



Emergency Department Management of Hypertension in the Context of COVID-19

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Abstract

Purpose of Review This review describes the relationship between COVID-19 and hypertension (HTN), and considerations for emergency medicine providers in the management of hypertensive patients during the COVID-19 pandemic.

Recent Findings Hypertensive patients with COVID-19 have a higher risk of severe disease/complications, hospitalizations, intensive care unit (ICU) admissions, and mortality than non-hypertensive patients. Studies have also shown the importance of consideration of various demographic factors (such as older age) and socioeconomic factors that may confound these relationships. Despite concerns at the start of the pandemic that RAAS inhibiting antihypertension medications may contribute to worsened outcomes in COVID-19 patients, subsequent research has shown that use of ACEi/ARBs is associated with neutral or even improved COVID-19 outcomes. Socioeconomic factors must also be considered including patients' potential delay of health care due to fear of contracting COVID-19, loss of health insurance, and barriers to accessing primary care appointments for post-ED follow-up care.

Summary While there is mixed evidence on biological considerations for HTN care during the COVID-19 pandemic, the pandemic has undoubtedly been a major stressor and barrier to effective chronic disease management. Emergency medicine and other providers should consider this when evaluating acute care patients with a history of HTN or newly elevated blood pressure.

Keywords Hypertension · COVID-19 · Emergency department · Chronic disease management · Socioeconomic factors

Introduction

There are 139 million emergency department (ED) visits annually in the US [1], and blood pressure (BP) is elevated at almost half (44%) of all ED visits — compared to 27% of primary care doctor visits [2]. From 2006 to 2012, hypertension (HTN)-related ED visits made up 24% of all ED visits and rose 5% per year [3]. Elevated blood pressure in the ED has been associated with subsequent incident atherosclerotic

cardiovascular disease (ASCVD), myocardial infarction, and stroke, suggesting that ED-measured blood pressure can be used as a tool to reduce HTN-related morbidity and mortality [4]. Additionally, patients who present to the ED with consistently elevated BP (\geq two readings), are shown to maintain elevated BP outside of the ED, suggesting that their elevated BP is from HTN, and not a result of pain or anxiety from the ED visit [5, 6].

Significant disparities in HTN outcomes exist, with minorities having higher rates of morbidity and mortality [7, 8]. Compared to non-Hispanic whites, African Americans are 40% more likely to have high BP [9], are less likely to have it under control [9, 10], are 20% more likely to die from heart disease [9], and are more likely to have heart failure at a young age (< 50 years) [11]. Racial/ethnic minority groups have also been disproportionately affected by COVID-19, especially the Hispanic population, which makes up 18% of the US population but 29% of COVID-19 cases [12].

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Relationship Between COVID-19 and Hypertension

Novel coronavirus SARS-CoV-2 is responsible for the COVID-19 pandemic. Angiotensin-converting enzyme 2 (ACE2) has emerged as an important modulator in not only the pathophysiology of HTN but in the severity of symptoms associated with SARS-CoV2 infection [13]. Coronaviruses are known to utilize the ACE2 receptor to help facilitate entry into the host target cell. ACE2 receptors are distributed throughout the body and are found in not only blood vessels, but also in the lungs and small intestines. ACE2 is a key regulator in the renin–angiotensin system (RAS) and converts angiotensin II (ANG II) to ANG 1–7, which has protective features of vasodilation and reducing inflammation and counterbalances the vasoconstriction of ANG II.

The SARS-CoV-2 virus attaches to the catalytic site of the ACE2 receptor and prevents it from performing its ability to convert ANGI to ANG 1,7. As a result, angiotensin II type 1 receptor (*AGTR1*), which typically is bound to ACE2, is now dissociated due to the SARS-CoV-2 virus thus allowing *AGTR1* to act unopposed and cause increased vasodilation, vascular permeability, blood pressure, pulmonary edema, and eventually ARDS [14]. The end result of the downregulation of ACE2 on the host cells leads to the angiotensin imbalances, which contributes to severe respiratory and cardiovascular manifestations of SARS-COV-2 seen in some patients [15].

Since the start of the pandemic, researchers across the world have explored whether HTN is a significant independent risk factor for COVID-19 and if HTN is associated with significantly worse clinical outcomes in COVID-19 patients. Individual studies have shown that approximately 16 to 57% of COVID-19 patients have HTN [16–23], while a meta-analysis of 65 studies estimates the overall prevalence of HTN in COVID-19 patients to be 17% [24]. HTN is generally found to be the most common comorbidity in COVID-19-positive patients [16–23], and one meta-analysis found HTN to be an independent risk factor for COVID-19, with an odds ratio of 2.29 [25].

Based on several large studies and meta-analyses, hypertensive patients with COVID-19 also appear to have a more than twofold greater risk of severe disease/complications [22, 26–29], including ICU or hospital admission [17, 24, 29, 30] and mortality [20, 24, 28, 29, 31, 32••, 33] than patients without HTN. However, other studies of similar size and power have found no association between HTN and disease severity [24, 30], while others have found a relationship in univariate but not multivariate analysis [23, 34–36]. Possible confounding factors, especially older age, may explain such discrepancies. Older

COVID-19 patients have higher rates of HTN and other comorbidities, along with higher rates of severe COVID-19 disease [37, 38].

The Centers for Disease Control and Prevention (CDC) categorize high-risk underlying medical conditions into groups based on the level of evidence for risk of severe COVID-19 outcomes. Given the mixed evidence of HTN on COVID-19, they have characterized HTN as a co-morbidity that is supported by mixed evidence, meaning there is an association in at least one meta-analysis or systematic review and other studies or reviews that reached different conclusions about risk associated with the condition. Other conditions in this category include asthma, immune deficiencies, and liver disease [39]. Comparatively, the CDC considers cancer, cerebrovascular disease, chronic kidney disease, chronic obstructive pulmonary disease (COPD), type 1 and type 2 diabetes mellitus, heart conditions such as heart failure, obesity (BMI ≥ 30 kg/m²), pregnancy, and smoking to be comorbidities with a significant association with risk of severe COVID-19 illness [39].

Impact of COVID-19 on Management of Hypertension in the ED

Considerations in Use of Antihypertensive Medications for Hypertensive Patients with COVID-19

At the start of the COVID-19 pandemic, researchers were concerned that RAAS inhibiting antihypertension medications — angiotensin-converting enzyme inhibitors (ACEi) and angiotensin receptor blockers (ARBs) — may contribute to worsened outcomes in COVID-19 patients. However, subsequent worldwide research has overwhelmingly shown that use of ACEi/ARBs is associated with neutral or even improved COVID-19 outcomes in patients. In a review of the literature, we found 32 original studies and meta-analyses exploring this topic. The findings shared here are those of all four meta-analyses ($N = 3936$ (9 studies) [40]; $N = 9890$ (10 studies) [41]; $N = 28,872$ (19 studies) [42]; $N = 2,100,587$ (53 studies) [43••]) and one large US national sample of patients ($N = 64,781$) [44••].

Two meta-analyses found that ACEi/ARBs treatment was not associated with COVID-19 disease severity [40, 41] or mortality [41]. Another found no association between prior use of antihypertensive medications, including ACEi/ARB, calcium channel blockers (CCBs), β -blockers, and diuretics, and COVID-19 risk and severity [43••].

Several large studies and meta-analyses have found benefits to ACEi/ARB usage with a significant relationship between

ACEi/ARBs treatment and lower COVID-19 mortality [40, 42, 43••, 44••]. Some meta-analyses have also found a significantly lower association with critical outcomes [42] and lower disease severity [43••] for COVID-19 patients with HTN who used ACEi/ARBs compared to those who did not. While the literature shows uncertainty between whether RAAS inhibitors have a neutral or positive relationship with COVID-19 severity and outcomes, no studies could be found that showed that use of RAAS inhibitors was associated with worse COVID-19 severity or outcomes. Thus, the American Heart Association (AHA), the Heart Failure Society of America (HFSA), and the American College of Cardiology (ACC) have jointly published a statement recommending continuation of angiotensin-converting enzyme inhibitors (ACE-i) or angiotensin receptor blocker (ARB) medications for patients already prescribed for HTN and other cardiovascular conditions.

Social and Economic Impacts of COVID-19 on Hypertension

Acute Management

The American College of Emergency Physicians (ACEP) Clinical Policy on Management of Adult Patients in the ED with Asymptomatic Hypertension considers markedly elevated blood pressure to be 160/100 mm Hg — consistent with JNC 7's definition of stage 2 HTN [45]. Patients with hypertensive emergencies have markedly elevated BP and findings of end organ injury. ACEP's clinical policy recommends that routine screening for acute target organ injury is not required in ED patients with asymptomatic markedly elevated BP. However, in patient populations with poor follow-up, ACEP recommends screening for an elevated serum creatinine level to identify kidney injury that affects disposition such as hospital admission [45].

Asymptomatic Management

ACEP's 2013 Clinical Policy on Adult Patients in the ED with asymptomatic elevated blood pressure recommends that routine ED medical intervention is not required. However, in some patient populations, such as those with poor follow-up, ED doctors may treat markedly elevated BP in the ED and/or initiate therapy for long-term control. Additionally, these patients should be referred for outpatient follow-up [45]. While ACEP has not modified these recommendations during the COVID-19 pandemic, a review of research on the use of antihypertensive medication for hypertensive patients with COVID-19 may alleviate confusion for emergency physicians on this evolving topic.

EDs tend to serve in a safety net capacity for underserved patients [46]. Even for patients with usual sources of medical care, benefits are diminished by barriers that limit effective and timely access to such care, resulting in increased ED visits [47]. The proportion of adults with uncontrolled HTN is greater for those without a usual care facility than those with one [10], suggesting high rates for ED patients without a source of usual care. During the COVID-19 pandemic, added stresses to patients and the health care system have created a new set of access to care challenges — affecting regular check-ups and post-ED follow-ups with primary care providers for patients with HTN.

In addition to direct effects of COVID-19 on HTN as outlined above, there exist potential effects of the pandemic on subsequent cardiovascular morbidity and mortality related to delayed or absent health care and social and economic impacts [48]. Primary impacts over days to weeks of delayed health care due to the pandemic may include out-of-hospital cardiac arrests and delayed presentation of myocardial infarction or stroke [48]. Secondary impacts over weeks to months of delayed health care can include heart failure from missed or late presentation of myocardial infarction, shortages of important CV risk-reducing medications, reduced adherence with medications due to 30-day refill restrictions, and reduced secondary cardiovascular prevention due to foregone outpatient visits, a shift to virtual visits, and inhibited routine outpatient laboratory monitoring [48]. Social and economic secondary impacts can include income loss and unemployment, physical inactivity, and mental health concerns (social isolation, depression, and anxiety). Given the lengthy nature of the pandemic, several secondary impacts can then continue for months to years to become tertiary impacts on cardiovascular mortality and morbidity [48].

Considerations in Follow-Up Care Challenges During the Pandemic

Even prior to the pandemic, a study of almost 85,000 patients found that two-thirds of hypertensive patients did not adhere to follow-up within 30 days of ED discharge [49]. Patients with no history of a recent primary care visit and multiple prior ED visits were risk factors for non-adherence, while history of filling antihypertension prescriptions was a protective factor for adherence to follow-up [49]. During the early days of the pandemic, one academic hospital found that 83% of ED patients were instructed to follow-up with a PCP while 73% of patients were also instructed to isolate at home after ED discharge. Additionally, only 27% had a PCP appointment scheduled prior to discharge, and 30% had no PCP identified at ED discharge [50].

Healthcare Utilization During COVID-19 Pandemic

Healthcare utilization dropped dramatically during the COVID-19 pandemic, including a 42% decrease in emergency department visits [51] and 50% decrease in office-based encounters [52] early in the pandemic. In December 2020 and January 2021, ED visits remained 25% lower than the same months in the year prior (pre-pandemic) [53] with an eventual cumulative decline in office visits during the pandemic of about 10% [54].

Two surveys of over 1000 adults each found that approximately 55% of survey respondents said they or someone in their household have delayed or skipped routine medical care during the pandemic [55, 56•]. Loss of employment or insurance is one of the most common reasons for delaying health care during the pandemic [56•], as the economic toll of the pandemic has resulted in a loss of jobs and health insurance for millions in the USA [57]. A national survey found that 45% of respondents had a change in employment status because of COVID-19, of which 26% lost their health insurance [56•].

Another common reason for delaying health care during the pandemic is safety concerns about contracting COVID-19 while seeking healthcare during the pandemic [55, 56•]. One survey early in the pandemic found that 80% of adults were concerned about contracting COVID-19 if they needed to go to the ED, and 73% were concerned about overstressing the healthcare system when considering a visit to the ED [58•]. Other reasons for delaying health care during the pandemic include care cancellation by the provider [56•], following government stay-at-home order [55], and wanting to free-up healthcare resources for COVID-19 [55].

Shift to Telehealth

It is important for emergency medicine providers to acknowledge that patient follow-up for HTN has changed dramatically as a result of the pandemic. Prior to the COVID-19 pandemic, telehealth was underutilized in cardiovascular assessments [59]; however, the pandemic resulted in a 20-fold increase in telemedicine utilization in the US [52]. While telehealth may be seen as favorable by many patients and providers [60–62], significant disparities exist in access to telemedicine, especially that with video visits, for elderly [63, 64••, 65, 66], lower income/less socially advantaged [52, 63, 64••, 65, 67], publicly insured [66, 68], Black [63, 64••, 66], Hispanic [63, 64••, 65], Asian [64••, 65], and non-English-speaking patients [64••, 65]. These populations with limited access to telemedicine are also those most disproportionately affected by both HTN and COVID-19. For patients with access to telehealth, challenges for its usage in cardiovascular care include potential impact on depersonalization of patient-clinician relationship [59] and a lack of

physical examination [59, 60]. Blood pressure level assessments [69] and ordering of medication or tests [68] are much less common in telemedicine visits compared to in-person visits. Thus, as practices reopen from the pandemic, patients will need to catch up on visits that require in-person services [70].

Considerations for Emergency Medicine Physicians

Findings are mixed on the strength of a link between HTN and COVID-19 risk and outcomes. However, overwhelming evidence has shown that hypertensive patients with COVID-19 on RAAS inhibiting antihypertension medications — angiotensin-converting enzyme inhibitors (ACEi) and angiotensin receptor blockers (ARBs) — may continue use of these medications without fear of worsened outcomes. As such, patients who need acute BP reduction, such as those with hypertensive emergencies, can safely receive ACEi including intravenous enalaprilat.

Arguably more important than the biological considerations for HTN care during the COVID-19 pandemic is the fact that the pandemic has undoubtedly contributed to major stressors and emotional distress in patients, for which health care providers must take into account when determining care for their patients [71]. A quarter of survey respondents said that they would feel safer about going to a medical facility if their doctor said it was safe, and 15% would feel safer if their local hospital said it was safe [56•]. Patients reported that their doctor/health care system was their most valuable source of COVID-19 information [55]. Thus, such communication to patients by emergency medicine providers may help increase follow-up care for HTN. Other recommendations to ensure that patient fear surrounding COVID-19 does not prevent them from seeking needed health care services such as HTN follow-up visits at PCPs include setting up “defaults” for care such as automatically scheduling PCP follow-up visits for patients [72]. Due to potential barriers to follow-up visits with primary care doctors, it is important for ED providers to ask their patients about their ability to follow-up for care and engage local resources to help facilitate an appointment if needed. Even if patients do receive follow-up care, the basic components of a HTN follow-up visit can be compromised by a telemedicine visit rather than in-person visit due to an inability for some hands-on elements such as a blood pressure reading.

Socioeconomic changes from the pandemic, such as job and insurance loss, should be realized by the ED provider when confronting the potential for cost-related medication non-adherence issues with patients. Additionally, ED physicians can consider longer courses of medication for

hypertensive patients, in anticipation of difficulty getting an appointment with a primary care provider or unease with leaving the home to fill the prescription. Ultimately, it may not be COVID-19 itself that negatively affects the health of hypertensive patients, but barriers to appropriately managing their care during the pandemic, which could lead to more severe health conditions.

Conclusions

This review provides considerations for emergency medicine providers in the management of hypertensive patients during the COVID-19 pandemic based on recent literature on the relationship between COVID-19 and HTN. Biological considerations for HTN care during the pandemic have shown mixed findings. Hypertensive patients with COVID-19 have a higher risk of severe disease/complications, hospitalizations, intensive care unit (ICU) admissions, and mortality than non-hypertensive patients, but studies have also shown the importance of demographic and socioeconomic factors that may confound these relationships. Additionally, research has shown that use of ACEi/ARBs is associated with neutral or even improved COVID-19 outcomes. The pandemic has been a major stressor and barrier to effective chronic disease management. Providers should consider socioeconomic factors such as patients' potential delay of health care due to fear of contracting COVID-19, loss of health insurance, and barriers to accessing primary care appointments for post-ED follow-up care when evaluating acute care patients with a history of HTN or newly elevated blood pressure.

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Declarations

Conflict of Interest Sara Heinert, Renee Riggs, and Heather Prendergast declare that they have no conflict of interest.

Human and Animal Rights and Informed Consent This article does not contain any studies with human or animal subjects performed by any of the authors.

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