SLEEP APNEA ASSESSMENT: TOOLS, TRICKS, AND TIPS

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Diagnosis of Obstructive Sleep Apnea in 2017

- Obstructive sleep apnea (OSA) is a relatively modern diagnosis within the history of the field of medicine. Sleep Medicine clinicians understand that snoring is harbinger of a sleep disorder and a potential long-term health risk.

- Scientific study clarified that airway closure is not all-or-none phenomenon, but is continuously variable.

    - Apnea = full airway closure
    - Hypopneas = partial airway closure, associated with oxygen desaturation and/or EEG-based arousal
    - Respiratory effort-related arousal (RERA) = smaller limitations in airflow than with a hypopnea associated with an EEG-based arousal from sleep.
    - Even trying to define the length of an impactful EEG arousal was a scientific process, with a 3 second change in EEG found to be most relevant to predicting daytime performance.[1]

- A clinically-focused paper from the AASM Clinical Practices Review Committee used the hypopnea definition of an abnormal respiratory event lasting ≥ 10 seconds in length with ≥ 30% reduction in airflow or chest wall movement, and with ≥ 4% oxygen desaturation.[2] This particular definition has been used by the Centers for Medicare and Medicaid Services (CMS) to determine treatment eligibility for patients with obstructive sleep apnea diagnosed with this definition.

- The 1st edition of the *Manual for the Scoring of Sleep and Associated Events* was published by the AASM in 2007 with two definitions for hypopneas.[3] The recommended definition in this edition was the same as the CMS definition: hypopnea scoring requires ≥ 30% reduction in nasal pressure signal excursions from baseline and associated ≥ 4% desaturation from pre-event baseline. The alternative hypopneas definition includes a ≥ 50% reduction in nasal pressure signal excursions and associated ≥ 3% desaturation or arousal. Later editions of the scoring manual have reversed the recommended and alternative definitions (the recommended definition is now hypopneas associated with 3% oxygen desaturation and arousal).

- Using the different AASM definitions for respiratory events = dramatic differences on determining OSA severity.

    - For instance, in one study, variation in rule application would lead on average to the same patient being diagnosed with mild OSA using one definition and high-moderate OSA with another definition, thus leading to potentially different treatment algorithms for the same patient.
    - Debate on a “true” definition for hypopneas is ongoing.

Section II: The AHI: Important, but Problematic

- Once respiratory events were more clearly defined, the apnea-hypopnea index (AHI) became the primary method of assessing OSA severity. The AHI is defined as the total number of apneas added to the total number of hypopneas divided by the total hours of sleep. The AHI is often used to stratify OSA severity (see table 1); severity level impacts the best treatment choices for the patient.

Table 1: OSA Severity by AHI Criteria

Severity	Total AHI
No OSA	0-4.99 / hr
Mild OSA	5-14.99 / hr
Moderate OSA	15-29.99 / hr
Severe OSA	≥ 30 / hr

- The AHI is often confused with the respiratory disturbance index (RDI), which adds RERAs to the apneas and hypopneas before dividing by total sleep hours.

- Epidemiological studies have linked obstructive sleep apnea (based on AHI) with myocardial infarction, congestive heart failure, and stroke.[4]

Section III: Beyond the Laboratory-based Polysomnogram

- With the advent of home sleep apnea testing (HSAT), patients are now able to be tested in their usual sleeping environment. The home testing devices are designed to be used by a patient at nighttime without significant technical assistance to evaluate them for obstructive sleep apnea. Table 2 compares and contrasts HSAT devices and in-laboratory polysomnography.

- The American Academy of Sleep Medicine (AASM) released "Clinical Guidelines for the Use of Unattended Portable Monitors in the Diagnosis of Obstructive Sleep Apnea in Adult Patients" in 2007.[5]

    - Based on the 2007 AASM guidelines, the HSAT devices should be used in patients who have a high pre-test probability of moderate to severe OSA.
    - The guidelines also suggest that the devices not be used in patients with significant sleep co-morbidities (periodic limb movements of sleep, insomnia, parasomnias) and severe medical co-morbidities which may affect breathing (COPD, congestive heart failure, neuromuscular conditions).

Table 2. Differences between HSAT Devices and In-laboratory Polysomnography

Differences	HSAT Device	In-Lab Polysomnogram
Location	Home	Sleep Laboratory
Attended with a technologist	No	Yes
Measures Sleep Time	Rarely	Always
Typical Measurement Leads #	3-4	16-20
Measures EEG	No	Yes
Diagnostic of:	OSA, occasionally CSA	Many Sleep Disorders
Expense per test	Low ($200-$400)	High ($800 – multiple thousands)

- The AASM has opted to call a HSAT breathing index the "respiratory event index (REI)". Though similar, the REI is not truly synonymous with the AHI, given the absence of EEG-scored sleep and EEG-based arousals; thus further muddying the already cloudy waters of OSA severity.

Section IV: Smartphones and Beyond:

- Less data is available about smartphone apps and other consumer devices that evaluate sleep-disordered breathing.
- New applications are arriving, including those hoping to evaluate OSA via smartphone technology; though none have cleared the Food and Drug Administration evaluation as of the writing of this syllabus

- In summary, the young field of Sleep Medicine has come a long way in a short time (medically speaking). However, future breathing metrics may better evaluate OSA severity than the AHI by linking more strongly with patient symptoms and important clinical outcomes.

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