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COVID-19, Co-Morbidities and Its Impact on Prognosis in a Tertiary Care Hospital of Bangladesh

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ABSTRACT

In December 2019, a new human coronavirus, severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), was discovered in Wuhan, China. Since then, the virus has spread over the world, affecting over 180 nations. SARS-CoV-2 has infected people of all ages, races, and genders, infecting both men and women and spreading at an alarming pace across communities. Given the virus's origin, much remains unknown; however, we do know that clinical presentations vary from a typical cold to more serious infections, including pneumonia, bronchitis, severe acute respiratory distress syndrome (ARDS), multi-organ failure, and even death. COVID-19 is thought to have a more fast and severe progression in people with underlying health issues or co-morbidities, frequently resulting in death.

Methods: *This retrospective study was conducted at Bangladesh's Tertiary care hospital. 534 patients were selected for this study. Medical history, age, gender, and co-morbidities (including Hypertension, Diabetes, and CKD, etc.) were recorded at the time of diagnosis, biochemical parameters such as CRP, ESR, creatinine, FBS, Hb, and LDH were also recorded. SARS-CoV-2 RNA was detected using a real-time reverse transcription-polymerase chain reaction (rRT-PCR) at diagnosis and throughout the follow-up of these patients.*

Results: *The comorbid conditions, illness progression, and death rates in patients from a Bangladeshi tertiary care hospital were investigated in this study. COVID-19 patients with co-morbidities, such as hypertension or diabetes, are more likely to have a more severe course and development of the disease. Furthermore, individuals over the age of 60 who have co-morbidities and are infected have a higher incidence of admission to the intensive care unit (ICU) and death from the COVID-19.*

Conclusion: *Where Vaccination, Early diagnosis, and Management lead to a better prognosis, patients with co-morbidities should take all steps to prevent contracting SARS CoV-2 since their prognosis is generally the poorest.*

Keywords
COVID-19, COVID-19 in Bangladesh, Comorbidities and COVID-19, Diabetes, Hypertension.

Introduction

The 2019 new coronavirus disease (COVID-19) outbreak in Wuhan, China, has quickly spread worldwide [1]. The World Health Organization and the International Committee on Virus Taxonomy designated this coronavirus severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) [2]. The World Health Organization declared COVID-19 on March 11, 2020. Since then, all COVID-19 siege practice, knowledge, and attitudes have been progressively improved. The completely clinical presentation of COVID-19 is yet unclear; however, cough, fever, dyspnea, and pneumonia were among the most prevalent symptoms.

As the new coronavirus is evolving with its new variants, we still do not know whom this virus will affect seriously. The prognosis for older persons and those of any age with underlying medical disorders, including hypertension and diabetes, has been found to be worse [3]. Diabetic individuals have higher rates of morbidity and death, as well as higher hospitalization and intensive care unit (ICU) admissions.

Physiological alterations, such as decreased lung reserve, decreased airway clearance, and a weakening of the defensive barrier, may be the consequence of changes in lung structure and muscle atrophy seen in the aging population [4]. The underlying diseases and age of the COVID 19 patient have a clear correlation with clinical results and duration of stay in hospital.

Our goal was to examine the clinical features and outcomes of COVID-19 patients by stratifying them based on the presence and type of co-morbidity, as well as ICU hospitalizations.

Materials and Methods

This prospective, tertiary hospital-based research was conducted in Bogura, Bangladesh. We enrolled a total of 534 consecutive patients who came to the hospital.

Ethics and Informed Consent

Prior to patient enrollment, the study was authorized by the review board of our institution's research committee. Each participant received all research information as well as assurances of absolute secrecy. The research only included individuals who gave their permission.

Exclusion criteria

To eliminate any confounding variables affecting the inflammatory markers that were measured in the research, patients with COVID-19 infection and inflammatory disorders such as chronic obstructive pulmonary disease or immunological diseases were excluded. Those who had missing data were also excluded.

Diagnosis of COVID-19

COVID-19 is diagnosed based on a history of epidemiologic exposure. Clinical symptoms such as Fever and/or respiratory symptoms; and total white blood cell counts revealing normal, decreased, or reduced lymphocyte count in the early onset stage are all clinical signs. Furthermore, a positive result for COVID-19 nucleic acid through real-time reverse transcript-ion-polymerase chain reaction (rRT-PCR) in samples from respiratory tract swabs done at a tertiary hospital in Bangladesh was used to make the diagnosis.

Confirmed infected COVID-19 cases were stratified according to the presence and category of co-morbidity and admissions in ICU.

Age, gender, nationality, BMI, associated morbidity (e.g., diabetes mellitus, hypertension, ischemic heart disease) were all documented in detail for the individuals included in the study. The following clinical symptoms were analyzed: fever, dry cough, sore throat, malaise, or headache. Complete blood counts and differential counts were used to recording hematological and biochemical data upon diagnosis, as well as CRP, ESR, creatinine, FBS, Hb, and LDH.

Statistical analysis

To compare all demographic and clinical aspects between the two groups (ICU and non-ICU), the paired student's t-test and the Mann-Whitney test for normal and skewed continuous variables, respectively, were employed (IBM SPSS Statistics, version 20). For all categorical comparisons between the two groups, we used the chi-square test (STATA, version 10). In Tables and Figures, data is presented as Mean S.D. or percentage. A P-value of 0.05 was considered statistically significant for all parameters in this study.

Results

A total of 520 participants in Bangladesh were analyzed using a cross-sectional study, and further research was carried out on the basis of a case-control system out of initial 534 enrolled young patients. The average age was 39.4 ± 13.9 years. Male participants made up 99.1% of the total cases, while female participants made up 0.9%. Out of these 520 patients, 493 (94.8%) were positive for rT-PCR, while 27 (5.2%) came out negative for COVID-19. Some of the most common symptoms include cough, fever, chills, shortness of breath (SOB), muscle aches, sore throat, unexplained loss of taste or smell, diarrhea, and headache. Symptoms can start as mild and become more intense over 5 to 7 days, worsening if pneumonia develops in patients. Out of these common symptoms, fever 75.7% showed up as the most common symptom, followed by dry cough in 38.3% patients. Other symptoms noted were Loss of tests or smell (73.3%), tiredness (11.8%), and sore throat (11.5%). The length of time spent in the hospital (days) was 12.7 ± 7.8. 8.3% of patients had diabetes mellitus, 38.5 % had hypertension, and 40% of patients had ischemic heart disease, according to the Co-morbidity variable. Steroids are utilized in 9% of cases, while anticoagulants are used in 11.6 % (Table 1).

Table 1: Demographics and clinical characteristics of study subjects (n=520).

Variable	Mean ± SD or percentage (%)
Age (years)	39.4 ± 13.9
Gender	
Male	99.1
Female	0.9
Residence	
Urban	95.3
Rural	4.7
Systolic blood pressure (mmHg)	121 ± 14.9
Diastolic blood pressure (mmHg)	78 ± 17.5
Pulse (per minute)	89 ± 15.0
Body temperature (F)	98 ± 5.7
RT-PCR result	
Positive	94.8
Negative	5.2
Clinical manifestations	
Fever	75.7
Dry cough	38.3
Tiredness	11.8
Sore throat	11.5
Difficulty breathing	92.3
Loss of tests or smell	73.3
Duration at hospital stay (days)	12.7 ± 7.8
Oxygen saturation (SpO2) (%)	96 ± 7.3
ICU support (days)	0.6 ± 2.5
C-reactive protein (*CRP*)	
Positive	34.8
Negative	65.2
Lactate dehydrogenase (LDH)	264 ± 126
Random blood Sugar (mmol/L)	7.85 ± 4.83
Hemoglobin (gm/dl)	14.3 ± 1.64
Recovery	
Fully	94.8
With post COVID residues	0.4
Expired	4.8
Co-morbidity	
Diabetes mellitus	8.3
Hypertension	38.5
Ischemic heart disease	40.0
Steroid used	9.0
Anticoagulant used	11.6
Using of anti-viral drugs (Tab. Favipiravir)	16.6

Values are presented as mean ± SD for continuous variables and percentage (%) for categorical variables.
COVID-19: coronavirus disease-2019; *ICU: intensive care unit;* SD: standard deviation.
Based on T-test for continuous variable and Pearson Chi-square test for categorical variable.

Among all these patients, 467 recovered without going into ICU while got admitted in ICU. The mean age of ICU admitted patients was 55.2 ± 14.3 years, while 36.5 ± 12.1 years was for non-ICU patients making it a significant factor (P-value <0.001) when talking about ICU admissions. While considering co-morbidities, Hypertension (78.3%) was the most prevalent among ICU patients (53=n), making hypertension and diabetes mellitus to be significant co-morbidities among ICU patients (P-value <0.001) (Table 2). Other co-morbidities such as Bronchial Asthma were not significantly linked with the covid patients admitted in ICU on the Pearson Chi-square test. When compared to non-ICU patients, the percentage of steroid, anticoagulant, and antiviral medications utilized is greater in ICU patients and statistically significant (Table 2).

Table 2: Characteristics of respondents corresponding to *intensive care unit (ICU) support***.**

Variable	ICU patients (N=53)	Non-ICU patients (N=467)	*P value*
Age (years)	55.2 ± 14.3	36.5 ± 12.1	<0.001*
Gender			
Male	100.0	99.1	0.502
Female	0.0	0.9	
Duration at hospital stay (days)	14.4 ± 12.4	12.4 ± 7.2	0.093
Oxygen saturation (SpO2) (%)	92.9 ± 15.5	96.9 ± 5.7	<0.001*
Signs and symptoms			
Fever	58.8	77.5	0.003*
Dry cough	39.6	38.8	0.913
Tiredness	7.9	11.3	0.523
Sore throat	8.2	12.6	0.369
Difficulty breathing	87.5	95.6	0.347
Loss of tests or smell	20.0	100.0	0.001*
Other's symptoms	65.8	53.2	0.120
Co-morbidity			
Diabetes mellitus	25.5	5.8	<0.001*
Hypertension	78.3	28.1	<0.001*
Bronchial Asthma	50.0	35.3	0.484
COPD	4.4	0.7	0.019*
Chronic kidney disease	33.3	0.0	0.001*
Steroid used	52.0	4.6	<0.001*
Anticoagulant used	46.2	8.3	<0.001*
Using of anti-viral drugs (Tab Favipiravir)	35.7	13.5	0.002*

Values are presented as mean ± SD for continuous variables and percentage (%) for categorical variables. *$P < 0.05$.
COVID-19: coronavirus disease-2019; *ICU: intensive care unit;* COPD: chronic obstructive pulmonary disease.
Based on T-test for continuous variable and Pearson Chi-square test for categorical variable.

Comparing the biochemical parameters among ICU and non-ICU patients, CRP was positive in 58.3% of ICU patients as compared to non-ICU, in which it was positive for just 34.6% of patients. Similarly, LDH was found to be higher among ICU patients (345 ± 246) as compared to non-ICU (259 ± 113) (P value 0.002). An interesting comparison was seen between FBS and RBS. FBS was non-significant among ICU and non-ICU patients (ICU=11.6 ± 3.0 mmol/L, non-ICU=12.0 ± 3.9 mmol/L, P-value 0.789) whereas, RBS were significant as it was in higher values among ICU patients (9.8 ± 5.0 mmol/L) as compared to non-ICU (6.9 ± 3.4 mmol/L) (P value 0.015). The mean level of haemoglobin is higher in the non-ICU group compared to the ICU group (ICU vs non-ICU: 12.2 ± 2.0 vs 14.4 ± 1.5) (Table 3).

Table 3: Clinical characteristics of subjects with or without *intensive care unit (ICU) support*.

Variable	ICU patients (N=53)	Non-ICU patients (N=467)	*P value*
Lactate dehydrogenase (U/L)	345 ± 246	259 ± 113	0.002*
Fasting blood sugar (mmol/L)	11.6 ± 3.0	12.0 ± 3.9	0.789*
Random blood sugar (mmol/L)	9.8 ± 5.0	6.9 ± 3.4	0.015*
Hemoglobin (gm/dl)	12.2 ± 2.0	14.4 ± 1.5	0.000*
C-reactive protein (positive)	58.3	34.6	0.019*

Values are presented as mean ± SD for continuous variables and percentage (%) for categorical variables.
COVID-19: coronavirus disease-2019; *ICU: intensive care unit;* SD: standard deviation. * $P < 0.05$.
Based on T-test for continuous variable and Pearson Chi-square test for categorical variable.

In the progression of COVID disease, 27 patients expired, and while comparing the co-morbidities among dead and alive patients, it is found that again Hypertension and Diabetes were the most significant co-morbidities. Among dead patients, 61.9% had hypertension, while 33.3% were suffering from diabetes as compared to alive, in which only 33.3% had hypertension, and 6.9% had diabetes (Table 4).

Table 4: Leading comorbidities of COVID-19 between deaths and alive cases.

Co-morbidity	Total cases	Dead cases	Alive cases	*P value*
Diabetes mellitus	8.3	33.3	6.9	<0.001*
Hypertension	38.5	61.9	33.3	0.015*
Bronchial Asthma	32.3	44.4	28.0	0.366
COPD	0.98	10.0	0.6	<0.001*
Chronic kidney disease	3.03	25.0	0.0	0.006*

Values are presented as percentage (%). Based on Pearson Chi-square test. * $P < 0.05$.
COVID-19: coronavirus disease-2019; COPD: chronic obstructive pulmonary disease.

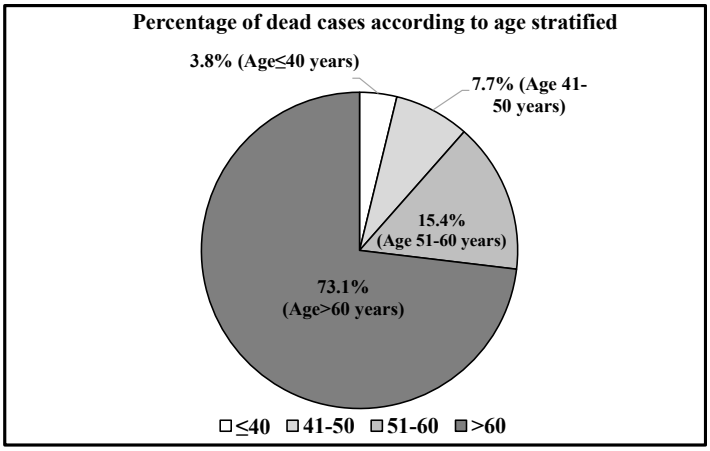
On the Pearson Chi-square test, age, Systolic Blood Pressure, Diastolic Blood Pressure, Pulse, Body temperature, Total duration at the hospital, Oxygen saturation (SpO2), ICU support, Lactate dehydrogenase, Random blood Sugar, fasting blood sugar, and Hemoglobin remained significant in binary logistic regression. The odds ratio (OR) for overall hospital stay (days) was 1.29 (CI 1.24-1.34, p<0.001), for oxygen saturation (SpO2) (percent) was 1.03 (CI 1.03-1.04, p<0.001), and for ICU support (days) was 1.28 (CI 1.12-1.49, p<0.001). Among relevant indicators, random blood sugar exhibited a higher odds ratio (OR 1.39, CI 1.22-1.58, p<0.001) (Table 5).

Figure 1: Among the death cases, 73.1 percent had an age higher than 60 years, while only 3.8 percent had an age equal to or less than 40 years, and the p-trend was <0.001.

Table 5: Univariate regression analysis corresponding to COVID-19 (negative vs positive).

Variable	Regression analysis		
	Odds ratio (OR)	**95% CI**	***P Value***
Age (years)	1.08	1.06-1.09	<0.001*
Gender	1.50	0.25-8.98	0.657
Systolic Blood Pressure (mmHg)	1.02	1.02-1.03	<0.001*
Diastolic Blood Pressure (mmHg)	1.04	1.03-1.04	<0.001*
Pulse (per minute)	1.03	1.03-1.04	<0.001*
Body temperature (F)	1.03	1.03-1.03	<0.001*
Duration at hospital stay (days)	1.29	1.24-1.34	<0.001*
Oxygen saturation (SpO2) (%)	1.03	1.03-1.04	<0.001*
ICU support (days)	1.28	1.12-1.49	0.001*
Lactate dehydrogenase (LDH)	1.01	1.0-1.01	<0.001*
Random blood Sugar (mmol/L)	1.39	1.22-1.58	<0.001*
Fasting blood sugar (mmol/L)	1.20	1.09-1.31	<0.001*
Hemoglobin (gm/dl)	1.24	1.20-1.29	<0.001*

COVID-19: coronavirus disease-2019; CI: confidence interval; * $P <$ 0.05. Based on binary logistic regression.



Discussion

Coronavirus disease (COVID-19) was discovered in Wuhan in December 2019. The disease features, severity, and mortality, especially in Bangladesh, remain unknown [5]; hence, the goal of our investigation was to shed light on these topics. COVID-19 infection was more common in older individuals but mild to moderate infection was more common in younger patients, according to the present research. This might be explained by a drop in cell-mediated immune activity with age, as well as a reduction in humoral immunological function [6,7].

Diabetes mellitus and hypertension were the most common chronic conditions among COVID-19 co-morbidities in our research. These results matched those of meta-analysis research that found hypertension, cardiovascular disease, and diabetes mellitus to be the most common underlying disorders among COVID-19 patients hospitalized [8].

The severity of COVID-19 disease development is linked to a number of co-morbidities. Many of the COVID-19's poorer results

have been linked to cardiovascular comorbidities, including hypertension [9,10]. This, on the other hand, might be a direct outcome of the cardiovascular problem or due to additional co-morbidities in addition to cardiovascular disorders [11]. COVID-19 severity was also shown to be higher in patients with type 2 diabetes. It was discovered in cohort analysis of 7337 COVID-19 patients with and without type 2 diabetes that individuals with type 2 diabetes needed more interventions during their hospital stay than those who were not diabetic [12].

A cytokine storm is an acute systemic inflammatory condition marked by fever and numerous organ failures. It has been observed that viral infection may cause a strong immunological response in the host, known as a cytokine storm. Acute-phase reactant generation is also induced by viral infection [13]. When compared to patients with mild to moderate infection, severe COVID-19 patients had considerably greater acute phase reactants (CRP, ESR, and LDH), which were strongly related to COVID-19 severity. Many investigations concurred with these conclusions [14,15].

Conclusion

COVID-19 patients with co-morbidities have a bad prognosis; moreover, those with age above 60 are also prone to have a bad prognosis. Where Vaccination, Early diagnosis, and Management leads to a better prognosis, patients with co-morbidities should take all necessary precautions to avoid getting infected with SARS CoV-2, as they usually have the worst prognosis.

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