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COMMENT

Additional benefits of evaluating short-term blood pressure variability: recommendation of twice-daily home blood pressure measurement

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Self-measurement of blood pressure (BP) at home is common and widely accepted. It provides BP readings under usual and relaxed situations, which appears to have superior prognostic value compared to that of conventional office BP measurements. Home BP monitoring (HBPM) has been a useful and essential tool in the management of hypertension. Previous studies have adopted mean BP as an indicator of cardiovascular risk. Some studies recently reported that in addition to evaluating the average or absolute BP value, measuring BP variability at home provides beneficial information for treating hypertension. The variability in BP is evaluated as (1) long term (in-clinic, seasonal, visit-to-visit), (2) mid term (daily, day-by-day), and (3) short term (circadian rhythm). It has been demonstrated that long-term variability, including seasonal variations in BP, is associated with stroke, coronary events, and target organ damage [1]. Day-by-day (mid-term) variability in BP is related to the risk of target organ damage, cardiovascular disease, stroke, and dementia [2, 3]. Recently, ambulatory BP monitoring (ABPM) has been widely used for evaluating short-term BP variability, which provides relevant information on patient prognosis [4].

Consequently, BP variability has been observed in hypertension management. However, its efficacy remains controversial. While mean systolic BP is related to cardiovascular events, BP variability does not contribute to risk stratification over and beyond the mean systolic BP [5]. Moreover, BP variability is significantly predictive of long-term cardiovascular mortality in individuals with untreated hypertension but not in normotensive community-based individuals [6]. As such, the additional benefits of evaluating BP variability may be limited.

The Japan Ambulatory Blood Pressure Monitoring Prospective (JAMP) study was designed to investigate the prognostic effect of ABPM parameters in general practice and has greatly contributed to the exploration of the relationship between BP variability and cardiovascular prognosis [7]. More than 6000 patients from 116 institutions were enrolled, and each provided 20 daytime and 7 nighttime ABPM recordings. One of the interesting findings from the JAMP study is the correlation of nighttime BP and cardiovascular prognosis. Nocturnal BP types are classified into four groups based on systolic BP reduction: asleep vs. awake (extreme dippers: ≥20%, dippers: ≥10% and <20%, nondippers: ≥0% and <20%, and risers: <0%) [8]. The riser pattern of nocturnal BP is significantly associated with total cardiovascular events, particularly heart failure [9]. These findings suggest the importance of antihypertensive strategies targeting nighttime systolic BP.

Similarly, a morning BP surge (MS) has been regarded to be a predictor of all cardiovascular, cardiac, coronary, and cerebrovascular events [10]. MS is defined using two methods: sleep-through MS (morning systolic BP minus lowest systolic BP during the night) and preawakening MS (morning systolic BP minus preawakening systolic BP). Since the definition of sleep-through MS is partially related to the nocturnal BP fall, the MS group and extreme dippers overlapped. Therefore, both MS and extreme dipping have a significant relationship with cerebrovascular events.

ABPM, which is an indispensable tool to evaluate nocturnal BP falls and MS, has become an important tool for evaluating hypertension in clinical practice. Dedicated and automatic devices are required to record BP, and it is sometimes difficult to obtain patients' consent to use the devices over 24 h. ABPM should be used more frequently in hypertension management, but some problems remain.

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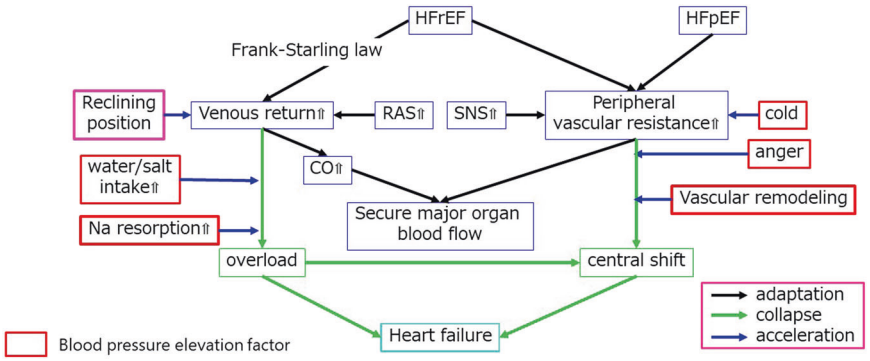

Fig. 1 Heart failure attacks in the night. HFrEF heart failure-reduced ejection fraction, HFpEF heart failure-preserved ejection fraction, RAS renin-angiotensin system, SNS sympathetic nervous system, CO cardiac output

The J-HOP Study (Japan morning-surge home blood pressure study), a nationwide multicenter prospective study, was designed to investigate the usefulness of home BP self-measurement to explore the cardiovascular prognosis in Japanese outpatients with cardiovascular risk. This study enrolled 4310 patients with a history or risk factors for cardiovascular disease in 71 institutions throughout Japan. HBPM is a simple and well-accepted method for evaluating BP. A search of PubMed Central and publisher websites up to June 2021 resulted in 37 reports published by Kario K. and the J-HOP study group. The authors have contributed substantially to investigating BP variability and establishing the management of hypertension in the Japanese population.

In the current study, Narita et al. reported that HBPM measuring the systolic BP twice a day (once in the morning and once in the evening), and simple calculation of the morning minus evening systolic BP would be useful for risk stratification of cardiovascular disease outcomes. It is difficult to accurately evaluate circadian BP variability, including nocturnal BP types and MS, without ABPM. However, it is remarkable that simple BP measurements twice a day also allow the achievement of important information under hypertension management. This is the first study to demonstrate that the difference between morning systolic BP and evening systolic BP is related to cardiovascular events and is independent of the average systolic BP. This suggests that we should take notice of the difference between morning and evening systolic BP, even in normotensive populations. Moreover, cardiovascular outcomes were divided into atherosclerotic disease (ASCVD) and congestive heart failure (CHF). Interestingly, the results were slightly different between these cardiovascular outcomes. After adjusting for covariates, the association with CHF events canceled in both elevated groups, while the association with ASCVD events remained significant. This may be explained by the difference in response to BP variability between ASCVD events and CHF events.

Regarding CHF occurrence, the mechanisms of HFpEF (heart failure with preserved ejection fraction) are still unclear. However, in HFrEF (heart failure with reduced ejection fraction), venous return is increased by the Frank-Starling law, and peripheral vascular resistance increases with renin-angiotensin-system and sympathetic-nervous-system stimulation to secure major organ blood flow. At night, the reclining sleep position increases venous return, and hemodynamics tend to overload. If factors, such as increased water or salt intake, sodium resorption, cold, anger stimulating BP elevation, and vascular remodeling are added, hemodynamic collapse will occur, leading to CHF (Fig. 1). Therefore, the evaluation of nocturnal BP by ABPM could be important to explore the mechanisms of CHF occurrence.

The current study analyzed data from the J-HOP Study database. The results confirmed the usefulness of HBPM. Twice-daily BP measurement is useful for predicting cardiovascular diseases, particularly ASCVD events. Further studies or analyses are expected to clarify the relation of CHF events and HBPM in a larger database.

Compliance with ethical standards

Conflict of interest The authors declare no competing interests.

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