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EDITORIAL

Resting Heart Rate: A Valuable Marker for Preventing Kidney Disease

Amr Abdin, MD; Michael Böhm, MD

Resting heart rate (RHR) is an easily available biological parameter in clinical practice. Increased RHR is a known marker of increased mortality and the incidence of heart failure and other cardiovascular disease.[1–3] The influence of elevated RHR on adverse outcomes and mortality in heart failure has been extensively studied, particularly in sinus rhythm with evidence that targeting an RHR <70 beats per minute (bpm) is beneficial.[4] Therefore, in cardiovascular conditions in general, elevated RHR might be a useful risk indicator, while only in heart failure RHR represents a significantly modifiable risk factor.[5] In addition, an association between high RHR and kidney disease has been established.[6] High RHR may also predict kidney injury including microalbuminuria, independent of other cardiovascular risk factors.[6–8]

See Article by Tsai et al.

In this issue of the *Journal of the American Heart Association* (*JAHA*), Tsai et al examined the association between RHR and the risk of end-stage renal disease (ESRD) by studying 2504 patients with ESRD with a median follow-up of 13 years.[9] They found that participants with an RHR of ≥80 bpm had a higher stage of chronic kidney disease, a lower estimated glomerular filtration rate, and more proteinuria than participants with an RHR of 60 bpm to 69 bpm. The risk of incident ESRD remained significantly elevated (HR 1.32, 1.10, 1.58 per 10-beat increase from 60 bpm). These results were consistent among all subgroups studied, including young and older people, men and women, and those with or without cardiovascular risk factors.

Tsai et al are to be congratulated on an important contribution to the evolving literature on the association between high RHR and kidney disease. Data from this study showed that even after excluding common cardiovascular risk factors such as smoking, hypertension, diabetes, hyperlipidemia, overweight, and obesity, high RHR continued to be significantly and independently associated with an increased risk of ESRD. A notable strength of the current analysis is that an increase in RHR between visits was also associated with an increased risk of ESRD. Even if RHR changed between 2 visits in the same patient, people with a higher RHR were at increased risk of ESRD.

Several mechanisms may underlie these effects. First, tachycardia is a recognized marker of the state of autonomic imbalance, sympathetic activation, and decreased vagal tone.[1,7] During sympathetic overactivation, the production of vasodilators decreases and the production of vasoconstrictor factors increases.[7] These autonomic imbalances lead to mitogenicity in the long-term effects on vascular smooth muscle and glomerular mesangial cells and consequently glomerular

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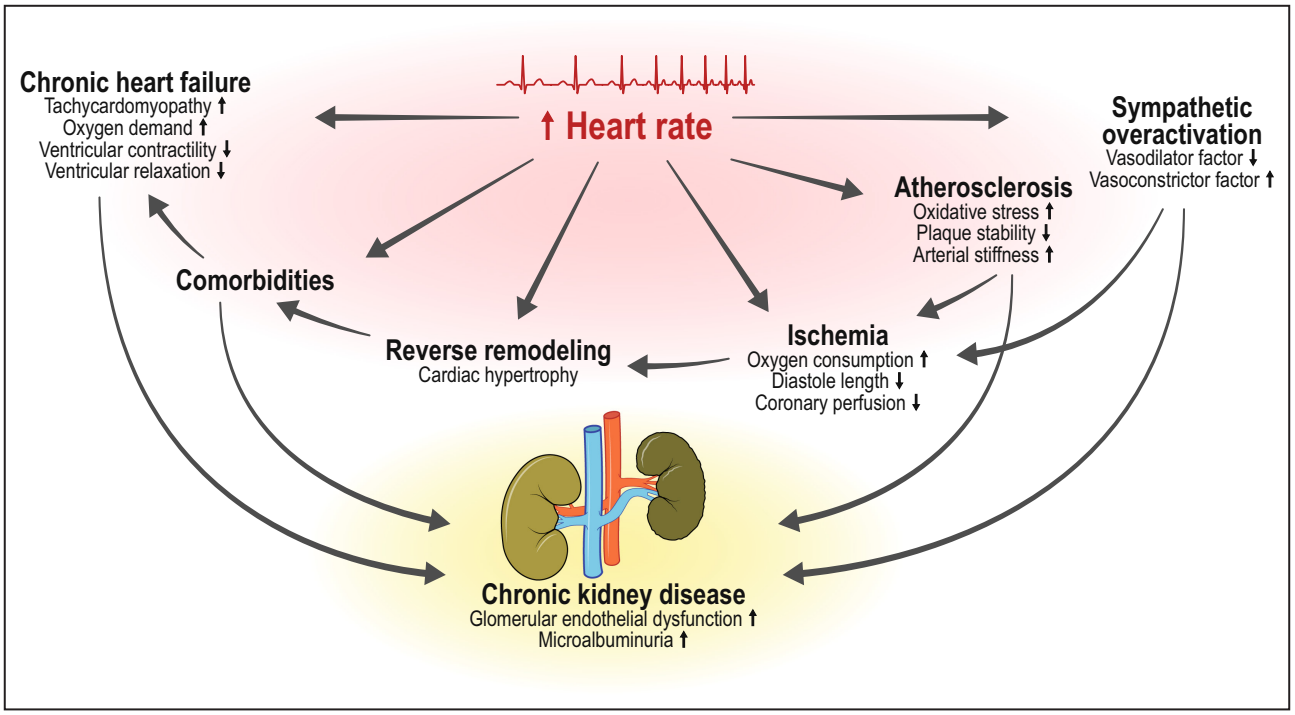

Figure **Pathophysiological effects of heart rate on the cardiovascular disease continuum and chronic kidney disease.**

endothelial dysfunction. Moreover, the progression of atherosclerosis and therefore nephrosclerosis due to changes in endothelial oxidative stress, which is sensitive to RHR reduction[6] (Figure).

Fortunately, drugs that lower HR, such as β-blockers and ivabradine, can be used safely in ESRD. Furthermore, ivabradine can be safely used to reduce RHR in patients with heart failure with higher symptom burden and critically ill patients without lowering the blood pressure.[10]

Interestingly, in this analysis, the hazard ratios for ESRD displayed a *J-shaped* relationship. These findings indicate potential risks associated with RHR values <60 bpm in relation to ESRD. Some previous analyses suggest that bradycardia (RHR <60 bpm) may impede renal perfusion, thereby increasing the likelihood of kidney diseases.[11] Consequently, the authors designated the RHR range of 60 bpm to 69 bpm as the reference group, as they postulate that maintaining an RHR within this range might be preferable. Further investigation is warranted to determine whether the risk of adverse outcomes is heightened among individuals with an RHR <60 bpm.

These results suggest that monitoring and managing changes in RHR over time may be an important part of ESRD risk management. In addition, RHR may serve as a valuable marker for identifying high-risk individuals, which may help in the early detection of kidney disease and enable timely application of preventive strategies.

ARTICLE INFORMATION

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