



## INITIAL CT SEVERITY SCORE IN PROGNOSIS AND OUTCOME OF THE SWAB POSITIVE PATIENT IN COVID 19

<b>Dr. C. Hari Hara Sudhan*</b>	M.D (Accident and Critical care), Assistant professor, Department of Emergency Medicine, Vinayaka Mission's Kirupananda Variyar Medical College & Hospital. *Corresponding Author
<b>Dr. Chanjal KS</b>	M.D. Emergency Medicine, Junior Resident (Post Graduate), Department of Emergency Medicine, Vinayaka Mission's Kirupananda Variyar Medical College & Hospital.
<b>Dr. Melvindominic</b>	M.D. Emergency Medicine, Assistant professor, Department of Emergency Medicine, Vinayaka Mission's Kirupananda Variyar Medical College & Hospital.
<b>Dr. V. P. Chandrasekaran</b>	M.D (Accident and Critical care), Deputy medical director/ Senior. Consultant, Department of Emergency Medicine, Vinayaka Mission's Kirupananda Variyar Medical College & Hospital.
<b>Dr. Abdussamad M</b>	M.D. Emergency Medicine, Junior Resident (Post Graduate), Department of Emergency Medicine, Vinayaka Mission's Kirupananda Variyar Medical College & Hospital.
<b>Dr. Syed Abthahir S</b>	M.D. Emergency Medicine, Junior Resident (Post Graduate), Department of Emergency Medicine, Vinayaka Mission's Kirupananda Variyar Medical College & Hospital.

**ABSTRACT**

**Introduction:** According to WHO recommendations, the real-time reverse transcription-polymerase chain reaction (RT-PCR) assay, is the initial technique used in COVID-19 diagnosis. Though this test is conclusive, this test can't predict the severity of the disease. Computed tomography (CT - chest), has been crucial in the diagnosis, assessment, and treatment of COVID-19 patients. This study has been conducted to assess the performance of a semi-quantitative CT severity score in predicting the severity of the patients. **Methods:** This is an observational analytical study done in Vinayaka Missions Kirupananda Variyar (VMKV) Medical College and Hospital, Salem, Tamil Nadu from the period of September 2020 to December 2020. After getting the informed consent, the patients with age 18 years and more, who were admitted to the hospital with CT thorax CORADS score more than and equal to 4 with irrespective of the RT-PCR report status were included in the study. **Results:** Totally, 531 individuals participated in the study. The majority of the study participants were females. About 36 percent of the patients have ageusia and anosmia. About 4.3 percent of them have died. When comes to CT-chest severity score, the mean score in our study was about 11 and about 17 percent have severe illness according to the CT-chest severity score category. The CT-chest severity scores have a statistically significant correlation with the duration of the hospital admission in days ( $p < 0.001$ ). **Conclusion:** The CT-chest severity score is a trustworthy tool to predict the severity of COVID-19 disease.

**KEYWORDS :** COVID-19, Prognosis, CT-Severity score, Disease outcome, and Salem.**INTRODUCTION:**

For the last two years, we've been in a challenge from COronaVirus Disease (COVID-19) pandemic. The SARS-CoV and MERS-CoV have generated epidemics over the last couple of decades, having mortality rates of around 9.5 percent and 34.4 percent, respectively.<sup>1</sup> The World Health Organization (WHO) reported in December 2019 that a new coronavirus (nCoV) known as "SARSCoV2" was implicated in the COVID19 pandemic.<sup>2</sup> HCoV229E, HCoVNL63, HCoVOC43, MERS-CoV, SARS-CoV, and SARSCoV2 are the majority of human coronaviruses (HCoVs) that have been found so far.<sup>3,4</sup> On September 2021, Globally, the total number of COVID-19 affected patients was 231 million and the death is about 4.7 million.<sup>5</sup> And in India, in September 2021, the total cases were about 33 million and the total death is about 4 lacks and 50 thousand.<sup>6</sup> Coronavirus disease (COVID-19) has multiple effects in the body and the respiratory syndrome caused by SARS-CoV-2 infection that can vary in severity from a moderate upper respiratory tract infection (URI) to severe interstitial pneumonia disease called acute respiratory distress syndrome (ARDS).<sup>7,8</sup>

SARS-CoV-2 is related to a certain Beta coronavirus genus as the coronaviruses that cause severe acute respiratory syndrome (SARS).<sup>9</sup> According to WHO recommendations, The real-time reverse transcription-polymerase chain reaction (RT-PCR) assay, is the initial technique used in COVID-19 diagnosis. Yet, delayed sample collection, inadequate kit performance, limited availability, and restrictive laboratory criteria may cause definitive diagnosis to be hampered.<sup>10,11</sup> Diagnostic imaging, like computed tomography (CT), has been crucial in the diagnosis, assessment, and treatment of COVID-19 patients.<sup>12,13</sup> It can be applied to diagnose COVID-19, as

well as to monitor the size of lesions and monitor any pathological changes in individuals who have had negative RT-PCR testing and plain radiography imaging.<sup>14</sup> With this background, this study has been conducted with the aim to assess the performance of a semi-quantitative CT severity score in the prognosis and outcome of COVID-19 positive patients.

**METHODOLOGY:**

This is an observational analytical study done in Vinayaka Missions Kirupananda Variyar (VMKV) Medical College and Hospital, Salem, Tamil Nadu from the period of September 2020 to December 2020. After getting the informed consent, the patients with age 18 years and more, who were admitted to the hospital with CT thorax CORADS score more than and equal to 4 with irrespective of the RT-PCR report status were included in the study. Patients with RT-PCR positive but CT chest CORADS score less than or equal to 3 were excluded from the study. The prevalence of the COVID 19 infection is assumed to be 50 percent and the estimated sample size was 400 with an absolute error of 5 percent and with a 95 percent of the confidence interval.

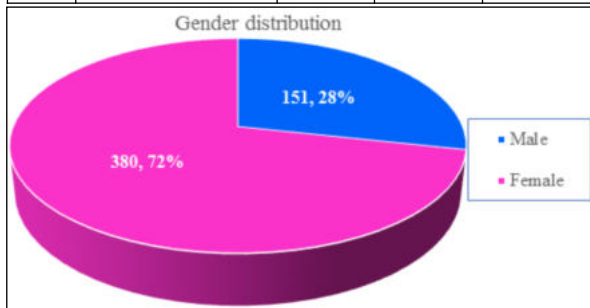
This study has been conducted after obtaining ethical clearance from the institutional ethical committee, VMKV Medical College and Hospital. The CT - chest severity score was classified into mild (score less than or equal to 7), moderate (score 8 to 17) and severe (score 18 to 25).<sup>15</sup> And CORADS 6 means patients with RT-PCR positive and CT Chest score - CORADS 5. Death due to any complication of COVID 19 and duration of admission in the hospital were taken as the outcome of the study. The data obtained were entered in Excel and analysed using SPSS version 21.

**RESULTS:**

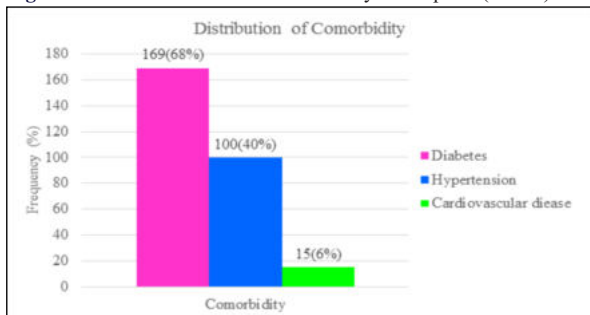
Totally, 531 individuals participated in the study. The majority of the study participants were females. About 30 percent of the study participants have the breathlessness while admission. About 36 percent of the patients have ageusia and anosmia. The baseline characters of the study participants are shown in table 1, figure 1, and figure 2. When comes to the outcome of the disease about 4.3 percent of the study participants have died due to COVID-19 disease which is shown in figure 3. In our study, the mean age of the study participants was 53.55 years. When comes to CT-chest severity score, the mean score in our study was about 11, and the mean duration of stay in the hospital is about 9 days which is shown in table 2. When comes to CT-chest severity score categories, about 10.3 percent of the study participants who were classified as a severe disease have died when compared to mild cases which are one percent. And the difference in proportion between the above groups is statistically significant by using the chi-square test. The association table is shown in table 3. The mean duration of hospital stays among the study participants who were classified as a severe disease by Ct – chest severity score was 11 days when compared to those who have the non-severe disease which was 8 days. And the difference between this mean is statistically significant by using an independent T-test which is shown in table 4. Among the study participants, about 17 percent have severe illness according to the CT-chest severity score which is shown in figure 4. Among the study participants, the CT-chest severity scores have a statistically significant correlation with the duration of the hospital admission in days ( $p < 0.001$ ). the scatter plot is shown in table 5 and figure 5.

**Table 1: Description Of Study Participants (n=531)**

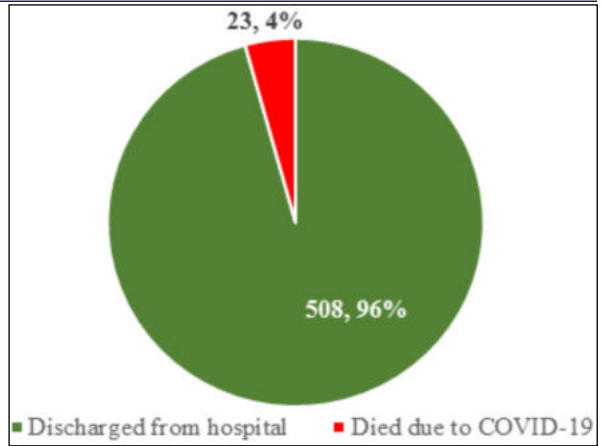
S. No	Variable		Frequency	Percentage
1	Fever	Yes	223	42
		No	308	58
2	Cough	Yes	160	30.1
		No	371	69.9
3	Breathlessness	Yes	164	30
		No	367	70
4	Loss of smell and taste	Yes	191	36
		No	340	64
5	Headache	Yes	187	35.2
		No	344	64.8
6	Throat pain	Yes	110	20.7
		No	421	79.3
7	Loose stools	Yes	118	22.2
		No	413	77.8
8	Swab – RT-PCR	Positive	437	82.3
		Negative	36	6.8
		Not taken	58	10.9



**Figure 1: Gender Distribution Of The Study Participants (n=531)**



**Figure 2: Distribution Of Comorbidities Among The Study Participants (n=247)**



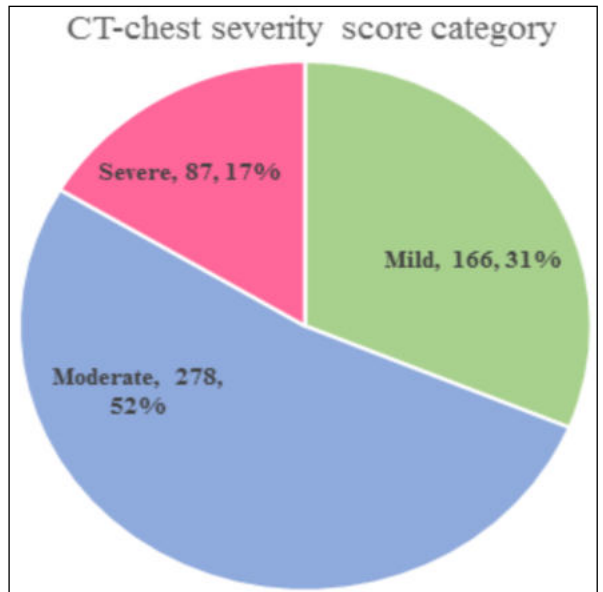
**Figure 3: Outcome Of The Treatment Among The Study Participants (n=531)**

**Table 2: Description Of Study Participants (n=531)**

	Age	Severity score	Duration of admission
Mean	53.55	10.94	8.74
Median	55.00	10.00	8.00
Mode	65	8	7
Std. Deviation	14.333	5.761	3.543
Minimum	13	1	1
Maximum	91	35	33
Percentiles	25	44.00	7.00
	50	55.00	10.00
	75	64.00	15.00

**Table 3: Association Between CT Severity Category And Death Of The Individual (n=531)**

CT severity category	Died		Total n (%)	Chi-square value	P-value
	No n (%)	Yes n (%)			
Mild	164(98.8)	2(1.2)	166(100)	11.508	0.003
Moderate	266(95.7)	12(4.3)	278(100)		
Severe	78(89.7)	9(10.3)	87(100)		



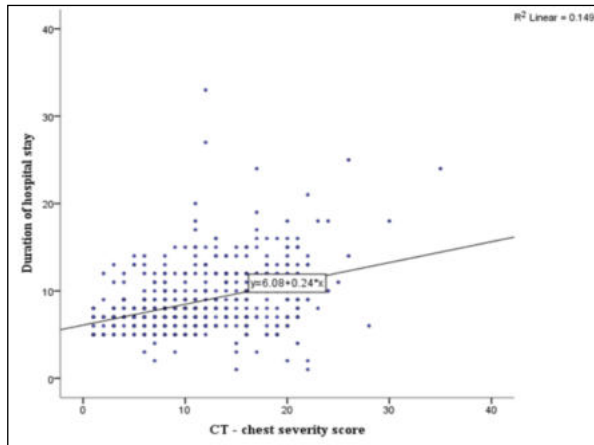
**Figure 4: Distribution Of Study Participants According To The CT - Chest Severity Score**

**Table 4: Association Between CT Severity Category And Duration Of Hospital Stay (n=531)**

	CT score category	Frequency	Mean	Mean difference	P-value
Duration of hospital stay	Not severe	444	8.32	-2.250	<0.001
	Severe	87	10.57		

**Table 5: Correlation Between CT Severity Score And Duration Of Hospital Stay (n=531)**

CT Severity score	Duration of hospital stay		
	Pearson Correlation	.386	
	Sig. (2-tailed)	P-value = <0 .001	
	N	531	

**Figure 5: Correlation Between CT Severity Score And Duration Of Hospital Stay (n=531)****DISCUSSION:**

In our study, the mean age of the study participants was 53.55 years. In contrast to our study a cross-sectional study done by Chaimayo et al., among 454 individuals who are RT-PCR positive for COVID-19, concluded that the mean age of the study participants was 38 years.<sup>16</sup> This indicates the variability of the distribution of COVID 19 infection across various regions. Similarly, a study done by Jakobsen et al, in Denmark among 4811 individuals, concluded that the mean age was 45 years.<sup>17</sup> This indicated the need for further research in various settings. In the same study, the majority of the affected individuals were female which constitutes 53 percent. This result is similar to our study where the females constitute about 72 percent. This may be the infective preference of the COVID 19 disease towards the female gender. But the difference in gender distribution has no statistical significance for severe disease and this needs further research. In our study, among the individuals who have comorbidities, the majority of them were diabetes (68%). In contrast to this study, a study done by Brojakowska et al., by using secondary data analysis, in 2020, concluded that the major comorbidity is obesity followed by hypertension (24.3%).<sup>18</sup> The prevalence of diabetes in the above study is only 15 percent. This study also concludes that the presence of co-morbidity in the COVID-19 affected individual has a statistically significant association with the severity of the disease and the adverse outcome. But in our study, there is no statistically significant association for the adverse outcome of the disease. This difference may be due to variation in the sample size and locality of the population and this indicates further research in various settings. In our study, about 17 percent of the individuals have severe illness and about 31 percent of individuals have mild illness according to CT severity scores. A review article written by Mujeeb Khan et al., shows similar results that about 15.7 percent develop severe illness after hospital admission.<sup>19</sup> In our study the prevalence of death among the affected individuals is 4 percent. In contrast to our study, a cross-sectional study done by Samudrala et al., among 1099 patients, concluded that the prevalence of severe patients was 5 percent and death was 1.4 percent.<sup>20</sup> This difference may be due to the difference in the sample size and varies with various countries. This may be due to the availability of quality health care systems in various countries. The prevalence of ageusia and anosmia in our study is 36 percent. And there is no statistical significance is observed between the above and severity of the disease or adverse outcome. In contrast to our study, there is about 85 percent prevalence among covid patients is found in the study done by Lechien et al., in Paris, among 417 patients. But the above study is also inconclusive about the association with the severity of the disease. This difference may be due to the coronavirus subtype variability and the susceptibility of the individual. This path is still open and needs more evidence for a conclusion. In our study, there is a statistically significant association between CT-severity score and mortality among the study participants ( $p = 0.003$ ). similar results are given by a cross-sectional study done by Francone et al., among 130 symptomatic patients states that there is a statistically significant

association between CT-severity score and the death of the patients.<sup>21</sup> In the same study there is a statistically significant correlation between the severity scores and high laboratory values which signifies the severe disease.

**STRENGTH AND LIMITATIONS:**

In our study minimum required sample size was met. And the data about the study participants were directly collected by the principal investigator which eliminates the inter-observer bias. Though, this study all the limitations incurred by a cross-sectional study and the association found in this study may not be a causal relation. This study is a hospital-based study that reflects the bias due to differences in the different rates of admission for different cases.

**CONCLUSION AND RECOMMENDATIONS:**

The CT-chest severity score is a trustworthy tool in predict the severity of COVID-19 disease. And there is a statistically significant correlation between the severity score and the duration of stay of hospital admission. Thus, every patient diagnosed with COVID-19 has been subjected to CT-chest and the patients can be classified according to the severity score for guiding the management of the patients.

**REFERENCES:**

- Petrosillo N, Viceconte G, Ergonul O, Ippolito G, Petersen E. COVID-19, SARS and MERS: are they closely related? *Clin Microbiol Infect.* 2020 Jun;26(6):729–34.
- Rodriguez-Morales AJ, MacGregor K, Kanagarajah S, Patel D, Schlagenhaut P. Going global - Travel and the 2019 novel coronavirus. *Travel Med Infect Dis.* 2020 Feb;33:101578.
- Zhu N, Zhang D, Wang W, Li X, Yang B, Song J, et al. A Novel Coronavirus from Patients with Pneumonia in China, 2019. *N Engl J Med.* 2020 Feb 20;382(8):727–33.
- Asghari A, Naseri M, Safari H, Saboory E, Parsamanesh N. The Novel Insight of SARS-CoV-2 Molecular Biology and Pathogenesis and Therapeutic Options. *DNA Cell Biol.* 2020 Oct;39(10):1741–53.
- Weekly epidemiological update on COVID-19 - 28 September 2021 [Internet]. World Health Organization. 2021 [cited 2021 Oct 4]. Available from: <https://www.who.int/publications/m/item/weekly-epidemiological-update-on-covid-19>
- India COVID - Cases and Deaths [Internet]. Worldometer. [cited 2021 Oct 4]. Available from: <https://www.worldometers.info/coronavirus/country/india/>
- Chen N, Zhou M, Dong X, Qu J, Gong F, Han Y, et al. Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: a descriptive study. *Lancet.* 2020 Feb 15;395(10223):507–13.
- Wang D, Hu B, Hu C, Zhu F, Liu X, Zhang J, et al. Clinical Characteristics of 138 Hospitalized Patients With 2019 Novel Coronavirus-Infected Pneumonia in Wuhan, China. *JAMA.* 2020 Mar 17;323(11):1061–9.
- Munster VJ, Koopmans M, van Doremalen N, van Riel D, de Wit E. A Novel Coronavirus Emerging in China - Key Questions for Impact Assessment. *N Engl J Med.* 2020 Feb 20;382(8):692–4.
- Ai T, Yang Z, Hou H, Zhan C, Chen C, Lv W, et al. Correlation of Chest CT and RT-PCR Testing for Coronavirus Disease 2019 (COVID-19) in China: A Report of 1014 Cases. *Radiology.* 2020 Aug;296(2):E32–40.
- Jin Y, Yang H, Ji W, Wu W, Chen S, Zhang W, et al. Virology, Epidemiology, Pathogenesis, and Control of COVID-19. *Viruses.* 2020 Mar 27;12(4):E372.
- Wang S, Kang B, Ma J, Zeng X, Xiao M, Guo J, et al. A deep learning algorithm using CT images to screen for Corona virus disease (COVID-19). *Eur Radiol.* 2021 Aug;31(8):6096–104.
- Li Y, Xia L. Coronavirus Disease 2019 (COVID-19): Role of Chest CT in Diagnosis and Management. *AJR Am J Roentgenol.* 2020 Jun;214(6):1280–6.
- Caruso D, Zerunian M, Polici M, Pucciarelli F, Polidori T, Rucci C, et al. Chest CT Features of COVID-19 in Rome, Italy. *Radiology.* 2020 Aug;296(2):E79–85.
- Saeed GA, Gaba W, Shah A, Al Helali AA, Raidullah E, Al Ali AB, et al. Correlation between Chest CT Severity Scores and the Clinical Parameters of Adult Patients with COVID-19 Pneumonia. *Radiology Research and Practice.* 2021 Jan 8;2021:e6697677.
- Chaimayo C, Kaewnaphan B, Tanlieng N, Athipanyasilp N, Sirijatuphat R, Chayakulkeeree M, et al. Rapid SARS-CoV-2 antigen detection assay in comparison with real-time RT-PCR assay for laboratory diagnosis of COVID-19 in Thailand. *Virol J.* 2020 Nov 13;17(1):177.
- Jakobsen KK, Jensen JS, Todsén T, Tolsgaard MG, Kirkyb N, Lippert F, et al. Accuracy and cost description of rapid antigen test compared with reverse transcriptase-polymerase chain reaction for SARS-CoV-2 detection. *Dan Med J.* 2021 Jun 14;68(7):A03210217.
- Brojakowska A, Eskandari A, Bissierier M, Bander J, Garikipati VNS, Hadri L, et al. Comorbidities, sequelae, blood biomarkers and their associated clinical outcomes in the Mount Sinai Health System COVID-19 patients. *PLoS One.* 2021 Jul 6;16(7):e0253660.
- Khan M, Adil SF, Alkhatlan HZ, Tahir MN, Saif S, Khan M, et al. COVID-19: A Global Challenge with Old History, Epidemiology and Progress So Far. *Molecules.* 2020 Dec 23;26(1):39.
- Samudrala PK, Kumar P, Choudhary K, Thakur N, Wadekar GS, Dayaramani R, et al. Virology, pathogenesis, diagnosis and in-line treatment of COVID-19. *Eur J Pharmacol.* 2020 Sep 15;883:173375.
- Francone M, Iaffrè 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. *Eur Radiol.* 2020 Dec;30(12):6808–17.