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Obstructive Sleep Apnoea - A Review

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Abstract
Obstructive sleep apnoea syndrome (OSAS) is characterized by recurrent episodes of partial or complete upper airway obstruction during sleep. This manifests as a reduction (hypopnoea) or complete cessation (apnoea) of airflow despite ongoing inspiratory efforts resulting in oxygen desaturation and arousals. Daytime symptoms such as excessive sleepiness are thought to be related to sleep disruption (repetitive arousals) and possibly to recurrent hypoxemia. It is a relatively common condition occurring in 2 to 4 % of males and 1 to 2 % of females in middle age. There are many causes of OSA like obesity, age, enlarged tonsils, narrower natural throat form, smoking and alcohol use etc. The severity of OSA must be established in order to make an appropriate treatment decision.

Key word: *Obstructive sleep apnoea, sleep disruption, breathlessness, snoring*

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I. Introduction

Sleep is common not only to humans but also to all the living creatures of this world. It is defined as the natural periodic suspension of consciousness during which the powers of the body are restored, characterized by lessened consciousness and slowed down metabolism. Sleep soothes and restores us after a long day of work and play.

During sleep, the muscles relax causing soft tissues in the back of throat to collapse, hence decreasing the size and stiffness of the airway. But in some people, this muscular laxity increases to such an extent that the tongue falls backwards, towards the posterior pharyngeal wall and causes obstruction to airflow. The obstruction to airflow may be partial or complete, leading to snoring, partial reductions of airflow and complete pauses in breathing during sleep. Most pauses last between 10 and 30 seconds, but some may persist for one minute or longer. This can lead to abrupt reductions in blood oxygen saturation, with oxygen levels falling as much as 40 percent or more in severe cases. The brain responds to the lack of oxygen by alerting the body, causing a brief arousal from sleep that restores normal breathing. This pattern can occur hundreds of times in one night. The result is a fragmented quality of sleep that often produces an excessive level of daytime sleepiness[1,2]

II. History Of Sleep And Normal Features Of Sleep

Sleep is a complex neurological state, with its primary function of providing rest and restoring the body's energy levels. The importance of sleep could be seen from the fact that people spend about one-third of their lifespan in sleep. Normal human sleep is divided into non–rapid eye movement (NREM) and rapid eye movement (REM) sleep, and the alteration between NREM and REM occurs about 4-5 times during a night of normal sleep. [3,4]

There are differences in sleep patterns in various parts of the world and in different times in history. Traditions, values, local conditions and environment influence sleep practices and attitudes. Every culture has different concepts about sleep. The rishis of India described sleep as a state of waking consciousness and dreaming. [5,6]

Upper airway is a collapsible compliant tube. As such it has to be able to withstand suction pressures generated by rhythmic contractions of diaphragm that sucks air into the lungs. This is accomplished by the rhythmic contractions of upper airway muscles such as genioglossus (tongue) and the hyoid muscles. In addition to the rhythmic innervation from the respiratory center in the medulla oblongata, the motoneurons controlling the muscles also receive tonic innervations that sets a baseline level of stiffness and size. Thus, this

tube is kept patent by various protective reflexes and normal tone of the surrounding muscles. [7,8]

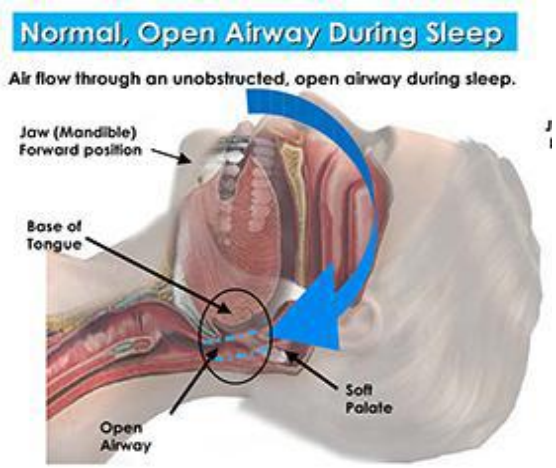

Figure 1- Normal airway during sleep

III. Pathology Of Sleep

Muscular laxity increases to such an extent that the tongue falls backwards, towards the posterior pharyngeal wall and causes obstruction to airflow. The obstruction to airflow may be partial or complete, leading to snoring (due to vibrations of the soft palate by passage of air through the narrowed airway), partial reductions of airflow (hypopnoea) and complete pauses (apneas) in breathing during sleep. Most pauses last between 10 and 30 seconds, but some may persist for one minuteor longer. This can lead to abrupt reductions in blood oxygen saturation, with oxygen levels falling as much as 40 percent or more in severe cases. The brain responds to the lack of oxygen by alerting the body, causing a brief arousal from sleep that restores normal breathing. This pattern can occur hundreds of times in one night. The result is a fragmented quality of sleep that often produces an excessive level of daytime sleepiness.[1] This condition is known as Obstructive sleep Apnoea. [9,1]

The cardinal features of OSA are snoring, sleep apnoea (usually reported by family members) and sleepiness during daytime that results in occupational deficits and an increased risk of automobile accidents.[6] Central Sleep Apnoea (CSA) is often caused by medical problems and conditions that affect the brainstem. People with heart ailments such as atrial fibrillation, congestive heart failure, stroke or tumors of brain are at greater risk. These different causes often lead to varying symptoms.[7] Mixed Sleep Apnoea / Complex Sleep Apnoea: is a combination of both obstructive and central sleep apnoea symptoms.

Snoring is the vibration of respiratory structures which lead to the noisy breathing due to the obstructed air movement while sleeping. It may occur on regular basis or intermittently. Hypopnea or hypopnoea is overly shallow breathing or an abnormally low respiratory rate. **Sleep apnea** also spelled **sleep apnoea,** is a sleep disorder characterized by pauses in breathingor instances of shallow breathing during sleep. Each pause, called apnea can last for a few seconds to several minutes. Sleep apnoea among the population, it can be classified into three main types (based on the cause of apnoea) [11]

A. OBSTRUCTIVE SLEEP APNOEA (OSA)

The obstructive sleep apnoea-hypopnea (OSAH) syndrome is defined as a patient sufferingfive or more apneas / hypopneas per hour of sleep with daytime symptoms, and is a relatively common condition occurring in 2 to 4% of males and 1 to 2 % of females in middle age. However, it is believed that only about 10% of people with OSA seek treatment leaving the majority of OSA sufferers undiagnosed. Estimates of OSAS prevalence in Asian population are similar (2-4%). It is likely that apart from obesity, other strong risk factors such as craniofacial features and ethnicity may be contributory to high prevalence of OSA in Asian population. Only two community-based prevalence studies have been done from India so far. The first conducted in a small sample of semi urban population in Delhi revealed that at least 13.7% and 3.8% of middle-aged Indian adults have OSA and OSAS, respectively. The symptoms range from nocturnal, snoring, awakening, choking, excessive sleepiness, mood swings, cognitive effect, insomnia, libido [12-15]

CLASSIFICATION OF OBSTRUCTIVE SLEEP APNEA

The American Sleep Disorders Association Arbitrarily classifies OSA: -

- Mild AHI: 5-15 events per hour.
- Moderate AHI: 15-30 events per hour.
- Severe AHI:> 30 events per hour.

B. CENTRAL SLEEP APNEA (CSA)

It occurs when the brain fails to signal the muscles responsible for controlling breathing. Unlike obstructive sleep apnoea, which is a mechanical problem, central sleep apnea is more of communication problem. CSA is much less common than obstructive sleep apnea. Some estimates claim that approximately 20% of sleep apnea cases are CSA, but many others believe that number to be much lower. CSA is often caused by medical problems and conditions that affect the brainstem. These different causes often lead to varying symptoms and different types of central sleep apnea.[7]

The symptom ranges from: Breathlessness or irregular breathing during sleep, Shortness of breath leading to awakenings, Excessive daytime drowsiness, Mood changes, Snoring, Chronic fatigue, and Difficulty in concentrating, Poor/Restless Sleep.

C. MIXED SLEEP APNEA / COMPLEX SLEEP APNEA

Mixed sleep apnea is a combination of both obstructive and central sleep apnea symptoms. Some patients being treated for obstructive sleep apnea with the use of CPAP machines develop symptoms of central sleep apnea upon PAP therapy.[7] This phenomenon had long been noticed in sleep laboratories, but had not been previously researched. In 2006 researchers from the Mayo Clinic conducted a study of223 sleep apnea patient and found that 15% of sleep apnea patients who were believed to have OSA in fact had mixed sleep apnea.[4]

During the Continuous Positive Airway Pressure (CPAP) treatment for the patients believed to have OSA, the patient's airways were successfully splinted open and free from obstructions, but the patients continued to have difficulty in breathing while asleep. Their symptoms of OSA shifted to symptoms of CSA while CPAP therapy wasbeing administered. [16]

Sleep disordered breathing is a term which includes simple snoring, upper airway resistance syndrome (UARS) and sleep apnea

IV. Investigations

1. **Radiographs**

Radiographic studies that have been found to be useful include lateral neck films that can demonstrate Aden tonsillar hypertrophy and some other airway lesions. The significant advantages of cephalometry are its easy access, low cost and minimal radiation. [17]

2. **Computed tomography (CT)**

CT scan has high spatial resolution and provides tomographic images, it is often used to diagnose pharyngeal obstruction.

However, CT provides only axial images and cannot image the entire pharyngeal airway in a single plane. It has been reported that on computed tomography examination reduced pharyngeal size correlated with increased sleep disordered breathing rates, and more severe nocturnal desaturations. The drawbacks to computed tomography are radiation exposure, expense and that it is a non-dynamic study. [18,19]

3. **Magnetic resonance imaging (MRI)**

It is a non-invasive modality that allowsexamination of the entire pharynx in multiple planes and in a short time, with no radiation exposure as compared to CT. It provides good temporal and a high contrast resolution. A single excitation is used to obtain mid-sagittal and axial projections during trans nasal shallow respiration at rest, simulation of snoring. In past, sedation was required for the evaluation of sleep apnoea.

4. Objective testing

The severity of OSA must be established in order to make an appropriate treatment decision. [20-22] No clinical model is recommended to predict severity of obstructive sleep apnea; therefore, objective testing is required. Two main methods of objective testing include: -

In-laboratory polysomnography (PSG) and

Home testing with portable monitors (PM).

5. Polysomnography

Polysomnography (PSG) is a type of sleep study, a multi parametric test used in the study of sleep. The test result is called a polysomnogram. Polysomnography is a recording of biophysiological changes that occur during sleep. It is usually performed at night when most people sleep.[23] The polysomnography is used to diagnose many types of sleep disorders including narcolepsy, idiopathic hypersomnia, parasomnias and sleep apnea. Although it is not directly useful in diagnosing circadian rhythm sleep disorders, it maybe used to rule out other sleep disorders. It requires recording the following physiologicsignals.[24]

V. Treatment Plan

The sleep specialist should review the results of objective testing with the patient, including education on the nature of the disorder and treatment options. Components of patient education programs include-

- Findings of study, severity of disease
- Pathophysiology of OSA
- Explanation of natural course of disease and associated disorders
- Risk factor identification, explanation of exacerbating factors, and risk factor modification.
- Treatment options
- What to expect from treatment?
- Genetic counseling when indicated
- Consequences of untreated disease
- Outline the patient's role in treatment, address their concerns, and set goals
- Drowsy driving/sleepiness counseling
- Patient quality assessment and other feedback regarding evaluation

General OSA Outcomes Assessment should include: -

Resolution of sleepiness

Patient and spousal satisfaction

OSA specific quality of life measures

Avoidance of factors worsening disease.

Obtaining an adequate amount of sleep

Adherence to therapy

Practicing proper sleep hygiene

Weight loss for overweight/obese patients

Selection of treatment(s) for individual OSA patients should be based upon balanced consideration of disease severity and site(s) of obstruction, subjective symptoms, risks morbidity and mortality and patient choice.

Treatment effectiveness is variable and dependent on patient needs. It is believed that treatment must be

evaluated over time for good patient outcome.

A) NONSPECIFIC THERAPY

These measures should be included in the treatment of all patients with OSA but shouldbe used exclusively only in patients with very mild apnea whose main complaint is snoring.

1. Overweight persons can benefit from losing weight. Even a 10 percent weight loss can reduce the number of apneic events for most patients.[14]

2. Individuals with apnea should avoid the use of alcohol for 4-6 hours prior to bedtimeand sleeping pills, which make the airway more likely to collapse during sleep and prolong the apneic periods.[25]

3. Positional therapy can be used to treat patients whose OSA is related to body positioning during sleep. There are several strategies which can help patients who have mild apnea when lying on their back. Positional pillows can be used to assist in sleeping on the side. Positional therapy has its limits, but it has been tried with success in some patients.[26]

B) SPECIFIC THERAPY

The specific therapy for sleep apnea is tailored to the individual patient based on medical history, physical examination and the results of polysomnography.[23] Medications are generally not effective in the treatment of sleep apnoea.

Historically, surgical procedures for OSA treatment have included intranasal procedures, reduction glossectomies, uvulopalatopharyngoplasty procedures and tracheostomy.[27]

VI. Conclusion

The rising trend of modern civilization to compete for better living and the people with obesity will probably make obstructive sleep apnea an increasingly important public healthproblem, especially in view of the neurocognitive and cardiovascular sequelae associated with this disorder. Furthermore, although CPAP has been established as the treatment of choice for sleep apnoea syndrome on the basis of randomized controlled trials andimprovements in our understanding of the underlying mechanisms of sleep apnea will hopefully lead to improved therapeutic strategies, oral appliances are widely prescribed forthe treatment of Oral Sleep Apnoea – Hypopnea (OSAH) syndrome, both as primary therapy and as an alternative to patients who are unable to tolerate CPAP.

There are currently a large number of different Oral appliances available for its treatment. Review of various trials on effectiveness of Oral appliances suggests that they are effective in improving subjective sleepiness and indices of sleep disordered breathing in selected patients with OSAH are less effective than CPAP in improving indices of sleep disorderedbreathing but certain patients prefer them. Despite considerable variation in the designs ofthese appliances, the clinical effects are remarkably consistent. Snoring is improved in almost all patients and is often eliminated. Approximately half of those patients who improve achieve an AHI OF <20 but as many as 40 % are left with notably elevated AHIs. Sleep is generally improved although significant sleep disturbance persists in the patients with residual apnea. Limited follow up data indicate that oral discomfort is a common but tolerable side effect, that dental and mandibular complications appear to be unknown and that long term compliance varies from 50% to 100% of patients.

Comparison of the risks and benefits of oral appliance therapy with those of other available treatments suggests that oral appliances present a useful alternative especially for patients with simple snoring and others with moderate OSA who cannot tolerate nasal CPAP. Orthodontists have a major role to play in sleep apnea treatment as the oral appliances prove to be a simpler alternative to CPAP. They are often considered by patients to be a more acceptable treatment modality compared to CPAP as they are quiet, portable, economical and do not require a power source. The newer techniques enable the Orthodontists to often modify the position of the mandible within the restricted mobility defined by the temporomandibular joint (TMJ) and the pterygoid muscles. However more studies are needed to define the therapeutic role of oral appliances in the spectrum of sleep disorders related to upper airway obstruction.

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