COMMENT

How to deal with hypertension in the COVID-19 era—the impact "ON" and "OF" hypertension

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The coronavirus disease 2019 (COVID-19) pandemic caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has affected the global population. While many people infected with SARS-CoV-2 show no or mild symptoms, people with chronic conditions, such as obesity, diabetes, hypertension, and pulmonary, cardiovascular, and kidney diseases, have an increased risk of severe COVID-19 or increased mortality [1]. One of the major causes of mortality in COVID-19 patients is cardiovascular disease. In particular, hypertension has been widely recognized as an independent risk factor for severity and mortality in COVID-19 patients [2, 3]. Consequently, an important aspect to consider is the impact of blood pressure (BP) control on COVID-19 prognosis. To the best of my knowledge, there are two reports from Wuhan, China, in terms of BP control and adverse outcomes of COVID-19 [4, 5]. If the adverse outcome was defined as mortality, ICU admission, respiratory failure, and heart failure for hypertensive patients and good BP control or poor BP control was defined as an average systolic BP (SBP)/diastolic BP (DBP) of <140/90 mmHg or ≥140/90 mmHg, respectively, during the hospital stay, poor BP control was independently associated with higher risks of adverse outcomes of COVID-19 [4]. In addition, increased SBP or DBP variability was associated with higher risks of mortality and ICU admission. Another study [5] reported the association between BP level and mortality in normotensive and hypertensive patients admitted to the ICU with COVID-19. All hypertensive patients had a longer stay in the ICU than normotensive patients. When the hypertensive patients were divided into four groups according to BP levels in previous medical records or measurements taken during ICU admission without antihypertensive drugs, patients in the highest BP group (SBP ≥ 180 mmHg and/or DBP ≥ 110 mmHg) developed cardiac injury, had more kidney injuries in the ICU, or presented a higher risk of death. Therefore, in the COVID-19 pandemic, hypertensive patients may benefit from good BP control on a daily basis. It is not yet clear whether certain types of antihypertensive drugs, especially renin angiotensin system (RAS) inhibitors, affect the prognosis of COVID-19, but at present, RAS inhibitors should generally be continued [6, 7].

Better risk stratification will not only improve clinical decisions and management for COVID-19 patients but also facilitate a personalized medical approach to prevention. Several studies have explored the influence of coronary calcium score (CAC), measured by chest computed tomography (CT), on the prognosis of COVID-19 [8–12]. CAC is a well-established biomarker used to identify individuals with subclinical coronary artery disease but at higher risk for cardiovascular events [13]. Some studies have shown that CAC volume is a predictor of in-hospital mortality of COVID-19 [8] or an independent biomarker for severe COVID-19 [9–11]. In the current issue of Hypertension Research [14], Cereda et al. reported that a hypertensive status and CAC volume cutoff of more than 400 mm^3 could better stratify the clinical outcomes. They showed that CAC volume was associated with an increased risk of death regardless of age, diabetes, creatinine, and lung involvement and that the increase was ~8% for every 100 mm^3 increase in CAC volume. As is the case with all similar studies, there is always a limitation as to what COVID-19-related deaths are. Patients with more cardiovascular calcifications are likely to have cumulative cardiovascular risks and be more fragile and elderly. Thus, such patients may have more complications from SARS-CoV-2 infection, including sepsis, heart failure, and other multiorgan failures, with higher mortality. In addition, it might be difficult to interpret the results depending on what the outcome is set to. For example, the most serious and compromised

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patients might not have been intubated, especially in the first wave of the COVID-19 pandemic in some countries. These limitations and biases should be considered in the COVID-19 literature. Regardless, during the COVID-19 pandemic, a comprehensive clinical assessment of cardiovascular comorbidity might be difficult for every patient, as it is both time- and medical-resource consuming. Instead, measuring CAC volume on CT, which is mostly performed in COVID-19 patients for pneumonia diagnosis, as a surrogate of individual cardiovascular risk, together with hypertension status, may be able to approximately predict the serious progression of COVID-19.

It will be of great interest to know whether the COVID-19 pandemic itself has caused poor BP control, as it has brought about several behavioral changes, such as prolonged stress, unfavorable lifestyle habits and some difficulties in accessing medical facilities. The answer to this question has been presented by Feitosa et al. in the current issue of Hypertension Research [15]. They examined the medium-term impact of the pandemic on BP level and control in a large Brazilian nationwide sample. The trajectory of office BP and home BP control was evaluated from January 2019 to December 2020 in 24,227 untreated or 27,699 participants treated with antihypertensive medication. They compared the prevalence of high office BP (defined as SBP ≥ 140 mmHg and/or DBP ≥ 90 mmHg) and high home BP (defined as SBP ≥ 135 mmHg and/or DBP ≥ 85 mmHg). In treated hypertensive participants, a modest and transient improvement in office BP level was observed in the early months of the COVID-19 outbreak compared to the same period before the pandemic. This finding is similar to reports from Italy and France, where lockdowns took place [16, 17]. Conversely, there was a slight and transient worsening of home BP control in untreated individuals at the early period of the pandemic. The mechanisms underlying these observations are not clear, but the important data are that there were no differences in office BP and home BP in late 2020 in either treated or untreated participants in comparison with the same period of 2019. Thus, the pandemic did not seem to have a significant impact on BP control in the medium term, which suggests that it is important to continue the treatment of hypertension as usual regardless of the pandemic. In addition, since the COVID-19 pandemic led to reduced outings and lifestyle changes, resulting in weight gain and lack of exercise, all of which affect BP control in the long term, it is important to examine whether there will be any adverse effects on BP over a longer period of time.

In recent years, it has been reported that self-measurement of home BP and telemedicine through internet-based communication can improve adherence to treatment and help control BP [18]. Furthermore, a cohort study of 28,189 US adults with elevated BP or hypertension showed that a self-management program of hypertension with a BP monitor and connected smartphone application with clinically-based digital coaching lowered BP in most participants and kept it low during a 3-year follow-up period [19]. Thus, in the midst of this pandemic, there is a strong possibility that self-management programs and internet or mobile technology will provide assistance in monitoring and controlling BP, and it is important to ensure that BP is well controlled using them.

Compliance with ethical standards

References

1. Steenblock C, Schwarz PEH, Ludwig B, Linkermann A, Zimmet P, Kulebyakin K, et al. COVID-19 and metabolic disease: mechanisms and clinical management. Lancet Diabetes Endocrinol. 2021;9:786–98.
2. Zhou F, Yu T, Du R, Fan G, Liu Y, Liu Z, et al. Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: a retrospective cohort study. Lancet. 2020;395:1054–62.
3. Shibata S, Arima H, Asayama K, Hoshide S, Ichihara A, Ishimitsu T, et al. Hypertension and related diseases in the era of COVID-19: a report from the Japanese Society of Hypertension Task Force on COVID-19. Hypertens Res. 2020;43:1028–46.
4. Ran J, Song Y, Zhuang Z, Han L, Zhao S, Cao P, et al. Blood pressure control and adverse outcomes of COVID-19 infection in patients with concomitant hypertension in Wuhan, China. Hypertens Res. 2020;43:1267–76.
5. Geng L, He C, Kan H, Zhang K, Mao A, Zhang C, et al. The association between blood pressure levels and mortality in critically ill patients with COVID-19 in Wuhan, China: a case-series report. Hypertens Res. 2021;44:368–70.
6. Kai H, Kai M. Interactions of coronaviruses with ACE2, angiotensin II, and RAS inhibitors-lessons from available evidence and insights into COVID-19. Hypertens Res. 2020;43:648–54.
7. Kai H, Kai M, Niiyama H, Okina N, Sasaki M, Maeda T, et al. Overexpression of angiotensin-converting enzyme 2 by renin-angiotensin system inhibitors. Truth or myth? A systematic review of animal studies. Hypertens Res. 2021;44:955–68.
8. Giannini F, Toselli M, Palmisano A, Cereda A, Vignale D, Leone R, et al. Coronary and total thoracic calcium scores predict mortality and provides pathophysiologic insights in COVID-19 patients. J Cardiovasc Comput Tomogr. 2021;15:421–30.
9. Fervers P, Kottlors J, Große Hokamp N, Bremm J, Maintz D, Tritt S. et al. Coronary artery calcification on low-dose chest CT is an early predictor of severe progression of COVID-19-A multi-center, multi-vendor study. PLoS One. 2021;16:e0255045. https://doi.org/10.1371/journal.pone.0255045.
10. Takeshita Y, Terada J, Fujita R, Hirasawa Y, Kinoshita T, Isaka Y, et al. Coronary artery calcium score may be a novel predictor of COVID-19 prognosis: a retrospective study. BMJ Open Respir Res. 2021;8. https://doi.org/10.1136/bmjresp-2021-000923.
11. Dillinger JG, Benmessaoud FA, Pezel T, Voicu S, Sideris G, Chergui N, et al. Coronary artery calcification and complications in patients with COVID-19. JACC Cardiovasc Imaging. 2020;13:2468–70.

12. Nai Fovino L, Cademartiri F, Tarantini G. Subclinical coronary artery disease in COVID-19 patients. Eur Heart J Cardiovasc Imaging. 2020;21:1055–56.

13. Bergström G, Persson M, Adiels M, Björnson E, Bonander C, Ahlström H, et al. Prevalence of subclinical coronary artery atherosclerosis in the general population. Circulation. 2021;144: 916–29.

14. Cereda A, Toselli M, Palmisano A, Vignale D, Khokhar A, Campo G, et al. Coronary calcium score as a predictor of outcomes in the hypertensive Covid-19 population: results from the Italian (S) Core-Covid-19 Registry. Hypertens Res. 2021:1–11. https://doi.org/10.1038/s41440-021-00798-9. Epub ahead of print.

15. Feitosa FGAM, Feitosa ADM, Paiva AMG, Mota-Gomes MA, Barroso WS, Miranda RD, et al. Impact of the COVID-19 pandemic on blood pressure control: a nationwide home blood pressure monitoring study. Hypertens Res. 2021:1–5. https://doi.org/10.1038/s41440-021-00784-1. Epub ahead of print.

16. Girerd N, Meune C, Duarte K, Vercamer V, Lopez-Sublet M, Mourad JJ. Evidence of a Blood Pressure Reduction During the COVID-19 Pandemic and Associated Lockdown Period: Insights from e-Health Data. Telemed J E Health. 2021. https://doi.org/10.1089/tmj.2021.0006.

17. Pengo MF, Albini F, Guglielmi G, Mollica C, Soranna D, Zambra G, et al. Home blood pressure during COVID-19-related lockdown in patients with hypertension. Eur J Prev Cardiol. 2021. https://doi.org/10.1093/eurjpc/zwab010.

18. Yatabe J, Yatabe MS, Okada R, Ichihara A. Efficacy of telemedicine in hypertension care through home blood pressure monitoring and videoconferencing: randomized controlled trial. JMIR Cardio. 2021;5:e27347. https://doi.org/10.2196/27347.

19. Gazit T, Gutman M, Beatty AL. Assessment of hypertension control among adults participating in a mobile technology blood pressure self-management program. JAMA Netw Open 2021;4: e2127008. https://doi.org/10.2196/27347.