

Diagnosis of Obstructive Sleep Apnea in Adults

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The diagnosis of obstructive sleep apnea syndrome (OSAS) requires the combined assessment of relevant clinical features and the objective demonstration of abnormal breathing during sleep, and current evidence indicates that attempts to base the diagnosis of the clinical syndrome on either aspect alone are unreliable. The present review discusses the clinical assessment of patients with suspected OSAS and also the potential added value of structured questionnaires and clinical prediction models that seek to improve the diagnostic value of clinical assessment from the formalized evaluation of selected clinical features. While the traditional "gold standard" for objective assessment is laboratory-based polysomnography, there is growing evidence that limited sleep studies focused on respiratory and cardiac variables are adequate in most cases, and are particularly suited to home-based assessment. The choice between home versus sleep laboratory studies should be decided by taking into account resource limitations and the clinical index of suspicion for OSAS. At present, patients with either a low or high clinical index of suspicion for OSAS appear most suited to home-based investigation, whereas those with intermediate levels of clinical suspicion, or who present with atypical clinical features, may best be assessed by full polysomnographic studies in the first instance.

Keywords: sleep apnea; diagnosis

Obstructive sleep apnea syndrome (OSAS) is a highly prevalent disorder (1–4) characterized by instability of the upper airway during sleep, which results in markedly reduced (hypopnea) or absent (apnea) airflow at the nose/mouth. Episodes are typically accompanied by oxyhemoglobin desaturation and terminated by brief microarousals that result in sleep fragmentation and diminished amounts of slow wave and REM sleep (5). Patients usually present with loud habitual snoring, witnessed apnea, and excessive daytime sleepiness. Despite the high prevalence of OSAS in the general population (at least 4% of males and 2% of females), the condition is frequently unrecognized and undiagnosed as patients often regard their symptoms as normal variants and/or a manifestation of poor lifestyle. Unfortunately, many patients who do seek medical attention are dismissed as having no significant illness without formal assessment. Despite having significant breathing problems during sleep, most patients have no readily detectable respiratory abnormality while awake. While sleep apnea is regarded as a relatively recently described disorder, there are isolated case descriptions in medical journals of patients with OSAS dating back to the 19th century (6).

The failure to recognize clinically significant OSAS is of particular importance as the disease is associated with significant morbidity and mortality. The excessive daytime sleepiness leads to significant impairments in quality of life, cognitive performance, and social functioning (7–9). Furthermore, the disorder is associated with a three- to sevenfold increase in the rate of road

traffic accidents (10, 11) that can be substantially reduced by effective therapy (12). Moreover, OSAS is an independent risk factor for the development of cardiovascular disease, particularly hypertension, but also coronary artery disease, congestive cardiac failure, and stroke (13–19). However, many of the studies of cardiovascular risk are cross-sectional, and thus potentially subject to confounding or bias. Effective treatment of the disorder has been associated with major improvements in quality of life (20–22) and also a diminished risk of cardiovascular morbidity and mortality (23–26). However, patients with OSAS have a high prevalence of other cardiovascular risk factors such as obesity, hyperlipidemia, and diabetes, which makes the identification of the independent association of OSAS with cardiovascular disease more difficult (27). OSAS also relates independently to diabetes and the metabolic syndrome (28–30). In view of these considerations it should not be surprising that untreated OSAS is associated with significant medical costs (31), which underlines the importance of maximizing the recognition and diagnosis of the disorder.

Ultimately, the diagnosis of OSAS is based on the characteristic clinical features together with the objective demonstration of sleep-disordered breathing (32).

CLINICAL FEATURES

A detailed clinical assessment forms an important part of the evaluation of patients suspected of having OSAS, although most reports indicate limited value of clinical features alone in the prediction of the disorder (33–37). This apparent discrepancy reflects the fact that the diagnosis of OSAS is based on the combined assessment of clinical features together with objective sleep study findings. Thus, symptoms compatible with OSAS such as snoring and daytime sleepiness may have an alternative basis and reflect the combination of snoring (which is common) coexisting with daytime sleepiness for other reasons such as poor lifestyle habits and/or other medical disorders that predispose to sleep disturbance. On the other hand, the diagnosis of OSAS is not based solely on the detection of abnormal respiratory events during sleep, but equally includes relevant clinical features. Community-based studies have indicated a relatively high prevalence of sleep-disordered breathing in the community, which falls considerably when taken in conjunction with relevant clinical features. For example, the Wisconsin Cohort Study (1) reported a prevalence of 29% for an apnea index exceeding 5 events/hour, which fell to 4% for an apnea index exceeding 5 events/hour combined with excessive daytime sleepiness.

When interviewing a patient with suspected OSAS it is highly desirable also to interview the partner, who can usually provide important additional information based on direct observation of the patient while asleep (38). The partner's input is valuable in the identification and characteristics of witnessed apnea and may also provide a different perspective from the patient's concerning daytime symptoms such as sleepiness and neurocognitive function. In this latter regard, it is common for the patient to report a lesser degree of functional impairment than that observed by the partner. The basis of this discrepancy is likely to be complex and reflects a number of factors such as denial, neurocognitive impairment, and/or habituation to the symptoms.

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Some useful predictive information can also be obtained from self-reported questionnaires given to the patient in advance of formal evaluation (39–41), and this procedure may simplify the clinical assessment of patients. The most widely used of such questionnaires are the Berlin Questionnaire (39) and the Multivariable Apnea Prediction Index (41). However, although such questionnaires may be useful in population screening studies, there is limited evidence that these questionnaires improve diagnostic accuracy in individual patients in a sleep clinic setting (42).

Nocturnal Symptoms

Snoring. Snoring is the hallmark symptom of sleep apnea because it reflects the basic pathophysiology underlying the disorder, namely a critical narrowing of the upper airway (5). In population surveys, 25% of men and 15% of women are habitual snorers and the prevalence of snoring increases progressively with age; reports indicate that 60% of men and 40% of women between the ages of 41 and 65 years habitually snore (1, 43). Snoring is the most frequent symptom of OSAS, occurring in up to 95% of patients, but has poor predictive value because of the high prevalence in the general population (44, 45). However, the absence of snoring makes OSAS unlikely and only 6% of patients with OSAS did not report snoring in one report (36).

Witnessed apneas. These events are a good diagnostic predictor of OSAS but do not predict severity of the disorder (33, 34). Concern by the bed partner about witnessed breathing pauses during sleep is a common reason for referral to a sleep clinic. Witnessed apnea is less common among female patients with OSAS (37, 43) and may be reported in up to 6% of the normal population (37).

Nocturnal choking or gasping. Many patients with OSAS report waking at night with a choking sensation, which can be quite frightening and presumably reflects an episode of outright wakening during an obstructive apnea. This choking almost invariably passes within a few seconds of wakening.

Insomnia. Sleep maintenance insomnia is often mentioned as a symptom of obstructive apnea and likely reflects the disturbing effect on sleep of recurring arousal. However, most patients with OSAS have little difficulty in initiating sleep.

Other nocturnal symptoms. Several other nocturnal symptoms may be reported by patients or their bed partner such as nocturia, enuresis, frequent arousals, diaphoresis, and impotence and a cause–effect relationship with OSAS is supported by reports that these symptoms improve with continuous positive air pressure (CPAP) therapy (20).

Daytime Symptoms

Excessive daytime sleepiness. Although sleep apnea is the most common cause of excessive daytime sleepiness (EDS), it has not been found useful as a clinical feature to discriminate between patients with and without the disorder. Between 30 and 50% of the general population report significant sleepiness (1, 3). Furthermore, several studies have found that the severity of EDS and sleep apnea do not correlate (26, 27, 46), which may reflect the fact that many other sleep disorders also cause EDS. One must also distinguish EDS from other symptoms such as fatigue and patients frequently underestimate the severity of sleepiness (47). This latter feature may reflect a genuine underestimation and/or a reluctance to admit the symptom for social or work-related reasons.

The severity of EDS can be assessed subjectively by various questionnaires, the most widely used being the Epworth Sleepiness Scale (48). The input of the partner can be useful in this assessment. Objective tests have some advantages but are expensive and time consuming. These include the Multiple Sleep

Latency Test (MSLT) (49), the maintenance of wakefulness test (MWT), (50) and the Osler Test (51), the latter being the simplest to apply.

Other daytime symptoms. Sleep apnea is reported to be associated with many symptoms other than EDS, such as fatigue, memory impairment, personality changes, morning nausea, morning headaches, automatic behavior, and depression (33–35). Although these features may be important in assessing the impact of sleep apnea on a patient and the effectiveness of therapy, there has been no systematic study of the capacity of these features to predict the presence or absence of OSA.

Physical Characteristics/Examination

Obesity. Obesity is common in OSAS, particularly upper body obesity, and there is evidence that patients with OSAS are particularly prone to having fat necks. Neck circumference is a strong predictor of OSAS (34, 52) and values less than 37 cm and greater than 48 cm are associated with a low and high risk, respectively.

Craniofacial anatomy. Anatomic factors that predispose to upper airway narrowing should be sought in the physical examination of a patient suspected of having OSAS. These include retrognathia, micrognathia, tonsillar hypertrophy, macroglossia, and inferior displacement of the hyoid. However, the most common physical finding in patients with OSAS is a nonspecific narrowing of the oropharyngeal airway, with or without an increase in soft tissue deposition (5).

Hypertension. A link between sleep apnea and hypertension has been consistently demonstrated in many studies (13–15), and the finding of hypertension in a patient with symptoms suggestive of OSAS increases the likelihood of the disorder. The likelihood of OSAS appears to be particularly high in patients with drug-resistant hypertension (53).

CLINICAL PREDICTION MODELS

Although clinical assessment alone, even by specialists in sleep medicine, has limited efficacy in the diagnosis of OSAS (34, 45), the evaluation of symptom combinations may improve diagnostic accuracy, which has led to the development of clinical prediction models (or rules). This concept implies that clinical features associated with OSAS severity, as judged by the apnea–hypopnea index (AHI), can be combined into a clinical prediction model, the diagnostic performance of which can be statistically assessed by traditional measures such as sensitivity and specificity, or likelihood ratios. In general terms, clinical prediction rules are developed by analyzing a large sample of patients who are suspected to have a particular clinical condition of interest and in whom a diagnostic test is then performed (54), and thus should be suited to the setting of OSAS.

To date, many sleep apnea clinical prediction rules have been developed (33, 36, 45, 55, 56). These usually include anthropomorphic variables such as the body mass index, waist circumference, and/or neck circumference, and some type of witnessed breathing abnormality during sleep (snoring, apneas, choking, and/or gasping). Overall, clinical prediction models for OSAS have been found to have reasonably high sensitivities (76–96%) but relatively low specificities (13–54%) (57). As a consequence, they can be useful in excluding the diagnosis but generally do not raise the probability of sleep apnea high enough to warrant initiating therapy without some type of objective sleep study to confirm the diagnosis. This finding further supports the view that clinical assessment alone is insufficient to make the diagnosis of clinically significant OSAS. Furthermore, clinical prediction rules may result in long, complicated mathematical formulas that are not user friendly, thus limiting their routine use in clinical

practice. As a consequence of these various limitations, clinical prediction models have not gained widespread use in clinical sleep practice.

OBJECTIVE SLEEP STUDIES

The "gold standard" for the diagnosis of OSAS is full polysomnography, which provides detailed information on sleep state and respiratory and gas exchange abnormalities, in addition to a range of other variables including body position, heart rate and rhythm, and muscle tone and contraction (58). However, these studies are resource intensive because they generally require the facilities of a full sleep laboratory and a trained technician. Thus, it is common to encounter long waiting lists for diagnostic sleep studies in sleep centers throughout the world (59). The high prevalence figures for OSAS make it necessary to consider other, simplified approaches to the diagnosis in selected cases (60). Furthermore, the prevalence of OSAS is so great that the clinical assessment of many patients will likely involve clinicians outside major sleep centers who may not have as detailed an understanding of the syndrome as clinicians who have undertaken specific training in sleep medicine, and the availability of simplified limited diagnostic systems further increases this likelihood. It is important, therefore, that clear-cut guidelines and criteria be available for the assessment and management of patients with suspected OSAS. The development of many limited diagnostic systems represents recognition of the logistic problems described above. Unfortunately, there is little uniformity among these devices, and the only consistent variable common to most of these systems is oxygen saturation (SaO_2).

Polysomnography

Polysomnographic (PSG) studies generally involve a minimum of 12 channels of recordings that include EEG, electrooculogram (EOG), electromyogram (EMG), oronasal airflow, chest wall effort, body position, snore microphone, ECG, and oxyhemoglobin saturation (58). The duration of the diagnostic study should be at least 6 hours, although this practice is broken in split-night studies, in which the initial part is devoted to diagnosis but the latter part involves the initiation of CPAP therapy, when an obvious case of OSAS is evident. The 6-hour duration of a diagnostic PSG allows the assessment of variability related to sleep stage and position with respect to the frequency of abnormal respiratory events and also other types of nocturnal events such as periodic limb movements. The obvious advantages of PSG studies include sleep staging and the recording of arousals, but there can be considerable interobserver variability in the scoring of arousals (61).

The respiratory variables in PSG studies are reproducible on a night-to-night basis in moderate to severe cases of OSAS, but mild cases can demonstrate sufficient variability in the AHI to result in a false-negative diagnostic rate as high as 50% when using a threshold of at least 5 events/hour (62). This variability can relate to a number of different factors, particularly time spent in the supine position where AHI is typically higher (63). Thus, the inclusion of body position is desirable in both PSG and limited cardiorespiratory sleep studies. Other factors that may contribute to night-to-night variability of the AHI include alcohol and drug consumption in addition to variability in sleep stage distribution, particularly REM sleep (5).

Home-based Sleep Studies

The large numbers of patients presenting for assessment of possible OSAS has focused attention on the role of home-based sleep studies. Although it might seem obvious that patients would prefer home-based sleep studies to the sleep laboratory

environment and might be expected to sleep better, one study reported that patients preferred laboratory-based studies (64). Although there are advantages to such home-based studies, particularly related to cost savings, there are also disadvantages. The lack of technician supervision means that dislodged leads are not replaced during the study, and consequently the likelihood of technically unsatisfactory studies is higher. Unattended PSG recordings from the Sleep Heart Health Study were deemed technically inadequate in 5% of all patients studied and sleep staging and arousal data were not reliable in 25% of these PSGs (65). Ultimately, the relative merits of detailed PSG studies in the sleep laboratory versus unattended home-based studies that focus on cardiorespiratory variables must be viewed in the context of accuracy, reliability, and overall cost, taking into account the likelihood that home-based studies are more likely to require repetition for technical reasons because of the lack of direct supervision by a technician.

Cost factors typically dictate that home studies will be either unattended by a technician, or continuously monitored by a technician from a centralized hub, which increases the likelihood of technically unsatisfactory home PSG studies (66). This factor results in the majority of clinical home-based sleep studies being limited cardiorespiratory studies, which are technically more feasible and reliable in an unattended setting. Several studies have directly compared in-laboratory with home-based sleep studies and generally reported good clinical agreement and significant overall cost savings (67–71). Furthermore, technology is now available that allows transfer of the relatively large amounts of information included in a PSG or cardiorespiratory sleep study over telephone lines and by satellite (66). This technology permits the collection and analysis of such studies at centralized hubs. Although limited cardiorespiratory studies have considerable potential in the evaluation of suspected OSAS, particularly in the home setting, the data from such studies require manual scoring by a qualified technician to achieve reliable results (69).

The current state of the art indicates that the choice between home versus sleep laboratory studies should be decided by taking into account resource limitations and the clinical index of suspicion for OSAS. Thus, when resources are limited, patients with a low or a high index of suspicion for OSAS could be initially assessed by home-based limited sleep studies, whereas those with intermediate levels of clinical suspicion, or who present with atypical clinical features, may best be assessed by full PSG studies in the first instance.

Role of oximetry. One of the simplest methods to evaluate suspected OSAS is the continuous recording of SaO_2 during sleep, and it is often sufficient in severe cases because of the characteristic pattern of repetitive desaturation. This method is well suited to ambulatory assessment and has been evaluated in several studies (72–74). Whereas oxygen desaturation is common with obstructive apnea, desaturation can be absent with hypopneas or in events associated with increased upper airway resistance. Desaturation is also likely to be minimal or absent in nonobese patients. Thus, oximetry alone is much less helpful in milder cases of the disease, and cannot confidently exclude the diagnosis. The sensitivity of nocturnal pulse oximetry in the diagnosis of OSAS ranges from 31 to 98% and specificity ranges from 41 to 100% (75). This wide variation likely reflects the diversity of patients studied and may also reflect the devices used. This latter aspect is important because some inexpensive commercial oximeters have averaging times up to 30 seconds, which blunts the characteristic pattern of repetitive transient desaturation and thus makes them insensitive to the diagnosis of OSAS except in the most severe cases. Furthermore, commercial oximeters allow the automated analysis of a wide range of variables including mean SaO_2 levels and cumulative time spent

below certain SaO_2 thresholds, such as 90 and 80%. In this writer's view, the most useful variables that can be obtained from oximetry studies are the frequency and severity of individual oxygen desaturations.

Thus, more detailed sleep studies are necessary in the majority of patients with mild to moderate disease, and one report highlights the limitations of oximetry recordings in this regard (76).

DIAGNOSTIC CRITERIA FOR OSAS

Given the requirement for both subjective and objective criteria in the diagnosis of OSAS, the report of a task force of the American Academy of Sleep Medicine (Westchester, IL), of which the present writer was a member, has provided a useful set of requirements for the diagnosis (32). The patient suspected of OSAS must fulfill criterion A or B, plus criterion C. These are as follows:

- A. Excessive daytime sleepiness that is not better explained by other factors
- B. Two or more of the following that are not better explained by other factors:
 - Choking or gasping during sleep
 - Recurrent awakenings from sleep
 - Unrefreshing sleep
 - Daytime fatigue
 - Impaired concentration
- C. Overnight monitoring demonstrates five or more obstructed breathing events per hour during sleep. These events may include any combination of obstructive apneas/hypopneas or respiratory effort-related arousals, as defined below.

This report also proposed a grading of severity of OSAS based on the frequency of abnormal respiratory events during sleep:

- Mild: 5–15 events/hour of sleep
- Moderate: 15–30 events/hour of sleep
- Severe: More than 30 events/hour of sleep

TECHNICAL ASPECTS OF RESPIRATORY RECORDINGS

Definitions of Abnormal Breathing during Sleep

Surprisingly, despite the central role played by apneas and hypopneas in the definition of OSAS, there has been a lack of uniformity in the definition of hypopnea, which can result in considerable variability in the reported AHI (77, 78). However, the American Academy of Sleep Medicine Task Force report (32) has also provided clear definitions of apnea, hypopnea, and respiratory effort-related arousal (RERA).

An obstructive apnea/hypopnea event is characterized by a transient reduction or complete cessation of breathing. In routine clinical practice it is not considered necessary to distinguish obstructive hypopneas from apneas because both types of events have similar pathophysiology. These events must fulfill criterion 1 or 2, plus criterion 3 of the following:

1. A clear decrease ($\geq 50\%$) from baseline in the amplitude of a valid measure of breathing during sleep. Baseline is defined as the mean amplitude of stable breathing and oxygenation in the 2 minutes preceding onset of the event (in individuals who have a stable breathing pattern during

sleep) or the mean amplitude of the three largest breaths in the 2 minutes preceding the onset of the event (in individuals without a stable breathing pattern).

2. A clear amplitude reduction of a validated measure of breathing during sleep that does not reach criterion 1 but is associated with either an oxygen desaturation of $\geq 3\%$ or an arousal.
3. The event lasts 10 seconds or longer.

An RERA refers to a sequence of breaths characterized by increasing respiratory effort leading to an arousal from sleep, but that does not meet criteria for an apnea or hypopnea. These events must last 10 seconds or more and demonstrate a pattern of progressively more negative esophageal pressure, terminated by a sudden change in pressure to a less negative level and an arousal.

These criteria allow a uniform and common-sense approach to OSAS diagnosis. Obstructive apneas and hypopneas are typically distinguished from central events by the detection of respiratory efforts during the event. Although the clinical significance of RERA is less evidence-based, there is some support for the notion that the inclusion of apneas, hypopneas, and RERAs in a single index, the respiratory disturbance index, is appropriate (79).

MEASUREMENT OF RESPIRATION

Assessment of Oronasal Airflow

The principal criterion for apnea and hypopnea is an absent or reduced airflow at the nose/mouth. Thus, an assessment of oronasal airflow forms an important part of the evaluation of OSAS, both in full PSG and limited cardiorespiratory studies. In the past, the predominant technique for assessing oronasal airflow during sleep was the thermocouple or thermistor. These sensors function by detecting a change in the air temperature (temperature is higher for expired air than for inspired air, which is room temperature). The sensor is positioned to sample air passing through the nose and mouth. The detection of airflow by thermal sensors provides qualitative information that is not well correlated with breath amplitude. Therefore a relative reduction in amplitude of this signal cannot be used to reliably indicate the presence of a hypopnea. Thermistors have been shown to have poor accuracy in recording hypopneas in awake subjects under ideal conditions (80).

In view of the inherent limitations of the thermocouple and thermistor techniques, alternative measurements have been developed to provide a more accurate assessment of oronasal airflow. Nasal pressure transduction is the most widely accepted method and has now become accepted as the measurement of choice. This technique provides a measurement of nasal airflow using a nasal cannula connected to a 2-cm H_2O pressure transducer to produce a simple flow waveform that can be analyzed for contour characteristics (81–84). Nasal pressure recordings can distinguish normal breathing from apnea and also detect the presence of flow limitation. However, nasal pressure is falsely increased in the presence of nasal obstruction and there is a nonlinear relation between nasal pressure and nasal flow. Square root linearization of nasal pressure greatly increases the accuracy for quantifying hypopneas and detecting flow limitation (82, 83). Mouth breathing can affect the measurement but pure mouth breathing is uncommon (84).

Assessment of Respiration from Ribcage and Abdominal Movements

A variety of techniques are available to assess respiration from recordings of chest and abdominal movements, the most widely

being respiratory inductance plethysmography. This technique detects changes in the volume of the chest and abdomen, and when properly calibrated the sum of these measurements provides a semiquantitative estimate of tidal volume (85). Furthermore, obstructive and central apnea/hypopnea can be distinguished by the presence or absence, respectively, of paradoxical movement of the rib cage and abdomen. However, it is difficult to maintain adequate calibration of respiratory inductance plethysmography when used as a measure of tidal volume over the course of a night's sleep in normal subjects (86). Respiratory inductance plethysmographic signals generally do not allow an accurate distinguishing of apneas from hypopneas in the absence of airflow measurement (85), although this differentiation is less important in routine clinical practice.

OTHER TECHNIQUES BY WHICH TO ASSESS RESPIRATION

Forced Oscillatory Measures of Airway Patency during Sleep

Forced oscillatory measures of airway patency during sleep estimates pharyngeal resistance, using the measurement of reflected random noise within the frequency range of 4 to 32 Hz, and has been proposed as a useful technique to measure upper airway resistance during sleep (87). Further study is required to determine whether this technique is a reliable and easily applied diagnostic tool in OSAS.

Esophageal Pressure Manometry

A hallmark of obstructive respiratory events is the continuation of respiratory effort despite an obstructed upper airway, which results in negative intrathoracic pressures during inspiratory efforts. This pressure can be measured from esophageal pressure recordings but is relatively invasive, and thus not suited to routine clinical practice. However, esophageal manometry may be useful in the assessment of patients with suspected upper airway resistance syndrome because routine sleep respiratory recordings such as oronasal airflow and oximetry may not demonstrate significant abnormalities, yet esophageal pressure recordings may demonstrate increasing respiratory effort during the relevant episodes (88).

OTHER TECHNIQUES BY WHICH TO ASSESS SLEEP-DISORDERED BREATHING

Several other techniques, most centered around cardiovascular variables, have been described as surrogate measures of sleep-related breathing disturbances. The assessment of heart rate variability has been proposed for many years as an indirect diagnostic tool for OSAS (89), and a preliminary report has suggested added value when heart rate variability is combined with SaO₂ recordings (90). Measurement of pulse transit time also appears to provide additional useful information in distinguishing obstructive from central apnea and may also give some information related to arousals (91, 92). Finally, reports suggest that a portable device based on peripheral arterial tone may be useful for unattended home studies (93). However, many of these recording techniques have yet to be fully evaluated in the setting of routine clinical practice and thus a firm recommendation cannot yet be provided.

The high prevalence of OSAS and the long waiting lists frequently encountered for diagnosis and treatment have also prompted some novel and possibly controversial approaches to management. One report has indicated that a management approach based on the combination of a diagnostic algorithm incorporating clinical features and overnight SaO₂ recordings followed by home titration with autoadjusting positive airway

pressure in selected cases was equivalent to conventional polysomnography (94). Another report suggested that the initiation of CPAP in a selected group of sleepy snorers without an initial diagnostic study may be a viable option in an effort to reduce waiting lists (95). However, this approach is questionable in view of the many studies indicated above that have demonstrated limited accuracy in the prediction of OSAS on the basis of clinical features alone. This finding likely explains the observation that less than 50% of patients succeeded with the CPAP trial in this particular study (95).

CONCLUSIONS

OSAS represents a major public health burden and current available resources allow only a minority of affected patients to be assessed and treated. In view of the adverse outcomes associated with untreated OSAS, there is an urgent need to evaluate approaches to management that do not unduly rely on sleep laboratory-based PSG studies. At present, international sleep and respiratory scientific societies are addressing the problem in a systematic way, and the future direction is likely to involve an increasing proportion of limited sleep studies outside the sleep laboratory environment.

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