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Original Research Article

Association of COVID-19 severity with body mass index and underlying comorbid conditions-a hospital-based cross-sectional study

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ABSTRACT

Background: To reduce the severity of the disease among COVID-19 patients with co-morbidities is the need of the hour. Obesity may contribute to adverse outcomes in coronavirus disease 2019 (COVID-19). This study aimed to find the association between the COVID-19 biomarker values and the underlying comorbid conditions and assess the severity of the disease according to the patients' body mass index (BMI).
Methods: A single centre cross-sectional study was conducted in a tertiary hospital among 184 COVID-19 patients admitted for one month (June-July 2021).
Results: The results show a statistically significant association between the COVID-19 severity and co-morbidity status of the patients, with diabetes mellitus being the most prevalent co-morbidity among the patients, followed by diabetes with hypertension. A statistically significant association was also seen between age and co-morbidity and biomarkers and co-morbidity.
Conclusions: Obesity and other comorbid conditions like diabetes mellitus and hypertension should be given utmost importance during treatment among COVID-19 patients. Biomarker screening should be routinely done in patients with co-morbidities and obesity. Awareness among the COVID-19 patients regarding the comorbid conditions and BMI is the need of the hour.

Keywords: COVID-19, Obesity, BMI

INTRODUCTION

The world witnessed a standstill from December 2019 since the COVID-19 pandemic began. The current COVID-19 case toll has reached 242,348,657 cases. Since the pandemic, deaths have reduced but account for 4,927,723 deaths worldwide. Even with the vigorous administration of vaccines worldwide, the constant mutations in the virus create newer variants, increasing the risk of a never-ending pandemic.[1]

India has also seen its share of COVID-19 cases and deaths and enormous economic loss. With more than three crore cases in India and 4.5 lakh deaths, India is still fighting hard with the pandemic. The vaccination drive in India, which began in January 2021, provided the much-needed support to fight back against the pandemic. But, also with the recent 100 crore mark of vaccinations, fight is still on.[2]

Being the second-most populous country globally, almost one in four Indians die of non-communicable diseases (NCDs) before 70 years. There has been a substantial increase in deaths due to NCDs in India since 1990. With the pandemic in full swing, other diseases like NCDs had taken a back step. Risk factors like physical inactivity, Unhealthy diet, and harmful behaviours like alcohol consumption, tobacco use and smoking, added to the increase in NCDs.[3] The severity among COVID-19 patients with co-morbidities has shown fatal outcomes. Biomarkers like D-dimer, LDH and C-reactive protein

(CRP) provide an effective screening tool for the categorization of patients according to severity.[4]

Since the pandemic's beginning, multiple systematic reviews and research have shown a linear association between the severity of COVID-19 disease and the presence of co-morbidities and BMI variations.[5] But not many studies have been conducted in India. This study, conducted in a tertiary care hospital during the peak of the COVID-19 disease pandemic, provided an insight into the associations of COVID-19 severity with co-morbidities and obesity.

METHODS

A cross-sectional, single-centre study was conducted in a tertiary hospital at Chengalpattu during the peak period of the COVID-19 pandemic from June to July 2021. The study population included all the COVID-19 cases confirmed by RT-PCR test from wards and ICUs of the tertiary hospital. Using a structured proforma, data collection was done. All those above 18 years of age and admitted with COVID-19 and RT-PCR confirmed were included. Critically ill patients, patients on high oxygen demand (SpO_2 <75%), patients who were unable to cooperate for anthropometric measurements and those who were not willing to participate were excluded from the study. According to the inclusion criteria, 164 patients were included in the study.

Data on socio-demographic details and laboratory measurements for selected biomarkers like D-Dimer, CRP, LDH and radiological investigation on CT Severity were recorded using structured proforma. A weighing scale was used for weight and a stadiometer for height for anthropometric measurements. Informed consent was obtained from all the patients who participated in the study. Standard guidelines on grading for biomarkers and BMI were used.

The biomarkers are categorized based on the severity of the inflammation according to WHO guidelines. For D-dimer, values <0.5 microgram/ml was classified as normal, value from 0.5 to 1.0 was classified as mild and value >1.0 was classified as moderate to severe. For CRP, the severity of inflammation was classified as follows-0-6 micro gram/ml: normal, <26 mg/ml: mild, 26-100 mg/ml: moderate, >100 mg/ml: severe. For LDH, values<250 U/l was normal and >250 U/l was taken as elevated.

Data were analyzed using descriptive statistics and a chi-square test. A p value less than 0.05 was considered statistically significant. SPSS (version 22) software was used.

RESULTS

In this study, 164 patients with COVID-19 were included. The majority of the patients were in the age group 50 to 59 years 66 (40.24%), with male predominance 94 (57.31%). Severe CT severity score in 16 (9.75%), unvaccinated 136 (82.9%), CRP increased to a severe level in 42 (25.6%), moderate to severe D-dimer level in 12 (7.31%) and high-risk LDH level in 110 (67.07%).

Table 1: Demographic and clinical characteristics of COVID-19 patients, (n=164).

Parameters		All patients	Patients without comorbidity	Patients with comorbidities	P value
Age (years)	18-39	50	38	12	<0.001
	40-59	66	26	40	
	>60	48	12	36	
Gender	Male	94	46	48	0.27
	Female	70	30	40	
CT severity	Mild	76	40	36	0.31
	Moderate	72	30	42	
	Severe	16	6	10	
Vaccine status	Taken	28	10	18	0.15
	Not taken	136	66	70	
Vaccine doses	No dose	138	66	72	0.675
	1 dose	16	6	10	
	2 doses	10	4	6	
CRP	Normal	18	10	8	0.062
	Mild	40	24	16	
	Moderate	64	22	42	
	Severe	42	20	22	
D-dimer	Normal	104	62	42	<0.001
	Mild	48	12	36	
	Mod-severe	12	2	10	
LDH	Normal	54	24	30	0.431
	High risk	110	52	58	

Table 2: Frequency of different co-morbidities among COVID-19 patients.

Co-morbidity	Number	Case with co-morbidities, (n=88) (%)	All cases, (n=164) (%)
Diabetes mellitus	40	45.45	24.3
Diabetes with hypertension	22	25	13.4
Hypertension	4	4.5	2.4
Bronchial asthma	4	4.5	2.4
Hypothyroidism	4	4.5	2.4
Pregnancy	4	4.5	2.4
Diabetes with hypertension and hypothyroidism	4	4.5	2.4
Coronary heart disease	2	2.27	1.21
Diabetes with coronary heart disease	2	2.27	1.21
Hypertension with chronic kidney disease	2	2.27	1.21

Table 3: Characteristics of COVID-19 patients by BMI groups, (n=164).

Characteristics		Underweight	Normal	Overweight	Obesity	P value
Age (Years)	18-39	4	8	30	8	<0.001
	40-59	0	24	18	24	
	>60	0	22	16	10	
Gender	Male	0	36	38	20	0.020
	Female	4	18	26	22	
CT severity	Mild	4	26	32	14	0.170
	Moderate	0	22	28	22	
	Severe	0	6	4	6	
Co-morbidities	Absent	4	22	38	12	0.002
	Present	0	32	26	30	
CRP	Normal	2	6	6	4	0.130
	Mild	2	12	18	8	
	Moderate	0	24	20	20	
	Severe	0	12	20	10	
D-dimer	Normal	4	40	42	18	0.035
	Mild	0	12	18	18	
	Mod-Severe	0	2	4	6	
LDH	Normal	4	20	18	12	0.022
	High Risk	0	34	46	30	

There is a statistically significant association in age group and co-morbidities in COVID-19 patients ($p<0.001$). Patients above 60 years with co-morbidities were more infected with COVID-19. There is a statistically significant association in D-dimer level and patients with co-morbidities ($p<0.001$). Patients with moderate to severe LDH levels were more in patients with co-morbidities.

DM and hypertension are commonest co-morbidities in this study. In patients with co-morbidities, 40 (45.45%) had DM and 22 (25%) had DM with hypertension.

There is a statistically significant association in age group and gender, and BMI in COVID-19 patients. Patients with co-morbidities, higher D dimer, and LDH levels associated with obesity. There is a statistically significant association.

DISCUSSION

With the COVID-19 pandemic continuing to spread worldwide, with its various variants, close attention has to be paid, especially to the comorbid patients in whom the severity of the disease is more than ordinary individuals. Therefore, this study aimed to assess the associations between BMI and comorbid conditions among COVID-19 patients.

More than half showed co-morbidities out of the 164 patients (53.65%). However, there was not much difference in co-morbidities between males (51.06%) and females (57.14%). The leading co-morbidity among the study participants is diabetes mellitus (45.45%), followed by diabetes with hypertension (25%). However, similar studies were done by Sanyaolu et al and Mkheder et al showed hypertension as the major co-morbidity among their study participants. This can be attributed to the geographical conditions and lifestyles among the countries.[6,7]

In our study, 83.33% of the patients with co-morbidity showed an increase in the D dimer and 63.6% with CRP levels. This was similar to the study done by Li et al and

Mkheder et al which also showed an increase in the inflammatory indicators like CRP and D dimer with an increase in the severity of the disease.[7,8]

Among the study participants, one fourth were obese, and around 39 % were overweight. Among the obese group, females (53.28%) had a higher percentage than males (47.62%), whereas in the overweight category higher rate of males (56.25%) were seen than females (40.60%). However, a study done by Cai et al showed a higher percentage of males with obesity than females. This can be attributed to the nature of work and lifestyle among the females and males in different countries.[9]

In our study, age and inflammatory markers like D dimer were statistically significant in association with co-morbidities. Among the various BMI categories, statistical significance was seen with age, gender, co-morbidities, and inflammatory biomarkers like D dimer and LDH. This was similar to the study done by Kang et al.[10]

CONCLUSION

Patients with severe COVID-19 disease show a significant association with a history of co-morbidities like diabetes mellitus and hypertension. Therefore, patients with such co-morbidities should be given prior attention and necessary precaution to avoid further worsening of the disease. Similarly, among the overweight and obese patients, there is a significant association with COVID-19 disease severity. Hence awareness among the overweight and obese patients regarding the seriousness of the COVID-19 disease should be advocated.

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