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Original Article* / *Çalışma - Araştırma

The relationship between septal deviation and concha bullosa

Septum deviasyonu ve konka bülloza arasındaki ilişki

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ABSTRACT

Objectives: This study aims to classify septal deviations according to the Mladina classification and to investigate the relationship between concha bullosa and septal deviation.

Patients and Methods: A total of 407 patients (229 males, 178 females; mean age 30.9±13.3 years; range 14 to 69 years) who admitted to our clinic with nasal obstruction, were identified to have deviation, and detected to have concha bullosa on computed tomography were included in the study. Patients' age, gender, type of deviation according to the Mladina classification, side of deviation, side of concha bullosa and the dominant side in bilateral cases were recorded.

Results: Rate of type 3 septal deviation (34.4%) was higher than the other septal deviation types. We detected that septal deviation in patients of concha bullosa was to the opposite side at a rate of 83% and the deviations were type 3 at a rate of 47%.

Conclusion: Concha bullosa may cause septal deviation, while septal deviation may cause concha bullosa as well. Both conditions affect each other physically. The fact that type 3 deviation is seen more frequently in this combination supports this finding.

Keywords: Concha bullosa; Mladina classification; septal deviation.

ÖZ

Amaç: Bu çalışmada septum deviasyonları Mladina sınıflamasına göre sınıflandırıldı ve konka bülloza ile septum deviasyonu arasındaki ilişki araştırıldı.

Hastalar ve Yöntemler: Kliniğimize burun tıkanıklığı ile başvuran, deviasyon saptanan ve bilgisayarlı tomografisinde konka bülloza bulunan 407 hasta (229 erkek, 178 kadın; ort. yaş 30.9±13.3 yıl; dağılım 14-69 yıl) çalışmaya alındı. Hastaların yaşı, cinsiyeti, Mladina sınıflamasına göre septum deviasyon tipi, deviasyon tarafı, konka bülloza tarafı ve iki taraflı olgularda dominant taraf kaydedildi.

Bulgular: Tip 3 septum deviasyonu oranı (%34.4) diğer septal deviasyon tiplerinden daha yüksekti. Konka bülloza hastalarındaki septum deviasyonunun %83 oranında karşı tarafa ve deviasyonların %47 oranında tip 3 olduğu saptandı.

Sonuç: Konka bülloza septum deviasyonuna neden olabilirken septum deviasyonu da konka büllozaya neden olabilir. Her iki durum birbirini fiziksel olarak etkilemektedir. Tip 3 deviasyonun bu kombinasyonda daha sık görülmesi bu bulguyu destekler niteliktedir.

Anahtar Sözcükler: Konka bülloza; Mladina sınıflaması; septum deviasyonu.

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In 1987, Mladina classified septal deviations into seven types. The first four types were classified as vertical, followed by two types of horizontal deformities, and the seventh was a combination of these types.[1,2]

Type 1 and 2 septal deviations are pathologies creating unilateral narrowing in the valve region. Type 2 is more severe than type 1 and affects valve functions more. Type 3 is a unilateral vertical crest, causing narrowing at the level of the head of the middle nasal concha. Type 4 is a mix of type 3 with type 1 or type 2 with obstruction in both nasal passages, also known as 'S' septum. In type 5, one side of the septum is straight, while the other side has a unilateral ridge on the base of the septum that is in contact with the lateral nasal wall in Cottle's region. In type 6, there is a unilateral crest in the base through the caudal part of the septum, while the other nasal cavity involves a sulcus formed between the high maxillary spine and septum. Type 7 is a combination of all these types and termed a 'Passali deformity'.[3]

Nasal turbinates are structures maintaining nasal functions of humidification, lubrication, olfaction, filtration and thermoregulation.[4] Concha bullosa or pneumatized middle turbinate is the most common anatomic variant of the middle turbinate (14-53.6%) and is diagnosed on computed tomography (CT).[5,6] This finding has become clearer on CT scans that have gained more use in preoperative evaluation.[7] Although mostly asymptomatic, overly pneumatized turbinates may lead to airway problems, affect osteomeatal complex drainage, and cause sinusitis. In addition, concha bullosa touching the nasal septum may cause contact headaches.[8]

Concha bullosa are divided into three groups according to pneumatization. The lamellar type has pneumatization of the turbinate vertical lamella, the bullous type includes pneumatization of the inferior segment, and the extensive form has pneumatization of both lamellar and bullous parts.[5,9]

In the present study, we aimed to investigate the relationship between septal deviation types and choncha bullosa and compare our results with the literature. Evaluating choncha bullosa in patients with septal deviation may contribute to our diagnosis and treatment.

PATIENTS AND METHODS

A total of 3,020 patients aged 14-69 years consulting at the Adana Numune Training and Research Hospital from January 2012 to March 2016 with septal deviation were identified for possible inclusion in the study. Patients with minor deviation, minimal concha bullosa, sinusitis and nasal polyps were excluded. The study included 407 patients (229 males, 178 females; mean age 30.9±13.3 years; range 14 to 69 years). The study protocol was approved by the Adana Numune Training and Research Ethics Committee. The study was conducted in accordance with the principles of the Declaration of Helsinki.

On physical examination, decongestion was obtained with adrenaline-soaked cotton pledgets (1 mg/mL adrealine (Biofarma İlaç Sanayi ve Tic. AŞ. İstanbul, Türkiye) diluated with 9 mL saline) inserted into the nasal cavity. Following anterior rhinoscopy, rigid endoscopic examination (with 4 mm diameter, 0 degree endoscope) was carried out. Paranasal sinus CT scans were obtained for patients who were clinically indicated for operation. Patient age, gender, type of deviation according to Mladina classification, side of deviation, side of bullous or extensive concha bullosa, and the dominant side in bilateral cases were recorded.

Statistical analysis

Data obtained in this study was analyzed utilizing the IBM SPSS version 20.0 package software (IBM Corp., Armonk, NY, USA). Chi-square analysis was used to investigate the relationship of nominal variables between the groups. Fisher's exact test was used if the volume of expected values in the cells of 2×2 contingency tables was not sufficient and Pearson's chi-square with Monte Carlo Simulation in RxC tables. Level of significance was set at $p<0.05$.

RESULTS

There were more type 3 septal deviations (34.4%) than other types. In 201 patients with concha bullosa, 142 had unilateral and 59 had bilateral concha bullosa. Septal deviation was found at the opposite side in 83.8% of 142 patients with unilateral concha bullosa (Table 1).

There was a significant correlation between the presence of concha bullosa and the type

Table 1. Frequency distribution of all variables

	n	%
Type of septal deviation		
1	39	9.6
2	79	19.4
3	140	34.4
4	20	4.9
5	111	27.3
6	15	3.7
7	3	0.7
Total	407	100
Presence of concha bullosa		
Yes	201	49.4
No	206	50.6
Total	407	100
Side relationship between concha bullosa and deviation		
Same	23	16.2
Different	119	83.8
Total	142	100

of septal deviation ($p<0.05$). The deviation was type 3 in 47.3% of patients with concha bullosa (Table 2).

While equal pneumatization was found in 45 of 59 patients with bilateral concha bullosa, one side was dominant in 14 of these patients. In those with equal pneumatization, 28% of patients had a type 3 deviation. Septal deviation was on the opposite side in 12 patients with concha bullosa showing dominance. Of these patients, seven had type 3, three type 2, one type 1 and one type 5 septal deviation (Table 3).

DISCUSSION

A number of various classifications have been used to determine the type of septal deviations. The Mladina classification we used is one of the most common (Table 4).[1]

In a study by Wee et al.[10] on 488 patients, type 1 septal deviation was more common compared to other types. In their study of 100 patients, Rao et al.[11] demonstrated that type 5 septal deviation was more frequent. In the present study, the incidence of type 3 septal deviation was significantly higher than the other types. In a study by Cingi et al,[12] of patients with chronic sinusitis from five different centers, type 3 septal deformity was found to be more common. This finding is consistent with our results that suggest the type 3 deviation is more common in the Turkish population.

The mechanism of concha bullosa, the most common anatomic variant of middle turbinate is not fully known. It may caused by the expansion of sinus pneumatization into the turbinate during the intrauterine period, fusion abnormality during intrauterine development or mucosal invagination of conchal bone microfractures toward the bullosa cavity during late puberty.[4] Another theory suggests that anterior and posterior ethmoidal air cells lead to pneumatization of concha bullosa.[5] Additionally Stammberger[13] suggested two theories: first, that

Table 2. Chi-square outcomes regarding the correlation between the presence of concha bullosa and types of septal deviation

	Chi-square test			
	Concha bullosa (+)			
	n	%	Chi-square	*p*
Type of septal deviation			57.153	0.001
1	26	12.9		
2	37	18.4		
3	95	47.3		
4	11	5.5		
5	30	14.9		
6	2	1		
7	0	0		
Total	201	100		

Table 3. Distribution of the types of septal deviation according to the status of bilateral concha bullosa

	Bilateral concha bullosa					
	Equal		Dominant			
			Same side		Opposite side	
	n	%	n	%	n	%
Type of septal deviation						
1	6	13.3	1	50	1	8.3
2	8	17.7	0	0	3	25
3	13	28.8	0	0	7	58.3
4	5	11.1	0	0	0	0
5	9	20.0	1	50	1	8.3
6	4	8.8	0	0	0	0
Total	45	100	2	100	12	100

in the opposite side of septal deviation, the nasal cavity air flow pattern plays a role in development of concha bullosa or ''e vacuo'' theory; second, that septal deviation and choncha bullosa are two anatomical variants found incidentally and concomitantly.

There are several reports in the literature investigating the relationship between septal deviation and concha bullosa. Concha bullosa may be unilateral or bilateral, usually associated with deviated septum towards the opposite side (Figure 1).[14] In a study by Yiğit et al.[15] contralateral concha bullosa was found to be significantly more common in patients with septal deviation compared to those having no deviated septum. In their study, Uygur et al.[16] demonstrated that the angle of septal deviation plays an important role in pneumatization of the concha on the opposite side. Likewise in our study the two pathologies were found at high rates in different sides, consistent with the literature.

Which causes the other? Does concha bullosa lead to septal deviation, or deviated septum cause concha bullosa? The answer to this question is not clear. According to the theory of Grymer and Melson,[17] posterior septal deviation is accepted as a genetic condition and we believe this may lead to concha bullosa with air flow theory. Is septal deviation the cause and concha bullosa the result?

In a study by Sazgar et al.,[18] a significant correlation was identified between unilateral concha or the dominant concha in bilateral cases and septal deviation. The authors have argued that deviation is an indirect result of concha bullosa and may be explained with the laws of physics.

Is concha bullosa the cause and septal deviation the result?

Qian and Wang[19] investigated the relationship between septal deviation and bulbous type concha bullosa in their study of 972 patients and found 33% bulbous concha bullosa in patients with high septal deviation versus 9% in those with low septal deviation.

To the best of our knowledge, there is no previous study in the literature investigating concha bullosa according the Mladina classification. In the present study examining the

Table 4. Mladina classification

Type	Deviation diagnosis
1	Mild deviation
2	Anterior vertical deviation
3	Posterior vertical deviation (middle meatus, middle concha region)
4	''S'' septum, one side in the posterior and opposite side in the anterior
5	Horizontal crest with or without deviation in the upper opposite side
6	Type 5 with a deep sulcus in the concave side
7	Combination of multiple types (1-6)

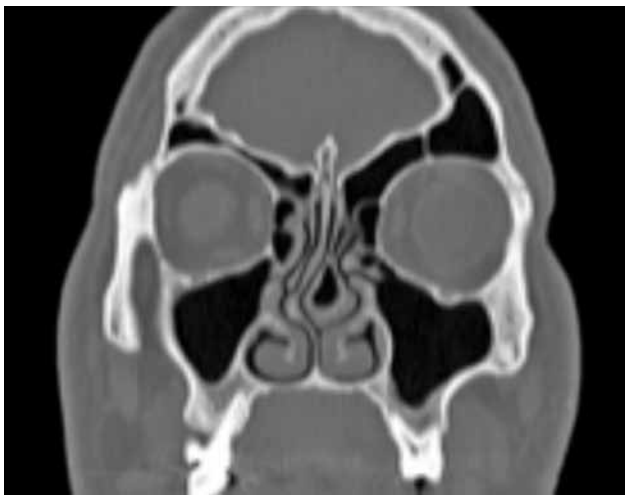

Figure 1. *Paranasal computed tomography scan showing concha bullosa on the opposite side of septal deviation.*

correlation between the types of septal deviation and concha bullosa, the incidence of concha bullosa was higher in patients with type 3 septal deviation. This finding suggests that the type of septal deviation, defined according to localization and degree of deviation, may have a role in the development of concha bullosa. Additionally, although what triggers the other is unknown, if intrauterine concha bullosa occurs, it is likely to cause septal deviation after the laws of physics.

In conclusion, concha bullosa and septal deviation may affect and cause each other. Concha bullosa is seen more with type 3 septal deviation than with other types. Following our results, when we find type 3 septal deviation on physical examination, we must keep concha bullosa in mind, although the relationship between septal deviation and concha bullosa is still under investigation and further studies are required.

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