

Coincidence of Concha Bullosa with Nasal Septal Deviation; Radiological Study

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Abstract *Introduction* Concha bullosa (CB) is the most common sinonasal anatomical variation reported in literature, it occurs most often in the middle turbinate. Causes of development are not clearly identified but coincident prevalence with deviated nasal septum (DS) is common. *Objective* To study the relationship between DS and development of CB. *Methods* A prospective study including 40 patients with DS, CT scans were thoroughly analyzed to detect the presence of CB, its type, and laterality. Effect of degree of septal deviation from the midline and level of deviation in the axial plane were also addressed. *Results* The study included 40 patients with DS; 15 of them had associated CB; the lamellar type of CB was the most prevalent followed by the true type. *Conclusion* Incidence of CB was higher in patients with increased angle of septal deviation and with lower level of deviation in the axial plane.

Keywords Concha bullosa · Deviated septum · Middle turbinate · Pneumatization

Introduction

Pneumatization of the nasal turbinates (known as concha bullosa-CB) is the most common sinonasal anatomical variation. The frequency of CB reported in literature ranges from 14 to 53.6%, it occurs most often in the middle turbinate, and less commonly, in the inferior or superior

turbinates [1, 2]. Causes of development of CB are not clearly identified; however, many etiological factors are suspected, such as developmental element, growth abnormalities of maxilla and other facial structures, congenital anomalies, and mouth breathing associated with adenoid and/or deviation of the nasal septum (DS) [3]. It is reported that coincidence of CB and DS is a likely frequent occurrence; however the etiological relation between them is not clearly understood [3, 4]. In this study we address the association and relationship between DS and development of CB.

Materials and Methods

This study included all patients with nasal symptoms due to DS who were admitted for surgical management in ENT department, in our tertiary referral center during the period from June 2016 to May 2017.

All patients were subjected to the following; full history taking, ENT examination and endoscopic nasal examination, CT Nose & PNS, and Surgical management.

CT Examination

All patients performed CT using GE Lightspeed ultra 8 slice CT scanner and Toshiba Alexion 16 slice CT scanner. Unenhanced 0.5 mm slice thickness scans were performed in the axial plane with patient in neutral supine position. The axial source images were used by a dedicated workstation to obtain coronal and sagittal reformatted images.

The presence of CB and its type (lamellar, bullous or true CB) was identified in the scans [5]. The angle of septal deviation in relation to the midline (as indicated by the crista galli) was estimated and cases were categorized into

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three groups according to degree of septal deflection: Group I- mild deviation (angle $\leq 20^\circ$), Group II- moderate deviation (angle: 21° – 30°), and Group III- marked deviation (angle $> 30^\circ$).

The level of deviation in the axial plane was identified and patients were classified into three categories: category A (angle of deviation against inferior turbinate), category B (angle of deviation between middle and inferior turbinate), and category C (angle of deviation against middle turbinate).

Data were analyzed using the Statistical Package for Social Sciences software (version 14; SPSS, Chicago, Illinois, USA), patients' demographics were expressed as mean \pm standard deviation and qualitative variables were expressed as numbers & percentages. Phi coefficient test was applied to measure the association between two variables and Wilcoxon Signed-Rank Test, Mann–Whitney test and Kruskal–Wallis test for nonparametric data.

Results and Analysis

This study included 40 patients with nasal symptoms due to DS, of these patients; 27 were females (67.5%) and 13 were males (32.5%). Age ranged from 18 to 47 years (mean age = 26.52, median = 26 and standard deviation = 7.47). Eighty five percent of the study population were young adults (18–35 years) and 15% were middle age (> 35 years old). Fifteen patients (37.5% had associated CB (Table 1).

The lamellar type, was the most prevalent type detected in 8 patients; two of them had bilateral CB (53.3%) followed by the true type (aeration involve both lamellar and bulbous segments) detected in 5 cases one of them had bilateral CB (33.3%). Bilateral CB was found in 2 patients (13.3)—(Table 2) (Figs. 1, 2, 3).

According to degree of septal deviation from the midline, there are three groups of patients: group I included 17 patients (42.5%), group II included 17 patients (42.5%), while the last group included 6 patients (15%) (Table 2).

There are also three categories of patients when classified according to axial level of deviation: category A

included 7 patients (17.5%), category B included 27 patients (67.5%) and category C included 6 patients (15%)—(Table 3) (Figs. 1, 2, 3).

CB was most prevalent among patients of group II (moderate septal deviation) followed by group III (marked septal deviation).

Lamellar type of CB was encountered more commonly in group II while group III patients had more bulbous and true types—(Table 4).

Using phi coefficient to measure the degree of association between the angle of deviation and development of concha bullosa we found moderate positive correlation with phi coefficient value = 0.413 but when studying the correlation between angle of deviation and type of CB we found a little correlation with Phi coefficient value = 0.288.

As regard level of septal deviation; CB was found in forty three percent (43%) of category A patients, 37% of category B patients and 33% of category C patients.

Using phi coefficient to measure the degree of association between the level of deviation and development of CB we found strong positive correlation with value = 0.936.

By using phi coefficient to measure the degree of association between the level of deviation and type of CB we found moderate positive correlation with value = 0.506.

More aeration of the CB was detected with increased angle of septal deviation and with low level of septal deviation.

Discussion

Occurring most often in the middle turbinate, a 14–53.6% prevalence of CB was reported in literature. It was also reported that there is a common association between DS and CB [1–4].

Many studies cited that DS is the most common pathology accompanying CB; these studies are particularly tended to reveal the relationship of DS and/or CB with sinusitis and sinonasal anatomical variants. There are very

Table 1 Correlation between angle of septal deviation and presence of CB

	Mild	Moderate	Marked	Total
CB				
Present	4 (23.5%)	6 (35.3%)	5 (83.3%)	15 (37.5%)
Absent	13 (76.5%)	11 (64.7%)	1 (16.7%)	25 (62.5%)
Total	17	17	6	40

phi coefficient value = 0.413 (Moderate positive correlation)

Table 2 Correlation between angle of septal deviation and type of CB

Type	Mild	Moderate	Marked	Total
Lamellar	1 (25%)	4 (66.7%)	1 (20%)	6 (40%)
Bullous	0	1 (16.7%)	2 (40%)	3 (20%)
True CB	1 (25%)	1 (16.7%)	2 (40%)	4 (26.7%)
Bilateral lamellar CB	1 (25%)	0	0	1 (6.7%)
Bilateral (Rt. True CB, Lt lamellar CB)	1 (25%)	0	0	1 (6.7%)
Total	4	6	5	15

phi coefficient value = .288 (little or no correlation)



Fig. 1 A-Group (I) category (B) septal deviation with lamellar type of concha bullosa seen on left side. B-Group (I) category (B) septal deviation with true type of concha bullosa of Rt middle turbinate. C- Group (III) category (B w) septal deviation with lamellar type of concha bullosa of Rt middle turbinate

Table 3 Correlation between level of septal deviation in the axial plane and presence of CB

	Category A	Category B	Category C	Total
CB				
Present	3 42.9%	10 37.0%	2 33.3%	15 37.5%
Absent	4 57.1%	17 63.0%	4 66.7%	25 62.5%
Total	7 100%	27 100%	6 100%	40 100%

phi coefficient value = .936 (Strong positive correlation)

few studies which put forth the incidence and correlation relationship between DS and CB [4, 6].

The variability in incidence of CB might be related to the position of the nasal septum. A study in 2008 found coexistence of DS and CB in 44% of the population series [7–9]. In our study, CT examination revealed that prevalence of CB among patients with complaints due to DS was 37.5%. In 2003, Uygur and his colleagues studied the incidence of CB in patients with DS and the correlation between the angle of deviation and degree of CB aeration through reviewing CT scans of patients with DS. They claimed that DS is not the cause of CB formation and both are coincident variants but pneumatization of preexisting

CB is augmented on the concave side of DS depending on degree of angle deviation [4].

Another study in 2004 supported a strong association between the presence of a CB and contralateral deviation of the nasal septum, but they did not demonstrate a causal relationship [6].

In this study we considered objective data to categorize the severity of septal deviations (according to the degree of deviation from the midline as indicated by the position of the crista galli); In addition, we studied the effect of level of deviation in the axial plane.

Our study revealed that CB was found in 83% of patients with marked septal deviation, 35% of patients with moderate septal deviation and 23.5% of patients with mild

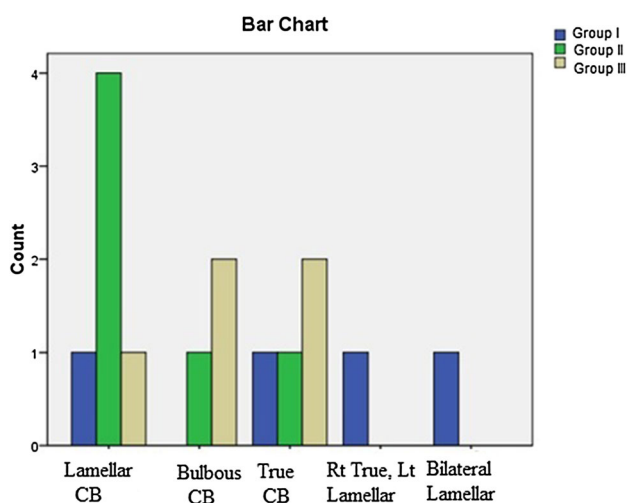


Fig. 2 Correlation between angle of septal deviation and type of CB

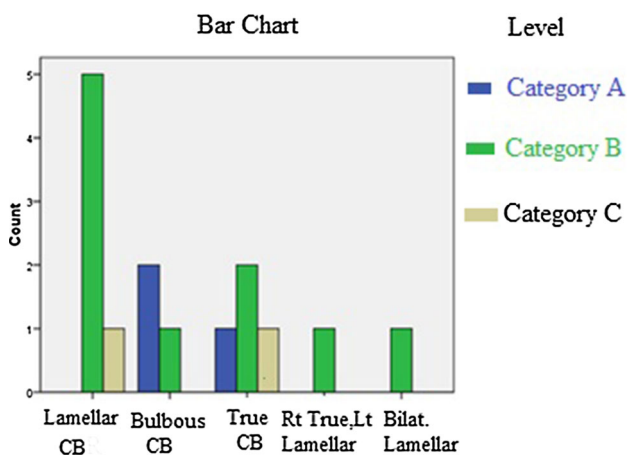


Fig. 3 Type of CB according to level of deviation

septal deviation. The percentage of bilateral CB was higher in patients with mild septal deviation. Our results are matching to what was stated by Stumberger in 1991 about the effect of DS on the development of CB [1].

Interestingly, we found a strong relationship between the presence of a CB (unilateral or bilateral CB) and DS ($P < .0001$).

Moreover, we identified the correlation between angle of septal deviation and type of CB which revealed 50% of patients with mild deviation have bilateral CB, 67% with moderate deviation were associated with lamellar type of CB, and 80% with marked deviation were bulbous and true CB types.

This comes in agreement with other authors who found that angle of DS was greater in patients with medium and large CB than in those with a small CB [3, 9].

The higher incidence of CB in association with low level septal deviation (category A), may explain the relationship between DS and development of CB; Air is directed upward as a result of low obstruction, the upward turbulence of air result in pneumatization of the middle turbinate. This may be also supported by the type of CB associated with different axial levels. In this study, 67% of category A population who have CB show bullous type, 70% of category B population who have CB show lamellar type and 50% of category C population who have CB show lamellar type. More studies with larger population may be needed to confirm this hypothesis.

Another question that needs to be answered: why CB did not develop in the other larger group of patients with DS?! This may support the idea that septal deviation is not the cause of CB formation but it augments pneumatization of a preexisting CB.

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“The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant national and institutional guidelines on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008.”

Summary

- Concha bullosa (CB) is the most common sinonasal anatomical variation.
- Causes of development of CB are not clearly identified with many suspected etiological factors.

Table 4 Type of CB according to level of deviation. phi coefficient value = .506 (moderate positive correlation)

Type	Level			Total
	A	B	C	
Lamellar CB	0	5 (50%)	1 (50%)	6 (40.0%)
Bulbous CB	2 (66.7%)	1 (10%)	0	3 (20%)
True CB	1 (33.3%)	2 (20.0%)	1 (50.0%)	4 (26.7%)
Bilateral(Rt True CB, Lt Lamellar CB)	0	1 (10%)	0	1 (6.7%)
Bilateral lamellar CB	0	1 (10%)	0	1 (6.7%)
Total	3	10	2	15

- Coincidence of CB and DS is a frequent occurrence; however the etiological relation between them is not clearly understood.
- The angle of DS influences the size and development of CB.
- There is higher incidence of CB in association with low level septal deviation.
- Septal deviation may not be the cause of CB formation but it augments pneumatization of a preexisting CB.

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