

Comparison of HRCT Chest Findings of COVID-19 Patients Having Clinical Co-morbid to Those Without Co-morbid Disease

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ABSTRACT

Objective: To determine the severity of High-Resolution Computed Tomography Chest findings of COVID-19 patients having co-morbid in comparison to those without co-morbid.

Study Design: Comparative cross sectional study.

Place and Duration of the Study: Radiology Department Combined Military Hospital, Multan Pakistan, from Mar to Sep 2020.

Methodology: Data was collected through the medical record system of positive COVID-19 tests. Patients were divided into patients with no co-morbidities and others having co-morbidities. Two radiologists interpreted High-Resolution Computed Tomography chests independently to assess the disease severity in these two Groups. Co-morbidities included diabetes mellitus, hypertension, chronic renal disease, heart disease, Chronic Obstructive Pulmonary Disease and liver diseases.

Results: A total of 200 patients were included. Out of 121 male patients, 85 had co-morbidities (71 had moderate to severe lung involvement; 14 had mild lung involvement); while 36 had no co-morbidities (5 had moderate to severe lung involvement; 31 had mild lung involvement). Out of 79 female patients, 47 had co-morbidities (15 had moderate to severe lung involvement; 32 had mild lung involvement); while 32 had no co-morbidities (3 had moderate to severe lung involvement; 29 had mild lung involvement).

Conclusion: The severity of lung involvement was remarkably higher in patients with associated co-morbidities compared to no co-morbidities. Older age male patients having co-morbidities pose a risk factor for the severity of disease progression as compared to younger age female patients having no co-morbidities

Keywords: COVID-19 patients, Co-morbidities, HRCT chest.

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INTRODUCTION

Recent studies have addressed the importance and sensitivity of 98% of High-Resolution Computed Tomography (HRCT) Chest for early diagnosis, even in patients with false negative RT-PCR results.^{1,2} HRCT Chest plays an important role in screening suspected patients and their diagnosis, assessing disease progression and its severity, detecting complications, and follow-up of patients after discharge.^{3,4}

Older patients with co-morbid have shown a higher risk for severe illness, poor prognosis, more hospitalization and Intensive Care Unit (ICU) admissions and higher mortality rates. In addition, changes are more severe in male patients than in female patients.^{5,6}

Literature shows that elderly and middle-aged COVID-19 patients having co-morbid factors like

Diabetes, hypertension and others have more exacerbated symptoms with bad prognoses as compared to patients having no comorbid.^{7,8,9} Therefore, we have analyzed and compared the severity of the lung manifestations on the HRCT chest in COVID-19 patients having associated co-morbidities/risk factors. Our rationale for the study is to help inform clinicians to pre-determine the severity of the course of disease on HRCT chest and prognosis of patients having co-morbidities and to assist in combating the epidemic.

METHODOLOGY

The comparative cross sectional study was conducted at Radiology Department Combined Military Hospital, Multan Pakistan, from March to September 2020 and approved the Ethical Committee of CMH Multan (certificate number 117 dated 20 Mar 2020).

Inclusion Criteria: Patients with positive COVID-19 PCR test, aged 30-70 year, of either gender genders with co-morbid disease like diabetes mellitus, hypertension, chronic renal disease, heart disease, Chronic

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Obstructive Pulmonary Disease (COPD) or liver diseases, were included in the study.

Exclusion Criteria: Patients having negative COVID-19 PCR test were excluded from our study.

All the diagnosed COVID-19 patients through RT-PCR tests and HRCT Chest at the Radiology Department CMH Multan were included. The clinical and laboratory data were collected through the medical record system. HRCT chest images were interpreted independently by two experienced radiologists. The data blinded both, and the final report was given to the patient by consensus.

All HRCT chest scans were performed on Toshiba Asterion 160 slice CT scanner. Images were attained during a single inspiratory breath hold. The scanning range was done from the apex of the lungs to costophrenic angles. Scanning parameters were tube current 350mAs, tube voltage 120kVp, rotation time 0.5 sec, the interval between slices 5mm, pitch 1.0 and reconstruction with 1.25mm slices for HRCT with <5 sec scanning time.

Patients were divided into two Groups, one Group included the COVID-19 positive cases with no associated co-morbidities, and the other Group included COVID-19 patients having co-morbidities. The co-morbidities included diabetes mellitus, hypertension, chronic renal disease, heart disease, COPD and liver diseases. HRCT severity scores were used to quantify the severity of changes in COVID-19 patients. Patients <30 years of age and patients with negative PCR tests were excluded from our study.

Statistical Package for Social Sciences (SPSS) version 22.0 was used for the data analysis. Quantitative variables were expressed as Mean±SD and qualitative variables were expressed as frequency and percentages. Chi-square test was applied to explore the inferential statistics. The *p*-value of ≤0.05 was considered statistically significant.

RESULTS

Our study included two hundred patients were included from 30 and divided into <45 and >45 years age Groups (Table-I). One hundred twenty-one were male, and 79 were female patients. Out of 121(60.5%) male patients, 85(70.2%) patients had co-morbidities like Diabetes Mellitus, hypertension, chronic renal disease, heart disease, COPD, and liver diseases, while 36(29.8%) patients had no co-morbidities. Of 85(70.2%) male patients (out of 121) having co-morbidities, 71 patients have moderate to severe >30% of lung

parenchymal involvement, while 14 patients have mild <30% of lung parenchymal involvement. Of 47(59.5%) female patients (out of 79) having co-morbidities, 15 patients have moderate to severe 30-90% of lung parenchymal involvement, while 32 patients have mild <30% of lung parenchymal involvement (Table-II).

Table-I: Severity of COVID-19 on HRCT According to Age Groups (n=200)

Years	COVID Severity on HRCT		<i>p</i> -value
	Moderate/Severe	Mild	
<45	06(9.8%)	55(90.2%)	<0.001
>45	88(63.3%)	5(36.7%)	
Total	94(47%)	106(53%)	

Table-II: Severity of COVID on HRCT According to Gender(n=200)

Gender	COVID Severity on HRCT		<i>p</i> -value
	Moderate/Severe	Mild	
Male	76(62.8%)	45(37.2%)	<0.001
Female	18(22.8%)	61(77.2%)	
Total	94(47%)	106(53%)	

Our results showed that patients with associated co-morbidities (including chronic renal disease, heart disease, COPD and liver diseases) have increased severity of disease, more marked lung parenchymal involvement and pose a risk factor for severity of disease progression and poor prognosis in COVID-19 patients. (Table-III). Moreover, male patients were more prone to increase lung parenchymal involvement having moderate to severe disease, while female patients were less prone to moderate/severe disease (Table-IV). Likewise, patients of >45 years of age were more prone to increase lung parenchymal involvement with moderate to severe disease, while patients of <45 years of age were less prone to moderate/severe disease and had mild lung involvement (Table-V).

Table-III: Severity of COVID on HRCT in Patients with and Without Co-morbids (n=200)

	COVID Severity on HRCT		<i>p</i> -value
	Moderate/ Severe	Mild	
Comorbids Present	86(65.2%)	46(34.8%)	<0.001
Comorbids Absent	8(11.8%)	60(88.2%)	
Total	94(47%)	106(53%)	

DISCUSSION

We focused on the analysis of HRCT chest findings. We compared the severity of the radiological manifestations of COVID-19 patients who had

associated co-morbidities to those with no additional co-morbidities. All the admitted patients were positive for COVID-19 on the RT-PCR test. The patients had a repeat RT-PCR test if the first test was negative to reduce the false negative diagnosis.

Table-IV: Comparison of Disease Severity in Different Age Groups with and Without Comorbids (n=200)

Age Groups	Comorbidities	COVID Severity on HRCT		p-value
		Moderate/ Severe	Mild	
<45 years	Comorbidities Present	2(33.3%)	4(66.7%)	0.042
	No Comorbidity	4(7.3%)	51(92.7)	
>45 years	Comorbidities Present	84(66.7%)	42(33.3%)	0.011
	No Comorbidity	4(30.8%)	9(69.2%)	

Table-V: Comparison of Gender of Disease Severity in Patient with and Without Comorbids (n=200)

Gender	Comorbidities	COVID Severity on HRCT		p-value
		Moderate/ Severe	Mild	
Male	Comorbidities Present	71(83.5%)	14(16.5%)	<0.001
	No Comorbidity	5(13.9%)	31(86.1%)	
Female	Comorbidities Present	15(31.9%)	32(68.1%)	0.019
	No Comorbidity	3(9.4%)	29(90.6%)	
Total		94(47%)	106(53%)	

Our study showed that male patients with co-morbidities have a poor prognosis, more ICU hospitalizations and higher mortality rates as compared to female patients with co-morbidities, which is the same as previous studies.¹⁰⁻¹² The majority of the patients admitted to our hospital had diabetes mellitus and hypertension as associated co-morbidities which are the same as a study done by Fang *et al.*¹³ In a cohort study of 7337 COVID-19 patients,¹⁴ it was shown that patients having type-2 diabetes had increased mortality, more hospital stay/interventions, and increased risk of complications than patients without type-2 diabetes. However, other associated co-morbidities were chronic renal disease, heart disease, COPD and liver diseases. Most of these co-morbidities are also seen in the study of Richardson *et al.*¹⁵ Fever was the most common clinical symptom, followed by cough and dyspnea, which is in correlation with the study of Zhou *et al.*¹⁶ The patients with severe symptoms were managed and admitted to the ICU

setting. The HRCT was done on admission and then repeated after one week or ten days for follow-up in clinically deteriorating patients; the same protocol was adopted by Sohail *et al.*¹⁷

The HRCT findings for co-morbid patients were more extensive involvement of the lungs with many lung segments. There was bilateral, subpleural and peripheral involvement of lungs, predominantly lower lobes followed by middle and upper lobes, but rarely involved unilaterally, which is in correlation with the study of Rubin *et al.*¹⁸ Lesions were mainly involved in the right lung and right lower lobe, likely due to the relatively thick and short right lower lobar bronchus which allows the virus to enter more easily.¹⁹

Common imaging features were ground glass opacities (GGO), GGO with consolidation and air-bronchograms, GGO with interlobular septal thickening, crazy-paving appearance and parenchymal bands. These similar findings were also seen in the study by Pan *et al.*²⁰

CONCLUSION

In conclusion, the study compares different patterns of lung involvement in patients with co-morbid to those without co-morbid. Pure GGO, GGO with consolidation, and crazy paving were found in both Groups; however, lung lobes' involvement was remarkably higher in patients having associated co-morbid. Bronchiectasis, Pleural effusions, mediastinal lymphadenopathy and pulmonary embolism, although uncommon findings, were found in patients with co-morbid. Male elderly age patients with underlying co-morbidities and progressive radiological and clinical deterioration pose a risk factor for the severity of the disease and poor prognosis in COVID-19 patients.

Conflict of Interest: None.

Authors Contribution

Following authors have made substantial contributions to the manuscript as under:

AQ & RA: Data analysis, drafting the manuscript, critical review, approval of the final version to be published.

SB & SK: Concept, data acquisition, approval of the final version to be published.

ZA & RM: Study design, drafting the manuscript, data interpretation, critical review, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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