Diagnostic Testing for Obstructive Sleep Apnea

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7.1 Background

Obstructive sleep apnea (OSA) is characterized by complete or partial closure of the upper airway during sleep and is the most common form of sleep-related breathing disorders. OSA is highly prevalent in the community; recent epidemiologic data suggest that 14% of men and 5% of women in the general population have OSA that is associated with excessive daytime sleepiness. Certain high-risk populations such as those with resistant hypertension, pulmonary hypertension, coronary artery disease, congestive heart failure, cardiac arrhythmias, stroke, and diabetes mellitus type 2 have significantly higher rates of OSA.

OSA is associated with several adverse individual and population health consequences. Hypoxemia, hypercapnia, sympathetic dysregulation, intrathoracic pressure swings, and increased arousals from sleep are thought to be the pathophysiologic mechanisms underlying these increased risks. OSA has been shown to be linked with adverse neurocognitive, cardiovascular, and metabolic sequelae. These include excessive daytime somnolence, enhanced risk of motor vehicle and work place accidents, mood disorders, and dementia. There is a heightened risk of systemic and pulmonary hypertension, coronary artery disease, congestive heart failure, arrhythmias, and stroke. OSA is associated with metabolic dysregulation and increased risk for diabetes. Additionally, OSA is linked with increased healthcare utilization.

OSA is generally well treated with continuous positive airway pressure (CPAP) and has been shown to decrease symptoms, rate of motor vehicle accidents, the adverse medical consequences noted above, and healthcare utilization as well as improve quality of life. However, a CPAP device may be cumbersome and difficult to tolerate for many patients. Oral appliance treatment is used as an alternative therapeutic option. Generally, this is less efficacious than CPAP in terms of eliminating disordered breathing events, but may be more acceptable to some patients. Oral appliance treatment is beneficial in reducing daytime sleepiness and blood pressure to a degree equivalent to CPAP.

Thus, OSA is a common medical disorder that is associated with significant injurious health consequences and increased healthcare costs. A false-negative test may leave symptomatic patients untreated, adversely affect their quality of life, and increase the risks of poor health outcomes. On the other hand, treatment of OSA may be difficult for many patients to tolerate. A false-positive test may expose patients to unnecessary inconvenience and expense. Therefore, it is imperative that the diagnosis of OSA be established as accurately as possible. Access to testing, ease and cost of the diagnostic procedures are other relevant factors that are important to consider from the patient perspective.

In this chapter, we describe the testing modalities that are currently available for the diagnosis of OSA in adults. Diagnosis of OSA in children and other sleep-related breathing disorders such as central sleep apnea syndromes and sleep-related hypoxemia/hypoventilation is beyond the scope of this chapter.

7.2 Diagnosis of OSA

7.2.1 History and Examination

The evaluation of OSA starts with a comprehensive sleep evaluation, comprising of a detailed history for symptoms suggestive of OSA, and to assess for the possibility of other sleep disorders, and presence of comorbid conditions. Physical examination should include an assessment of the body mass index (BMI), neck circumference, blood pressure, focused ear, nose, and throat examination (e.g., the presence of nasal septal deviation, nasal turbinate hypertrophy, nasal mucosal erythema/discharge, nasal polyps, nasal valve collapse, micro- and/or retrognathia, maxillary hypoplasia, high-arched palate, overbite, cross-bite, overjet, Friedman palatal position, decreased anteroposterior and lateral dimensions of the oropharynx, macroglossia, ankyloglossia, dental marks on the tongue, and tonsillar hypertrophy) as well as an examination of the cardiovascular and respiratory systems. See ► Chap. 6 for further information on the clinical evaluation of OSA.

7.2.2 Screening Tools

Screening questionnaires and prediction algorithms are not sufficient to make the diagnosis of OSA as they have been found to have a low accuracy when compared to traditional diagnostic tests in several studies. Many of these studies were performed in high-risk populations for OSA such as the elderly, bariatric surgery candidates, and commercial vehicle drivers and thus may not be generalizable to other patient groups. In general, the specificity of these screening tools was noted to be low, resulting in a large number of false positives. Furthermore, the rate of predicted false negatives was more than 1 in 10, which would render these measures as unacceptable for the purposes of diagnosing OSA. The most recent American Academy of Sleep Medicine (AASM) clinical practice guideline for the diagnostic testing for adult OSA recommended that these tools may be used in clinical settings, but not as a substitute for objective sleep testing. Examples of questionnaires and algorithms used in screening for OSA include the Epworth Sleepiness Scale, Berlin Questionnaire, Stop-BANG, sleep apnea clinical score,

Kushida Index, OSAS score, OSA50, Multivariable Apnea Prediction Questionnaire, and morphometric models.

7.2.3 Diagnostic Tests

The diagnosis of OSA involves measurement of respiratory parameters in sleep. Attended or in-laboratory polysomnography (PSG) is considered the gold-standard test for making the diagnosis of OSA and requires the simultaneous measurement of eight or more physiological parameters during sleep, including electroencephalography (EEG), electrooculography (EOG), electromyography (EMG), electrocardiography, air flow (with an oronasal thermistor and nasal pressure transducer), chest/abdominal muscle effort (usually with respiratory inductance plethysmography), pulse oximetry, heart rate, snoring (with a microphone), and body position. Time-synchronized audio and video recording is generally available as well. Due to issues with access to in-laboratory PSG requiring the presence of skilled personnel and associated cost, home sleep apnea tests (HSATs) have emerged as a viable option for the diagnosis of OSA in well-selected patients.

7.2.4 Types of Sleep Studies

Sleep studies are traditionally classified as types I–IV (Table 7.1). Type I is attended in-laboratory PSG. Unattended sleep studies are categorized into types II–IV. Type II studies are similar to type I except that they are unattended studies and can be performed outside of the sleep laboratory. Type III studies utilize oximetry, two respiratory, and one cardiac channel. Type IV studies use only one or two sensors, for example, airflow or oximetry and pulse rate. There is considerable device variation even within the same sleep study category. In addition, since this original classification was devised, newer technologies such as those incorporating peripheral arterial tonometry to diagnose OSA have emerged. The SCOPER (sleep, cardiovascular, oximetry, position, effort and respiratory parameters) classification, proposed by the AASM more recently after a comprehensive technology evaluation, is an alternative and more complex classification system that includes these newer technologies.

7.2.5 Definition of OSA

The International Classification of Sleep Disorders, Third Edition, defines OSA as being present if a respiratory index (RDI) of ≥5 per hour is noted on PSG or HSAT, associated with typical symptoms of OSA, that is, loud snoring, choking/gasping/breath-holding episodes, witnessed apneas, unrefreshing sleep, sleepiness, fatigue, insomnia, and/or a diagnosis of mood disorder, cognitive dysfunction, hypertension, coronary artery disease, stroke, congestive heart failure, atrial fibrillation, stroke, or type 2 diabetes mellitus. Alternatively, an RDI of ≥15 per hour on PSG or HSAT in the absence of these symptoms or comorbid medical conditions is sufficient to make the diagnosis of OSA.

7.2.6 Scoring of Respiratory Events

The RDI comprises apneas, hypopneas, and respiratory effort-related arousals (RERAs) per hour of sleep, whereas the apnea-hypopnea index (AHI) includes only apneas plus hypopneas per hour of sleep. The criteria for defining hypopneas have changed over the years, rendering an evaluation of the medical literature regarding the diagnosis and outcomes of OSA difficult. The AHI (and therefore the RDI) may be considerably different in an individual person depending upon which definition of hypopnea is employed. The most recent AASM Manual for the Scoring of Sleep and Associated Events version 2.4, 2017, recommends scoring hypopneas in adults when there is a ≥ 30% reduction in nasal pressure

Table 7.1 Types of sleep studies

	Tech	EEG	EOG	EMG	ECG	Airflow	Resp effort	SpO_2
Type 1	X	X	X	X	X	X	X	X
Type 2		X	X	X	X	X	X	X
Type 3					X	X	X	X
Type 4								X

Abbreviations: *tech* sleep technologist, *EEG* electroencephalography, *EOG* electrooculography, *EMG* electromyography, *ECG* electrocardiography, *Resp* respiratory, *SpO_2* pulse oximetry

signal excursion (alternative hypopnea sensor if this is unavailable) or positive airway pressure (PAP) device flow for at least 10 seconds accompanied by a ≥ 3% oxyhemoglobin desaturation or arousal. However, many laboratories are also using ≥4% desaturation criterion (with no arousal criteria), along with a ≥ 30% or ≥ 50% reduction in nasal pressure excursion, in keeping with the "acceptable" definition of hypopneas in the current scoring manual and the definition in the older version of the manual from 2007 respectively. This is largely due to the lack of reimbursement from certain medical insurance companies (mainly Centers for Medicare and Medicaid Services) for OSA diagnosed based on the latest recommended scoring criteria and paucity of data demonstrating a difference in long-term clinical outcomes with the different criteria in use.

7.2.7 Clinical Guidelines

The AASM published practice parameters for the indications for PSG in 2005 and initial clinical guidelines for the use of HSATs in 2007. In some geographic areas, there has been a significant upswing in the number of HSATs performed relative to PSGs for the diagnosis of OSA; there are a number of potential reasons for this including changes in payor policies. As noted above, AASM published an updated clinical practice guideline for the diagnostic testing for adult OSA in 2017, incorporating a meta-analysis of 87 randomized controlled trials (RCTs) and observational studies from 2005 to 2016 evaluating the accuracy of diagnosis of OSA using clinical prediction rules, HSAT, and PSG as well as relevant clinical outcome measures. Four recommendations in this guideline were graded "strong" based on the quality of the evidence, benefits versus harms, patient values and preferences, and utilization of resources. The remaining two recommendations were rated "weak." These recommendations will be discussed throughout the chapter.

7.3 Home Sleep Apnea Test (HSAT)

This type of sleep study is one that can be conducted outside of the sleep laboratory setting in the absence of a trained sleep technologist during the recording period.

7.3.1 Advantages

Potential benefits of performing a sleep study in the home setting include greater convenience and comfort to the patient, increased access to testing and possibly decreased cost. HSAT may be particularly advantageous in some situations where it might be difficult for the patient to leave the home or healthcare setting due to complexity of cares. Aside from being able to sleep in a familiar environment, generally, fewer sensors are applied during a HSAT, which may also serve to enhance patient comfort. In one RCT in which both HSAT and PSG were performed in the same patient, over three-fourths of the subjects preferred HSAT.

7.3.2 Disadvantages

HSAT is less accurate when compared to PSG in the diagnosis of OSA and tends to underestimate severity. Usually, EEG is not recorded; therefore, the degree of sleep fragmentation secondary to OSA cannot be determined. Other sleep disorders cannot be assessed on a HSAT. Furthermore, central sleep-disordered breathing (SDB) events may not be well differentiated from obstructive events, and in most cases, RERAs cannot be detected. There is no opportunity to titrate positive airway pressure (PAP) and assess response to this or troubleshoot in the home setting. Chain of custody issues may arise, for example, in a commercial vehicle driver or pilot, in ensuring that the patient for whom the study is being ordered is the one undergoing the test. Lastly, if the HSAT is negative for OSA, a PSG is indicated for further evaluation in the patient with suspected moderate-to-severe OSA (assuming they were appropriately selected for HSAT). In this situation, one study suggested that there were a significantly high proportion of patients who did not follow through with the recommended second round of testing with PSG, thus leaving their OSA untreated with potential attendant long-term risks.

7.3.3 Patient Selection

The AASM recommends that HSAT be performed in an uncomplicated patient with an increased clinical pre-test probability of moderate-to-severe OSA.

An uncomplicated patient is one that does not have a condition that would place them at a greater risk of nonobstructive SDB, such as central sleep apnea, sleep-related hypoxemia, or hypoventilation (e.g., cardiopulmonary disease, potential respiratory muscle weakness due to a neuromuscular condition, history of stroke, or current chronic opioid medication use). Patients with significant safety-related issues such as driving or workplace accidents due to sleepiness may also best be studied by PSG. If a screening oximetry suggests the presence of significant hypoxemia and/or hypoventilation or the patient has other risk factors for hypoventilation for example, a BMI in excess of 40 kg/m^2, PSG would be preferable. In some geographic areas, third-party payors have their own criteria for coverage of HSAT versus

PSG. In patients in whom there is a suspicion for other sleep disorders that require evaluation (e.g., central disorders of hypersomnolence, parasomnias, sleep-related movement disorders) or can interfere with the conduct or accuracy of HSAT (e.g., insomnia), PSG is the recommended test. Other situations that may preclude the conduction of HSAT may involve personal (e.g., cognitive dysfunction, physical limitations) or environmental (unsuitable living conditions) factors that can limit the acquisition and interpretation of data.

There is very limited medical literature evaluating the validity of HSAT in patients with significant cardiopulmonary/neuromuscular conditions, insomnia, and those on opioid medications or at high risk of hypoventilation. HSAT may result in an inaccurate assessment of SDB in these situations, and thus PSG is the recommended test of choice. If there are other extenuating circumstances, such as an inability to leave the hospital or home setting, then it may be reasonable to proceed with HSAT than to perform no testing at all.

According to the recent AASM clinical practice guideline for the diagnostic testing for adult OSA, an increased pretest probability of moderate-to-severe OSA is indicated by the presence of excessive daytime sleepiness with at least two of the following three factors: (1) habitual loud snoring, (2) witnessed apnea, or (3) hypertension.

7.3.4 Data Obtained

The recording channels usually comprise a combination of respiratory (including oximetry) and pulse rate parameters. Newer technologies may employ measures of peripheral arterial tonometry to determine disordered breathing events and estimate sleep time/stages. All of these technologies generally include snoring and body position sensors as well.

A technically adequate device per AASM guidelines is one that has at least nasal pressure (for airflow), chest and abdominal respiratory inductance plethysmography (for effort), and oximetry. In the case of devices that utilize peripheral arterial tonometry, these measures in addition to actigraphy are required. Detailed requirements for the sensors are described in the most recent edition of the AASM Manual for the Scoring of Sleep and Associated Events.

Typically, sleep staging channels such as EEG, EOG, and EMG are not present in HSAT, thus the number of disordered breathing events is calculated per hour of recording time and not sleep time. To reflect this difference, the HSAT usually reports severity of SDB as a "respiratory event index" (REI), as opposed to an RDI or AHI. The REI represents a potential underestimation of events that might be calculated on PSG. Secondly, due to the absence of sleep staging, respiratory events resulting in cortical arousals per current recommended scoring criteria cannot be determined, which may also result in a lower severity of SDB than that gauged by PSG.

7.3.5 Conduct and Interpretation of Test

It is recommended by the AASM (and required by most third party payors) that the HSAT be administered by an accredited sleep center under the supervision of a board-certified or board-eligible Sleep Medicine physician. Similarly, the test should be interpreted by a board-certified or eligible Sleep Medicine physician.

A single HSAT is conducted over one night. Studies of single versus multiple nights of recording have demonstrated a marginal increase in accuracy and increased probability of insufficient information with multiple recordings compared to a single night of data. It should be noted that the recordings in these studies utilized only a single channel (nasal pressure transducer or oximetry) and efficiency of care as well as long-term clinical outcomes were not assessed.

Based on available studies, a technically adequate HSAT requires a minimum of 4 hours of recorded data obtained for a duration that includes the patient's habitual sleep period. This includes a minimum of 3 hours of oximetry data and 2 hours of airflow information. There is no literature regarding the accuracy of results obtained from less than 4 hours recording on a HSAT compared to PSG and the influence of the number of recording hours on any long-term clinical outcomes.

7.3.6 Accuracy of Results

There is moderate evidence of the potential for misclassification of severity of SDB in either direction, based on 27 studies that assessed the accuracy of HSAT versus PSG. This is partly due to night-to-night variability of OSA and possibly due to different hypopnea definitions used in the two test types.

The accuracy of type II and III studies compared to PSG (AHI cut-off of ≥5 per hour or ≥ 15 per hour) is in the range of 80–90%, for patients thought to be at high risk for OSA. The accuracy deteriorates in low-risk groups. The use of single-channel oximetry has significantly high false-positive and false-negative rates when compared to PSG (more than 1 in 5). Three studies assessed HSAT using peripheral arterial tonometry and actigraphy against PSG. These studies showed a misdiagnosis rate of about 1 in 10 in high- as well as low-risk patients, a low specificity of about 0.45 for an AHI of ≥5 per hour and ranging from 0.77–1.0 for AHI cutoffs of ≥15 or ≥ 30 per hour.

7.3.7 Discussion of Results

After a positive HSAT, the patient can be commenced on auto-titrating PAP (APAP) if thought to be appropriate by the treating provider. Alternatively, the management pathway may include titration PSG after a positive HSAT. If the results are complex, then an in-laboratory split-night PSG (described below) or titration PSG may be required, depending upon the individual patient.

Based on currently available literature, the chance of a technically inadequate study is approximately 20%. If the HSAT is negative, inconclusive, or technically inadequate in a patient with a high pretest probability of OSA, then attended PSG is recommended as the next step rather than a repeat HSAT. This is because evidence from one study suggested that the likelihood of a second inconclusive or technically inadequate is about 40%. Furthermore, in this study, the rate of nonadherence with the recommended next step of a PSG was high (approximately 20%); to maximize the rate of a definitive diagnosis in this situation after a failed first study, PSG is the recommended test. However, patient preference, available resources, and clinician judgment regarding the possibility of a second failed HSAT will need to be taken into account before making this decision in an individual patient.

7.3.8 Recommended Follow-Up

Early follow-up is recommended following the initiation of APAP after HSAT. Most RCTs examining the HSAT-APAP pathway included a follow-up APAP visit within 2–7 days after HSAT with skilled technical staff. It should be noted that these RCTS were conducted in tertiary care or academic settings comprising of highly skilled medical and technical personnel teams.

7.3.9 Clinical Outcomes

In seven RCTs, after CPAP was commenced, patient-reported outcomes (sleepiness, quality of life, and PAP adherence) did not differ between HSAT and PSG groups. Information regarding cardiovascular and other outcomes is currently not available.

7.3.10 Cost-Effectiveness

The overall cost-effectiveness of an HSAT versus PSG pathway of management of OSA is not fully clear. In the long term, the PSG pathway has been noted to be more beneficial in patients with moderate-to-severe OSA in some studies due to the favorable cost-effectiveness of treatment of OSA in this group of patients. False negatives with HSAT that leave patients untreated with downstream costs relating to adverse health consequences and healthcare utilization, the cost of retesting with PSG in the setting of negative, inadequate, inconclusive or complex HSAT results, and the potential for false positives with unnecessary treatment may tilt the balance in favor of PSG. Conversely, in the one RCT that evaluated the expense associated with HSAT versus PSG, there was a 25% lower cost with HSAT.

If HSAT is utilized in appropriately selected patients and within the care management pathway described above, it is likely to be more cost-effective than if the recommended guidelines are not followed. From the provider perspective, cost may not always be lower with the HSAT pathway because a large number of components are required to ensure that the quality of the HSAT pathway-mediated care for OSA is similar to a PSG pathway.

7.3.11 Summary of HSAT

The use of HSAT in an uncomplicated patient with a high pretest probability of moderate-to-severe OSA, using a technically adequate device and recording period, under the supervision of personnel with the requisite expertise and with a clear management pathway in place, can provide similar clinical outcomes as PSG when used in the diagnosis of OSA.

7.4 Polysomnography (PSG)

In-laboratory PSG, consisting of the simultaneous monitoring of multiple physiological parameters in sleep, in the presence of skilled technical personnel, is the current gold-standard recommended test for the detection of OSA.

7.4.1 Patient Selection

Currently available evidence includes only patients with comorbid heart failure and chronic obstructive pulmonary disease. The utility and validity of HSAT in patients with other comorbidities, environmental and personal factors that can affect testing have not been systematically studied. In the research that has been conducted to date, the specificity of HSAT in identifying central SDB or hypoventilation was low or not evaluated. Since these respiratory abnormalities are potentially associated with significantly increased risk of morbidity and mortality, and may not be adequately assessed by HSAT and/or require treatment modalities other than CPAP/APAP,

PSG is recommended for the diagnosis of SDB in patients with the comorbidities or complicating factors described above.

7.4.2 Number and Duration of Tests

A split-night protocol (where PAP is applied after the diagnostic portion of the study) is generally appropriate and may be used instead of a full night diagnostic study for the purposes of detecting OSA. For a split-night study, a moderate-to-severe degree of OSA needs to be observed during a minimum of 2 hours of recording time on the diagnostic portion of the PSG and at least 3 more hours should be available for PAP titration.

The accuracy of split-night PSG has been found to be comparable to full night diagnostic PSG, even in those with milder degrees of OSA. Many of these investigations were not RCTs and the types of sensors utilized were inconsistent across studies. Currently, there is no definitive data regarding the optimal AHI threshold at which to initiate PAP after the diagnostic portion of the PSG.

The split-night protocol, in theory, leads to decreased cost and increased efficiency of care by facilitating diagnosis and treatment of OSA during a single night's recording. One study did demonstrate lower cost with the split-night PSG protocol compared to the full night pathway, based on cost per quality of life year gained. However, further research regarding cost-effectiveness is needed. It is worth noting that the studies evaluating split-night versus full night diagnostic PSG excluded certain patient groups such as those with severe insomnia, claustrophobia, and other suspected sleep disorders. Thus, individual patient factors determining eligibility for the split-night pathway are not fully known at this time. Additionally, if the diagnostic and/or titration portions of the study are inadequate or inconclusive, these may need to be repeated; alternatively, in the case of an inadequate/inconclusive titration, APAP may need to be used if thought to be appropriate by the treating clinician.

Most studies have shown no significant differences in patient-related outcomes such as the rates of adherence to CPAP or the residual AHI on CPAP treatment in subjects who underwent split-night or full night diagnostic PSG.

7.4.3 Conduct and Interpretation of the Study

As with HSAT, it is recommended that PSG be administered by an AASM accredited facility with appropriately trained personnel and the study interpreted by a physician who is board-certified or board-eligible in Sleep Medicine.

7.4.4 Follow-Up

After undergoing PSG for the diagnosis of OSA, discussion of the results must take place within a reasonable time frame after the study and the patient commenced on treatment if appropriate.

7.4.5 Discussion of Results

If the results of PSG are negative for OSA and there is still a high clinical suspicion for OSA, it is recommended that a second PSG be considered for the diagnosis of OSA. There are a few studies of two-night versus one-night PSG that have shown significant night-to-night variability in AHI in a subset of patients, although there were no overall differences in AHI between the groups. Up to a third of individuals had a change in the classification of severity of their OSA in either direction after the second study. Body position was not noted, but an increased proportion of rapid eye movement sleep was noted on the second PSG in one of these studies. The available evidence indicates that 8–25% of symptomatic patients with an initial negative PSG will have OSA diagnosed after the second PSG.

A false-negative study may exclude a patient from therapy and expose them to increased morbidity in the long term. On the other hand, repeat PSG after an initial negative study carries with it the potential for increased expense and inconvenience to the patient and the possibility of a false-positive test. If the patient is symptomatic, the potential benefits of this approach may outweigh the risks, but the evidence supporting this recommendation is weak. A thorough discussion with the patient is warranted in this situation so that they can make an informed choice about undergoing a second PSG.

7.4.6 Repeat Testing in the Long Term

There is a general lack of evidence regarding the performance of repeat PSG in patients with OSA with stable symptoms, weight, and comorbidities who are adherent to PAP, in terms of whether this affects classification of type or severity of SDB in an individual patient or has any influence on long-term clinical outcomes. According to current Centers for Medicare and Medicaid Services (CMS) coverage criteria for PAP devices in the United States, a repeat diagnostic and/or titration PSG showing an AHI ≥5/hour is required if more than 10 years have elapsed since the time of the original diagnostic study and the patient has not obtained a new PAP device in this time frame,.

If there is a significant change in medical comorbidities (and there is a suspicion for change in type/severity of SDB or PAP device type/pressure requirements) or ≥ 10% change in body weight from the time of the diagnostic or titration study, repeat PSG could be considered. CMS requires a titration PSG demonstrating adequate control of SDB (AHI <10/hour) on PAP titration PSG before nocturnal supplemental oxygen treatment can be prescribed for persistent hypoxemia.

7.4.7 Summary of PSG

PSG is considered the gold-standard test for the diagnosis of OSA. While HSAT may be appropriate in certain situations, PSG is recommended for the evaluation of OSA in patients with coexisting cardiopulmonary/neuromuscular comorbidities and/or other complicating medical, environmental, or personal factors, and when other sleep disorders are suspected.

7.5 Conclusions

More accurate screening tools may help identify which patients are candidates for testing with HSAT or PSG for the diagnosis of OSA. The advent of biomarkers that can screen for OSA and/or identify patients at increased risk for adverse outcomes may also help with the prioritization and individualization of testing and treatment for OSA. Research on the factors influencing inadequate/inconclusive/negative/complex ("failed") HSAT in patients with a high pretest probability of moderate-to-severe OSA as well as patient preferences regarding mode of testing is needed. Further studies are required regarding the accuracy and long-term outcomes of HSAT versus PSG in more diverse patient populations, including more female and ethnically/racially diverse populations, those with significant comorbid cardiopulmonary and neuromuscular conditions, and patients with other complicated environmental/personal factors. The accuracy, clinical implications and cost-effectiveness of portable monitoring or "HSAT"s versus PSG performed in the hospital setting, single versus multiple-night HSAT, PSG versus repeat HSAT for a failed HSAT, split-night versus full night PSG, second versus no PSG when the first one is negative and the role of repeat PSG in chronic disease management needs clarification.

7.6 Summary Box

Based on the AASM Clinical Practice Guideline for the Diagnostic Testing for Adult OSA

No.	Recommendation	Strength of evidence
1	Questionnaires, clinical prediction tools and algorithms should not be used (in the absence of PSG or HSAT)	Strong
2	PSG should be used, or HSAT with a technically adequate device in an uncomplicated patient with increased clinical pretest probability of moderate-to-severe OSA	Strong
3	PSG should be performed in the event of a single negative/inconclusive/technically inadequate HSAT	Strong
4	PSG should be performed instead of HSAT in patients with significant cardiopulmonary/neuromuscular conditions, suspected hypoventilation, chronic opioid medication use, history of stroke or severe insomnia	Strong
5	Split-night rather than full night PSG should be performed if clinically appropriate	Weak
6	A second PSG can be considered if the initial PSG is negative and there is still a clinical suspicion for OSA	Weak

Abbreviations: *AASM* American Academy of Sleep Medicine, *OSA* obstructive sleep apnea, *No* number, *PSG* polysomnography, *HSAT* home sleep apnea test

Further Reading

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