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Management of sleep apnoea syndrome

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ABSTRACT: Obstructive sleep apnoea is a chronic condition characterized by repetitive episodes of upper airway collapse during sleep, leading to sleep fragmentation. The management of sleep apnoea consists of general and specific measures.

General measures should include weight loss in overweight patients; avoidance of alcohol during the evening hours; avoidance of any hypnotic drug. Specific measures may range from simple position training in patients with positional sleep apnoea (sleep apnoea appearing only when lying on the back) of slight severity; to oral appliances with the aim of creating a prognathism during sleep, to the introduction of a nasopharyngeal tube during sleep every night. When position training, oral appliances or a nasopharyngeal tube are used, their effect should be monitored by full night polysomnography.

The best specific treatment for sleep apnoea is nasal continuous positive airway pressure. The main problem with nasal continuous positive airway pressure is the long-term compliance which should be assessed regularly over the years. In cases where nasal continuous positive airway pressure is not tolerated or compliance is bad, a surgical treatment can be proposed. Uvulopalatopharyngoplasty seems to give disappointing results. By contrast, maxillomandibular surgery is credited with the best results available as far as surgery is concerned, comparable to nasal continuous positive airway pressure.

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The management of patients with sleep apnoea should aim to achieve three objectives: 1) alleviation of symptoms; 2) decrease in morbidity; and 3) decrease in mortality.

As in many diseases, when several options exist, the choice of a particular treatment for a particular patient should take into account the effect of the treatment on these three objectives. In addition, the side-effects of therapy should be considered, and the treatment with the lowest possible level of side-effects should have a high priority.

In the majority of diseases, the development of medical treatments has been empirical and based on symptom alleviation. Sleep apnoea, essentially the obstructive type, is an exception to this rule. Indeed, therapy of sleep apnoea was from the beginning based on the pathophysiology of the disease [1]. Since obstructive sleep apnoea is due to a complete or incomplete collapse of the upper airway at the pharyngeal level during sleep, treatments have been designed to circumvent the obstruction or to prevent it. The effects of treatments upon morbidity and mortality have only recently come under scrutiny and criticism [2]. Data are still scarce for objectively assessing some of these effects [3, 4]. In 1995, it is thus difficult, and perhaps more difficult than 10 yrs ago, to obtain a clear picture of the optimal management of patients with sleep apnoea.

General measures

Weight loss

About three quarters of patients with obstructive sleep apnoea are obese [5]. There is a clear relationship between excess weight, usually expressed as the body mass index (BMI), and the number of sleep-related respiratory disturbances [6]. Some authors have found that the relationship is linked to the BMI, whereas others have suggested that the relationship is due to fat deposits in the neck, assessed through neck circumference [6]. In any case, weight loss has definite effects and results in improvement or (exceptionally) disappearance of sleep-related disordered breathing in many patients [7]. The effect of weight loss may be due to an improvement in nasopharyngeal collapsibility or to an increase in lung volumes, oxygen reserve and an improvement in resting blood gases.

Weight loss is difficult to achieve and especially to maintain. Several studies have reported on weight loss obtained with caloric restriction in severely obese patients. In general, only modest reductions in BMI are obtained, with improvements in sleep architecture and sleep-related disordered breathing. However, cure of sleep apnoea is the exception rather than the rule [8].

Despite these disappointing results, weight loss should be encouraged in obese patients with obstructive sleep apnoea.

Several studies have reported on surgical procedures aimed at obtaining a substantial decrease in BMI. Most of them show significant improvements or cure of obstructive sleep apnoea in a limited number of patients [9, 10]. Jejunio-ileal shunt, gastroplasty or gastric bypass have all been advocated. However, all these procedures carry a substantial risk of postoperative morbidity and mortality, and require strong and continuous motivation from patients [8].

Alcohol and hypnotics avoidance

There is a well-proven influence of a number of drugs on pharyngeal collapsibility. These include alcohol, hypnotics, sedatives, and opioid analgesics [11–13]. Experimental data exist in animals and humans showing that these drugs decrease the electromyographic (EMG) activity of pharyngeal muscles without interfering with the EMG activity of the diaphragm. Therefore, the balance between the dilating and collapsing forces at the pharyngeal level is altered with a resulting increase in collapsibility.

Alcohol and hypnotics do not cause obstructive sleep apnoea, but rather exaggerate it. Thus, their avoidance might seem a minor point. Nevertheless, one cannot forget that the extremely wide use both of alcohol and hypnotics makes this minor point quite important in the management of patients with obstructive sleep apnoea. Every effort must be made to decrease consumption of hypnotics and alcohol.

Position training

It is generally accepted that snoring increases in intensity when patients lie on their back, rather than on the side or on the belly. Several studies have shown that obstructive apnoeas are more frequent when the patients lie on their back [14, 15]. Some authors have described groups of patients that only have obstructive apnoeas when lying on their back [16]. This is called positional obstructive sleep apnoea and, in this category of patients, it has been suggested that position training (training the patients to avoid sleeping on their back) could be enough to achieve the disappearance of obstructive sleep apnoea.

Exclusive positional sleep apnoea is probably present in a minority of patients. Position training may, nevertheless, be helpful in a large number of patients that have more apnoeas in the dorsal decubitus than in other positions. Position training may also be useful in patients having a low number of apnoeas, for instance 5–15 episodes·h⁻¹ who would not be considered for treatment by other means.

Position training may be obtained by a number of devices acting through acoustic signals, electric shocks, or discomfort. One simple method to avoid dorsal

decubitus is to sew a pocket on the back of the pyjamas and to put inside a golf ball or a tennis ball.

Oral appliances

Oral appliances are prosthetic devices that either pull the tongue or the mandible forwards creating a prognathism. Oral appliances are used during the night, for sleeping. One group with a great deal of experience using this type of treatment has described improvements and even complete resolution of obstructive sleep apnoea, but results are less impressive in other studies [17–19].

Oral appliances, especially those designed for mandible advancement, have side-effects, such as excessive salivation or temporomandibular arthritis, that may be a reason for treatment failure. Overall compliance has been estimated at about 50%. This treatment has been proposed as an alternative for patients unable to tolerate other types of treatment, such as nasal continuous positive airway pressure (nCPAP).

Nasopharyngeal tube

A few case reports and one short series have described the use of the nasopharyngeal tube to treat obstructive sleep apnoea [20, 21]. The idea is that a small bore latex tube, 3–7 mm external diameter, is passed through the nose by the patient himself every night. The tube is about 15 cm length, so that the tip of the tube rests a couple of centimetres above the epiglottis. It is believed that the tube acts as an irritant, or as a mechanical device keeping the tongue away from the posterior pharyngeal wall. Other authors believe that people can breathe through the tube. This is unlikely, given its small internal diameter.

Few subjects are able to tolerate the nasopharyngeal tube for the whole night. The introduction of the tube is facilitated by lidocaine jelly. Even in subjects able to tolerate the tube, the results may vary. In a few subjects, obstructive sleep apnoea completely disappears. Success seems limited to mild forms of sleep apnoea in slim patients. More frequently, apnoeas are converted into hypopnoeas and sleep architecture is not significantly modified [18].

The main advantages of this method are its low cost and simplicity. Patients can use it as an alternative to other forms of treatment, such as nasal continuous positive airway pressure, for instance during short trips away from home.

Surgical management of obstructive sleep apnoea

Surgical management of obstructive sleep apnoea includes several different techniques. We shall briefly review those most frequently used: tracheostomy, tonsillectomy and nasal surgery, uvulopalatopharyngoplasty (UPPP) and its variants, and finally maxillomandibular osteotomy.

Tracheostomy, almost completely abandoned today,

was the first treatment described in obstructive sleep apnoea [1, 2, 22]. Tracheostomy acts by allowing airflow to take place below the pharyngeal obstruction [1]. Indeed, the airway outlet with a tracheostomy is located below the pharyngeal obstruction. The effects of tracheostomy are immediate, with complete normalization of breathing and sleep architecture and fragmentation from the first night. The tracheostomy is closed during the daytime, to allow normal nasal breathing and speech, and is opened at night.

The well-known side-effects of tracheostomy, including bleeding, excessive secretions and coughing, granuloma formation and infection, led to its substitution by less aggressive alternatives when these became available.

Tonsillectomy and nasal surgery may be extremely useful in children, in whom this type of surgery can cure obstructive sleep apnoea [23]. This is not the case in adults, where encouraging results from early studies have been unconfirmed in later ones [24]. Nevertheless, nasal surgery may still be needed in the implementation of nCPAP (see below) in patients in whom this type of therapy fails due to nasal blocking or nasal obstruction for structural reasons.

UPPP consists in a wedge resection of the posterior pillar mucosa adjacent to the root of the uvula, with removal of the pillar mucosa between the palatal arches. Many variations of the technique exist, including section and removal of the entire uvula, removal of some muscle (the more dorsal part of the levator, and part of the palatoglossus and/or palatopharyngeus), tonsillectomy, and resection of part of the base of the tongue [25].

When surgical success is defined as a reduction of 50% or more in the respiratory disturbance index, most show a success rate of about 50%. However, not all data agree. Many series show success (defined as 50% reduction of sleep-related disordered breathing) in less than half of the patients. If success is defined as a normalization of sleep structure and fragmentation and less than 10 respiratory disturbance events per hour of sleep, the success rate of UPPP is less than 50%, but is very difficult to evaluate in quantitative terms in the literature. Indeed, most series do not report enough data to verify the effects of surgery on sleep [26].

UPPP-related morbidity is characterized by pain, rhinorrhoea and transient nasopharyngeal reflux. Haemorrhage is not infrequent and can be life-threatening. In one published series, mortality due to UPPP was about 1% [27].

It is, up to now, quite difficult to predict which patients are more likely to benefit from UPPP. Many different methods have been applied in attempting to predict the more likely anatomical level of obstruction in the pharynx. These include endoscopy during wakefulness, cephalometrics, computed tomography (CT)-scan and magnetic resonance of the pharynx, multiple pressure catheter monitoring during sleep, cineradiography, acoustic reflection, and more recently pharyngeal endoscopy during sleep with the pharynx in a completely passive configuration [28]. None of the above techniques seem able to predict the patients who will benefit from UPPP and those who will not [29].

Some data exist on mortality after UPPP compared to "spontaneous" mortality (*i.e.* mortality when therapy was limited to advice on weight loss). One published series showed that after UPPP mortality was the same as without treatment and amounted to as much as 40% at 9 yrs [2]. A recent paper concluded that mortality was the same after UPPP as with treatment by nCPAP [30]. However, on close scrutiny, cardiovascular mortality (*i.e.* mortality presumably due to the obstructive sleep apnoea) appears significantly higher after UPPP.

Maxillomandibular surgery is credited with the best results available as far as surgical therapy of obstructive sleep apnoea is concerned (*i.e.* comparable to nCPAP or tracheostomy). This type of surgery consists of a variable combination of several surgical procedures performed sequentially and including anterior mandibular osteotomy, hyoid bone suspension, Lefort I osteotomy, sagittal splitting of the mandibular ramus. The whole procedure may take 6–8 months, and patients should remain under nCPAP during this period. This approach is technically demanding, and only a small number of groups have reported on a substantial number of patients. The results are as good as with nCPAP, and lead to normalization both of breathing and sleep abnormalities [31].

Nasal continuous positive airway pressure

This therapeutic method involves connecting the subject to a blower delivering air at a predetermined positive pressure, that is continuously maintained throughout both phases of the respiratory cycle [32]. The connection is generally performed via the nose, with a variety of nasal masks. The positive pressure acts as a pneumatic splint opening up the occluded pharyngeal airway, and allowing the patient to breathe. The level of pressure required (5–15 cmH₂O in most patients) must be individually determined, and must be high enough to eliminate snoring, hypopnoeas, apnoeas and sleep fragmentation. A large variety of commercial nCPAP devices are now available on the market, with an extensive number of mask models for all sizes and forms of nose.

Nasal CPAP has side-effects: skin sores and erosions, nasal stuffiness, blocking or congestion, and discomfort due to the device itself (essentially noise and bulkiness) [33]. The beneficial effects of nCPAP are rapid and spectacular, with almost complete disappearance of sleepiness and nocturia from the first night of therapy [34].

Although some cases of cure after relatively short periods of nCPAP have been published, the general rule is that treatment must be applied every night for an undetermined period of time (perhaps lifelong). This poses the problem of compliance to long-term therapy. Several recent papers have reported on very poor short- and medium-term compliance to nCPAP, much less than previously believed [35]. However, unpublished data show that good levels of compliance can be obtained. In 84 patients on nCPAP we found, over a 2 year follow-up period, a median daily use of nearly 6 h, with 77% of

patients exceeding 4 h of use per night. For 34 patients with two consecutive follow-up periods (about 1 and 2 yrs respectively), there was no significant difference in compliance between the two periods. It may be postulated that the implementation of nCPAP constitutes a critical period that may influence compliance to therapy, insofar as enough time is dedicated to the patient to explain the benefits and limitations of the treatment, its side-effects and the means to solve them.

In patients needing high levels of pressure, some authors have proposed the use of devices with two levels of pressure: a higher one limited to the inspiratory time and a lower one during expiration. On randomized studies however, the use of these more sophisticated (and expensive) machines does not seem to bring any advantage with respect to nCPAP [36].

In conclusion, obstructive sleep apnoea is a symptomatic disease associated with morbidity and mortality. Treatments exist that allow symptom disappearance and reduce mortality. General measures including alcohol and hypnotics avoidance and weight loss should be strongly and continuously recommended. For patients (and doctors) looking for a radical cure, a surgical option does exist, *i.e.* maxillofacial surgery. However, it should be remembered that this is not a single operation, but rather a series of procedures extending over several months during which patients should receive nCPAP, until polysomnographic controls demonstrate the disappearance of sleep apnoea [37]. Surgical risk is of concern, as is the technical expertise of the surgical team. Uvulopalatopharyngoplasty (and its numerous variations) should not be considered as an established therapy for sleep apnoea; it does not seem to decrease mortality in the long-term and results cannot be reliably predicted before the operation.

Nasal continuous positive airway pressure is the best medical treatment available. It is effective, quite rapid in action and generally well-accepted. However, it is a lifelong therapy, with a number of not serious but disturbing side-effects that must be adequately managed by an experienced, receptive and available team.

Position training, oral appliance and the nasopharyngeal tube may be useful in selected patients, or as an adjunct for short interruptions of nCPAP therapy.

Pharmacological treatments are not available at present. Given the large number of potential patients that recent epidemiological studies have brought to light [38], full control of obstructive sleep apnoea will be a difficult task until drugs become available.

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