± 0.56	67. 20± 44.84

IV. DISCUSSION

On the basis of HRCT findings, patients enrolled in this study were classified as having mild, moderate, or severe disease. The biochemical markers were assessed and found to be related to the CTSS. Our patient population was relatively older, with 34% of patients falling into the high risk category of age > 60 years. The CT severity of disease and oxygen saturation had an inverse relationship, with a significant positive correlation between all of the inflammatory markers studied.

There are numerous limitations to this study, the most significant of which is the lack of randomization of the samples chosen. There were no representations from all age groups due to a lack of data, primarily from the paediatric age group. The sample size is small, which limits the ability to generalise the results. Comorbidities were not considered as a factor that could influence biochemical markers, particularly D dimer. The final result was not tracked or correlated with the inflammatory markers.

V. CONCLUSION

We concluded in this retrospective study that HRCT can be used as an effective tool for screening patients and predicting disease severity. Both clinically and radiologically, the severity of disease increased with increasing age and there is inverse relation between oxygen saturation and the ct severity score as observed from the study. The CT severity score is related to inflammatory biochemical markers and the clinical severity of the disease. A large-scale study would be required to generalise the results and use these factors for prognostication in the final outcome.

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