

CORRELATION OF CLINICAL SEVERITY WITH HRCT THORAX FINDINGS AMONG COVID -19 PATIENTS: A TERTIARY CARE HOSPITAL BASED STUDY

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Abstract:

Introduction: After 2019 outbreak of Coronavirus Disease 2019 (COVID-19), it has become an international emergency. Patients with mild disease generally present with fever, dry cough, and malaise but severe disease may lead to persistent airway and lung damage leading to respiratory failure and death. There is currently no specific treatment for severe COVID-19 patients, so early diagnosis is a must. Chest computed tomography (CT) has been widely practiced as a non-invasive tool for lung condition assessment. The present study aims to correlate clinical severity with HRCT thorax findings among COVID-19 patients in tertiary care centre of Belagavi, Karnataka. **Material and Method:** This cross-sectional study was conducted on COVID-19 patients admitted at KLES Dr. Prabhakar Kore Hospital, Belagavi from January 2021 to December 2021. After taking ethical clearance and applying exclusion criteria, a total of 100 COVID patients were included in the study. The diagnosis of COVID-19 was based on RT-PCR, CBNAAT or Rapid antigen test of nasal and pharyngeal swab specimens. All confirmed cases of COVID-19 were referred for HRCT chest evaluation. After obtaining informed consent, patients were subjected to thorough history taking and clinical examination. Clinical severity of the patients is noted and it is compared with CT severity score. Statistical analysis was done by SPSS software using descriptive analysis and chi-square test. A p-value<0.05 was considered to be statistically significant.

Result: Out of total 100 patients, 76 were males and 24 were females. Mean age of the patients in current study was found to be 53.61± 14.28 years with range of 27-87 years. Patients mostly presented with fever, cough, dyspnea and myalgia. Hypertension and diabetes were the most common comorbidities. 18 patients were having clinically mild COVID, 25

had moderate COVID and 57 patients were suffering from severe COVID. Patients with severe CT score were having maximum proportion of severe COVID i.e. 72.09% and the association between CT severity and clinical severity was found to be significant. CT scan can play an important role in the early evaluation and treatment of COVID-19 pneumonia.

Key words: COVID-19, HRCT, Clinical severity, Correlation, SARSCoV-2

Introduction:

Severe acute respiratory syndrome coronavirus 2 (SARSCoV-2) was initially described in a group of 41 people who presented with pneumonias of unknown causes in Wuhan, China, in December 2019.[1] The disease it causes was named Coronavirus Disease 2019 (COVID-19) by WHO in February 11, 2020. [2] SARS-CoV-2 belongs to β - coronavirus, which is a typical RNA virus.[3] Since the first observation, SARS-CoV2 infection epidemic has developed into a rare global healthcare emergency that has lately met the epidemiological requirements to be classified as a pandemic by the World Health Organization.[4]

Symptoms resulting from COVID-19 infection in the prodromal phase include fever, dry cough, and malaise which are nonspecific. Some patients may not even have obvious symptoms.[5] However advanced symptoms of COVID-19 include persistent airway and lung damage leading to respiratory failure. [6,7]

Most patients with COVID-19 demonstrate mild symptoms with a good prognosis, while some severe patients rapidly develop acute respiratory distress syndrome (ARDS), acute respiratory failure and other serious complications that eventually lead to critical outcomes. There is currently no specific treatment for critically ill COVID-19 patients, and case fatality rate for these patients is almost 20 times greater than that of non-severe patients, and they frequently require extensive medical resource consumption.[8] Thus, it is crucial for clinical purposes to identify patients as soon as possible who are at risk of developing serious COVID-19 problems.

For patients with COVID-19, chest computed tomography (CT) has been widely practiced as a non-invasive tool for lung condition assessment, [1,9,10] and because CT has been shown to be very sensitive investigation in SARS-CoV-2-infected patients, it is frequently employed to assist with patient care. Therefore, chest computed tomography (CT), in particular high resolution computed tomography (HRCT) represent valuable tools identifying patients with COVID-19 infections in an early stage when clinical symptoms may be unspecific or sparse.[5] Given that CT score and illness severity are closely connected, using it to expedite the diagnostic process in symptomatic cases may be advantageous. There are only few clinical studies explaining the relationship between clinical and CT severity in patients of COVID-19 in India. The present study aims to correlate clinical severity with HRCT thorax findings among COVID-19 patients in tertiary care centre of Belagavi, Karnataka.

Material and Method:

This cross-sectional study was conducted on COVID-19 patients attending the casualty and admitted at KLES Dr. Prabhakar Kore Hospital, Belagavi from January 2021 to December 2021. The diagnosis of COVID-19 was based on RT-PCR, CBNAAT or Rapid antigen test of nasal and pharyngeal swab specimens at any time during hospitalization. Ethical clearance

was obtained from institutional ethics committee. Sample size was estimated by using the optimal CT-SS threshold for identifying severe COVID-19 was 19.5 (area under curve, 0.892), with 83.3% sensitivity and 94% specificity from the study by Ran Yang et al. using the formula $n = [Z\alpha^2 * Sn * (100 - Sn)] / (d^2 * p)$ where Z = Standard normal value at 95% Confidence level, Sn = Sensitivity = 83.3%, $100 - Sn = 16.7%$, d = desired absolute precision = 5%, p = assumed prevalence = 5%. By considering above value the sample size came out to be 43 COVID-19 patients. To get confirmative results the sample size was increased to 100.

Patients <18 years, pregnant & lactating women, patients with lung surgery or with any other causes of common bacterial or viral pneumonia, pre-existing pulmonary disease or patients having cardiopulmonary comorbidity were excluded from the study. All confirmed cases of COVID-19 were referred for HRCT chest evaluation. An informed consent was obtained from all the subjects in the study. Patients were subjected to thorough history taking and clinical examination. After staging the clinical severity, it is compared with the CT severity score. Clinical severity stages were categorized as mild, moderate and severe based on Clinical management protocol: Covid 19, Government of India, Ministry of health and family welfare.[11] Sum of individual lobar score (3 lobes on the right and 2 lobes on the left) indicates the overall severity of five lobes and classified as mild (score <8), moderate (score 8-15) and severe (score >15). [12] Statistical analysis was done by SPSS software using descriptive analysis and chi-square test. A p-value<0.05 was considered to be statistically significant.

Results:

Mean age of the patients in current study was found to be 53.61 ± 14.28 years with range of 27-87 years. Almost 50% of the patients were in the age range of 41-60 years of age. There were 76 males and 24 females in the study with male: female ratio of 3.17:1.

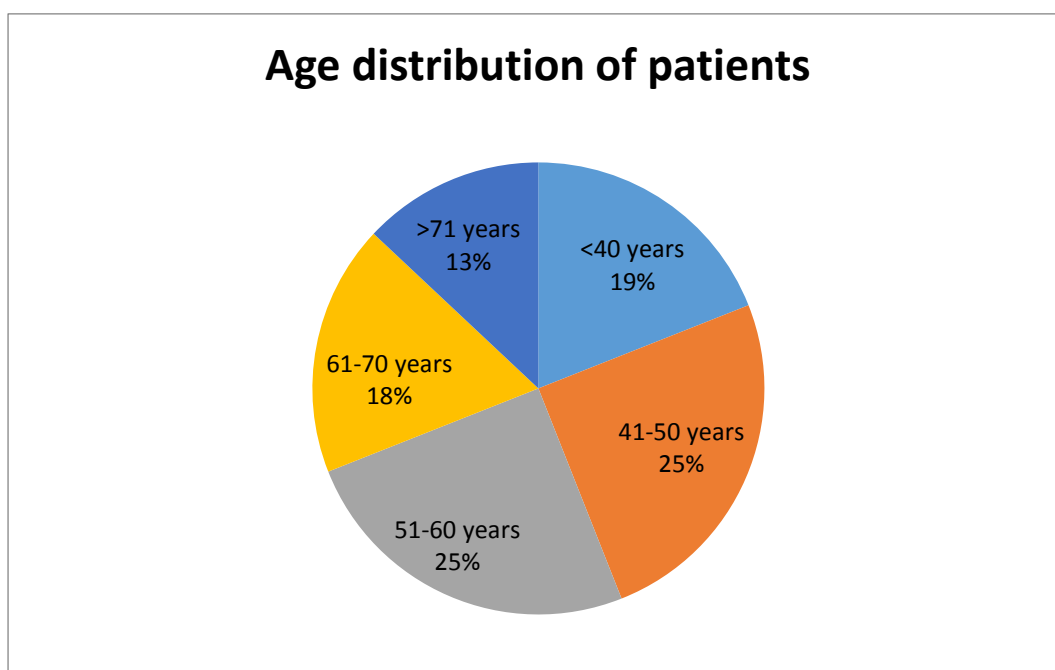


Table 1 shows clinical presentation and co-morbidities associated with COVID patients. As can be seen, the commonest symptom was fever (79%), cough (70%), dyspnea (69%), myalgia (21%) and other symptoms like altered sensorium, diarrhoea, vomiting etc. The most common comorbidity which was observed in our present study was hypertension which was 34%, diabetes mellitus in 31%, 7 patients with ischemic heart disease, 2 patients were with chronic kidney disease, 7 patients had other comorbidities (Hypothyroid, Seizure disorder, Cerebrovascular accident etc.)

Table1: Clinical presentation and co-morbidities associated with COVID patients

Clinical Characteristics		Present	Absent
Symptoms	Cough	70	30
	Fever	79	21
	Myalgia	21	79
	Breathlessness	69	31
	Other symptoms	6	94
Co-morbidities	Hypertension	34	66
	T2DM	31	69
	IHD	7	93
	CKD	2	98
	Others	7	93

Based on clinical severity, patients were classified into mild, moderate and severe covid infection as per Clinical management protocol: Covid 19, Government of India, Ministry of health and family welfare.[11] As can be seen in table 2, out of total 100 patients, 18 were having mild covid infection, 25 were having moderate covid and 57 were suffering from severe covid. Based on HRCT thorax observation the scoring was deployed for these patients and we categorized them into mild, moderate and severe based on CT scoring. We found mild cases were 15 patients, moderate were 42 patients and severe cases were 43 patients.

Table 2: Clinical and CT severity of COVID patients

Characteristics	Mild	Moderate	Severe	Total
Clinical severity	18	25	57	100
CT score severity	15	42	43	100

Clinical severity of patients was compared with their CT severity. Among patients with mild CT score (<8), six (40%), three (20%) and six (40%) patients were having clinically mild COVID, moderate COVID and severe COVID respectively. Among moderate CT score patients the proportion was 21.43%, 30.95% and 47.62% respectively for clinically mild,

moderate and severe COVID. Patients with severe CT score were having maximum proportion of clinically severe COVID i.e. 72.09%. There was a significant association between CT severity and clinical severity. (Table 3)

Table 3: Comparison of Clinical Severity COVID with HRCT thorax

CT severity	Mild COVID	Moderate COVID	Severe COVID	Total	Chi-square	p-value
Mild	6	3	6	15	11.3600	0.0230
Moderate	9	13	20	42		
Severe	3	9	31	43		
Total	18	25	57			

Mean CT score of COVID patients in this study was 14.15 ± 5.44 . Mean CT score of mild, moderate and severe COVID patients was compared by ANOVA and a significant difference was found among them. Mean CT score of mild, moderate and severe COVID was 10.72 ± 5.19 , 13.60 ± 4.44 and 15.47 ± 5.48 respectively.

Table 4: Comparison of Clinical severity with CT score

Parameters	Mild COVID		Moderate COVID		Severe COVID		Total		F-Value	p-value
	Mean	SD	Mean	SD	Mean	SD	Mean	SD		
CT Severity	10.72	5.19	13.60	4.44	15.47	5.48	14.15	5.44	5.9177	0.0003*

We observed the involvement of upper and lower lobes both was more followed by lower lobe. Only one patient had involvement of upper lobe and that too in mild group. By transverse view comparison the peripheral distribution was more observed in all the groups as compared to diffuse distribution which was seen only in moderate and severe groups. The association of craniocaudal and transverse distribution with clinical severity of COVID was found to be non-significant. When we observed distribution of lung lesion by scattered means, we found multi-focal involvement of lungs to be most common (81%) followed by diffuse (13%) and focal (6%) involvement. The association of scattered distribution was found to be significant with clinical severity.

Table 5: Comparison of clinical severity of COVID with different views of CT

CT view	Category	Mild COVID	Moderate COVID	Severe COVID	Total	Chi-square	p-value
Craniocaudal distribution	Lower lobe	10	13	26	49	5.576	0.233
	Upper lobe	1	0	0	1		
	Both upper and lower lobe	7	12	31	50		
	Total	18	25	57	100		
Transverse Distribution	Peripheral	18	21	45	84	4.511	0.105
	Diffuse	0	4	12	16		
	Total	18	25	57	100		
Scattered Distribution	Diffuse	0	0	13	13	14.672	0.005
	Focal	1	0	5	6		
	Multi-focal	17	25	39	81		
	Total	18	25	57			

Discussion:

Present study was conducted on 100 COVID-19 patients admitted at KLES Dr. Prabhakar Kore Hospital, Belagavi from January 2021 to December 2021 to correlate clinical severity with HRCT thorax findings. The mean age of our patients in our study was 53.61 ± 14.28 years with range of

Saeed et al. [13] found mean age of the patients to be 44.2 ± 11.9 years in their study of 902 patients. Study by Gupta et al., [14] they also observed in their study population the mean age was 43.3 years and patient age ranged from 16- 73 years although, their study population was very small.[15] In our present study there was male preponderance observed (n = 76) female (n = 24) with a ratio of male: female of 3.17:1. Study Zhao et al, [16] observed a slight male preponderance in their study group of 101 patients. Study Saeed et al, [13] observed male preponderance, almost 85% compared to 14.7% female patients in their study group of 902 patients.

The commonest symptom being was fever (79%), cough (70%), dyspnea (69%), myalgia (21%) and other symptoms which were observed in 6 patients consisting of headache, vomiting, diarrhoea, seizures and confusional state. Bhandari et al., [17] also observed fever, cough, myalgia as the commonest symptoms. Study by Huang et al., [18] in their study population of 41 patients the commonest symptoms observed was fever, cough and dyspnea. As far as comorbidities are seen, hypertension followed by diabetes was the most common comorbidities in this study. Study by Bhandari et al., [17] found type II diabetes mellitus followed by hypertension as the commonest comorbidities in their study population.

On the basis of clinical severity the proportion of patients having mild, moderate and severe Covid was 18%, 25% and 57% respectively. In current study, HRCT severity score was also done and found 43 patients in the severe group which is much less than found by Sharma et al. [19]

When we compared clinical severity and HRCT findings among COVID patients, a significant correlation was observed between clinical and HRCT findings. Same comparison with one way ANOVA method also reflected the p value statistically being significant in these groups of patients. Other studies also found similar outcomes. Saeed GA et al. [20] found that oxygen requirements increase with the increasing CT severity. This may be due to direct damage of lungs by the virus causing inflammatory changes in alveolar wall that limit oxygen exchange, leading to acute respiratory distress, pulmonary fibrosis, and eventually death.

Also significant pulmonary thromboembolic effects were found more among patients with high CT severity score. [21,22]

In craniocaudal view, involvement of upper and lower lobes both was found to be more followed by lower lobe. A study by Zhao et al. [16] have described craniocaudal view by HRCT in their study group and found most of their study population the involvement was more in the lower lobes. By transverse view comparison the peripheral distribution was more observed in all the groups as compared to diffuse distribution. Zhao et al. [16] also observed peripheral distribution more in their study population. Comparison with clinical severity with scattered distribution on HRCT was done and we found multi-focal involvement of lungs to be most common (81%) followed by diffuse (13%) and focal (6%) involvement. This is in sharp contrast by Zhao et al. [16] who have observed 78% had diffuse pattern.

Limitations of the study: In this study the sample size is small, the results of which cannot be extrapolated. A larger cohort study is required to obtain a definitive answer.

Conclusions: In conclusion, there is male predominance in COVID with mean age of 53.61 ± 14.28 years. Fever, Cough and Dyspnea are the most common symptoms of COVID. The most common comorbidity which was observed in our present study was hypertension. Based on clinical severity, most of the patients in this study were having severe disease. Patients with high CT score tended to be suffering from clinically severe disease. The association between CT score severity and clinical severity was found to be statistically significant. Involvement of upper and lower lobes together was most common. Multi-focal involvement of lungs was more common especially among clinically severe COVID patients than diffuse and focal involvement. CT scan can play an important role in the evaluation and further treatment of COVID-19 pneumonia.

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