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CLINICAL STUDY

Evaluation of upper airway in obstructive sleep apnea-hypopnea syndrome and habitual snorers

Selma Kurukahvecioglu[1], Hikmet Firat[2], Sadik Ardic[2]

CAG Hospital Ear Nose Throat Department, Ankara, Turkey. **selmakurukahveci@yahoo.com**

Abstract: *Objectives:* The purpose of this study was to evaluate upper airway in obstructive sleep apnea-hypopnea syndrome patients and habitual snorers, and to determine the correlation with apnea-hypopnea index.

Methods: 193 patients who applied to our Ear Nose Throat Clinic between years 2000 and 2002 with the complaint of witnessed snoring and/or apnea were included in the study. Each patient was evaluated by a complete head and neck examination and polysomnography. Physical examination included anterior rhinoscopy, nasal endoscopy, examination of oropharynx and hypopharynx and Muller maneuver. The correlation between the Ear Nose Throat examination parameters and the apnea/hypopnea index was investigated.

Results: Patients were distributed into two groups according to the apnea-hypopnea index: habitual snorers (34.3 %) and obstructive sleep apnea-hypopnea (65.7 %). There was a statistically significant correlation between apnea-hypopnea index and Muller maneuver, tongue base, lateral pharyngeal fold. There was a statistically significant correlation between body mass index, Muller maneuver and uvula.

Conclusions: Obstructive sleep apnea-hypopnea patients results from changes in the upper airway. Anatomic and functional findings correlated with the apnea-hypopnea index. In the majority of patients with OSAHS, pharyngeal abnormalities and nasal obstruction were found to be statistically significant *(Tab. 2, Fig. 1, Ref. 14).* Full Text (Free, PDF) *www.bmj.sk.*

Key words: obstructive, sleep apnea, upper airway, apnea-hypopnea index.

Obstructive sleep apnea hypopnea syndrome (OSAHS) is a syndrome characterized by recurrent episodes of upper airway obstruction during sleep and a consequent fall in blood oxygen saturation (1). It was first defined in 1973 by Guilleminault et al (2, 3). Since OSAHS creates a potential risk for cardiovascular and cerebrovascular diseases, its diagnosis and treatment is very important (3).

The physiopathology of OSAHS has not been completely understood and its etiology is multifactorial. Anatomic abnormalities of the upper respiratory tract (URT), in particular, lead to an increased risk of OSAHS. Muscular activity is also of great significance in the etiopathogenesis of OSAHS. Anatomically narrow airways require the dilator muscular activity of the airway to be further increased against the negative pressure that occurs during inspiration. If the increased pressure is greater than the tonus of the muscles that help to keep the pharyngeal lumen open, the airway collapses. Total obstruction of the airway causes OSAHS while a partial obstruction leads to snoring (4, 5, 6).

It has been demonstrated that the site of obstruction in OSAHS is between the nasopharynx and the supraglottic larynx. There are various URT pathologies that may lead to OSAHS and snoring. Nasal septum deviation that narrows the diameter of URT, adenoid vegetation and enlarged tonsils are considered to be predisposing factors. The body mass index (BMI) >40 especially increases the risk of disease. BMI is directly proportional to the apnea hypopnea index (AHI) (7). Apart from this, thick neck circumference, smoking, alcohol, endocrine disorders and neurological diseases are ancillary risk factors (8, 9). However, there are also patients with snoring or OSAHS whose physical examination results are completely normal.

According to literature, we recognize that none of the physical examination findings alone are as objective as polysomnography (PSG) in both, diagnosing and establishing the severity of OSAHS. BMI, Modified Mallampati Classification (MMC), Muller Maneuver (MM) and physical examination findings just help us to think that "this patient might have OSAHS". Since the primary step in making the diagnosis is based on considering the particular disease, all kinds of information and physical examination findings that might provide us with clues are invaluable. As OSAHS carries potential risks for the patient, it is highly important to differentiate it from habitual snoring and to start the appropriate treatment immediately. Moreover, physical examination findings are also very important for choosing the treatment modality for patients with different degrees of OSAHS. In this study, we compared the patients' physical examination findings with PSG results in order to try to determine which of the

[1]CAG Hospital Ear Nose Throat Department, Ankara, and [2]Health Minister Diskapi Yildirim Bayazit Hospital Chest and Sleep Clinic, Ankara, Turkey

Address for correspondence: Selma Kurukahvecioglu, 30. cadde No: 20/33 Doga Sitesi Karakusunlar, Ankara 06530/Türkiye.
Phone: +0905058156496

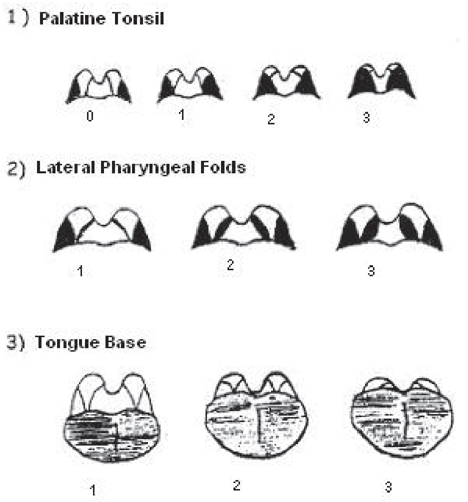

Fig. 1. Modified McKenzie's Classification. 1 – Tonsils; Grade 0: Tonsillectomy, Grade 1: Tonsils inside the tonsillar fossa lateral posterior pillars, Grade 2: Tonsils occupying 25–50 % of oropharynx, Grade 3: Tonsils occupying 75 % or more of oropharynx. 2 – Lateral Pharyngeal Folds; Grade 1: Normal, Grade 2: LFP occupying 25 % of tonsils, Grade 3: LPF occupying 50 % or more of tonsils and Lateral pharyngeal folds flask. 3 – Tongue base; Grade 1: All the oropharynx including tonsils, pillars, soft palate and the tip of uvula are visible, Grade 2: Tonsils upper polo and the uvula are visible, Grade 3: Part of the uvula and soft palate are visible.

physical examination findings are valuable for differentiating OSAHS from habitual snoring and predict its severity.

Methods

In this study, 193 adult patients (age range between 21 and 76 with a mean of 46.5±10.7; 151 male and 42 female) who were diagnosed with habitual snoring (62 patients) or OSAHS (131 patients) between years 2000–2002 were retrospectively evaluated. Patients who had previous surgery for snoring or apnea were excluded. After being assessed by an ear nose and throat (ENT) specialist, all patients were evaluated by a chest diseases specialist and a standard full-night polysomnography (PSG) test was done in the sleep laboratory. The history of all patients was investigated and they were assessed regarding hypertension, diabetes, heart and lung diseases, neurological diseases and allergy. The ENT examination included anterior rhinoscopy, nasal endoscopy, examination of oropharynx and hypopharynx, Muller maneuver (MM), and facial morphology that was examined in respect of craniofacial pathologies like retrognathia and micrognathia. Nasal cavity and nasopharynx were examined by anterior rhinoscopy and nasal endoscopy. Pathologies that could possibly lead to obstruction such as deviated septum, nasal polyp, conchal hypertrophy, adenoid vegetation were determined. Oral cavity was examined and evaluated in respect of teeth structure, tonsil size, uvula, tongue base, lateral pharyngeal folds (LPF) and posterior air way opening. The oral cavity and oropharynx findings were graded according to Modified McKenzie's classification as shown in Figure 1. The uvula was classified as normal or long. The obstruction sites in the upper airway were determined by performing MM, and graded between 0–3; 0: no obstruction, 1: oropharyngeal obstruction, 2: tongue base and hypopharyngeal obstruction, 3: Obstruction at both levels. We also examined the body mass index (BMI) of the patients. All patients and their PSG results were evaluated by a chest diseases specialist. The PSG parameters included chin and tibialis electromyogram, electroencephalogram, chest and abdomen plethismograhs for respiratory movements, body position, pulse oxymeter (fingertip), right and left movements. In addition to AHI, any other associated pathologies (periodic leg movement etc.) were noted.

The patients were divided into two groups according to AHI. Patients with AHI≥5 were included in the group having OSAHS, and those with AHI<5 in the group having habitual snoring. Those with AHI = 5–14 were classified as having mild OSAHS, those with AHI = 15–29 as moderate OSAHS, and those with AHI≥30 as severe OSAHS.

The correlation between the physical examination results and AHI was statistically evaluated by applying Pearson Correlation, T test and logistic regression test. For all tests, the level of significance was at a p value less than or equal to 0.5. Patients with BMI≥25, MM grade 2–3, Tonsil grade 2–3, LFP grade 2–3 and TB grade 2–3 were selected as being at high risk of AHI. Statistical analysis was performed with SPSS 13.0 for Windows.

Results

Of the 193 patients, 93 patients (48.1%) had nasal septum deviation, 3 patients had nasal polyps (1.5 %), and 9 patients had allergic rhinitis (4.6 %). 59 patients had grade 3 LPF (30.6 %), 69 patients had grade 3 tongue base hypertrophy (35.8 %), 185 patients (95.9 %) had elongated uvula, 45 patients (23.3 %) had grade 2–3 tonsils and 99 patients (51.3 %) had grade 2–3 MM. The physical examination findings of the patients with ha-

Tab. 1. Head and neck examination findings in patients with obstructive sleep apnea hypopnea syndrome (OSAHS) and habitual snoring.

	Habitual Snoring (%) (n=62)	OSAHS (%) (n=131)
Normal uvula	7 (11.2 %)	1 (0.7 %)
Long uvula	55 (88.7 %)	130 (99.2 %)
Tonsils degree 0-1	48 (77.4 %)	100 (76.3 %)
Tonsils degree 2-3	14 (22.5 %)	31 (23.6 %)
Muller maneuver 0-1	51 (82.2 %)	43 (32.8 %)
Muller maneuver 2-3	1 (1.6 %)	88 (67.1 %)
Lateral pharyngeal fold 1–2	40 (64.5 %)	94 (71.7 %)
Lateral pharyngeal fold 3	22 (35.4 %)	37 (28.2 %)
Tongue base 1-2	51 (82.2 %)	73 (55.7 %)
Tongue base 3	11 (17.7 %)	58 (44.2 %)
Nasal polyp	2 (3.2 %)	1 (0.7 %)
Septal deviation	41 (66.1 %)	52 (39.6 %)
Allergic rhinitis	5 (8 %)	4 (3 %)

Tab. 2. Multivariate analysis of apnea-hypopnea index (AHI) and body mass index (BMI), Muller maneuver score (MMS), tongues base grade (TBG), tonsil size (TS) and lateral pharyngeal fold grade (LPFG).

		AHI	95%CI	p value
BMI	<24,9	1	0.153–1.106	NS
	≥25	0.412		
MMS	0–1	1	0.055–0.259	0.0001
	2–3	0.119		
TS	0–1	1	0.514–2.911	NS
	2–3	1.223		
LPFG	1	1	0.246–1.387	NS
	2–3	0.585		
TBG	1	1	0.277–1.760	NS
	2–3	0.698		

bitual snoring and OSAHS are given in Table 1.

When all the patients were assessed, two patients had upper airway resistance syndrome (UARS), 2 patients had periodic limb movement disorder (PLMS), 3 patients had panic attacks, 1 patient had insomnia, 5 patients had chronic obstructive pulmonary disease (COPD) and 2 patients had hypothyroidism.

According to the classification of AHI, 39 patients had mild OSAHS (19.2 %), 30 had moderate OSAHS (15.5 %), and 62 had severe OSAHS (64.8 %).

In the statistical assessment of AHI and physical examination findings, AHI was found to be correlated with BMI (r: 0.370, $p<0.01$), MM score (r: 0.571, $p<0.01$), tongue base size (r: 0.363, $p<0.01$) and LPF grade (r: 0.290, $p<0.01$). These facts indicate that AHI is high also in patients with high BMI, high MM score and high grades of tongue base or LPF. There was no significant correlation between AHI and presence of deviated septum or elongated uvula, or hypertrophic tonsils. When MM score, tongue base grade, tonsil hypertrophy grade, LPF grade and BMI were evaluated with multivariate logistic regression test, only MM score was found to affect the index (p: 0,0001) (Tab. 2). BMI on the other hand, was found to be highly correlated with MM score (r: 0.306, $p<0.01$).

Discussion

The physiopathology of OSAHS has not been completely understood, and its etiology is multi-factorial. The presence of snoring, witnessed apnea and daytime somnolence in the anamnesis is important, yet the gold standard in diagnosis is PSG.

URT pathologies may cause snoring and OSAHS. Conditions narrowing the URT, like deviation, tonsil hypertrophy and adenoid vegetation are especially predisposing. The main problem in OSAHS is the airway collapse and the subsequent narrowing of the air passage. In studies conducted in patients with OSAHS, the pressure that provides the closure of URT has been found to be lower than in normal people (11). The obstruction in URT leads to building up a greater negative pressure for inspiration and this in turn causes apnea (11).

According to literature OSAHS was found to be correlated with BMI, neck circumference, and pathologies that narrow the URT such as pharyngeal anatomic abnormalities, tonsil hypertrophy, abnormal uvula and micrognathia (13). Friedman et al also found BMI, MM and tonsil size to be associated with OSAHS. The results of these studies signify the correlation between MMC, tonsil size, BMI and AHI. In our study we also found AHI to be correlated with BMI, MM, TB and LPF. We detected an especially strong correlation between AHI and BMI. But we did not find any correlation between tonsil size and AHI. When we evaluated BMI, MM score, TB and LPF with multivariate logistic regression test, only MM score was found to be significantly affecting the index (p: 0.0001).

According to literature, physical examination findings of BMI, MMC and pharyngeal pathologies were found to be statistically correlated in the prediction and assessment of OSAHS severity. Similarly, we found that AHI increases with high BMI, MM score, tongue base grade and LPF grade. Additionally we found a prominent correlation between BMI and MM score. Although Zonato et al found nasal obstruction to be greater in the OSAHS group than in the snoring group (13).

In our study we did not find any statistical correlation between nasal septal deviation and OSAHS, but we observed that the complaints of patients whose deviation was corrected (93 patients 48.1 %) markedly improved, and the patients using continuous positive airway pressure (CPAP) had increased their device compliance. Upon examination of literature, it can be observed that the incidence of nasal obstruction in patients treated with CPAP ranges from 29.1 % to 66 %. In the study conducted by Friedman et al. the impact of nasal surgery on AHI was also found to be low but it was also detected to be effective in reducing CPAP pressure. For patients who have been recommended to use CPAP, we recommend that URT pathologies that cause obstruction be detected beforehand and corrected. Thus, the patient has better compliance with the device and needs lower CPAP pressure.

There may be some patients in whom OSAHS is detected despite having no marked pathology in the physical examination. In our study too, there were 3 patients without marked pathology yet in whom moderate OSAHS was detected. This may be due to the fact that all the physical examination findings are evaluated while the patients are awake. For instance, obstruction may be encountered together with obesity and neural diseases. Pathologies like obstruction and obesity can be evaluated while the patient is awake, but since neural pathologies emerge during sleep it is difficult to predict the events occurring during sleep while patients are awake. This can be explained by the fact that the etiology is primarily based on muscular activity whereas URT pathologies are predisposing factors.

In this study, our aim was to be able to understand the relationship of physical abnormalities with OSAHS and to be able to diagnose OSAHS beforehand by having a look at the physical examination findings. Since the number of sleep centers in our country is small, PSG is still not widely performed. At the same time PSG takes longer than ENT examination and costs more.

Therefore it is important to identify the patients who should be referred to sleep centers. Among the upper airway pathologies, we found Muller maneuver score to be the most prominent factor for predicting a high apnea-hypopnea index. Two easy and practical evaluations, namely MM and BMI can be combined to differentiate habitual snoring and OSAHS and to predict the severity of OSAHS.

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