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Noise in the Signal or Bad Vibrations?

Commentary on Marshall et al. Snoring is not associated with all-cause mortality, incident cardiovascular disease, or stroke in the Busselton Health Study. SLEEP 2012;35:1235-1240.

Thomas B. Rice, MD, MS

Division of Pulmonary, Allergy, and Critical Care Medicine, University of Pittsburgh School of Medicine, Pittsburgh, PA

The debate continues about whether snoring, independent of frank obstructive sleep apnea (OSA), poses risk for cardiovascular disease (CVD). Animal models show convincing data that vibrations from snoring affect the carotid artery[1] via localized endothelial dysfunction[2] and lead to reduced baroreceptor sensitivity.[3] One human study of objectively measured snoring showed dramatically higher rates of carotid plaque in those with heavy snoring compared to those without.[4] OSA has been confirmed as an independent risk factor for CVD in multiple cohorts.[5-7] But snoring, which usually accompanies OSA, is not recognized as part of the known pathophysiology of OSA. The current paradigm suggests that intermittent hypoxia, fragmented sleep, and large negative intrathoracic pressure swings due to OSA lead to the development of CVD.[8,9] Epidemiologic data where OSA is measured suggest that self-reported snoring without OSA is not associated with excess CVD risk,[5] but longitudinal data on objectively measured snoring is nonexistent in the current literature.[10]

To address this gap, Marshall and colleagues[11] have gone back to the original data collected as part of the Busselton Health Study in 1990. The four-channel home portable monitor used to quantify OSA utilized a microphone encased in plastic that was taped next to the participants' larynx. Snoring events were scored based on the power spectra recorded, yielding a percentage of epochs spent snoring during the night. They also examined the time above a threshold for "loud snoring." In this way they defined one's exposure to snoring at baseline, to examine the long term impact of snoring on mortality, cardiovascular events, and strokes.

In their fully adjusted analyses that controlled for OSA, Marshall and colleagues[11] found no increase in mortality, cardiovascular events, or stroke across quartiles of their snoring severities or with any other snoring quantification. It should be noted that their earlier work showed a strong association between OSA and all-cause mortality with a greater than 6-fold fully adjusted risk of death at 17 years in those with moderate to severe OSA.[12] This suggests that their characterization of disordered breathing during sleep is accurate and argues against any role for snoring leading to death, CVD, or stroke, after accounting for OSA.

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Address correspondence to: Thomas B. Rice, MD, MS, Division of Pulmonary, Allergy, and Critical Care Medicine, University of Pittsburgh School of Medicine, UPMC Sleep Medicine Center, 3459 5th Ave, Suite 639, MUH, Pittsburgh, PA 15213; Tel: (412) 692-2880; Fax: (412) 692-2888; E-mail: ricetb@upmc.edu

While there are a number of strengths to this study, particularly the quantitative measurement of objective snoring, the community based nature of the population, and the careful ascertainment of vitality status at 17 years, there are some important limitations. While the long follow-up is advantageous with respect to increasing events of interest, it does limit our ability to know what is happening with snoring over time and whether their one-time baseline assessment reflects their true burden of snoring throughout the period of study follow-up. That did not limit their ability to see an adverse effect of OSA on mortality at 17 years though, as above.[12] More notable, however, is the lack of statistical power to find a difference across snoring severities for stroke. The modest sample size and event rates resulted in very low power, 51% and 36%, to detect a difference in stroke rates for their continuous and categorical measures, respectively, of snoring exposure. While statistical power was adequate for mortality and cardiovascular events, stroke is the cardiovascular outcome of most interest given the animal and human data lending biologic plausibility for snoring as a local vibratory insult to the carotid artery.[1,2,4]

Since the recent OSA epidemiologic data point to increased rates of stroke as the type of cardiovascular event most closely associated with OSA,[6,13] with more modest effects of OSA on the heart,[14] a role for snoring in the pathogenesis of stroke should be entertained. Increased rates of stroke due to OSA could result from altered cerebral blood flow or regulation, enhanced atherosclerosis, or as a consequence of greater rates of atrial fibrillation, paroxysmal or otherwise.[13,15] But snoring, unmeasured in almost all the OSA data, could be contributing to alterations in both cerebral blood flow and regulation, or enhanced atherogenesis. Perhaps snoring vibration primes the local carotid endothelium for the ill effects of subsequent intermittent hypoxemia and inflammation, thereby accelerating atherogenesis.

Although not the focus of the manuscript, what is also interesting from the study of Marshall et al.[11] is a reminder about the wide heterogeneity with which people snore and have apneas. There are individuals in the Busselton Health Study who objectively snore more than 80% of the night but have no OSA.[11] On the other hand, there are individuals with moderate or severe OSA who snored less than 40% of the night. This heterogeneity of snoring and apnea is further detailed in the original Busselton report.[16] While snoring and the apnea hypopnea index were modestly correlated ($\rho = 0.5$), they may be separate phenomena, or at least separate upper airway responses to airflow limitation that is of unclear consequence. Understanding differences in the degree of snoring within individuals with OSA could be important in determining vascular risk, even if snoring alone is not associated with greater vascular risk.

For now, it appears that snoring does not increase risk for cardiovascular events or mortality in this community-dwelling sample, after accounting for the presence and severity of OSA. Whether or not this is true for stroke is uncertain due to statistical power issues, but we applaud Marshall and colleagues'[11] first contribution to the cardiovascular epidemiology of objectively measured snoring.

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