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REVIEW ARTICLE

OBSTRUCTIVE SLEEP APNEA: A REVIEW

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ABSTRACT

Obstructive Sleep apnea is the most common type of sleep apnea caused by complete or partial obstructions in the upper airway. It is characterized by repeated episodes of shallow or slow breathing during sleep, despite the effort to breathe, and is generally associated with a reduction in blood oxygen saturation. These episodes of reduced breathing, called "apneas" (literally, "without breathing"), usually last between 20 and 40 seconds. Obstructive sleep apnea (OSA) is a common medical condition associated with considerable morbidity and is recognized and diagnosed more frequently. Patients with OSA are generally overweight and, in general, have a long history of excessive Russians and daytime sleepiness and associated obesity. The diagnosis is established with polysomnography (PSG), although the decision about who should be sent to a sleep laboratory must be individualized, especially for those patients whose main complaint is snoring. The most important factor in the pathogenesis of OSA is a narrow and flexible pharyngeal airway. Among the various treatment modalities available today, the most successful is the application of continuous positive airway pressure (CPAP) during sleep

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INTRODUCTION

Almost twenty years ago, obstructive sleep apnea was considered a medical curiosity of little importance, and snoring was only the subject of humor instead of serious investigation. Obstructive sleep apnea syndrome (OSAS) is a serious medical condition characterized by repeated partial or complete upper airway obstruction during sleep. 1. OSAS is the most common condition evaluated in the disorders. of sleep and has higher rates. High morbidity and mortality compared to any other sleep disorder. OSAS is associated with hypertension, increased risk of congestive heart failure, coronary heart disease and myocardial infarction 2. OSAS also has immediate health consequences, such as excessive daytime sleepiness (EDS), which in turn can affect cognitive functioning and vigilance 3. An often cited illustration of the possible short-term impact of EDS associated with apnea of sleep, involves the seventh highest rate of motor vehicle accidents involving people with OSAS 4.

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A recent study on the replication of sleep-related accidents in patients with sleep apnea concluded that people with sleep apnea syndrome moderate have a 15 times greater risk of car accidents than normal revisions 5.Obstructive sleep apnea (OSA, in short) is a prevalent condition in close association with obesity worldwide, and is characterized by repetitive, partial or complete collapse of the upper airway during sleep, causing alterations in exchange disorders of gas and sleep. It is the most common form of breathing disorders in sleep (SDB) worldwide, as demonstrated in indifferent epidemiological studies. There is more evidence that OSA is an independent risk factor for the cardio-metabolic-adverse profile6, and has been associated with increased cardiovascular and cardiovascular morbidity and mortality, although much of the card and causal mechanisms are I am not understood yet. The hypothesized link between OSA and cardiovascular disease is complex, and the underlying interactions of pathophysiological mechanisms in the SDB involve the interactions of various metabolic risk factors. Other health consequences of OSA are also important: excessive daytime sleepiness, cognitive dysfunction, poor work performance, anxiety, difficulty in personal relationships and an increased risk of fatal and non-

fatal road accidents leading to loss of life and huge economic burden in our modern8 world. Despite recent advances in diagnostic technology in the field of sleep medicine and the sensitization of OSA in the public, most of those affected have not yet been diagnosed 9. Obstructive sleep apnea syndrome (OSAS), which is caused by a complete or partial obstruction of the upper airway producing apnea or hypopnea, is a sleep disorder characterized by repetitive cessation of breathing occurring during sleep or as absence of breathing for 10 seconds or more despite an effort to breathe.

Obstructive sleep apnoea–hypopnoea syndrome definition[10]
An individual has obstructive sleep apnoea–hypopnoea syndrome when he or she fulfils criterion A and/or B, plus criterion C:

A. Excessive daytime sleepiness that is not better explained by other factors.
B. Two or more of the following that are not better explained by other factors;

- choking or gasping during sleep
- recurrent awakenings from sleep
- unrefreshing sleep
- daytime fatigue
- impaired concentration

C. Overnight monitoring demonstrates five or more obstructed breathing events per hour during sleep.

History

From the age of renaissance, Shakespeare described an affliction similar to sleep apnea. In the play *Henry IV,* the character Falstaff in one scene is described to be fast asleep, snorting like a horse and then having to fetch his breath. [13] Another contemporary writer, Cervantes, used snoring as a characteristic of a good sleep in his work *Don Quixote*. Here, Sancho Panza is described as fat, a good sleeper and a habitual heavy snorer in contrast to the insomniac Don Quixote**.**[14] Some centuries later Charles Dickens, in the *Posthumous Papers of the Pickwick Club,* gave a very detailed description of the loudly snoring fat boy Joe who suffered from somnolence, very much like many of today's patients referred for evaluation of OSA. From a modern medical perspective the first known descriptions of OSA date from the second half of the 19th century. [15]

Lavie tells that the first description of what probably was mixed sleep apnea was published by Broadbent in 1877, that Caton in 1889 presented *A case of narcolepsy* which most likely was a case of Sleep-disordered breathing, and that another case, similar to Catons, was described by Morison later the same year. Then, in 1889 the term *Pickwickian* was coined by Heath (the term borrowed from Charles Dickens) to describe the overweight patient suffering from breathing difficulties during sleep presented by Caton earlier the same year**.**[16] After that, obstructive Sleep-disordered breathing seems to have been more or less forgotten during the first half of the 20th century. In 1965 Gastaut *et al.* (1965)[17] devised the first polysomnographic recording to objectively showed the occurrence of repeated apneas during sleep in so called *Pickwickian* patients. In 1967, Schwartz and Escande[18] were able to show by cineradiography that the site where the apneas occurred was located in the upper airway. Fortunately for today's patients, the last 30 years have seen a tremendously increasing interest in Sleep-disordered breathing and today the search terms "sleep disordered breathing" yields more than 20000 hits on the PubMed website.

Sleep cycle

- **Stage 0** (Awake) From lying down to falling asleep and occasional nocturnal awakenings; constitutes 1-2% of sleep time. EEG shows α activity when eyes are closed and β activity when eyes are open. Eye movements are irregular or slow rolling.
- **Stage 1** (dozing) α activity is interspersed with θ waves. Eye movements are reduced but there may be burst of rolling .neck muscles relax .occupies 3-6% of sleep time.
- **Stage 2** (unequivocal sleep) θ waves with interspersed spindles, K complexes can be evoked on sensory stimulation; little eye movement; subjects are easily arousable. This comprises 40-50% of sleep time.
- **Stage 3** (deep sleep transition) EEG shows θ, δ and spindle activity, K complexes can be evoked with strong stimuli only. Eye movements are few; subjects are not easily arousable; comprises5-8% of sleep time.
- **Stage 4** (cerebral sleep) δ activity predominates in EEG, K complexes cannot be evoked. Eyes are practically fixed; subjects are difficult to arouse. Night terror may occur at this time. It comprises 10-12% of sleep time.

During 2,3 and 4 heart rate, BP and respiration are steady and muscles are relaxed. Stages 3 and 4 together are called slow wave sleep (SWS). REM sleep (paradoxical sleep) EEG has waves of all frequency, K complexes cannot be elicited. There are marked, irregular and darting eye movements; dreams and nightmares occur which may be recalled if the subject is aroused. Heart rate and BP fluctuate; respiration is irregular. Muscles are fully relaxed, but irregular body movements occur occasionally. Erection occurs in males. About 20-30% of sleep time is spent in REM. Normally stages 0 to 4 and REM occur in succession over a period of 80-100 min. the stages 1-4 REM are repeated cyclically.

Classification

Central sleep apnea, obstructive sleep apnea, and mixed sleep apnea are the variations of apnea that occur in the syndrome. In central sleep apnea, respiratory muscle activity ceases simultaneously with airflow at the mouth and nostrils. [19,20] This disorder is found in patients with central nervous system (CNS) insufficiency that affects the outflow of neural output from the respiratory center to the diaphragm and other muscles of respiration. CNS disorders associated with central sleep apnea include brainstem neoplasms, brainstem infarctions, bulbar encephalitis, bulbar poliomyelitis, spinal surgery, cervical cordotomy, and primary idiopathic hypoventilation. [19] Patients with central sleep apnea have been treated with some success by using respiratory-stimulating drugs such as theophylline, progesterone, and acetazolamide. In severe central apnea, modalities of treatment have included phrenic nerve pacemaker implantation to ensure regular respiration during sleep and nocturnal mechanical ventilation with a negative pressure ventilator for more severe cases. [19] There are no simple and convenient methods of treatment for mild central apnea. The most common type of sleep apnea by far is obstructive sleep apnea. This is characterized by sleep-induced obstruction of the upper airway that results in cessation of airflow with preservation of respiratory effort, respiratory

center drive, and diaphragmatic contraction. [19] Mixed sleep **apnea** is a combination of central and obstructive apnea. This pattern begins with an episode of central apnea with no airflow detectable at the mouth and nostrils and no respiratory muscle activity. The pattern ends with an episode of obstructive apnea with only cessation of airflow at the mouth and nostrils.[19,20]

Etiology: The major risk factors for OSA include advanced age, male sex and obesity, although the underlying mechanisms remain unclear. It has been proposed that the pathophysiological pathways linking these risk factors for OSA can be explained by anatomical abnormalities, increased pharyngeal dilator muscle dysfunction, lowered arousal threshold, increased ventilatory control instability, and / or reduced lung volume.[21]

- ***Age***: The increased prevalence of SDB breathing in the elderly appears to plateau after 65 yr[22], it is estimated to be 10 per cent. Mechanisms proposed for the increased prevalence of sleep apnoea in the elderly include increased deposition of fat in the parapharyngeal area, lengthening of the soft palate, and changes in body structures surrounding the pharynx.[23]
- ***Sex***: It is not clear why OSA is more common in men than women. It can be attributed to anatomical and functional properties of the upper airway and in the ventilatory response to the arousals from sleep[24]. Imaging studies have revealed that men have increased fat deposition around pharyngeal airway as compared with women. Interestingly, in post-menopausal women taking hormonal replacement therapy, the prevalence of OSA is similar to premenopausal women[25]. It would be of great interests to understand why female hormonal status may protect against the development of OSA in premenopausal women. [26]
- ***Obesity***: Obesity / visceral obesity is the major risk factor for the development of OSA, it is thought to be associated with anatomic alterations that predispose to upper airway obstruction during sleep, by increasing adiposity around the pharynx and body. Central obesity has been associated with reduction in lung volume, which leads to a loss of caudal traction on the upper airway, and hence, an increase in pharyngeal collapsibility. In addition, subjects with severe obesity, BMI of >40, the prevalence of sleep apnoea was markedly increased to 40-90 per cent.[29] It was well demonstrated that a 10 per cent body weight reduction was associated with a parallel 26 per cent decrement in AHI.[30] Thus, weight reduction is an important conservative treatment for sleep apnoea.
- ***Family history and genetic predisposition***: Familial aggregation and genetics factors are thought to play a role in the development of OSA. First degree relatives of those with OSA increases the relative risk compared to those without OSA by 1.5 -2.0, and familial susceptibility to OSA increases directly with the number of affected relatives.[31,32] Obesity is closely associated with OSA and itself aggregates in families, so it is possible that familial aggregation of OSA is related to the genetics of obesity. Besides, apolipoprotein E (APOE) is particularly associated with OSA in younger subjects, the odds ratio for subjects with this allele who are < 65 yrs of having an AHI > 15 is 3.1.[33]
- ***Craniofacial abnormalities***: The structural factors in the upper airway may alter its mechanical properties. Differences in craniofacial morphology may explain some of the variation in risk for OSA in different ethnic groups. Craniofacial abnormalities are important in the pathogenesis of OSA, particularly in non-obese patients.[35]
- ***Smoking and alcohol consumption***: Cigarette smoking and alcohol have been shown to be risk factors for OSA. Smoking is associated with a higher prevalence of snoring and sleep-disordered breathing.[36,37] In Winconsin Sleep Cohort Study, current smokers had a much greater risk of moderate or worse degree of OSA (odds ratio, 4.44) compared with never smokers.[38] It can well be explained by the cigarette induced airway inflammation and damage which could change the structural and functional properties of the upper airway, and increasing the risk of collapsibility during sleep.
- ***Nasal Congestion***: The importance of the role of nasal congestion in OSA is indicated by the increased frequency of snoring and sleep apnea as related to seasonal rhinitis when symptomatic, as opposed to symptom-free. Understanding the role of allergy-related nasal congestion is of particular importance, because this condition can be diminished by desensitization, allergen avoidance, or pharmacologic therapy.[40–]Although the studies highlight a role for surface tension in OSA pathogenesis, the clinical relevance of surface tension in OSA remains less certain.[45-47]

- ***Anatomic Factors***; It is commonly assumed that obesity with enlargement of the soft tissue structures in the upper airway is the predominant mechanism of OSA. The exact location of collapse varies in different individuals, the main reason for failure of various surgical procedures or devices fabricated to treat OSA (Fig. 1). Comprehensive clinical examination and radiographic analyses using panoramic and cephalometric studies, computerized tomography, and magnetic resonance imaging have demonstrated that there are many skeletal and soft-tissue structural differences between individuals with and without OSA during wakefulness. Although the retropositioning of the tongue is one of the most common features of patients with OSA, the dimension of pharyngeal lumen and the elongation of the uvula and soft palatal draping also seem to play important roles (Fig. 2). One should distinguish the causes of snoring and OSA that may be common but are limited to less anatomic factors. Snoring intensity could be significantly reduced by combined procedures performed on the soft palate, such as laser-assisted uvulopalatopharyngoplasty (LA-UPPP), and nasal turbinate and septal procedures, such as radioablation and septoplasty.[48-] Reduction of tonic and phasic contractions of the muscles during sleep has been well demonstrated.

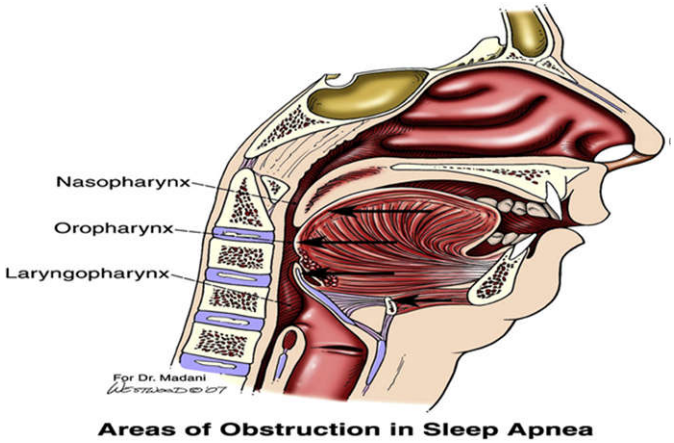


Fig. 1.

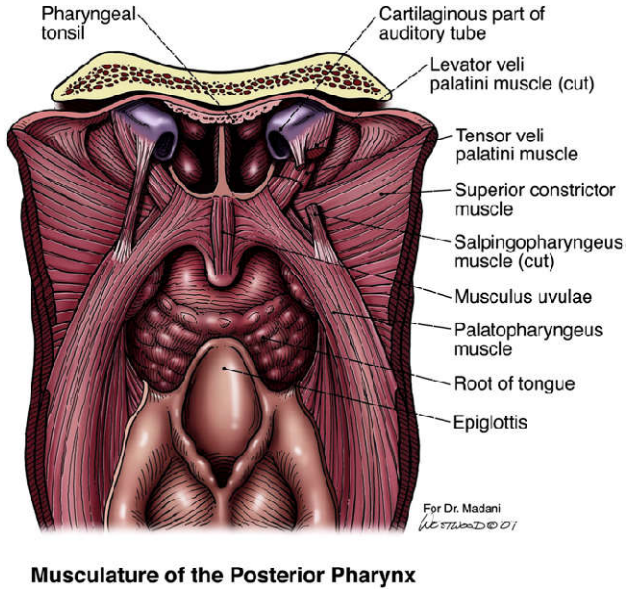


Fig. 2.

Physical Examination: For each patient, the clinician should perform a comprehensive head and neck examination and assess the respiratory, cardiovascular, and neurologic systems. The tonsils, tonsillar pillars, tongue, uvula, soft palate and hard palate can be assessed by direct examination and the anatomic findings can be graded, using the Friedman Staging System (FSS).The FSS (Table 1) consists of three components of evaluation including (1) Friedman palate position (FPP) (Fig. 4)), (2) tonsil size (Fig. 5), and (3) BMI. [54]

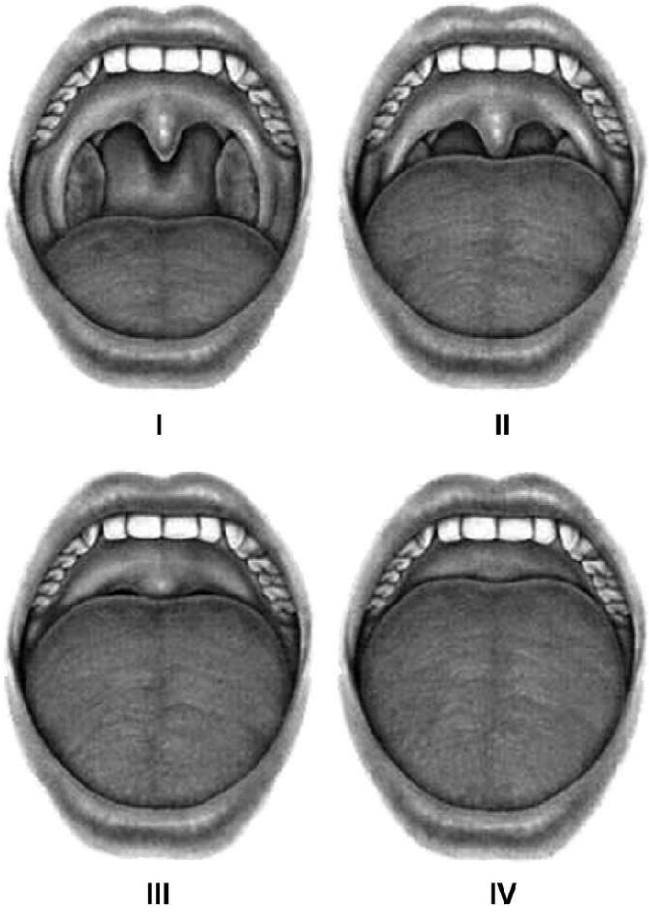


Fig. 4.

Fig. 4. The Friedman palate position is based on visualization of structures in the mouth with the mouth open widely without protrusion of the tongue. Palate grade I allows the observer to visualize the entire uvula and tonsils. Grade II allows visualization of the uvula but not the tonsils. Grade III allows visualization of the soft palate but not the uvula. Grade IV allows visualization of the hard palate only. (From Friedman M, Ibrahim H, Joseph NJ. Staging of obstructive sleep apnea/hypopnea syndrome: a guide to appropriate treatment. Laryngoscope. Mar 2004;114(3):455).

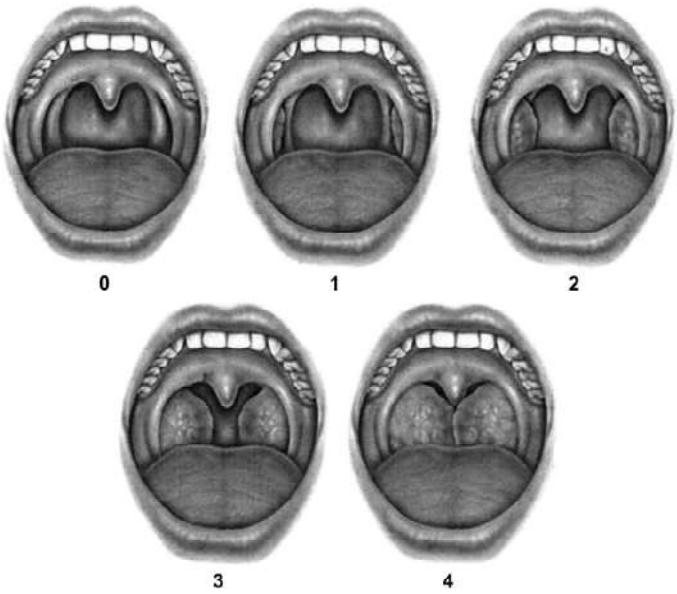
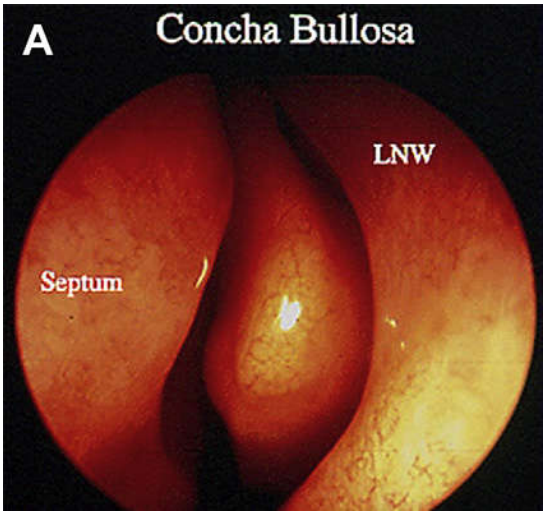
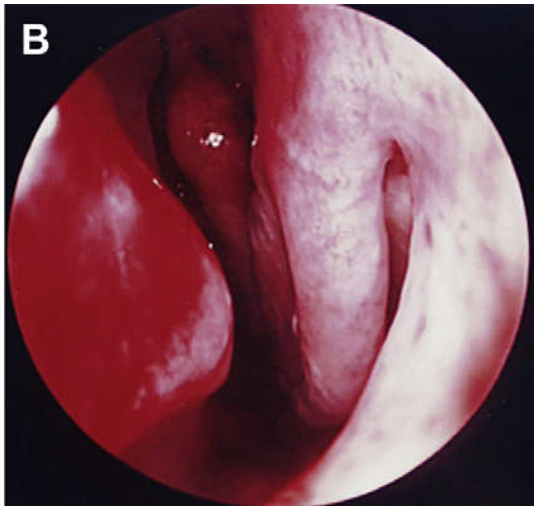


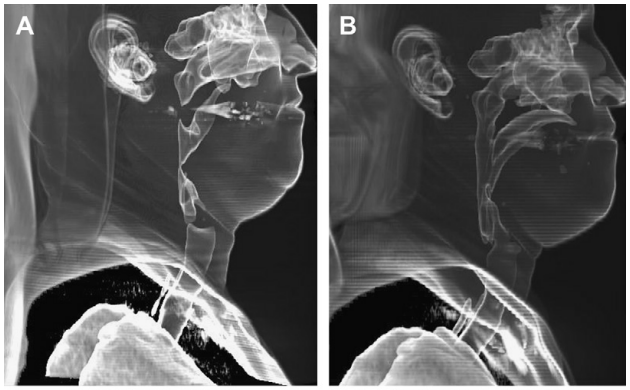
Fig. 5.

Fig. 5. Tonsil size is graded from 0 to 4. Tonsil size 0 denotes surgically removed tonsils. Size 1 implies tonsils hidden within the pillars. Tonsil size 2 implies the tonsils extending to the pillars. Size 3 tonsils are beyond the pillars but not to the midline. Tonsil size 4 implies that tonsils extend to the midline. (From Friedman M, Ibrahim H, Joseph NJ. Staging of obstructive sleep apnea/hypopnea syndrome: a guide to appropriate treatment. Laryngoscope. Mar 2004;114(3):455).

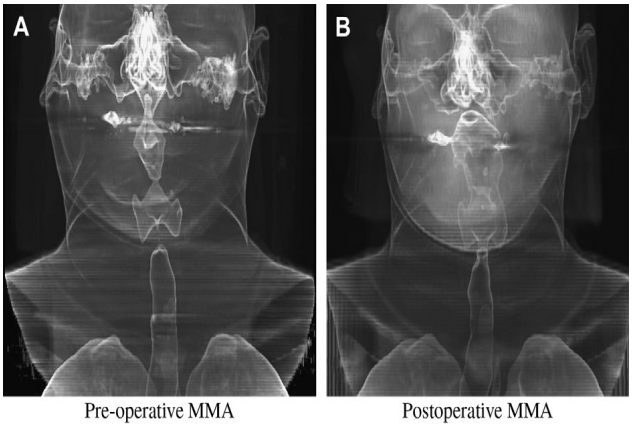
Imaging: Upper airway imaging modalities primarily include nasopharyngoscopy, cephalometrics, computed tomography (CT), and magnetic resonance imaging (MRI). These imaging modalities have been used to study the effect of respiration, weight loss, dental appliances, and surgery on the upper airway. MRI and CT allow quantification of the airway and surrounding soft tissue structures in three dimensions.[58] In recent years, sleeping fiber optic endoscopy has been applied as an effective method to locate the obstruction site. This also can be a disturbance to normal sleep, however, and sometimes is refused by examinees. Most sleep centers do not perform nocturnal endoscopy routinely. Because most patients prefer radiological examinations, high-speed CT is an ideal way to locate the obstructive site.[59] Novel imaging techniques using computer fluid dynamics (CFD) for evaluating the upper airway in OSAS, and possibly predicting treatment interventions are now available. This is a very complex bioengineering process using the most powerful computers.[60] Jackson *et al*[79] and Fredberg *et al*[80] first described the use of an acoustic reflection switch that relies on the fact that sound is reflected by changes in impedance caused by changes in the pharyngeal cross-sectional areas. Acoustic reflection provides a means to assess the patient's airway. Fluoroscopy provides information about the dynamic function of the airway and the level of stenosis or occlusion during sleep.







Pre-operative MMA Postoperative MMA



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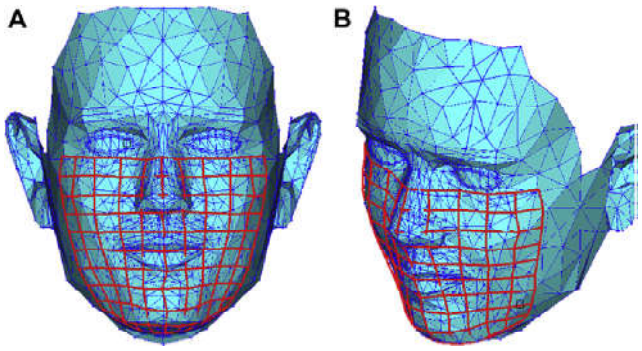

The velopharynx is the area where upper airway collapse most often begins.[82]Oropharyngeal obstruction also may occur, usually promoted by increased negative inspiratory pressure after primary velopharyngeal obstruction. PSG evaluates sleep-disordered breathing, sleep architecture, and oxygen desaturations. A typical 8-hour nocturnal laboratory PSG involves measurement of multiple channels of physiologic parameters, including electroencephalogram, electrooculography, chin movements, leg movement via electromyography, ECG, heart rate, respiratory effort, chest wall movement, abdominal wall movement, airflow, and oxygen saturations. As these physiologic parameters are scored, a sleep technologist documents body position.[88]

Treatment: Soothing agents, tranquilizers, antihistamines and alcohol has been shown to increase the number of disordered breathing disorders episodes during sleep. Alcohol may not be just the seriously of the OAS, but it can also turn a trap into a mustache and a non-apnea snorkel with apnea whiskers. Consequently, Patients with OSA should be advised to use alcohol and solvents or sleeping pills. It is reported that 60% - 70% of patients with OSA he is overweight. Obesity predisposes to the development of OS A causing a narrowing of the pharynx and exacerbating the hypoxaemia of the OSA by reducing the residual functional capacity, thus creating areas of mismatch ventilation / perfusion. weight the loss of 5 kg to 10 kg is advantageous. Although the mechanism improvement is not completely understood, it is probably multifactorial, consisting in the improvement of the pharcine e structure function, neuromuscular control and a functional increase residual capacity.

The magnitude of weight loss and the degree of improvement is not always directly related, although it is it has been shown that a weight variation of 1% is associated with a 3%change to AHI. Bariatric surgery must be considered in all patients with BMI 35 mg / kg2 or more.14A number of drugs, such as nasal decongestants, respiratory stimulants and tricyclic antidepressants used to treat patients with OSA. But the effectiveness of this Therapy has not been established yet. He was an agent tested in a small, double-blind controlled study is protryptyline. It works by suppressing REM sleep, where most episodes of Severe hypoxia occurs. Recent animal work suggests it The drug can also increase the tone of the upper airway muscles, thus stabilizing the respiratory tract and making it less susceptible invasion. The anticholinergic side effects of protryptilin, like dry eyes, dry mouth, difficulty urinating, and ejaculation problems are common with the dosesuse (10-30 mg) and limit the usefulness of this drug. Stimulants such as amphetamines, methylphenidate and modafinilincrease the awakening. They are more used in the treatment of Excessive daytime somnolence (EDS) observed in patients with OSA.

Modafinil, like other CNS stimulants, increases the release of monoamine, especially catecholamines, norepinephrineand dopamine from the synaptic terminal. but Modafinil also increases histamine levels of the hypothalamus what makes it a "waiving agent" rather than a classic stimulant similar to amphetamine. Many other drugs like acetazolamide, medroxyprogesterone, theophylline, doxapramand almitria is investigated. The main advance in the medical treatment of the OSA was the introduction of continuous positive airway pressure (CPAP) 9, described for the first time by Sullivan. CPAP can be administered via a nasal mask, nasal inserts or a full face mask (in patients who suffer from dyspnea during sleep) .3 CPAP has the advantage of not being invasive and has shown that the number of episodes of apnea and hypoxia during sleep. The equipment is now commercially available and consists of a blower and a flexible mask that attaches to the nose, but not to the mouth, which causes the patient a minimum discomfort. The ventilator can provide positive pressure on the patient's nose and the oropharynx. The positive pressure provides a "pneumatic splinter" that keeps the throat open, thus reversing the OSA.23.

Furthermore, it may increase residual functional capacity (FRC), leading to better hypoxemia. CPAP is 100% effective not only in the suppression of obstructive apnea, but also unexpectedly in the central one. 5.12 The normal pressure needed to stop apnea varies between 5 cm and 15 cm H2 0. Treatment with CPAP has no significant side effects in addition to occasional irritation of conjunctiva, due to air leaks around the mask, and some irritation of the nasal mucosa, due to the flow of dry air.24 When the system is properly regulated and adjusted, Patients do not find it uncomfortable, and constantly Improving the fan design keeps noise to a minimum. Surgical treatment of obstructive sleep apnea is directmainly after correction of some anatomical malformations that clearly obstruct the upper airways, such as deviation of the nasal septum, obstruction of the nasal valve or enlargement adenoids or deficiencies. 13 So, the operations that can be offered Patients with OSA include nasal surgery (septoplasty, sinussurgery and others), tonsillectomy with / without adenoidectomy, uvulopalatopharyngoplasty (UPPP), laser assistive uvuloplasty (LAUP), volumetric reduction of radiofrequency tissue, slidinggenetoplasty and osteotomy of mandibular-mandibular promotion.In patients with idiopathic OSA (ie without anatomic obviousness malformations) uvulopalatopharyngoplasty (UPPP) recently become popular. UPPP was introduced by Fujita and colleaguesin 1981 in the United States for the first time. This operation involves tonsillectomy, uvulectomy, partial resection of the soft palate, and the removal of excess mucosa from the pharynx. The general objective is to enlarge the oropharyngeal opening. Successful treatment Only 40% to 50% of patients are reported. Ofcourse, only those patients in whom the airway obstruction site is relatively high, behind the palate will have the highest chance to take advantage from UPPP. Except for strict precautionary measures. The identification of the airway obstruction site is performed. The success of UPPP seems to be an accident.

Conclusion

The field of sleep medicine is a relatively new arena has undergone many changes in recent years. There is it was a number of important advances in diagnosis, The effects and management of sleep apnea are worrisome.

Increase awareness and medical attention for sleep respiratory disorders have led to a huge increase in number of references to sleep in laboratories over a decade or so. Despite ever better ways and infrastructures to diagnose the United States At the moment, it is not yet connected to the management section a processing mode that can guarantee compliance with healing. We hope that a continuous search for high quality and the exercise will result in further understanding and treatment of patients with OSA.

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