Office and Out-of-Office Heart Rate and the Development of Metabolic Disorders

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Obesity, insulin resistance, and diabetes mellitus may be associated with sympathetic nervous system activity.¹ Heart rate may be considered to be an expression of sympathetic nervous system activity.¹,² A previous study demonstrated that there was a positive relationship between resting heart rate and the presence of obesity, insulin resistance, and diabetes mellitus.² However, whether resting heart rate has the power to predict the development of obesity, insulin resistance, and diabetes mellitus has not been studied.

In this issue of the Journal, Shigetoh et al. reconfirmed the existence of a cross-sectional relationship between higher heart rate measured by electrocardiogram and a cluster of cardio-metabolic factors, including fasting plasma glucose and HOMA index, and they also demonstrated that higher heart rate (≥80 bpm) predicted the development of obesity, insulin resistance, and diabetes mellitus 20 years later in the general population.³ Several studies reported the relationship between elevated heart rate and prognosis.²,⁴,⁵ It has been demonstrated that resting heart rate measured in the clinical setting was predictive of cardiovascular mortality in a large number of studies.³ Heart rate measured at home also predicted cardiovascular mortality in the general Japanese population.⁴ Conversely, the level and diurnal variation of the ambulatory heart rate did not predict cardiovascular mortality; it only predicted non-cardiovascular mortality.²,⁵ Although the reason for this discrepancy was unclear, heart rate measured in the clinical setting, self-measured home heart rate, and heart rate obtained by ambulatory monitoring may represent different conditions of sympathetic nervous system activity. Although it should be pointed out that heart rate was measured by echocardiogram in the study by Shigetoh et al., they emphasized the value of heart rate measurement in the clinical setting for assessing the cardiovascular risk profile. In particular, an elevated resting heart rate in the clinical setting might represent an alert reaction (i.e., white-coat reaction of the heart rate) through transient activation or hypersensitivity of the sympathetic nervous system to stress. If so, these reactions might partly reflect the development of obesity, insulin resistance, and diabetes mellitus.

From the epidemiological perspective, clarifying the relationship between office heart rate, self-measured home heart rate, and ambulatory heart rate and the development of metabolic disorders may help us understand the relationship between sympathetic nervous activity and the development of metabolic disorders. Therefore, further studies need to investigate the relationship between sympathetic nervous system activity and the development of obesity, insulin resistance, and diabetes mellitus. Additionally, heart rate is controlled not only by sympathetic nervous system but also by parasympathetic nervous system or a balance between sympathetic and parasympathetic nerve activities. Therefore, heart rate variability and baroreflex sensitivity analysis need to clarify the contribution of sympathetic and parasympathetic nerve activities to the development of obesity, insulin resistance, and diabetes mellitus.

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