Original Article* / *Çalışma - Araştırma

Role of nasal problems on positional and nonpositional obstructive sleep apnea

Burun problemlerinin pozisyonel ve pozisyonel olmayan tıkayıcı uyku apnesi üzerindeki rolü

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ABSTRACT

Objectives: This study aims to examine the relationship between nasal pathologies and positional (PP) obstructive sleep apnea (OSA) or nonpositional (NPP) OSA.

Patients and Methods: A total of 44 male OSA patients (mean age 48.0±6.8 years; range 31 to 60 years) suffering from nasal obstruction were retrospectively evaluated for nasal obstruction scores, overall apnea hypopnea index (AHI) and AHI in supine and nonsupine positions, daytime sleepiness scores, and body mass index (BMI). Patients were divided into two equal groups as PP group and NPP group. Output parameters were snoring severity index, clinical nasal obstruction score, septal deviation score, conchal hypertrophy score, and allergic rhinitis (AR) score. These parameters were correlated with the type of OSA.

Results: Apnea hypopnea index was significantly lower in PP group than in NPP group ($p<0.03$). Spearman correlation analysis revealed significant negative correlation between AR score and PP ($r=-0.40$, $p<0.0001$). Pearson correlation test revealed significant correlation between AHI and BMI ($r=0.32$, $p<0.05$).

Conclusion: We suggest that AR is not only an important risk factor for OSA, but also patients with AR tend to be NPP OSA patients because of the serious nasal obstruction which already causes an increase in nasal resistance or pharyngeal collapsibility.

Keywords: Allergic rhinitis; nasal airway obstruction; obstructive sleep apnea.

ÖZ

Amaç: Bu çalışmada burun patolojileri ve pozisyonel (PP) tıkayıcı uyku apnesi (TUA) veya pozisyonel olmayan (PO) TUA arasındaki ilişki incelendi.

Hastalar ve Yöntemler: Burun tıkanıklığı olan toplam 44 erkek TUA hastası (ort. yaş 48.0±6.8 yıl; dağılım 31-60 yıl) burun tıkanıklığı skorları, genel apne hipopne indeksi (AHİ) ve sırtüstü ve sırtüstü olmayan pozisyonlarda AHİ, gündüz uykululuk skorları ve vücut kütle indeksi (VKİ) açısından retrospektif olarak değerlendirildi. Hastalar PP grubu ve PO grubu olmak üzere iki eşit gruba ayrıldı. Çıktı parametreleri horlama şiddeti indeksi, klinik burun tıkanıklığı skoru, septum deviasyonu skoru, konka hipertrofisi skoru ve alerjik rinit (AR) skoru idi. Bu parametreler TUA tipi ile ilişkiliydi.

Bulgular: Apne hipopne indeksi PP grubunda PO grubundan anlamlı olarak daha düşüktü ($p<0.03$). Spearman korelasyon analizi AR skoru ve PP arasında anlamlı negatif ilişki gösterdi ($r=-0.40$, $p<0.0001$). Pearson korelasyon testi AHİ ve VKİ arasında anlamlı ilişki gösterdi ($r=0.32$, $p<0.05$).

Sonuç: Alerjik rinitin sadece TUA için önemli bir risk faktörü olduğunu değil, AR'li hastaların nazal direnç veya farengeal çökebilirlikte halihazırda artışa yol açan ciddi burun tıkanıklığı nedeniyle PO TUA hastaları olma eğilimi gösterdiğini ileri sürmekteyiz.

Anahtar Sözcükler: Alerjik rinit; burun hava yolu tıkanıklığı; tıkayıcı uyku apnesi.

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Sleep position has been claimed as a related factor for both snoring and obstructive sleep apnea (OSA) by pointing out that the supine position is more risky for severe OSA.[1,2] Oksenberg et al.[1] suggested that OSA cases could be divided into positional (PP) OSA patients, i.e. patients with a supine respiratory disturbance index that is at least two times higher than their lateral respiratory disturbance index, and nonpositional (NPP) OSA patients, i.e. patients with a supine respiratory disturbance index less than two times higher than the lateral respiratory disturbance index. It has been reported that PP OSA patients had less severe apnea hypopnea index (AHI) values.[3,4] Furthermore it has been suggested that positional or milder sleep disordered breathing in the lateral position was most likely to respond to the nasal valve device.[5]

Regarding supine position, the following variables have been assumed to be most likely related to OSA physiopathology: increased nasal resistance in relation to upright position,[6,7] increase in pharyngeal collapsibility in relation to lateral position[8,9] and morphological differences in upper airway detected by cephalometrics.[10,11] It has also been shown that daytime nasal obstruction is an independent risk factor for OSA, and nasal obstruction also augments airway collapse during sleep.[12] In light of the above information the following question comes to the mind: Is PP OSA less or more common in subjects with nasal obstruction? The answer to this question is still open in the otorhinolaryngologic- or sleep-literature. As a scientific ambivalence, both "yes" and "no" answers for this question could be partially supported by the background literature. For example, it could be speculated that subjects with nasal pathologies causing nasal obstruction do not present any change in relation to position because they already have increased nasal resistance in both daytime and sleep in either supine or lateral position. Correspondingly, in these subjects, nasal obstruction-related pharyngeal collapsibility during both supine and lateral positions is already increased. On the other hand, subjects with particularly unilateral nasal obstructions caused by septal deviation have an ipsilateral positional preference to maintain better nasal airway during sleep. If so, it could be hypothesized that these cases may reveal better polysomnographic data and less snoring when they prefer an ipsilateral position during sleep. Therefore, it may be speculated that PP patients might be the subjects with unilateral nasal problems, and that since they prefer one lateral side as obligatory, they have less or no OSA and/or snoring in this preferred lateral side-sleep. To the best of our knowledge, PP OSA has not been evaluated with regard nasal pathologies until now.

The aim of the present study was to demonstrate whether there is a relation between nasal pathologies and PP or NPP OSA.

PATIENTS AND METHODS

The study has been conducted in accordance with the principles of the Helsinki Declaration and approved by the local Institutional Review Board. The medical records of 50 OSA patients suffering from snorring and fitting to the following criteria were retrospectively evaluated. Finally, a total of 44 male patients (mean age 48.0±6.8 years; range 31 to 60 years) were included. Of these, 22 patients were included in the PP group, while 22 patients were included in the NPP group. The remaining six simple snorers were not included in the analysis. Medical records of the patients were reviewed for the presence of the following data: *(i)* Full otorhinolaryngologic examination including rigid nasal and flexible posterior nasal and pharyngeal endoscopy; *(ii)* Severe habitual snoring measured by snoring severity index (SSI) by using a 10 cm visual analog scale. *(iii)* Clinic nasal obstruction score (CNOS) in daytime and at night. *(iv)* Full-night polysomnography (PSG) performed in a registered sleep laboratory. Patients with previous nasal or pharyngeal soft tissue surgery and previous orthodontic treatment, the ones who are already under treatment for any apparent nasal and/or paranasal diseases, the ones with apparent craniofacial abnormality, and the ones older than 60 years of age were excluded from the study.

Output parameters

Full-night polysomnography: Full-night PSG was performed in either one of two registered sleep laboratories using the same standards. Physicians in these centers were pulmonologists who were certified as sleep specialists by Turkish Sleep Board Certification Program. Further, all

of the sleep technicians in these centers were also trained and certificated by Association of Sleep Technicians in Turkey. Body mass index (BMI), daytime sleepiness score (DSS),[13] and the following PSG data were uploaded to the computer as variables: AHI, AHI in supine (s-AHI) and non-supine (ns-AHI) positions. Subjects with OSA in only supine position and those patients in whom s-AHI was at least two times higher than their ns-AHI were included in PP group, while the rest of the patients were included in NPP group, as based on description by Oksenberg et al.[1]

Snoring severity index: The degree of snoring was recorded by room or bed partner of each patient. A score of 0 represented no snoring and a score of 10 very disruptive snoring regarding its loudness and continuity during night; those with an SSI equal to or higher than 7 were included.

Clinical nasal obstruction score: Severity of CNOS was measured using 10 cm VAS, as previously reported.[14-16] The degree of nasal obstruction was recorded by each patient under supervision of either first or second author of the study. A score of 0 represented no obstruction and no episode of nasal obstruction, and a score of 10 indicated complete nasal obstruction. The patients pointed this scale twice, one for degree of nasal obstruction in daytime (dtCNOS) and the other for the night (nCNOS), respectively.

In the medical records, the following nasal pathologies were also noted: *(i)* Septal deviation [septal deviation score (SDS): 0= absent; 1= present]; *(ii)* Inferior choncal hypertrophy [choncal hypertrophy score (CHS): 0= absent; 1= present in one side; 2= present in two sides]; *(iii)* Allergic rhinitis [Allergic rhinitis score (ARS): 0= absent; 1= present]. Furthermore, all patients were scored for severity of the nasal pathology based on a surgeons decision (0= no need for an operation; 1= an operation was required). All scores described above were used for the calculation of nasal pathology score (NPS) of each patient.

Statistical analysis

Data were analyzed using the IBM SPSS version 21.0 software (IBM Corporation, Armonk, NY, USA). A normal distribution of the quantitative data was checked using Shapiro-Wilk test. Parametric tests were applied to data of normal distribution and non-parametric tests were applied to data of questionably normal distribution. Since data in AHI, BMI and DSS variables revealed normal range, group differences for these variables were tested by the student t test. On the other hand, the Mann-Whitney U test was used for dtCNOS and nCNOS, which were found to be out of normal range. Spearman correlation analysis was performed among group scores and other variables, while Pearson correlation test was used for the relationships among AHI, DSS, BMI, dtCNOS and nCNOS. Chi-square test with Fisher correction was used for statistical evaluation of rate of SDS, CHS, ARS and NPS between PP group and NPP group. All differences associated with a p value of 0.05 or less were considered statistically significant.

RESULTS

We found that 41 of 50 subjects had mean AHI higher than five, and 19 of 41 OSA subjects presented PP OSA while no change in AHI by position was present in the remaining 22 subjects (NPP group). Further three of six subjects with simple snoring presented OSA in supine position. Hence we added them to our PP group and further analysis was done for 22 PP and 22 NPP subjects (Table 1).

As seen in Table 2, only AHI revealed significant statistical difference between the PP group and NPP group ($p<0.03$). The AHI was significantly lower in the PP group than in the NPP group. Spearman correlation analysis revealed significant negative correlation between ARS and PP OSA ($r=-0.40$, $p<0.0001$). Pearson correlation test revealed significant correlation between AHI and BMI ($r=0.32$, $p<0.05$).

Table 1. The subjects presenting positional and nonpositional obstructive apnea

	Full night mean AHI	
	<5	≥5
OSA in only supine position	3*	5*
Two times higher OSA in supine position than lateral position	0	14*
No change by position	6	22**
Total	9	41

* Totally 22 subjects presenting positional OSA; ** The subjects with OSA who presented no change by position. AHI: Apnea hypopnea index; OSA: Obstructive sleep apnea.

Table 2. Comparison of positional and nonpositional patients' subgroups

Variables	Subgroups	n	Mean±SD
Apnea hypopnea index*	Nonpositional group	22	35.7±29.9
	Positional group	22	19.2±13.0
Daytime sleepiness score	Nonpositional group	22	9.2±5.2
	Positional group	22	10.6±6.6
Body mass index	Nonpositional group	22	29.3±3.4
	Positional group	22	29.4±3.8
Daytime CNOS	Nonpositional group	22	2.3±2.3
	Positional group	22	3.4±3.6
Night CNOS	Nonpositional group	22	3.3±2.8
	Positional group	22	4.1±4.0

SD: Standard deviation; * Student t test; $p<0.03$; CNOS: Clinic nasal obstruction score.

Chi-square test demonstrated that there was no case with AR in the PP group, while 27.27% of NPP group were suffering from AR ($p<0.03$). There was no significant difference in rates of septal deviation and conchal hypertrophy, and NPS between the PP group and NPP group.

The AHI of subjects with AR was 45.5±37.6, while it was 24.3±20.3 in remaining cases.

DISCUSSION

Although Oksenberg et al.[1] showed that 55.9% of 574 consecutive OSA patients were in PP group; in the present study, 46.34% of OSA patients were in PP group. Furthermore, in the present study mean AHI in PP group was significantly lower than in NPP group in accordance with the previous reports.[1,4]

In the present study, a significant relationship was found between AR and NPP OSA. None of the subjects with clinically evident AR showed changes in AHI by position during sleep. This data was statistically proven by both the correlation test between group scores of PP and AR, and chi-square test showing rates of AR in PP group and NPP group. The correlation coefficient between ARS and PP in our study was found to be much higher than the well-known association between BMI and AHI. It has been clearly stated that incremental increase in BMI was related with incremental increase in AHI,[16,17] and in the present study, the power of this correlation was 0.32 within the significant level. Recently a Turkish population study of 97 cases revealed a correlation between AHI and BMI ($r=0.42$, $p<0.001$).[18] Therefore, we could suggest that suffering from AR negatively correlated with having PP OSA. In another words, AR cases present no (or less) positional change in AHI. This data supports our first assumption that since serious nasal obstruction could have already caused increase in nasal resistance or in pharyngeal collapsibility in AR cases, positional changes did not manage to either increase or decrease it more or less. Hence, PP OSA appears to be less in AR patients.

It has been shown that nasal congestion in subjects with AR was a major risk factor for both OSA and habitual snoring.[19-22] McNicholas et al.[19] clearly demonstrated that an increase in nasal resistance was directly associated with an increased AHI rate in parallel to corresponding changes in O_2 desaturation. Meng et al.[23] reported that subjects with AR presented moderately more severe data in PSG compared to healthy controls. Although they did not find a significant difference in AHI between groups, rates of the subjects with AHI >5 was significantly higher in AR subjects than healthy control groups by chi-square test. Our subjects with AR also presented higher AHI than others. This data also appears to be in accordance with the knowledge that OSA in the NPP group was more serious than in the PP group.[1,2] On the other hand, the present study did not reveal any negative or positive evidence for side preference of unilateral nasal obstruction, since this retrospective survey did not include ratios of left or right side preference of the subjects. Nevertheless, having septal deviation and/or turbinate hypertrophy was not found to be related to PP OSA or overall AHI.

As also reported by Meng et al.,[23] the ARIA guideline states that it is unclear whether AR is associated with OSA.[24] Therefore, although it was collected from a small study group, our data appears to be a limited but important contribution to the rhinologic literature by pointing out a clear association of AR with NPP OSA, but not with PP OSA.

Prospective study designs utilizing objective tests and better clinical criteria are needed to determine association not only of AR but also of other nasal pathologies with either PP or NPP OSA. Further intervention studies are also of major importance to understand the role of treatment options[21] of AR and/or other nasal pathologies on PP or NPP OSA.

Limitations of our study include the retrospective design and relatively small number of our series. In addition, some details of history and factors that may influence the outcome may not be completely documented. Due to these restrictions, associations should be interpreted with caution.

In conclusion, we suggest that allergic rhinitis is not only an important risk factor for OSA, but also the subjects with AR tend to be NPP OSA patients because of the serious nasal obstruction which already causes an increase in nasal resistance or pharyngeal collapsibility.

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