



OBSTRUCTIVE SLEEP APNEA AND ITS MANAGEMENT

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ABSTRACT

Obstructive sleep apnea [OSA] is a potentially serious disorder affecting millions of people around the world. Many of these individuals are undiagnosed while those who are diagnosed are not compliant with any single treatment. Behavior modifications, continuous positive airway pressure, oral appliances are the non surgical modalities of treatment. Surgical procedures like uvulopalatopharyngoplasty, maxillomandibular advancement surgery are done in the management of OSA. This review article discusses about the etiology, pathophysiology, predisposing factors, clinical features, diagnosis of OSA and also about the various treatment modalities for OSA.

KEYWORDS: obstructive sleep apnea, CPAP, UPPP, oral appliances, MMA

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INTRODUCTION

Obstructive sleep apnea (OSA) is a common condition that affects 5% of the population.¹ It is characterized by periodic reductions (hypopnea) or cessations (apnea) in breathing secondary to obstruction of the upper airway during sleep and is associated with daytime sleepiness, poor quality of life, road traffic accidents, and an increased risk of cardiovascular disease – coronary artery disease [systemic hypertension], type 2 diabetes, depression, cognitive impairment, cor pulmonale, left ventricular dysfunction, cardiac arrhythmias, stroke and premature death.^{1,2,3} There are 3 types of sleep apnea: central, obstructive and mixed. OSA, the most prevalent of all the apneas, is a disturbance in normal sleep patterns and when combined with excessive day time sleepiness is termed obstructive sleep apnea syndrome (OSAS). Due to OSA, there is blood oxygen (oxyhemoglobin) desaturation and carbon dioxide accumulation. Many treatment modalities are available for treating OSA. OSA if undiagnosed and left untreated, can result in serious complications involving cardiovascular and respiratory systems. So a thorough knowledge is necessary in evaluating the condition and choosing the prompt treatment option for the affected person.

EPIDEMIOLOGY

OSA Prevalence in middle aged persons is 4% in men and 2% in women.¹ 10% of men and 5% of women of 30-40 age groups have habitual snoring and it increases with age.

ETIOLOGY⁴

Enlarged and elongated uvula, Hyperplastic or thick soft palate, Constricted oropharynx, Macroglossia Enlarged tongue base, Prominent oropharyngeal folds, Skeletal deformities, Maxillary & Mandibular Retrognathism or hypoplasia, Receded chin, Adenoids, Obstructive tonsils, Deviated septum, Enlarged nasal turbinates, Nasal polyps or any other obstructive masses

PATHOPHYSIOLOGY⁴

Three factors that play a significant role in the development of OSA are: (i) a reduction in the dilating forces of the pharyngeal dilators, (ii) the negative inspiratory pressure generated by the diaphragm, and (iii) abnormal upper airway anatomy, the element most effectively addressed by surgery.

PREDISPOSING FACTORS

Age [>60 years]⁵, males⁶, ethnicity⁷, Obesity [main factor]⁸, family history, menopause, craniofacial abnormalities^{9, 10}, Smoking¹¹ and alcohol consumption¹², sleeping position [supine], medications [CNS depressants], anatomic block due to inflammation, infection or tumour in the upper airway. Obese patients with an increased neck circumference (collar size greater than 16-17 inches) or those with a high body mass index (BMI > 25) are potential candidates for OSAS. An increase in the thickness of the lateral pharyngeal wall is a main predisposing agent for OSA.

CLINICAL FEATURES¹³

Patients with undiagnosed or untreated OSA will have memory problems, excessive day time sleepiness [cardinal symptom], difficulty in concentrating, night drooling of saliva, depression¹⁴, irritability, xerostomia, loud snoring and gasping for breath at night [with or without arousals] , Poor work performance, occupational accidents, reduction in social interactions and other aspects of quality of life¹⁵, exacerbations of epilepsy¹⁶, asthma¹⁷, and hypertension and higher incidence of Motor vehicle accidents¹⁸ compared to healthy people.

DIAGNOSIS

Diagnostic modalities include history, clinical examination, polysomnography, oximetry , multiple sleep latency test and imaging. Nocturnal attended polysomnography, which requires an overnight stay in a sleep facility is the golden standard diagnostic modality which records sleep staging like

electroencephalography (EEG), electrooculography (EOG), electromyography (EMG), and physiological variables like sleep positioning, respiratory activity, oxygen saturations, blood pressure, and ECG. Imaging includes MRI, orthopantomogram, lateral cephalogram [skull], temporomandibular joint views.

INDICES MEASURED FOR DIAGNOSIS AND TREATMENT

Apnea is defined as the cessation of airflow—a complete obstruction for at least 10 sec—with a concomitant 2 to 4% drop in arterial oxygen saturation. Hypopnea is a reduction in airflow of at least 30 to 50% with a drop in oxygen saturation. The apnea-hypopnea index (AHI) is the average number of apneas and hypopneas per hour of sleep. The severity of OSA is classified on the basis of the patient's AHI index¹⁹ into three categories 1. Mild OSA (5 to 15 events per h), 2. Moderate (15 to 30 events per h) 3. Severe (more than 30 events per h) Epworth sleepiness scale²⁰ is a validated questionnaire indicating patient's level of day time sleepiness. Scores range from 0 to 3, and measure the likelihood of the patient dozing off while watching television, driving, or reading: 0 = would never doze, 1 = slight chance of dozing, 2 = moderate chance of dozing, 3 = high chance of dozing. 5.9 ± 2.2 – Normal individuals, 11.5 ± 4.2 – Moderate OSA, 17.5 ± 3.5 – Narcolepsy Respiratory distress index [RDI] means the average number of episodes of apnea, hypopnea, and respiratory event-related arousal per hour of sleep. An RDI of 0 to 5 is normal; 5 to 20 is mild; 20 to 40 is moderate and over 40 is considered severe. Oxygen saturation levels - normal [95 – 100%] Mallampati score²¹ – 1 to 4 predicts incidence of OSA. An individual is diagnosed to be sleep apneic if there are five or more episodes of apnea per hour, and/or decrease in oxygen saturation of at least 4% during episodes.

TREATMENT MODALITIES

Management of obstructive sleep apnea involves: i) General ii) Non-Surgical iii) Surgical modalities. Treatment options for adult patients with OSA is based on the severity of the sleep

disorder, preference of the patient, the patient's general health, and the preference and experience of the team members. Less invasive treatment options are selected wherever possible. The first and simplest option is behavior modification, followed by insertion of oral devices suited to the patient, especially in those with mild to moderate OSA. CPAP and surgical options are chosen for patients with moderate to severe OSA.

General measures

Lifestyle changes by reducing body weight^{22,23} avoidance of smoking and alcohol consumption, alteration in sleep position (30 degrees elevation of the upper body, sideways position instead of supine position), avoiding medications that relax the central nervous system (sedatives and muscle relaxants), Prescribing anti-depressant medications.

Non- surgical management²⁴

A.) Positive airway pressure

1. CPAP²⁵ - Continuous positive airway pressure is the widely used, first line golden standard treatment for moderate to severe OSA and is very effective. A breathing machine pumps a controlled stream of air through a mask worn over the nose, mouth, or both. The additional pressure holds open the relaxed muscles and enlarges the upper airway and keeps it from collapsing in the deeper stages of REM sleep.

2. VPAP or variable positive airway pressure, also known as bilevel or BiPAP, uses an electronic circuit to monitor the patient's breathing, and provides two different pressures, a higher one during inhalation and a lower pressure during exhalation. Other variants include:

3. APAP or automatic positive airway pressure, ["Auto CPAP"] 4. Nasal EPAP

B.) Oral appliances

Oral devices are basically thermoplastic materials with retainers and supports and are usually custom made. 1. Mandibular repositioning or advancement devices (MRD/MAD) which may be titratable. They

function by engaging one or both of the dental arches to modify mandibular protrusion.

2. Tongue repositioning or retaining devices (TRD), e.g., SnorEx. 3. Soft-palate lifters. 4. Tongue trainers. 5. A combination of oral appliance and CPAP in the new products deliver pressurized air directly into the oral cavity and eliminates the use of head gear or nasal mask and avoids the problems of air leaks and the claustrophobia associated with CPAP treatment. [oral pressure appliance].

Mandibular advancement devices (MAD)^{26, 27}

They work by holding the lower jaw and the tongue forward during sleep, thereby increasing the upper airway size and reduces the risk of sleep apnoea and snoring. Appliance designs are: silencer, klearway, PM positioner, thornton adjustable positioner [TAP], modified herbst, elastic mandibular advancement [EMA].

Indications

Mild to moderate OSA and patients who do not exceed 25-50% of their ideal body weight, Upper airway resistance syndrome with snoring and mild OSA, Mandibular retrognathia, Patient refuses surgery, Patients who are at poor surgical risk, medically compromised, or elderly and non compliant with CPAP.

Contraindications

Severe periodontal disease, TMJ disorders, Painful masseter muscles, Incomplete dentition which compromises retention of the appliance, Atrophic edentulous ridges, Severe hypoxemia, Severe OSA, Growing children, restricted mouth opening. The main advantages of using oral appliances are that there is good patient compliance and the appliances are noninvasive and relatively inexpensive; they can also be easily carried anywhere by the patient. Complications include Dental malocclusion, TMJ pain, TMJ Dislocation, excessive salivation, tongue dryness, tooth pain, posterior open bite, and insomnia.

Surgical management^{28, 29, 4}

A) Tracheostomy²⁸

Permanent Tracheostomy was used earlier as it decreases the OSA symptoms. It is rarely used

now as first line treatment because of disadvantages like speech problems, aesthetic disfigurement, tracheal stenosis and blood vessel erosion.

B) Midline laser glossectomy

C) Uvulopalatopharyngoplasty (UPPP)³⁰

UPPP, as first described by Fujita, in 1981 a procedure that enlarges the retropalatal airway through excision of tonsils if present, trims and reorients the posterior and anterior tonsillar pillars, and excises the uvula and posterior portion of the palate. Wolford's modification of the original technique resulted in less postoperative complications.

D) Laser assisted Uvuloplasty (LAUP)

This is an outpatient procedure to enlarge the retropalatal airway, in which the uvula and posterior margin of the soft palate are ablated with carbon dioxide laser through series of incisions.

E) Uvulopalatopharyngoglossoplasty (UPPGP)

F) Maxillo-mandibular Advancement (MMA) surgery⁴

It is the first line treatment in patients with jaw abnormalities with hypopharyngeal and/or velo-orohypopharyngeal narrowing, which usually occur with co-existent skeletal hypoplasia, and may clinically manifest as retrognathia. It is a multilevel skeletal surgery designed to enlarge the velo-orohypopharyngeal airway without direct manipulation of the pharyngeal tissues. It advances the anterior pharyngeal tissues (soft palate, tongue base, and suprahyoid musculature) attached to the maxilla, mandible and the hyoid bone, and is accomplished by 10-15 mm advancement of maxilla by Le Fort I osteotomy and BSSO- Bilateral sagittal split osteotomy of mandible. The tension of muscles of lateral pharyngeal walls are increased thereby preventing its collapse. The results are very good with success rates upto 96%.^{31, 32, 33}

G) Other adjunctive surgical therapies^{29, 4}

Anterior mandibular osteotomy with genioglossus advancement, anterior

mandibular osteotomy with inferior border advancement (genioplasty), reduction glossectomy (in cases of macroglossia), Lingualplasty, nasal reconstruction (Procedures such as nasoseptoplasty, nasal turbinectomies, columella narrowing, enlargement of the luminal valves, nasal polypectomies, and reconstruction of external cartilage and bone are indicated for correction of nasal airway obstruction), tonsillectomy and adenoidectomy (to eliminate hypertrophied tonsillar and adenoid tissue obstructions from the airway) soft palatal implants, microimplant mandibular advancement therapy [MiMA], upper airway radiofrequency ablation [RFA].If necessity arises one or many of the above mentioned surgeries can be done in the patient simultaneously [multi-level simultaneous surgery], or in phases [multi-level phased surgery].

OSA in children⁴

In children with at least mild adenotonsillar hyperplasia, adenotonsillectomy is the first-line surgical treatment. For patients with craniofacial anomalies such as the apert's, and crouzon's syndrome, down's syndrome, pierre-robin syndrome, surgical procedures including tongue reduction, labioglossopexy, distraction osteogenesis and even tracheostomy are utilized for airway management. Children who are diagnosed with attention deficit hyperactivity disorder (ADHD) may actually have attention problems in school because of disrupted sleep patterns caused by obstructive sleep apnea.

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CONCLUSION

OSA is an asymptomatic chronic condition which often remains unnoticed in the early stages. Prompt and early diagnosis of the condition will help to reduce the severity of the symptoms in patients. Patient is usually unaware of this problem and family members play a vital role in giving history about the patient's condition. Dentist plays an important role in identifying OSA. When intravenous sedation for dental treatment is given, repeated apneic events may occur in patients with OSAS. Many treatment modalities are available but it must be individualized for each and every patient according to the level of obstruction in the upper airway. Behaviour modifications are advised and CPAP is the first line of treatment and is highly effective. Oral appliances are non-invasive and achieve good outcomes in suitable patients. Soft tissue [palatal-pharyngeal] surgical procedures are not very successful and present with complications when compared to MMA.³⁴ Maxillomandibular advancement surgeries are becoming popular due to higher rate of success, lesser complications and are also aesthetically pleasing.^{33, 34} Instead of a single surgical procedure two or more procedures may be needed for treating OSA. Dental professionals, particularly orthodontists and oral surgeons play an important role in the management of OSA.³⁵ Treatment of a patient with OSA not only improves the physical health of the patients, but also the mental and social well-being.

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