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Characteristics of Patients with Hypertension Admitted for COVID-19 Treatment in Khulna: Single-Centre Cross-Sectional Study

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Abstract

Background: The outbreak of coronavirus disease 2019 (COVID-19) has become a large threat to global health due to its high contagious nature and varied mortality. Arterial hypertension repre-sents one of the most common comorbidities in patients with COVID-19. Close connections be-tween inflammation and blood pressure (BP) have been described, and inflammation plays a key role in the outcome for patients with COVID-19. **Objective:** This study aims to investigate the clinical characteristics of patients with hypertension admitted for COVID-19 treatment in Gazi Medical College Hospital (GMCH), Khulna, Bangladesh. **Methods:** This was a cross-sectional type of observational study on patients with hypertension who were diagnosed with COVID-19 based on laboratory and/or radiological findings and admitted to Gazi Medical College Hospital, Khulna, Bangladesh, from July 1 to July 31, 2021. In that timeframe, overall, 215 patients with COVID-19 were admitted. Among them, 37 patients having hypertension fulfilled the inclusion criteria for the study. Demographic, clinical, laboratory and radiological data of those 37 patients were recorded and analyzed. **Results:** Among 37 study subjects, 54.1% were female. The mean age of the patients was 59.6±13.9 years. Among the study subjects, diabetes (56.8%) was the most common comorbidity. Regarding laboratory parameters, the mean Hb of the patients was 11.4±1.9 g/dl. In addition, the mean random blood sugar (RBS) level was 11.6±2.9 mmol/l. Neutrophilia and lymphocytopenia were observed in 86.5% and 83.8% cases, respectively. The mean D-dimer (2.4 mg/l) and CRP (72.5 mg/l) levels were well above their normal limits. In high resolution CT scan of the chest (HRCT chest), bilateral lung involvement was present in 89.2% cases. Ground-glass appearance was the most frequent (91.9%) radiologic pattern. Among antihypertensive drugs, losartan potassium was the most frequently used category (29.7%). Total 7 (18.9%) pa-tients were severely affected with COVID-19 and admitted to the ICU, requiring mechanical venti-lation. During our study, 2 patients (5.4%) died either due to multiple organ dysfunction syndrome or cardio-respiratory failure. **Conclusion:** The study provides key information to better understand the clinical characteristics of patients with hypertension admitted for COVID-19 treatment, which may help physicians to identify the factors associated with adverse outcomes in this disease.

Keywords: Covid-19, Hypertension

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Introduction

Towards the end of December 2019, pneumonia cases with no identifiable cause began to appear in Wuhan and quickly spread to most of China. The genetic makeup of the virus isolated from these patients revealed that it is one of the members of the Coronaviridae family; as a result, it was given the names "severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2)" and "coronavirus disease 2019" (COVID-19) to describe the illness it causes.[1] Since the World Health Organization (WHO) designated this sickness a pandemic in early March 2020, it has already spread to several nations worldwide.[2] The management of COVID-19 patients is extremely difficult in countries like Bangladesh since the little medical resources are soon exhausted. IEDCR, the nation's epidemiology institute, released information about the first three instances on March 8th, 2020. Since then, the epidemic has progressively spread over the entire country, and the number of victims has been rising.[3] Bangladesh has experienced a threefold increase in coronavirus incidence during the previous several months. The specialized beds in many other hospitals are likewise filled, as are all COVID-19 hospitals in the capital and other cities.[4] As of June 2021, it has been noted that Sylhet has the lowest confirmed cases rate (9.75%) out of all eight divisions in Bangladesh, while Khulna division possesses the highest known cases rate (19.94%).[5]

Several underlying medical conditions are associated with increasing the risk of COVID-19 severity and are associated with a higher mortality rate.[6] Hypertension (HTN) is a major disease that increases the risk of acute respiratory failure, hospital admission and mortality rate among patients with COVID-19.[7] It is a main co-morbidity among patients with COVID-19 and management of HTN in COVID-19 is an essential for reduction of mortality and morbidity. Older hypertensive patients are more vulnerable to severe COVID-19 outcomes and may experience large fluctuations in BP along with psychological stress such as anxiety, depression, or other negative emotions.[8]

In this study, we sought to better understand the clinical characteristics of patients with hypertension who were admitted to Gazi Medical College Hospital in Khulna, Bangladesh, for COVID-19 management.

Materials and methods

Study design

This was a cross-sectional, observational study of patients with diabetes who were diagnosed with COVID-19 based on laboratory and/or radiological findings and admitted to Gazi Medical College Hospital, Khulna, Bangladesh, from July 1 to July 31, 2021. In that timeframe, overall, 215 patients with COVID-19 were admitted. Among them, 51 patients had hypertension. Thus, 23.7% (51/215) of all patients admitted with COVID-19 had coexistent hypertension.[9] Among them, 37 patients who fulfilled the inclusion criteria, were selected for the study. This study was approved by the Ethical Review Board of the concerned institute [Ethical Clearance No: GMC/IERB/2021/01].

Inclusion criteria

- Patients of either sex aged ≥18 years
- COVID-19 positive patients who had hypertension
- Patients who gave consent to be included in the study

Exclusion criteria

- Pregnant women having gestational hypertension
- Patients who had incomplete data regarding clinical and laboratory profile

Case definitions

- A positive reverse transcription-polymerase chain reaction (RT-PCR) test for COVID-19 and/or consistent imaging results from chest radiography or chest high-resolution computed tomography (HRCT), that is, radiological features of COVID-19 that are pathognomonic (for example, ground-glass opacity), were required to confirm a diagnosis of COVID-19.

- HTN was defined clinically as systolic blood pressure (SBP) 140 mmHg or greater or diastolic blood pressure (DBP) 90 mmHg or greater averaged over two or more readings on two or more occasions following an initial screening.
- Laboratory tests ordered within 24 hours after hospital admission were referred to as initial tests.
- When patients were clinically healthy and were negative on two consecutive nasopharyngeal swab tests (laboratory tests) for COVID-19 RT-PCR, they were released from the hospital.

Data collection

We looked through each study participant's medical records, nursing notes, test results, and HRCT chest report. From patients' case files and electronic medical records, the information on demographic, clinical, biochemical, and radiological characteristics, treatments, as well as outcomes was collected and then put into standardized data collecting forms. Up to July 31, 2021, clinical outcomes (such as discharges, death, and readmission) were monitored.

Data analysis

For descriptive explanations, the clinical and demographic parameters of the patients were collated. According to the situation, continuous variables were either reported as means ± standard deviations (SDs) or medians (with interquartile ranges, IQR). We computed the frequencies and proportions of patients in each group for categorical variables. Microsoft Excel and Jamovi Open Statistical Software Version 2.4.8.0 for Windows were used for all analyses.

Results

The demographic characteristics, laboratory findings, information about comorbidities and HRCT chest reports of the 37 study subjects are described below.

Demographic characteristics:

We included 37 patients in this study, with 20 (54.1%) females and 17 (45.9%) males (Table 01). The age of the patients ranged from 27 to 86 years; mean age of the patients was 59.6±13.9 years. Among the study subjects, 25 (67.6%) came from urban areas and 12 (32.4%) came from rural areas.

Laboratory findings:

The first results of the laboratory tests after admission were analyzed. The routine blood tests showed that, the mean Hb concentration of the study subjects was 11.4±1.9 g/dl. The blood counts of 32 patients out of 37 (86.5%) showed neutrophilia (neutrophil count >70%) and 31 patients (83.8%) showed lymphocytopenia (lymphocyte count <20%). Also, 2 (5.4%) patients had thrombocytopenia (platelet count <1,50,000/cmm). In addition, the mean random blood sugar (RBS) level was 11.6±2.9 mmol/l. The mean D-dimer level of the study subjects was 2.4±2.8 mg/l. The mean plasma CRP level and serum creatinine level were 72.5±12.7 mg/l and 1.7±1.2 mg/dl respectively. The median oxygen saturation level (SpO2) was 84 (IQR, 62 to 96) [Table 02].

Comorbidities:

Among the study subjects, 25 patients had either one or more comorbidities. The most common comorbid condition was Diabetes [21 (56.8%)], followed by ischemic heart disease [6 (16.2%)], bronchial asthma [3 (8.1%)]. Coexisting cerebrovascular disease, chronic kidney disease and chronic liver disease were found in 2 (5.4%) patient each (Table 03).

HRCT of chest:

All the 37 patients had abnormal findings on HRCT; bilateral lung field involvement was observed in 33 (89.2%) and unilateral lung field involvement was observed in 4 (10.8%) patients (Figure 01). Ground-glass opacity, the predominant CT imaging pattern, was observed in 34 (91.9%) patients, followed by patchy consolidation shadow-in 19 (51.4%) patients. Interstitial abnormalities, including reticular appearance and interlobular septal thickening were found in 4 (10.8%) patients (Figure 02).

Table 01: Demographic characteristics of the study subjects.

Demographic characteristics	Patients (N = 37)
Sex	
Male	17 (45.9%)
Female	20 (54.1%)
Locality	
Urban	25 (67.6%)
Rural	12 (32.4%)

Table 02: Laboratory findings of the study subjects.

Laboratory findings	Frequency (percentage)
Hb concentration (g/dl)	11.2±1.9*
Neutrophilia (neutrophil count >70%)	32 (86.5)
Lymphopenia (lymphocyte count <20%)	31 (83.8)
Thrombocytopenia (platelet count <1,50,000/cmm)	2 (5.4)
RBS (mmol/l)	11.6±2.9*
D-dimer (mg/l)	2.4±2.8*
Plasma CRP (mg/l)	72.5±12.7*
Serum creatinine (mg/dl)	1.7±1.2*
Finger oxygen saturation level (SpO_2)	84 (62 to 96) **

***Mean±SD **Median (IQR)**

Table 03: Comorbidities of the study subjects.

Comorbidities*	Frequency (percentage) [n = 25]
Diabetes	21 (56.8)
Ischemic heart disease	6 (16.2)
Bronchial asthma	3 (8.1)
Cerebrovascular disease	2 (5.4)
Chronic kidney disease	2 (5.4)
Chronic liver disease	2 (5.4)

***More than one comorbidity was reported in some patients**

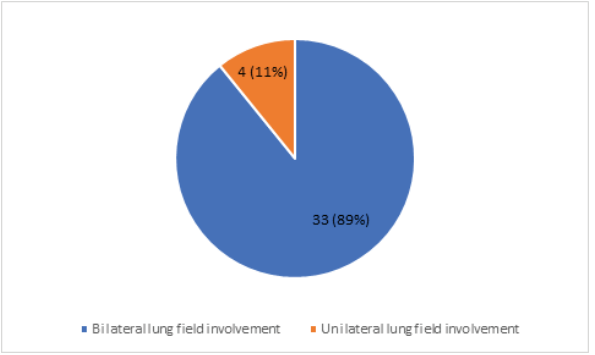

Figure 01: Lung field involvement of the study subjects reported by HRCT of chest

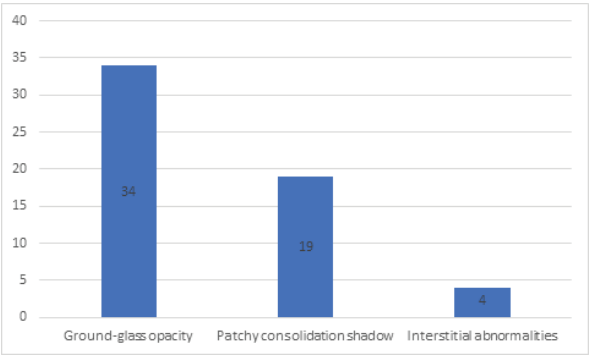

Figure 02: Imaging pattern found in HRCT of chest

The pattern of antihypertensive drug use and clinical outcome of the study subjects are described below.

Pattern of antihypertensive drugs used:
Survey of the treatment regimen of the patients showed that, different classes of antihypertensive medications were prescribed to the patients. Among those, followed by a β-blocker, bisoprolol [8 (21.65)]. The list of antihypertensives used in our study subjects is shown in Table 04.

Table 04: Pattern of antihypertensive drug use among study subjects.

Antihypertensive drugs*	Frequency (percentage)
β-blockers:	
Bisoprolol	8 (21.6)
Metoprolol	2 (5.4)
Ca^{2+} -channel blockers:	
Cilnidipine	7 (18.9)
Amlodipine	3 (8.1)
Angiotensin Converting Enzyme Inhibitors:	
Ramipril	1 (2.7)
Angiotensin II Receptor blockers:	
Losartan	11 (29.7)
Olmesartan	3 (8.1)
Drug combinations:	
Amlodipine+Losartan	5 (13.5)
Losartan+ Hydrochlorothiazide	1 (2.7)
Bisoprolol+ Hydrochlorothiazide	1 (2.7)

***The same patient could have received more than one drug**

Clinical outcome:

Among the study subjects, 7 (18.9%) patients were severely affected with COVID-19 and admitted to the ICU due to moderate or severe ARDS, requiring noninvasive mechanical ventilation therapy. The median PaO2 level of ICU admitted patients was 72 mmHg (IQR: 54 to 86). During the study period, 2 patients (5.4%) died either due to multiple organ dysfunction syndrome or cardio-respiratory failure-all of whom were in the ICU (Table 05).

Table 05: Clinical outcome of the study subjects.

Clinical outcome	Frequency (percentage)
ICU admission	7 (18.9)
PaO_2 level (mmHg)	72 (54 to 86) *
Mortality	2 (5.4)

***Median (IQR)**

Discussion

This is a single center study conducted at Gazi Medical College Hospital, Khulna, Bangladesh on the patients with COVID-19 with hypertension (HTN). In our study, 23.7% of all patients admitted with COVID-19 had coexistent hypertension. Previous researches have documented that comorbid hypertension can exacerbate COVID-19 in all age patients. Hypertension had a more pronounced effect on in-hospital death in the present study, when compared to previous studies that focused on patients of all ages.[9,10] The cellular entry of SARS-CoV-2 depends on its recognition of angiotensin-converting enzyme 2 (ACE2), and leads to the activation of T cell proliferation and differentiation into Th1 cells[11], which secretes proinflammatory cytokines and eventually triggers immune hyperresponsiveness, and this is referred to as a "cytokine storm".[12] There is substantial evidence that human circulating T cells are activated in hypertension, and inflammation has been considered to have a significant role in the promotion and maintenance of hypertension.[13]

Overactivated circulating T cells in pre-existing hypertension may amplify the cytokine storm of COVID-19, and thereby exacerbate the condition. The present study revealed that elderly patients with hypertension had significantly higher NLRs, indicating their overall inflammatory status. In addition, the levels of LDH, hs-CRP and D-dimer were higher in the hypertension group, which usually increase after the onset of inflammation, cell damage, or tissue injury, and this may be associated with the more serious tissue damage led by the cytokine storm magnified by hypertension.[14] Another possible explanation for the correlation between severe COVID-19 and hypertension is that the end-organ damage from chronic hypertension may have led to some degree of immune dysfunction in the elderly.[15]

Similar to previous findings,[16,17] the lymphocyte count of patients was significantly lower, suggesting that immune cell depletion and immune system dysregulation were more severe in the hypertensive patients. In addition, the higher chest CT score denotes the further involvement of lung infection. This also indirectly supports the notion that hypertensive patients are more likely to develop immune dysfunction.

Since hypertensive patients suffering from COVID-19 may be more severely ill at baseline and more likely to have a worse prognosis, when compared normotensive patients, they may require more intense clinical care. Ran et al[18] reported that poor blood control during hospitalization is associated with higher risks of adverse outcomes for COVID-19. Thus, maintaining normal and stable blood pressure during hospitalization may contribute to a favourable prognosis in COVID-19 patients with comorbid hypertension. The early initiation of clinical intervention in the initial stages of the disease may be also helpful to improve the prognosis and shorten the time to disease resolution.[19] Regardless of whether people of all ages and genders are generally susceptible to COVID-19, patients with comorbidities like hypertension tend to be more critically ill, and have higher mortality.[20]

Limitations and conclusion

It is important to consider the present study's limitations. First off, because we conducted the study at just one center, our sample size was rather small. Therefore, the current study does not accurately reflect the COVID-19 burden in the Khulna area. Our study's lack of a control group of individuals without hypertension to compare the outcomes to is another drawback. Additionally, most of our patients lacked information on how accurately they might be classified as overweight or obese, despite the fact that obesity is associated with a more severe disease and a higher death risk. This is because during a short period of time, a rising number of new patients presented to our healthcare institution with COVID-19 symptoms.

Despite these drawbacks, we think our study offers important insights into the characteristics of hypertensive patients hospitalized for COVID-19 management. This study may aid medical professionals in determining the causes of unfavorable outcomes in hypertensive individuals hospitalized with COVID-19 by using clinical and laboratory data.

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Conflicts of interest

None declared.

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