REVIEW ARTICLE

Ambulatory Diagnostic-therapeutic Approach for Obstructive Sleep Apnoea Syndrome (OSAS)

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Introduction

Sleep-disordered breathing (SDB) or sleep apnoea syndromes (SAS) represent a group of conditions that are characterized by an abnormal respiration during sleep. There are three distinct forms of sleep apnea: central, obstructive, and complex (a combination of central and obstructive) In obstructive sleep apnea (OSA) breathing is interrupted by obstruction to airflow despite respiratory effort while in central sleep apnea (CSA) breathing is interrupted by the lack of respiratory effort. In complex sleep apnea (CompSAS), there is a transition from obstructive to central features during the events, often worsened during positive airway pressure treatment. OSA, CompSAS and CSA constitute 84% 15% and 0.4%, of cases respectively[1], making OSA the commonest variety of SAS. Nasal continuous positive airway pressure (CPAP) is the most effective treatment for patients with moderate to severe OSAS.[2,3]

The estimated prevalence of obstructive sleep apnea syndrome-OSAS (objective sleeping respiratory disturbance associated with daytime sleepiness) in the United States is 2% in women and 4% in men.[4] Epidemiological study from other countries also show that 1-5% of adult men suffer from OSAS.[5] The prevalence of OSAS in adult Indian population is approximately 3.5%.[6,7,8] This suggests that in India, up to about 34 million people may be suffering from OSAS, which, if diagnosed and treated appropriately, could relieve disabling symptoms related to the disorders. Despite being a common disease, a large number of OSAS cases; an estimated 82% are not diagnosed.[9]

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Diagnostic-Therapeutic Algorithm for Obstructive Sleep Apnoea Syndrome

Full polysomnography (PSG) is currently the "gold standard" for the diagnosis of OSAS and titration of effective continuous positive airway pressure (CPAP).[10,11,12,13,14] PSG 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.[11] Split-night studies are also performed, in which the initial part is devoted to diagnosis but the latter part involves the initiation of CPAP therapy. The following criteria are recommended for the diagnosis of OSAS[11].

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 (RERAs)

The patient suspected of OSAS must fulfill criterion A or B, plus criterion C. Further OSAS severity based on the frequency of abnormal respiratory events during sleep is graded as (a) mild : 5–15 events/hour of sleep (b) moderate: 15–30 events/hour of sleep and (c) severe: more than 30 events/hour of sleep.

PSG is time-consuming, requiring 2 nights for at least 6 hours in a sleep laboratory. Limited availability and high cost of PSG is also an important limitation of in-laboratory PSG. 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.[13] Diagnostic-therapeutic approach such as overnight home monitoring using limited PSG (cardio-respiratory variables only) or oximetry in conjunction with ambulatory CPAP titration are alternatives for improved access to diagnostic testing and therapy at least in the initial management of the classic OSAS.

Usual care (PSG obtained before CPAP) or ambulatory management (CPAP without doing PSG).

A recent study combined portable home monitoring and auto titrating CPAP in the experimental arm, thus obviating the need for a sleep laboratory based PSG. This randomized, controlled, open-label trial[15]], found that PSG confers no advantage over the ambulatory approach in terms of diagnosis and CPAP titration in the initial management of OSA. Sixty eight patients with a high pretest probability of moderate to severe OSA by sequential application of the Epworth Sleepiness Scale (ESS)[16], Sleep Apnoea Clinical Score (SACS)[17], and overnight oximetry in the home randomly assigned to usual care (PSG obtained before CPAP) or ambulatory management (CPAP without doing PSG). After 3 months, the PSG and ambulatory groups did not differ in the primary outcome, AHI on CPAP or in the secondary outcomes, ESS score, Sleep Apnea Quality of Life Index (SAQLI), and CPAP. Adherence to CPAP therapy was better in the ambulatory group compared with the PSG group. When resources are scarce, the ambulatory approach provides care for patients most in need of urgent treatment.[15]

Ambulatory Testing to Diagnose Obstructive Sleep Apnoea Syndrome Comparable to Polysomnography

Ambulatory diagnostic algorithms for the OSAS have been previously described. Several portable monitors have been proposed that range in complexity from full PSG to oximetry alone.[18] Monitors that record respiratory variables together with oximetry but without electroencephalography (EEG) and electromyography (EMG) are particularly attractive because the same definition of OSAS as in standard PSG can be employed, and the test can be self-administered by patients in their home, thereby increasing accessibility.[19] Overnight oximetry and portable sleep monitoring at home can identify OSA with a high degree of accuracy. [20,21,22] There is no difference between home- or laboratory based sleep apnea testing on compliance or improvements in sleep apnea–specific quality of life, one of the only verified outcomes of sleep apnea therapy.[19] Exclusion criteria[21] like absence of daytime sleepiness, heart disease, congestive cardiac failure (CCF), cor pulmonale, hypoventilation, stroke, seizures, psychosis and other serious conditions like asthma, hepatic or renal failure should be considered as contraindications to ambulatory sleep apnea testing.

Alternative Methods of Titrating Continuous Positive Airway Pressure

It has traditionally been recommended that technicians should titrate CPAP pressures overnight in patients with OSA until most of the apnoeas and arousals are abolished, as monitored by PSG. [14] The required pressure is then delivered by a fixed pressure CPAP machine. Overnight PSG based titration is, however, time consuming and labour intensive. Autoadjusting CPAP (auto- CPAP), which adjust pressure according to inspiratory flow limitation; snoring and apnoeas are also used in overnight CPAP titration.[23,24,25] The 95th centile overnight airway pressure determines the effective level of CPAP required. This pressure may be delivered using a fixed pressure CPAP or patients may use the auto-CPAP machines long term. The auto titration method can be used to initiate CPAP treatment at home or in hospital[26, 27, 28]. Home titration can deliver the same benefits as in-laboratory titration for about two thirds the cost.[29]

Another method is to start CPAP by using a formula[30] instead of a formal titration in a sleep

laboratory. These predict the required CPAP pressure based on neck circumference/ body mass index and oxygen desaturation/ AHI[31,32,33]. West et al[34] randomised prospectively patients diagnosed recently with OSA to one of three different methods of CPAP therapy i.e., (1) long term autotitration, (2) autotitration for 1 week with long term fixed pressure thereafter, and (3) an algorithm method of pressure determination and showed that the method of determining CPAP pressure for treatment of moderate to severe OSA makes no significant difference to clinical outcome measures.

This study showed that although the formula based group (8 cmH_2O) was lower than the split-night titration (9.5 cmH_2O) pressure, the patients improved equally with respect to sleepiness and adverse effects in both groups. However, the formula is complicated and difficult to use in practice. Another simple method is to put patients on a CPAP pressure based on the body mass index (BMI)[35]. The recommended pressures are 8cm H_2O for BMI<30/Kg m^2, 10cm H_2O between BMI of 30-35/Kg m^2 and 12 cm H_2O for BMI>35/Kg m^2. Both the algorithm based or arbitrary-pressure pressure approach to determine CPAP pressures for treatment of OSA are simple and equally effective alternatives to the labour intensive overnight PSG based titration or the expensive auto-CPAP titration.

Empiric Auto-adjusting CPAP for Diagnosis And Therapy of OSAS

Another ambulatory approach is the response to empirical auto-CPAP therapy during 2 weeks in sleepy snorers with clinically suspected OSAS [36]. In this study the CPAP trial predicted the OSAS (AHI 10 events per hour) with positive and negative predictive values of 97% and 78%, respectively. Furthermore, the trial identified patients using CPAP for more than 4 months who experienced persistent symptomatic improvement with positive and negative predictive values of 92% and 100%, respectively. Therefore, a CPAP trial may help to diagnose the OSAS, identify patients who benefit from CPAP, and reduce the need for PSG.

Determining Clinical Probability of Obstructive Sleep Apnoea Syndrome

The ambulatory diagnostic-therapeutic approach requires accurate identification of probable cases of OSAS. Objective sleeping respiratory disturbance associated with daytime sleepiness define the obstructive sleep apnoea syndrome-OSAS. Therefore measures of daytime sleepiness and clinical prediction scores are important to determine probability of OSAS. The Epworth Sleepiness Scale (ESS) [16] is a simple, self-administered questionnaire which is a measure of the probability of falling asleep in a variety of situations i.e. the level of daytime sleepiness. ESS scores correlate significantly with sleep latency measured during the multiple sleep latency test (MSLT) and during overnight PSG.[37] Total ESS scores significantly distinguished normal subjects from patients in various diagnostic groups including obstructive sleep apnea syndrome, narcolepsy and idiopathic hypersomnia. Sleepy snorers are most likely to suffer from OSAS. While the ESS scores of simple snorers do not differ from controls, in patients with OSAS the ESS scores correlate with the respiratory disturbance index and the minimum overnight oxygen saturation. Total ESS scores therefore distinguish patients with primary snoring from those with OSAS. A higher score (up to 24) indicates more sleepiness and correlate with the severity of OSAS.[38] Objective sleepiness can be also be measured by a modification of the Maintenance of Wakefulness test (MWT), a behavioural sleep resistance challenge in which the patient is required to stay awake in a darkened sound protected room.[39] The time taken to fail repeatedly to respond to a visual signal is measured, so a lower score indicates more sleepiness.[40,41]

The use of an evidence based clinical prediction tool to accurately assess the pretest probability of OSAS can outperform clinical estimates by sleep specialists[42] In order to help identify the urgency of need for treatment, these clinical features most useful for establishing an accurate estimate of the probability of OSA. The Sleep Apnea Clinical Score SACS[17] is a screening tool based on snoring, witnessed episodes of apnea, neck circumference, and systemic hypertension. A score of 15 or greater gives a likelihood ratio of 4.45 of having moderate to severe OSA.[17] A simple way of using SACS is calculation of adjusted neck circumference i.e. measured neck circumference in cm + 3 cm for snoring, 3 cm for witnessed apnoeas and 4 cm for systemic hypertension. Adjusted neck circumference of <43, between 43-47.9 cm and >49 cm indicate low risk, intermediate risk and high risk for OSAS.[43]

Conclusion

Specialist guidelines favour laboratory-based testing for

diagnosis and treatment of sleep apnea; however, this facility is not available to many patients.[43] The high prevalence of OSAS makes it necessary to consider simplified approaches to the diagnosis at least in selected cases[44]. Screening for snoring and sleepiness by the ESS can be followed up using a simple risk assessment tool for sleep apnea such as the SACS. Enough evidence now exists that simple ambulatory diagnostic–therapeutic strategies have an equivalent clinical outcome compared with the conventional laboratory-based approach.[43] These simplified strategies should therefore be used where there is inadequate access to PSG. The ambulatory approaches may also be adopted as a first-line strategy for all high-probability OSAS patients.[45, 46] Protocols to enhance long term CPAP compliance have been developed and physicians may use experienced CPAP vendors to assist in follow-up to their patients.[43] Patients who have a low sleep apnea probability or who do not respond favorably to CPAP or have difficulties during ambulatory management should be referred to a sleep centre for in-laboratory full PSG.[43, 45]

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