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ORIGINAL ARTICLE

The Effect of Uvulopalatopharyngoplasty with Tonsillectomy in Patients with Obstructive Sleep Apnea

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Abstract In the current study, we evaluated the effectiveness of uvulopalatopharyngoplasty (UPPP) in treatment of patients with obstructive sleep apnea (OSA) syndrome. All patients were previously received medical treatment but their symptoms did not resolve. A prospective study was conducted in Shahid Sadoughi Hospital in Yazd, Iran. Several sleep indices were evaluated using polysomnography (PSG) in all patients before performing UPPP and tonsillectomy. All patients were visited 6 months after surgery and PSG was repeated to assess the efficacy of surgical intervention. A total of 48 patients were enrolled and underwent UPPP and tonsillectomy. Six months after surgery, significant improvements were observed in all indices of sleep (apnea–hypopnea index, respiratory distress index, arterial oxygen saturation, and snoring index). The score of daytime sleepiness (assessed by Epworth score) was also improved. According to the result of this study, using UPPP surgery in patients with OSA can cause symptoms improvement in 64 % of cases. It seems that Muller's maneuver test has assisted in briefly increasing success rate after surgery, though to prove this claim; other studies should be designed and performed in a randomized clinical trial.

Keywords Obstructive sleep apnea · Tonsillectomy · Polysomnography · Apnea · Hypopnea · Snoring

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Introduction

Obstructive sleep apnea (OSA) applies to complete or partial obstruction of the airway during sleep causes airflow cessation (apnea) or airflow reduction (hypopnea) despite the resulting increase in breathing effort [1]. The prevalence of this disorder increases with age, which is most common in 62 % of elderly men over 65 years old [2]. An awaken person transmits messages from the nerve system to pharynx muscles constantly that prevent OSA to happen. The number of these stimulations naturally decreases during sleep [3]. Along with a decrease in stimulations, anatomical disorders (tongue, pharyngeal tissue increases, palate moved down) cause obstruction in the airways and apnea related seizures—hypopnea in people who suffer from OSA—occur. Pharyngeal narrowing can occur in several anatomical regions (velopharynx, oropharynx and hypopharynx) that in most of the patients with OSAS, obstruction and narrowing occur at the velopharyngeal level [4, 5].

Obstructive apnea accompanies by multiple comorbidities such as increase in blood pressure and metabolic syndrome [6], daily sleepiness and increase in driving crashes [7]. The gold standard for diagnosing this disease is split-night polysomnography (PSG) which studies, patient sleep cycle during the night [1].

Recommended treatment processes in patients suffering from OSA include broad spectrum. In the initial phase, change in lifestyle (weight loss, no alcohol consumption, no smoking and no sedative-hypnotic drugs) is recommended [8]. If the syndrome is not treated, using continuous positive airway pressure (CPAP) can greatly prevent collapse in the airways during sleep [9]. Surgical treatment as the last procedure in these patients can be effective, as well. Laser-assisted uvulopalatoplasty (LAUP) is suggested for treatment of snoring and mild OSA [10]. Electro cautery Uvulopalatoplasty [11] and Snare Uvulopalatoplasty [12] are also used.

The objective of the current study is to investigate the efficacy of surgical procedure of uvulopalatopharyngoplasty (UPPP) with tonsillectomy for treating patients suffering from OSA syndrome.

Methodology

This work was carried out in accordance with the Declaration of Helsinki (2000) of the World Medical Association and was approved ethically by the university ethics committee. In this prospective study which is done between the years 2010 and 2012 in Shahid Sadoughi hospital in Yazd, Iran, the effect of surgical procedure of UPPP with tonsillectomy on treating syndromes in patients suffering from OSA was examined. Study protocol directed the Declaration of Helsinki and the medical behavior committee of Yazd University confirmed that. Total patients filled out the informed consent questionnaire before the study to be conducted.

Participating criteria for this study included: (1) Over 18 years of age (2) Suffering from OSA, which did not respond to medical and CPAP treatments and the symptoms are not treated (3) A positive Muller's maneuver during which the patients breathe in while their nose and mouth are closed, then the examiner measures the level of closure in the hypopharyngeal opening mouth of lateral (LAT) surface or anterior–posterior (AP) surface. Positive Muller's maneuver is defined as hypopharynx collapse. The patients who were suffering from chronic disease at the same time in the way that surgical procedure could cause danger and the patients those who were suffering from nasal obstruction were excluded.

The total patients, before study to be conducted, were asked to fill out the questionnaire related to Epworth Sleepiness Score. In the next step, the patients underwent an instrumental evaluation, PSG to make known their secondary sleep disorders to OSA. Then the patients underwent the surgical procedure of UPPP with tonsillectomy and after hospital discharge, they were examined by the same surgical committee until 6 months and for establishing the efficacy of this treatment, the second PSG was done.

PSG variables which were examined and compared before and after surgery are such as: apnea–hypopnea index (AHI), respiratory distress index (RDI), mean arterial oxygen saturation, minimum arterial oxygen saturation, snoring index.

Statistical analysis

To analyze the statistics, SPSS version 20 was used. For continuous variables, mean and standard deviation were calculated and for categorical variables, frequency was calculated. To compare the efficacy of the performed intervention, statistical tests such as paired *t* test and Wilcoxon rank were used. In all of these statistical analyses, *P* value was less than 0.05 and it was reported as "*statistically significant*".

Results

In this study 54 patients who were suffering from OSA, underwent UPPP with tonsillectomy. Among total patients, 36 (75 %) were men and 12 (25 %) were women. The median age of participants (patients) was 40.6 ± 7.8 (ranged from 24 to 54 years old).The average body mass index (BMI) in the patients was 29.3 ± 2.5 before entering this study (Table 1). In all of the patients who participated in this study, Muller's maneuver was positive.

Polysomnography test was used before performing surgery to diagnose the severity of sleep disorders in total patients. Accordingly, AHI (the average number of episodes of apnea and hypopnea per hour) was 23.2 ± 6.6 (with domain of 7.1–30) before surgery. RDI of patients' average was 26.4 ± 8.4. Mean arterial oxygen saturation in patients who participated in this study was 91.4 ± 1.4 with average minimum arterial oxygen saturation of 78.8 ± 2.9 during sleep. Moreover, snoring index (the number of snores per hour) in patients was studied according to which snoring index was 367.05. The results of split-night PSG show well that obstructive sleep disorder in participants had a considerable negative effect on different indices (Table 2).

Table 1 Baseline characteristics of study population

Age	40.6 ± 7.8
Gender	
Male	36 (75 %)
Female	12 (25 %)
BMI	29.3 ± 2.5

Table 2 Polysomnographic findings and Epworth sleepiness score before and after surgery

	Baseline	After 6 months	Change (%)	*P* value
Apnea-hypopnea index	23.2 ± 6.6	10.5 ± 3.3	−55	0.001
Respiratory distress index	26.4 ± 8.4	9.4 ± 3.3	−65	0.001
Mean arterial oxygen saturation	91.4 ± 1.4	91.7 ± 1.3	+1	0.025
Minimum arterial oxygen saturation	78.8 ± 2.9	81.8 ± 2.4	+3.5	0.001
Snoring index	367.0 ± 143.3	162.4 ± 60.5	−56	0.001
Epworth sleepiness score	12.6 ± 2.2	7.1 ± 1.1	−45	0.001

All of the patients underwent UPPP with tonsillectomy and split-night PSG was repeated for them 6 months after the surgery. In obtained results in a patient's follow-up, BMI decreased concisely and reached 29.07 ± 2.7 (*P* value = 0.001).

In this performed PSG, even after the surgery, AHI decreased to 10.5 ± 3.3 (decreased by 63 %) which this process of decrease was statically significant in paired *t* test (*P* value = 0.001). RDI also decreased to 9.4 ± 3.3 (decreased by 65 %) which this process of decrease was also statistically significant (*P* value = 0.001). Mean arterial oxygen saturation and minimum arterial oxygen saturation orderly increase to 91.7 ± 1.3 and 81.8 ± 2.4 which these changes in statistical tests still showed a more significant difference than the time before surgical intervention (*P* value = 0.001, 0.025). The snoring index also reached 162.4 (*P* value = 0.001) (Table 2).

The average number of daily sleepiness in patients based on Epworth questionnaire before performing surgery was 12.6 ± 2.2 that decreased to 7.0 ± 1.1. According to statistical tests, there is a significant difference in daily sleepiness before and after intervention (*P* value = 0.001) (Table 2). Several studies have defined success rate as decrease in AHI to less than 50 % of primary condition and a reduction in AHI to less than 20; therefore, the same criteria are used in this study. Based on this and due to obtained results in follow-up PSG, 64.6 % of patients showed decrease in AHI to less than primary 50 %; and success rate of intervention was 64.6 % in the current study.

Discussion

In this study, 48 patients who were suffering from OSA underwent UPPP with tonsillectomy. All of the patients were tested by split-night PSG before performing surgery and 6 months after surgery. This test was used to diagnose sleep disorders in them. For assessing treatment response rates in patients, several polysomnographic indices like AHI, RDI, mean arterial oxygen saturation, and minimum arterial oxygen saturation were used. In all patients who underwent the operation, AHI and RDI showed a significant reduction. The rate of mean arterial oxygen saturation and minimum arterial oxygen saturation increased so that these changes were still statistically significant. Based on the defined criteria for success rate of intervention, 64.6 % of patients had AHI of less than primary 50 %; thus we can say that in this group of patients, the surgical intervention in symptoms treatment was successful.

The main purpose of trying various treatment processes in OSA is to decrease long-term mortality of this disease, for this reason, CPAP and UPPP are used to decline this [13]. OSA is proved to be accompanied by illnesses such as blood pressure [6], cardiovascular disease [14], lung disease [15] and an increase in driving crashes [7]. Performed studies by Keenan et al. [16]. Demonstrated that using CPAP and UPPP could be effective in achieving those purposes.

Since UPPP surgery is feasible and doable, is usually used by Otolaryngology surgeons to treat the patients suffering from OSA [17]. Further studies which are done by several researchers have shown different results which caused some doubts in the efficacy of this procedure. This difference can largely be due to different criteria for assessing the success rate of surgery, which are used by different researchers.

A group of researchers have considered reaching AHI of <5 to be a treatment success [17].

But the most common criterion which is currently used by many different researchers for assessing treatment response is AHI of less than primary 50 %.; The same criterion is used in the current study [18].

In a research which was carried out by Conway et al. [19], 66 patients with OSA syndrome were evaluated based on AHI of less than primary 50 % and finally 33 patients were recovered and the patient's symptoms greatly improved.

In a study conducted by Frieberg et al. [20] in which 56 patients participated, 87 % of patients reported a decline in snoring index. And again, success rate after surgery was 60 %, the same rate as the present study.

The other reason for the partial efficacy of UPPP in patients with OSA can be the point that the level of anatomical obstruction in different patients is different and

some have more than one level of anatomical obstruction (multiple anatomic sites) in the pharynx. Various solutions to this problem have been raised like endoscopic evaluation of the abstraction level when the patient is awake (Muller's maneuver) [21].

Some have also recommended that rhinoplasty can cause an improvement in symptoms (decrease in nightly snoring) in groups of patients who suffer from respiratory distress during sleep, but since, in the patients with OSA, the level of obstruction is usually confined to anatomical pharynx, rhinoplasty has not affected symptom improvement drastically [1, 22].

The other point that should be mentioned is, in studying researches by different researchers, some noticeable apnea relapse is reported after UPPP surgery. For example, Tomita et al. [23], have demonstrated that success rate after surgery has decreased from 96 to 78.6 % during 2 years. Levin et al. [24], Also claimed that in the time period of 6–12 months, 46 % of patients observed apnea relapse. In opposite, Frieberg et al. [20] stated that success rate of 60 % in patients remained stable during 3 years and there was no symptom relapse in them.

Therefore, according to obtained results of previous studies, even in approaching success after surgery, patients need follow-up evaluation to be sure that there is no symptoms relapse.

Conclusion

In conclusion, using UPPP surgery in patients with OSA can cause symptoms improvement in 64 % of cases. It seems that Muller's maneuver test has assisted in briefly increasing success rate after surgery, though to prove this claim, other studies should be designed and performed in a randomized clinical trial in which one group selection is based on positive Muller's maneuverability test and the other group (as the controlled group) is selected randomly; the hypothesis is that carrying out Muller's maneuver test can lead to more right selection of patients or not. It is obvious that according to the way of doing this study and performing Muller's test in all patients, it cannot be ensured that there is a cause and effect relationship.

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