

Editorial Comment

The Morning–Evening Difference in Self-Measured Blood Pressure: A Potential Predictor of Cardiovascular Disease

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A circadian rhythm of blood pressure (BP) is normally seen in healthy people, but abnormalities of the normal variations may be harmful. An excessive morning rise of BP is one example. There is a growing body of evidence that a morning rise in BP is a better predictor of cardiovascular risk than clinic BP or other measurements of circadian BP.

Our study (1) and another study (2) have shown that the average BP during the first 2 h after waking, evaluated by ambulatory BP monitoring, was an independent predictor of stroke events (1) and cardiovascular mortality (2). These findings were recently supported by a clinical study showing that a morning rise of BP was associated with plaque instability, which was directly associated with cardiovascular events (3). It has also been shown that morning rise in BP was associated with increased left ventricular mass (LVM) (4, 5), impaired diastolic function (4), a greater carotid intima-media thickness (IMT) (6), and decreased glomerular filtration rate (7). In patients with diabetes, home BP, particularly when measured in the morning, correlates better with target organ damage than office BP (8). Patients with metabolic syndrome (9) and regular alcohol drinking (10) have been shown to have a high rate of morning hypertension.

In order to evaluate the morning rise of BP, ambulatory blood pressure monitoring (ABPM) throughout the day is necessary to detect the lowest BP during sleep. Because ABPM requires special equipment, we have suggested using a morning–evening BP difference as an alternative way of evaluating the “morning BP surge.” Using the same database

as in our previous publication (1), we were able to validate the utility of morning–evening difference of systolic BP >20 mmHg as an independent risk factor of incident stroke (11). In this issue of *Hypertension Research* Shibuya *et al.* report that their subjects with a morning rise in BP (morning–evening difference >10 mmHg) had a higher LVMI than those without a morning rise (12). The difference of the cutoff value of morning–evening difference of BP results from the difference of the method of BP measurements; ambulatory BP measures the BP during daily activity, but home BPs are taken when subjects are at rest. Their results were in agreement with our findings and demonstrate that morning–evening difference of BP is also associated with hypertensive target organ damage.

There is a growing body of evidence that morning BP surge can be a direct trigger of cardiovascular events, and is closely associated with certain pathophysiological conditions. The rate of systolic BP variation during the morning BP surge has been reported to be correlated with increased carotid IMT (13). A high rate of BP variation during the morning BP surge may trigger exaggerated shear stress and wall tension, which are associated with various pathophysiological conditions, such as endothelial dysfunction, vascular spasm, and activation of the renin-angiotensin-aldosterone system (14), all of which can cause destabilization of plaque (3). That may be because the reactivity of BP and heart rate to a given unit change in activity is highest in the morning (15). The morning surge of BP may be involved in both the initial stage and pro-

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gression of atherosclerosis, and morning BP surge and vascular remodeling constitute a vicious cycle of cardiovascular risk (16).

Most of the above-mentioned studies were performed without antihypertensive medication. In patients taking antihypertensive medications, morning BP readings have been shown to be superior to evening BP for the prediction of cardiovascular risk (17, 18) and increased LV mass (19). These findings emphasize the importance of BP measurements taken first thing in the morning even when taking antihypertensive medication. The above-mentioned study of Shibuya *et al.* (12) was performed in treated subjects. Therefore, the morning surge or morning hypertension can be a pitfall of treatment for those who are already being treated because insufficient treatment of BP in the morning will sometimes be overlooked unless out-of-office BP is checked (20).

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