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A STUDY OF CLINICAL CO-RELATION WITH RADIOLOGICAL FINDINGS IN PATIENTS WITH COVID-19 POSITIVE STATUS.

General Medicine

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ABSTRACT

Background: Radiological imaging in COVID-19 disease has a significant role in correlating with clinical symptoms and signs, the severity of the disease, and the overall outcome of patients with the disease. **Method:** This study was a single-centred cross-sectional study conducted on COVID-19 positive patients in the Medicine Department, Civil hospital, Ahmedabad, from September 2020 to September 2021. **Result:** There was a significant association between the severity of the disease on the chest CT and the death of the patient (p = <.0001). The mean CT severity score among patients who died was significantly higher than that of patients who survived. (p = <.0001) **Conclusion:** chest CTs in COVID-19 disease play a significant role in correlating with clinical symptoms and signs, severity of the disease, early diagnosis and intervention, and predicting the overall outcome of patients with the disease.

KEYWORDS

COVID-19, CORADS classification, CT severity score.

INTRODUCTION:

The unprecedented COVID-19 pandemic originated in December 2019 in the city of Wuhan, Hubei Province, China[1]. The causative agent was identified as a novel coronavirus, initially named 2019-nCoV and later officially named SARS-CoV-2 due to its genetic similarity to the Severe Acute Respiratory Syndrome Coronavirus (SARS-CoV). The emergence of the novel coronavirus, SARS-CoV-2, in late 2019 has thrust the global community into an unprecedented public health crisis, with COVID-19 at its forefront.

The virus is predominantly transmitted via respiratory droplets released during coughing, sneezing, or talking by an infected person. This highly contagious respiratory illness swiftly transcended international borders, challenging healthcare systems, economies, and societal norms worldwide. Characterized by a diverse clinical spectrum, ranging from mild respiratory symptoms to severe pneumonia and acute respiratory distress syndrome (ARDS), COVID-19 has posed formidable challenges to our understanding of infectious diseases. The rapid spread of the virus has prompted an urgent need for comprehensive research, encompassing epidemiology, virology, clinical manifestations, diagnostics, and therapeutic interventions. As the world continues to grapple with the multifaceted impact of the pandemic, a deeper understanding of the virus and its associated disease is crucial for formulating effective public health strategies, mitigating transmission, and ultimately bringing an end to this global health crisis.

The present study was carried out to see whether CTs could play an essential role in identifying patients with a high likelihood of grave outcomes and thus early diagnosis and planning intervention, as well as their correlation with various clinical and laboratory parameters routinely done in COVID-19-positive patients.

Study Design:

This study was a single-centred cross-sectional study conducted on COVID-19-positive inpatients at the Medicine Department, 1200-bed Hospital, Civil Hospital, Ahmedabad, from September 2020 to September 2021. The study was conducted after the Institutional Ethics Committee's approval.

Subject Selection:

- Inclusion Criteria:

All patients with confirmed COVID-19 pneumonia (RTPCR or rapid antigen positive) with an age >18 years of age, with their consent, were included.
All the COVID-positive patients' entries were done on the ICMR portal.

- Exclusion Criteria:

Patients with an age <18 years, pregnant females, RTPCR or RAT-negative patients, and patients who did not give their consent.

Study Process:

All the details had been recorded in the standard case record (Annexure-II) form, and all these data were entered in a Microsoft Excel sheet. Results were presented as mean ± standard deviation SD, or percentages. Intergroup comparisons were made using the chi-square test. A graphic and statistical display of various variables was done.

Treatment was given to all patients, according to updated protocol as per recommendation and guidelines of government of India.

RESULTS:

Demographic factors like Age, gender, clinical presentation, comorbidities were collected. Laboratory investigations and CT findings and scores were compiled for comparison.

As mentioned in Table 1, the CT severity score was graded as mild (grade 1) (<8), moderate (grade 2) (8-15), and severe (grade 3) (>15). 40 (40%) patients had grade 3 severity, followed by moderate severity in 36 (36%) patients; 14 (14%) patients had grade 1 CTSS; and 10 (10%) patients had normal chest CT.

Table 1: CT Severity Score

CT Severity	No. of Patients(N=100)
Mild	14(14%)
Moderate	36(36%)
Severe	40(40%)

Normal	10(10%)
Total	100

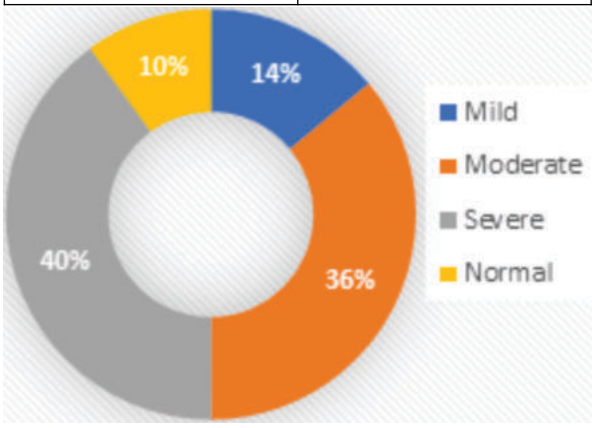

Figure 1: CT Severity score

Table 2: CT Findings Comparison Between Different CT Severity Groups

		All (N=100)	Mild (n=14)	Moderate (n=36)	Severe (n=40)
Distribution	Right Upper lobe	42 (42%)	3 (21.43%)	14 (38.89%)	25 (62.5%)
	Right Middle lobe	76 (76%)	4 (28.75%)	33 (91.67%)	39 (97.50%)
	Right lower lobe	85 (85%)	10 (71.43%)	36 (100%)	39 (97.50%)
	Left Upper lobe	58 (58%)	4 (28.57%)	20 (55.56%)	34 (85%)
	Left lower lobe	86 (86%)	12 (85.71%)	36 (100%)	38 (95%)
	Peripheral	77 (77%)	13 (92.86%)	32 (88.89%)	32 (80%)
	Peripheral & Central	35 (35%)	0	8 (22.22%)	27 (67.50%)
	Focal	6 (6%)	6 (42.86%)	0	0
	Bilateral	84 (84%)	8 (57.14%)	36 (100%)	40 (100%)
	Lung involvement >50	41 (41%)	0	7 (19.44%)	34 (85%)
	GGO	77 (77%)	9 (64.29%)	33 (91.67%)	35 (87.50%)
Main Pattern on CT	Crazy paving	46 (46%)	0	18 (50%)	28 (70%)
	Consolidation	60 (60%)	6 (42.86%)	21 (58.33%)	33 (82.50%)
	Mixed GGO & Consolidation	56 (56%)	4 (28.57%)	21 (58.33%)	31 (77.50%)
	Reticular/ Nodule/ Band	24 (24%)	3 (21.43%)	10 (27.78%)	11 (27.50%)
	Pleural Effusion	1(1%)	1(7.14%)	0	0
	Clear	10 (10%)	0	0	0

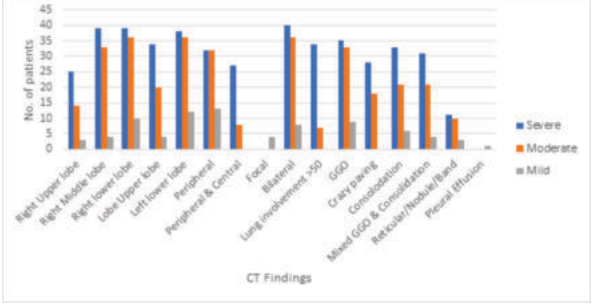

Figure 2: CT Findings Comparison Between Different CT Severity Groups

As mentioned in Table 2, the common CT findings in all groups included GGO (77%), consolidation (60%), mixed GGO & consolidation (56%), crazy paving (46%), reticular/nodule/band (24%), and pleural effusion (1%). 10% of patients had a normal chest CT. The occurrence of these typical CT pattern findings was significantly higher in the severe group as compared to the other two groups.

The lesions were predominantly in the peripheral zones, with 77 (77%) patients having peripheral distribution, while 35 (35%) patients had central and peripheral distribution. The lesions were focal in 6 (6%) patients, while they were bilateral in 84 (84%). All the patients in the moderate and severe categories had bilateral involvement (36 and 40 patients respectively).

The lower lobes of the lungs were the most commonly involved areas across all the grades of severity [Right: (85%), Left: (86%)].

Table 3: Demographic And Baseline Characteristic Correlation Between Different CT Severity Groups

Variables		CT Severity				P value
		Normal (n=10)	Mild (n=14)	Moderate (n=36)	Severe (n=40)	
Age	21-40	6 (60%)	4 (28.6%)	8 (22.2)	7 (17.5%)	0.015896
	41-60	4 (40%)	7 (50%)	17 (47.2%)	20 (50%)	
	61-80	0	3 (21.4%)	11 (30.6%)	12 (30%)	
	Above 80	0	0	0	1 (2.5%)	
Gender	Male	8 (80%)	13 (92.9%)	24 (66.7%)	23 (57.5%)	0.33362
	Female	2 (20%)	1 (7.1%)	12 (33.3%)	17 (42.5%)	
Symptoms	Cough	4 (40%)	10 (71.4%)	22 (61.1%)	30 (75%)	
	Sore throat	3 (30%)	7 (50%)	18 (50%)	11 (27.5%)	
	Congestion and runny nose	3 (30%)	6 (42.9%)	2 (5.6%)	7 (17.5%)	
	Loss of smell or taste	1 (10%)	2 (14.3%)	6 (16.7%)	6 (15%)	
	Fever	7 (70%)	10 (71.4%)	22 (61.1%)	25 (62.5%)	
	Chills/ rigors	4 (40%)	7 (50%)	16 (44.4%)	18 (45%)	
	Shortness of breath	0	7 (50%)	25 (69.4%)	31 (77.5%)	
	Body ache	3 (30%)	5 (35.7%)	7 (19.4%)	0	
Co-morbidities	With Comorbidity	1 (10%)	7 (50%)	25 (69.4%)	32 (80%)	0.0326
	Without Comorbidity	9 (90%)	7 (50%)	11 (30.6%)	8 (20%)	
	Hypertension	0	5 (35.7%)	17 (47.2%)	21 (52.5%)	0.1188
	Diabetes Mellitus	0	3 (21.4%)	7 (19.4%)	15 (37.5%)	0.0179
	Obesity	1 (10%)	1 (7.1%)	1 (2.8%)	5 (12.5%)	0.1486
	COPD/ Asthma	1 (10%)	1 (7.1%)	2 (5.6%)	6 (15%)	0.1925
	Thyroid Disease	0	0	3 (8.3%)	3 (7.5%)	0.5436
	IHD	0	1 (7.1%)	5 (13.9%)	10 (25%)	0.04
	CKD	0	0	1 (2.8%)	10 (25%)	0.002

	Pulmonary Tuberculosis	0	2 (14.3%)	0	0	
	Cancer	0	0	1 (2.8%)	3 (7.5%)	0.1408
Risk Factors	Smoking	1 (10%)	2 (14.3%)	3 (8.3%)	2 (5%)	0.4714
	Alcohol	0	1 (7.1%)	1 (2.8%)	4 (10%)	0.148
Hospital Stay (in days)		5.70 (1.64)	5.14 (2.14)	8.17 (5.39)	12.8 (10.93)	0.0124

As mentioned in Table 3, normal chest CT was seen in 21-40 age group (60 %). Mild CTSS in 41–60year age group (47.2%) and least in those above 80 years (0%). Severe disease was detected mainly in 41–60year age group (50%) and least in those above 80 years (1.25%). There was a significant correlation between the severity of disease and the increasing age of the patient (p = 0.015896). A higher proportion of cases with mild disease had a younger age compared to cases with severe disease, which was present in older age groups.

There was no significant association between the severity of the disease and gender of the patient (p = 0.33362). The distribution of cases with moderate and severe disease was comparable, with a higher number of male patients in both groups. Females had a higher proportion of cases in the moderate and severe categories.

Severe cases had a significantly higher number of patients with comorbidities (80%), as compared to the milder group (50%) (p = 0.0326). The percentage of patients having comorbidities in the moderate group was found to be (69.4%).

A significant association was found between diabetes mellitus, ischemic heart disease (IHD), and chronic kidney disease (CKD) and the severity of the disease. (0.0179, 0.04, and 0.002, respectively). No significant association was found with hypertension, obesity, chronic obstructive pulmonary disease (COPD), thyroid disease, pulmonary tuberculosis, and cancer. (p = 0.1188, 0.1486, 0.1925, 0.5436, and 0.1408, respectively)

The mean (SD) hospital stays in the normal, mild, moderate, and severe categories were 5.70 (1.64), 5.14 (2.14), 8.17 (5.39), and 12.8 (10.93) days, respectively. On comparing the mild and severe groups, the difference between the two groups was statistically significant (p = 0.0124).

Table 4: Outcome

	Patients survived(n=57)	Patients Died(n=43)	p value
Normal	10 (17.54%)	0	< .0001
Mild	13 (22.81%)	1 (2.33%)	
Moderate	26 (45.61%)	10 (23.26%)	
Severe	8 (14.04%)	32 (74.42%)	
Mean (SD)	9.08(5.93)	18.30 (4.8)	< .0001

Among the patients who died due to COVID-19 disease (43 out of 100), 32 (74.42 %) patients had severe disease, and 10 (23.26 %) patients had moderate grade disease, while only 1 of the patients (2.33%) had mild grade disease.

A significantly higher proportion of cases who died had a severe grade of disease, according to CTSS.

In contrast, among the patients who survived (57 out of 100), 13 (22.81%), 26 (45.61%), and 8 (14.04%) patients were in the mild, moderate, and severe categories, respectively.

All 10 (100%) patients with normal CT scans survived, and none of them died. In the mild category, 13 (92.86%) patients survived, and only 1 (7.14%) patient died. In the moderate category, 26 (72.22%) patients survived, and 10 (27.78%) patients died, while only 8 (20%) patients survived in the severe category and 32 (80%) patients died.

There was a significant association between the severity of the disease on the chest CT and the death of the patient (p = <.0001). The mean CT severity score among patients who died was significantly higher than that of patients who survived. (p = <.0001)

Table 5: Laboratory Findings

Biochemical Markers	All	Normal	Mild	Moderate	Severe	p value
Hb	12.41	13.17	12.87	12.31	12.15	.63908
NLR	4.97	2.88	5.42	4.48	5.77	.00139
Neutrophils	8013.00	5150.80	7671.57	7158.78	9616.85	.00154
Lymphocytes	1727.83	1844.80	1531.86	1813.39	1690.18	.96247
TC	10507.7	7701.00	9732.00	9781.28	12134.65	.00309
Platelet	238224.08	253400.00	250242.86	236861.33	231450.0	.42305
ESR	46.22	16.70	37.79	49.64	53.48	.00380
Ferritin	788.20	130.81	371.12	645.26	1227.18	.00042
LDH	506.14	275.40	337.64	512.36	617.20	.00017
CRP	8.57	0.60	5.10	9.28	11.15	<.0001
D-dimer	2.25	0.24	1.38	1.48	3.74	<.00001
Fibrinogen	422.05	304.40	405.29	447.01	434.88	.01194
Il-6	200.04	3.14	13.35	116.87	389.45	<.00001
Procalcitonin	2.00	0.16	0.09	1.02	4.01	.01737
CTSS	13.05	0.00	2.88	12.08	20.03	

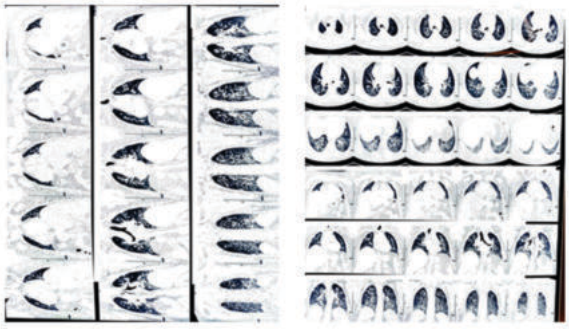

Figure 3: HRCT Thorax

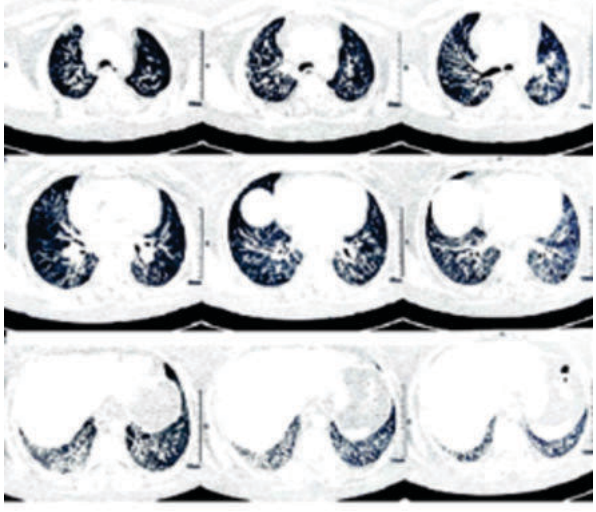

Figure 4: HRCT Thorax

DISCUSSION:

Over the past years, many studies have been conducted to understand the correlation between clinico-radiological findings in patients with COVID-19 disease. They have proven the role of chest CT in predicting disease severity and outcome in COVID-19 patients.

In our study, the mean age was 51.59 ± 15.11, which was comparable to the study done by Sharma et al.[3] (54.446 ± 16.71) & Li et al.[4] (45.5 ± 12.3). Additionally, the findings of our study show that the chance of developing a serious illness gradually rises with age, starting from 41 to 60 years old, and a statistically significant positive correlation was found between the severity of disease and the age of the patient. (p =.015896)

A higher proportion of cases with mild-moderate disease had a younger age compared to severe disease, which was present among the older age group.

In our study, female patients (32%) were fewer than males (68%). There was no significant association between severity of the disease and gender of the patient.

In our study, COVID-19 pneumonitis patients presented with chief complaints of cough (66%), fever (64%), and sore throat (39%). Our study had a higher percentage of patients with shortness of breath owing to the fact that mainly patients with moderate to severe disease were admitted to the tertiary care hospital.

Among all patients, 65% had some or other underlying comorbid disease like diabetes mellitus, hypertension, COPD, and others, which is comparable to the study done by Citu et al.[2] and Sharma et al. [3].

As mentioned in Table 5, we correlated laboratory parameters with CT severity scores. This association of laboratory parameters with CT plays a vital role in the diagnosis and management of patients with SARS-CoV-2 infection. Severe disease was associated with a significantly lower lymphocyte count compared to mild disease. In contrast, CRP, D-dimer, and serum ferritin were significantly higher in severe cases compared to mild cases. A strong correlation between lymphopenia and disease severity can be related to the inflammatory cytokine storm in COVID-19 patients.

As mentioned in Table 5, statistically significant correlation was found between raised CRP, IL-6, LDH, PCT, ferritin levels and increasing CT severity. Previous studies have also suggested that these inflammatory markers can be used as a predictive marker for the likelihood of disease progression and can guide clinicians in early treatment at an early disease stage. Similarly, higher D-dimer levels were seen in severe disease and can be used as a prognostic indicator.

In our study, patient survival was significantly decreased among patients with severe CT findings (20% in severe vs. 92.86% in mild). The mean CT severity score among patients who died was significantly higher than that of patients who survived. These findings were comparable to the study done by Sharma et al [3]. The considerable number of deaths could be attributed to samples taken from tertiary care hospitals, which admit comparatively sicker patients.

CONCLUSION:

Although the majority of people with COVID-19 disease have only mild to moderate symptoms, this disease can at times cause severe complications and lead to death in a few people.

- Older people or people with existing medical conditions are at greater risk of becoming seriously ill with COVID-19.
- As evident from this study, clinical factors like older age, multiple comorbid conditions, symptoms like shortness of breath, and several laboratory parameters had a significant positive correlation with the severity of the disease, according to the CTSS.
- In our study, as expected, oxygen requirement increased with increasing CTSS. It may be due to the direct damage to the lungs by the virus, causing inflammatory changes in the alveolar wall, thus limiting oxygen exchange, leading to ARDS, pulmonary fibrosis, and eventually the death of the patient.
- Patients with severe disease, according to the CTSS, also had a longer hospital stay, higher mortality, and thus a poorer prognosis as compared to the mild and moderate groups.
- In conclusion, chest CTs in COVID-19 disease play a significant role in correlating with clinical symptoms and signs, severity of disease, early diagnosis, intervention, and predicting the overall outcome of patients with the disease.

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