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CLIN-IQ

Are at-home sleep studies performed using portable monitors (PMs) as effective at diagnosing obstructive sleep apnea (OSA) in adults as sleep laboratory-based polysomnography (PSG)?

Reuben Walia, MD (PGY-3); Allison Achilefu, MD (PGY-2); Steven Crawford, MD; Vikas Jain, MD; Stacy D. Wigley; Laine H. McCarthy, MLIS

Residency Program: University of Oklahoma Health Sciences Center, Department of Family and Preventive Medicine, Oklahoma City, OK

Answer: In patients with suspected OSA, it is reasonable to use PMs if the patient has a high pretest probability (based on an Epworth Sleepiness Scale (ESS) ≥10 and clinical symptoms*) without significant co-morbid heart disease or other sleep disorders and he/she is able to prove competency in setting up the home equipment properly without assistance. However, if the patient has a negative PM, it is standard to perform PSG as it appears approximately 20% will have a false negative PM.

(*Clinical symptoms include snoring, witnessed apneas, obesity, pulmonary hypertension, refractory hypertension, morning headaches, increased neck circumference — >17 inches in men, >16 inches in women — daytime sleepiness.)

Level of Evidence for the Answer: A

Search Terms: obstructive sleep apnea, polysomnography, portable home monitors, efficacy

Inclusion Criteria: polysomnography, ambulatory, adults, humans

Exclusion Criteria: children

SUMMARY OF THE ISSUES

Sleep apnea is a medical condition that, untreated, can exacerbate and possibly cause a multitude of medical conditions, such as hypertension, heart disease, stroke and many others.[1] Sleep apnea is defined as episodes of involuntary pauses of breathing (apnea) or a decreased respiratory rate (hypopnea) during sleep. This review focuses on obstructive sleep apnea (OSA), the most common form of sleep apnea, which is caused by upper airway obstruction. It is difficult for patients to monitor their own OSA symptoms because they are asleep during the apneic events. Their significant others, however, often notice episodes when the patients stop breathing or experience significant snoring.

The gold standard for diagnosis is with a laboratory-based, technician attended polysomnography, also known as a PSG or Type I monitor. PSGs are effective at diagnosing OSA due to a controlled environment and multiple monitors recording brain waves, heart rhythm, eye movements, respirations, leg movement and oxygen and carbon dioxide levels. However, PSGs can be very expensive and cause a less than optimal night's sleep.

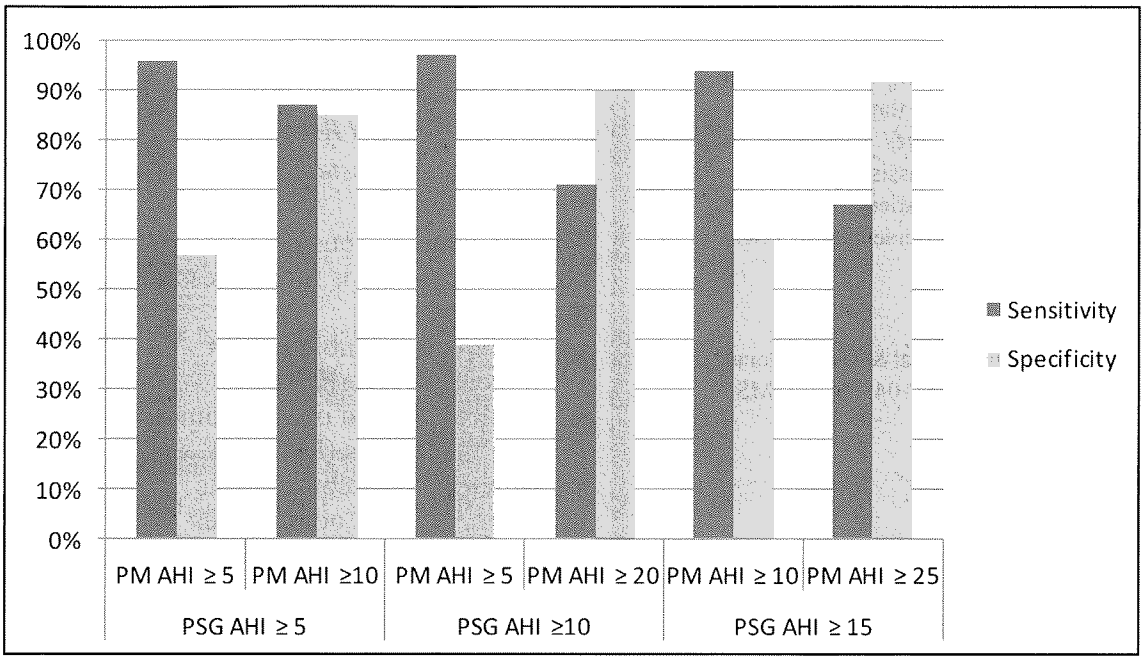
A possibly less expensive and more comfortable alternative to a PSG is a home sleep study, or unattended portable monitor (PM). There are several classes of home monitors: Type II records identical information as a PSG, but is done without the monitoring of a technician and is done outside of a controlled sleep lab; Type III measures four physiologic variables including at least two respiratory variables, but cannot tell whether the patient is awake or asleep; Type IV monitors are defined differently by different organizations. The American Academy of Sleep Medicine defines Type IV monitors as devices that record one or two variables (e.g., arterial oxyhemoglobin saturation and airflow) and can be used without a technician. This review evaluates the effectiveness of home PM studies verses in-laboratory PSGs in diagnosing OSA in adults.[2]

SUMMARY OF THE EVIDENCE

Masa et al. sought to demonstrate that PM studies were non-inferior in diagnosing OSA compared to PSGs. Three-hundred forty-eight participants from eight sleep study centers in Spain underwent both PMs and PSGs, but were randomized to which order the tests were performed (PSGs vs PMs first). Subjects were referred for the study based on "suspected" OSA supported by witnessed apneas, snoring, or daytime somnolence. Subjects with significant heart disease, other sleep disorders or inability to set up the PM were disqualified. Sensitivities and specificities were calculated for various apnea-hypopnea indices (AHIs) in the PM study group in order to obtain cutoff values. AHI

Corresponding author: Laine H. McCarthy, MLIS, Coordinator, Clin-IQ Program, Oklahoma Clinical & Transitional Sciences Institute, Department of Family & Preventive Medicine, University of Oklahoma Health Sciences Center, 900 NE 10th Street, Oklahoma City, OK 73104, Phone: (405) 271-8000 x 32206, Email: Laine-McCarthy@ouhsc.edu.

Figure 1. Patient Characteristics by Age Group



is calculated by adding the number of apneic and hypopneic episodes and dividing by the total sleep time. In this study, apneas were defined as "the absence of airflow (≥90% reduction) for ≥10 seconds"; hypopnea was defined as measurable reduction in airflow (≥30% and <90%), also for ≥10 seconds, "with a ≥3% drop in oxygen saturation or arousal."[3] Results suggested that a higher AHI was needed to support an OSA diagnosis in the PM group versus PSG group. For an AHI cutoff ≥5 for PSG with a high pretest probability (PTP, 90%), a PM AHI ≥10 successfully confirmed the diagnosis due to a positive likelihood ratio (+LR) of 6.25. A PM AHI <5 excluded OSA as the PTP was lowered from 90% to 39%. The indeterminate zone also increased as the severity of OSA increased, suggesting more repeat PSGs would be required if PM was used to diagnose only mild to moderate OSA (Figure 1). However, +LR increased in each PM group with increasing OSA severity.[3]

The second article evaluated was a multicenter, randomized study sponsored by the American Sleep Medicine Foundation and aspired to prove home PMs and autoPAP are non-inferior in diagnosing and treating OSA when paralleled to sleep laboratory PSG and continuous positive airway pressure (CPAP) titrations. Participants included in the study were adults from a pool of seven different academic sleep centers in five different cities that had a high PTP of carrying the diagnosis of moderate to severe OSA (AHI of ≥15). This was established by an "adjusted neck circumference" of ≥43 cm, along with an ESS of ≥12. Participants were randomized into either the PSG or PM group and were considered "eligible" for the study if an AHI ≥15 was reported via either PSG or PM. In the PSG group only 49% remained eligible for the study. In the PM group, 45% from initial PM and 12% from a crossover PSG remained eligible. In the PM group 27% became ineligible due to a final AHI <15. Of the people who had an inadequate initial PM study due to AHI <15, 20% who completed the PSG crossover proved to have moderate to severe OSA based on an AHI ≥15.[4]

Additional outcomes important to note include almost equal dropout rates and increased overall quality of life in treated patients of both groups. In regards to treatment, there was an equal percentage (10%) in both PSG and PM subjects who had to repeat their titration studies. Based on the 2011 Medicare Fee Schedule, this study estimated a 25% lower cost for home diagnosis and treatment of OSA than in laboratory testing. This study agreed with the Masa study[3] in who approximately 20% of PM patients with severe OSA may require repeat testing. However, once a patient was diagnosed with OSA via PM, a PSG was not performed for comparison of AHI values.[4]

The Agency for Healthcare Research and Quality released a systematic review in 2011 examining the best methods for diagnosing and treating OSA. After reviewing 99 articles, the reviewers determined that Type III and IV PMs are as accurate as PSGs in diagnosing OSA with a "moderate" level of evidence. One interesting finding revealed was that "the American Academy of Sleep Medicine uses an AHI threshold of 15 to define OSA, with or without OSA clinical symptoms or AHI ≥5 with clinical symptoms."[2] Clinical symptoms include snoring, witnessed apneas, obesity, pulmonary hypertension, refractory hypertension, morning headaches, increased neck circumference (>17 inches in men, >16 inches in women), and daytime sleepiness. However, the diagnosis of OSA between different studies fluctuated significantly from 5 to 20 AHI. Overall, Type III PMs were best at diagnosing OSA with AHI ≥5.[2]

CONCLUSION

The debate between using home PM versus sleep laboratory PSG as a less expensive but reasonably accurate diagnosis for OSA has been under fairly intense scrutiny over the past several years. We concluded it is reasonable to use PMs for diagnostic purposes in patients with a high PTP of having OSA based on an ESS $\geq$12 and clinical symptoms only if they are without severe co-morbidities and the patient proves competent in setting up home equipment properly without assistance. Further investigation should be sought regarding patient compliance with treatment, cost-effectiveness and reimbursement of PSGs versus PMs.

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REFERENCES

1. Su S, Baroody FM, Kohrman, Suskind D. A comparison of polysomnography and a portable home sleep study in the diagnosis of obstructive sleep apnea syndrome. *Otolaryngology Head and Neck Surgery*. 2004;131(6):844-50.
2. Balk EM, Moorthy D, Obadan NO, Patel K, Ip S, Chung M, et al. Diagnosis and Treatment of Obstructive Sleep Apnea in Adults. Comparative Effectiveness Review No. 32. (Prepared by Tufts Evidence-based Practice Center under Contract No. 290-2007-10055-1). AHRQ Publication No. 11-EHC052-EF. Rockville, MD: Agency for Healthcare Research and Quality. July 2011. Available at: www.effectivehealthcare.ahrq.gov/reports/final.cfm Accessed August 28, 2013.
3. Masa JF, Corral J, Pereira R, Duran-Cantolla J, Cabello M, Hernandez-Blasco L, et al. Effectiveness of home respiratory polygraphy for the diagnosis of sleep apnea and hypopnoea syndrome. *Thorax*. 2011; 66(7): 567-73.
4. Rosen CL, Auckley D, Benca R, Foldvary-Schaefer N, Iber C, Kapur V, et al. A multisite randomized trial of portable sleep studies and positive airway pressure autotitration versus laboratory-based polysomnography for the diagnosis and treatment of obstructive sleep apnea: the HomePAP study. *Sleep*. 2012;35(6):757-67