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Obstructive sleep apnea syndrome

Summary

Obstructive Sleep Apnea Hypopnea Syndrome (OSAHS) is a frequent, chronic and progressive disorder. It is associated with increased cardiovascular, neurocognitive, and metabolic morbidity, risk of accidents, poor quality of life, and increased mortality. It affects 5% of the adult population, mainly men, and 2% of children between 4 and 5 years of age. Diagnosis is based on suspicion and joint evaluation of the clinical picture with appropriate confirmatory nocturnal studies such as polysomnography. The treatment has two fundamental objectives: to eliminate the respiratory obstruction and, therefore, the breathing stops (apneas) or the hypoventilations (hypopneas) and the drops in oxygen in the blood (desaturations) in any body position or phase of sleep and ensure that the subject sleeps well, improving their sleep quality and reducing or eliminating awakenings and micro-awakenings, which are the main causes of the symptoms.

Keywords: apnea, sleep, hypopnea

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Abbreviations: OSAHS, obstructive sleep apnea hypopnea syndrome; AASM, American academy of sleep medicine; PPR, partial resection of the palate; RERA, respiratory effort related arousal; MAD, mandibular advancement device; CPAP, continuous positive airway pressure

Introduction

Sleep is par excellence the physiological condition that has received the most attention throughout human history. Its dynamic nature, the fact that it matters a third of our lives, constitutes the period of greatest vulnerability to the environment, and its close relationship with waking behavior has generated constant interest. There are many specialties that have been linked to sleep disorders in the context of a comprehensive approach, including medicine, cardiology, intensive care, pulmonology, psychiatry, psychology, otorhinolaryngology, and pediatrics, among others.

According to history, respiratory disorders during sleep were already described by Aelianus (c. 330 BC), who described Dionisius of Heraclia, king of Pontus (obese glutton, with great difficulty breathing and who, to prevent him from drowning, was awakened with needles) and later a similar case was also described in the figure of the king of Cyrena (258 BC). There is also a reference to Cayo Plinio Secundus, known as Pliny the Elder (79 AD), with all the currently accepted symptoms (daytime hypersomnolence, snoring and marked obesity).

Charles Dickens described a case of sleep apnea syndrome in the figure of Joe, in the Pickwick Club posthumous papers, which is why this entity has long been called Pickwick syndrome. For a long time, partly due to the lack of reliable and affordable diagnostic equipment, but above all due to the lack of effective and noninvasive treatment, it was relegated as a curious entity, but with no health relevance.

In 1889 Willian Hill provided a children's version of the association between evident clinical manifestations during wakefulness with sleep disorders, describing the presence of apathy, clumsiness and headaches in children who presented mouth breathing due to nasal obstruction, and whose sleep was agitated, irregular and with abundant snoring. Carpenter et al. in 1892 also detected the coexistence of upper respiratory tract dysfunction, irregular sleep, and intellectual deterioration. Wells et al. in 1898 also associated the presence of nasal obstruction with problems of daytime hyper somnolence.[1,2]

Thanks to all the articles published and the study of the subject, the determining role played by the upper respiratory tract in the genesis of important daytime and nighttime medical disturbances was demonstrated.

Obstructive sleep apnea-hypopnea syndrome (OSAS) is one of the most common respiratory disorders and is defined as a condition characterized by excessive daytime sleepiness, cognitive-conceptual, respiratory, cardiac, metabolic or inflammatory disorders secondary to repeated episodes of obstruction of the upper airway during sleep. These episodes cause repeated transient awakenings that give rise to unrefreshing sleep and drops in oxygen saturation, which is the probable cause of cardiovascular changes in the medium to long term.[3]

Pathological findings are defined as the existence of more than 10 apneas/hypopneas per hour of sleep. Although apnea is clearly defined as the absence of oronasal flow for at least 10 seconds, the definition of hypopnea is more controversial and usually includes a significant decrease in flow, together with the presence of desaturations or microarousals.

Obstructive Sleep Apnea is classified according to the number of respiratory events that occur per hour of sleep (RDI) as mild (10 to 20), moderate (20 to 40) and severe (greater than 40).[4]

According to the American Academy of Sleep Medicine (AASM, American Academy of Sleep Medicine, sleep breathing disorders are classified into:

Obstructive apnea: Suspension of airflow for a minimum time of 10 s. The episode is obstructive if respiratory effort persists during apnea.

Central apnea: Suspension of airflow for a minimum time of 10 s. The episode is central if during the apnea there is no respiratory effort.

Mixed apnea: Suspension of airflow for a minimum time of 10 s. The episode is mixed if the apnea begins as central, but respiratory effort develops late.

Hypopnea: Abnormal respiratory episode, showing at least a 30% reduction in thoracoabdominal movement, or airflow, lasting 10 s or more and a drop in oxygen saturation of 4% or more.

Respiratory effort related arousal (RERA): Respiratory sequence with gradually increasing respiratory effort, leading to awakening, as demonstrated by recording increasingly negative esophageal

pressures, for a minimum of 10 s prior to awakening that terminates the pressure sequence negative.

Simple snoring is defined as the low respiratory sound produced in the upper respiratory tract during sleep, without episodes of apnea, hypoventilation, desaturations, or evidence of snoring-related insomnia or hypersomnia.

All these entities that have just been cited share the same pathophysiological profile, consisting of the existence of alterations, whether anatomical, functional, or even functional, that hinder, to a greater or lesser extent, the inspiratory airflow to the larynx.

OSAHS is a highly frequent disorder that affects 2% to 4% of women and 4% to 6% of men in the middle-aged adult population. There is evidence that its prevalence increases with age and also that the risk of developing OSAHS is closely related to obesity and the male gender. In women, OSAHS occurs mainly in the post-menopausal age. There is also a genetic component manifested by the tendency to family grouping of OSAS and snoring.

Craniofacial alterations can cause obstruction of the upper airways at different levels (nasal, pharyngeal and laryngeal).[5–7]

It is a common occurrence in children, with a prevalence of around 2% between 4 and 5 years of age, with consequences similar to those described in adults.[8,9]

There are anatomical or functional alterations of the upper airway that may favor or be involved in the origin of obstructive sleep apnea syndrome, including:

1. **Structural or functional abnormalities of the fossae**

   Nasal or oro-nasopharyngeal

   a) deviation of the nasal septum

   b) polyps and nasal tumors

   c) hypertrophy of the nasal turbinates

   d) adenoids or rhinopharyngeal tumors

   e) macroglossia

   f) hypertrophic pharyngotonsillar folds

   g) tonsillar or velopalatal hypertrophy

   h) micrognathia, retrognathia or other structural defects of the facial mass

2. **Neuromuscular disorders affecting the oro-nasopharynx**

   a) myotonic dystrophy

   b) syringomyelia

   c) poliomyelitis

   d) amyotrophic lateral sclerosis

   e) myopathies

3. **Deposit of fat or other substances on the walls of the upper airway**

   a) obesity

   b) lymphomas and other tumors

   c) lipomatosis

   d) goiters

   e) various cervical masses

4. **Endocrine-metabolic diseases**

   a) obesity

   b) acromegaly

   c) hypothyroidism

   d) amyloidosis and thesaurismosis[10]

Pathophysiology

Snoring is the expression of the narrowing of the pharynx, product of the vibration of the soft parts of the upper airway (pharyngeal walls, soft palate and uvula). It is also the most common symptom reported by patients with OSAS and by their spouses. The snoring becomes louder as a result of the increased activity of the respiratory muscles, which try to overcome the airflow limitation. At a certain moment the pharynx collapses, which determines the beginning of a period of apnea. Thoraco-abdominal movements (respiratory effort), stimulated by hypoxemia and hypercapnia, increase progressively, even becoming paradoxical. Finally, the silence of the apnea is broken by a rattling snort, reflecting the restoration of airway patency. Respiratory blood gases normalize, sleep recovers, and thus a cycle that repeats itself multiple times each night is restarted.

Obstructive apneas can also cause important alterations in intrapulmonary gas exchange, which in turn are responsible for the increased risk of cardiovascular and cerebrovascular diseases. Apneas and hypopneas give rise to repeated episodes of hypoxemia and hypercapnia, which secondarily cause pulmonary and systemic arterial vasoconstriction. On the other hand, the respiratory efforts that appear in each apnea produce fluctuations in intrathoracic pressure and in the homeostasis of the vegetative nervous system.

These disorders cause, in addition to complex neurohumoral changes, an increase in sympathetic adrenergic tone, which also contributes to elevated systemic and pulmonary arterial pressure and a greater susceptibility to cardiovascular complications.[11,12]

Clinical picture

Clinically, the typical form of apnea presentation is that of a middle-aged, overweight or obese man, with long-standing progressive snoring, increasingly intense and annoying. To this are added nocturnal respiratory pauses, observed by their partners or roommates. In the natural history of this disease, the symptoms become evident or are markedly accentuated in relation to weight gain of 5-10 or more kilos, with a turning point between 30 and 40 years of age, at menopause in women. The use of tranquilizing or relaxing drugs, favoring the instability of the upper airway, the installation of the disease and the appearance of symptoms.

The physical examination can show, in addition to being overweight, age and gender, inspection of the neck and skull looking for masses, thickening, infiltrates, micro or retrognathia , and evaluation of bite and occlusion, evaluating nasal permeability (nasal obstruction due to allergic rhinitis, adenoids or asthma), In the mouth, inspection of the size, mobility and displacement of the tongue (in decubitus). Evaluate dentition and absence of teeth. Assess the pharyngeal space, tonsillar size, appearance of the uvula, and soft palate. Cardiovascular (HBP, arrhythmias), neurological (cognitive deficit), metabolic (diabetes mellitus), endocrine (goiter).

The main nocturnal symptoms are: observed apneas, snoring, choking, abnormal movements, nocturias (adults), enuresis (children), insomnia, gastroesophageal reflux, polydipsia at night, nocturnal

diaphoresis, nasal congestion, excessive salivation, nightmares and the main symptoms. Daytime we can find excessive sleepiness, unrefreshing sleep, tiredness or chronic fatigue, morning headache, irritability, apathy, depression, difficulty concentrating, memory loss, altered libido and impotence, morning pharyngeal and mouth dryness.[13]

Positive diagnosis

Clinical suspicion is fundamental in the diagnosis of OSAHS, so a detailed history and physical examination constitute the cornerstone of the initial evaluation for any patient presenting with symptoms of a respiratory or other sleep disorder. The definitive diagnosis must be carried out in a respiratory unit through a nocturnal respiratory study.

Polysomnography is the most accurate diagnostic method, although it is also the most laborious, complex and expensive, since, for example, it requires the constant presence of specialized personnel to supervise and attend to the study throughout the night.

There are two fundamental types of polygraph records:

1. **Conventional polysomnography:** in which the neurophysiological and cardiorespiratory variables are simultaneously analyzed and in which the patient is monitored continuously during the night. This is a technique that makes it possible to assess the impact of apneas and hypopneas on cardiorespiratory function and sleep organization. Polysomnography includes, as cardiorespiratory recordings, nasobuccal airflow, chest and abdominal movements (ventilatory effort), transcutaneous oxygen saturation, electrocardiogram (ECG), and body position. Sleep architecture and its relationship with apneas, hypopneas, and desaturations are studied through neurophysiological recordings, which include the submental electroencephalogram (EEG), electrooculogram (EOG), and submental electromyogram (EMG). Other analyzes may also be included in polysomnography, such as respiratory sounds (snoring), movements of the extremities, intraesophageal pressure, etc., which are indicated on some occasions and may be useful in the differential diagnosis of patients especially complexes.
2. **Nocturnal cardiorespiratory polygraphy:** in which nasobuccal airflow, thoracoabdominal respiratory movements, transcutaneous oxygen saturation, body position, electrocardiogram and, occasionally, snoring are monitored. As the neurophysiological variables are not recorded, it is not possible to study the architecture of sleep, the duration of its different phases or the time during which the patient has been asleep.[13,14]

Differential diagnosis

1. With disorders that present with hypersomnia and/or excessive daytime fatigability to

a) Due to alveolar hypoventilation

i. Central sleep apnea syndrome

ii. Central alveolar hypoventilation syndrome

iii. Myopathies

b) Due to neuropsychiatric disorders

i. Narcolepsy

ii. Nocturnal myoclonus

c) Due to poor sleep hygiene

i. Insomnia

ii. Excessive delay in going to bed

iii. Abuse of hypnotics or other drugs that depress the central nervous system

iv. Alcoholism

v. Disturbances of the circadian rhythm of sleep

d) For multifactorial reasons

i. Hypothyroidism

ii. Dyssomnias and parasomnias

2. With disorders that present with dyspnea or nocturnal "drowning"

a) Heart failure

b) Mitral stenosis

c) Bronchial asthma

d) Gastroesophageal reflux

3. With disorders that occur with excessive nocturnal motor activity

a) Restless legs syndrome

b) Nocturnal myoclonus

c) Nocturnal epilepsy

Most frequent complications:

i. Psychiatric syndromes

ii. Labor and traffic accidents

iii. Pulmonary hypertension, respiratory failure and chronic cor pulmonale

iv. Chronic alveolar hypoventilation

v. Arterial hypertension

vi. Ischemic heart disease

vii. Cardiac arrhythmias

viii. Sudden death

ix. Cerebrovascular accidents

Treatment

Snoring can be managed through different strategies. Many of them will be complementary to each other, and will depend on the causes of the problem that have been established during the evaluation of the patient.

General measures

Obesity, almost always present, must be vigorously treated, although it is true that significant success is rarely achieved in the long term. Good sleep hygiene should be sought, seeking regularity in habits and schedules and suppression, at least after a certain time in the afternoon, of alcohol and hypnotic or sedative drugs. Structural abnormalities of the upper airway (septal deviations, hypertrophy of the turbinates, tonsils or adenoids, etc.), which usually increase

resistance, should be corrected if they exist and to the extent that their causative involvement is suspected. To the passage of air and, consequently, aggravate the OSAS.

Postural maneuvers: In most cases, snoring worsens in the supine position and attenuates in the lateral or prone position. This phenomenon can be corroborated by the partner, and in some cases the sleep study can confirm a predominance of apnea when sleeping on the back. To manage this problem, different sleeping devices have traditionally been used that make being in the supine position uncomfortable and thus habituate the patient to sleep on their side, such as some modified backpacks or shirts with a pocket on the back, where a ball is located tennis. More recently, electronic systems have been developed that detect when the patient sleeps in the supine position, sending vibro-tactile signals to change his position without waking him up.

Mandibular advancement device (MAD): Similar to the relaxation planes indicated for bruxism, MADs are designed and adapted by specialist dentists and maxillofacial surgeons, with the purpose of moving the mandible forward during sleep, preventing the posterior collapse of the tongue and enlarging the pharyngeal dimensions. It is indicated in snoring patients without apnea, or in mild to moderate sleep apnea, without associated nasal pathology.

Continuous positive airway pressure: Known as CPAP for its acronym in English, it is a treatment that provides pneumatic support to the upper airway through a continuous flow of air that is applied through nasal interfaces (nose cups) or oronasal masks. In general, it is reserved for patients with moderate to severe OSAHS, it is highly effective in reducing obstructive events and daytime sleepiness, but its long-term adherence does not exceed 60-70%.

Surgical procedures can be divided into:

1. **Content reduction surgery**

   a) **Nasal surgery:** It is performed with the aim of improving the nasal obstructive sensation, snoring, the sensation of sleeping better and being more active during the day. They are performed according to the anatomical alterations found (septoplasty with turbinectomy, polypectomy by sinonasal functional endoscopic surgery techniques.

   b) **Adenoidectomy and tonsillectomy**: In children, hypertrophy of the tonsils and adenoids is the main cause of snoring and sleep apnea. Adenotonsillectomy is one of the most frequent surgeries performed in the pediatric age, it is a safe procedure with rapid recovery, which significantly alleviates the quality of life of children with sleep-disordered breathing, snoring and obstructive apnea. However, associated conditions such as obesity, Down syndrome, craniofacial anomalies, neuromuscular disorders, allergic rhinitis, and mucopolysaccharidoses are associated with an elevated risk of snoring and post-adenotonsillectomy residual obstructive apnea.

   c) **Palatopharyngeal surgery:** Partial resection of the palate (PPR) and uvulopalatopharyngoplasty (UPPP) are currently the most widely used surgical techniques due to their relative simplicity. They are based on the removal of the tonsils, adenoids, uvula, and redundant soft tissues of the oropharyngeal area, theoretically responsible for the inspiratory collapse of the upper respiratory tract that occurs during sleep in OSAS.

   d) **Lingual surgery:** It is based on the resection of a wedge at the base of the tongue to increase the retrolingual space, using CO_2 laser or harmonic scalpel.

   e) **Laryngeal procedures:** endoscopic procedures to fix the epiglottis towards the base of the tongue (epiglottopexy) or partial resections of the epiglottis (epiglottoplasty), usually in association with procedures to reduce the base of the tongue.

2. **Continent widening surgeries**

Maxillofacial surgery: Alterations in the morphology of the facial skeleton can cause abnormalities in the respiratory tract, since the pharyngeal musculature is closely related to the neighboring bone structures. Mandibular osteotomy with genioglossal repositioning, hyoid suspension techniques and maxillomandibular advancement procedures can be performed .[14]

Conclusion

Snoring is a very frequent pathology, which affects the quality of life of millions of people globally. Currently there are multiple treatment alternatives, which will be specific for each patient. It is important to carry out an individual anamnesis and physical examination for each patient and in this way be able to determine the etiopathogenic factors that play a relevant role in their pathology and in the same way be able to choose the effective treatment method reestablishing a restful sleep and, with it, improving the quality of life of our patients.

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Conflicts of interest

The authors declare there are no conflicts of interest.

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