Brazilian Journal of Medical and Biological Research (2006) 39: 1137-1142
ISSN 0100-879X

Obese obstructive sleep apnea patients with tonsil hypertrophy submitted to tonsillectomy

F.L. Martinho[1], A.I. Zonato[2], L.R.A. Bittencourt[2], M.C.M. Soares[1], R.F.N. Silva[1], L.C. Gregório[1] and S. Tufik[2]

[1]Departamento de Otorrinolaringologia, Universidade Federal de São Paulo, São Paulo, SP, Brasil
[2]Instituto do Sono, Departamento de Psicobiologia, Universidade Federal de São Paulo, São Paulo, SP, Brasil

Abstract

The physiopathology of obstructive sleep apnea-hypopnea syndrome (OSAHS) is multifactorial and obesity has been shown to be one of the main factors correlated with its occurrence. In obese patients with anatomical alterations of the upper airways it is often difficult to predict success for surgical correction since obesity is a limiting factor. Therefore, the aim of the present study was to evaluate the results of tonsillectomy in a specific group of patients, i.e., obese OSAHS patients with tonsil hypertrophy. Seven OSAHS patients with moderate obesity with obstructive palatine tonsil hypertrophy were submitted to tonsillectomy. All patients were submitted to pre- and postoperative appraisal of body mass index, otorhinolaryngology examination and polysomnography. Patients' average age was 36.4 ± 10.3 years and average preoperative body mass index was 36.6 ± 6.3 kg/m^2. Postoperative weight did not differ significantly from preoperative weight (P = 0.27). Average preoperative apnea and hypopnea index (AHI) was 81 ± 26/h and postoperative AHI was 23 ± 18/h (P = 0.0005). Average preoperative minimum oxyhemoglobin saturation (SaO_2 min) was 69 ± 14% and the postoperative value was 83 ± 3% (P = 0.038). In relation to AHI, 6 (86%) of the 7 patients studied showed a reduction of 50% in relation to preoperative level and of these, 4 (57%) presented AHI of less than 20%. Only one patient presented a reduction of less than 50% in AHI, but even so showed improved SaO_2 min. Tonsillectomy treatment for OSAHS in obese patients with obstructive palatine tonsil hypertrophy caused a significant reduction in AHI, with improvement in SaO_2 min. This procedure could be eventually considered as an option of treatment for obese OSAHS patients with significant tonsil hypertrophy when continuous positive air pressure therapy is not possible as the first choice of treatment.

Correspondence
F.L. Martinho
Rua Purpurina, 131, Conjunto 44
05435-030 São Paulo, SP
Brasil
Fax: +55-11-3815-2116
E-mail: femartinho@uol.com.br

The authors neither received any financial support nor had any involvement with organization(s) with financial interest in the subject matter.

Publication supported by FAPESP.

Received June 28, 2005
Accepted March 30, 2006

Key words
- Sleep apnea syndrome
- Obesity
- Surgery
- Tonsillectomy
- Apnea and hypopnea index

Introduction

Obstructive sleep apnea and hypopnea syndrome (OSAHS) is a prevalent condition, with 2% of women and 4% of men reporting excessive daytime sleepiness and an apnea and hypopnea index (AHI) of over 5 per sleep hour determined by polysomnography (1). The physiopathology of OSAHS is multifactorial and derives in part from upper airway or craniofacial anatomical alterations associated with alterations of the neuromuscular pharynx (2). The highest prevalence is among males and in the 40- and 50-year-old groups (3). Other factors such as obesity and upper airway or craniofacial anatomical alterations have also been correlated with the disease (2). The main upper airway anatomical alterations correlated with OSAHS are enlarged tongue, soft thick palate, web (membrane formed by low insertion of the posterior pillar in the uvula) posteriorized in relation to the oropharynx, medialized tonsillar pillars, long and thick uvula, hypertrophic tonsils, and modified Mallampati classification (MMC) levels III and IV (4-8). The MMC is graded according to palatal length and tongue size: in level III just part of the uvula and soft palate is visible, in level IV practically only the hard palate is visible. Anatomical craniofacial alterations have also been correlated with OSAHS, especially maxillary retro-projection (retrognathia) (6,9,10). Obesity is the main factor correlated with the occurrence and severity of OSAHS (11), although some studies have indicated that the correlation with severity is still controversial (11,12).

The incidence of OSAHS in obese persons may vary from 39 to 95%, which raises the question as to which factor causes some obese patients and not others to present disease. However, few studies have followed this line of research (13-16). Studies including pre- and post-bariatric surgery polysomnography for the treatment of morbid obesity have shown improvement in AHI after weight loss (17,18), but in some cases there is no cure for the disease, and obesity is not the only factor related to its physiopathology even in these patients (19,20). Pillar et al. (21) showed that bariatric surgery was effective in maintaining weight reduction in 14 long-term patients (averaging 7.5 years of treatment) but AHI increased again after this period, showing that the treatment of obesity was also of limited effectiveness in the treatment of OSAHS and that the disease tends to develop over the years.

Several forms of treatment have been proposed to control the OSAHS, but continuous positive airway pressure (CPAP) has been the most effective, and patients should always be encouraged to use it. Some patients cannot tolerate the use of CPAP and in these cases different therapeutic measures may be required (22,23). Obesity has been shown to be one of the limiting factors for success in pharyngeal surgeries (24,25), and therefore these surgical procedures are often not suggested for obese patients even in the presence of obstructive anatomical alterations. In obese patients with obstructive upper airway anatomical alterations, it is difficult to predict the roles that these factors play in the physiopathology of the disease in each patient.

The aim of the present study was to evaluate the effect of tonsillectomy in treating this specific group of patients, i.e., obese OSAHS patients with obstructive tonsil hypertrophy, who had first been introduced to CPAP therapy, but did not tolerate or refused to use it.

Patients and Methods

The study was conducted at a public clinic for patients with sleep breathing disturbances in the Otorhinolaryngology Department and the Sleep Institute of Universidade Federal de São Paulo (UNIFESP) from March 2002 to December 2003. During this period, 64 OSAHS patients were submitted to oropharyngeal surgery (tonsillectomy with

or without partial uvulectomy). None of the 64 patients were submitted to uvulopalatopharyngoplasty, a type of surgery that is no longer performed in our service. The protocol used at the public clinic consists of directed patient interview, anthropometric physical examination (body mass index, BMI), and physical examination of the upper airways and craniofacial features. During the interview, patients were asked about symptoms related to the disease, such as snoring, daytime sleepiness, breathing pauses, cognitive deficit, mood alterations, and morning migraine. They were also asked about the presence of co-morbidities such as systemic arterial hypertension, cardiac conditions, and hypothyroidism. BMI was calculated using the formula weight/height^2.

Only 7 patients in the group as a whole presented both obesity (BMI of 30 kg/m^2 or over) and obstructive tonsil hypertrophy and were included in this report. The average age of the patients (5 men and 2 women) was 36.4 ± 10.3 years (range: 23-54 years) and average BMI was 36.6 ± 6.3 kg/m^2 (maximum: 46.9 kg/m^2).

The criterion used for the diagnosis of obstructive tonsil hypertrophy was level III and IV hypertrophy, i.e., 50 to 75% obstruction of the oropharyngeal orifice (level III) or 75-100% obstruction (level IV) (4,5,8). All 7 patients had difficulty in adapting to overnight CPAP pressure titration or refused to use it. In this group of patients, especially due to the presence of obstructive tonsil hypertrophy, tonsillectomy was proposed as an alternative treatment option.

All patients had been submitted to a full-night polysomnography sleep study using the SAC-Oxford, version 10.0, with electroencephalogram monitoring, submental and tibial electromyogram, electrocardiogram, airway flow measured by a nasal cannula and oral thermistor, respiratory effort measured by thoracic-abdominal belts, oxyhemoglobin saturation measured by a wrist oximeter, and snoring and sleeping position recordings. All patients presented AHI of over five and were therefore OSAHS patients according to the criteria of the American Academy of Sleep Medicine (26). After surgery, all patients were again submitted to polysomnography to evaluate the effect of the surgical procedure on OSAHS. Pre- and postoperative polysomnography findings were analyzed statistically by the Wilcoxon test.

Patients were submitted to surgery under general anesthesia. The surgical technique consisted of bilateral tonsillectomy by dissection, closing the tonsil fossa on two planes separately (muscular first and mucosa second), with or without partial uvulectomy (removal of only the tip of the uvula when it was redundant).

The present study was approved by the UNIFESP Ethics Committee and written informed consent was obtained from all patients.

Results

The results of the physical examinations are shown in Table 1 and the results of pre- and postoperative polysomnography are shown in Table 2. Postoperative polysomnography was performed on average 65 days after the surgical procedure (range: 7-13

Table 1. Physical examination of the 7 obese patients with obstructive sleep apnea hypopnea syndrome studied.

	N = 7	%
Retrognatia	0	0
Narrow hard palate	2	29.0
Web palate	5	71.4
Enlarged tongue	2	28.6
Abnormal soft palate	1	14.3
Abnormal uvula	5	71.4
Tonsil level III	4	57.1
Tonsil level IV	3	42.9
MMC level III	4	57.1
MMC level IV	3	42.9

MMC = modified Mallampati classification.

weeks). The average preoperative and postoperative AHI were 81 ± 26 and 23 ± 18/h, respectively; and average oxyhemoglobin saturation (SaO_2 min) was 69 ± 14% preoperatively and 83 ± 3% postoperatively. There was a statistically significant improvement in AHI and SaO_2 min after the surgical procedure. Regarding the polysomnography parameters, we also observed significant improvement in percentage of slow wave sleep (stages 3 and 4 of NREM sleep; Table 2). Six (86%) of the 7 patients studied showed a reduction of AHI of at least 50% compared to the preoperative level. Patients' average weight was 112 ± 30 kg at the time of the preoperative polysomnography and 107 ± 33 kg at the time of the postoperative polysomnography, thus not showing a significant variation (P = 0.27) that could interfere with the polysomnography results (Table 3).

Patients stayed in the hospital for only 1 day after surgery. Only 1 patient presented breathing discomfort after the end of anesthesia and was submitted to temporary tracheotomy. This patient was also released the day after the surgical procedure and was decannulated on the 7th day after surgery. No other postoperative complications were observed.

Discussion

There is no doubt that the first choice of treatment for obese patients with moderate to severe OSAHS is CPAP therapy. Another treatment is considered only if these patients do not adhere to or refuse CPAP use. Many studies have shown that obesity and severity of disease are limiting factors for the success of pharyngeal surgeries (24,25,27,28), a fact that often discourages surgeons from performing more aggressive pharyngeal procedures (especially uvulopalatopharyngoplasty) in these patients. On the other hand, we

Table 2. Pre- and postoperative polysomnography parameters of the patients studied.

	SE	AHI	S1	S2	S3/4	REM	SaO_2 min
Preoperative	90 ± 4%	81 ± 26	9 ± 9%	71 ± 5%	6 ± 6%	14 ± 14%	69 ± 14%
Postoperative	88 ± 10%	23 ± 18*	7 ± 5%	60 ± 9%	16 ± 5%*	16 ± 9%	83 ± 3%*

Data are reported as means ± SD. SE = sleep efficiency; AHI = apnea and hypopnea per sleep hour index; S1 = percentage of stage 1 NREM sleep; S2 = percentage of stage 2 NREM sleep; S3/4 = sum of stages 3 and 4 of NREM sleep; REM = percentage of REM sleep; SaO_2 min = minimum oxyhemoglobin saturation.
*P ≤ 0.05 compared to preoperative values (Wilcoxon test).

Table 3. Patient data.

Patient	Age (years)	AHI Preop.	AHI Postop.	SaO_2 min Preop.	SaO_2 min Postop.	Surgery
1	29	106	8	51%	84%	To
2	54	63	11	82%	85%	To + Uv
3	36	95	40	60%	81%	To
4	23	105	29	66%	85%	To
5	30	92	53	71%	79%	To
6	40	36	6	91%	82%	To
7	43	73	17	60%	88%	To + Uv
Mean ± SD	36 ± 10	81 ± 26	23 ± 18	69 ± 0.14	83 ± 0.03	

AHI = apnea and hypopnea per sleep hour index; Preop. = preoperative; Postop. = postoperative; SaO_2 min = minimum oxyhemoglobin saturation; To = tonsillectomy; Uv = partial uvulectomy.

think that a less aggressive and more physiological pharyngeal surgical procedure such as tonsillectomy should eventually be considered as an option for the treatment of obese OSAHS patients with significant tonsil hypertrophy when CPAP therapy is not possible as the first choice of therapy.

Studies attempting to correlate the presence of anatomical alterations with disease severity found the highest correlations for tonsil hypertrophy and MMC (score levels of III and IV) (4,5). Zonato et al. (4) showed that only 14.4% of OSAHS patients have significant tonsil hypertrophy (levels III or IV), which shows that this physical abnormality is not observed in the majority of OSAHS patients. Considering the degree of obesity of OSAHS patients, Zonato et al. (29) reported in a series of 624 patients that 39.5% of public patients and 39.6% of private patients had a BMI over 30 kg/m^2. Moderately obese patients (BMI over 30 kg/m^2) also having tonsil hypertrophy (levels III or IV) may be a rare situation, with these patients representing a minority group among OSAHS patients as a whole. In view of this situation, we think that the data of this small case report series, as a preliminary study, may be relevant to show that tonsillectomy can be performed safely, and may lead to significant improvement in polysomnography data.

Our data did not show a complete resolution of the disease, but definitely represented substantial improvement in AHI severity, oxyhemoglobin saturation and sleep quality (increase in NREM sleep 3 and 4). Although all patients presented significant improvement in AHI and SaO_2 min, the level of improvement varied. The preoperative AHI of the 7 patients was quite high, with respective values of 106, 105, 95, 92, 73, 63, and 36. After surgery, the highest AHI was 53/h. These data represent a significant change and perhaps a treatment option to be considered for specific patients. There was no correlation of this variation with other parameters such as age, BMI or the presence of craniofacial alterations visualized by physical examination. We did not identify any factor that might predict which patients would benefit most or least from surgery.

This study has considerable limitations regarding the number of treated patients, the absence of a control group and the short-term follow-up data. Surgical procedures usually show different results in long-term follow-up. Our purpose was to show that a simple and physiological procedure such as tonsillectomy may be a possibility for an uncommon group of patients, i.e., those with moderate obesity and huge tonsils who are unable to adhere to another therapy. These data are the preliminary results of a case report series and future studies are still needed and should be encouraged.

We performed tonsillectomy in this group of patients, first because we did not have another option (since CPAP was not accepted), and second, because all of them had huge tonsils, and also because it is known that treatment of obesity alone is often not enough to cure OSAHS patients (19-21). We believe that for obese patients the correction of obstructive upper airway anatomical alterations (tonsil hypertrophy levels III and IV) may be considered as a possibility for therapy, not as a routine, but for selected patients.

We showed here that tonsillectomy as a treatment for OSAHS in obese patients with tonsil hypertrophy led to a significant reduction in AHI, improvement in SaO_2 min and better quality of sleep (improvement in slow wave sleep). These data are the preliminary results of a small case report series, but may encourage future investigations. Tonsillectomy may be eventually considered as an option of treatment for obese OSAHS patients with significant tonsil hypertrophy, when CPAP therapy is not possible as the first choice of therapy.

References

1. Young T, Palta M, Dempsey J, Skatrud J, Weber S, Badr S. The occurrence of sleep-disordered breathing among middle-aged adults. *N Engl J Med* 1993; 328: 1230-1235.
2. Kuna S, Remmers JE. Anatomy and physiology of upper airway obstruction. In: Krieger MH, Roth T, Dement WC (Editors), *Principles and practice of sleep medicine*. 3rd edn. Philadelphia: W.B. Saunders; 2000. p 840-858.
3. Olson LG, King MT, Hensley MJ, Saunders NA. A community study of snoring and sleep-disordered breathing. Prevalence. *Am J Respir Crit Care Med* 1995; 152: 711-716.
4. Zonato AI, Bittencourt LR, Martinho FL, Junior JF, Gregorio LC, Tufik S. Association of systematic head and neck physical examination with severity of obstructive sleep apnea-hypopnea syndrome. *Laryngoscope* 2003; 113: 973-980.
5. Friedman M, Tanyeri H, La Rosa M, Landsberg R, Vaidyanathan K, Pieri S, et al. Clinical predictors of obstructive sleep apnea. *Laryngoscope* 1999; 109: 1901-1907.
6. Woodson BT. Examination of the upper airway. *Atlas Oral Maxillofac Surg Clin North Am* 1995; 7: 257-267.
7. Rombaux P, Bertrand B, Boudewyns A, Deron P, Goffart Y, Hassid S, et al. Standard ENT clinical evaluation of the sleep-disordered breathing patient; a consensus report. *Acta Otorhinolaryngol Belg* 2002; 56: 127-137.
8. Zonato AI, Martinho FL, Bittencourt LR, de Oliveira Campones BO, Gregorio LC, Tufik S. Head and neck physical examination: comparison between nonapneic and obstructive sleep apnea patients. *Laryngoscope* 2005; 115: 1030-1034.
9. Teculescu DB, Montaut-Verient B, Hannhart B, Virion JM, Cornette A, Michaely JP. Breathing pauses during sleep: can a non-invasive ENT examination help identify subjects at risk in epidemiological settings? *Med Hypotheses* 2001; 56: 653-656.
10. Tsai WH, Remmers JE, Brant R, Flemons WW, Davies J, Macarthur C. A decision rule for diagnostic testing in obstructive sleep apnea. *Am J Respir Crit Care Med* 2003; 167: 1427-1432.
11. Ward FW, McNicholas WT. Clinical prediction of the sleep apnea syndrome. *Sleep Med Rev* 1997; 1: 19-32.
12. Fogel RB, Malhotra A, Dalagiorgou G, Robinson MK, Jakab M, Kikinis R, et al. Anatomic and physiologic predictors of apnea severity in morbidly obese subjects. *Sleep* 2003; 26: 150-155.
13. Valencia-Flores M, Orea A, Castano VA, Resendiz M, Rosales M, Rebollar V, et al. Prevalence of sleep apnea and electrocardiographic disturbances in morbidly obese patients. *Obes Res* 2000; 8: 262-269.
14. Van Boxem TJ, de Groot GH. Prevalence and severity of sleep disordered breathing in a group of morbidly obese patients. *Neth J Med* 1999; 54: 202-206.
15. Broussolle C, Piperno D, Gormand F, Cambursano H, Berthier M, Perrin-Fayolle M, et al. Sleep apnea syndrome in obese patients: are there any predictive factors? *Rev Med Interne* 1994; 15: 161-165.
16. Vgontzas AN, Tan TL, Bixler EO, Martin LF, Shubert D, Kales A. Sleep apnea and sleep disruption in obese patients. *Arch Intern Med* 1994; 154: 1705-1711.
17. O'Brien PE, Dixon JB, Brown W, Schachter LM, Chapman L, Burn AJ, et al. The laparoscopic adjustable gastric band (Lap-Band): a prospective study of medium-term effects on weight, health and quality of life. *Obes Surg* 2002; 12: 652-660.
18. Scheuller M, Weider D. Bariatric surgery for treatment of sleep apnea syndrome in 15 morbidly obese patients: long-term results. *Otolaryngol Head Neck Surg* 2001; 125: 299-302.
19. O'Keeffe T, Patterson EJ. Evidence supporting routine polysomnography before bariatric surgery. *Obes Surg* 2004; 14: 23-26.
20. Guardiano SA, Scott JA, Ware JC, Schechner SA. The long-term results of gastric bypass on indexes of sleep apnea. *Chest* 2003; 124: 1615-1619.
21. Pillar G, Peled R, Lavie P. Recurrence of sleep apnea without concomitant weight increase 7.5 years after weight reduction surgery. *Chest* 1994; 106: 1702-1704.
22. Grunstein R, Sullivan C. Continuous positive airway pressure for sleep breathing disorders. In: Krieger MH, Roth T, Dement WC (Editors), *Principles and practice of sleep medicine*. 3rd edn. Philadelphia: W.B. Saunders; 2000. p 894-912.
23. Powell NB, Zonato AI, Weaver EM, Li K, Troell R, Riley RW, et al. Radiofrequency treatment of turbinate hypertrophy in subjects using continuous positive airway pressure: a randomized, double-blind, placebo-controlled clinical pilot trial. *Laryngoscope* 2001; 111: 1783-1790.
24. Sociedade Brasileira de Otorrinolaringologia. Atualização otorrinolaringológica em cirurgia do ronco e apnéia. *Rev Bras Otorrinolaringol* 2002; 68: 1-24.
25. Sher AE, Schechtman KB, Piccirillo JF. The efficacy of surgical modifications of the upper airway in adults with obstructive sleep apnea syndrome. *Sleep* 1996; 19: 156-177.
26. American Academy of Sleep Medicine. Sleep-related breathing disorders in adults: recommendations for syndrome definition and measurement techniques in clinical research - AASM Task Force. *Sleep* 1999; 22: 667-689.
27. Janson C, Gislason T, Bengtsson H, Eriksson G, Lindberg E, Lindholm CE, et al. Long-term follow-up of patients with obstructive sleep apnea treated with uvulopalatopharyngoplasty. *Arch Otolaryngol Head Neck Surg* 1997; 123: 257-262.
28. Dunlevy TM, Karakla DW. Uvulopalatopharyngoplasty: the Naval Medical Center, Portsmouth, experience. *Am J Otolaryngol* 1998; 19: 174-177.
29. Zonato AI, Bittencourt LR, Martinho FL, Baiard P, Togeiro SM, Edito-Silva AA, et al. A comparison of public and private obstructive sleep apnea clinics. *Braz J Med Biol Res* 2004; 37: 69-76.