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Nasal surgery versus pharyngeal surgery in the treatment of obstructive sleep apnea

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ABSTRACT

The endemic spread of obesity and unhealthy behaviors of modern society led to revisiting the real prevalence related to obstructive sleep apnea. Recent data support a paradigm shift towards individually tailored treatments which include functional surgery of the upper airways. This paper presents the results of a randomized interventional, prospective study on 68 patients referred by the general practitioner for obstructive sleep apnea. The eligible cohort consisted of 28 patients who were offered functional surgery for definitive relief of obstructive symptoms. After topographic diagnosis of the obstruction site and grading of the severity of the obstructive sleep apnea, the eligible lot was randomized for either nasal surgery or pharyngeal surgery. Subjective and objective measurements were carried out at presentation and three months after surgery. Results showed a significant reduction in AHI (more than 50%) after functional surgery, with marginal benefit for those treated with nasal surgery. Functional improvement is unequivocal for both surgical methods, but the superior results reported in the nasal surgery group could be related to the relatively small size of the study group. The involvement of a larger cohort in subsequent studies with a similar design could confirm these results.

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Introduction

Obstructive sleep apnea (OSA) is a sleep disorder consisting of partial or complete collapse of the upper airways during sleep, leading to pauses in breathing, decreased oxygenation, hypercapnia and increased sympathetic overdrive and blood pressure. Repeated episodes of airway collapse during the night sleep causes sequences of arousals and sleep interruptions. A low quality of the night sleep is translated into daytime increased sleepiness, reduced concentration, morning headaches, decreased quality of life and low work performance. The latter has become of high interest in professions such as drivers and airplane pilots due to an elevated risk for safety hazards [1].

OSA registers high prevalence among the adult population worldwide, as approximately 425 million people on the planet are suffering from moderate to severe forms of OSA [2]. This sleep disorder precipitates various forms of cardiovascular impairment such as increased blood pressure, arterial fibrillation, sudden cardiac death or stroke [3-5]. Other concerning clinical reverberations of OSA have been linked to metabolic conditions including type 2 diabetes as stated by numerous papers [6-8].

Considering the high prevalence of OSA, its implication on the individual health and the safety of work environments, many authors advocate for increased awareness of this condition, early diagnosis and easy access to treatment. Although the gold standard treatment is still positive air pressure devices, this does not offer a definitive treatment as functional surgery does, nor it discriminates between the subtypes of OSA and their different physio-pathology. In addition, many patients find it hard to tolerate face masks leading to low treatment compliance rates and poor outcomes. Moving forward from this universal recipe approach, results of recent

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research is supportive of a paradigm change in favor of upper airways surgery [9].

A various number of surgical procedures for upper respiratory tract obstructions are available nowadays. From endoscopic endonasal surgery, adenoidectomy to uvulopalatopharyngoplasty and epiglotoplasty, all can be performed using either cold steel instruments or laser/coblation/radiofrequency techniques.

Endoscopic endonasal surgery refers to surgical removal of endonasal sites of obstruction such as deviated nasal septum, hypertrophic inferior turbinates or any masses growing in the nasal cavity and causing blockage. The presence of nasopharyngeal adenoids can also decrease airflow generating OSA, reason for which they must also be surgically addressed.

Oropharyngeal obstruction is considered the most common site of obstruction in OSA. It can be secondary to hypertrophic tonsils, oversized uvula, flaccid soft palate, decreased pharyngeal tonicity during sleep or any combination. The most common surgical operation for this aria is uvulopalatopharyngoplasty which leads to an enlarged oropharyngeal luminal diameter and increased airflow.

Although the treatment of OSA depends on its' severity and associated comorbidities, conservatory treatment such as PAP devices and mandibular advancement devices are not the only approach available, anymore. In selected cases surgical treatment of the obstruction of the upper airway should be presented to the patients as a viable first line of treatment.

Materials and Methods

This paper is based on a randomized interventional, prospective study on patients referred by the general practitioner (GP) to the outpatient department for query obstructive sleep apnea. It represents the personal experience of the authors and all subjects signed an informed consent about participating into the study, protecting their personal information. An approval of the Ethics Committee of the hospital was obtained before the beginning of the study.

The diagnosis of OSA was performed through home sleep apnea test (HSAT). All subjects received a full physical examination and an awake fiberoptic endoscopy. Inclusion criteria for the patients were age greater than 18 years old, all genders, AHI higher that 5, all Mallampati grades, single or multiple sites of obstruction and all BMI. Patients with history of upper airway surgery were excluded. Patients with apnea hypopnea index (AHI) higher than 30 events/hour were also excluded from the group and received as first line of treatment a positive air pressure (PAP) device. The remaining patients were included in the study group with the intent to having a surgical procedure as first line of treatment. The group was divided in two subgroups depending on the surgery they were suited for: nasal surgery of pharyngeal surgery in accordance with awake flexible endoscopy findings. Epworth sleepiness scale (ESS) was applied before the surgery and at 3 months after the surgery to the entire study group, regardless of the initial obstruction site. Another HSAT was performed at 3 months after surgery in order to objectively quantify the results.

Results

Eighty-six patients were referred to the outpatient department with query OSA by their GP and an Epworth Sleepiness Scale (ESS) was applied. Sixty-eight patients met the score for further investigations for OSA. Forty-seven patients were diagnosed in our clinic with different severity degrees of OSA, and a number of 28 patients were found with AHI between 5/hour and 30/hour. The aim of this study is to demonstrate the positive outcomes on the severity of OSA of nasal surgery and velopharyngeal surgery by comparing the impact of nasal surgery versus velopharyngeal surgery on apnea-hypopnea index (AHI), oxygen desaturation index (ODI) and respiratory disturbance index (RDI). Anthropometric data such as gender, age and BMI were also registered and compared within the study group.

From the 28 patients admitted in the study, 21 were male and 7 were female. The evident discrepancy between genders is supported by international data which notes a higher incidence of OSA in male population [10]. Incidence and severity of OSA increase with the age [11]. In our study group age relative distribution shows the majority of the patients being in the middle age or older. The distribution of the body mass index in females is more unitary with maximum and minimum close to the median compared to the wider distribution in males. Half of the patients underwent surgery to increase their nasal airway: septoplasty, turbinoplasty and adenoidectomy. Uvulovelopharyngoplasty was the surgical operation performed on the other half of the patients with the purpose of increasing the diameter of the oropharyngeal lumen and prevent soft tissue collapse during sleep.

All patients were evaluated using a HSAT prior to surgery and 3 months after surgery in order to analyze the impact on AHI, ODI and RDI therefore on OSA severity.

Through nasal surgery an optimized nasal airflow was delivered to the patients and the consequences on AHI, ODI and RDI were observed. All parameters decreased significantly after nasal surgery.

All 14 patients from the pharyngeal branch underwent a uvulovelopharyngoplasty. Postoperative HSAT show improvement of AHI, ODI and RDI.

Both types of surgical procedures brought significant improvement of the severity of OSA, increasing overall health status of the patients by decreasing cardiovascular

risks and quality of life. We must also take into account the various underlying conditions they have, one of the most often remaining either a cardiological disease or a neurological one [12,13]. These conditions must be thoroughly compensated, especially when a surgical intervention is considered. We must refrain from any intervention if an equilibrium is not obtained or if the patient undergoes treatments such as chemotherapy or antiplatelets for a significant recent cardiovascular event [14,15]. ESS showed important changes in subjective perception of daytime sleepiness.

Comparing the impact of nasal surgery and pharyngeal surgery on AHI, ODI and RDI, we obtained in our study relatively similar results. There are mild differences that tip the scales towards either surgery, making it difficult to estimate which type of surgery led to better outcomes (Figures 1-3).

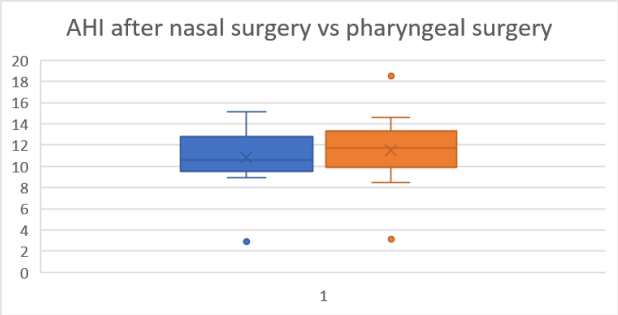

Figure 1. AHI comparison after nasal and pharyngeal surgery.

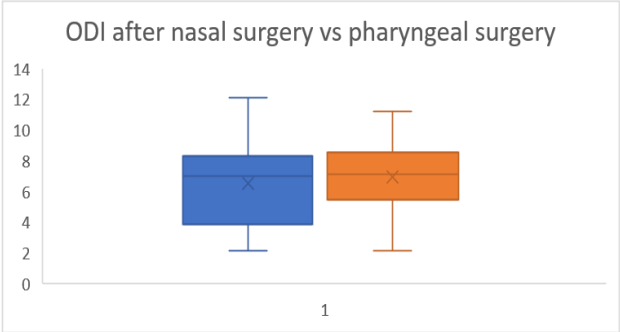

Figure 2. ODI comparison after nasal and pharyngeal surgery.

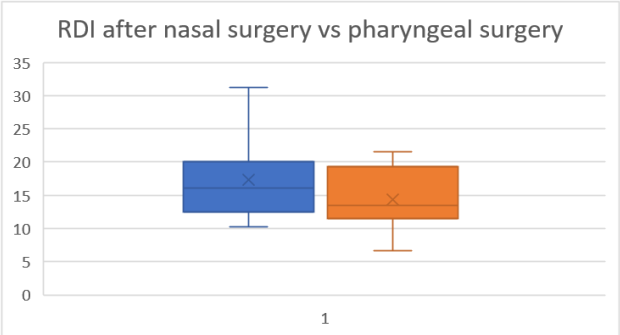

Figure 3. RDI comparison after nasal and pharyngeal surgery.

Discussion

Nasal obstruction leads to decreased airflow and increased resistance which determines negative pressure at retropalatal and retroglossal levels [16,17]. According to various studies, nasal blockage may precipitate habitual snoring and also has a higher incidence in OSA patients [18-20]. Therefore, restoring airflow patency through the nose can reduce the snoring intensity and daytime sleepiness or increase adherence to CPAP. However, most authors state that it wouldn't significantly impact polysomnographic measurements [21-23]. Although functional nasal surgery alone may not lead, in most cases, to improving OSA indexes, it is considered the first step in treating multilevel obstruction sites.

Depending on the gravity of the nasal obstruction and the structures that cause it, recalibration of the nasal passage can decrease the apnea-hypopnea index and alleviate the sleeping-related condition. If just the inferior turbinates are incriminated in the shrinkage of the airways, local decongestants may come in handy. But if there is a static obstruction such as a deviated nasal septum, only through surgery can one achieve proper nasal breathing [24,25]. Septoplasty and turbinoplasty are armamentaria the ENT surgeon can use to reestablish a convenient airflow through the nose. If there is no visible interference in the nasal cavity using conventional examination methods, a fiberoptic exam is needed in order to evaluate the nasopharynx. Enlarged adenoids can also generate improper nasal breathing by creating an obstruction of the choana, and in such cases, adenoidectomy should be performed [1,2].

Oropharyngeal obstruction is the most common site of obstruction encountered in OSA. Whether it is the enlarged palatine tonsils, collapsed soft palate, hypertrophic uvula, hypotonicity of the pharyngeal walls, parapharyngeal thick adipose layer or all together, the oropharynx plays a vital role in the etiology of obstructive sleep apnea [26,27]. Some of the above-mentioned contributors can be surgically removed to restore proper airflow through this site. Many authors separate the oropharynx from OSA point of view in two segments: retropalatal and retroglossal [28]. The retropalatal aria starts superiorly at the Passavant ring and is bordered inferiorly by the superior margin of the base of the tongue. At this level, obstruction can be encountered in 80-95% of OSA patients [29]. The retroglossal aria, which is incriminated in a smaller number of OSA patients (40-55%) [30], extends from the superior margin of the base of the tongue to the inferior pharyngeal stalk. The oropharyngeal arm of this study only had retropalatal obstructions such as enlarged palatine tonsils, collapsed soft palate and hypertrophic uvula, which were all surgically addressed in the same intervention, uvulovelopharyngoplasty. Khan et al. reported a 54.4% reduction of mean AHI postoperatively in his study group

with a 51% traditional success rate (50% reduction of initial AHI and/or an AHI of 20 episodes/hour or less) [31].

The aim of this study is to compare the results of nasal surgery and oropharyngeal surgery in a group of patients suffering from mild and moderated OSA exclusively. The outcomes of the surgeries were objectively evaluated using polysomnographic indexes AHI, ODI and RDI. According to the analyzed data from our lot, there was a significant improvement in both arms with a mild variation. However, most of the studies other authors conducted also included patients with severe OSA, leading to an essential difference in the success rates. Therefore, the acceptance in the study group of only mild and moderated forms of OSA may be seen as a setback from a statistical point of view. However, severe cases need preconditioning using PAP devices, which could have been a bias in postoperative measurements.

In order to state if these surgical interventions will provide the same benefits to patients suffering from severe OSA, a study that includes such patients needs to be conducted [32-35]. A comparison between nasal and oropharyngeal surgery on subjects with AHI higher than 30 episodes/hour could offer important information regarding the outcomes of these invasive maneuvers and maybe change the current paradigm: CPAP is the gold standard treatment for OSA [36,37].

Conclusions

The results of this study show significant decrease in the number of respiratory events per hour and respiratory distress and an increase in oxygen levels during sleep. The majority of the patients had more than 50% reduction of the initial AHI suggesting a good outcome. More than 75% of the patients had less than 15 episodes /hour suggesting a de-escalation of OSA severity. When dealing with obstructive sleep apnea cases, even though positive air pressure devices are considered the gold standard treatment in severe cases, surgery should be considered due to increase in adhesion and quality of life. Nasal surgery or pharyngeal surgery alone can bring benefits but combining multilevel surgeries in a multistep approach of the upper airways could increase the final outcomes and give better improvements on both objective and subjective measurements. Considering the outcomes of this study, further larger studies are needed in order to state which surgical procedure is more efficient in terms of reducing the severity of OSA and if a multilevel and multistep approach is more beneficial for the possibility of curing this sleep disorder.

Highlights

- ✓ This study is based on a randomized interventional, prospective study on patients referred by the general practitioner (GP) to the outpatient department for query obstructive sleep apnea.
- ✓ The diagnosis of OSA was made using a home sleep apnea test. The outcomes of both nasal and pharyngeal surgery were measured with the same home sleep apnea test.
- ✓ Comparing the impact of nasal surgery and pharyngeal surgery on AHI, ODI and RDI it results in similar outcomes. Further larger studies are needed in order to obtain higher statistical power.

Conflict of interest disclosure

There are no known conflicts of interest in the publication of this article. The manuscript was read and approved by all authors.

Compliance with ethical standards

Any aspect of the work covered in this manuscript has been conducted with the ethical approval of all relevant bodies and that such approvals are acknowledged within the manuscript.

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