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Nasal Obstruction and Unilateral Chronic Otitis Media: Evaluation by Acoustic Rhinometry

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Objectives: In a prospective study at Umraniye Research and Education Hospital, we aimed to evaluate the differences in acoustic rhinometric findings between the affected and nonaffected sides in patients with unilateral chronic otitis media (COM) and to investigate whether unilateral COM correlates with the side of nasal obstruction.

Methods: Fifty-five consecutive patients with unilateral COM were involved in this study. All patients were evaluated with acoustic rhinometry, the Nasal Obstruction Symptom Evaluation (NOSE) scale, and measurement of their nasal mucociliary transport time.

Results: The mean cross-sectional area 1, mean cross-sectional area 2, volume 1, and volume 2 values were not different between the affected and nonaffected sides ($p > 0.05$). The NOSE score had a reverse correlation with the mean cross-sectional area 2 ($p < 0.05$) and volume 2 ($p < 0.01$) of the affected side. Saccharin time was not correlated with the acoustic rhinometric values of the affected side ($p > 0.05$).

Conclusions: These findings do not support the hypothesis that unilateral COM is correlated with the side of nasal obstruction.

Key Words: acoustic rhinometry, chronic otitis media, nasal obstruction.

INTRODUCTION

The etiopathogenesis of chronic otitis media (COM) is multifactorial. Upper airway infections, recurrent otitis media, infection of the eustachian tube (ET) and nasopharynx, ciliary dysfunction, and allergy are among the investigated probable risk factors.[1] Dysfunction of the ET is thought to be the most important factor in the causation of inflammatory disorders of the middle ear.[1,2] The ET is frequently involved in pathological processes of the nasal, paranasal, and nasopharyngeal cavities.[3,4] It has been previously postulated that nasal obstruction alters the function of the ET and can lead to middle ear hypoventilation.[3,5] Nasal packing was reported to increase the incidence of ET dysfunction as a consequence of the absence of nasal airflow and inflammatory mediator release.[6]

We speculated that unilateral COM might be correlated with the obstructed nasal side. In this study we aimed to evaluate the differences in acoustic rhinometric findings between the affected and nonaffected sides in patients with unilateral COM. In this way, we planned to investigate the correlation between the side of nasal obstruction and the side of COM.

MATERIALS AND METHODS

Permission was obtained from the Haydarpasa Numune Research and Education Hospital research ethics board.

Study Subjects. Fifty-five consecutive patients (19 male and 36 female) with unilateral COM admitted to our outpatient clinic between March 2012 and October 2012 were involved in this study. The average age of the patients was 32.56 ± 12.60 years (range, 18 to 59 years). Chronic otitis media is defined as the chronic inflammation of the middle ear and mastoid mucosa accompanying tympanic membrane perforation and otorrhea.[2] It causes a wide range of disorders, including chronic suppurative otitis media, chronic nonsuppurative otitis media, adhesive otitis media, retraction pockets, and cholesteatoma.[7] In order to study a homogeneous group, we included only patients with unilateral central dry perforations in the study. The exclusion criteria were cholesteatoma, actively discharging ears, a history of nasal surgery, smoking, administration of nasal drops, upper airway infections, and a history of ear trauma and/or ear surgery.

Patient Evaluation. A detailed medical history was

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TABLE 1. ACOUSTIC RHINOMETRIC MEASUREMENTS ACCORDING TO AFFECTED AND NONAFFECTED SIDES

	Affected Side	*Nonaffected Side*	*p**
MCA1 (cm^2)	0.46 ± 0.27	0.50 ± 0.28	0.227
MCA2 (cm^2)	0.52 ± 0.29	0.52 ± 0.30	0.984
V1 (cm^3)	0.52 ± 0.30	1.70 ± 0.57	0.630
V2 (cm^3)	4.31 ± 2.34	4.25 ± 2.20	0.883

Data are mean ± SD. See text for definitions of measurements.

*Paired-samples *t*-test.

TABLE 2. CORRELATION BETWEEN ACOUSTIC RHINOMETRIC DATA AND NOSE AND ST DATA

		NOSE		*ST*	
		r	*p*	*r*	*p*
Affected side	MCA1	–0.141	0.318	0.027	0.857
	MCA2	–0.332	0.016*	–0.086	0.564
	V1	–0.119	0.401	0.147	0.325
	V2	–0.400	0.004†	0.039	0.800
Nonaffected side	MCA1	0.120	0.397	0.074	0.621
	MCA2	–0.031	0.826	0.163	0.274
	V1	0.146	0.303	0.057	0.703
	V2	–0.123	0.389	0.325	0.030*

See text for definitions of measurements. NOSE — Nasal Obstruction Symptom Evaluation score; ST — saccharin time (time taken to first perception of sweet taste after saccharin application); r — Pearson correlation coefficient.

*$p < 0.05$.

†$p < 0.01$.

obtained. Evaluation of nasal obstruction symptoms was performed with the Nasal Obstruction Symptom Evaluation (NOSE).[8,9] All subjects underwent a complete otolaryngological examination. The nasal mucociliary activity was evaluated with the saccharin time (ST) measurement. The size of the nasal cavity was assessed with acoustic rhinometry.

Evaluation of Nasal Mucociliary Transport Time. To evaluate nasal mucociliary activity, we performed the ST measurement on the affected side without the use of a topical anesthetic agent. The saccharin granules were 2 to 3 mm in diameter. With the patient in a sitting position, a saccharin granule was placed on the frontal edge of the inferior turbinate. The ST was defined as the time taken to the first perception of a sweet taste after saccharin application and was recorded as the mean ± SD.

Acoustic Rhinometry. RhinoMetrics (RhinoScan; Interacoustics, Assens, Denmark) was used for acoustic rhinometric evaluations. The subjects were seated upright in an otolaryngological examination chair. Each nasal cavity was tested 3 times. The means of the cross-sectional area and their standard deviations were measured by computer software. The nasal minimum cross-sectional area (MCA) was defined as the area at the distance range between 1 cm and 5 cm from the nostril.[8] The term MCA1 was used to denote the nasal MCA at the level of the nasal isthmus, and MCA2 was used to denote the nasal MCA at the level of the erectile tissues of the head of the inferior turbinate and of the septal tuberculum.[10] Volume 1 (V1) was used to designate the volume of the segment located between 10 and 32 mm from the nostril, corresponding to the nasal valve region. Volume 2 (V2) was used to designate the volume of the segment located between 33 and 64 mm from the nostril, corresponding to the turbinate region.[11]

Statistical Analysis. All statistical calculations were performed with NCSS statistical software (Kaysville, Utah). In addition to the standard descriptive statistical calculations (median, frequency, and ratio), a paired-samples *t*-test and the Pearson correlation coefficient were used in the assessment of data. The statistical significance level was established at a p level of less than 0.05.

RESULTS

We evaluated 55 consecutive patients (19 men [34.5%] and 36 women [65.5%]) with a diagnosis of unilateral COM with dry eardrum perforation in our clinic. The mean (±SD) age was 32.56 (±12.60) years (range, 18 to 59 years). Of these patients, 25 (45.5%) had COM on the right side and 30 (54.5%) had COM on the left side. The acoustic rhinometric measurements are shown in Table 1. The MCA1, MCA2, V1, and V2 values were not different between the affected and nonaffected sides ($p > 0.05$). The mean (±SD) NOSE score was 4.22 (±4.65), with a range of 0 to 13 and a median score of 2. The NOSE symptom score had an inverse correlation with the MCA2 (33.2%; $p < 0.05$) and V2 (40%; $p < 0.01$) values of the affected side. The mean (±SD) ST was 10.39 (±4.21) minutes, with a range of 6 to 19 minutes and a median of 10 minutes. The ST was not correlated with the acoustic rhinometric values of the affected side ($p > 0.05$; Table 2).

DISCUSSION

Dysfunction of the ET has been previously reported to be the most important factor in the pathogenesis of middle ear diseases.[1,5] Maier and Krebs[12] reported that dysfunction of the ET frequently occurs in patients with deviation of the nasal septum and conchae. A significant increase in middle ear pressure in the ear on the side of nasal blockage after nasal septal surgery was reported.[6] Watson[13] emphasized the importance of nasal obstruction in unilateral COM. He found that nasal airway resistance was higher on the side affected by COM.[13] However, in a recent study, the differences in nasal airway resistance and in the cross-sectional area measurements

of the two nasal cavity sides of subjects with unilateral COM were not statistically significant.[7] Our results are in accordance with those. We studied patients with unilateral COM to find out whether there was a difference between the right and left sides of the nasal cavity in terms of nasal cross-sectional area and volume. In a difference from the previous study,[7] all of the present subjects had a dry tympanic membrane perforation without discharge, retraction pockets, or cholesteatoma.

Cingi et al[1] found a reduction in mucociliary transport time of technetium 99m on the side of the affected ear in patients with unilateral COM. They suggested a causal relationship between impaired ciliary function and COM. They found a mean mucociliary transport time on the affected side of 9.72 minutes as compared to 13.16 minutes in controls.[1] We found a mean ST of 10.39 ± 4.21 minutes (range, 6 to 19 minutes), which is within the normal range. The mean mucociliary transport time in adults is reported to range from 9.6 to 14.3 minutes.[1]

Acoustic rhinometry is one of the most commonly used noninvasive objective methods for the assessment of the nasal airway, and it is highly correlated with subjective symptoms of nasal obstruction.[14,15] In the present study, the MCA2 and V2 were significantly correlated with the NOSE scores on the affected side. However, the values measured by acoustic rhinometry were not different between the affected and nonaffected sides. Our hypothesis about lateralization for the side of nasal obstruction and the side of COM was not supported by the results of the study.

However, some published data have suggested that septoplasty should be performed before tympanoplasty in patients with severe septal deviation because ET dysfunction frequently occurs in patients with septal deviation and hypertrophy of the conchae.[12] According to Low and Willatt,[6] the nasal patency measured with a peak inspiratory nasal flowmeter and the middle ear pressure increased significantly after septal surgery. They suggested that a deviated nasal septum might be associated with middle ear problems.[6] In contrast, Watson[13] demonstrated no statistically significant difference in nasal resistance on the side of the affected ear after decongestion, although the pre-decongestion difference was statistically significant. Inflammatory and infectious conditions other than structural ones that lead to mucosal edema seem to be more likely to play a role in nasal obstruction and the etiopathogenesis of COM. This might be the reason that we found no statistically significant difference in objective findings between the affected and nonaffected sides, despite a subjective nasal obstruction.

In conclusion, differences in cross-sectional area between the sides of the nasal cavity were not statistically significant in patients with unilateral dry tympanic membrane perforations. Although it has not been proven to cause COM, many authors still prefer to treat nasal obstruction before treating COM in order to provide a normally functioning ET.[6,12]

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