Obstructive Sleep Apnea Syndrome: Recognition, Treatment, and Adherence – Part II

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Learning Objectives
After completing this activity, the learner should be better able to

- Identify various treatment modalities for patients with obstructive sleep apnea syndrome
- Employ strategies for assessment of obstructive sleep apnea syndrome treatment to improve patient adherence and effectiveness of treatment including resolution of residual symptoms

Introduction
Management of obstructive sleep apnea syndrome (OSAS) consists of not only specific interventions but also appropriate education. The patient needs to be educated about the importance of OSAS, the risk factors, and the importance of treatment, as well as the consequences of untreated OSAS. In addition, education should include discussion about the potential for accidents, particularly motor vehicle accidents, as well as job-related accidents, and accidents around the home. Excessive daytime sleepiness associated with sleep apnea can cause impairment of judgment and cognition and patients should be aware of this. Patients need to understand the appropriate lifestyle changes that may be important in helping to manage their OSAS.[1]

The treatment modalities that need to be considered include not only lifestyle changes but also the use of positive airway pressure (PAP). Dental appliances, positional therapy, and surgery also need to be considered and may be more appropriate for certain patients (Figure 1).
Case Study
Bill Johnston presents to your practice complaining of loud snoring, tiredness, and not feeling rested, and has a mild headache upon awakening. He is also concerned that he needs to urinate frequently at night and wonders if his prostate is getting larger. He had recently been referred to the sleep center for a polysomnogram and the results have just come back.

Medications: HCTZ 25 mg
Examination: BP 145/92, 325 lbs, 5’9” tall. Obese, large neck
Family history of snoring and stroke
Labs: LDL 140, triglycerides 221
PSG: apnea/hypopnea index 35; Lowest oxygen saturation: 78%; Mild bradytachycardia seen during the recording
Epworth Sleepiness Scale: 14/24

Q1. What would you recommend that he do next?

a. Start a program for weight reduction
b. Undergo a trial of nasal CPAP
c. Start a statin
d. See a urologist
e. A, B, and C
f. All of the above

His elevated lipids require therapy now, but treating the OSAS may reduce the need for medications in the future and so it is important to monitor his lab results. Nocturia is a frequent symptom of OSAS and will likely resolve with successful therapy. If not, or there are other urologic complaints, then further workup is needed.

Lifestyle Changes
Lifestyle changes include not only avoidance of medications and drugs that may exacerbate sleep apnea, such as central nervous system depressants or alcohol, but also other measures such as stopping smoking, good sleep hygiene, and weight loss.[2-4]
Body position can affect the occurrence of upper airway obstruction. Some patients with mild OSAS have positional apnea and will have apnea while lying supine that does not occur when lying on the side. Most patients are advised to avoid sleeping on the back if possible. Sleeping on the side may be recommended as a primary treatment to some patients who have mild apnea who are able to keep off their back throughout the night.

Weight loss is strongly encouraged for all patients who are overweight and even those who are at an ideal body weight should be counseled about the importance of maintaining that body weight and not putting on additional weight. Increasing body weight will worsen OSAS. However, reduction in body weight is not necessarily associated with an improvement, although there are studies that have shown that a 10% weight loss is associated with a 26% decrease in apnea/hypopnea index. The patient needs to be aware that weight loss is not the sole treatment for moderate-to-severe OSAS, but is an adjunctive treatment that needs to occur in conjunction with other forms of treatment.[4,5]

**Positive Airway Pressure**

The first line of treatment for the management of OSAS is positive airway pressure (PAP).[6] Continuous PAP (CPAP) is effective because, in the sleeping state, the upper airway will collapse during inspiration in a patient with OSAS.[6] By applying a slight positive pressure, the patient is able to inspire through an open airway. PAP needs to be applied under evaluation by the clinician in order to ensure optimal resolution of symptoms and improvement in key features, such as respiratory disturbance and oxygen desaturation. The patient is fitted with a nasal mask, which is attached to the head by straps and connected by tubing to a small pressure machine that maintains a constant air pressure of between 4 and 20 cm of water pressure. The pressure opens the posterior pharyngeal airspace as the patient breathes in and allows unobstructed breathing during sleep. Usually the titration is done during a second night of polysomnographic evaluation after a baseline night, but sometimes it is done after an initial period (approximately 2 hours) of baseline recording during one night of polysomnographic evaluation, a so called split-night study.

CPAP can also be applied without the need for titration by a technician, particularly when access to a sleep disorders center is not feasible or timely. Auto-titrating continuous positive airway pressure (APAP) devices are able to detect the positive airway pressure required to eliminate the apneas. APAP devices can be used during attended titration with polysomnography to identify a single pressure for use with standard CPAP for treatment of moderate-to-severe OSA. However, APAP devices may under or over estimate the pressures required and not all the devices use the same algorithms and may deliver slightly different results. Careful titration by a technician is generally regarded as being preferable when it is readily available.
An alternative modality to CPAP is bi-level positive airway pressure (BiPAP) that adjusts the expiratory pressure to a lower setting so it is easier for the patient to breathe out against. Various alternative devices are available for those with complex OSAS that is complicated by cardiovascular impairment, such as congestive heart failure that causes central sleep apnea in addition to the obstructive sleep apnea. These new devices, called adaptive-servo ventilation, are alternative modalities that may be effective for a small percentage of patients.[7] In addition to the PAP devices, oral appliances and surgery need to be considered in some patients.

Medicare approves the evaluation by PAP devices if the patient has an AHI greater than 15 regardless of symptoms, or 5 to 15 with additional clinical features of excessive sleepiness, hypertension, or cardiovascular disease.

CPAP has been shown to not only eliminate apneas, improve oxygen saturation, and reduce cardiac arrhythmias, but also improve subjective and objective sleepiness.[8] The improvement with CPAP is demonstrated by a change in the Epworth Sleepiness Scale (ESS) of approximately 3 points on average. Although this may not seem a lot, it can produce a definite improvement clinically in the patient. Similarly, objectively, the average improvement is less than 2 points on the Multiple Sleep Latency Test or Maintenance of Wakefulness Test score. Again, these objective improvements, although not large changes, often are very clinically relevant.

In addition to improving subjective and objective excessive sleepiness, CPAP will lower cardiovascular risk factors. High-sensitivity CRP (C-reactive protein), homocysteine, total cholesterol, total cholesterol/HDL-C ratio, and Apolipoprotein B and A-I ratios have all been shown to improve with CPAP.[9]

CPAP has also been shown to improve blood pressure.[10] Effective CPAP will lower blood pressure during sleep at night, but also will lower daytime blood pressures. Many patients, approximately one-third of patients with OSAS, have hypertension and if CPAP reduces blood pressure, it generally will improve it to the point that the patient may be able to lower some of his or her antihypertensive medications, but CPAP does not usually eliminate hypertension.

CPAP has also been shown to reduce mortality. Improvement is often dependent upon the amount of time that the patient uses the CPAP machine.[11]
Q2. The patient is started by the sleep center on CPAP but returns to you 1 month later complaining that he cannot tolerate the CPAP because of air leaking from the mask into his eyes and he finds the pressure too high. What should you advise?

a. Check the fit of the mask and possibly change the mask.
b. Lower the pressure slightly until he gets used to the CPAP.
c. Add heated humidification to the system.
d. Adjust the ramp so the pressure rises slowly for the first 20 minutes.
e. All of the above

One of the greatest disadvantages of CPAP is compliance. Patients have great difficulty in adhering to the use of CPAP. Patient reports indicate only about 60% of patients continue to use CPAP.[12] Typically one would try to have the patient use the CPAP more than 4 hours per night, at least 5 nights a week. Objectively, measured compliance in such patients has ranged between 34% and 83%. [13,14] This adherence and compliance with treatment is somewhat similar to that seen with asthma medication adherence, which is approximately 50%. [15,16]

In order to improve patient adherence to CPAP, it is important that the mask is comfortable and effective (Figure 2).[17,18] The mask type, size, and fit all need to be determined for each particular patient. Also, one may need to consider a variety of different mask options. Some masks just cover the nose, whereas patients who have a tendency for mouth breathing might use a full-face mask, which covers both the nose and mouth. Rarely, patients might use a PAP device applied through the mouth, particularly if there is severe nasal breathing impairment. Many patients prefer to use a small device termed nasal pillows, which applies the air pressure through 2 small nipples, one in each nostril.

Increasing the ramp setting allows a lower pressure setting for approximately 20 minutes that enables the patient to get used to the air pressure while still awake before falling asleep. After 20 minutes the pressure increases to the prescribed setting and the higher pressure will eliminate the respiratory events. Adding humidification to the CPAP system prevents dry air from irritating the nose and the patient will find the pressure more comfortable. Additional symptoms that can be induced by CPAP include dry mouth, rhinitis, nasal congestion, and other nasopharyngeal irritations. An evaluation by an otolaryngologist may be required to improve nasal-pharyngeal symptoms in some patients on CPAP.
Q3. The patient returns 1 month later and says that the pressure is still too high and he just cannot get used to using the CPAP for any more than 1 hour a night. He feels claustrophobic with the mask. What would you do now?

- a. Tell him there is no point in continuing with PAP treatment.
- b. Have him undergo a sleep study with BiPAP.
- c. Start some CPAP desensitization steps.
- d. Tell him to see a surgeon.
- e. Start an oral appliance.
- f. B and C
- g. None of the above

The PAP pressure setting is important; if the pressure is too low, patients will continue to have respiratory events and will consequently have arousals, which makes their ability to tolerate the CPAP worse. If the pressure is too high it might be disturbing and awaken the patient. Critical CPAP pressure is determined during polysomnographic evaluation and is the pressure at which the respiratory disturbance is corrected and all evidence of upper airway obstruction, as manifest by snoring, is eliminated. Heated humidification can be helpful for many patients to improve their tolerance to the nasal air flow.[19]

If the patient has significant nasal breathing impairment because of nasal congestion, polyps, or large turbinates, then upper airway surgery may improve nasal breathing, thereby improving management with CPAP. Patients when first given CPAP should be carefully counseled by the clinician and this may involve having the patient watch a video of effective CPAP use. The patient needs to be monitored closely, particularly over the first month of treatment.
Some CPAP machines have a ramp setting, which allows the patient to increase the pressure over the first 20 minutes or so, prior to reaching the effective maximum pressure. Some patients have a severe claustrophobia and may require desensitization steps that are employed at home to get the patient to adjust to the CPAP (Figure 3).

Table 3. Desensitization Steps

1. Wear the PAP at home while awake for 1 hour each day.
2. Attach the mask to the CPAP device, and switch the unit “on”; breathe through the mask for 1 hour while watching TV or other sedentary activity.
3. Use the PAP during scheduled 1-hour naps at home.
4. Use PAP during initial 3-4 hours of nighttime sleep.
5. Use PAP through an entire night.

The pace of treatment is determined by the reported rate of progress.

An alternative modality to CPAP is bi-level positive airway pressure (BiPAP). This device is particularly useful for those who have some impairment in venous return to the heart, such as those with mild congestive heart failure. The patient will breathe in at a higher pressure than he or she breathes out, so a typical BiPAP setting might be 15 cm inspiratory airway pressure (IPAP) and 10 cm expiratory airway pressure (EPAP). The lower expiratory pressure is more comfortable for the patient. This option is an especially helpful second line therapy for some patients who cannot tolerate the perceived “too high” pressure of CPAP which some describe as a claustrophobic sensation. The downside is the additional cost and complexity of the machine, and the need to undergo a second sleep study, this time with BiPAP.

**Oral Appliances**

An alternative to CPAP is an oral appliance. These are usually indicated in patients with mild-to-moderate OSAS and not recommended for patients with moderate-to-severe sleep apnea. An oral appliance is most often used when the patient has difficulty in adhering to a CPAP device because of mask discomfort or claustrophobia. Although not as efficacious as CPAP, oral appliances are indicated for use in patients with mild-to-moderate OSA who prefer oral appliances to CPAP, or who do not respond to CPAP, are not appropriate candidates for CPAP, or who fail CPAP or behavioral measures such as weight loss or change in sleep position. The efficacy of oral appliances is variable\[20\] and oral appliances can cause some discomfort. Most commonly temporomandibular joint (TMJ) discomfort can occur. It can also cause some dental misalignment and may cause patients to have excessive salivation and swallowing during the night.
Upper Airway Surgery

There are a variety of surgical alternatives and this is most appropriate in children with enlarged tonsils or adenoids, where removal can be associated with resolution of the obstructive apnea (Figure 4).[21] Other surgical alternatives may include nasal breathing improvement by means of septoplasty, reduction of turbinates, or removal of polyps. This generally does not eliminate the obstructive apnea, but may improve mild sleep apnea or snoring and may allow the more effective use of CPAP. Other operative procedures often involve an uvulopalatopharyngoplasty (UPP) surgery. This involves reducing the tissues in the posterior pharyngeal air space by removing the uvula and shortening the pillar of fauces. However, more invasive surgical treatments may involve genioglossus or hyoid advancement. In cases of severe retro or micrognathia, maxillomandibular advancement may be required. Newer procedures may involve radiofrequency tongue base reduction or insertion of palatal pillars to stiffen the soft palate.

Evaluation for primary surgical treatment is considered in patients with mild OSA who have severe obstructing anatomy that is surgically correctible (eg, tonsillar hypertrophy obstructing the pharyngeal airway). Surgery may be considered when the patient has an inadequate response or is noncompliant to PAP or the use of oral appliances, despite adequate encouragement to use these devices.[1] If the patient refuses from the onset to even try a PAP device, then oral surgery may be contemplated. If the patient has appropriate features that are amenable to upper airway surgery that stand a high chance of resolution of the sleep apnea, these should be considered, particularly in young patients to prevent a life of having to use a CPAP machine. Surgery is also considered as an adjunct therapy when obstructive anatomy or functional deficiencies compromise other therapies or to improve tolerance of other OSA treatments.

The effectiveness of surgery is quite variable.[22,23] The best studies have shown approximately 40% success rate, but it does depend upon how patients are selected for the surgery. Success rate in patients with large tonsils is greater than patients who have
small or no tonsils. There is a perioperative risk to surgery that needs to be considered for each patient.

**Bariatric Surgery**
An alternative surgical measure is bariatric surgery.[24] This is to be considered in patients who are morbidly obese. Reduction in body weight can lead to an improvement in OSAS and in patients who otherwise are qualified for bariatric surgery; this may be an effective adjunctive treatment to the management of obstructive sleep apnea.

Q4. The patient tried the desensitization steps with a definite but small improvement. A sleep study was then performed with BiPAP and the patient was able to tolerate the device throughout the night and it was effective. With the desensitization steps he increased his use of BiPAP to 7 hours per night. However, after 3 months, although the snoring was gone, he continued to complain of tiredness and sleepiness despite getting plenty of sleep at night. What would you do now?

a. Increase the BiPAP pressure.
b. Start him on an antidepressant.
c. Start modafinil in the daytime for his sleepiness.
d. Add a sleeping pill to extend his nighttime sleep.
e. None of the above

**Residual Sleepiness**
Despite these alternative treatment measures, CPAP is the most widely used form of treatment. However, studies have shown that there is residual sleepiness that is present despite effective treatment by CPAP.[25] Approximately 65% of patients will have objective sleepiness, as measured by a Multiple Sleep Latency Test of less than 7.5 minutes after use of CPAP for 3 months or more. Subjective sleepiness is also not normalized in approximately 34% of patients who will continue to have an ESS of greater than 11. Functional impairment may persist, as measured by the Functioning Outcomes of Sleep Questionnaire (FOSQ), which has demonstrated 43% of patients having some residual impairment despite 3-months' use of CPAP.[25]

There are a number of reasons why residual sleepiness occurs in OSAS. It may be due to inadequate total of sleep time, in that the patient will awaken early and have less than 6 hours of sleep during the nighttime. It may also be due to inadequate CPAP pressure that causes a continuation of respiratory disturbance during sleep at night that impairs breathing and thereby leads to fragmented sleep and daytime sleepiness. CPAP devices themselves are not particularly comfortable and sleep disruption is not uncommon because of the interface between the patient and the CPAP device. There may be co-existent illnesses or medications that can be contributing to excessive sleepiness, such as periodic leg movements during the night. A psychiatric disorder such as depression,
restless leg syndrome, or narcolepsy may be co-existent with the sleep apnea. In addition to these potential causes of residual sleepiness in OSAS, there is evidence to suggest that moderate-to-severe OSAS, when present for many years, may produce central nervous system changes, leading to hypoxic brain injury that may account for some irresolvable excessive daytime sleepiness.[26,27]

Treatment of residual sleepiness in OSAS involves optimizing CPAP therapy by checking the mask fit and type, adjusting the pressure when appropriate, adding humidity to the system if not already present, and treating upper airway nasal obstruction if present.[27] Sleep hygiene should be optimized. When these measures fail to relieve the excessive sleepiness, despite good and effective use of CPAP, then one might consider the use of medications such as modafinil or armodafinil, for the treatment of residual sleepiness.[28]

Modafinil and armodafinil are the only medications that have been FDA-approved for the treatment of residual sleepiness in CPAP-treated patients with OSAS. [28] These medications have been shown to increase wakefulness, as measured by the Maintenance of Wakefulness test. The use of these medications may help reduce potentially dangerous sleepiness and improve quality of life for patients. Medications are not without potential for side effects that may include headache, nausea, nervousness, anxiety, insomnia, or dizziness. These medications may also render oral contraceptive use less effective.

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**Figure 5. Treatment of Residual Sleepiness**

- Optimize CPAP therapy
  - Check mask fit/type
  - Adjust pressure
  - Adjust humidity
  - Treat rhinitis/sinusitis and nasal obstruction
- Optimize sleep hygiene
- Medications
  - Modafinil and armodafinil
Conclusion

In conclusion, OSAS is an important condition that requires effective treatment. Patients should be counseled as to the various treatment modalities available and, in most cases, initial treatment with CPAP should be undertaken. Patients should always be counseled about weight reduction and patients need to be followed carefully in order to monitor their adherence to CPAP, manage any comorbidity that may occur in conjunction with OSAS, monitor symptoms and look for recurrence of symptoms, particularly excessive daytime sleepiness. If medication is prescribed to treat the residual sleepiness associated with sleep apnea syndrome, the patient should be monitored for the effectiveness of the medication and patients counseled that the medication may improve wakefulness but may not eliminate all daytime sleepiness.
References: