

# OBSTRUCTIVE SLEEP APNEA

## Clinical and Laboratory studies

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### SUMMARY

Our study included 42 patients with obstructive sleep apnea (OSAS) confirmed by polysomnography. In these patients we investigated the clinical manifestations, the results of the laboratory examinations, including polysomnography, ORL observations and tests of pulmonary function, as well as the therapeutic results. Our patients presented a serious set of symptoms which included excessive daytime sleepiness, snoring, obesity, cranio-facial abnormalities, systemic hypertension, cardiac arrhythmias, incapacity to work with precocious retirement, marital conflicts and high incidence of accidents, namely traffic accidents. An adequate treatment, mostly with nasal CPAP (continuous positive airway pressure), induced marked relief of the symptoms; some patients had an advantage in surgical treatment and weight reduction. OSAS is a frequent entity, affecting mostly male adults after the 5th decade. The lack of knowledge about this entity and the common social acceptance of some of its cardinal symptoms induces considerable delays in its diagnosis. The severity of the symptoms, the personal and social risks of excessive daytime sleepiness, the cardio-circulatory effects and the risk of sudden death during sleep justify an early diagnosis in order to prevent the severe evolution of the disease. Its complex physiopathology and multiple etiological factors justify a multidisciplinary approach.

### INTRODUCTION

Sleep apnea is one of the most frequent diagnoses in sleep pathology.

Its high incidence, the consequences on the patient's daily life, the repercussions on other functional systems and the bad prognosis concerning life, when it is not treated, determine the general interest in this pathology.

Excessive daytime sleepiness impedes the patient from performing his normal tasks and may induce situations of risk; the association with high blood pressure and with cardiac pathology severely worsens the prognosis, there is also the risk of sudden death during sleep to be added to this severity.

After Guilleminault's initial descriptions in 1970 and the establishment of precise definitions some years later<sup>1,2</sup>, the specific literature increased dramatically. Sleep apnea is currently a clinical area of research, in which various specialists intervene<sup>1,3,4</sup>.

According to the international classification, apnea is individualised into various syndromes: obstructive apnea, central apnea, central alveolar hypoventilation (acquired and congenital), and apnea in the first months of life.

There are still many neurologic or medical situations which are linked with apnea, associations of apnea with other sleep pathologies; and nocturnal breathing disfunctions which are, or not, linked with apnea.

This multiplicity of situations provides some insight to the complexity of the problem.

The clinical state is characterised by recurring episodes of higher airway obstruction, occurring during sleep and generally associated to a reduction in oxygen saturation<sup>5</sup>.

Obesity and/or alterations in the cephalometric indices are frequent findings in obstructive apnea syndrome.

A *Bird-like* facies is characteristic in adults: there is septal deviation, micro and retrognathia, a soft palate and macroglossia. In children there is generally tonsil or adenoid hypertrophy (adenoidal facies).

Hypothyroidism, acromegaly and multiple neurologic diseases (particularly those which involve the control of the respiratory musculature) may induce or intensify sleep apnea.

ECG abnormalities are common. During apnea bradycardia is typical, with slowing during the pause and acceleration when it ends. Extrasystoles, signs of right cardiac insufficiency, and pulmonary and high blood pressure are frequent. The cardiovascular

repercussions are one of the most feared effects, as they may result in sudden death.

The patients may have chronic respiratory insufficiency. For this to occur the association of the obstructive apnea syndrome with obesity and/or chronic obstructive pulmonary disease (COPD) is determinant, thus constituting an overlap syndrome.

The association of COPD is not rare, although its true incidence is unknown. The diagnosis of these patients may be difficult. The presence of diurnal values of PaO<sub>2</sub> and PaCO<sub>2</sub> not explained by the degree of obstruction in the upper airways, and/or the detection of high pulmonary blood pressure in the absence of acute diurnal hypoxaemia, may be indications of an obstructive apnea syndrome.

Obesity is a classic cause of hypoxaemia (generally moderate). The cases of extreme obesity may be responsible for the occurrence of alveolar hypoventilation, thus contributing to the occurrence of chronic respiratory insufficiency (CRI).

The seriousness of the obstructive apnea syndrome described by its apnea index, is not a determining element in the occurrence of CRI, in view of the fact that the patients with very high apnea indexes and with prolonged apnea accompanied by significant nocturnal hypoxaemias, do not usually present CRI.

This paper focuses on obstructive apnea and excludes the cases of central apnea and those associated with neurologic diseases.

We review the cases observed with a multidisciplinary approach at the Santa Maria Hospital with data from the Sleep Laboratory of the Egas Moniz Research Centre (Neurology), of the Otorhinolaryngology and Pneumology Departments.

## METHODS

The patients were observed at the Sleep Laboratory; on their first appointment, apart from the clinical interview, a sleep questionnaire was filled out and auxiliary tests were requested; these included a polysomnography (diurnal and/or nocturnal), ECG, functional respiratory tests, laboratory routines. The suspicion of OTL abnormalities implied specialised observation. Only the patients with the diagnosis of obstructive apnea, made by laboratory confirmation, were included in the study.

Nocturnal polysomnography was performed at the sleep laboratory, in a sound attenuated room with temperature control; recordings took place between 11 pm and 8 am. In the morning, a questionnaire on the quality of sleep was filled out (General Questionnaire on Sleep); the subjective sleep evaluation, in terms of sleep quality and morning vigilance were also noted by patients on visual analog scales <sup>6</sup>.

The data were recorded on paper, digitally (cartridge), and on video. Video recordings were made by two cameras: an infrared was focussed on the patient and the other at the polygraph readout; the images were synchronised, mixed and recorded on VHS, on low play, for 8 consecutive hours.

Polysomnographic recordings included:

- 9 EEG channels using the earlobes as reference (A1 + A2); the active(negative) electrodes were as follows: F4, Fz, F3, C4, Cz, C3, O2, Oz, O1;
- 1 EOG channel with electrodes placed at the outer canthus of both eyes (2cm laterally and 0,5cm from the horizontal, above on the right and below on the left);
- 1 EMG channel with two chin electrodes;
- 2 respiration channels, one with oronasal thermistors to determine the oronasal flow and another with thoracic electrodes to record trans-thoracic impedance;
- 1 ECG channel, bipolar between the right infraclavicular space and the left costal edge;
- 1 channel for plethysmography by means of a photo-electric sensor placed on the last phalanx of the left index finger.
- 1 channel to record oxymetry at the earlobe and another for the expired CO<sub>2</sub> (optional).

Diurnal sleep recordings were made in the morning, after sleep deprivation for patients with severe diurnal sleepiness; they included 4 EEG channels, EOG, EMG, ECG, oro-nasal flow and thoracic respiration.

Sleep recordings were visually classified in terms of sleep staging according to the criteria of Rechtschaffen and Kales <sup>7</sup>, in order to obtain the respective hypnograms, that is, the graphic representation of the succession of various sleep stages. Apneas were classified as obstructive, central and mixed, and always implied a minimal duration of 10 seconds. The apnea index is the number of apneas per hour, during sleep. The inclusion in this study implied a predominance of obstructive apneas.

The functional respiratory tests were, in most of the cases, performed at the Respiratory Physiopathology Laboratory.

Otorhinolaryngology observation consisted of general ORL observation with particular incidence on nasal cavities, oropharynx (tonsils, tonsil pillars, soft palate, uvula, posterior wall of the pharynx and base of the tongue), nasopharynx, hypopharynx and larynx. Following this observation, a hard tube endoscopic examination using rigid fibroscopy oriented towards the nasopharynx, hypopharynx and larynx was done together with CT scans in some selected cases.

Statistical analysis focussed on anamnesis and the *statview* programme was used for the data from auxiliary tests, thus determining the averages and variances, as well as the incidences of symptoms and laboratory data abnormalities.

## RESULTS

**a) Population** – In the studied adult population, the male incidence was notorious (40 male patients and 2 female); the average age was 50.7 years, sd=8.3, with extremes at 35 and 69 years.

The disease had a variable duration which, in our cases, was on average 6.9 years; sd=6.3. It usually began with the dominant symptoms: snoring and excessive sleepiness. Snoring usually had a longstanding duration,

but worsened some time before the occurrence of excessive sleepiness.

There were no special incidences in particular professions and patients from various cultural levels were examined. It should, however, be pointed out that 26.6% of the patients were already retired and approximately 20.7% had a profession involving risks, which were aggravated by diurnal sleepiness.

Table 1 – Habits

Habitual Consumption of Alcohol	
Non existent	17,1%
Not pronounced	14,3
Moderate	60,0
Pronounced	8,6
Smoking Habits	
Non existent	50%
20 cigarettes/day	28,6
40 cigarettes/day	21,4

A large majority of the patients were married (95,2%), with only one bachelor and one widower. Approximately 20,7% of the patients slept in separate rooms or on separate beds.

Alcohol consumption was not too high, however strong smoking habits were frequent (Table 1).

**b) Symptomatology** - We subdivided the symptoms into groups according to the respective time of occurrence. Among the nocturnal symptoms intense snoring was remarkable, since it occurred in 100% of the cases. The patient is not aware of the intensity of his snoring, which is particularly disturbing for the family, very often giving rise to marital conflict and tension, with the spouse sleeping on another bed or in another room. In some cases the snoring is so intense that, apart from marital conflicts, there may be problems with neighbours. One of our patients, who lived on a ground floor, had frequent complaints from *the third floor neighbour*.

Nocturnal breathing is very suggestive: respiratory arrests lasting from 20 to 30 seconds, and concluded with an intense respiratory noise are typical. At the end of the respiratory pause there is a general arousal and a body movement. *Figure 1* is an example of an obstructive apnea.

Respiratory arrest are frequently mentioned by the patient's wife, who often fears for the patient's life: *I get scared that he won't breathe again*.

The patient may also have suffocation or death sensations, and during the end of the apnea, body movements may be extreme with great agitation or a rush to the window in order to *take in air*. The percentage of respiratory pauses was 82.4%, and nocturnal suffocation was 59.4%.

Nocturnal agitation was also frequent (87.5%); a lower number of patients presented leg kicks

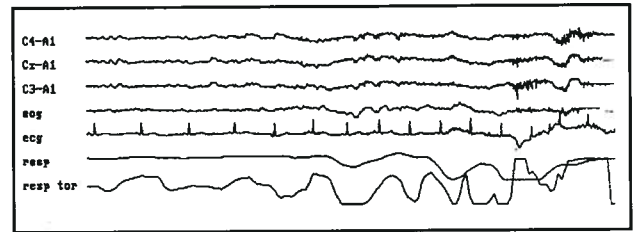


Fig. 1 – Obstructive apnea. Notice the arrest in nasal flow and persistence of thoracic movements; during apnea there is discrete bradycardia. The end of the respiratory arrest is associated to tachycardia, muscular activity and EEG activation.

(myoclonia)(48.4%) and sleep talking (52.2%). Nocturnal agitation is sometimes so intense that it might give rise to anecdotal episodes (slapping and kicking the spouse, knocking over objects at hand, etc.).

A more restricted number of patients declared nocturnal perspiration (5.9%).

During apnea, there is an increase in intra-abdominal pressure, which may give rise to oesophageal reflux, or to a loss of vesicle sphincter control. In our cases, enuretic episodes were relatively common (42.8%). The association with other parasomnias although less frequent, was significant (20%). Only 7.7% of the patients declared insomnia. The incidence of the various nocturnal symptoms is represented in *Fig. 2*.

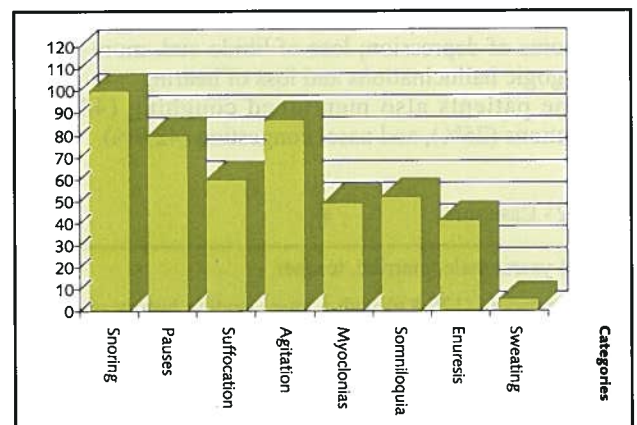


Fig. 2 – Nocturnal symptoms of OSAS. The various categories of symptoms are indicated in the legend; the vertical axis indicates the % of patients in which the symptom occurred.

Morning headaches, dry mouth and fatigue are the most frequent on awakening. Morning headaches persist for a few hours after awakening and may constitute the first and only symptom with tension type characteristics. Headaches occurred in approximately 58.1% of the patients, dryness of mouth in 97.2%, and fatigue in 81.6%. In *Fig. 3* we give a graphic representation of the incidence of morning symptoms.

Excessive sleepiness during the day was dominant and frequently severe; it occurred in 100% of the patients, the circumstances in which it occurred were multiple and dangerous, as is shown in *Fig. 4*. The indicators of

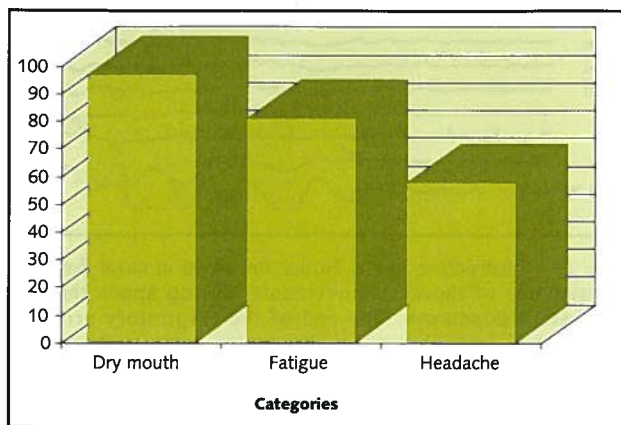


Fig. 3 – Morning symptoms of OSAS. Graphic representation identical to Fig. 2.

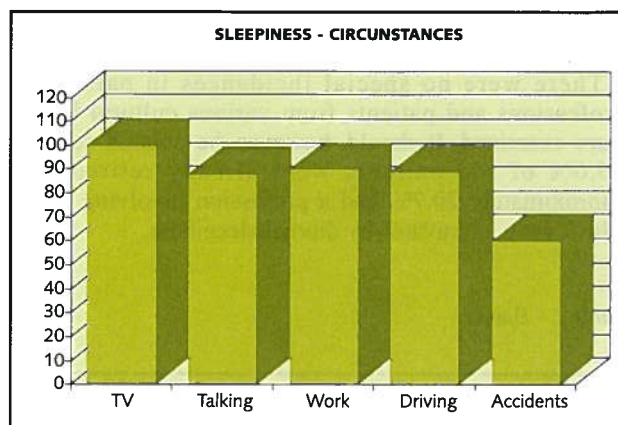


Fig. 4 – Daytime sleepiness of OSAS. Graphic representation identical to that in Fig. 2.

danger on an ascending scale clearly showed the severity of the situation: falling asleep during monotonous tasks occurred in all cases; 87.2% of the patients would fall asleep while talking to friends; 88.9% declared excessive sleepiness at work; 88.6% while driving, various patients referred to car accidents (59.1%), and a significant number fell asleep during meals (69.2%); only one case would fall asleep in any circumstances, including daily tasks such as dressing, etc.<sup>8</sup>. The graphic representation of these parameters is given in Fig. 4.

Apart from sleepiness, there are personality modifications, with manifestations of aggressiveness and symptoms of depression; loss of libido and, more rarely, hypnagogic hallucinations and loss of hearing.

Some patients also mentioned coughing (44.4%), palpitations (25%), and nasal congestion (42.9%).

Table 2 - Case study

VG, 53 years; male, married, teacher.

Obese patient (125 Kg) with a long-standing history of intense snoring. He had multiple complaints regarding nocturnal sleep, taking on patterns of insomnia for which various hypnotic drugs had been prescribed; with a limited effect. In the last year there was a clear aggravation of complaints with possible respiratory problems (sic), nocturnal agitation, episodes of loss of sphincter control and marked daytime sleepiness, which occurred in particularly inadequate situations, such as business meetings, driving, etc., although it was possible to control them (sic). He eats to induce sleepiness, from what he eats and drinks before going to bed. He does not give many details when explaining nocturnal problems. However, these led to the adoption of separate beds a few years before hand. The patient was referred because he had fallen into a deep sleep during an audiologic test.

Past history - Psychiatric disease (Maniac Depressive Psychosis). Had lost about 50 Kg a few years ago; felt worse psychologically and gained weight again.

Polysomnography - Frequent obstructive apneas. Reduction of deep sleep. Preservation of rapid eye movement (REM) Sleep. Striking agitation.

Treatment - Treatment with CPAP was proposed, and the reduction of hypnotic drugs advised; however, different advice was given by another colleague and consequently the patient did not begin treatment.

Most of the observed patients did not present clinical manifestations which would suggest COPD; among these, some of them complained of impotence.

**c) Observation** – Obesity was common. In the patient's reports there is often reference to a recent aggravation of snoring, associated to a weight gain.

In our experience the mean weight was of 98.2 Kg, (sd=19.0, maximum=136 and minimum=70). Body mass index was clearly high: the average was 33.8 (sd=6.0).

The case study presented in Table 2<sup>10</sup> stresses the *obesity* factor, the coexistence of insomnia, the attempt to undervalue the seriousness of the symptoms, the association with other entities, and the errors in treatment orientation.

When there is no obesity there are evident alterations in the cephalometric rates, with reduction of upper airway permeability.

In the assessment of the oro-naso-maxillofacial region, the following should be considered: septal deviation, crooked nose, micro and retrognathia, swelling of the parotid glands, macroglossia, soft palate enlargement, swelling of the tonsils, pharyngeal oedema, and an increase in the cephalometric radiological indices, in cases with evident abnormalities. Table 3 describes the % of these alterations in our series.

Table 3 – Cranio-facial abnormalities in OSAS

Cranio-Facial Abnormalities	
Septal deviation	68.2
Swollen parotids	45.5
Micrognathia	26.3
Macroglossia	52.9
Soft palate enlargement	52.9

Table 4 reports the history of a patient with cranio-facial abnormalities, extreme severity of the clinical situation, and surgical therapeutic solutions<sup>8,9</sup>.

Table 4 – Case Study

AQ, 52 years, male, married, stone mason.

Onset of the symptoms at 49 years, with: excessive diurnal sleepiness, great nocturnal agitation, very intense snoring. He knocks over nearby objects during agitation at night; he rises from his bed and says unintelligible things, facts which he does not recall. Obnubilated during the day, he falls asleep in any situation (eating, dressing, talking). He lost his libido and was no longer able to work.

Observation – Apathy. Easily asleep. Bilateral palpebral ptosis. Nasal voice. Septal deviation. Micrognathia. Macroglossia. Cranio-facial abnormalities. Flaccid palate. He is not obese; he does not have a short neck.

#### Auxiliary tests:

ECG – left ventricular hypertrophy with overburden.

EMG – muscular biopsy and enzymes without alterations.

Arterial gasometry – PO<sub>2</sub>=59.1mmHg; PCO<sub>2</sub>=50mmHg; pH=7.37

Rhinodebitomanometry – Severe bilateral nasal obstruction.

Perinasal sinus X-ray – accentuated deviation of the nasal septum; right maxillary sinusitis. Polysomnography – fragmented sleep with reduction of deep and REM sleep.

Very frequent obstructive apneas.

#### Treatment:

**1st Step** – Tracheotomy: pronounced improvement of the clinical presentation (daytime sleepiness disappeared) and of nocturnal sleep.

**2nd Step** – Uvulopalatopharyngoplasty (UPPP) and correction of the septal deviation: partial regression of the initial symptoms.

**Comments** – The patient should have begun with CPAP, an aspect which had no practical resolution at the time.

The incidence of high blood pressure was notorious: 74.1% of our patients were hypertensive.

**d) Laboratory tests** - In the routine ECG: 52% were normal; 23% had arrhythmias; 9.5% arrhythmia along with ischaemia; and 14.5% had patterns of ischaemia. However, during nocturnal recordings 53% of the patients showed arrhythmias.

The laboratory routines were generally normal, some patients presenting a certain degree of polycytemia.

15 patients were submitted to a functional respiratory test. No alterations were found in ventilation and arterial gasometry was also normal in the majority.

Polysomnography - 30 nocturnal and 12 diurnal recordings were made.

The subjective assessment of nocturnal sleep provided the following results in terms of sleep quality (4.7; sd=2.3) and of morning vigilance (4.4; sd=2.6).

All the patients had obstructive apneas; however, 4 cases had mixed apneas; the rate of apnea was very high, the average being 42.4; sd=18.6, with a minimum of 9 and a maximum of 70 apneas/hour.

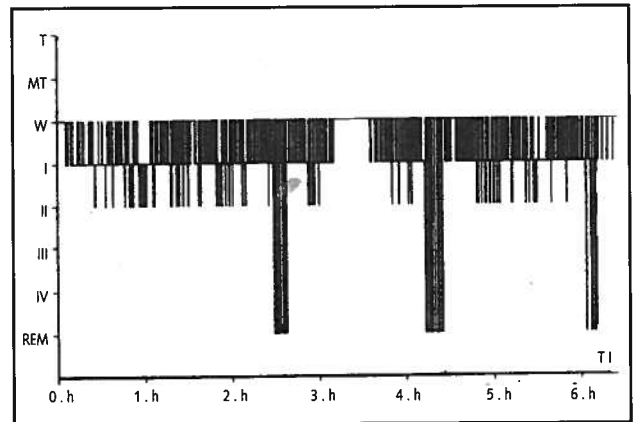
The effects of apneas on the organisation of sleep were related to the severity of the condition<sup>10</sup>.

When the apnea index is very high there is a complete disruption of nocturnal sleep; as soon as the patient falls asleep he has an apnea which ends after various seconds with a transitory alertness, he falls asleep once again, another apnea and this goes on successively. Nocturnal

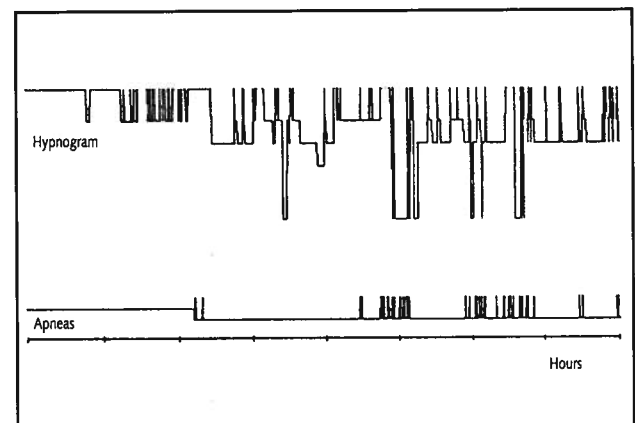
sleep oscillates between stages 1, 2 NREM (non-REM) and wakefulness, and there is a marked reduction in REM sleep.

A typical example is shown in *Fig. 5*.

When apneas are less intense the disruption of the hypnogram is considerably lower; the sleep cycles are relatively preserved and apneas tend to be more frequent towards the end of the night, being related with REM sleep, a phase in which they become more severe and frequent. Figure 6 illustrates this aspect.



*Fig. 5* – Hypnogram of a case with frequent apneas. An evident disruption of nocturnal sleep and a high frequency of apneas represented in the lower graph. The horizontal axis represents the hours of sleep.



*Fig. 6* – Apneas in REM sleep. The hypnogram of this case denotes reasonable preservation of nocturnal sleep; the apneas represented in the lower graph arise in relation to REM sleep.

**e) Treatment** - The first step of the therapeutic attitude consisted in explaining the disease and the risks to the patient, in a clear and simple way. The second step was based on the explanation of treatment possibilities.

In sleep apneas the therapeutic attitudes which mechanically solve the obstruction problem are, for the time being, the only effective ones. In this group, continuous positive airway pressure (CPAP) should be pointed out.

The patients with obstructive apnea treated with CPAP show rapid and significant improvement. The shortcomings occur due to a bad adaptation to the

machine, or, from our experience, advice against this treatment from other doctors who are not familiar with it.

Positive pressure was administered to 24 patients; of these, 2 refused the treatment, another 2 had difficulties in adapting, and the remaining 20 improved substantially.

In *Table 5* we present the case of a patient with multiple pathologies (obesity, cranio-facial abnormalities and pneumologic pathology) effectively treated with CPAP.

Table 5 – Case Study

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CM, 52 years, male, married, sales representative.  
 Onset of symptoms 4 years ago with: excessive daytime sleepiness. Falls asleep in the following circumstances: periods of inactivity, while talking to friends, writing (signing contracts), at work (e.g. meetings with administrators), driving (really had an accident!). While asleep there is: intense snoring, suffocation and nocturnal agitation. He wakes up tired in the morning, with a dry mouth and headaches. For these reasons, he cancelled his employment contract 2 years ago.

Past history - Specific pleurisy, with pulmonary atelectasis.  
 Observation: Obese patient: 101 Kg; 1,72m; BP: 140/85mmHg  
 Routine laboratory tests - normal  
 ECG - Moderate ischaemic compromise of the myocardium  
 Echocardiogram - Normal  
 Functional respiratory test - Normal  
 ORL - Parotid swelling. Tonsil hypertrophy. Flaccid pharyngeal tissue.  
 Nocturnal sleep - Obstructive apneas of a moderate degree.  
 Treatment - CPAP with low pressure values; very significant improvement with a very substantial reduction in excessive sleepiness, which is currently sporadic.

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Among the other treatments with mechanical effects strategies must be considered:

- Tracheotomy, which is advised in cases with severe hypoxaemia and cardiac problems (see case study in *Table 4*). It is often understood as an intermediate stage for other more final surgical interventions, or for treatment with CPAP.
- Correction of the deviation of the septum, uvulopalatopharyngoplasty, correction of macroglossia and of the mandible have more variable effects, there being no unanimity regarding the effects and the indications<sup>11,12</sup>.
- Tonsillectomy is justified when there is a considerable obstruction, in children as well as adults.

## DISCUSSION

It is typically a disease of men over 40, with a prevalence in the general population of 1-2%, being more frequent in males (8:1). Our cases have a similar distribution to that described in series of other authors in what concerns age; however, they show an even greater predominance of males (20:1).

Cultural acceptance regarding obesity, snoring and diurnal sleepiness lead to delays in diagnosis with late

identification of the cases, the symptomatology therefore being particularly severe in the patients observed.

There are multiple factors which indicate this severity, namely: the seriousness of the sleepiness; the risks associated to the circumstances of its occurrence; the high rate of apneas; and also the significant incidence of cardio-circulatory abnormalities.

**Excessive sleepiness** is a severe symptom and is one of the most frequent complaints. In severe cases it occurs in situations which impede social and family contact since it interferes with actions such as eating, dressing, etc. It is dangerous for the patient's life and the life of others (e.g. in driving), and makes professional activities difficult. The incidence of retired people was, in our series, considerable; however, the incidence of traffic accidents was also a cause for concern.

The professions vary from self employment to the tertiary sector. However, the professions involving risks should be taken into consideration, that is, drivers, railway workers, etc. 20% of our patients had professions involving risks; driving should be considered absolutely out of the question until an effective therapeutic control is attained; even in this situation, long distance driving is not advised.

Snoring was constant and very often disturbed the family environment. Stating that – *I don't notice it, it is her that complains* – does not contribute at all to finding a solution to the problem, which is only sought when daytime sleepiness becomes evident. Many of our patients slept on separate beds or in separate rooms and it was the spouse who often ensured that an appointment was made to see the doctor.

Obesity was common, as the average weight of the group at almost 100 Kg testifies, with body mass indexes clearly abnormal. Weight loss, when possible, significantly improved the condition; weight loss was, however, difficult, inductor of anxiety and transitory (see case 1).

It should also be pointed out that the frequency of high blood pressure and cardiac abnormalities; among these, arrhythmias were more frequent than ischaemia.

The association of obesity, ronchopathy, high blood pressure and sleep apnea is so common that some authors suggest that in the presence of any of the remaining factors sleep apnea is to be suspected.

The alterations of ORL are frequent, multiple and frequently small, often not sufficient enough to explain the whole condition.

The use of the functional respiratory test as a means of diagnosing obstructive apnea syndrome was not particularly useful. Only in 5 patients was it possible to find a quotient above 1 between FEF and FIF. In none of the patients were the saw tooth images observed. Technical problems, associated with the poor collaboration of patients during the tests, made it very often difficult to attribute a pathological significance to these abnormalities.

Polysomnography was essential in diagnosis. Although the majority of the recordings included nocturnal sleep, we considered that in many cases (mainly when

sleepiness is very strong) diurnal sleep is sufficient. These recordings, which are more economical and less uncomfortable for the patient, certainly have some limitations: they do not detect REM sleep apneas, since it is difficult for this phase to occur during the day; they did not diagnose associated situations, such as periodic or movements or parasomnias, which typically only occur at night. The nocturnal recordings are usually diagnostic.

The apnea index was, in our series, extremely high; the apneas, which were generally brief, were accompanied by bradytachyarrhythmia. Approximately 20% of the patients had other sleep abnormalities, namely periodic movements, nightmares or REM sleep parasomnias; these cases can only be fully investigated in nocturnal recordings.

Obstructive apnea should be differentiated from other entities, a fact which implies laboratory confirmation of the apneas. Diagnostic thoroughness is in fact important in treatment orientation.

**Central apnea syndrome** differs from the obstructive type in various aspects: the apneas are of the central type, that is, there is a cessation or reduction of the effort of ventilation associated to oxygen desaturation; insomnia is more frequent than excessive sleepiness; snoring is not prominent and is an indicator of the association of the 2 entities; there is generally no obesity.

The predisposing factors are: cardiac pathology (mainly congestive cardiac insufficiency), neurologic diseases, as is the case of cerebro-vascular diseases which affect the central control of ventilation; nasal obstructions; metabolic alkalosis and hypoxia.

The remaining clinical manifestations and consequences coincide in both syndromes, that is, diurnal sleepiness, sensation of fatigue, cognitive disfunctions, morning headaches, cardiac arrhythmias, pulmonary hypertension, cardiac arrest and alterations in gasometry. The loss of libido is less accentuated, however, depressive reactions are more evident.

In central apneas there is a disturbance in ventilation effort, the control over breathing being affected, a loss of central chemo-receptor sensitivity, and the cessation of neuronal activity in the respiratory muscles, and also a disfunction of the proprioceptive receptors of the upper airways. The abnormalities in response to oscillations of CO<sub>2</sub> and O<sub>2</sub> give rise, in certain cases, to patterns of periodic respiration.

The physiopathology of apneas of the central type is therefore complex; this aspect makes it necessary to investigate each case in detail in order to propose an orientation for treatment.

The first treatment step consists of determining if there are predisposing factors which can be treated and correct them. Acetazolamide, positive nasal ventilation, oxygen and CPAP<sup>13</sup> may be considered among the possibilities for treatment.

**Obesity and hypoventilation syndrome** – Commonly known as the Pickwick Syndrome, has, as cardinal manifestations, obesity, hypoventilation and hypercapnia in wakefulness, and excessive sleepiness; there is a worsening of the condition during sleep with apneas. In

these patients the main problem lies in the reduction of reactivity to hypoxia and to hypercapnia<sup>12</sup>, from which the patients may benefit from the treatment with medroxyprogesterone<sup>14</sup>, and with weight reduction.

**Central alveolar hypoventilation syndrome** is characterised by a disturbance in ventilation with oxygen desaturation, which is aggravated by sleep; the condition occurs in patients with normal lung mechanical properties<sup>5</sup>.

In **chronic obstructive pulmonary disease (COPD)** sleep is frequently altered and worsens metabolic disturbances (hypoxaemia and hypercapnia) existing in wakefulness. The patients complain of insomnia, with difficulty in falling and remaining asleep, and frequent awakenings. In the polysomnography, apart from these aspects, there is a reduction of deep sleep and REM sleep, and periods of hypoxaemia coinciding with REM sleep. Sleep complaints may accentuate pulmonary symptoms and cardio-circulatory manifestations. These patients generally do not have apneas. However, the association of the two entities (COPD + obstructive apnea) is possible and therefore constitutes a specific syndrome, designated as **overlap syndrome**<sup>5</sup>.

**Snoring** is a predominant inspiratory noise produced by the vibration of the soft parts of the oropharynx walls<sup>15</sup>. It may occur continuously in all respiration without great modifications in amplitude, thus constituting a normal variant without clinical risk, or it can be intermittent with distinct variations in amplitude with intervals of silence (the apneas).

The incidence is clearly greater in males; the occurrence in families is also known<sup>15</sup>. Snoring, as apneas, is influenced by medication and toxics, namely benzodiazepines and other tranquilisers, barbiturates and alcohol.

There are beneficial measures to be considered: slimming; avoiding alcohol, hypnotics and sedatives before going to bed; frequent change of position during sleep avoiding dorsal decubitus.

Surgical treatment of ronchopathy by means of uvulopalatopharyngoplasty or mandible correction has recognised effectiveness.

In younger subjects, other hypersomnias may be considered in the differential diagnosis, such as idiopathic hypersomnia and narcolepsy. Polysomnography very often provides the key to the diagnosis<sup>16</sup>.

In obstructive apnea the choice treatment is, in most cases, CPAP, treatment with high efficacy and with a reduced number of side effects<sup>15</sup>. Success varies in the published series but generally reaches 80%<sup>15</sup>, a number also confirmed in our experience.

Positive pressure is induced by means of a nasal mask, with a small portable device placed close to the patient's bed. It should be used daily.

Treatment success depends on various factors:

- 1 - Preparation and elucidation of the patient
- 2 - Enrolment of the patient, resulting from a positive consideration of benefits and costs, that is: a substantial improvement in diurnal sleepiness is well worth the inconvenience of the machine.
- 3 - Pressure adjustment - the ideal pressure level

implies the cessation of snoring and the control of apneas.

4 – Mask adjustment – perfect adjustment is very important for pressures above 10 or 12 cm H<sub>2</sub>O; it is less critical for lower pressure levels

5 – Enrolment of the spouse – the spouse, who may complain about the noise the machine makes, can be counselled to use ear plugs.

6 – Effective control of therapeutic results and side effects.

Apart from controlling apneas and snoring, it is also possible to stabilise blood pressure, significantly increasing patients' life expectancy.

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