Efficacy of Multilevel Pharyngeal Surgery for OSA on Cardiac arrhythmias

*Ossama H. Abdel-Latif, M.D.; Mona M. Rayan, M.D. **
Department of Otolaryngology, Ain Shams University, Cairo, Egypt
** Department of Cardiology, Ain Shams University, Cairo, Egypt*

Abstract

OBJECTIVE: Is to determine the efficacy of multilevel pharyngeal surgery for severe obstructive sleep apnea (OSA) on relieving symptoms and cardiac arrhythmia.

STUDY DESIGN: Prospective nonrandomized study

Methods: Thirty five patients with severe OSA were enrolled in this study after clinical examination, endoscopy and polysomnography. 24 hour ambulatory ECG monitoring was done 24 hour before and 1-3 month after surgery .Surgery included uvulopalatal flap and radiofrequency treatment of the tongue base. Questionnaire including relevant symptoms associated with sleep disorders and Epworth Sleepines Scale (ESS) were recorded at baseline and 1-3 months after surgery.

RESULTS:

All patients reported symptomatic improvement. Multilevel pharyngeal surgery resulted in 94% improvement in snoring, 80% improvement in chocking, 89% improvement in apnea, and 82% in awakenings. Postoperatively, pathologically significant rhythm disturbances persisted in 4 (40%) out of ten patients whereas the non significant rhythm disturbances show resolution in the other 20 patients. Successful outcome regarding the cardiac arrhythmia was achieved in 86.6%.

CONCLUSION: Successful outcome, defined by subjective improvement of symptoms and resolution of cardiac arrhythmia, was achieved with multilevel surgery for most patients with sever OSA.

Key words: obstructive sleep apnea (OSA); multilevel pharyngeal surgery; cardiac arrhythmia.

Introduction

Obstructive sleep apnea (OSA) is characterized by recurrent obstruction of the upper airway during sleep, usually in combination with serious repercussions for the affected person (Battagel, 1996). Narrowed upper airway and abnormal collapsibility during sleep are the main causes of OSA (Isono et al., 1997). The consequences of the collapse of the upper airway are airway resistance, hypopnea, and apnea. Increased ventilatory effort causes EEG microarousals, alterations in sleep architecture, sleep fragmentation, hypersomnolence, and neurological symptoms of OSA (Naegele et al., 1998). Reduced airflow results in hypoxemia that can lead to hypertension, cerebral vascular accident, arrhythmias and myocardial infarction (Bananian et al., 2002).

Nocturnal cardiac rhythm disturbance are common in patients with obstructive sleep apnea syndrome (OSAS) (Randazzo et al., 1996). Indeed, rhythm disturbances such as bradycardia with or without alternating tachycardia are typical features of OSAS (Bonsignore et al., 1997) .However, the incidence of pathologically significant rhythm disturbances, such as heart block, supraventricular tachycardia, and ventricular arrhythmia, is not clear-cut. The incidence of which is of particular clinical significance in view of the reported Increase in cardiovascular morbidity and mortality among patients with OSAS (Liston et al., 1994).

Nasal continuous positive airway pressure (CPAP) is considered the gold standard and the primary treatment for OSA. However, the therapeutic use of CPAP is seriously limited by low long-term compliance (Meurice et al., 1994). In the case of CPAP intolerance, various so-called multilevel surgical procedures exist and are increasingly used. These procedures consist of either a combination or sequential surgery of the nose, the soft palate, the tongue base, the hyoid, the upper jaw, and the lower jaw (Verse et al., 2006).

Aim of this study Is to determine the efficacy of multilevel pharyngeal surgery for severe obstructive sleep apnea (OSA) on relieving symptoms and cardiac arrhythmia.

Patients and Methods:

Patient Selection and Evaluation

This is a prospective analysis of data gathered from 35 severe OSA patients treated with multilevel pharyngeal surgery between May 2004 and July 2007 at the Department of Otorhinolaryngology of AinShams University Hospitals. Adults with OSA were included in the study only if the preoperative apnea-hypopnea index (AHI) was above 30/h. The exclusion criteria were simple snoring, mild and moderate OSA (RDI < 30/h) and previous surgery for OSA.

All patients underwent a complete head and neck evaluation, fiberoptic nasoendoscopy in conjunction with Muller 's maneuver, and overnight standard polysomnography (PSG), including electroencephalography (EEG), electrooculography (EOG), measurement of oral and nasal airflow with thermistors, electrocardiography (ECG), O2 saturation (SpO2), EMG (chin, intercostal) anterior tibialis and thoracic and abdominal respiratory efforts, snore sound via microphone, and monitoring of body position.

PSGs were evaluated and scored according to a universally accepted criteria for respiratory disturbance index (RDI), apnea index (AI), hypopnea index (HI). Obstructive apneas were defined as cessation of airflow for >10 seconds. Hypopneas were defined as >50% reduction of inspiratory airflow for >10 seconds with an associated 4% decrease in oxyhemoglobin saturation. RDI was defined as the number of obstructive apneas and hypopneas and respiratory effort-related arousals (RERA)/h. AI was defined as the number of apneic episodes that occur during sleep divided by the number of hours of sleep (ICSD,2005).

Standard cephalometric radiographs were obtained preoperatively and posterior airway space (PAS) was determined. The Epworth Sleepiness Scale and questionnaire including relevant symptoms associated with sleep disorders, such as Snoring, witnessed apneas , nocturnal choking or gasping, and Awakenings were assessed by asking the patient to grade their symptoms on a scale of 0 to 3 (0, symptoms absent; 3, symptoms always present).

All patients were offered the option of nasal CPAP as a first choice. Patients were selected for surgery based on the clinical examination findings, Muller maneuver, cephalometric radiographs and PSG results (RDI >30/h). All patients underwent preoperative counseling and informed consent was obtained. According to the clinical examination, all patients were classified as having retro palatal and retro lingual obstruction. All patients underwent multilevel pharyngeal surgery including UPPP (the uvulopalatal flap) and radiofrequency volume reduction of the base of tongue (BOT RFVR) under general anaesthesia.

Six -lead, three -channel ambulatory ECG recordings were applied to all patients 24 hours before and 1-3 months after surgery (from 10:00 am to 10:00 am the next morning) using a Holter monitor (Helmed Medical; Oxford, UK) .The ambulatory monitors were fitted to the patients by experienced staff. ECG tapes were each interpreted by one experienced cardiologist. The interpreting system used was Helmed Medical. All deviations from normal sinus rhythm were recorded.

For the purpose of the present study, rhythm disturbances considered pathologically significant include Ventricular tachycardia or fibrillation, complex ventricular ectopy (including runs of three beats or more, recurrent bigeminy, or polygeminy), new-onset supraventricular tachycardia other than sinus tachycardia, pauses of >100 msec, and second- or third-degree atrioventricular (AV) block which is defined as intermittent or persistent loss of association between P waves and QRS complexes seen on the ECG. Other rhythm disturbances, recorded but not deemed significant, included asymptomatic sinus bradycardia or tachycardia, and isolated atrial or ventricular premature beats.

Surgical Technique:

The surgical protocol included

(1) Uvulopalatopharyngoplasty was carried out in a manner similar to the uvulopalatal flap of Powell et al., 1996 in combination with a tonsillectomy (if tonsils were still in place). Oral soft palate mucosa and submucosa was sharply debrided and the uvular tip was minimally trimmed. The palate was then reflected anterior-superiorly to the mid soft-hard palate junction and approximated using 3-0 vicryl sutures. In addition, for most patients, incisions were made in the palatoglossal muscles, at the level of the palatal rim and approximation was carried out superolaterally after medial undermining. If tonsils were absent, a trough was created in the tonsillar fossa and approximation was carried out superolaterally after medial undermining.

(2) a radiofrequency surgery of the tongue base (RFVR) Tongue base radiofrequency was applied under general anesthesia in conjunction with Uvulopalatopharyngoplasty. BOT RFVR was the only procedure used to treat the base of tongue in this protocol. Tongue base radiofrequency has the potential for tongue base abscess and airway obstruction. Pretreatment with an antiseptic oral rinse (Chlorhexidine) and systemic oral antibiotic directed toward oral flora significantly lessen this risk. Because of the highly vascular tongue muscle, infiltrated fluid will rapidly dissipate, and radiofrequency treatment should be performed immediately after injection of the treatment site. Infiltration with a mixture of 0.45 N saline and 1% lidocaine with 1:200,000 epinephrine should be performed in the midline or either side of midline with 4-5 mL/treatment site. Treatment should be directed within 1-1.5 cm of midline to avoid the lingual neurovascular bundle.

It should be on the posterior aspect of the dorsal surface of the tongue, slightly anterior to the circumvallate papillae. A minimum of 4 sites should be treated at each session, with 750 J/site, target temperature 85°C, and a maximum power of 10 W. Two sites are treated in the posterior tongue base and 2 in the anterior tongue base, approximately 1-2 cm apart.

All patients were treated postoperatively with systemic oral antibiotics along with analgesics as needed for 3 days. Steroids were not used. Patients were seen the day after treatment, at 4 days, at 4 weeks, or as needed to assess swelling, pain, and potential complications. Treatment sessions (RFVR) can be performed on a monthly basis with 2-3 treatment sessions and until the patient was symptom free as evidenced by questionnaire and Epworth Sleepiness Scale (ESS) as Post-operative Polysomnograms were not obtained, for reasons of patient expense.

Postoperative Diagnosis

After a minimum of 1-3months depending on the improvement of the patientó s symptoms ,all patients were asked to undergo a further otorhinoloaryngological examination, 24 hour ambulatory ECG monitoring and to conduct a questionnaire and the Epworth Sleepiness Scale .

The Multiple Sleep Latency Test (MSLT) is often considered to be the gold standard assessment for EDS (Carskadon., et al 1986) but the expense and time required for laboratory-based, technician-monitored EEG, electrooculographic, and electromyographic recording has motivated investigators to develop alternative measures. The Epworth Sleepiness Scale was proposed in 1991 by Johns as one such alternativeas for measurement of EDS. Eight items regarding the likelihood of dozing in sedentary situations are rated by a patient on a Likert scale from 0 (never) to 3 (high chance), and the total of the responses is the Epworth score (ES), which can range from 0 to 24 with a score of greater than 10 indicating EDS.

Results:

Forty-three patients underwent concurrent UPPP and RFVR of tongue base procedures over a 3-year period. From this group, 8 patients were excluded for lack of post-operative 24 hour ambulatory ECG monitoring. The remaining 35 patients with complete records were analyzed.

The study population included 35 patients (29 men and 6 women) suffering from severe OSA (diagnosed by standard overnight polysomnography).The age range was 23-48 year (mean: 36 y).

Subjective assessment of the patients was carried out pre-operatively and at 1-3 months post-operatively by questionnaire and the Epworth Sleepiness Scale. Patients were interviewed whether symptoms were no longer present or largely resolved. Excessive daytime sleepiness was common pre-operatively and was considerably reduced in most patients after surgery. The Epworth score was reduced from 14.0 to 7.0. The improved symptom in the self-reported questionnaire is defined as improvement of the complaint in at least one ranking step (score 3 became score 2 or 1) whereas the cured symptom is defined as complete resolution or disappearance of the complaint (became score 0). Based on these criteria, the results of the self-reported questionnaire showed improvement in symptoms, including almost uniform resolution of snoring (94%) and major improvements in apneas (89%) , frequent awakenings (82%) and choking (80 %).

Table (1): preoperative AHI related to the presence or absence of cardiac arrhythmia.

Study population	Number of patients	AHI(mean)	Type of arrhythmia
Group A	5	36	No arrhythmia
Group B	20	48	Non significant arrhythmia
Group C	10	57	Pathological arrhythmia

Based on the results obtained by preoperative Holter monitoring, patients were classified into three groups: **group A**: those with no rhythm Disturbances; **group B**: those with non significant rhythm disturbances; and **group C**: those with pathologically significant rhythm disturbances. Out of the 10 patients of group C, eight patients had complex ventricular ectopy (recurrent bigeminy), one patient had second-degree AV block lasting 4.5 min, and another patient developed sinus pauses >100 msec. All rhythm disturbances occurred between the 11:00 pm and 9:00 am.

The incidence of arrhythmia was related to the severity of AHI as shown in table (1).

Successful outcome was defined as post-operative disappearance of the cardiac arrhythmia on postoperative 24 hour ambulatory ECG monitoring and this have been accomplished in 26 patients out of 30 patients of group B and C (86.6 %).Postoperatively, pathologically significant rhythm disturbances persisted in 4 patients (40%), three were discovered to have systemic hypertension that required therapy and the other patient had ischemic heart disease. Surgery was associated with resolution of non significant rhythm disturbances in the other 20 patients (Fig. 1and 2).

Complications in the patient series consisted of 2cases of secondary post tonsillar fossa hemorrhages that were treated conservatively. Temporary oronasal reflux occurred in 3 patients.

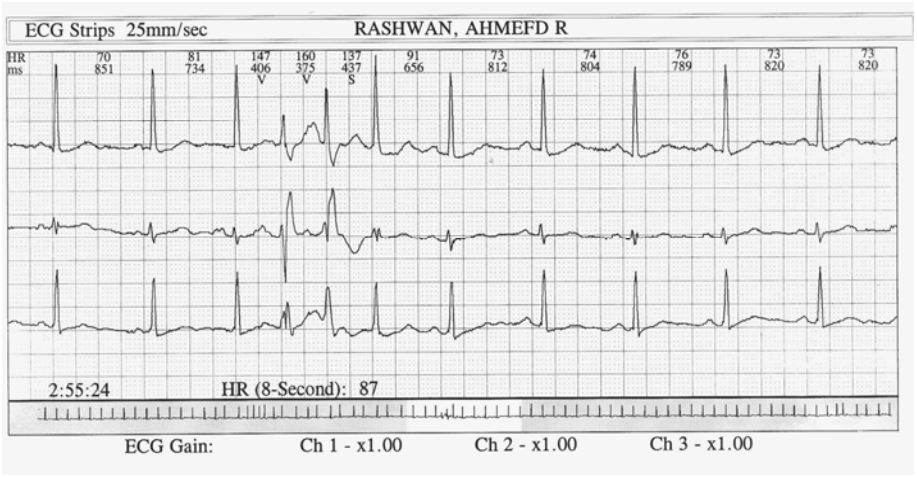

Fig. (1) Preoperative 3 channel Holter monitoring of a patient in group (c) that showed a run of two multifocal ventricular permatures.

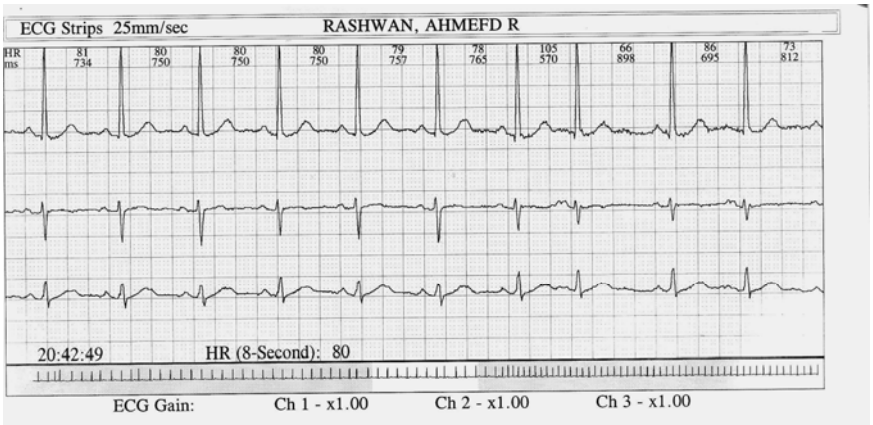

Fig. (2) Postoperative 3 channel Holter record of the same patient.

Discussion:

In 1989, a multi-level procedure for the surgical therapy of OSA was presented for the first time by Waite et al. They combined nasal surgery with a UPPP, a partial tongue base resection, genioglossus advancement, and a maxillomandibular advancement osteotomy. Basically, the classification of the upper airway into different levels of obstruction goes back to Fujita, 1993 who discriminated between retro palatal and retro lingual obstruction. On the basis of this definition, Riley et al., 1993 developed the concept of multilevel surgery.

Our study presents a combination of upper airway surgery. On the velopharyngeal level, a uvulopalatal flap was performed. If tonsils were still in place, a tonsillectomy was performed in addition because tonsillectomy has been proven to be very effective in the therapy of OSA (Verse et al., 2000). The palatal pillars were then sutured together as known from uvulopalatoplasty. To address retro lingual obstruction, the protocol comprises a radiofrequency treatment of the tongue base which is considered as a minimally invasive therapy (Stuck et al., 2003).

As regards symptomatic improvement, multilevel pharyngeal surgery resulted in 94% improvement in snoring, 80% improvement in chocking, 89% improvement in apnea, and 82% in awakenings. These outcomes are near to those reported by KAO et al ., 2003 who found that surgery resulted in symptomatic improvement in 95.2% of snoring, 86% of chocking , 97.6% of apnea ,and 90.5% of awakenings .

Powell et al., 2005 reported that cardiovascular derangements (arrhythmia, hypertension) are an indication for surgery in OSA. The present findings indicate that cardiac rhythm disturbances, found in patients with OSAS, are greatly abolished following surgery. However, to our knowledge there are no studies that adopt surgery as a measure to relieve arrhythmias.

The exclusive nocturnal nature of the rhythm disturbances in these patients is different from the common pattern of rhythm disturbances in patients with cardiac disease, where rhythm disturbances are less frequent during sleep than during wakefulness. Potential mechanisms for rhythm disturbances in patients with OSAS include the recurrent episodes of hypoxemia and arousal that are typical features of apnea and which are associated with increased Sympathetic activity and heightened adrenergic response.

An interesting finding of the present study is that severity of OSA was greater in patients with rhythm disturbances as compared to those without. This finding contrasts other reports that failed to show a relationship between the presence of rhythm disturbances and the severity of OSA.Flemons et al.,1993 studied 200 consecutive patients referred for suspected OSA and found that cardiac arrhythmia was not common in OSA patients and that the presence of arrhythmia was not related to the severity of OSA. This controversy may be due to different patient cohort included in both studies. As in Flemons', he included patients with suspected OSA whereas, in the present study, we included only patients with documented severe OSA.

The limitations of the present study are the small study population who were followed for short period and the lack of post-operative PSGs that was not done due to cost.

Conclusion: We conclude that cardiac rhythm disturbances during sleep in patients with OSAS are correlated with OSA severity, and that they are effectively treated by multilevel surgery including uvulopalatal flap and a radiofrequency surgery of the tongue base**.**

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