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The Effects of Nasal Septoplasty on the Severity of Obstructive Sleep Apnea Syndrome: A Quasi-experimental Study

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Abstract

Background: Sleep disorders of breathing encompass a spectrum of disorders ranging from primary snoring to obstructive sleep apnea syndrome (OSAS), which leads to septoplasty in the most patients.

Objectives: The aim of this study was to evaluate the effects of nasal septoplasty surgery on the severity of OSAS.

Methods: The current quasi-experimental self-controlled study was conducted on adult patients with deviated nasal septum and were candidate for nasal septoplasty. Before surgery and two months after surgery, patients underwent respiratory polygraph. The parameters assessed included the airflow and oximetry indices. The severity of sleep apnea will be assessed based on the Apnea-Hypopnea Index (AHI). Also, the severity of snoring was scored from zero to 10 based on the visual analog scale (VAS). The severity of daytime sleepiness was also determined using the Epworth Sleepiness Scale (ESS). Data were analyzed by using SPSS software.

Results: There was a significant reduction in the mean score of ESS after the surgery (P<0.001), daytime fatigue (P=0.002), and daytime sleepiness (P<0.001). Also, breathing quality during sleep showed that the severity of apnea (P<0.001), snoring (P<0.001), as well as ESS (P<0001) were significantly improved. There were no significant changes in the means of oxygen saturation (P=0.14) and rapid eye movement (REM) sleep (P=0.06) after non-REM stage 1-2 (P=0.09), but following non-REM stage 3-4 significantly improved (P=0.03).

Conclusion: The correction of nasal obstruction improved the general health of OSAS patients. These results further reflected that the corrective surgery could improve the patients' emotional state and social performance, effectively upgrading their quality of life.

Keywords: Nasal Obstruction, Obstructive Sleep Apnea Syndrome, Rhinoplasty

1. Background

Sleep disorders of breathing encompass a spectrum of disorders ranging from primary snoring to obstructive sleep apnea syndrome (OSAS). Obstructive sleep apnea is a chronic, recurrent, and underdiagnosed condition characterized by the recurrent collapse of upper airways during sleep. The prevalence of this disorder in different societies varies between 2% and 7%. The symptoms of OSAS include continuous snoring, noticeable apnea, hypersomnia, fatigue, and hypoxia. The prevalence of these symptoms among Iranians has been estimated at 28%.[1] This disorder is more frequently observed in males, the elderly, people with a high body mass index (BMI), and those suffering from adenotonsillar hypertrophy, craniofacial abnormalities, and neuromuscular problems. The correct diagnosis of this disease is necessary not only to ensure proper treatment but also to prevent its associated complications such as systemic hypertension, cardiovascular diseases (e.g., infarction), abnormal glucose metabolism, developmental problems, neurological abnormalities, and behavioral problems.[2]

Some degrees of deviation and deformity of the midline nasal septum are observed in 75%-80% of adults with OSAS. Septoplasty for correcting the deviated or deformed midline nasal septum is the third ENT surgery performed in the United States, aiming to increase patients' quality of life.[3] Although other etiologies such as mucosal congestion, nasal turbinate hypertrophy, adenoid hypertrophy, and nasal masses can also cause nasal obstruction, the septal deformity is always considered among the main causes of obstruction. Surgeons often rely on their clinical judgment on the presence and severity of deformity and obstruction

to choose the appropriate treatment, which is often surgery.[4]

Septoplasty is the only way to treat a deviated septum that makes breathing through the nose difficult, forcing the person to breathe through the mouth, which leads to a dry mouth. Difficulty in nasal breathing worsens throughout the night, causing sleep disturbance. The success of surgical treatment depends not only on the severity of obstruction but also on the patient's medical condition as a prominent determinant. Upper airway surgery may be a viable therapeutic option in selected patients with OSAS, and it has been confirmed to have long-term effectiveness equal to continuous positive airway pressure (CPAP) therapy.[5]

According to the effects of nasal septoplasty surgery on the severity of OSAS, it is possible to provide patients with deviated septa with a better disease management strategy. Considering the importance of the issue, this study aimed to evaluate the effects of nasal septoplasty surgery on the severity of OSAS.

2. Methods

2.1. Study Design and Population

The present study was a quasi-experimental self-controlled study conducted from April-December 2021 on adult patients with deviated nasal septum and were candidate for nasal septoplasty, who referred to Otorhinolaryngology Department of Imam Khomeini Hospital, one of the biggest teaching hospital in Kermanshah, west of Iran, and affiliated to Kermanshah University of Medical Sciences, Kermanshah, Iran.

2.2. Participants

Inclusion criteria were adult patients with confirmed diagnosis of deviated nasal septum, and despite receiving medical treatment, they still complained of lack of recovery and nasal obstruction, and they were candidate for nasal septoplasty.

Patients with maxillofacial abnormalities, those with any pre-diagnosed sleep disorder, and patients experiencing more than 10% change in BMI during the study, as well as those refusing to sign the written informed consent form, were excluded from the study.

2.3. Sample Size and Sampling Method

Convenience sampling was performed to recruit patients for this study. According to a previous report,[6] and considering 95% confidence level and 90% study power, the sample size was determined as 20 using G-power software.

2.4. Study Protocol and Intervention

Sampling was started after obtaining the necessary permissions from the Kermanshah University of Medical Sciences. In this study, patients with deviated nasal septa diagnosed based on clinical examinations and computed tomography (CT) scan findings, who still complained of nasal obstruction despite receiving medications, were examined as candidates for septoplasty surgery. Written informed consent was obtained from all the participants.

The patients were initially subjected to general anesthesia, and all patients underwent surgery by the same surgical team. Nasal tampons were removed on the first day after the surgery, and then nasal irrigation with normal saline was ordered. The patients underwent respiratory polygraphy at home before and two months after the surgery.

2.5. Measurements

The parameters assessed included the airflow and oximetry indices. The data obtained were interpreted by the physician. Based on the Apnea-Hypopnea Index (AHI), the severity of OSAS was divided into four categories: normal (AHI ≤4.9), mild (AHI between 5 and 14.9), moderate (AHI between 15 and 29.9), and severe (AHI >30) (14). Also, the severity of snoring was scored from zero to 10 based on the visual analog scale (VAS). The severity of daytime sleepiness was also determined using the Epworth Sleepiness Scale (ESS). All data were collected in a data gathering form.

2.6. Statistical Analysis

All statistical analyses were performed with the Statistical Package for Social Sciences (SPSS Inc., Chicago, IL, USA) version 22.0 for Windows. The paired-sample *t* test and chi-square tests were used to compare the findings. The results are presented as mean ± standard deviation (SD) for continuous variables and are summarized in frequencies (percentage) for categorical ones. Two-sided $P < 0.05$ and confidence interval (CI) of 95% were set to be statistically significant.

3. Results

Totally, 20 patients were enrolled. The mean ± SD of age was 34.1±7.2 years, and 15 (75%) patients were male (Table 1).

The participants had an average overweight of 1.5±2.5 kg post-surgery; however, weight changes were not significantly different before and after the surgery (P=0.63). Post-surgery anterior rhinoscopy examination revealed a considerable improvement in the breathing process; however, some patients still complained of a feeling of suffocation. As shown in Table 2, there was a significant reduction in the mean score of ESS after the surgery compared to before the surgery (P<0.001), daytime fatigue (P=0.002) and daytime sleepiness (P<0.001). Also, breathing quality during sleep showed that the severity of apnea (P<0.001), snoring (P<0.001), as well as ESS (P<0001) were significantly improved compared to before the septoplasty surgery, but not in the number of apnea (P=0.31).

Also, AHI decreased in eight patients while it increased in 12 patients. Out of 12 patients with elevation in AHI, four patients had significant remarkable increases in AHI; six patients showed a non-significant decrease in AHI, and two patients completely recovered (P=0.69). All patients had adequate sleep length before and after the surgery.

Table 1. The Patients' Demographic Characteristics

Variables	Values
Age (year) (mean ± SD)	34.1±7.2
Gender (%)	
Male	15 (75)
Female	5 (25)

SD: standard deviation

Table 2. The Results of the VAS Questionnaire Before and After the Intervention

Variables	Before Intervention	After Intervention	*P* Value
Daytime fatigue	5.4±2.7	3.1±3.0	0.002*
Daytime sleepiness	5.5±2.3	3.8±2.2	<0.001*
Snoring	8.6±2.3	4.9±2.3	<0.001*
Number of apnea	170.6±138.5	149.1±137.3	0.31
Severity of apnea	6.5±2.5	3.2±2.6	<0.001*
AHI	35.5±22.5	32.3±24.6	0.69
ESS	9.3±5.1	5.9±3.9	<0.001*
Sleep quality	82.3±11.1	84.8±9.8	0.08
Sleep pattern			
REM sleep	16.9±7.5	19.3±18.3	0.06
Non-REM stage 1-2	71.9±10.0	72.9±9.1	0.09
Non-REM stage 3-4	8.6±6.3	11.6±7.3	0.03*
Oxygen saturation	91.2±3.8	92.1±3.1	0.14

AHI: apnea hypopnea index; ESS: Epworth sleepiness scale; REM: rapid eye movement.
* Statistically significant.

There were no significant changes in the means of oxygen saturation (P=0.14) and rapid eye movement (REM) sleep (P=0.06) after non-REM stage 1-2 (P=0.09), but following non-REM stage 3-4 significantly improved (P=0.03).

4. Discussion

Previous studies show that sleep breathing disorders may occur due to various causes of nasal congestion, such as mouth breathing and abnormal nasal reflexes, leading to irregular contractions and increased negative pressure during inhalation. Various clinical and experimental studies show that nasal inflammations exaggerate sleep apneas. In addition, some other studies have shown that nasal obstruction compromises sleep quality and triggers apnea and hypo-apnea in men.[5]

In the current study, it was observed that sleep quality improved in patients after compared to before the surgery; however, this improvement was not statistically significant, which agrees with the report of Sufioğlu et al.[5] On the other hand, several prospective trials evaluating the effectiveness of nasal septoplasty surgery in patients with OSAS have reported contradictory results.[7,8]

The ESS index, which was designed by Johns, is the most widely used scale in evaluating hypersomnia, especially when the goal is to evaluate response to treatment.[9] In the present study, a significant improvement in the average ESS score was observed, reaching from 9.3 before the surgery to 5.9 after the surgery. This observation was consistent with the report of Verse et al[10] and other studies asserting that the correction of nasal airway obstruction can mitigate hypersomnia in patients with OSAS.[11,12]

Snoring is a common finding in patients with an obstructed nasal passage, compromising their sleep quality and causing interrupted sleep, hypersomnia, and reduced quality of life. In this study, snoring was significantly reduced after surgery compared to before surgery. Patients may be unaware of their snoring, but the partner's suffering from snoring may encourage the patient to seek treatment. Daytime sleepiness is the predominant symptom of OSAS. Individuals suffering from nasal obstruction generally have more daytime sleepiness and poorer quality of life. These patients are often referred for nasal surgery, believing that improved breathing can mitigate their daytime sleepiness, a notion that is supported by the patients receiving treatment in the present study.[10-12]

In this study, no significant change was observed in AHI or blood oxygen saturation before and after the surgery. As OSAS is a multifactorial disease caused by pathological nasal obstruction at different levels, it is not sensible to consider all patients to be candidates for surgery. As observed in the current study, relatively deep stage 3-4 non-REM sleep can be attributed to the improvement of breathing in patients undergoing surgery. This finding was in line with the results of Nakata et al.'s study. Although the mean AHI did not significantly change after the surgery, a reduction in nasal resistance resulted in the improvement of CPAP titration pressures, which resulted in more patients being successfully treated with CPAP. Moreover, a lower pressure level is expected to be associated with better CPAP tolerance.[13]

Our results indicated that the correction of nasal obstruction improved the general health of OSAS patients, and these effects were particularly noticeable in terms of the limitations caused by physical or emotional problems. These results further reflected that the corrective surgery could improve the patients' emotional state and social performance, effectively upgrading their quality of life.

One of the limitations of the present study was that it was a single-center study with relatively small sample size. It is recommended to design multicenter studies with larger sample sizes and longer follow-up periods. Also, taking into mind geographical and ethnic variations, relevant OSAS etiologies and their consequences can be investigated.

5. Conclusion

Although more research is required to elucidate the impacts of nasal obstruction on the quality of life of affected individuals, our results revealed that the surgical treatment of OSAS can significantly improve patients' quality of sleep. The patients undergoing surgery experienced marked improvements in snoring during sleep, as well as in daytime fatigue and sleepiness. Also, apnea and ESS were significantly shortened after surgery; nevertheless, HAI and mean oxygen saturation showed no significant amelioration. Altogether, it is advisable to tailor surgical

Research Highlights

What Is Already Known?

- Sleep disorders of breathing encompass a spectrum of disorders ranging from primary snoring to OSAS.
- OSAS leads to septoplasty in most patients.

What Does This Study Add?

- The correction of nasal obstruction improved the general health of OSAS patients.
- The patients undergoing septoplasty experienced marked improvements in snoring during sleep, as well as in daytime fatigue and sleepiness.

management in patients with OSAS according to nasal obstruction pathogenesis and etiology.

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Author Contributions

MAF, AD and AH: get the idea and designed, MAF and AH: data acquisition, AH and MH: data analysis, MAF and AD: supervised the study. All authors: wrote the original manuscript version. All authors: manuscript editing. All authors have read and confirmed the final draft.

Ethical Approval

The current study was approved by Kermanshah University of Medical Sciences (Grant No. 3010413), as well as the Ethics Committee (IR.KUMS.REC.1399.1167). To consider ethical issue, the collected data were not revealed to anyone, except for the researchers. All participants signed a written informed consent. All methods were performed in accordance with the relevant guidelines and regulations.

Conflict of Interest Disclosures

All the authors have no conflicts of interest to disclose.

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