Is There any Relationship Between Nasal Septal Deviation and Concha Bullosa

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ABSTRACT

Aim: *To evulate relationship between nasal septal deviation and concha bullosa (CB) by using deviation angles and concha bullosa pneumatization index (CBPI).*

Method: *Ninety patients with both nasal septal deviation and CB were evaluated by computerized tomography (CT) of paranasal sinus in coronal plane. Deviation angles and concha bullosa pneumatization index (CBPI) was calculated. Paranasal sinus pathologies were recorded on paranasal sinus CT.*

Result: *Contralateral, ipsilateral and bilateral CB according to nasal septal deviation were found in 45 (50%), 16 (17.8%) and 29 (32.2%), respectively. Contralateral CB was significant higher than ipsilateral CB ($p<0.05$). CBPI and deviation angle in the patients with contralateral CB were significant higher than in the patients with ipsilateral CB ($p<0.05$). In contrast, there was not any association between ipsilateral sinus pathology and nasal septal deviation and CB ($p>0.05$).*

Conclusion: *Results suggested that there was a significantly relationship between nasal septal deviation and contralateral CB.*

Key words: *Concha bullosa, deviation angle, nasal septal deviation, paranasal sinus pathology.*

Nazal Septal Deviasyon ile Konka Bülloza Arasında Herhangi Bir İlişki Var Mı?

Amaç: *Bu çalışmanın amacı nazal septal deviasyon ile konka bülloza arasında herhangi bir ilişki olup olmadığını deviasyon açısı ve konka bülloza pünamatizasyon indeksi (KBPİ) kullanarak değerlendirmektir.*
Metod: *Hem nazal septal deviasyonu hem de konka büllozası olan 90 hastanın koronal plan paranazal sinus bilgisayarlı tomografisi değerlendirildi. Deviasyon açısı ve KBPİ hesaplandı. Paranazal sinus patolojileri kaydedildi.*
Bulgular: *Kırkbeş (%50) olguda kontralateral konka bülloza, 16 (%17.8) olguda ipsilateral konka bülloza ve 29 (%32.2) olguda bilateral konka bülloza tespit edildi. Kontralateral konka bülloza, ipsilateral konka büllozadan anlamlı derecede fazla idi (p<0.05). Hem KBPİ hem de deviasyon açısı kontralateral konka büllozalı hastalarda ipsilateral konka büllozalı hastalara göre anlamlı derecede yüksek idi (p<0.05). Bunun yanı sıra, ipsilateral sinus patolojisi ile nasal septal deviasyon ve konka bülloza arasında herhangi bir anlamlı ilişki tespit edilmedi (p>0.05).*
Sonuç: *Sonuçlarımız nasal septal deviasyonla konka bülloza arasında önemli bir ilişki olduğunu göstermiştir.*
Anahtar kelimeler: *Deviasyon açısı, konka bülloza, nasal septal deviasyon, paranazal sinus patolojisi.*

INTRODUCTION

The nasal septum is an important physiological and support structure of the nose (1). It is formed by the quadrangular cartilage anteriorly, the vomer and perpendicular plate of the ethmoid bone posteriorly. Nasal septal deviation is highly accounted disease in the population. It is reported between 18.8-57.6% in the literature (2,3). Nasal septal deviation can occurred by pressure and expansion during the downward growth of the septum from the ethmoid ossification centers, upward growth of the maxillar crest, and the development of the premaxilla and vomer (2). Trauma, particularly which is occurred by injures in infancy and childhood, is a significant factor in the etiology of septal deformity (1-3). The other important etiological factors are irregularity in the growth of the maxilla, asymmetric development of maxillary sinuses and turbinates, thumb-sucking, tongue-pressure habits which cause shifts in the alveolar ridge, genetic and environmental factors (2).

Concha bullosa (CB) is defined as aeration located in the middle turbinate (5). It is the most common anatomic variation of the ostiomeatal complex region (6). Cause of pneumatization of middle concha was yet unclear. Trauma, development defects, growth anomalies of maxilla and other facial structures, congenital deformities, breathing through the mouth because of adenoid hyperplasia, nasal septal deviation may be responsible from etiology (3). It is reported in literature that together CB and nasal septal deviation were mostly common and both of them were a relationship (3,7-11). But this association of cause is not clear yet. Therefore, the aim of the present study was to investigate relationship between nasal septal deviation and CB by using deviation angles and concha bullosa pneumatization index (CBPI).

MATERIALS AND METHODS

Paranasal sinus CT scans of 90 patients with nasal septal deviation and CB patients were retrospectively evaluated. All subjects were asked about typical symptoms of nasal septal deviation, CB and paransal sinus disease such as unilateral or bilateral nasal obstruction, nasal or postnasal discharge, facial pain or pressure, hedache, hyposmia/anosmia and cough. The patients with allergic rhinitis, nasal polyposis, cystic fibrosis, asthma, immune deficiency, malignancy, metabolic disease, and those previous underwent maxillofacial trauma, sinus surgery were excluded in this study. They underwent a standard otolaryngological and nasal endoscopical examination. Paranasal sinus CT scans in coronal plane with 5 mm slice thickness were taken for each. Direction of nasal septal deviation, classification of CB and paranasal sinus pathologies (ranging from minimal mucosal thickening to total sinus opacification) were recorded on paranasal sinus CT scans of all the cases. Direction of nasal septal deviation was determined by the convexity of the septal curvature. CB's were classified as unilateral, contralateral and bilateral according to the direction of nasal septal deviation. The middle turbinate pneumatization was classified as lamellar, bullous and true CB by using classification which is defined by Borger et al. (8). Deviation angles were calculated according to the angle between crista galli and the most prominent point of the deviation. CB pneumatization was measured in millimeters-squared compared with the ipsilateral orbital area in the same scan to standardize the pneumatization (Figure 1, 2). CBPI was calculated for each case, as below (10).

$$CBPI = \frac{\text{Area of concha pneumatization (mm}^2\text{)} \times 100}{\text{Area of orbita on the same site (mm}^2\text{)}}$$

__Table 1__. Symptoms of patients with CB and nasal septal deviation

	n	%
Nasal obstruction		
Unilateral	*73*	*81.1*
Bilateral	*17*	*18.9*
Nasal discharge	*13*	*14.4*
Postnasal discharge	*26*	*28.8*
Facial pain or pressure	*16*	*17.7*
Headache	*28*	*31.1*
Hyposmia/anosmia	*3*	*3.3*
Cough	*17*	*18.9*

__Table 2__. Disturbance of CB according to direction of nasal septal deviation

	n	%	X^2	p value
Contralateral CB	*45*	*50*	*14.06*	*0.001*
Ipsilateral CB	*16*	*17.8*		
Bilateral CB	*29*	*32.2*		

Overall descriptive statistics including mean, medians and standard deviations for continuous variables and frequencies for categorical variables were calculated. Statistical analysis was performed using t-test, chi-square, and Pearson correlation test in SPSS 10.0 for Windows software package. Statistical significance was considered as p<0.05.

RESULTS

The mean age of the 90 patients (62 males, 28 females) was 32.4+12.03 years (range, 18 to 75 years). Symptoms of patients are given in Table 1. Convexity of nasal septal deviation was to the right side in 46 cases (51.1%) and to the left side in 38 cases (42.2%). Six cases (6.7%) had biconvex nasal septal deviation. Contralateral, ipsilateral and bilateral CB were found in 45 (50%), 16 (17.8%) and 29 (32.2%), respectively. Contralateral CB was significantly higher than ipsilateral CB in the patients (p<0.05, Table 2). The middle turbinate pneumatization were found as true CB in 63 (70%), bullous CB in 20 (22.2%) and lamellar CB in 7 (7.8%). The mean of deviation angle was 8.9±3.2 degree (range, 3 to 17).

Deviation angles of the patients with contralateral CB, ipsilateral CB and bilateral CB were 10.8±2.8 degree (range, 5 to 17), 8.1±2.6 degree (range, 3 to 13) and 6.6±2.1 degree (range, 3 to 12), respectively. Deviation angle of patients with contralateral CB was found significantly higher than patients with ipsilateral CB (p<0.05, Table 3). CBPI of cases with contralateral CB, ipsilateral CB and bilateral CB were 11.8±4.6 (range, 2.18 to 23), 8.7±4.1 (range, 3 to15) and 10.4±4.4 (range, 3.1 to 22), respectively. CBPI of patients with contralateral CB were found significantly higher than patients with ipsilateral CB (p<0.05, Table 4). Also, there was a significantly correlation between deviation angle and contralateral side CBPI (p<0.05). Paranasal sinus disease was determined in 35 patients (38.9%) including in 16/35 (45.6%) of patients with maxillary sinus disease, 10/35 (28.6%) of patients with anterior ethmoid sinus disease, 5/35 (14.3%) of patients with frontal sinus disease, 3/35 (8.6%) of patients with posterior ethmoid sinus disease and one patient (2.9%) with sphenoid sinus disease. When considering the relationship between sinus disease and nasal septal deviation, 24/90 (26.7%) of patients with nasal septal deviation was found ipsilateral sinus disease and 11/90 (12.2%) of patients with nasal septal deviation was found contralateral sinus disease (p>0.05, Table 5). On the other hand, there was not any

__Table 3__. Disturbance of angles of nasal septum deviation

	Deviation angle (nȮ)			
	Mean±SD	Range	t	p value
Contralateral CB	*10.8Ȯ±2.8*	*5-17*	*3.31*	*0.002*
Ipsilateral CB	*8.1Ȯ±2.6*	*3-13*		
Bilateral CB	*6.6Ȯ±2.1*	*3-12*		

__Table 4__. Pneumatization degree of CB

	CBPI* Mean±SD	Range	t	p value
Contralateral CB	*11.8±4.6*	*2.18-23*	*2.37*	*0.021*
Ipsilateral CB	*8.7±4.1*	*3-15*		
Bilateral CB	*10.4±4.4*	*3.1-22*		

**CBPI: Concha bullosa pneumatization index*

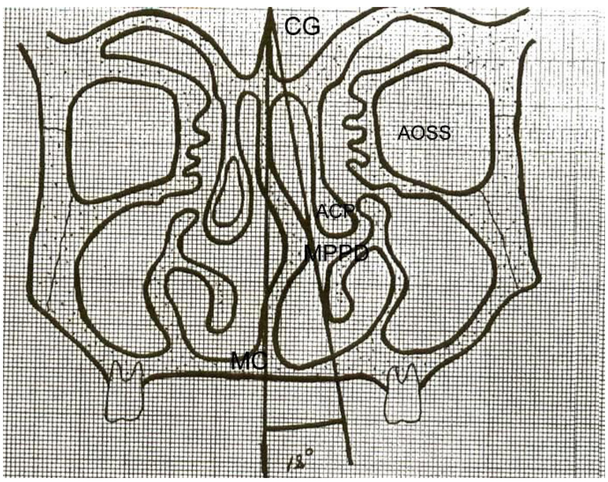
Table 5. Frequency of paranasal sinus pathology

	Ipsilateral sinus pathology positive	negative	t	p value
Nasal septal deviation (n, %)	29 (32.2)	61 (67.8)	0.845	0.325
Patients with CB (n, %)	21 (23.3)	69 (76.7)	0.187	0.852
Deviation angle (Mean+SD)	9.4+3.3	8.7+3.1	0.271	0.788
CBPI (Mean+SD)	11.4+4.7	10.4+4.5	0.461	0.648

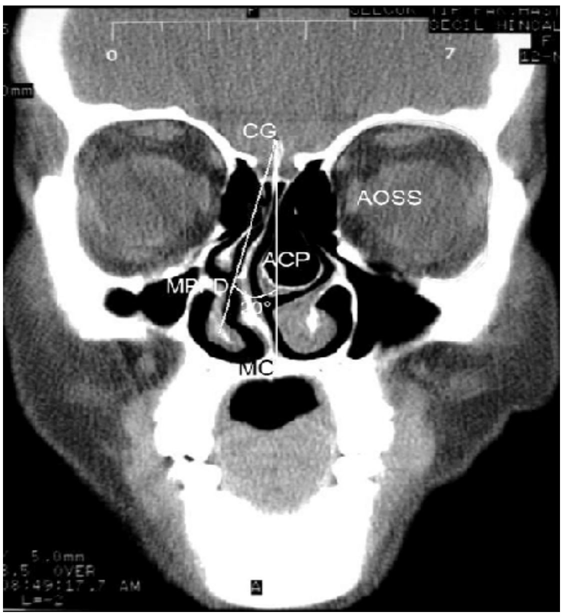
association between ipsilateral paranasal sinus disease and CB, deviation angle, CBPI (p>0.05, Table 5).

DISCUSSION

The incidence of CB in the population is ranged from 13 to 72.2% in literature (3,4,8). Although the exact mechanism of CB formation has been unclear, it is considered that the airflow pattern of the nasal cavity plays an important role. This theory is named as "e vacue". As the airflow is markedly reduced in the nasal cavity with convexity of the deviation, pneumatization of the middle turbinate is augmented in the contralateral site (3). This theory can explain the association between contralateral CB and nasal septal deviation. However, nasal septum is away from the dominant concha for preserving adjacent air channels, and therefore nasal septal deviation can be occurred. Stalman at al. (10) reported contralateral nasal septal deviation in 69.5% of patients with unilateral CB or dominant CB. Uygur et al. (11) and Aktas et al. (3) were determined rate of CB in the cases with nasal septal deviation, 35% and 88.8%, respectively. Those studies suggested that there is a strong association between unilateral or dominant CB and contralateral nasal septal deviation. Similarly, in the present study, contralateral CB (50%) was found significantly higher than ipsilateral CB (17.8%) in the patients with nasal septal deviation (p<0.05).



Figures 1. *CG, crista galli, AOSS, area of orbita on the same site, ACP, area of concha pneumatization, MPPD, most prominent point of the deviation, MC, maxillary crest. Calculate of deviation angle according to the angle between CG and MPPD. Measurement of AOSS and ACP by a transparent mm².*

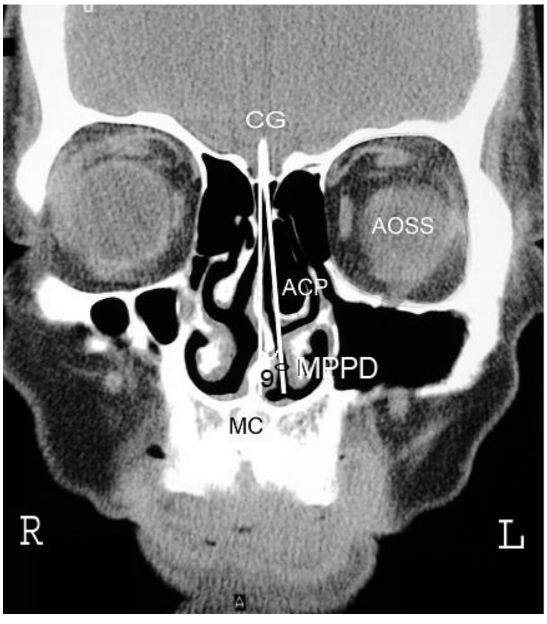


Figures 2. *Coronal plane of paranasal sinus CT scan of patient with nasal septum deviation and contralateral CB. Deviation angle, AOSS, ACP and CBPI are 20°, 82mm², 625mm² and 13.1, respectively.*

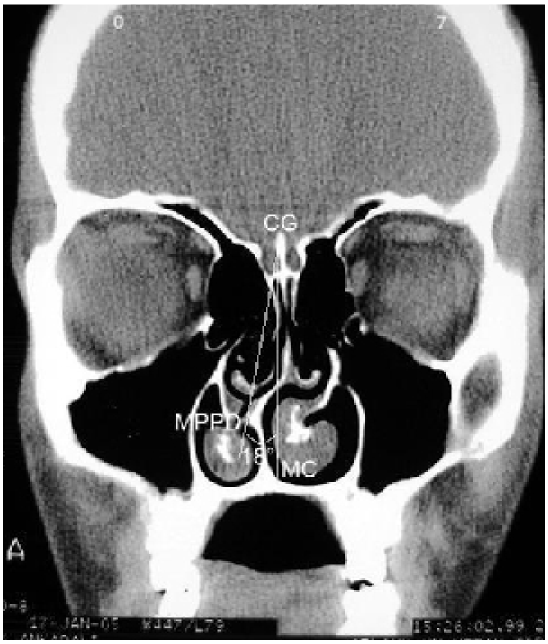
Bolger et al. (8) classificated middle turbinate pneumatization into three patterns. In the first pattern, air cells were localizated in the vertical lamella of the turbinate, described as “lamellar CB”. In the second pattern, air cells were localized in the bulbous segment of turbinate, described as “bullous CB”. In the third pattern, air cells were presented in both the lamellar and the bullous segment of the turbinate, described as “true CB”. It was reported that CB’s were classified as true CB in 15.7%, lamellar CB in 46.2% and bullous CB in 31.2%. Tonia and Baba (6) have been reported in 52%, 28%, and 19% of their subjects, respectively. Similarly, we found that CB’s were classified as true CB in 70%, bullous CB in 22.2% and lamellar CB in 7.8%. Lamellar CB was mostly acceptable as a normal anatomical variation. True and bullous CB were caused obstruction and pressure to surrounding structures more frequently, which could lead to paranasal sinus disease by obstructing the middle meatus, ethmoid infindubulum and frontal recess, changing the normal airflow, mucoclilary activity and mucus drainage and lead to mucosal edema (2-4). Aktas et al. (3) were found that sinusitis was present in 24% of lamellar and in 75% of bullous CB cases. In the present study, sinusitis was determined in 14.3% of lamellar, in 30% of bullous and in 44.4% true CB cases.

In the literature, the incidence of CB is reported as 21 to 29% of chronic sinusitis patients (13-15). However, in the some studies, this incidence was found as 53.6% to 55% of patients with paranasal sinus disease (8,16). Stallman et al. (10) reported that 72% of patients with CB had sinus disease, but 78% of patient without CB had sinus disease. They found that there was no relationship between CB and sinus disease. However, severe nasal septal deviation has been noted as a contributing factor for paranasal sinus disease (17,18). On the other hand, in some studies were reported to be anyone relationship nasal septal deviation and paranasal sinus disease (3,10,11). Similarly, in the present study, we did not find association between paranasal sinus disease and CB, nasal septal deviation.

Nasal septal deviation usually causes to unilateral nasal obstruction. Biconvex nasal septal deviation and contralateral inferior concha hypertrophy may lead to bilateral nasal obstruction in patients with septal deviation. However, contralateral CB could also be the cause of this symptom. In the present study, 76.5% of patients with bilateral nasal obstruction were determined nasal



***Figures 3**. Coronal plane of paranasal sinus CT scan of patient with nasal septum deviation and ipsilateral CB. Deviation angle, AOSS, ACP and CBPI are 9°, 66mm2, 500mm^2 and 13.2, respectively.*



***Figures 4**. Coronal plane of paranasal sinus CT scan of patient with nasal septum deviation bilateral CB. Deviation angle is 18°.*

septal deviation and contralateral CB. Therefore, in the patients with nasal septal deviation complain of bilateral nasal obstruction, if there is not contralateral concha hypertophy or biconvex nasal septal deviation, it should be suspected from contralateral CB.

Stalmann et al. (3) and Aktas et al. (10) found that nasal septal deviation angle was greater in the patients with medium and large concha than in those with a small concha. Uygur et al. (11) observed that angle of deviation in cases with CB was correlated with contralateral side CBPI. In the present study, it was determined a significant correlation between deviation angle and contralateral side CBPI ($p<0.05$).

Although there is a strong relationship between CB and nasal septal deviation, this relationship is yet unclear. The incidence of nasal septal deviation and CB are lower in children than in adult and also the incidence increasing with age. If the CB develops first, the nasal septum somehow “senses” the mass effect of the concha could developed away from this side. On the other hand, if the septal deviation develops first, the concha enlarges to partially fill the expanded air channel (10). In order to determine cause of this relationship are needed prospective studies beginning from infancy to adulthood.

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