Obstructive Sleep Apnea Syndrome –
A Review for Primary Care Physicians and Pulmonologists
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ABSTRACT
Obstructive sleep apnea syndrome (OSAS) is a prevalent sleep disorder that leads to excessive daytime sleepiness and poor quality of life. OSAS is characterized by intermittent hypoxia and sleep fragmentation and is associated with increased risk of cardiovascular and neurocognitive disorders. The focus of our article is to discuss the approach to diagnosis and management.

KEYWORDS: obstructive sleep apnea, apnea, polysomnography, AHI, positive airway pressure therapy

Epidemiology and Clinical Manifestations
Obstructive sleep apnea (OSA) is a sleep-related breathing disorder that is defined by either partial or complete collapse of the airway that interrupts ventilation. These interruptions in breathing during sleep can result in intermittent hypoxia, sleep fragmentation, and lack of restorative sleep. OSA refers to symptomatic obstructive sleep apnea.

Fatigue, daytime sleepiness, and poor quality of life are hallmark symptoms of OSA. Other common symptoms include headaches, awakenings with gasping or choking sensation, concentration and memory problems, irritability, and depression. Additionally, OSA is associated with increased risk of hypertension, atrial fibrillation, myocardial infarction, pulmonary hypertension, insulin resistance, and stroke. This risk is primarily applicable to patients with moderate to severe disease. A 2021 meta-analysis found that OSA was associated with an increased risk for cardiac and all-cause mortality. There is data suggesting that OSAS increases the risk of developing dementia and cancer. A cohort study found that patients with sleep disordered breathing developed mild cognitive impairment at an earlier age than those who did not have self-reported sleep disordered breathing. In a prospective study of 298 women 65 years or older without dementia, those with OSA were more likely to develop mild cognitive impairment or dementia (45% vs 35%, p=0.02, adj. odds ratio 1.8). With regards to malignancy, the theory is that repetitive hypoxic episodes lead to a change in gene expression for angiogenesis. A study that followed patients from the Wisconsin Sleep Cohort for 22 years found that as the severity of OSA increased the cancer mortality also increased.

Diagnosis
Patients to consider for testing are those with any of the above signs or symptoms. Snoring in conjunction with suggestive OSA symptom(s) or comorbidities is an indication for testing. On exam, patients may have a wide neck, large tongue, large adenoids/tonsils, and a Mallampati score of III-IV. Questionnaires can be helpful in identifying patients who should be screened for OSAS. A score of ≥10 on the Epworth Sleepiness Scale and/or a score ≥3 on STOP-BANG questionnaire are concerning for possible sleep apnea. The STOP-BANG screening tool that asks yes or no questions about snoring, fatigue, observed apneas, hypertension, BMI, age, neck circumference, and gender has ~90–93% sensitivity for sleep apnea. While useful, this and other screening tools have not been validated in all populations, such as in patients undergoing bariatric surgery, in whom excessive daytime sleepiness may be lacking. OSA is highly prevalent in the bariatric patient population and there is increased risk of peri- and postoperative complications if sleep apnea is not monitored and treated. Therefore, all patients should undergo testing to determine if they have sleep apnea and start treatment if the sleep apnea is found to be significant.

Polysomnography (PSG) or home sleep testing is generally required to diagnose OSAS. An all-night in-laboratory PSG involves use of EEG, EOG [electrooculography], EMG, pressure sensors to detect air flow, EKG, and chest/abdomen belts to detect respiratory effort. Despite PSGs being the gold standard test, there are drawbacks of cost, possible lack of insurance coverage, and lower patient acceptance compared to home testing.
Home sleep apnea testing [HSAT] use has been on the rise, due to benefits of convenience, lower cost, and increased access to evaluation, as well as improved quality of this testing. Compared to PSG, HSAT does not utilize EEG or EMG and therefore actual sleep time is not known. HSAT should be used when there is a high pretest probability for OSA, there are no severe comorbidities and no concern for additional sleep disorders. HSATs can underestimate severity or miss OSA. False negative rate of this test is approximately 17%. Thus, if HSAT is negative then the patient should generally complete a formal PSG.

One ambulatory sleep study device that is gaining traction is the WatchPAT, a peripheral arterial tonometer. The WatchPAT measures apnea or hypopnea by using an algorithm that utilizes data on the changes in peripheral arterial blood volume, desaturations on pulse oximetry, and changes in heart rate. A meta-analysis showed that WatchPAT’s respiratory indexes did correlate with scoring from PSGs. The peripheral arterial tonometry has a positive predictive value of 76% and negative predictive value of 83%. Currently however, a PSG or HSAT is required to initiate therapy.

The tests mentioned determine the apnea-hypopnea index [AHI] score and help guide treatment options for OSA. AHI is the number of hypopnea/apnea events per an hour and is used for classification of OSA severity. In adults, AHI 5-14.9 is mild OSA, AHI 15-29.9 is moderate OSA, and AHI ≥ 30 is severe OSA. Of note, this classification system does not account for other factors that could contribute to severity of OSA, such as the level of desaturation, degree of sleep fragmentation, or level of sympathetic system activation.

TREATMENT

Lifestyle changes and conservative measures

Lifestyle changes can improve OSA and in those with mild disease and symptoms can sometimes be the primary form of management. The following are beneficial:

1. Weight loss lowers severity of OSA, but especially in moderate to severe disease is often not curative.
2. Patients should limit alcohol, opiate, and benzodiazepine use.
3. Smoking cessation may help as well. Nicotine is thought to increase upper airway muscle collapse due to muscle relaxation and increased sleep fragmentation.
4. Many patients have worse AHI scores in the supine position in part due to airway closure due to tongue relaxation. It has been shown that sleeping in the lateral decubitus position can decrease sleepiness and AHI scores. There are many positional devices that can be used to help patients sleep off their back.
5. Treatment of nasal congestion to improve upper airway patency.

Positive Airway Pressure Therapy (PAP)

The mainstay of OSA treatment is PAP therapy, in which positive pressure is applied to keep the upper airway patent during sleep, thereby reducing apneas and hypopneas. PAP therapy can be either CPAP, APAP (auto-titrating), or BiPAP (bilevel). According to the American Academy of Sleep Medicine [AASM] clinical practice guidelines, PAP therapy is recommended for patients with excessive sleepiness.

There have been 38 randomized control trials that have shown that PAP decreases excessive sleepiness with minimal side effects. Effective PAP pressures can be determined during split PSG testing, in which pressures are titrated during the second half of the night. Positive pressure titration in the sleep center is recommended for patients with CHF, COPD, central sleep apnea, and obesity hypoventilation syndrome. Otherwise, APAP can be prescribed. APAP is set over a range of PAP pressures and the unit titrates the pressure to achieve the lowest AHI score. Once the patient is using APAP for a period of time, the patient’s sleep medicine provider reviews efficacy of therapy and makes additional adjustments to settings if needed.

Per the AASM guidelines, there is a conditional recommendation of prescribing PAP therapy to patients with diagnosed OSA with HTN or impaired sleep-related quality of life. There have been five randomized control trials showing that PAP therapy can lower blood pressure, though a meta-analysis did not support this. Similarly, in terms of impaired sleep-related quality of life, a meta-analysis did not support the positive benefits seen in 19 randomized control trials.

Additionally, the AASM guidelines list that there is not enough evidence on the use of PAP therapy for asymptomatic OSA patients. There is mixed data regarding whether implementation of PAP therapy reverses the increased risk of cardiovascular disease or mortality. Observational studies have shown a positive response to PAP therapy for cardiovascular outcomes, while four randomized control trials have not confirmed, but have not excluded benefit in this regard. Negative results may be related to exclusion of patients with more significant cardiovascular disease and the relatively low PAP adherence in these randomized trials.

A recent study found that the degree of heart rate increase in relation to apneas/hypopneas was a predictor of poor cardiovascular outcomes, and perhaps these patients should be included in future randomized trials. In a recent subgroup analysis of a large RCT, it was found that patients with CAD who used CPAP for more than 4 hours a night had lower rates of cardiovascular or neurovascular events compared to patients who used it for less than 4 hours a night. About 20% of OSA patients have pulmonary hypertension, and small studies have shown that CPAP therapy lowers right ventricular and pulmonary artery pressures.

Adherence to PAP therapy is a significant issue for patients with OSAS. To improve compliance, finding a well-fitting
and comfortable interface and using in-line humidification can be helpful. Despite these adjustments, PAP adherence can still be poor, especially in those who require higher pressures. A ramp function with which the starting pressure is gradually increased can also help with comfort. It has been recently shown that remote electronic monitoring of PAP use by patients and their providers can lead to improved overall compliance with therapy. Over the past one to two decades there have been significant improvements in PAP technology, leading to improved comfort with therapy.

Other Therapies for OSA

Other therapies for OSAS include oral appliances, upper airway surgery, and hypoglossal nerve stimulation.

Mandibular Advancement Devices are often a good alternative to PAP therapy for mild to moderate OSAS. The mandibular device causes the mandible to jut forward, advancing the tongue and lifting the palate thereby reducing airway collapse. One retrospective study of OSA patients with mild to severe disease found that a mandibular device led to 37% of patients having resolution of their OSA and 64% of patients having their AHI score cut in half. However, the response to the mandibular device was not as profound in patients with severe OSA. Lastly, various surgeries have been used to treat OSA. The data for this treatment option is mostly limited to case series and a handful of RCTs. There is no RCT comparing PAP therapy against surgical interventions for OSA treatment. Two RCTs have compared upper airway surgery with conservative management in patients who did not tolerate PAP or mandibular advancement devices. The SKUP3 RCT trial found that uvulopalatopharyngoplasty (UPPP) reduced AHI on average from 53.3 to 21.1, though a few patients had an increase in AHI after surgery. Similarly, the SAMS RCT trial found that those who had UPPP with radiofrequency ablation to reduce tongue size had average drop in AHI from 47.9 to 20.8. Only 28% of patients had resolution of OSA. Other surgical interventions include tonsillectomy (usually performed with UPPP), genioglossus advancement, and maxillo-mandibular advancement. Generally, in select patients with certain anatomical abnormalities who do not tolerate PAP or mandibular devices, surgical intervention is an option. Surgery can reduce the severity of OSA and in well-selected patients it can sometimes completely treat sleep apnea.

Hypoglossal nerve stimulation (HNS) is a newer therapy that stimulates the nerve to act on the genioglossus muscle during sleep to help open the upper airway. A cohort study in 2014 found the hypoglossal nerve stimulator lowered the median AHI score by 68% in 12 months and also decreased level of daytime sleepiness in OSA patients. HNS is considered if the patient fails or doesn’t tolerate PAP therapy, does not have concentric collapse of the upper airway on drug-induced sleep endoscopy (DISE), and there is no anatomical obstruction, $\text{BMI} \leq 35\ \text{kg/m}^2$, and AHI is 15–65.

**CONCLUSION**

OSAS is a highly prevalent sleep disorder that can negatively affect quality of life and is linked to cardiovascular disorders and neurocognitive abnormalities. Diagnosis is generally made with PSG or home-sleep testing. Primary treatment for symptomatic OSA, especially if moderate or severe, is usually with positive airway pressure therapy, but other therapies are available and evolving. PAP therapy has been shown to improve excessive daytime sleepiness, AHI score, and blood pressure. It is likely that there are benefits for primary and secondary prevention of cardiovascular events including stroke, but results of randomized controlled trials are mixed and there are large ongoing studies examining this topic.

**References**


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