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COMMENTARY

Watch What You're Doing!

Commentary on Kinoshita et al. Impact of arterial stiffness on WatchPAT variables in patients with obstructive sleep apnea. *J Clin Sleep Med.* 2018;14(3):319–325.

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There is growing recognition of the widespread prevalence and impact of sleep-disordered breathing at a population level, while concurrently there is increasing societal and political attention being given to reducing health care costs. Home sleep apnea tests (HSAT) for obstructive sleep apnea (OSA) have been proposed as less costly alternatives to gold standard in-laboratory polysomnography (PSG) for both diagnostic purposes and for large scale screening of certain populations.[1] Compared to PSG, HSAT allows for testing in the comfort of the patient's own home.

Key to the proper use and interpretation of HSAT is patient selection. In 2017, the American Academy of Sleep Medicine (AASM) released updated guidelines on the diagnosis of OSA,[2] including the role of HSAT. The guidelines recommended patients could be considered candidates for HSAT if they have signs and symptoms suggesting an increased likelihood of moderate to severe OSA, in the absence of suspected complex or central sleep-disordered breathing, or complicating medical comorbidities such as congestive heart failure.

The most commonly used HSAT devices fall into the category of "Type III" monitoring, recording four physiologic variables (typically two respiratory variables, one cardiac variable, and arterial oxygen saturation).[3] Type III monitors do not include electrophysiologic parameters by which to stage sleep. Type IV monitors record two physiologic variables (such as pulse oximetry and heart rate) and are sometimes also used in practice, though are generally not considered sufficient for diagnostic purposes.[2] By contrast, the WatchPAT device (Itamar Medical Ltd., Caesarea, Israel) measures peripheral arterial tone (PAT) along with heart rate and arterial oxygen saturation to identify respiratory events during sleep based on stereotypic changes in the PAT and other signals.[4,5] Sleep and sleep stages (wake, NREM and REM sleep), are assessed algorithmically utilizing PAT, pulse rate variability and actigraphy.[6,7]

PAT signals take advantage of adrenergic-mediated changes to blood volume in the fingertip.[8] This indirect measurement of autonomic nervous system tone allows for the detection of arousals (eg, after an obstructive respiratory event)[9–12] and for differentiating wake, NREM and REM sleep.[13] The ability to detect arousals and sleep stages, albeit indirectly, offers important advantages over other types of HSAT devices and has been validated against in-laboratory PSG[14] with high levels of agreement.

Dependence on measuring adrenergic-mediated vasoconstriction also means that factors modulating adrenergic activity may affect the reliability of such measurements. For example, alpha adrenergic antagonists (particularly anti-alpha-1 antihypertensive agents) are known to negatively impact the reliability of PAT signals.[8,15] In addition, most studies comparing WatchPAT to PSG have excluded patients with clinically recognized vascular disease. It is, however, not well understood whether subclinical vascular disease might lead to similar reliability issues.

In this issue of the *Journal of Clinical Sleep Medicine*, Kinoshita and colleagues report on the influence of a measure of arterial stiffness on the accuracy of the WatchPAT device to detect respiratory events compared to PSG. The authors found a correlation between brachial-ankle pulse wave velocity (baPWV), a measure of arterial stiffness, and accuracy of the WatchPAT respiratory event index (WP-AHI). In individuals with greater vascular stiffness (ie, higher baPWV), the correlation between WP-AHI and PSG-derived apnea-hypopnea index (PSG-AHI) was poor compared to those with less vascular stiffness (ie, lower baPWV).[16]

Importantly, the patients recruited for this prospective study reflect the typical "OSA population," with relatively representative rates of hypertension, diabetes, and obesity, although with a lower average body mass index than would typically be expected in a North American cohort. The prevalence of peripheral vascular disease, both clinical and subclinical, likely approximates that seen in typical cohorts of patients with OSA.

Methodological differences in scoring of respiratory events between PSG and WatchPAT in this study should be pointed out. The WatchPAT respiratory event index (WP-AHI) can be ascertained using PAT-derived arousals and either 3% or 4% oxyhemoglobin desaturations, similar to the PSG 3% or 4% desaturation criteria for scoring hypopneas as defined by the AASM and Centers for Medicare and Medicaid Services, respectively. Some of the discordance between WP-AHI and PSG-AHI values reported in this study may relate to the more stringent (4%) criteria used for the WP-AHI and the less stringent (3%) criteria used for the PSG-AHI. In other words, the

overall underestimation of respiratory events by WatchPAT compared to PSG may relate to definitional differences as opposed to intrinsic test characteristics of the WatchPAT.

Nonetheless, the clear relationship between increasing arterial stiffness and decreasing reliability of WatchPAT-detected respiratory events found in this study is striking. It is important to note that baPWV values above the threshold of 1400 cm/s have been shown to be associated with an increased risk of cardiovascular events[17] and thus being able to accurately diagnose OSA in those with high baPWV values has clinical relevance. The fact that agreement between the WatchPAT and PSG AHIs became significantly less reliable at baPWV values above 1550 cm/s suggests that a population of patients with subclinical yet meaningful vascular disease are likely suboptimal candidates for home-based testing with WatchPAT. However, screening for subclinical vascular disease in patients suspected of having OSA, though potentially relevant to test selection, is not likely to be time- or cost-effective.

This study suggests there may be additional factors to consider when choosing between different diagnostic testing modalities for OSA and poses some important questions and concerns. Is a "one size fits all" approach for HSAT studies appropriate, or are better patient selection criteria needed? And if so, are there predictors of subclinical arterial stiffness that would not require additional testing? Measurements of baPWV are subject to circadian variability in normotensive subjects,[18] so standardization of testing methodology is important. And finally, in addition to this being a small single center study, the baPWV measurements performed (brachial and tibial arteries) have been correlated with adverse cardiovascular outcomes only in Asian populations to date,[19] so generalizability of the study findings may be limited. As the effect of subclinical arterial stiffness on testing validity is further elucidated, appropriate selection of patients for PAT-based home sleep apnea testing may continue to evolve.

CITATION

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