Obstructive Sleep Apnoea Syndrome: An Insight

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ABSTRACT

Obstructive sleep apnoea (OSA) is a respiratory sleep disorder characterized by recurrent episodes of obstructive breathing while a person is asleep due to collapse of the upper respiratory tract, despite ongoing breathing efforts. It is a chronic disorder affecting 2-4% of the population with prevalence to middle age men. Predisposing factors mainly include narrowed upper airway, dysfunctional upper airway dilator muscles, and obesity. It is also accompanied by various morbidities, including excessive daytime sleepiness, increased risk of traffic, and industrial accidents and cardiovascular complications. Obstructive sleep apnoea has also been linked to other medical conditions like Myocardial Infarction, Congestive Heart Failure, Stroke, and Diabetes Mellitus though not definitively. Suggestive treatment modalities include continuous positive airway pressure (CPAP), oral appliance therapy, bariatric surgery, uvulopalatopharyngoplasty, maxilla-mandibular advancement. However, a multidisciplinary approach is highly recommended for accurate management of the disease.

KEYWORDS: Continuous positive Airway Pressures, Obstructive Sleep Apnoea, Oral Appliance Therapy

INTRODUCTION

Obstructive sleep apnoea is characterized by repetitive episodes of a complete or partial collapse of the upper respiratory tract mainly the oropharyngeal tract during sleep, with a consequent cessation/reduction of the airflow. Disturbances in respiratory gas exchange lead to oxygen desaturation, hypercapnia, and sleep fragmentation, which contributes to the consequences of obstructive sleep apnoea. An abnormally narrowed or collapsible pharynx puts individuals at greater risk.

During the 1950s Obstructive Sleep Apnoea Syndrome was known as Pickwickian syndrome coined by Sir William Osler and classically described by Burwell et al. Alexander and his colleagues reported Pickwickian syndrome associated with obesity. While sleep-induced respiratory dysrhythmias in non-obese patients were made by Duron et al, Lugaresi et al, and Kuhl et al. At the suggestion of a respiratory specialist P Sadou and a neurologist-sleep researcher E. Lugaresi, the first symposium on sleep-related respiratory problems that included specialists from both areas was held in Italy in 19729. As a result of this intellectual confrontation, a new concept of “Sleep-Induced Apnoea Syndromes” have evolved.

The landmark study investigating the prevalence of Obstructive Sleep Apnoea was 1993 Wisconsin Sleep Cohort Study. This study reported that the prevalence of Obstructive Sleep Apnoea—defined as more than five apnoeas or hypopnoeas per hour of sleep was 4% in middle-aged men and 2% in middle-aged women (age 30–60 years).1

<table>
<thead>
<tr>
<th>Stage</th>
<th>FTP</th>
<th>Tonsil size</th>
<th>BMI</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>I, Ia, Iib</td>
<td>3 or 4</td>
<td>≤40</td>
</tr>
<tr>
<td>II</td>
<td>I, Ia, Iib, III or IV</td>
<td>0, 1, or 2, 3 or 4</td>
<td>≤40</td>
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<tr>
<td>III</td>
<td>III or IV</td>
<td>0, 1, or 2</td>
<td>≤40</td>
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<tr>
<td>IVa</td>
<td>1-IV</td>
<td>0–4</td>
<td>&gt;40</td>
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Table 2 Friedman staging system as determined by Friedman tongue position (FTP), tonsil size, and BMI

Tongue Position: The evaluation of the tongue’s position was relative to the tonsils/pillars, uvula, soft palate and hard palate. It was based on Mallampati stages used in context with difficult endotracheal intubation.

The grading of tongue positions are (Fig 1):
- allows the observer to visualize the entire uvula and tonsils or pillars.
- Ila - allows visualization of the uvula, but the tonsils are only partially seen.

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Obstructive sleep apnoea syndrome is associated with habitual snoring, daytime fatigue, impaired concentration, or memory. As the disorder progresses, the sleepiness becomes increasingly dangerous, causing weak performance at work, and this will directly lead to major work-related and road accidents.\(^2\)\(^\text{14}\)

Obstructive sleep apnoea leads to systemic hypertension, as seen in animal studies showing increased systemic blood pressure with the induction of sleep apnoea, which resolves with the relief of apnoea.\(^\text{15}\) It is now well established that, if left untreated, OSA is a major determinant of cardiovascular morbidity and mortality.\(^\text{16}\)\(^\text{17}\) Compared with the general population, the incidence of OSA is much higher in populations with cardiovascular conditions, such as Heart Failure (12–53%)\(^\text{18}\)\(^\text{19}\), Ischaemic Heart Disease (30–58%) and Stroke (43–91%).\(^\text{20}\)

Risk factors for obstructive sleep apnoea include obesity and gender. Several studies suggest that airway is longer in men than in women. Age is another major risk factor. The efficiency of the upper airway dilator muscles might fall with age. Additional risk factors for the development of obstructive sleep apnoea include genetic factors and race. Menopause—-independent of age and body mass index (BMI)—is also a risk factor. Smoking is also commonly linked with obstructive sleep apnoea. Although the exact mechanisms of this association are not clear.\(^3\)

### DIAGNOSIS

Diagnostic criteria for obstructive sleep apnoea are based on clinical signs and symptoms determined during a comprehensive sleep evaluation, which includes a sleep oriented history and physical examination, and findings identified by sleep testing (Standard).\(^\text{21}\)

The diagnosis of OSA starts with a detailed sleep history which includes an evaluation for snoring, witnessed apnoeas, gasping/choking episodes, excessive sleepiness not explained by other factors, including assessment of sleepiness severity by the Epworth Sleepiness Scale\(^5\), total sleep amount, nocturia, morning headaches, sleep fragmentation/sleep maintenance insomnia and decreased concentration and memory of the suspected patient.

The severity of OSA has to be recognized in order to make an appropriate treatment decision.\(^\text{4}\) No clinical model is recommended to predict severity of obstructive sleep apnoea (Option)\(^6\) therefore objective testing is required. The two accepted methods of objective testing include in-laboratory Polysomnography (PSG) and home testing with Portable Monitors (PM). By using PSG for evaluating OSAOne can record Electroencephalogram (EEG), Electrooculogram (EOG), Chin Electromyogram, airflow, oxygen saturation, respiratory effort, and Electrocardiogram (ECG) or heart rate.\(^9\) Additional recommended parameters to be recorded include body position and leg EMG derivations.\(^\text{22}\)

Portable Monitors when used at home, ideally the patient should be able to put it on and take it off on his or her own. Thus, it must be relatively simple to use. A Portable Monitor should, at a minimum, record airflow, respiratory effort, and blood oxygenation. Prior evidence reviews have suggested that PMs are not as accurate as polysomnography in diagnosing sleep apnea.\(^\text{23}\)

The 3-Dimensional data of the upper airway using cone-beam computed tomography (CBCT) will provide aid in the early understanding and evaluation of respiration and Dentofacial anatomy, which will in turn help in early treatment planning for efficient treatment of the patient.\(^\text{24}\)
TREATMENT

Patients with OSA should be approached with long-term, multidisciplinary management including medical, behavioral, and surgical options for the treatment. Adjunctive therapies can be used when needed to supplement the primary treatment options.

Positive Airway Pressure: The key goal to control obstructive sleep apnoea is the elimination of nocturnal apnoeic events and intermittent hypoxia efficiently. The PAP device functions as pneumatic support that allows one to maintain upper airway patency by increasing the upper airway pressure above a ‘critical’ value (pressure value below which the airways collapse).

The device is worn by the patient, as an oronasal mask, overnight or during sleep hours at a set positive pressure. This pre set pressure can vary with the severity of OSA and higher pressures are needed to eliminate those apnoeas occurring during rapid eye movement sleep, in the supine position or in the presence of severe obesity.

The various delivery methods of PAP are continuous (CPAP), bilevel (BPAP), or auto-titrating (APAP) modes.

Continuous PAP (CPAP), which is administered through the nose (nCPAP), is undoubtedly considered the gold standard treatment for OSA. Worldwide, nCPAP is generally recommended as the first treatment choice for patients with moderate to severe OSA.26,22

Bilevel PAP, or APAP can be considered for the management of OSA in CPAP-intolerant patients. Bilevel PAP ventilation suggests two different levels of pressure, higher during inhalation and lower during expiration. This method can potentially treat OSA at a lower mean pressure than CPAP, and can also improve lung ventilation via a pressure support at the same time.

Auto-CPAP woks by automatically and continuously adjusting the delivered pressure within a maximal and minimal value that is already set by the operator in order to maintain upper airway patency following changes in airflow resistance.26

Positional Therapy: The position of how one sleeps called as sleep position can affect airway size and patency with a decrease in the area of the upper airway. When a patient is in supine position, due to the effect of the gravity on tongue and soft palate position, occurrence of apnoeas/hypopnoeas is generally in higher numbers. For this reason, to discourage supine position in OSA patients, supine alarm devices, a number of positional pillows, ‘tennis ball technique’ etc can be advised.

Oral Appliance Therapy: Over the last decade, for the treatment of patients with mild to moderate OSA and for those patients with severe disease intolerant to CPAP, oral appliances have gained increasing recognition as a useful alternative to CPAP.29 The most commonly used oral appliances among OSA patients are mandibular advanced splints (MAS). These devices attach to both the upper and lower dental arches in order to advance and retain the mandible in a forward position, however, tongue retaining devices (TRD) hold only the tongue in a forward position with respect to the resting position, without mandibular repositioning.

Surgical Treatment: Surgery and its advancement in various dimensions plays a vital role in the management of OSA. However, its role remains extremely controversial. The aim of the surgery is to eliminate the cause of upper respiratory tract obstruction and to widen the airway, after a precise detection of the site where the obstruction has occurred. Patients with OSA generally have disproportionate tissue in the oropharyngeal tract.

Uvulopalatopharyngoplasty (UPPP), either the conventional method or the advanced laser-assisted method (LAPP), is a widely established surgical procedure for the treatment of OSA in selected patients. This technique consists of the resection of the uvula, a part of the soft palate, and any tissue excess located in the oropharynx.30

In cases where nasal obstruction leads to obstructive sleep apnoea syndrome various surgical procedures such as correction of the deviated nasal septum (DNS), correction of the inferior turbinate and polypectomy can be fundamental to help the patient to better tolerate CPAP. Tonsillectomy and adenoidectomy are the most frequently used surgical procedures to treat OSA in children and are considered highly effective.25

Certain craniofacial features identified by cephalometric analysis have also been suggested as risk factors, and the correction of some of the craniofacial deformities, such as mandibular or maxillomandibular deficiency has been shown to improve OSA.

Constriction of the maxilla is suggested as a possible risk factor for OSA. Kushida et al. found that the intermolar distance of the maxilla is related to the presence of OSA. The technique of Distraction Osteogenesis was used to achieve widening of the maxilla and mandible. DO involve the generation of new bone in the stretched fracture callus between bone fragments. Karp et al. demonstrated that bone formation during DO in the maxillofacial region is similar to that of long bones, which is predominately by intramembranous ossification.31

In most cases of upper airway obstruction, the retro-palatal (velopharynx) and retro-glossal (oro- pharynx) regions are the areas that are most commonly obstructed. Few numbers of studies have shown that procedures on the tongue base, such as partial resection of the tongue and suspension, can improve AHI, symptoms, and quality of life. Considering this process alone, its success rate is only 36.6% hence the procedure should be included in a multidimensional surgical approach for selected patients.27

Advancement of the maxillomandibular complex alone or in combination with genioplasty is a powerful procedure for the relief of upper airway obstruction. They are procedures that anteriorly reposition the genial tubercles
pull the attachments of the genioglossus and geniohyoid forward and hence increase the airway space by advancing the tongue base. Various modifications of genioplasty procedures (rotational) along with hyoid suspension techniques have also been implemented for the treatment of Obstructive Sleep Apnoea.

Finally, as per recent studies tracheotomy is suggested as the most effective surgical treatment for OSA and must be held in reserve exclusively for patients with severe OSA whose life is in danger and for whom all other treatment approaches have failed.22

**Adjunctive Therapy:**

**Bariatric Surgery:** Bariatric surgery is an effective surgical method to achieve major weight loss and is indicated in individuals with a body mass index (BMI) greater than or equal to -40 kg/m2 or those with a BMI greater than or equal to -35 kg/m2 with significant co morbidities and in whom serious dietary control attempts have been ineffective. Bariatric surgery can be considered as an adjunctive in the treatment of OSA in obese patients22.

**Pharmacologic Agents:** Topical nasal corticosteroids will help in improving the AIH in patients with OSA and concurrent rhinitis, and thus may be considered as a useful adjunct to primary therapies for OSA, comorbid respiratory disease.28 A drug named Modafinil is prescribed for the treatment of excessive daytime sleepiness in OSA patients who have drowsiness despite effective PAP treatment and who lack any other identifiable cause for their sleepiness.22

**CONCLUSION**

The etiology of OSA is multifactorial, comprising of a complex interplay between anatomic and neuromuscular factors, causing upper airway collapsibility. So a multidisciplinary approach is necessary for accurate management of the disease. Future treatments for obstructive sleep apnoea are likely to be targeted to the cause of disease since the disease occurs for different reasons.

**REFERENCES**


