

LETTERS TO THE EDITOR

Sleep Apnea Severity Classification – Revisited

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As I read Ho et al.,¹ I was abruptly reminded of a dilemma that our field of sleep medicine has failed to clarify: the relationship between the apnea-hypopnea index (AHI) and the severity categorization of sleep-disordered breathing (SDB). As polysomnogram (PSG) scoring criteria have changed over time, severity classification categories have remained constant. These authors make it blatantly clear that the AHI can vary widely with the use of different hypopnea scoring criteria. In this study, the original Sleep Heart Health Study PSGs were rescored using three hypopnea definitions: “decrease in airflow or chest wall or abdominal excursion greater than 30% from baseline, but not meeting apnea definitions associated with either: (1) a 4% or greater fall in oxyhemoglobin saturation; (2) a 3% or greater fall in oxyhemoglobin saturation; or (3) a 3% or greater fall in oxyhemoglobin saturation or an event-related arousal.” They investigated the change in SDB severity classification that occurred with the change in AHI. The severity classifications used were: mild (AHI = 5-14), moderate (AHI = 15-30), and severe (AHI > 30).² From the 1999 “conservative” hypopnea scoring criteria, $\geq 4\%$ oxyhemoglobin desaturation,² to the new, “liberal” definition, $\geq 3\%$ oxyhemoglobin desaturation or an event-related arousal,^{3,4} there was a dramatic increase in the AHI and SDB severity in this representative “normal” US population. The prevalence of those with a combined moderate + severe sleep apnea increased from 22% to 45% and the prevalence of those having a normal PSG (AHI < 5 events/h) decreased from 48% to 17% with use of the “liberalized” scoring criteria. It would seem logical that as AHI increases with use of the “liberal” hypopnea scoring criteria, the SDB severity classification also should be modified.

Ho et al. is not the first publication describing this AHI variability. In fact, Sleep Heart Health Study data have been analyzed previously. Redline et al.⁵ showed large variation in the respiratory disturbance index (RDI) from 2 to 29 events/h, depending on the PSG scoring criteria used. Consistency was found in RDIs that required some level of arterial oxyhemoglobin desaturation versus RDIs based on oronasal flow variability or arousals. Ruehland et al.⁶ found similar results in a sleep clinic referral population with the percent of this population having OSA, as defined by an AHI of ≥ 5 events/h ranging from 59% to 92%, depending on which hypopnea scoring criteria were used.⁶ In a very detailed study, Tsai et al.⁷ found that including arousal in the hypopnea scoring criteria in a sleep clinic referral population significantly increased the diagnosis of SDB,⁷ again without changing the SDB severity classification.

The aforementioned SDB severity categories were formalized primarily empirically in 1999 with the following proviso: “The data to justify a severity index based on event frequency are derived from the Wisconsin Sleep Cohort data that show an increased risk of hypertension that becomes substantial at an AHI of approximately 30.⁸ Currently there are no data

available to indicate an appropriate distinction between mild and moderate degrees of obstructed breathing events during sleep.”² Surely, these guidelines are based on insufficient evidence to determine severity of SDB.

Yes, a positive correlation has been identified between AHI and comorbidities, such as self-reported cardiovascular disease. As Punjabi et al.⁹ point out, this correlation is significant using the $\geq 4\%$ oxyhemoglobin desaturation criterion for AHI scoring, not the $\geq 3\%$ desaturation criterion with or without an arousal.⁹ As indicted by Redline et al., several other studies have shown a relationship between AHI and various cardiovascular disease variables, significant arrhythmias, and cardiovascular risk factors.¹⁰ Several of these studies did not demonstrate a threshold AHI level for the association between AHI and cardiovascular disease, therefore, not supporting the designation of distinct categorical ranges to define SDB severity. Surely, use of various hypopnea scoring criteria makes it difficult to predict the susceptibility of individual patients or subject groups to the potential comorbidities of SDB. As Berry et al.⁴ concluded “...thresholds for identification of the presence and severity of OSA, and for inferring health-related consequences of OSA, must be calibrated to the hypopnea definition employed.”⁴ The field of sleep medicine has failed to make this important adjustment.

The wide variability in AHI scoring, in addition to the various qualitative respiratory flow and effort sensors used in various laboratories, leaves the PSG as a less-than-ideal tool for assessing SDB severity. As the results of Ho et al¹ indicate, patients with rather low AHIs, who often present a diagnostic and therapeutic dilemma, are susceptible to being part of different SDB severity categories, depending on the hypopnea scoring criteria used to score their PSGs.

It would be appropriate and timely for one of our professional organizations to sponsor a re-evaluation of SDB severity categorization along with the recommendations to change the scoring criteria. Further research may be needed to define the relationship between AHI variation and clinical symptomatology, cognition, sleepiness, and cardiometabolic co-morbidities. In the meantime, the PSG is best viewed as only one of the tools for determining SDB severity and subsequent therapy, as stated in the 1999 guideline.² The AHI should not dictate patient care solely, but best be considered as a continuous variable without being forced into an arbitrary severity category. Of at least of equivalent if not of higher significance, the clinician should take into account symptoms, degree of daytime sleepiness, sleep time and quality, body mass index, pharyngeal anatomy, cognitive function, behavioral factors, occupation, and the presence or absence of cardiometabolic diseases and/or other co-morbidities in identifying SDB severity. This view of evaluating SDB severity is supported by the discussion of severity criteria within the International Classification of Sleep Disorders: “...a single numerical cut point (such as apnea

index) is often not an appropriate division between levels of severity, and clinical judgment of several indexes of severity is considered superior.”¹¹

Patients with SDB would be best served if sleep medicine practitioners remain cognizant of AHI scoring criteria used when incorporating the AHI into their diagnosis and therapeutic plan.

CITATION

Hudgel DW. Sleep apnea severity classification – revisited. *SLEEP* 2016;39(5):1165–1166.

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SUBMISSION & CORRESPONDENCE INFORMATION

Submitted for publication February, 2016

Submitted in final revised form March, 2016

Accepted for publication March, 2016

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DISCLOSURE STATEMENT

Dr. Hudgel has indicated no financial conflicts of interest.