Clinical applications

Managing with obstructive sleep apnea

Obstructive Sleep Apnea (OSA) is a potentially serious breathing disorder that disrupts healthy sleep, leading to excessive day-time sleepiness and possibly contributing to the development of several adverse health conditions. People with OSA frequently complain about feeling tired, and may nod off at work, while doing activities with family or friends, or watching TV. Many people dismiss these symptoms as the consequences of their busy lifestyle. They insist they will be fine if only they could get “a good night’s sleep.” For these unfortunate sufferers, however, a good night’s sleep is elusive due to an untreated disease process.

When a person sleeps, there are two main phases of sleep: REM (Rapid Eye Movement) sleep and non-REM sleep, with non-REM sleep accounting for about 75% of sleep time and REM sleep accounting for the remaining 25%. During non-REM sleep, a person progresses through a series of sleep stages from drowsiness and light sleep (Stage 1) through to deep sleep (Stage 4).

During non-REM, the patient’s respiratory rate will decrease, heart rate will decrease, and blood pressure will fall as the body enters a restorative phase of sleeping. About every 90 minutes, a person will enter REM sleep. During this phase, the heart and respiratory rate may rise compared to NREM sleep. During the night, a person without OSA will be able to maintain oxygenation and ventilation due to normal respiratory drive and function (Figure 1).

In a patient with OSA, the normal restful pattern is disturbed. As the patient enters sleep (both REM and non-REM sleep), the airway becomes unstable and either partially (hypopnea) or completely collapses (apnea) (Figure 2). The collapse of the airway leads to a substantial reduction in airflow to the lungs causing a decrease in ventilation and oxygenation. The brain senses these changes and sends a signal through the nervous system to increase ventilation. When this does not occur due to the obstructed airway, the patient will generally have to awaken in order to take an adequate breath.

Simultaneously, the sympathetic nervous system is activated, stimulating the heart and vasculature. As the patient awakens, he or she restores airway patency and hyperventilates to correct the low oxygen and high carbon dioxide. In addition, heart rate and blood pressure surge. Once the blood gases are corrected, the patient relaxes, and reverts to sleep. Throughout the night, the cycle of airway collapse and sympathetic stimulation will occur repeatedly. In individuals with OSA, these pauses in breathing can be as few as five times per hour or as many as hundreds of times per night.

OSA can affect anyone, but is commonly found in men, post-menopausal women, individuals who are overweight, and individuals with a history of snoring or family history of sleep apnea. In the United States, it is estimated that up to 5-6% of the adult population may have sleep apnea and 1 to 3% of children are affected.

Contributing risk factors in the development of
OSA include gender, race, obesity, aging, and upper airway anatomical structure (that is, the small airway behind the tongue, uvula, and soft palate). In children, sleep apnea is generally associated with large adenoids and tonsils [1].

**Dangers of untreated sleep-disordered breathing**

Left untreated, OSA can lead to adverse physical as well as cognitive consequences, in addition to the potential for increased automobile accidents. At a minimum, excessive daytime sleepiness can diminish productivity, increase irritability, and lead to mood swings and possibly an increase in cognitive errors that could jeopardize the patient’s employment. At its worst, an OSA sufferer may fall asleep on the job causing a major industrial accident threatening not only themselves but also others [2]. An increase in the risk of cardiac arrhythmias while sleeping is also possible [3].

Far more serious in the long run are the potential adverse cardiovascular consequences associated with untreated OSA. A number of studies suggest that sleep apnea contributes to the development of hypertension, stroke; myocardial infarction, Type II diabetes, congestive heart failure (CHF), and depression [1,4,5,6,7].

Not surprisingly, cardiologists and other healthcare providers treating patients with OSA tend to focus on how the patient presents while awake to determine problems that may be occurring during sleep.

**Diagnostic criteria and methods**

As 80 – 85% of individuals with OSA remain undiagnosed [3], people with this disorder are more likely to see a healthcare provider for fatigue, or other health-related issues instead of seeing their physician specifically for a sleep complaint. In addition, patients may seek treatment because of prompting from their bed partner. Because individuals suffering from OSA usually find ways to cope with excessive sleepiness during the day, they may not realize how exhaustion affects their activities.

It is important for healthcare professionals to be aware of common signs and symptoms of patients who may have sleep apnea, and to ask patients basic questions about their sleep habits when examining for other common disorders linked with OSA. The common signs and symptoms of sleep apnea are:

- Loud disruptive snoring
- Witnessed apneas or cessation of breathing during sleep
- Choking or gasping
- Morning grogginess or sleepiness
- Dry mouth, or dry or sore throat on waking
- Reduced libido
- Depression, moodiness or irritability.

The questions that should be asked of patients suspected of having the disorder are:

- Do you snore loudly at night?
- Has anyone observed you to gasp or stop breathing during sleep?
- Do you feel refreshed when you wake up in the morning or are you tired during the day?
- Have you ever woken up choking or gasping?
- Do you have a history of hypertension?

If a sleep apnea is suspected, the doctor will usually recommend that the person go to a sleep lab where polysomnography - or sleep study - can be performed. A sleep study is a comprehensive overnight examination during which a number of physiologic variables are monitored while a patient sleeps. Before falling asleep, the individual is outfitted with electrodes and sensors applied to the head, face, chest, finger and legs.

The sensors record brain activity, eye movement, muscle activity, heart rhythm (ECG), breathing, respiratory effort, and oxygenation during sleep. After the study, the signals are scored and the number of apneas (complete cessation of breathing for more than 10 seconds) and hypopneas (decrements in breathing for more than 10 seconds) per hour of sleep can be determined. This is called the apnea-hypopnea index (AHI). These data can delineate the presence and severity of sleep apnea.

Once sleep apnea has been identified, an effective course of treatment needs to be determined. Frequently, patients will have a study where the first half of the night is used to diagnose the sleep apnea while the second half of the night is used to initiate therapy. The patient could then be discharged from the laboratory with a treatment for the disorder in hand. The following are the diagnostic criteria for Obstructive Sleep Apnea based on an Apnea Hypopnea Index obtained from the polysomnogram:

- AHI equal to, or greater than 15 events per hour or
- AHI equal to or greater than 5 but less than 15 events per hour with documented symptoms of excessive daytime sleepiness, impaired cognition, mood disorders, insomnia, hypertension, ischemic heart disease or history of stroke.
- If the patient fits either criteria, they are then eligible for treatment by PAP therapy.

**Obstructive Sleep Apnea (OSA) is associated with potential adverse cardiovascular consequences.**

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Treatment options

In cases of mild sleep apnea, certain lifestyle changes can sometimes achieve positive results. The following are common recommendations for patients with mild sleep apnea:

- Exercise and proper sleep habits: increased physical activity helps reduce body weight and contributes to healthy sleep.
- Weight Loss: Losing weight will usually improve sleep apnea and if the reduction in weight is enough, may lead to a complete cure.
- Oral Appliances: These devices generally advance the mandible during the night thereby pulling the tongue off the posterior pharyngeal wall. The use of oral appliances has been shown to reduce the number of apnic and hypopnic episodes when fitted correctly [8].
- Avoidance of alcohol and sleeping pills: Alcohol and certain sleeping or pain medications can make throat muscles relax more than normal so they cannot keep the airway open effectively at night. Alcohol and medications can also make it harder for the brain to register the oxygen deficiency caused by an apneic episode resulting in longer and more serious pauses in breathing.
- Sleeping on the side of the body: Sleeping on one’s back allows gravity to pull the tongue, soft palate, and uvula into the airway, causing the upper airway to become narrow or collapse completely. Sleeping on the side minimizes these effects.

In patients with moderate to severe OSA, the most common and effective therapy is Positive Airway Pressure (PAP) therapy, generally in the form of Continuous Positive Airway Pressure (CPAP) [9]. CPAP provides a flow of air through the patient’s nose and/or mouth that creates positive pressure in the airway that will maintain patency during sleep (Figure 3). The precise pressure needed by an individual patient is often determined during the sleep study and the patient’s response to the positive airway pressure can be assessed at that time.

CPAP delivers a steady, constant pressure during inspiration and exhalation (Figure 4). If patients have difficulty with CPAP, alternative forms of PAP therapy can be offered such as bi-level therapy or Auto CPAP. Bi-level therapy provides two different levels of pressure to the patient while he or she sleeps. With bi-level therapy (Figure 5), the patient receives one level of pressure on inspiration, and a lower level of pressure on expiration. By reducing the pressure on expiration, breathing may be more comfortable for the patient. A second alternative therapy used for patients with OSA is Auto CPAP. Auto CPAP provides PAP with the pressure being constantly adjusted throughout the night based on airway patency. The internal algorithm of the device constantly determines the needed pressure, based primarily on flow patterns, and maintains the pressure at the lowest effective pressure (Figure 6). With Auto CPAP, the prescribed pressures will vary throughout the night but the patient’s airway will be kept patent, generally at a lower average pressure.

To provide PAP therapy to a patient, a mask or interface best fitting the patient’s lifestyle, facial contours, and sleeping requirements needs to be selected. There are a variety of masks available for patients with OSA. Traditional full-face masks cover the nose and mouth and are better for patients who breathe through their mouths while asleep. Nasal masks, which cover only the nose, are the most commonly prescribed interfaces for patients with OSA. A growing number of patients are seeking alternative nasal masks with smaller, lighter configurations that cover the nose or the mouth. The goal of the provider is to work with the patient to determine the best interface that will allow the patient to sleep comfortably through out the night with the mask sealed. Finally, humidification of the air passing through a PAP device has been shown to improve comfort and compliance [9].

Patient education and follow up

Adjusting to life with CPAP therapy can be challenging. While great strides have been made toward increasing patient comfort through modifications of pressure profiles, humidification, and mask comfort, the fact remains that a person with OSA must wear a mask to bed. This adjustment in lifestyle – and comfort – can take some time to get used to, not only for the patient, but also for the patient’s bed partner.

Patients and their partners or caregivers need to work together with their healthcare providers to overcome issues related to their treatment and correct any problems early in the treatment.
process. In addition to working with the patient on the therapy, the dangers posed by noncompliance also need to be discussed.

Healthcare professionals need to take an active role in educating the patient about OSA therapy products, the possible side effects, and potential treatments for addressing the side effects. There are often simple corrections that can be made to help the patient adjust to PAP therapy but this intervention needs to occur early in the treatment process. The American Academy of Sleep Medicine recently reported overwhelming evidence that failure to correct treatment problems early usually leads to the discontinuation of therapy; early identification and correction of problems can thus lead to increased compliance.

**Other therapies for moderate to severe obstructive sleep apnea**

If the patient ultimately finds CPAP unacceptable, other therapeutic approaches need to be considered. Second line therapy for most patients would be an oral appliance. As stated above, these devices connect to both the upper and lower teeth and advance the mandible (lower jaw). As the tongue is attached to the mandible, it moves forward as well often leading to improved airway patency during sleep. Although such appliances are often easier to use than CPAP, they are not completely effective in many patients. Thus, a repeat sleep study is often needed with the device in place to assess efficacy.

Third line therapy is generally surgery of the upper airway. Most such surgeries involve removal of the uvula and portions of the soft palate with or without moving the tongue forward. The primary problem with this approach is that the surgery is often not effective and there are currently no good methods to determine in which patients these procedures will be curative. However, certain patients prefer this approach to CPAP.

**Conclusion**

Obstructive sleep apnea remains a common and potentially debilitating disorder that can affect the health and quality of life of the afflicted individual. However, with proper diagnosis, identification of appropriate therapy, and a conscientious effort from healthcare providers, OSA can be overcome and a consistently good night’s sleep attained.

**References**


