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COMMENT

Seasonal variation in blood pressure and its impact on target organ damage and cardiovascular disease incidence

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Keywords Seasonal variation · Nighttime blood pressure · Target organ damage · Cardiovascular risk

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It is well known that incidence of cardiovascular diseases increases in winter [1, 2]. Seasonal variation of blood pressure (BP) is considered as one of factors for the seasonal difference in cardiovascular incidence [3, 4]. Chen et al. conducted a cross-sectional study and reported that nighttime BP evaluated by ambulatory BP monitoring was higher in summer than that in winter. Chen et al. also found that the correlation between nighttime BP and target organ damage such as urinary albumin-to-creatinine ratio (UACR) was stronger in summer than that in winter [5]. In a meta-analysis, Kollias et al. reported that nighttime ambulatory systolic BP is 2 mmHg of higher in summer than in winter [6]. Additionally, the authors' research group also reported that nighttime BP measured by home BP device and the prevalence of masked nocturnal hypertension, i.e., elevated nighttime BP with controlled daytime BP, was higher in summer than in winter [7]. In mechanical standpoint, elevation of nighttime BP in summer may be due to the shorter sleep duration in summer, heat-induced perturbations in sleep, and nocturia [8–10]. Increasing fluid and salt intake aimed to prevent dehydration in summer may affect increasing nighttime BP. In addition, physicians often taper antihypertensive medications due to the decreased daytime BP in summer, which could contribute to the elevation of nighttime BP [11]. Medical practitioners thus should consider that elevated nighttime BP is a particularly important residual risk factor in summer, even in patients with well-controlled daytime BP by conventional measurements.

The relationship between nighttime ambulatory BP and biomarker such as UACR was stronger in summer than that in winter in Chen et al.'s study [5]. However, in the authors' previous study, the relationship of nocturnal hypertension defined by nighttime home BP with UACR was significant in all seasons and there was no difference between summer and other seasons [7]. Compared to our previous findings, the present findings from Chen et al.'s study may provide pathological significance in increasing nighttime BP in summer. An epidemiological report indicated that some types of stroke such as non-ischemic cerebral infarct, and evening and nighttime-onset stroke and cardiovascular events were observed more frequently in the summer than the winter [12, 13]. Evening and nighttime-onset CVD events might thus occur more frequently in summer compared to winter. Cardiovascular events in winter are recognized as more common in the morning and uncontrolled morning BP level has been reported to be associated with increased cardiovascular incidence onset in winter [14]. Increasing nighttime BP would be associated with cardiovascular events developed at nighttime in summer (Fig. 1).

Since Chen et al.'s study is a cross-sectional analysis, it is possible that the strong association between nighttime BP and UACR in summer may be due to causal reversal. In the authors' previous study regarding the simple predictive score for nocturnal hypertension, elevated UACR was reported as one of the risk factors for nocturnal hypertension [15]. In perspective, a prospective study aimed to assess the seasonal variation of nocturnal BP among same individual and the progression of organ damage such as chronic kidney disease and the development of cardiovascular disease should be considered.

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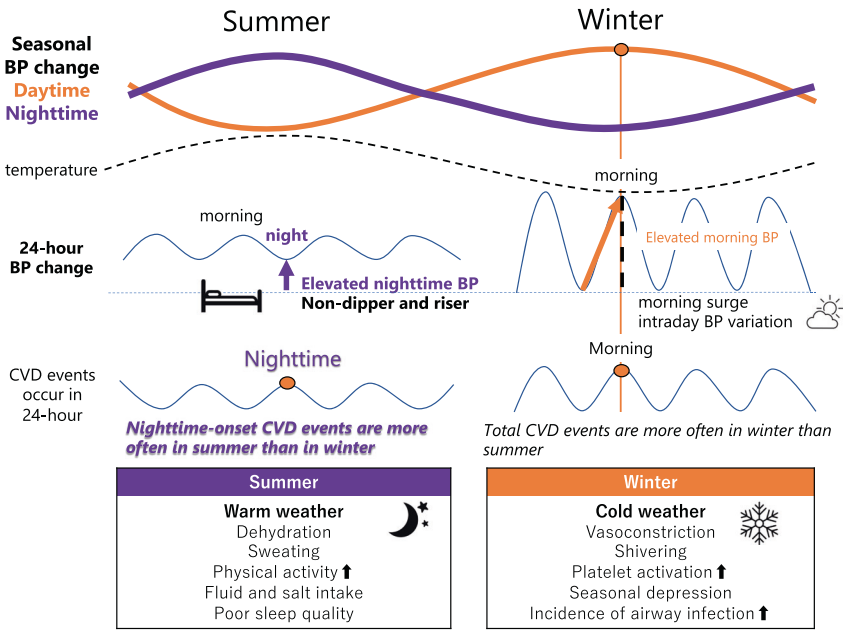

Fig. 1 Mechanisms and pathological significance of seasonal variation in blood pressure. The time phase in which BP increases and cardiovascular disease develops is the same. Nighttime BP is higher in summer than that in winter, which may be associated with the development of cardiovascular diseases in nighttime

Compliance with ethical standards

Conflict of interest KK received research funding from Omron Healthcare Co., Fukuda Denshi, and A&D Co.

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