

# Prevalence and control of hypertension in COVID-19 positive cases

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## ABSTRACT

**Background:** The coronavirus disease (COVID-19) is an infectious disease caused by the newly discovered SARS-CoV-2 virus. Patients diagnosed with COVID-19 experience several complications including hypertension or elevated blood pressure which is a serious medical condition that significantly increases the risks of heart, brain, and kidney diseases. **Objectives:** To assess the prevalence and control of hypertension in COVID-19 patients. **Methods:** Cross-sectional descriptive hospital-based study conducted in an isolation center at Atbara Teaching Hospital in 2021. The data were collected by interviewing patients through a close-ended questionnaire and analyzed using a statistical computerized program (SPSS version 21). **Results:** The main results of the study revealed that the prevalence of blood pressure amongst patients diagnosed with COVID-19 was mild 45%, moderate 17.7%, and severe 10%; of the cases, 25.7% were newly discovered hypertension cases, of the cases 26.7% were diabetic patients; and 70.7% of the study group full recovered from COVID-19 at discharge. **Conclusion:** The study concluded that most of the study group had hypertension with COVID-19, some of them were newly discovered cases of hypertension and also had diabetes mellitus which indicates that COVID-19 may cause the onset of hypertension.

**Keywords:** Atbara Hospital, COVID-19, cross-sectional, hypertension, isolation center, prevalence

## Introduction

Coronavirus disease emerged in December 2019 most probably due to a zoonotic transmission from wild animals linked to a

large wet market in Wuhan, China. The responsible virus, Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) is a novel coronavirus that belongs to the same family as Severe Acute Respiratory Syndrome Coronavirus (SARS-CoV) and the Middle East Respiratory Syndrome Coronavirus (MERS-CoV). Because it is highly contagious, COVID-19 spread quickly and escalated into a global pandemic. As of June 18, 2020, there were over 8 million documented cases and 450,000 deaths worldwide, including more than 2 million cases and 118,000 deaths in the United States.<sup>[1]</sup>

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Early reports from major COVID-19 epi centers including Wuhan, China, and Lombardy, Italy revealed higher morbidity and mortality rates among patients with a history of hypertension (HTN), coronary artery disease, diabetes mellitus, chronic kidney disease, and obesity. Since SARS-CoV-2 infects human cells via the angiotensin-converting enzyme II (ACE2) receptor that acts on the renin-angiotensin-aldosterone system, a key regulator of blood pressure, questions have been raised about a possible link between hypertension and severe COVID-19 infection.

Hypertension, defined by the American College of Cardiology and the American Heart Association as a systolic blood pressure (BP)  $\geq 130$  or diastolic BP  $\geq 80$  mm<sup>3</sup>, is a primary modifiable risk factor associated with atherosclerotic cardiovascular disease. The prevalence of hypertension in US adults is around 50% and higher rates correlate directly with advancing age. According to the Centers for Disease Control, 63% of adults over the age of 60 are hypertensive, a number that will continue to rise as our population ages. Approximately 50% of US patients with hypertension are prescribed angiotensin converting enzyme inhibitors, aldosterone receptor blockers, and aldosterone antagonists, collectively called RAAS inhibitors, and are among the most frequently prescribed anti-hypertensive medications.<sup>[2]</sup>

Given the importance of COVID-19 and its complications, this study is beneficiary for practitioners and patients because it explore the state of our understanding of the relationship between hypertension and COVID-19 by; (i) assessing the prevalence and control of hypertension in COVID-19 patients; (ii) identifying the effect of COVID-19 on hypertensive patients; (iii) illustrating the difference between known hypertension patients from newly discovered cases after COVID-19 infection; and (vi) reviewing published studies evaluating outcomes of hypertensive COVID-19 patients treated with RAAS inhibitor.

## Materials and Methods

### Study design

Cross-sectional descriptive hospital-based study.

### Study area and setting

The study was conducted in Atbara locality, River Nile State in Atbara Teaching Hospital which is situated in the Northwestern part of Atbara town. It consists of a ward and refers clinic of surgery, medicine, pediatrics, and obstetric specialists. Also, a center for dialysis and another for diabetes, casualty, and a newly built CCU, ICU nursery, and ICU. There are about two laboratories, three pharmacies, and other services such as X-ray and ultrasound. The study was done among patients who attended the ICU nursery unit. It is well-equipped, and it includes a part for prematurity, a part for neonatal sepsis, and a part for neonatal jaundice.

### Study population

All patients admitted with COVID-19 to isolation center who agrees to participate.

### Sample size

300 COVID-19 patients.

### Inclusion criteria

All patients with confirmed COVID-19.

### Exclusion criteria

All patients with confirmed COVID-19 who refused to participate.

### Data collection methods

The data were collected by interviewing the participants through a close-ended questionnaire.

### Data management and analysis

The data were analyzed by using the statistical computerized program SPSS (Statistical Package of Social Sciences) version 21.

### Ethical consideration

The Department of Community Medicine obtained formal ethical approval from the faculty of medicine, Nile Valley University number 113/04/0202. Also, verbal consent from the participants was obtained after explaining the research objectives.

## Results

The data of 300 participants were obtained of which the majority were; (i) males (67%) compared with females (33%); (ii) aged 61-80 (42.7) followed by those who were 41-60 (35%), 20-40 (13%), and above 80 (9%);(iii) came from urban areas (53%) compared with rural areas (47%); and (vi) married (78%) followed by those who were single (12%), widowed (8%), and divorced (3%).

The data shows that patients suffered from different combinations of several symptoms as shown in Table 1. More than half (60%) of participants, reported experiencing headaches and shortness of breath (SOB).

The data revealed that some patients suffered from certain co-morbid diseases of which the main co-morbid disease was diabetes mellitus as shown in Table 2.

**Table 1: Distribution of study group according to symptoms**

Symptoms	Frequency	Percent
Headache; SOB	181	60.3%
No symptoms	34	11.3%
Headache; Chest pain; SOB	19	6.3%
Headache; SOB; Palpitations; Vision problem	16	5.3%
Headache; SOB; Palpitations	15	5.0%
SOB	14	4.7%
Headache	10	3.3%
Headache; SOB; Vision problem	7	2.3%
SOB; Palpitations; Vision problem	4	1.3%
Total	300	100%

With regards to HTN, some patients experienced hypotension (27%) while the majority experienced hypertension in different degrees; mild (45%), moderate (18%), and severe (10%) as shown in Figure 1. Also, the duration of which patients suffered from hypertension varied as shown in Table 3.

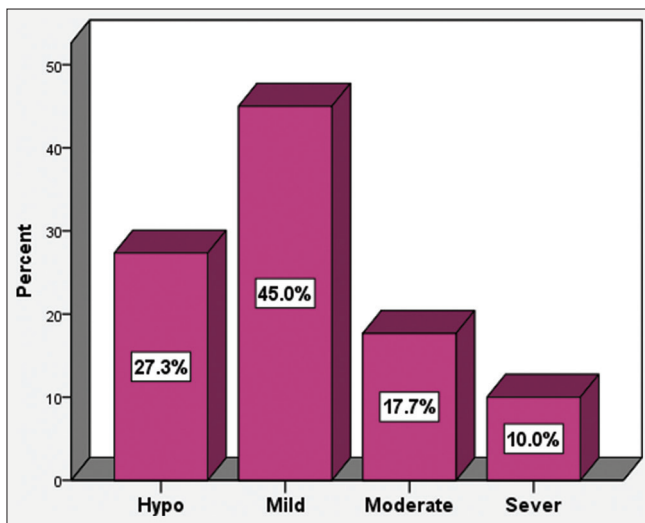
The data show that patients suffered from one or more types of complications including respiratory failure, shock, and organ failure in Table 4.

Eventually, the majority of participants (71%) were fully recovered as shown in Table 5.

Significant relationship was found between blood pressure at discharge and complications of COVID-19 ( $P$ -value = 0.000) as shown in Table 6.

A significant relationship was found between blood pressure at discharge and the health state of the patient ( $P$ -value = 0.000) as shown in Table 7.

A significant relationship was found between blood pressure upon entering the hospital and HTN duration ( $P$ -value = 0.002) as shown in Table 8.



**Figure 1:** Distribution of study group according to blood pressure at presentation

**Table 2: Distribution of study group according to co-morbid disease**

Co-morbid disease	Frequency	Percent
No co-morbid disease	162	54.0%
DM	80	26.7%
Cardiovascular disease	22	7.3%
Asthma	13	4.3%
Renal problem	12	4.0%
DM; Cardiovascular disease	9	3.0%
Respiratory diseases	2	0.7%
Total	300	100%

## Discussion

Hypertension or elevated blood pressure is a serious medical condition that significantly increases the risks of heart, brain, kidney, and other diseases. COVID-19 is a respiratory disease caused by SARS-CoV-2; a new coronavirus discovered in 2019. There are many studies explained the correlations of COVID-19 and some other chronic diseases. This study difference is that it aimed to assess the prevalence and control of hypertension in COVID-19-positive cases in a limited resource setting with low immunization coverage and high refusal rate of vaccination.

**Table 3: Distribution of study group according to HTN duration**

HTN duration	Frequency	Percent
<5 years	54	18.0%
5-10 years	82	27.3%
>10 years	43	14.3%
No HTN	121	40.3%
Total	300	100%

**Table 4: Distribution of study group according to complications of COVID-19**

Complications of COVID-19	Frequency	Percent
No complications	223	74.3%
Respiratory failure	61	20.3%
Shock	9	3.0%
Organ failure	4	1.3%
Respiratory failure; Shock	3	1.0%
Total	300	100%

**Table 5: Distribution of study group according to situation at discharge**

At discharge	Frequency	Percent
Full recovery	212	70.7%
Severe	88	29.3%
Total	300	100%

**Table 6: Cross tabulation between blood pressure at discharge and complications of COVID-19**

Complications		Blood pressure			Total
		Mild	Moderate	Severe	
Respiratory failure	Count	2	0	59	61
	%	3.3%	0.0%	96.7%	100.0%
Shock	Count	0	0	9	9
	%	0.0%	0.0%	100.0%	100.0%
Respiratory failure; Shock	Count	0	0	3	3
	%	0.0%	0.0%	100.0%	100.0%
Organ failure	Count	0	0	4	4
	%	0.0%	0.0%	100.0%	100.0%
No complications	Count	201	9	13	223
	%	90.1%	4.0%	5.8%	100.0%
Total	Count	203	9	88	300
	%	67.7%	3.0%	29.3%	100.0%

\* $P$  is significant if  $\leq 0.05$

**Table 7: Cross tabulation between blood pressure at discharge and the health state of the patient**

BP		Situation at discharge		Total
		Full recovery	Dead	
Mild	Count	203	0	203
	%	100.0%	0.0%	100.0%
Moderate	Count	9	0	9
	%	100.0%	0.0%	100.0%
Severe	Count	0	88	88
	%	0.0%	100.0%	100.0%
Total	Count	212	88	300
	%	70.7%	29.3%	100.0%

**Table 8: Cross tabulation between blood pressure at presentation and hypertension duration**

Blood pressure		HTN duration				Total
		< 5 years	5-10 years	> 10 years	No HTN	
Normal	Count	15	14	9	44	82
	%	18.3%	17.1%	11.0%	53.7%	100.0%
Mild	Count	28	32	13	62	135
	%	20.7%	23.7%	9.6%	45.9%	100.0%
Moderate	Count	7	23	10	13	53
	%	13.2%	43.4%	18.9%	24.5%	100.0%
Severe	Count	4	13	11	2	30
	%	13.3%	43.3%	36.7%	6.7%	100.0%
Total	Count	54	82	43	121	300
	%	18.0%	27.3%	14.3%	40.3%	100.0%

Most of the studies found relations with chronic diseases such as hypertension, Giuseppe Lippi, Johnny Wong, and Brandon M. Henry, mentioned that Hypertension was associated with a nearly 2.5-fold increased risk of severe COVID-19, as well as with a similarly significant higher mortality risk.<sup>[3]</sup>

The study found that the majority of patients had headaches and shortness of breath which is contradictory to the study of Gao J *et al.*, Koria, 2021. in which a total of 983 patients with COVID-19 only 12% had the same symptoms.<sup>[4]</sup>

70.7% of the study group fully recovered at discharge, which is similar to findings by Li Zhong *et al.*, Koria, 2021, in which a total of 297 (89%) COVID-19 patients with hypertension survived, and 35 (11%) died.<sup>[4]</sup>

59.7% of patients exhibited pre-existing hypertension on admission, which is similar to findings by Lippi, *et al.*,<sup>[3]</sup> in which they observed that more than 16% of the enrolled patients exhibited pre-existing hypertension on admission. The study clarified that there were significant relations between Bp at discharge and complications of COVID-19, blood pressure at discharge and the patient's health state at discharge, and also a significant relation between blood pressure at presentation and HTN duration. All these relations agree with Akpek M, 2022.<sup>[5]</sup> Another study by Andargew Yohannes Ashamo, *et al.*,<sup>[6]</sup> concluded that hypertension was associated with the severity of

COVID-19 pneumonia, and so were diabetes mellitus, chronic cardiac disease, and an increase in pulse rate.

According to random blood sugar at admission, the majority of the study group had diabetes mellitus, which is similar to what was reported by Mahmut Akpek,<sup>[5]</sup> 2021 in which 59% of confirmed COVID-19 patients were diabetic. Chen Y, Yang D, *et al.*<sup>[7]</sup> also showed significant difference in the clinical characteristics and outcomes of patients with diabetes and COVID-19 when comparing with non-diabetic patients.

The study explained that the majority of participants had hypertension. Most of them had mild blood pressure, which is contradictory with the study performed by Sanliarp SC, Sanliarp SC *et al.*,<sup>[8]</sup> in which both systolic ( $120.9 \pm 7.2$  vs  $126.5 \pm 15.0$  mmHg,  $P < .001$ ) and diastolic BP ( $78.5 \pm 4.4$  vs  $81.8 \pm 7.4$  mmHg,  $P < .001$ ) were significantly higher in the post COVID-19 period than on admission. New onset hypertension was observed in 18 patients at the end of  $31.6 \pm 5.0$  days on average ( $P$ -value  $< .001$ ). These findings suggest that COVID-19 increases systolic and diastolic BP and may cause new onset of hypertension.

Another study by Sohrabivafa M *et al.*, revealed that a health condition that commonly accompanies and affects the outcomes of COVID-19 is hypertension. Therefore, COVID-19 patients with hypertension should be given priority and benefit from a preventive, therapeutic approach.<sup>[9]</sup>

## Conclusion

The study concluded that most of the study group had HTN with COVID-19, but only a quarter of them were newly discovered as hypertensive patients and had DM, there are strong relations between COVID-19 and high blood pressure, and findings suggest that COVID-19 increases systolic and diastolic BP and may cause new onset of high blood pressure.

## Recommendations

1. The health authorities should adopt educational programs to raise the awareness among population about COVID-19 comorbidities through audio and visual media.
2. The medical staff should recommend adhering to the laid guidelines to ensure the spread of the virus is curbed while also enhancing the eradication of the pandemic.
3. More studies needed to be conducted about COVID-19 on HTN patients.

## Study limitations

No funds were available, and time constraints.

## Financial support and sponsorship

Nil.

## Conflicts of interest

There are no conflicts of interest.

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