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Osas incidence in septal deviation Mladina type 7

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Abstract

Aim: Obstructive sleep apnea syndrome (OSAS) is a disease that progresses with attacks of upper respiratory tract obstruction during sleep, causing recurrent hypoxia as a result. These obstructions usually occur due to mechanical (septum deviation, concha bullosa, concha hypertrophy) or inflammatory (acute/chronic rhinitis) causes and pose a risk for OSAS. Therefore, clinical and radiographic findings guide the diagnosis of the disease. Among the radiographic examinations, the most common, thin-section paranasal computed tomography (CT) is used for determining the obstruction site and preoperative treatment planning. In this study, we aimed to investigate the paranasal BT findings of OSAS patients.

Materials and Methods: Patients with OSAS were included in the study. Seven hundred seventy-seven patients whose paranasal CT results were registered in the hospital information system and met the inclusion criteria were included in the study.

Results: When the patients were evaluated according to the paranasal CT findings, the most common finding was deviation of the septum, followed by the agger nasi cells. Type 7 deviation according to Mladina classification in OSAS was significantly higher than simple snoring and type 1 deviation in mild OSAS was significantly higher than moderate-severe OSAS ($p < 0.05$) All other deviations, except type 1 deviation, were seen most frequently in severe OSAS. The most common sinonasal pathology in all groups is the agger nassi cell. All sinonasal pathologies were most common in the severe OSAS group.

Conclusion: As a result, ıt should not be forgotten that OSAS may be observed when we detect Mladina type 7 septum deviation in patients who come to the ENT outpatient clinic with suspicion of sleep apnea, and we should refer them to the sleep clinic for PSG. The physician's knowledge of nasal-sinus anatomy and variations through imaging will be a guide for both diagnosis and surgical treatments.

Introduction

Obstructive sleep apnea syndrome (OSAS) is a disease that progresses with attacks of upper respiratory tract obstruction during sleep, causing recurrent hypoxia as a result. Since it was defined by Guilleminault in 1976, interest in this disease has gradually increased, and many studies have been conducted on the pathophysiology and treatment of the disease. The prevalence of the disease varies between 2-4% and is gradually increasing [1].

Hypoxia, which is the main factor in pathogenesis, causes an increase in hypercapnia and decrease in intrathoracic pressure, sympathetic nervous system activation, and impairment in cerebral blood flow, increased blood pressure, and interruption of sleep. Failure to take action may result in death. It is not well known in society that the disease has such serious consequences. The individual usually does not go to the physician because he is not aware of or does not care about the disease [2].

Obesity, middle and advanced age, male sex, family history, smoking and alcohol consumption, having short and thick height, large waist circumference, diabetes, and hypertension are the main risk factors determined for OSAS [3].

Polysomnography (PSG) is the gold standard test in the diagnosis of OSAS [4]. The degree of disease is classified according to apnea-hypopnea index (AHI) in the polysomnography report. Those with AHI ≤5 are considered as having simple snoring, those with AHI: 5-14.9 as having mild OSAS, those with AHI: 15-29.9 as having moderate OSAS, and patients with AHI ≥30 as having

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severe OSAS [5].

Patients with OSAS have significant differences in the upper respiratory tract compared with normal individuals, and airway collapse occurs in the retropalatal region in more than 75% of the patients [6]. Apart from this, obstructions occurring in the nasal area also cause an increase in air-flow resistance and difficulty in breathing. These obstructions usually occur due to mechanical (septum deviation, concha bullosa, concha hypertrophy) or inflammatory (acute/chronic rhinitis) causes and pose a risk for OSAS [7].The most common mechanical cause of nasal obstruction in the population is deviation of the septum. There are different types of septum deviation and the Mladina Classification is often used to determine the type of deviation [8]. In Mladina classification, septum deviation is divided into 7 types. The severity of the obstruction increases from type 1 with mild deviation to type 7, where multiple deviations are seen. Clinical and radiographic findings guide the diagnosis of the disease. Among the radiographic examinations, the most common, thin-section paranasal computed tomography (CT) is used for determining the obstruction site and preoperative treatment planning [9]. However, OSAS can be seen in a minority of patients who have no risk factors.

The aim of this study was to examine the paranasal CT of patients who underwent PSG in terms of sinonasal pathologies and to investigate whether these pathologies were related to the severity of the disease.

Materials and Methods

All patients (956 patients) who applied to Adana City Training and Research Hospital Ear Nose and Throat Clinic with complaints of snoring and sleep apnea between July 2019 and July 2020 and underwent PSG in the sleep laboratory of the Ear Nose and Throat Clinic were included in the study.

Although other anatomical regions of the head and neck, such as the skull base and base of the tongue, are effective in OSAS, we examined the nasal region with paranasal CT in our study and excluded 156 patients with severe pathology in other areas. We also excluded 23 patients with missing PSG report and paranasal CT results. In our clinic, paranasal CT is routinely performed to investigate the presence of upper respiratory tract pathology before PSG in pathologies with nasal complaints and endoscopically detected. Seven hundred and seventy-seven patients whose paranasal CT results were registered in the hospital information system and met the inclusion criteria were included in the study. PSG results and paranasal CT images were analyzed retrospectively.

Polysomnography

PSG recordings of all patients were evaluated retrospectively and cross-sectionally. Sleep and physiologic variables were monitored using Comet-PLUS Grass® (Astro-Med Industrial Park, West Warwick, USA) PSG. Electroencephalography (EEG) with 10 channels (C3, C4, O1, O2, Fp1, Fp2, F3, F4, P3, P4), submental electromyography (EMG), right and left eye electrooculography (EOG), electrocardiography (ECG), oronasal airflow (thermal sensor and nasal pressure transducer), body position, thoracic and abdominal motility (inductance plethysmograph), arterial blood oxygen saturation measurement with finger pulse oximetry, left and right leg motion sensors (EMG), and a tracheal microphone were used. Apnea was defined as a reduction of more than 90% in the airflow signal measured by the thermal sensor for at least 10 seconds. Hypopnea was defined as a decrease in nasal pressure signal for at least 10 seconds, more than 30% compared with basal and resulting in desaturation or arousal more than 3% compared with basal [10]. The study population was first divided into two according to AHI values; AHI 0-4.9 simple snoring, AHI$>$ 5 OSAS. Than OSAS group divided into three groups; AHI 5-14.9 mild OUAS, AHI: 15-29.9 moderate OSAS, AHI$>$ 30 severe OSAS.

Body mass indexes (BMI)

It was calculated without PSG by measuring height and weight using sensitive scales and a tape measure in the outpatient clinic. All measurements were made by the same person and the results were reported to the nearest 0.5 cm. The purpose of this was to reduce the margin of error of the person making the measurements.

Paranasal CT findings

Paranasal CT findings of the patients were reviewed by 2 blind ENT specialists from the hospital information system, and CT images were evaluated retrospectively. Anatomical variations and pathologies were recorded as present / absent by providing a common view of both observers in thin-sectioned coronal paranasal CT images. Septum deviation types were divided according to Mladina classification [8]. The presence of concha hypertrophy, concha bullosa, paradoxical middle turbinate, the haller cell, the agger nasi cell , onodi cell and maxillary cyst , mucosal thickening were investigated [11-16]. Three millimeter thickening in the maxillary sinus floor was accepted as mucosal thickness [17-19]. To evaluate the repeatability of the observations, one week after the completion of the study, 20 randomly selected paranasal CT images were examined again by two observers, and anatomic variations and pathologies were noted. The types of septum deviation and sinonasal pathologies were examined according to the simple snoring and OSAS groups and compared between the groups.

The study was approved by Adana City Training and Research Hospital Clinical Research Ethics Committee on July 1st 2020 (Decision Number: 962).

Statistical analysis

Since our data were categorical, the Chi-Square test was used for statistical analysis. If the observed value less than 5 is above 20%, the Fisher Exact test was used. The analysis of the data was performed using the SPSS 22.0 package program. The relationship of AHI with paranasal CT findings was analyzed using Pearson's correlation test.

Results

A total of 777 patients, 591 men, 186 women, participated in the study. The mean age of the patients was 44.13 $\pm$ 11.47 years and the mean BMI was 30.0 $\pm$ 5.39 kg/m^2.

Table 1. Classification of sleep apnea by sex.

	Male		Female		Total		p
	n	%	n	%	n	%	
Simple snoring	87	14.7	61	32.8*	148	19.0	<0.001
OSAS	504	85.3*	125	67.2	629	81.0	
Mild OSAS	133	22.5	54	29.0*	187	24.1	
Moderate OSAS	129	21.8	30	16.1	159	20.5	<0.001
Severe OSAS	242	40.9*	41	22.0	283	36.4	
Total	591	100.0	186	100.0	777	100.0	

p: Chi-square test * refers to the higher ratio, OSAS: Obstructive sleep apnea syndrome.

Table 2. Type and number of sinonasal region pathologies according to paranasal CT findings.

	n	%
Septum deviation	361	46
The Agger nasi cell	244	31.4
Concha bullosa	135	17.4
Haller cell	113	14.5
Mucosal thickening	99	12.7
Onodi cell	80	10.3
Concha hypertrophy	70	9
Maxillary cyst	50	6.4
Paradoxical middle concha	20	2.6
Total	777	100

p: Chi-square test * refers to the higher ratio.

Age and BMI averages did not differ according to sex ($p > 0.05$).

There is a significant difference in gender distribution in the groups we made according to AHI values ($p < 0.001$). Accordingly, the rate of women was higher in simple snoring and , the rate of men was higher in severe OSAS (Table 1) ($p < 0.001$).

When the patients were evaluated according to the paranasal CT findings, the most common finding was deviation of the septum, followed by the agger nasi cells (Table 2).

Septum deviation was observed in 361 (46%) of 777 patients. Type 2 and Type 3 deviation are the most common types of deviation in general. The most common types of deviation are type 3 in simple snoring, type 2 in OSAS. According to OSAS groups type 1 in mild OSAS, type 2 in moderate OSAS and type 3 in severe OSAS were seen. Type 7 deviation in OSAS was significantly higher than simple snoring and type 1 deviation in mild OSAS was significantly higher than moderate-severe OSAS ($p < 0.05$) (Table 3). All other deviations, except type 1 deviation, were seen most frequently in severe OSAS.

The most common sinonasal pathology other than septum deviation is the presence of agger nasi cells. The most common sinonasal pathology in all groups is the agger nasi cell. All sinonasal pathologies were most common in the severe OSAS group (Table 4).

Discussion

Various risk factors are described for OSAS. One of the most important is anatomic pathologies that obstruct the upper respiratory tract. Although there are multilevel anatomic pathologies in OSAS, the first anatomic region where air passes is the nasal airway. Our study was conducted to evaluate paranasal region in OSAS. The most common anatomical deformity in patients with OSAS is septum deviation, and all anatomical deformities are most common in severe OSAS.

In 1987, Mladina classified septal deviations into seven types [8]. The first four types were classified as vertical, followed by two types of horizontal deformities, and the seventh was a combination of these types. Type 2 and type 3 septum deviation are the most common types [19]. To our knowledge, there is no grouping of septum deviation in OSAS according to the Mladina classification in the literature.

Yeğin et al. rated septum deviations according to the Mladina classification in patients who underwent septoplasty and observed the most common type 3 and second type 2 deviation [8]. When we look at the literature, the most common type 3 septum deviation is observed according to the Mladina classification [19,20].

Orman et al. evaluated paranasal CT volumetric findings in patients with OSAS in their study [9]. Forty-eight patients with OSAS were analyzed retrospectively. The most common sinonasal pathology was septum deviation. However, in their study, they rated septal spur (56%) and septal spur contact (33%) in septum deviation. In our study, we rated septum deviation according to the Mladina classification. Type 2 and type 3 deviation are the most common types of deviation like in the literature in our study. Type 7 deviations in OSAS were significantly higher than simple snoring and type 1 deviation in mild OSAS was significantly higher than moderate-severe OSAS. As the severity of deviation increases, the severity of OSAS increases.

In a study conducted by Adışen et al., the frequency of anatomic variation and pathology in the sinonasal region among individuals with high risk for OSAS and individuals with low risk was investigated. Patients were classified as low and high risk for OSAS according to the Epworth Sleepiness Scale. They evaluated septum deviation as a deviation of 4mm or more from the midline. No statistically significant result was found between the anatomic variations and pathologies of the sinonasal region and OSAS, but mucosal thickening in the maxillary sinus was more common in the high-risk group. We classified patients according to PSG results and evaluated septum deviation according to the Mladina classification and found that sinonasal pathologies were more common in severe OSAS. According to the results of their study, Adışen et al. concluded that anatomic variations and pathologies of the sinonasal region could not be considered as primary risk factors for OSAS and nasal surgery should only be performed in selected patients. Apnea attacks and negative pressure during sleep are mostly observed in the severe

Table 3. Distribution of septum deviation types between groups.

		AHI												
		Simple snoring (n:148)		OSAS (n:629)		p	Mild OSAS (n:187)		Moderate OSAS (n:159)		Severe OSAS (n:283)		Total		p
		n	%	n	%		n	%	n	%	n	%	n	%	
Type 1	No	132	19.1	559	80.9	0.912	155	22.4	143	20.7	261	37.8*	691	88.9	0.017
	Yes	16	18.6	70	11.1		32	37.2*	16	18.6	22	25.6	86	11.1	
Type 2	No	127	18.6	555	88.2	0.418	166	24.3	137	20.1	252	37.0	682	87.8	0.679
	Yes	21	22.1	74	11.8		21	22.1	22	23.2	31	32.6	95	12.2	
Type 3	No	125	18.3	557	88.6	0.171	165	24.2	146	21.4	246	36.1	682	87.8	0.243
	Yes	23	24.2	72	11.4		22	23.2	13	13.7	37	38.9	95	12.2	
Type 4	No	143	18.9	614	97.6	0.492	183	24.2	154	20.3	277	36.6	757	97.4	0.810
	Yes	5	25.0	15	2.4		4	20.0	5	25.0	6	30.0	20	2.6	
Type 5	No	143	18.9	615	97.8	0.414	182	24.0	156	20.6	277	36.5	758	97.6	0.822
	Yes	5	26.3	14	2.2		5	26.3	3	15.8	6	31.6	19	2.4	
Type 6	No	143	19.0	610	97.0	0.821	183	24.3	152	20.2	275	36.5	753	96.9	0.662
	Yes	5	20.8	19	3.0		4	16.7	7	29.2	8	33.3	24	3.1	
Type 7	No	148	19.6	607	96.5	0.021**	180	23.8	155	20.5	272	36.0	755	97.2	0.108
	Yes	0	0.0	22	3.5		7	31.8	4	18.2	11	50.0	22	2.8	

p:Chi-Squred test **Fisher Exact test *refers to the higher ratio OSAS: Obstructive Sleep Apnea Syndrome, AHI: Apnea hypopnea index.

Table 4. Distribution of sinonasal pathologies between groups.

		AHI												
		Simple snoring (n:148)		OSAS (n:629)		p	Mild OSAS (n:187)		Moderate OSAS (n:159)		Severe OSAS (n:283)		Total		p
		n	%	n	%		n	%	n	%	n	%	n	%	
Concha hypertrophy	No	133	18.8	574	91.3	0.595	174	24.6	146	20.7	254	35.9	707	91	0.602
	Yes	15	21.4	55	8.7		13	18.6	13	18.6	29	41.4	70	9	
Concha bulosa	No	127	19.8	515	81.9	0.256	146	22.7	132	20.6	237	36.9	642	82.6	0.261
	Yes	21	15.6	114	18.1		41	30.4	27	20	46	34.1	135	17.4	
Onodi cell	No	136	19.5	561	89.2	0.330	168	24.1	143	20.5	250	35.9	697	89.7	0.717
	Yes	12	15	68	10.8		19	23.8	16	20	33	41.3	80	10.3	
Agger nasi cell	No	94	17.6	439	69.8	0.139	119	22.3	120	22.5*	200	37.5	533	68.6	0.047
	Yes	54	22.1	190	30.2		68	27.9	39	16	83	34	244	31.4	
Paradoxical middle concha	No	145	19.2	612	97.3	0.640	184	24.3	155	20.5	273	36.1	757	97.4	0.589
	Yes	3	15	17	2.7		3	15	4	20	10	50	20	2.6	
Haller cell	No	124	18.7	540	85.9	0.521	161	24.2	139	20.9	240	36.1	664	85.5	0.805
	Yes	24	21.2	89	14.1		26	23	20	17.7	43	38.1	113	14.5	
Maxillary cyst	No	143	19.7	584	92.8	0.092	173	23.8	146	20.1	265	36.5	727	93.6	
	Yes	5	10	45	7.2		14	28	13	26	18	36	50	6.4	
Mucosal thickening	No	132	19.5	546	86.8	0.434	157	23.2	137	20.2	252	37.2	678	87.3	0.346
	Yes	16	16.2	83	13.2		30	30.3	22	22.2	31	31.3	99	12.7	

p:Chi-Squred test **Fisher Exact test *refers to the higher ratio OSAS: Obstructive Sleep Apnea Syndrome, AHI: Apnea hypopnea index.

OSAS group. This negative pressure causes inflammation in the mucous membranes and the inflammatory process may predispose to changes in the sinonasal region [17].

In a study by Cerrah et al. the authors retrospectively examined coronal section CT imaging of 1,008 patients with sinonasal pathology in ENT outpatient clinic and investigated the frequency of anatomic variations in the sinonasal region [18]. The most common anatomic variation was the agger nasi cells, followed by concha bullosa, haller cells, onodi cells, and parodoxical middle concha. However, they did their studies in patients with sinonasal pathology who came to the ENT outpatient clinic, and we did it in OSAS patients To the best of our knowledge, there are insufficient studies investigating the frequency of sinonasal pathology in patients with OSAS. In our study, the agger nasi cells were seen in 244 (31.4%) of 777 patients with OSAS and

this was the most common sinonasal region pathology after septum deviation. When we look at the AHI values, the most common sinonasal pathology in mild, moderate and severe OSAS is the presence of the agger nassi cells.

The most important limitation of our study is tongue base and the entire airway were not described which may largely affect the airway because, it was a retrospective study with large number of subjects. Prospective studies are needed in the future.

As a result, ıt should not be forgotten that OSAS may be observed when we detect Mladina type 7 septum deviations in patients who come to the ENT outpatient clinic with suspicion of sleep apnea, and we should refer them to the sleep clinic for PSG. The physician's knowledge of nasal-sinus anatomy and variations through imaging will be a guide for both diagnosis and surgical treatment.

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Ethics approval

The study was approved by Adana City Training and Research Hospital Clinical Research Ethics Committee on July 1st 2020 (Decision Number: 962).

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