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ORIGINAL PAPERS

The influence of Waldeyer's ring hypertrophy on snoring and sleep apnea

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ABSTRACT

BACKGROUND: A severe adenotonsillar hypertrophy can be the main responsible for the nocturnal respiratory affections, as it is confirmed by the improvement of symptoms after adenotonsillectomy. An unsuccessful surgical treatment can be due to cranio-facial morphological alterations. Perhaps hypotony of the pharyngeal muscles can be responsible together with tonsil hypertrophy.
MATERIAL AND METHODS: We have enrolled in our study 125 patients (87 males and 38 females), from 3 to 8 years old, suffering from chronic snoring. All the patients underwent adenotonsillectomy. The follow-up was carried out at 2, 4, 6 months after the operation.
RESULTS: Snoring and nocturnal apneas were no more present in almost all the patient.
CONCLUSIONS: Overnight polysomnography remains the gold standard diagnostic test for OSAS, but its feasibility in clinical practice is debated. Rhinomanometry, which gives an objective evaluation of the ventilatory nasal function, acoustic rhinometry, which measures the cross-section in fixed nasal areas, and nasal mucociliary transport time can be considered useful tests to evaluate the cause of respiratory obstruction. In any case OSAS cannot be left untreated: the evaluation of the individual pathophysiology gives the best opportunity to restore an adequate upper respiratory ventilation by the rational choice between medical or surgical treatment.

INTRODUCTION

The obstructive sleep apnea syndrome (OSAS) occurs in patients of all ages. Much remains unknown about the pathophysiology of the syndrome. Researches suggest that OSAS is due to a combination of both anatomic airway narrowing and abnormal upper airway neuromotor tone. A smaller upper airway probably predisposes to airway collapse during sleep, and alterations in upper airway neuromotor tone also play an important role in the etiology of OSAS (Arens et al., 2004)[1].

Severe adenotonsillar hypertrophy is the most frequent cause of respiratory alterations in children: about 80% of children may benefit from the surgical procedure (Ameli et al., 2007)[2]. Nevertheless the role of the pharyngeal obstruction in the pathogenesis of the obstructive apnea syndrome is still debated in literature. According to Suen et al. (1995) a severe adenotonsillar hypertrophy can be the only responsible for the nocturnal respiratory affections: this is confirmed by the improvement of symptoms and of the "respiratory disturbance index" after adenotonsillectomy[3]. However adenotonsillar hypertrophy is not always accompanied by nocturnal obstructive disturbances and there isn't a clear relationship between dimensions of adenoids/tonsils and apnea indexes. Therefore, according to some authors, other anatomopathological factors can influence the respiratory disturbances. For example, a congenital little pharynx, typical of these subjects, can be an important predisposing factor of OSAS.

According to Shintani et al. (1998) an unsuccessful surgical treatment can be due to the presence of cranio-facial morphological alterations, as the limited epipharyngeal air space or a not sufficient development of maxilla and mandible[4]. Performing a cephalometric analysis of an OSA group and an age-matched control group, Shintani et al. (1996) defined the role of adenotonsillar hypertrophy and facial morphology in obstructive sleep apnea (OSA) in children[5]. Maxillary protrusion was significantly smaller in the OSA group for elderly children (5-9 years old). Mandible protrusion was significantly smaller in the OSA group even at younger ages (1-2 years). The hyoid bone was significantly lower in the OSA group than in the control group, who were from 3 to 6 years. However as Shintani's data (1998) show, adenotonsillectomy gives good results, confirmed by the improvement of the apnea-hypopnea index (AHI) and by the values of oxygen saturation in blood (O2Sa) in the 78% of the enrolled patients[4].

The effect of adenotonsillectomy on changes of position during sleep was evaluated by Choi et al. (2009)[6]. Forty-four polysomnograms from 22 children with OSAS were ana-

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lyzed. By comparing the frequency of positional changes during sleep and the distribution of sleep positions before and after surgery, the authors concluded that adenotonsillectomy significantly improved all the respiratory parameters studied. The total number of positional changes during sleep ($p<0.001$) and the positional change index ($p < 0.001$) significantly decreased. The proportion of sleep time spent in the supine position was significantly increased ($p = 0.001$), and the proportions spent in lateral ($p = 0.003$) and up ($p = 0.018$) positions were significantly decreased.

Adenotonsillar hypertrophy seems to be strictly linked to nocturnal respiratory disturbances, nevertheless the obstruction in condition of "rest" doesn't always allows to evaluate or to foresee the degree of the obstruction during sleep when there is a physiological reduction of the muscular tone, especially of the genioglossus muscle. Perhaps hypotony or alterations of the neural control of the pharyngeal muscles or a particular laxity of the ligaments can be responsible together with tonsil hypertrophy for the pharyngeal obstruction, as it sometimes occurs in very young children. The attempt to look for histological changes of palatopharyngeal muscle typical of OSAS children was not successful. Vuono et al (2007) analysed the palatopharyngeal muscle in 34 oral-breathing children with hypertrophic tonsils and adenoids[7]. The participants were divided into children without sleeping disorders (group I) and children with primary snoring (group II) or apnea (group III). The main histological findings (fiber size variability; perimysial connective tissue infiltration; intracytoplasmatic mitochondrial proliferation; internal architecture alteration) were similar in the three groups. The authors concluded that such changes could be a normal histological feature of this muscle rather than the sign of a neurogenic or myopathic pathology.

Since the breast-feed babies' airways are very narrow, a reduction in few millimetres can cause a 65% decrease of the diameter, determining a remarkable obstruction. According to our experience, adenotonsillar hypertrophy remains one of the most frequent causes of respiratory disturbances in children, especially snoring, that sometimes can be followed by a real OSAS.

PERSONAL EXPERIENCE

Snoring and adenotonsillectomy

We have enrolled in our study 125 patients (87 males and 38 females), aged from 3 to 8 years, suffering from chronic snoring. Clinical history elicited a persistent and noisy day-night oral breathing. Particular attention was paid to other night disturbances such as apnea episodes, nocturnal awakening, enuresis and to day disturbances as sleepiness, hyperreactivity, aggressiveness, absent-mindedness and scarce school outcomes.

Flexible optic fibers evaluation of the upper airways stenosis had been performed in all the children. In 65% of the patients snoring was not accompained by nocturnal apneas. All the patients underwent adenotonsillectomy.

The follow-up was carried out at 2, 4, 6 months after the operation. Snoring and nocturnal apneas were no more present in almost all the patient.

A second adenoidectomy was necessary in two children, because the increasing lymphoid activity was responsible for an incomplete surgical removal of the lymphoid tissue in the youngest patients (3ys old).

DISCUSSIONS

Etiopathogenesis and diagnosis of upper respiratory obstruction

According to our results management of OSAS includes tonsillectomy and/or adenoidectomy to which most of the cases responded. Nevertheless other risk factors and coexisting conditions should be investigated and treated prior to considering surgical treatment.

Ng et al. (2006) reviewed the literature to evaluate the association between allergic rhinitis (AR) and OSAS in childhood[8]. They concluded that allergic rhinitis affected approximately 40% of children and OSAS occurred in 2% of children. As AR is associated with nasal obstruction, enlargement of tonsils and adenoids, and an elongated face, it can be considered a risk factor for OSAS. The treatment of AR is helpful to decrease the severity of OSAS and prevent emergence of an elongated face, which is responsible for a smaller upper airway size.

Overnight polysomnography remains the gold standard diagnostic test for OSAS, but its feasibility in clinical practice is debated, because its use is complex, and expensive. Furthermore, interpretation of its results is not unanimously agreed on. History and physical examination can be still considered useful diagnostic tools. A significant contribution to the clinical picture can be given by some tests, which are specific for evaluating the nasal physiopathology.

Rhinomanometry gives an objective evaluation of the ventilatory function of the nose and the physiology of the rhino-pharyngo-tubal district, if performed according to the rules suggested by the Committee on Standardization. When anterior rhino-manometric examination reveals lower than normal values for nasal conductance, we carry out the nasal decongestion test (N.D.T.). It allows to differentiate functional from structural stenosis and to address the patient to medical or surgical therapy. The N.D.T. is performed as follows:1) Basal Anterior Active Rhino-

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manometry (A.A.R.); 2) Nasal decongestant: 2 sprays in each nostril; 3) After 10' control A.R.R. If this test proves negative (total nasal resistance unchanged), one might envisages the possibility of a surgical correction of the pathology, already revealed in the course of the objective examination and confirmed by X-ray examination.

Acoustic rhinometry is a relatively new method of using acoustic reflections from the airway to estimate their shape and the morphological changes induced by the congestion of the mucosa. By comparing the acoustic wave reflected from the nasal cavity to the incident wave this technique makes it possible to measure the cross-section in fixed areas at varying distances from the nostril. The reactivity of the mucosa to the administration of nasal decongestant is documented by changes in the profile of the acoustic rhinogram. This method needs more standardization such as the choice of the most suitable acoustic wave, the way of connecting the nose-piece to the nostril or the positioning of the head in respect to the incident wave. We perform acoustic rhinometry with the aid of an optometric craniostat.

The degree of involvement of the nasal mucosa in pathologic reactions is also well documented by the determination of the efficiency of nasal mucociliary transport (Muco-Ciliary Transport time-MCTt). Nasal mucociliary function is one of the main defence mechanisms of the airways against environmental pollution. Its functional and/or structural impairment is responsible for mucociliary dysfunctions.The measure of the MCTt can be performed by several methods: radio-active tracers, coloured tracer elements and radio-opaque elements. In a previous study we had found comparable values with the three techniques (Passàli et al., 1985). So we had chosen a mixture of charcoal powder and 3% saccharine; charcoal powder is an insoluble tracer and it is used for monitoring the transport efficiency of the particles entrapped into the outer gel layer; saccharine is a soluble marker, and give us the time of clearance into inner sol layer. The normal values for the charcoal powder are 8 +/- 3 minutes in children and 13 +/-2 in adults. The normal values for the saccharine are 11 +/- 6 minutes in children and 17 +/-5 in adults (Passàli et al., 1984).In perennial nasal allergy the inflammation may be responsible for alterations of the ciliary structure or for the metaplasic transformation of the respiratory mucosa into squamous epithelium. In seasonal allergic rhinopaties, as a consequence of increased glandular secretion, the ratio between the sol and gel phase of the mucus is altered and the efficiency of muco-ciliary clearance is impaired. In our experience we have found delayed times in seasonal forms and blocked clearance in perennial forms.

In perennial allergy we have pointed out 27,3+/-3,8 and 30+/-8,2 minutes, respectively with charcoal powder and saccharine.In seasonal allergy we have pointed out 15,2+/-4 and 24+/-6 minutes, respectively with charcoal powder and saccharine.All the above mentioned methods are useful in the differential diagnosis between sleep apnea syndrome and other noises caused by the turbulence that inspired air causes getting in contact with the walls of the nose and the pharynx.

CONCLUSION

Together with the history and the clinical examination, the above mentioned tests are sensitive tools, even thought relatively aspecific. Surgery can restore the patency of the upper airways, contributing to contrast the neuromuscular hypotonia as a result of the effect of the surgical scar. Primary snoring and OSAS are a continuum, and surgery may be defined as a form of prevention against pathology with potential complications. As suggested by Ameli et al. (2007) polysomnography cannot be carried out routinely due to the lack of specialised centres and because of its excessive cost. It could be prescribed only in unsuccessful adenotonsillectomies and for those children who have complicated presentations from the outset.

In any case OSAS cannot be left untreated: the evaluation of the individual pathophysiology gives the best opportunity to restore adequate upper respiratory ventilation by the rational choice between medical or surgical treatment.

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