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Hypertension and COVID-19: A Comprehensive Study on Prevalence, Clinical Features, and Health Outcomes

Narendar Kumar[1,2], Syed Azhar Syed Sulaiman[1], Furqan Khurshid Hashmi[3], Pushp Lata Rajpoot[4], Rabbiya Ahmed[1], Ali Qureshi[1], Siti Maisharah Sheikh Ghadzi[1]**

[1] Discipline of Clinical Pharmacy, School of Pharmaceutical Sciences, Universiti Sains Malaysia, Pulau Pinang, Malaysia

[2] Department of Pharmacy Practice, Faculty of Pharmacy, University of Sindh, Jamshoro, Pakistan

[3] College of Pharmacy, University of the Punjab, Allama Iqbal Campus, Lahore, Pakistan

[4] Department of Health Education and Promotion, College of Public Health and Tropical Medicine, Jazan University, Jazan, Saudi Arabia

* Corresponding author: maisharah@usm.my

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Abstract: Hypertension is a widely recognized cardiovascular comorbidity among patients infected with COVID-19, significantly elevating the risk of severe illness and mortality. This study evaluated the prevalence of hypertension in COVID-19 patients and their clinical features and health outcomes. The authors conducted a retrospective observational study at Indus Hospital, Karachi, Pakistan, involving COVID-19 patients hospitalized between April 2020 and March 2021. Data were extracted from the electronic medical record database and analyzed using IBM SPSS v.27. The relationship between different categorical variables was examined using chi-square test. Among 1029 patients, a majority were male (n = 707, 68.7%) with an average age of 57.2 ± 14.6 years and 60 years and above (n = 516, 50.1%). Hypertension was found to be prevalent among 50.3% of COVID-19 patients. Most patients experienced fever before admission (n = 803, 78.0%), shortness of breath (n = 775, 75.3%), dry cough (n = 354, 34.4%), and productive cough (n = 193, 18.8%). Hypertensive COVID-19 patients had more critical illness (40.3% vs. 27.8%) than non-hypertensive patients. In most patients, 29.3% had cardiac arrest, followed by acute respiratory distress syndrome (17.6%) and sepsis (12.1%) during the hospital stay. Additionally, hypertensive patients posed more fatal outcomes (n = 220, 42.5% vs. n = 148, 28.9%, $p < 0.001$) than non-hypertensive patients. A significant correlation was observed between cardiac and respiratory complications such as acute respiratory distress syndrome (ARDS) and hypertension in these patients (all p values < 0.05). In conclusion, our study revealed a high prevalence of hypertension among COVID-19 patients. Common clinical symptoms on admission include fever, shortness of breath, cough, weakness, and malaise. Hypertension was significantly associated with gender, age groups, clinical characteristics, severity, mortality, and complications in COVID-19 patients.

Keywords: hypertension, COVID-19, prevalence, severity, mortality.

高血压和新冠肺炎：关于患病率、临床特征和健康结果的综合研究

摘要：高血压是感染了新冠肺炎 的患者中一种广泛认可的心血管合并症,显著增加了重症和死亡的风险。本研究评估了新冠肺炎患者的高血压患病率及其临床特征和健康结果。我们在巴基斯坦卡拉奇梧桐医院进行了一项回顾性观察研究，涉及 2020 年 4 月至 2021 年 3 月期

间住院的新冠肺炎患者。数据从电子病历数据库中提取，并使用国际商业机器社会科学统计包第 27 版进行分析。使用卡方检验检查不同分类变量之间的关系。1029 名患者中，大多数为男性（707 例，68.7%），平均年龄 57.2 ± 14.6 岁，60 岁及以上（516 例，50.1%）。研究发现 50.3%的新冠肺炎患者患有高血压。大多数患者入院前出现发热（n = 803，78.0%）、气短（n = 775，75.3%）、干咳（n = 354，34.4%）和咳痰（n = 193，18.8%）。高血压的新冠肺炎患者比非高血压患者有更多的危重病（40.3%与 27.8%）。在大多数患者中，29.3%的患者在住院期间出现心脏骤停，其次是急性呼吸窘迫综合征（17.6%）和败血症（12.1%）。此外，与非高血压患者相比，高血压患者的致命性结果更高（n = 220, 42.5%与 n = 148, 28.9%，p < 0.001）。在这些患者中，观察到心脏和呼吸系统并发症（例如急性呼吸窘迫综合征）与高血压之间存在显着相关性（所有 p 值< 0.05）。总之，我们的研究揭示了新冠肺炎患者中高血压的患病率很高。入院时常见的临床症状包括发烧、气短、咳嗽、虚弱和不适。高血压与新冠肺炎患者的性别、年龄组、临床特征、严重程度、死亡率和并发症显着相关。

关键词：高血压、新冠肺炎、患病率、严重程度、死亡率.

Introduction

Coronavirus Disease of 2019 (COVID-19) is a very contagious infection of the respiratory tract caused by severe acute respiratory syndrome Coronavirus 2 (SARS-CoV-2). The virus was first discovered in Wuhan, China in December 2019. The World Health Organization (WHO) acknowledged this outbreak as a pandemic since it has spread globally [1]. COVID-19 produced a substantial impact on world economies, the healthcare system, and daily life [2, 3]. Patients with hypertension (HTN) when contracting COVID-19 become susceptible to the worst prognosis and deteriorating outcomes such as pneumonia, acute respiratory distress syndrome, cardiac complications, acute kidney injury, stroke, and mortality [4, 5]. However, the scientific literature has discovered that the prevalence of HTN ranges from 2% [6] to 74% [7] among COVID-19 patients. Besides HTN, other confounding factors, such as age, obesity, comorbid disease state, and clinical characteristics are also involved in determining the intensity of a COVID-19 infection [8, 9]. Moreover, the strength of the association between HTN and severe COVID-19 infection can be influenced by the individual and the specific circumstances of their infection. The findings of different observational studies on the relationship between HTN and mortality risk in COVID-19-infected patients are inconsistent. In some studies, the impact of HTN on mortality risk was significantly decreased or even nonexistent when adjusted for other confounders [10, 11]. Understanding the relationship between HTN and unfavorable outcomes of COVID-19 infection holds significant importance in the field of public health. Therefore, conducting research to explain the association between HTN and the progression toward a severe state of COVID-19 infection is essential. The current study contributes valuable insights to the existing literature by shedding light on the relationship of HTN with COVID-19 infection. Additionally, our analysis of health outcomes during the initial phases of the pandemic serves to elucidate the previous ambiguous or potentially biased association between HTN and COVID-19 severity and mortality [12]. Most available epidemiological studies were short-term regarding the prevalence of HTN among COVID-19-infected patients. In addition, many did not report the criteria for diagnosing HTN among COVID-19, whether HTN was diagnosed in the hospital through blood pressure measurements or self-reported by patients or their caregivers. Given that the actual prevalence of HTN in COVID-19 patients might be underestimated because patients might be unaware of their condition [13]. However, consistent evolution in the prevalence of HTN in COVID-19 from different regions makes it challenging to provide accurate estimation. Furthermore, there are disproportionate data on the prevalence of HTN and clinical features associated with severe and fatal outcomes among COVID-19 patients in Pakistan. Therefore, it is essential to determine the prevalence of HTN among COVID-19 patients and the clinical features and health outcomes among these infected patients.

1. Methodology

1.1. Study Design

This study was based on a retrospective observational design. COVID-19 patients were divided into two cohorts; hypertensive and nonhypertensive. Moreover, demographic characteristics, clinical presentation, health outcomes, and complications were also compared between these two cohorts.

1.2. Study Settings

The research was conducted in high-dependency units (HDU) and intensive care units (ICU). Data of patients were extracted from the electronic medical record database of individuals with COVID-19 who were admitted to Indus Hospital in Karachi, Pakistan, from April 1, 2020 to March 31, 2021.

1.3. Study Population

The study included individuals aged 18 years and above who had a confirmed diagnosis of COVID-19 through reverse transcriptase polymerase chain reaction (RT-PCR), admitted to HDU and ICU. However, suspected COVID-19 patients without confirmed diagnosis using RT-PCR, children under 18 years of age, and pregnant women were excluded from the study. Moreover, duplicate medical records and incomplete medical records were also excluded. Cochran's formula determined the minimum sample size of the study as 385.

1.4. Sampling Technique

For this phase, consecutive sampling method was used to collect the sample size. After thoroughly screening all electronic medical record databases, 1073 medical records were identified within the timeframe. Therefore, after fulfilling the selection criteria, 1029 COVID-19 patients remained in this study phase (Fig. 1).

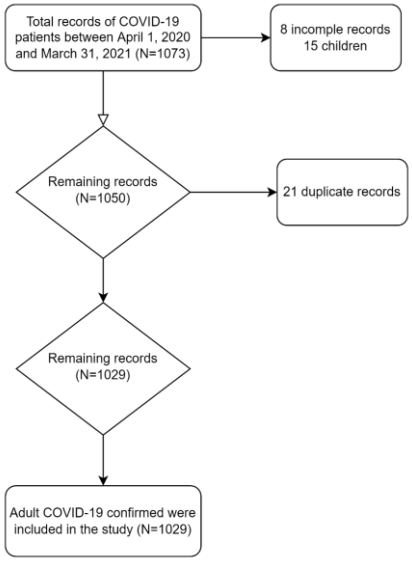

Fig. 1 Patients' inclusion criteria

1.5. The Data Collection Process and Research Tool

For data collection, the patient's information was extracted from the electronic patients' medical profiles and recorded on a pre-designed data collection form. The data included patients' gender, age, comorbidities, clinical presentations, vital signs and severity of illness on admission, and duration of COVID-19 illness. The patients were then divided into two groups; hypertensive and non-hypertensive. Then, they were compared for health outcomes (need for respiratory support, severity, the health status of the patient, duration of hospitalization, and COVID-19 complications).

1.6. Health Outcomes

During the study period, HTN prevalence and clinical features were determined in terms of frequency and percentage. In addition, hypertensive and nonhypertensive COVID-19 patients were compared for differences in age groups, gender, clinical features, baseline vitals, comorbidities, and health outcomes (need for respiratory support, severity levels [14], death outcomes, complications).

1.7. Statistical Analysis

The final data were analyzed using IBM SPSS 27.0. Descriptive statistics were employed to present categorical variables as numbers and percentages.

The distribution of continuous variables was checked using the Kolmogorov-Smirnov test for normality. If data followed a normal distribution, numerical values were presented as mean ± SD; otherwise, they were expressed as median (IQR). To compare categorical data such as gender, age groups, comorbidities, clinical presentation, baseline severity, type of respiratory support, complications, and survival outcomes with HTN, the chi-square test or Fisher's exact test was applied. For comparing medians of continuous data such as baseline blood pressure, heart rate, respiratory rate, blood oxygen saturation, duration of illness, and duration of hospital stays between hypertensive and non-hypertensive groups, the Mann–Whitney U test was employed. The statistical significance was set at p-values of ≤ 0.05 providing a 95% confidence interval.

1.8. Ethical Consideration

Ethical approval was sought from the Institutional Review Board (IRB) of Indus Hospital and Health Network, Korangi Campus, Karachi, Pakistan (Reference No. IHHN_IRB_2021_06_008).

2. Results

2.1. Patients' Demographic Characteristics

During the period from April 1, 2020 to March 31,

2021, 1029 confirmed cases of COVID-19 were hospitalized. Among these patients, the majority were male (n = 707, 68.7%) with an average age of 57.2 ± 14.6 years. The age group 60 years and above accounted for a significant proportion (n = 516, 50.1%), followed by 40–59 years (n = 386, 37.5%). HTN was prevalent among (n = 518, 50.3%) COVID-19 patients, followed by diabetes mellitus (n = 388, 37.7%), cardiovascular diseases (n = 130, 12.6%), and chronic kidney disease (n = 83, 8.1%). The results also reported that the prevalence of HTN increased in the proceeding age groups. HTN was significantly associated with gender, mean age, age groups, diabetes mellitus, cardiovascular disease, chronic kidney disease, and cerebral vascular arrest (all $p < 0.001$), as shown in Table 1.

Table 1 Demographic characteristics of COVID-19 patients (N = 1029)

Characteristics	Total patients N (%)	Non-Hypertensive (N = 511)	Hypertensive (N = 518)	p-value
Gender				
Female	322 (31.3)	134 (26.2)	188 (36.3)	< 0.001
Male	707 (68.7)	377 (73.8)	330 (63.7)	
Age (years), Mean ± SD	57.2 ± 14.59	51.76 ± 15.43	62.7 ± 11.38	< 0.001
Age groups				
18–39 years	127 (12.3)	113 (22.1)	14 (2.7)	< 0.001
40–59 years	386 (37.5)	222 (43.4)	164 (31.7)	
60 years and above	516 (50.1)	176 (34.4)	340 (65.6)	
Comorbidities				
Diabetes mellitus	388 (37.7)	155 (30.3)	233 (44.9)	< 0.001
Cardiovascular disease	130 (12.6)	23 (4.5)	107 (20.6)	< 0.001
CKD	83 (8.1)	22 (4.3)	61 (11.7)	< 0.001
Asthma	40 (3.9)	17 (3.3)	23 (4.4)	0.356
Cerebral vascular disease	38 (3.7)	6 (1.1)	33 (6.6)	< 0.001
Hypothyroidism	19 (1.8)	8 (1.5)	11 (2.1)	0.506
Chronic obstructive pulmonary disease	17 (1.7)	10 (1.9)	7 (1.3)	0.446
Benign prostate hyperplasia	11 (1.1)	3 (0.5)	8 (1.5)	0.135
Hepatitis	10 (1.0)	9 (1.7)	1 (0.1)	0.010
Other*	59 (5.7)	30 (5.8)	29 (5.5)	0.851

Notes: SD = standard deviation; * Epilepsy, arthritis, osteoarthritis, rheumatoid arthritis, liver cirrhosis, ischemic lung disease, osteoarthritis, Parkinson's disease, gout, depression, anemia

2.2. Clinical Characteristics of COVID-19 Patients

The baseline clinical presentation of the patients at the time of admission to the hospital is presented in Table 2. Clinical features of patients were fever before admission (n = 803, 78.0%), shortness of breath (n = 775, 75.3%), dry cough (n = 354, 34.4%), productive cough (n = 193, 18.8%), weakness (n = 93, 9.0%), and malaise (n = 90, 8.7%).

Additionally, the baseline vital signs are also presented in Table 2. The median (IQR) of systolic blood pressure (SBP) was 135 (120-148), diastolic blood pressure (DBP) 80 (71-89), heart rate (HR) 90 (80-104), temperature in Fahrenheit (^{o}F) 98.4 (98.4-98.75), respiratory rate (RR) 25 (21-30), and oxygen saturation (%) 91 (85-96). The median (IQR) duration of patients' illnesses was 7 (4-10) days. Regarding baseline severity, most patients (n = 500, 48.6%) presented with non-severe illness. Hypertensive and nonhypertensive patients were compared for clinical characteristics associated with COVID-19, and no significant difference was observed between the two groups for clinical features (all $p > 0.05$).

Table 2 also depicts the baseline vital signs comparing hypertensive and non-hypertensive COVID-19 patients. There was a significant association of median blood pressure (systolic and diastolic) and oxygen saturation with HTN (all p-values < 0.05). Compared with nonhypertensive COVID-19 patients, hypertensive COVID-19 patients were more severe (n = 224, 43.2% vs. n = 180, 35.3%) and critically ill (n = 69, 13.4% vs. n = 56, 10.9%) at admission. Furthermore, baseline severity was significantly associated ($p < 0.001$) with HTN among COVID-19 patients.

Table 2 Clinical characteristics of COVID-19 patients (N = 1029)

Characteristics	Total patients N (%)	Non-Hypertensive (N = 511)	Hypertensive (N = 518)	p-value
Signs and symptoms				
Asymptomatic	13 (1.3)	9 (1.7)	4 (0.7)	0.156
Fever	803 (78.0)	398 (77.9)	405 (78.2)	0.908
Shortness of breath	775 (75.3)	374 (73.2)	401 (77.4)	0.116
Dry cough	354 (34.4)	169 (33.1)	185 (35.7)	0.372
Productive cough	193 (18.8)	97 (19.0)	96 (18.5)	0.853
Weakness	93 (9.0)	41 (80.3)	52 (10.1)	0.260
Malaise	90 (8.7)	46 (88.9)	44 (8.4)	0.773
Chest pain	76 (7.4)	38 (7.4)	38 (7.3)	0.951
Vomiting	71 (6.9)	43 (8.4)	28 (5.4)	0.057

Continuation of Table 2				
Altered level of consciousness C	64 (6.2)	29 (5.6)	35 (6.7)	0.473
Diarrhoea	63 (6.1)	28 (5.5)	35 (6.7)	0.393
Chills and rigors	50 (4.9)	25 (4.9)	25 (4.8)	0.961
Abdominal pain	36 (3.5)	22 (4.3)	14 (2.7)	0.162
Sore Throat	33 (3.2)	19 (3.7)	14 (2.7)	0.355
Anorexia	31 (3.0)	15 (3.0)	16 (3.1)	0.886
Other*	59 (5.7)	30 (5.9)	29 (5.5)	0.851
Baseline vital signs, median (IQR)				
Systolic blood pressure, mm Hg	135 (120-148)	130 (118-142)	139 (122-150)	< 0.001
Diastolic blood pressure, mm Hg	80 (71-89)	80 (70-87)	80 (71-90)	0.046
Heart rate, beats/min	90 (80-104)	90 (80-104)	90 (80-103)	0.266
Temperature, (oF)	98.4 (98.4-98.7)	98.4 (98.4-99.2)	98.4 (98.4-99.4)	0.847
Respiratory rate, breaths/min	25 (21-30)	24 (21-29)	25 (22-30)	0.436
sPO2, %	91(85-96)	90 (82-94)	88 (80-92)	0.026
The duration of illness (days)	7 (4-10)	7 (4-11)	7 (4-10)	0.529
Baseline severity				
Non-severe	500 (48.6)	275 (53.8)	225 (43.4)	< 0.001
Severe	404 (39.3)	180 (35.3)	224 (43.2)	
Critical	125 (12.1)	56 (10.9)	69 (13.4)	

* Constipation, chest congestion, flu, insomnia, nausea, palpitations, loss of smell and/or taste

2.3. Comparison of Health Outcomes among Hypertensive and Non-Hypertensive COVID-19 Patients

Table 3 describes HTN impact on the need for respiratory support, mortality, and complications of COVID-19 patients. Regarding the need for respiratory support, compared to the non-hypertensive group, hypertensive patients needed more non-invasive mechanical ventilation (n = 90, 17.4% vs. n = 56, 11.0%). Moreover, the need for respiratory support and final severity was also significantly associated ($p < 0.001$) with HTN in these patients.

While comparing the two cohorts, hypertensive patients posed more fatal outcomes (n = 220, 42.5% vs. n = 148, 28.9%) than nonhypertensive patients. Additionally, HTN significantly affected overall health outcomes ($p < 0.001$). However, there was no difference in the median duration of hospitalization between the two groups ($p = 0.091$)

COVID-19 patients were observed to have many complications during their hospital stay. The majority of patients (n = 302, 29.3%) had cardiac arrest, followed by acute respiratory distress syndrome (n = 181, 17.6%) and sepsis (n = 125, 12.1%). Moreover, cardiac arrest and acute respiratory distress syndrome were significantly associated ($p < 0.001$) and ($p = 0.002$) with HTN, respectively.

Table 3 Health outcomes of COVID-19 patients

Characteristics	**Total N (%)**	**Non-Hypertensive (N = 511)**	**Hypertensive (N = 518)**	**p-value**
Respiratory support				
No need	143 (13.9)	93 (18.2)	50 (9.6)	< 0.001
O_2 supply through nasal prong/face mask	272 (26.4)	143 (28.0)	129 (25.0)	
O_2 supply through High flow nasal canula	266 (25.9)	123 (24.0)	143 (27.6)	
Non-invasive ventilation	146 (14.2)	56 (11.0)	90 (17.4)	
Invasive mechanical ventilation	202 (19.6)	96 (18.8)	106 (20.4)	
Final stage severity				
Non-severe	459 (44.6)	264 (51.7)	195 (37.6)	< 0.001
Severe	219 (21.3)	105 (20.5)	114 (22.0)	
Critical	351 (34.1)	142 (27.8)	209 (40.3)	
Death outcome	368 (35.8)	148 (28.9)	220 (42.5)	< 0.001
The duration of hospitalization (days), median (IQR)	6 (3-10)	6 (3-9)	6 (4-10)	0.091
Complications				
Cardiac arrest	302 (29.3)	113 (22.1)	189 (36.5)	< 0.001
Acute respiratory distress syndrome	181 (17.6)	71 (13.9)	110 (21.3)	0.002
Acute kidney injury	58 (5.6)	26 (5.1)	32 (6.2)	0.449
Septic shock	9 (0.8)	7 (1.3)	2 (0.3)	0.090
Sepsis	125 (12.1)	62 (12.1)	63 (12.2)	0.989
Non-ST elevated myocardial infarction	22 (2.1)	8 (1.5)	14 (2.7)	0.207
Post COVID-19 sequelae	16 (1.5)	6 (1.2)	10 (1.9)	0.327
Multiple organ dysfunction syndrome	44 (4.2)	21 (4.1)	23 (4.4)	0.793

3. Discussion

A global health crisis has been observed due to the recent outbreak of COVID-19, which has had severe implications for countries' healthcare systems and economies worldwide, Pakistan being no exception. HTN is a chronic condition already prevalent among

many Pakistanis, affecting the severity and mortality of COVID-19 patients [15]. The purpose of this study was to examine the prevalence of HTN, clinical characteristics, and health outcomes in COVID-19 patients hospitalized at Indus Hospital, Karachi, Pakistan.

The current study confirms that HTN is the most prevalent (50.3%) existing comorbidity among hospitalized COVID-19 patients, consistent with a previous study from the United States of America [16]. Furthermore, our study revealed a higher prevalence of HTN among COVID-19 patients compared with the general population in Pakistan, which may implicate an increased risk of COVID-19 [17]. Additionally, COVID-19 may exacerbate pre-existing HTN or lead to new cardiovascular complications, including HTN, myocarditis, and thromboembolism. These complications may also result from immune response and systemic inflammation due to COVID-19 infection [18].

Previous research has highlighted a higher frequency of HTN in male patients infected with COVID-19 [19]. In line with these studies, the authors observed a similar pattern, with a higher proportion of male hypertensive patients infected with COVID-19. This is possibly due to a higher proportion of COVID-19-infected patients being male (68.7%) in our study. This differential prevalence is due to the regulation of the immune response based on gender, which can lead to variations in pathogenesis and mortality for various pathogens. Moreover, females exhibited more robust humoral, innate, and cell-mediated immune responses against different pathogens compared with males [20].

The prevalence of HTN increases with increasing age [21]. McFarlanes and co-authors found that the incidence of HTN was higher in COVID-19 patients aged over 60 years [22]. Our analysis also confirmed that most hypertensive COVID-19 patients fell in the same age, which may be redundant due to many COVID-19 patients in the same age group. Therefore, the higher prevalence of HTN observed in our study may be attributed to a larger proportion of patients belonging to the age group (> 60 years).

Hypertensive patients often have other underlying conditions; diabetes mellitus (DM), cardiovascular disease (CVD), and kidney disease. Previously, Zhong et al. [23] determined a significant association between concurrent comorbidities, including DM, CVD, and CKD, and HTN in COVID-19 patients. Indeed, the authors also found a similar association of the said comorbidities with HTN in COVID-19 patients. This may be possible due to diabetes mellitus and HTN in the Pakistani population. Furthermore, cardiovascular and chronic kidney diseases often coexist with HTN, and their prevalence also increases with age progression. Moreover, the population's primary risk factors for CVD and CKD are the prevalence of uncontrolled HTN due to inadequate treatment, limited healthcare access, poor socio-economic conditions, unhealthy diet, and a sedentary lifestyle [17].

In the current cohort, fever, shortness of breath, and cough were the frequently observed symptoms among COVID-19 patients, in line with the findings of other studies [24-27]. Fever is a physical response that occurs due to inflammation, and it is triggered by abnormal production and release of cytokines and chemokines when a virus invades the body. This response is particularly pronounced when immune cells such as macrophages, dendritic cells, and lymphocytes become infected [28]. SARS-CoV-2 primarily targets the respiratory system, leading to inflammation, swelling, and lung tissue damage. This damage results in decreased lung function, and impaired oxygen exchange may cause the shortness of breath and other respiratory symptoms, including cough [29].

The authors observed elevated systolic and diastolic blood pressure medians among hypertensive COVID-19 patients than among non-hypertensive patients, which is supported by a previous study [23]. Uncontrolled blood pressure during hospital stay may lead to higher risks for severe and fatal outcomes for COVID-19 patients [30]. Therefore, initiating appropriate antihypertensive therapy in the early stages of COVID-19 may help improve the prognosis and speedy recovery [31]. Similarly, a significant difference was also observed in median blood oxygen saturation between hypertensive and non-hypertensive

While non-hypertensive COVID-19 patients, hypertensive patients' baseline median blood oxygen saturation differed significantly from non-hypertensive COVID-19 patients [32], which confirms our results reflecting a lower median blood oxygen saturation in hypertensive patients than in non-hypertensive patients infected with COVID-19. This may reflect a higher proportion of patients with severe/critical illnesses (56.6% vs 46.2%) and older in hypertensive patients than in non-hypertensive patients. The lung capacity and respiratory volumes decrease with age, which may lead to decreased oxygen saturation [33].

Regarding the severity of COVID-19 patients, following previous studies [34], our findings suggested that COVID-19 patients with HTN posed more severe and critical illnesses during hospital stays. One potential explanation for this association is the imbalance of cytokines such as IL-6, IL-7, granulocyte-macrophage colony-stimulating factor, and tumor necrosis α, which has been a critical indicator for developing cytokine storms in COVID-19 patients [35]. Similarly, IL-6 has been linked with unfavourable outcomes in COVID-19 patients [36]. It plays a critical role in modulating inflammatory and immune responses during HTN. Furthermore, individuals with HTN may experience an imbalance in the renin-angiotensin-aldosterone system, which can contribute to an excessive release of cytokine and inflammatory markers, vasoconstriction, and cell damage [37].

The authors determined several health outcomes, including complications, the need for intensive care, and mortality among hypertensive and non-hypertensive COVID-19 patients. Cardiac arrest, acute respiratory distress syndrome (ARDS), acute kidney injury (AKI), sepsis, and multiple organ dysfunction syndrome were the major complications compared between the two groups. Moreover, the need for intensive care and death outcomes were also compared between the two groups. Previous literature has discovered that HTN is associated with worsening health outcomes such as severe COVID-19 illness, ARDS, ICU admission, and even death [38, 39]. Following these results, our study reiterated that cardiac arrest, ARDS, intensive care need, and mortality was significantly higher among hypertensive COVID-19 patients than non-hypertensive patients.

COVID-19 may directly affect the cardiovascular system, leading to cardiac complications such as myocardial infarction, arrhythmias, and heart failure. Many previous studies have determined different incident rates of cardiac arrest among COVID-19 patients. Our study revealed a significantly higher incidence of cardiac arrest in the hypertensive cohort. In contrast, Chen J. et al. reported that incidences of cardiac arrest were not considerably different between hypertensive and non-hypertensive COVID-19 patients [40].

J. Chen et al. indicated that HTN is not associated with incidences of ARDS among COVID-19 patients [40]. On the other hand, the current study showed a greater frequency of ARDS among hypertensive patients than among nonhypertensive COVID-19 patients. The possible explanation for our results could be that most hypertensive patients already had severe and critical illness, leading to poor prognosis among COVID-19 patients with HTN.

Our study determined that hypertensive COVID-19 patients had lower oxygen saturation and a greater need for respiratory support than non-hypertensive patients. In line with our findings, some other studies have described that hypertensive COVID-19 patients needed a more intensive care support than non-hypertensive patients. [41]. The increased need for respiratory support may be due to the cytokine storm that occurs in response to the SARS-CoV-2 virus, which leads to lung tissue damage and acute respiratory distress [42]. Moreover, HTN may exacerbate this response [43].

Hypertensive individuals contracting COVID-19 are more likely to experience severe pneumonia and organ damage and are more prone to developing exacerbated inflammatory responses, which may contribute to higher mortality risk than non-hypertensive COVID-19 patients [44]. Our study revealed significantly higher mortality among hypertensive than non-hypertensive COVID-19 patients, supported by previous studies [34, 45].

4. Conclusion

In conclusion, the goal of this study was to investigate the prevalence of hypertension (HTN) and its effects on clinical traits and health outcomes in COVID-19 patients admitted to the Indus Hospital in Karachi, Pakistan. The study's key findings showed that HTN is extremely common. 50.3% of COVID-19 hospitalized patients have HTN. This prevalence agrees with a recent study conducted in the US. The study also discovered that COVID-19 patients had greater rates of HTN than the Pakistani general population, indicating a higher risk of COVID-19 for hypertensive people.

The study also showed that patients with COVID-19 who were male and over 60 years old had a higher prevalence of HTN. Other comorbidities such as diabetes mellitus, cardiovascular disease, and kidney disease were found to be associated with HTN. Fever, shortness of breath, and coughing were the most frequent symptoms among COVID-19 patients in our study, and these findings are similar to earlier studies.

Compared with non-hypertensive patients, COVID-19 individuals with hypertension had higher systolic and diastolic blood pressures, lower blood oxygen saturation, and more serious and critical diseases. Patients with hypertension were more likely to experience complications such as cardiac arrest, acute respiratory distress syndrome (ARDS), acute kidney injury (AKI), sepsis, and multiple organ dysfunction syndrome. Patients with hypertension who had COVID-19 also had considerably greater mortality rates and the need for critical care.

According to the study findings, HTN is a substantial comorbidity that is connected to subpar health outcomes in COVID-19 patients. These findings emphasize the value of early antihypertensive medication beginning in COVID-19 patients to enhance prognosis and hasten recovery. The study also highlights the need for improved hypertension management, particularly in older people and people with comorbid conditions, to lower the risk of severe COVID-19 disease and mortality.

The study the authors conducted had some limitations. First, since this research was limited to a specific location, it is possible that the results do not apply to the entire nation. However, during the retrospective part of the trial, data were collected on a large number of patients over a lengthy period, estimating the prevalence of HTN in COVID-19 patients and perhaps improving the generalizability of our findings. As an observational study, there was a dearth of patient data on laboratory results. However, by comparing the hypertensive and non-hypertensive patients in a large sample, the authors were able to better grasp the connection between HTN and COVID-19 and pinpoint the risk factors for serious and fatal outcomes. Third, it was impossible to predict how

demographic and clinical traits might affect health outcomes over the long term.

According to the study findings, hypertensive people should be given priority for the COVID-19 vaccine and that they should be given the proper antihypertensive treatment. Multicenter studies should be the main focus of future research in order to confirm the results and examine the long-term effects of HTN on COVID-19 outcomes. In the context of the COVID-19 pandemic, efforts should be made to enhance hypertension treatment and healthcare access to lessen the burden of HTN-related consequences.

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