Original Research

Outcomes of Upper Airway Surgery in Obstructive Sleep Apnea

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Abstract

Background and Objective: Obstructive sleep apnea (OSA) is defined as a sleep disordered breathing due to partial or complete obstruction of upper airways. This study aimed to investigate treatment outcomes and clinical complications among patients with OSA who underwent upper airway surgery in clinical settings.

Materials and Methods: All patients undergone upper airway surgery for OSA were called upon to enroll in this follow-up study. Demographic characteristics, Epworth sleepiness scale (ESS), snoring, dry mouth, nocturia, improvement of high blood pressure, and complications of surgery including bleeding, infection, pain, and temporary voice change were recorded at median of 8 months after the surgery. 12 patients accepted to undergo follow-up polysomnography (PSG).

Results: Among 41 participants, mean age was 44.2 ± 11.6 years, and 33 (78.6%) were male. In three patients (25%) with follow-up PSG, mean respiratory disturbance index (RDI) was decreased by 50%. The baseline and post-surgery RDI was 34.0 ± 26.2 and 24.8 ± 13.2/hours, respectively. Mean ESS pre-surgery was 9.0 ± 4.5 with a decrease of 3.9 ± 4.2 post-surgery. Most of the participants reported improved snoring. More than half of the patients reported improvement of hypertension, dry mouth, nocturia, and sleep quality. The most common reported complications were temporary changes in voice and pain.

Conclusion: Surgery improved snoring, daytime sleepiness, and OSA-related problems. RDI improvement in a small subset of patients indicates importance of follow-up PSG after upper airway surgery and warrants further studies. Moreover, evaluation of the reasons of non-participation for undergoing follow-up PSG requires more investigation.

Keywords: Obstructive sleep apnea; Upper airway surgery; Sleep breathing disorder

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Introduction

Obstructive sleep apnea (OSA) is defined as a sleep disordered breathing due to partial or complete obstruction of upper airways (1). Being more common in men, several clinical outcomes such as cardiovascular diseases, neurocognitive disturbance, metabolic syndrome, and 2-3-fold increases in traffic accidents following hypoxia are expected (2-9). Several therapeutic approaches have been recommended for management of OSA according to severity of the disease among which weight loss and changing life style, oral appliances, using positive airway pressure (PAP) during sleep and upper airway surgery are prevalent and well-known (8, 10). PAP is considered the goal standard treatment for OSA at the present, though claustrophobia, feeling discomfort, device noise, and patients' intolerance during the night of PAP titration might reduce patients' compliance to 50% (10). Based on the American Academy of Sleep Medicine (AASM), upper airway surgery is recommended for the OSA management whenever other therapeutic modalities such as oral appliance and continuous PAP (CPAP) are neither effective nor tolerable for the patient (11-13). Several studies recommend to not using surgery as a treatment of OSA in adult patients (14, 15). However, it is reported that upper airway surgery has fewer negative effects on patients' quality of life in

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comparison with CPAP, despite the higher rate of surgery complications in comparison to CPAP (16). Along with the debate over effectiveness of surgery on reducing apnea hypopnea index (AHI), complications of OSA, and recurrence of the disease, further research seems imperative. To the best of our knowledge, limited studies are conducted regarding outcomes of upper airway surgery on improvement of patients' subjective symptoms such as excessive daytime sleepiness (EDS), snoring, and objective polysomnographic findings including AHI in Iran. Thus, this study was conducted to evaluate the effectiveness of surgery in volunteer patients with OSA undergone upper airway surgery.

Materials and Methods

This was a follow-up study conducted in Baharloo Sleep Clinic, affiliated to Tehran University of Medical Sciences during 2015-2016. In addition to recorded data from the sleep clinic data bank, a total of 700 patients who were visited at the clinic and undergone polysomnography (PSG) with diagnosis of OSA were called by telephone. Those patients who underwent upper airway surgery (pharyngeal and nasal surgery for treatment of their sleep apnea according to patients' histories taken by phone call) were followed for further investigation. Consent form was obtained from all study participants. Study was approved by Ethical Committee of Tehran University of Medical Sciences.

The study participants who underwent upper airway surgery for treatment of apnea were interviewed by a physician. The participants were asked through telephone calls in terms of EDS by validated Epworth sleepiness scale (ESS) questionnaire, snoring, dry mouth, nocturia, improvement of high blood pressure, and complications of surgery including bleeding, infection, pain, and temporary voice change. The ESS questionnaire comprised of eight multi-option questions measuring EDS, each with scores of 0, 1, 2, 3 respective to the degree of sleepiness. The Persian questionnaire is validated by Sadeghniiat-Haghighi et al. (17).

The follow-up time for patients ranged between 2 and 114 months with the median of 8 months. During each telephone interview, patients were asked to perform one night PSG at sleep laboratory. PSG findings were then recorded for the patients.

Collected data were described and analyzed by proper statistics pre- and post-upper airway surgery. PSG findings and changes in sleep-associated parameters were also evaluated in those agreed to perform follow-up PSG after surgery. SPSS software (version 16; SPSS, Inc., Chicago, IL, USA) was used for analysis.

Results

Among the participants called by telephone, 41 ones underwent upper airway surgery. Mean age ± standard deviation (SD) of study participants was 44.2 ± 11.6 years, and 33 (78.6%) were male. Mean ± SD of BMI before surgery was 31 ± 13 kg/m^2 (Table 1).

Table 1. Demographic characteristics of study participants

Characteristics	Mean ± SD
Sex (male)	33 (78.6%)[¥]
Age (year) (mean ± SD)	44.2 ± 11.6
BMI before surgery (kg/m^2) (mean ± SD)	31 ± 13

[¥]Number (Percent).
SD: Standard deviation; BMI: Body mass index

Snoring was improved in 97% of the patients (N = 40). Three out of five patients with previous hypertension reported improvement of their blood pressure or decreased using anti-hypertensive medications. Sleep quality of the patients got better in 34 (81%), whereas few patients (two out of five) reported improvement of morning headache. Mean ESS before surgery was 9.0 ± 4.5 with a 3.9 ± 4.2 decrease post-surgery.

Patients did not report any major complication post-surgery. Among common complications, the most frequent were temporary change in voice (< 1 week) and pain in 13 (31%) and 11 (26.2%) patients, respectively (Table 2). Infection was the least reported complication in only one patient (Table 2).

Out of 41 patients with upper airway surgery, 13 (31.7%) agreed to undergo overnight PSG post-surgery. In patients with follow-up PSG, mean respiratory disturbance index (RDI) was decreased by 50% in only 3 (25%). The baseline and after surgery RDI was 34.3 ± 26.2/hours and 24.8 ± 13.2/hours; respectively. Mean ± SD O_2 saturation level was 92.0 ± 1.5 before upper airway surgery while it was 91.0 ± 4.4 post-surgery (Table 3).

Discussion

Findings of the current study indicate that surgery improves snoring, daytime sleepiness in patients undergone upper airway surgery in different levels of upper airway; although, RDI was improved in a small subset of patients.

Table 2. Patients' characteristics after upper airway surgery

Characteristic	Total number	Category	N (%)
Decreased snoring	41	Yes	40 (97)
		No	1 (2)
High blood pressure change	5	Decreased	3 (7.1)
		No change	2 (4.8)
Dry mouth	9	Improved	7 (16.7)
		No change	2 (4.8)
Sleep quality	40	Improved	34 (81)
		No change	6 (14.3)
Nocturia	4	Improved	2 (4.8)
		No change	2 (4.8)
Morning headache	7	Improved	2 (4.8)
		No change	5 (11.9)
Bleeding	41	Yes	6 (14)
		No	35 (83)
Infection	41	Yes	1 (40)
		No	40 (95.2)
Temporary (< 1 week) changing voice	41	Yes	6 (14.3)
		Nasality	7 (16.7)
		No	28 (66.7)
Pain	41	Yes	11 (26.2)
		No	30 (71.4)

Consistent with previous reports on effects of the surgery, present study found a nearly 97% improvement in snoring (12-14). Previous studies also have mentioned a significant improvements of snoring followed upper airway surgeries such as uvolopalatopharyngoplasty (UPPP), septoplasty, and maxillomandibular advancement (MMA) (12-14). Noteworthy none of the patients in the current study underwent MMA surgery. The most performed surgeries for OSA treatment in this study were performed at the nasal and pharyngeal level.

Table 3. PSG parameters of participants with follow-up PSGs

Patient	RDI (1)*	RDI (2)¥	Mean O_2 saturation (1)	Mean O_2 saturation (2)
1	22.6	36.4	93.8	93.9
2	7.4	4.1	93.8	93.0
3	31.0	-€	93.7	89.3
4	8.1	22.4	93.0	92.0
5	17.5	18.09	93.0	93.0
6	20.9	20.9	92.6	95.4
7	28.3	27.5	92.0	93.4
8	24.1	14.4	91.6	88.5
9	19.7	53.9	91.6	94.5
10	68.4	12.6	91.3	-
11	96.3	23.3	91.2	93.0
12	37.5	38.7	90.0	79.0
13	64.1	26.4	88.4	88.0

€Missing data; *Before upper airway surgery for sleep apnea; ¥After upper airway surgery for sleep apnea
PSG: Polysomnography; RDI: Respiratory disturbance index

EDS also was among the symptoms of OSA, which we found to be significantly improved post-surgery. Along with our findings, other studies also have shown an improvement in ESS score as a measure of EDS after surgery (14, 18-23). This may indicate considerable influence of the surgery on treatment of EDS in patients with OSA in current study.

Treatment of OSA may have significant influence on cardiovascular consequences of the disease such as hypertension as well (1). The authors mentioned a decreased need to use antihypertensive medications as an indicator for the effect of surgery on hypertension. Three out of five patients with hypertension reported reduced need to medications for control of their high blood pressure. Islam et al. (24) in accordance with these results also indicated decreasing diastolic blood pressure following upper airway surgery. The point to be considered is that current study used improvement of patients' high blood pressure through self-report which could be a subject to bias. Therefore, future studies using objective measurements of blood pressure following several visits is highly recommended.

Patients who undergo surgery for treatment of their sleep apnea are recommended to perform a follow-up PSG 3-6 months after surgery to verify improvement of objective parameters of apnea (1). In the present study, a small subset of patients (13 out of 41) accepted to perform an overnight PSG after surgery, an issue that should be explored more thoroughly in the future. About

25% of the patients had decreased RDI for more than a half post-surgery. A meta-analysis in 2010 reported a significant decrease in AHI following both MMA Phases I and II (soft palate surgery). The reported AHI decrease after UPPP was also significant (40.3-29.8) (25). Friedman et al. (25) also reported a 40% success in AHI decrease after surgery. Thus, the reported results are not consistent with current findings which may be due to considering RDI instead of AHI as a measure of improvement. Otherwise, upper airway surgery may have significant influence on the number of detected apnea and hypopneas and not respiratory effort related arousals. This requires more investigation regarding influence of surgery in terms of AHI and RDI in the treatment of OSA.

In the present study, no major complication such as massive bleeding, disabling condition, or death was observed. Pain, bleeding, and change in voice were among the temporary complications reported after surgery. Change in voice remained longer in patients which may be due to the interference of surgery in function of soft palate muscles.

There were several limitations in this study. All the participants were not agreed to undergo an overnight PSG after surgery. Therefore, the findings may underestimate the effectiveness of upper airway surgery in those who did not agree to follow PSG and improved OSA in terms of RDI and PSG findings. Furthermore, a wide range of differences exist in terms of type of surgery selected by the each surgeon; making a possible bias in comparison of surgery outcomes. The unavailability of objective documents of type of surgery also made comparison of data difficult. However, due to multilevel surgery of upper airway, the current results seem to be generalized to patients with OSA undergoing surgery.

Conclusion

Surgery improved snoring, daytime sleepiness, and OSA-associated problems. Improvement of RDI in a small subset of patients indicates importance of follow-up PSG after upper airway surgery and warrants further studies. Moreover, an investigation of the reasons of non-participation for undergoing follow-up PSG is required.

Conflict of Interests

Authors have no conflict of interests.

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