Selected surgical managements in snoring and obstructive sleep apnoea patients

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Abstract—Obstructive sleep apnea syndrome (OSAS) may contribute to the development of some somatic diseases and disorders of perception and emotion. The problem often concerns multilevel decrease in airway patency. For that reason the diagnostic process and the appropriate surgical procedures are crucial to reach the best results in the treatment of OSAS.

The aim of this study was to assess the efficacy of the surgical treatment in patients with OSAS.

We have therefore reviewed operative findings in patients with mild, moderate and severe OSAS. A precise laryngological examination and screening polysomnography (Poly-Mesam) were performed in all patients before surgery. The patients filled in the questionnaires concerning their complaints. The results of the above examinations let to qualify patients to the appropriate surgical procedures. For this study we include patients qualified to septoplasty, laser assisted uvulopalatoplasty (LAUP), uvulopalatopharyngoplasty (UPPP) and radiofrequency induced thermotherapy of the tongue base (RITT). Outcome evaluation of surgery was performed on the basis of data received from follow-up laryngological examinations (in early and late postoperative treatment), selected parameters obtained from Poly–Mesam test as well as follow-up questionnaires for subjective opinion of patients performed 6 months after surgery.

The improvement, defined as decreasing some sleep parameters, such as a respiratory disturbance index (RDI) more than 50%, decreasing the loudness of snoring, decreasing the number of hypopneas and better values of blood saturation we observed in most cases. After UPPP we noticed changes in retropalatal space, soft palate dimensions and uvula–posterior pharyngeal wall distance. In postoperative period we didn't observe severe complications. In some cases we found short-lived palatal deficiency after UPPP. Patients after tongue base reduction experienced sometimes discomfort and throat pain lasting from two to four days. In two patients we observed swelling tongue base which decreased in a few days. Our results indicate that surgery in OSAS contribute to normalization in some sleep parameters. In majority patients declared the subjective improvement after surgery.

Keywords—OSAS, snoring, septoplasty, uvulopalatoplasty, uvulopalatopharyngoplasty, radiofrequency induced thermotherapy.

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I. Introduction

Snoring and obstructive sleep apnoea syndrome (OSAS) are prevalent and important causes of sleep disturbance. Snoring, historically considered to be only a habitual annoyance, has significant physical and social consequences. OSAS is now considered to be a major public health concern with significant morbidity and mortality. It is a serious medical problem producing both physical and behavioral derangement. It is essential to provide a thorough workup and evaluation of all patients seeking care for snoring and apnoeas. OSAS is characterized by repeated narrowing or even upper airway collapse while breathing during sleep. It results in a continuum of increasing upper airway resistance, reduced blood oxygen levels, fragmentation of sleep and clinical manifestations from snoring alone to obstructive sleep apnoea, cardiovascular and pulmonary complications, daytime hypersomnia which leads to occupational disability and behavioral changes. The patophysiology of OSAS is related with local anatomical predispositions to OSAS such as craniofacial anomalies, adenoid and tonsillar hypertrophy, macroglossia, hypertonic oropharyngeal soft tissue, base of tongue proptosis, mandibular hypoplasia, posterior mandibular displacement, maxillary retrusion, enlarged uvula, retrognathia, and inferior positioning of the hyoid [1]. Generally in most cases there are three areas need to be taken care of by laryngologists, i.e. nasal cavity, naso-pharyngeal space and middle pharynx. These areas of the upper air ways can be improved after surgery. Surgical approaches may also include hyoid advancement and suspension, septoplasty with turbinate reduction, tongue base excisions, myoplasty of tongue, displacement of hyoid, maxilla or mandible fragments [2]. Continuous positive airway pressure mask (CPAP) is considered the treatment of choice for OSAS patients, however it is observed poor patient acceptance especially in younger patients, mask expense as well as contraindications for using the mask and compliance remain problematic. Surgical procedures have been developed to alter the offending anatomic abnormalities responsible for OSAS. Identification of the offending anatomic site with application of the most appropriate surgical procedure is essential for effective surgical treatment of OSAS. When the region of narrowing or upper airway collapse is indentified the certain surgical procedure could be applied. Septoplasty,

septorhinoplasty and laser mucotomy are suggested for snoring and OSAS patients when increased air nasal resistance is observed.

First known mention of rhinologic surgery we find in the 3500-year-old Ebers Papyrus. One of the first studies about the role of the nasal obstruction in patients with disturbed sleep, insomnia, nightmares, impaired intellect and memory was described by Carpenter in 1892 [3]. Most data concerning the meaning of the nasal surgery in patients with OSAS started in 1980s.

The role of nasal patency in the pathogenesis of OSAS is not fully understood. Chronic nasal obstruction is often caused by enlargement of the inferior nasal turbinate. It is commonly associated with anatomical and pathological conditions such as hypertrophic inferior turbinates, deviated septum and allergy [4]. Obstruction of the air flow due to mucosal swelling of the inferior turbinates may affect patients throughout the day as well as during sleep, contribute to headaches, olfactory disturbances and sleep disorders such as snoring and obstructive sleep apnoea. The inferior nasal turbinates play an important role in protecting the pharynx and larynx from the effect of direct insult of airflow and have influence on entire lung resistance. There are conflicting data in the literature considering the influence of the nasal resistance on RDI. It is important to use the minimally invasive, safe and effective method for volume reduction of hypertrophied turbinate. Instead of conventional surgery of the turbinates, laser CO_2 vaporization can be used [5]. However the effectiveness of nasal surgery such as laser mucotomy reached 55% in the group of unselected mild to moderate OSAS patients. Snoring volume decreased to the level that did not disturb sleep of others in 75% of patients. These surgical procedures caused noticeable decrease of snoring volume that was corroborated both subjectively and objectively. At the same time snoring was more reduced than RDI in studied group of patients [6].

One of the most common surgical procedure in OSAS patients is uvulopalatopharyngoplasty (UPPP). UPPP was described by Ikematsu in 1952. This method has taken on a new lease of life in 1980s when Fujita disseminated the procedure in USA [7]-[8]. Its efficacy is generally accepted, and its use, especially in cases of obstructive sleep apnea syndrome, is the only treatment of the palatal velum at present practiced. It is a procedure used to remove excess tissue in the middle pharynx to widen the airway.

LAUP is a staged office-based procedure involving removal of excessive uvular mucosa and creation of transpalatal vertical troughs to effectively widen the retropalatal airway. It is mainly used as an alternative method to treat habitual snoring. LAUP was first performed by Kamami in 1988 [9]. The procedure can reduce the airway obstruction in the oropharynx level. LAUP is the simple, reliable surgical procedure performed in an office setting under the local anesthesia, without hospitalization.

Tongue base radio frequency volume reduction (RITT) has been proposed as means of correcting the obstruction caused by the collapse or hypertrophy of the tongue base in patients having sleep-disordered breathing. It is a procedure performed under local anesthesia. I usually use the Celon system which is a bipolar technique allows for a more rapid energy transmission into the tissue. We administer between 8 and 16 lesions per session depending on the size of the tongue base.

II. MATERIALS AND METHODS

Seventy nine randomly selected patients with snoring and varying degrees of sleep-disordered breathing were included in this study. Disease was suspected on the basis of a history of snoring in all patients with or without daytime hypersomnolence or chronic fatigue. The study was approved by the Bioethic Committee and all patients signed the deliberate agreement to participate in the study. All patients were evaluated by otolaryngological examination and rhinometry which is an objective method for nasal resistance measurements. In the study group there were sixty one men and eighteen women ranging in age from 38 to 71 years. All patients had preoperative test using Poly-Mesam as a reliable, screening examination for recognition of the characteristics of ventilatory disorders and for diagnosis of OSAS, preoperative craniofacial CT scans for cephalometric evaluation. Variables examined include age, sex, body mass index (BMI), respiratory disturbance index (RDI) and lowest oxygen saturation. We divided patients for two groups: snoring patients and OSAS patients. OSAS patients had at least RDI more than 5, minimal oxygen saturation less than 85% and more than 50% of sleeping time were snoring.

The nasal patency to airflow was estimated by means of active anterior rhinomanometry (Rhinomanometry 300, Atmos 300, GmbH, Germany) using standard technique. Snoring or OSAS patients with hypertrophy of lower turbinates underwent CO_2–laser mucotomy under local anesthesia (1% Lidocaine) with a microslad attached to a Sharplan 15watts . The patients were in supine position with the head elevated to 30^0. The procedure was performed by vaporizing the anterior 2-3 cm of each inferior turbinate. The average time of procedure was few minutes. No antibiotics or other medications were used following surgery.

Snoring and OSAS patients with deviation of nasal septum with increased nasal resistance underwent septoplasty under general anesthesia.

Snoring patients with hypertrophy in middle pharynx (enlarged uvula, soft palate and palate-pharyngeal arches) underwent LAUP under local anesthesia (1% Lidocaine). The average time of procedure was also few minutes. No antibiotics were used following surgery. Antiseptic spray was usually useful.

Patients with snoring or OSAS with enlarged mass of tongue base (at least III^0 in Mallampati scale) underwent radiofrequency induced termoteraphy (CELON) under local anesthesia (1% Lidocaine). No antibiotics were used following surgery. Antiseptic spray and pain killers were usually useful and necessary.

OSAS patients with hypertonic oropharyngeal soft tissue, enlarged tonsils, uvula and soft palate with RDI and AHI (apnea-hypopnea index) more than 10 were classified for UPPP performed under general anesthesia. Antibiotics were always administered following surgery as well as pain killers and antiseptic spray.

Postoperative evaluation was performed on the 1st day, 1st week, 1st month and 6 months after the surgery. Follow-up questionnaires and Poly–Mesam were done 6 months after the surgery.

III. RESULTS

The improvement, defined as decreasing some sleep parameters, such as a respiratory disturbance index (RDI) more than 50%, decreasing the loudness of snoring, decreasing the number of hypopneas and better values of blood saturation we observed in most cases.

Most patients from the study group experienced subjective improvement of their symptoms after laser mucotomy. No immediate major complications were observed. Only in one case we have observed crusting and one patient complained of small bleeding 1 month after procedure. The present report will focus on histological findings of nasal mucosa, olfactory measurements and rhinomanometric results. Nasal patency was improved after 3 months in 82% of patients, who complained of disorder of air flow. It was objectively measured by anterior rhinomanometry. Comparing the average resistance in nasal cavity before and after turbinoplasty we obtained significant reduction of nasal resistance Rhinomanometry after 6 months showed a reduction in mean total resistance from the pretreatment level. In 8 patients we didn't observed the reduction of nasal airway resistance. CO_2 laser mucotomy is an efficacious, minimally invasive and easy to use treatment of inferior turbinate hypertrophy, which can be performed under local anesthesia, with little discomfort for the patient and does not require hospitalization. It is an effective treatment for nasal obstruction in snoring and mild OSAS patients.

After UPPP we noticed changes in retropalatal space, soft palate dimensions and uvula–posterior pharyngeal wall distance. In postoperative period we didn't observe severe complications . In some cases we found short-lived palatal deficiency, smell and taste, pharyngeal dryness, globus sensation, voice change, and pharyngonasal reflux after UPPP.

LAUP occurred as well tolerated and quick procedure. The main complain reported by patients was mild pain in the operated area during first three days after the surgery. We observed 4 patients with severe throat pain required pain killers for seven to nine days. We did not observe any other complications. The loudness of snoring decreased significantly in most cases.

Patients underwent RITT showed mild improvement concerning snoring and sleep parameters. It is crucial to perform further evaluation after two years. Patients after tongue base reduction experienced sometimes discomfort and throat pain lasting from two to four days. In two patients we observed swelling tongue base which decreased in a few days.

IV. DISCUSSION

The upper airway obstruction during sleep in snoring and obstructive sleep apnoea syndrome can be improved after surgical treatment. In this study we selected the following procedures for snoring patients: laser mucotomy, septoplasty, LAUP and RITT of the base of tongue. For OSAS patients we performed: CO_2 laser mucotomy, septoplasty, UPPP and RITT of the base of tongue. Therefore the only treatment that has not been performed for snoring patients was UPPP. It is in the agreement of the Standards of Practice Committee of the American Academy of Sleep Medicine reviewed the available literature, and developed these practice parameters as a guide to the appropriate use of this surgery. Littner et al. emphasized that LAUP was not recommended for treatment of sleep-related breathing disorders. However, it does appear to be comparable to uvulopalatopharyngoplasty (UPPP) for treatment of snoring. Individuals who are candidates for LAUP as a treatment for snoring should undergo a polysomnographic or cardiorespiratory evaluation for sleep-related breathing disorders prior to LAUP and periodic postoperative evaluations for the development of same [10]. Surgical normalization of nasal resistance was emphasized by Sulsenti et al. as a necessary requirement before uvular palatoplasty [11]. Surgical corrections of anatomic obstruction in the area of nasal cavity may include for instance correction of the nasal valve area, septoplasty, turbinate reduction and polipectomy [12]-[15]. Nasal surgery may be the indispensable procedure in the treatment of nasal continuous positive airway pressure (CPAP). Increased nasal resistance or obstruction is highly related to CPAP non-acceptance. Upper airway surgical treatments, such as: radiofrequency reduction of the inferior turbinate, septoplasty, septoplasty with inferior turbinectomy and with inferior turbinate submucosal diathermy, septoplasty with tonsillectomy may provide some benefits by reducing nasal CPAP pressure levels [16]. Surgical correction of severe nasal obstruction should be considered to facilitate treatment of OSAS patients with CPAP [17]. Patients using oral appliances can also obtain some benefits after decreasing nasal resistance owing to nasal surgery [18]. Generally we can assume that the reduction of nasal resistance significantly improves daytime fatigue and sleep quality of patients with snoring and sleep disorder breathing. Nasal surgery may reduce the sound intensity of snoring by 5-10 dB in only snoring patients [19]. With the majority of OSAS patients, the normalization of nasal resistance leads to a positive impact on the well-being and the sleep quality but not on the severity of OSAS. The success rate of only nasal surgery for simple snoring is less than 20% [20]. The elevation of nasal resistance results in an increase in negative oropharyngeal pressure during inspiration. In this way nasal obstruction may also predispose to multilevel upper airway collapse. In the experiment with nasal obstruction in healthy volunteers a

statistically significant increase in the number of obstructive hypopneas and obstructive apneas was observed. The nasal obstruction influences also rapid-eye-movement (REM) latency, showing change in sleep architecture [21]. On the other hand proper nasal breathing leads to correct craniofacial growth. Mouth breathing is an important cause of abnormal craniofacial development. Mouth-breathing children are more likely to have a retruded mandible, more inclined occlusal and mandibular planes, a smaller airway space, and a smaller superior pharyngeal airway space. Juliano presents inadequate breathing through the nose as a direct factor associated with apnea-hypopnea index contributing to OSAS developing in children [22]. Many studies evaluating subjective and objective reports of nasal surgery efficacy of nasal surgery in patients with OSAS have generally reported more positive subjective responses as compared to objective responses on sleep-related polysomnographic parameters [14]. Significantly subjective improvement of nasal resistance, relieving from snoring and daytime sleepiness are found in the surgical group by Li et. al. The influences of lower body weight index, less daytime sleepiness, and lower tongue position are also emphasized [23]. In a randomised, controlled trial of nasal surgery in 49 patients with moderate to severe OSAS and fixed nasal obstruction due to deviated septum only a 15% of success rate was observed. The ability to switch from oral to nasal breathing occurred an important determinant of a positive outcome of nasal surgery [24]. Significant improvements in AHI following nasal surgery in a group of mild OSAS were observed in patients with normal pre-operative cephalometry. This finding supports the meaning for pre-operative diagnostic and emphasizes the role of nasal obstruction with the absence of oropharyngeal narrowing and confirms a relationship between the nose and pharynx in the pathophysiology of OSAS [25].Because of multilevel decrease in airway patency some patients require multistage surgical treatment to achieve the best results. In some cases combined surgical treatment of palatal and retroglossal obstruction may be required. UPPP combined with radiofrequency thermotherapy of the tongue base in selected patients with OSAS seems to be more successful compared to UPPP alone [26].

There is still the lack of algorithm that can be applied to all patients suffering from snoring and OSAS. It is difficult to state the individual treatment for patients because of the multifactorial etiology in this syndrome. [27].

V. CONCLUSION

Our results indicate that surgery in OSAS contribute to normalization in some sleep parameters. In majority patients declared the subjective improvement after surgery. Surgical procedures also caused noticeable decrease of snoring volume. Nasal surgery increased the effectiveness of UPPP in selected cases. Identification of the offending anatomic site with application of the most appropriate surgical procedure is crucial for effective surgical treatment. Cephalometric evaluation may serve as an useful diagnostic tool for qualification for surgical procedure. Multilevel surgery after the precise diagnostic tests is usually required to obtain the best efficacy.

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