Our experience in the surgical treatment of Obstructive Sleep Apnea

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Resume

Background: Obstructive Sleep Apnea (OSA) is a sleep-related breathing disorder, leading to decreased quality of life, increased risk of cardiovascular morbidity and mortality, increased frequency of automobile accidents. Continuous positive airway pressure (CPAP) remains the first line of treatment for OSA. Many patients are unwilling or incapable to tolerate the treatment and therefore turn to surgical options to alleviate symptoms and sequela of the disease.

Aim: To present our experience in the surgical treatment of OSA.

Materials and Methods: 50 patients (48 male / 2 female) underwent surgical treatment for OSA in our clinic for a period of 10 years. Subjective complaints were evaluated by interview of the patient and partner pre- and postoperatively, with key factors studied being snoring level (visual analogue 1–10) and Epworth Sleepiness Scale (ESS). Objective data were Body Mass Index (BMI), nasal endoscopy, pre and postoperative polysomnographic data, rhinomanometry, Mallampati score, diagnostic imaging of the nose and sinuses.

Results: The mean BMI of the patients was 29.8 ± 3.4 . 21 patients had nasal obstruction for which they underwent surgical treatment. 5 patients had micro or retrognathia. 37 Patients had a Mallampati score of 3 and 13 of 4. All 50 patients underwent Uvulopalatopharyngoplasty (UPPP) and 6 patients also had Radiofrequency tongue base reduction. There were no serious complications. Subjective improvement in the severity of the symptoms was obtained in 88% (44) of patients. Objective success was obtained in 56% (28) of the patients.

Conclusions: Surgical treatment of OSA leads to a significant subjective improvement in the severity of symptoms and acceptable objective results. For maximal results a multidisciplinary approach is required for the complex treatment of OSA.

Key words: UPPP, OSA, surgical treatment

Background

Sleep-related breathing disorders range from partial airway collapse and increased upper airway resistance to episodes of hypopnea or complete airway collapse. The indices and events used to describe sleep-disordered breathing according to Kushida et al ^[1] are presented in table 1, 2

Table 1. Respiratory events definition and types

Event	Definition
Apnea	A cessation of airflow for at least 10 second
Hypopnea	A reduction in airflow ($\geq 30\%$) at least 10 seconds with $\geq 4\%$ oxyhemoglobin desaturation OR a reduction in airflow ($\geq 50\%$) at least 10 seconds with $\geq 3\%$ oxyhemoglobin desaturation or an electroencephalogram (EEG) arousal
Respiratory effort-related arousal (RERA)	Sequence of breaths for at least 10 seconds with increasing respiratory effort or flattening of the nasal pressure waveform, leading to an arousal from sleep when the sequence of breaths does not meet the criteria for an apnea or a hypopnea
Obstructive apnea	Continued thoracoabdominal effort in the setting of partial or complete airflow cessation
Central apnea	The lack of thoracoabdominal effort in the setting of partial or complete airflow cessation
Mixed apnea	A respiratory event with both obstructive and central features, with mixed events generally beginning as central events and ending with thoracoabdominal effort without airflow

Table 2. Indexes of sleep-distorted breathing

Index	Definition
Apnea index	Number of apneas per hour of total sleep time
Hypopnea index	Number of hypopneas per hour of total sleep time
Apnea-hypopnea index	Number of apneas and hypopneas per hour of total sleep time
Respiratory effort-related arousal (RERA) index	Number of RERAs per hour of total sleep time
Respiratory disturbance index	Number of apneas, hypopneas, and RERAs per hour of total sleep time
Central apnea index	Number of central apneas per hour of total sleep time
Mixed apnea index	Number of mixed apneas per hour of total sleep time

Obstructive sleep apnea (OSA)

OSA syndrome is defined by five or more respiratory events – apneas, hypopneas, or RERAs – in association with excessive daytime somnolence; waking with gasping, choking, or breath holding; or witnessed reports of apneas, loud snoring, or both. Each episode of apnea or hypopnea must last a minimum of 10 seconds, which is commonly accompanied by reductions in blood oxygen saturation of at least 3% to 4%, and is usually terminated by brief, unconscious arousals from sleep as diagnosed by polysomnography. The American Academy of Sleep Medicine classifies mild OSA as 5 to 15 events per hour, moderate as 15 to 30 events, and severe as 30 events or more.

The most common symptoms are loud snoring, daytime hypersomnolence, witnessed episodes of apnea, choking or gasping during sleep by bed partner. There have also been other symptoms connected with OSA such as – morning fatigue or irritability, memory loss, decreased cognitive function, depression personality or mood changes, decreased libido, impotence, morning and nocturnal headaches, nocturnal sweating and enuresis.

Pathophysiology

The obstruction that occurs in OSA is a result from the collapse of the pharyngeal airway during sleep. Its etiology and mechanism is multifactorial but is largely due to the interaction of an easily collapsi-

ble upper airway with relaxation of the pharyngeal dilator muscles. The collapse can have anatomical (obesity, retrognathia, soft tissue hypertrophy) neuromuscular (reduce patency due to relaxed pharyngeal dilator muscles) causes. The three major areas of obstruction are the nose, palate, and hypopharynx, although OSA associated with laryngeal obstruction (laryngomalacia, bilateral laryngeal paralysis) has been reported [2]

The genioglossus muscle is considered to be the most important muscle in maintaining airway patency in OSA. Elevated genioglossal and tensor palatini muscle activity has been observed in awake OSA patients compared with normal awake subjects who have lower levels of activity. This suggests that even while the patient is awake, airway dilator muscle activity compensates for a more anatomically compromised upper airway in the OSA patient. [2]

Nasal obstruction contributes to increased airway resistance and may worsen OSA, but it is rarely the sole cause. Nasal obstruction may contribute to open-mouth breathing during sleep, which increases upper airway collapsibility and may decrease the efficacy of dilator muscles. [3]

Consequences of untreated OSA

A number negative health effects and reduced quality of life have been attributed to untreated OSA including an increased in mortality, cardiovascular disease (hypertension, coronary heart disease, congestive heart failure, arrhythmia, pulmonary hypertension, stroke, and sudden death) [4], neurocognitive difficulties [5], insulin resistance and metabolic syndrome [6]. Treatment of OSA has a positive effect on these comorbidities.

Treatment

The treatment of OSA can be conservative or operative. Conservative options are continuous positive airway pressure (CPAP), oral appliances, nasal dilators, tongue retaining devices. CPAP is considered the gold standard in the treatment of OSA but low patient adherence remains a significant obstacle.

Surgical treatment should be considered according to the patient's wishes, CPAP tolerance, severity of symptoms, severity of disease, comorbidities, and site and severity of upper airway collapse. Many patients are either incapable or unwilling to toler-

ate CPAP treatment and turn to surgical options to alleviate symptoms and sequela of OSA.

Aim

The aim of this study is to present our experience in the surgical treatment of OSA.

Material and methods

We have included 50 (48 male, 2 female) patients for a period of 10 years (2010–2020) who underwent surgical treatment for OSA in the clinic. Subjective complaints were evaluated by interview of the patient and partner pre- and postoperatively, with key factors studied being snoring level (visual analogue 1–10) and Epworth Sleepiness Scale (ESS). Objective data were Body Mass Index (BMI), nasal endoscopy, pre- and postoperative polysomnographic (PSG) data, rhinomanometry, Mallampati score, diagnostic imaging of the nose and sinuses. The criteria we have chosen for objective success from surgical treatment is $AHI \leq 12$ or 50% reduction of AHI obtained from PSG 3 months post-operatively.

Results

The mean BMI of the patients was 29.8 ± 3.4 . 18 (28%) had solely retropalatal obstruction while 32 (72%) had multilevel obstruction – 5 with micro or retrognathia; 21 with nasal obstruction; 6 with retrolingual obstruction. 37 (74%) Patients had a Mallampati score of 3 and 13 (26%) of 4. The patients with nasal obstruction underwent surgical treatment for it as a first stage. All 50 patients underwent Uvulopalatopharyngoplasty (UPPP) and for the 6 patients with retrolingual obstruction – tongue base radiofrequency ablation (TBRF). There were no serious complications from the treatment. There were 8 (16%) cases of temporary nasal reflux and 3 (6%) cases of post-operative hemorrhage. 44 (88%) patients reported subjective improvement in the severity of the symptoms based on snoring level visual analogue and ESS. The preoperative results for snoring level were (7.8 ± 1.2) postoperatively (3.4 ± 1); for ESS preoperative (16.2 ± 3) postoperatively (8.5 ± 3). Objective success was obtained in 28 (56%) of patients; 16 (32%) had an improvement in PSG data but did not cover the criteria for objective success; 6 (12%) were non-responders.

Discussion

There are many questions still left considering

surgical treatment of OSA. UPPP is the most commonly performed operation for OSA by otorhinolaryngologist. Three main factors should be considered – 1) the overall low objective success from the operation indicated by many studies; 2) patient selection is crucial for the success of the treatment; 3) there is a chance to aggravate the symptoms [7]. In our study although there was overall low objective success (58%), most patients reported reduction in symptoms (88%). We attribute this to the fact that although the patients didn't cover the criteria for objective success, there was an improvement in PSG data and therefore reduction in subjective symptoms indicated by snoring level visual analogue and ESS. The importance of patient selection is explored by Fujita et al, Friedman et al [8] [9] who proposed staging criteria for patients undergoing UPPP for OSA which focus on Mallampati score, BMI, tonsil size and the site of obstruction as factors for the success of the operation. For us the group with objective success included all of the patients with solely retropalatal obstruction; $BMI \leq 29$; patients were with moderate to mild OSA with the range being AHI 15–28; Mallampati score 3. For the partial responders; all had multilevel obstruction, $BMI \leq 35$; moderate to severe OSA with the range of AHI being 26–35; 9 patients had a Mallampati score of 3 and 7 Mallampati score of 4. For the non-responders that group included all the patients with micrognathia or retrognathia; $BMI \geq 35$; all patients had severe OSA with $AHI \geq 35$. In our clinic we don't have experience with mandibular advancement surgery and therefore didn't treat the site of obstruction for the patients with retrognathia or micrognathia. Furthermore, the high BMI, multilevel obstruction (nasal, retrolingual and retropalatal) and severity of OSA were contributing factors for the 6-th patient in the group. Our findings correspond with those of other studies.

Conclusion

Surgical treatment of OSA leads to acceptable objective results and significant subjective improvement in severity of symptoms in carefully selected patients. Proper identification of the site of obstruction and selecting surgical treatment targeting the site is the key to success. Multidisciplinary approach is required for the complex treatment of OSA.

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