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Relation of Concha Bullosa Types to Sinusitis and Nasal Septal Deviation

Sameh Mohamed Hosny, Magdy Ibrahem Gouda,
Mohammed Ali Abdulqadir Ihreez*, Mohamed Mohamed Rabea
Department of Otorhinolaryngology, Faculty of Medicine, Zagazig University, Egypt
Corresponding author: Mohammed Ali Abdulqadir Ihreez, **Mobile:** (+20)01115652000,
E-Mail : ehrezmohammed@gmail.com

ABSTRACT
Background: Concha bullosa (CB) is the most prevalent anatomical variant in the osteo-meatal complex. Middle Easterners have a disproportionately high incidence of nasal septal deviation (NSD).
Objectives: To determine if concha bullosa increases the risk of developing rhinosinusitis and NSD.
Subjects and Methods: Thirty people who were diagnosed with chronic rhinosinusitis at the ENT Outpatient Clinic at Zagazig University Hospitals participated in this prospective study. All subjects undergone full clinical evaluation as well as Computerized tomography study on the nose and paranasal sinuses.
Results: None of the groups differed significantly in terms of the quantity or location of NSD, and between 88% and 12% of the patients with CB, the air channel was either intact or completely obliterated. About 96% of the patients with NSD had preserved air channel and 4% of them had obliterated air channel.
Conclusion: CT-imaged concha bullosa, regardless of its size or shape, does not increase the likelihood of sinusitis or NSD.
Keywords: Concha Bullosa, Nasal Septal Deviation, Sinusitis.

INTRODUCTION

Concha bullosa (CB) is the most prevalent skeletal abnormality in the osteo-meatal complex region. Pneumatized middle turbinate is the simplest way to put it[1]. Prevalence of Concha bullosa was reported at 55% in a previous study's sample. While 34% of **Zinreich *et al.*** [2] sample had Concha bullosa, this was not the case for the rest of the sample. Although nasal septal deviation (NSD), mouth breathing, and trauma have all been identified as risk factors for Concha bullosa, the actual causes of pneumatization remain unknown [3].

Mucociliary drainage in the maxillary sinuses can be disrupted by CB, which can increase the risk of maxillary sinus illness. Concha bullosa is typically asymptomatic, although its link to sinus disease is currently the subject of investigation. This occurs when the osteo-meatal complex becomes obstructed[4].

Septal deviation of the nose is particularly frequent in Middle Eastern people. Early childhood trauma has been identified as the leading cause of reported septal deformities. However, there is scant evidence suggesting that variations in nasal air volume, such as those caused by nasal septal deviation or pneumatization of the middle turbinate, contribute to the development of sinus pathology[5].

Because of this, nasal septal deviation and concha bullosa may enhance an individual's susceptibility to sinus disease; nevertheless, the connection between this phenomena and volumetric changes of the nasal sinuses remains unclear[6].

A more thorough examination of nasal septal deviation may be necessary for patients with chronic rhinosinusitis. When it comes to the sinonasal complex, CT scans are a go-to diagnostic tool for spotting anomalies and diseases. Patients with cystic fibrosis, immunodeficiency, and immunosuppression are at a higher risk for developing serious, life-threatening orbital and intracranial infections, hence screening for NSD and CB presence may be warranted to avoid the development of maxillary sinusitis. A variety of diagnostic methods, such as anterior rhinoscopy, nasal endoscopy, and imaging, can be utilized to spot potential problems. More frequently, septum surgery should likely be scheduled[7].

This study goal was to assess if the presence of concha bullosa is associated with the development of rhinosinusitis and NSD.

SUBJECTS AND METHODS

Subjects:

This prospective study was conducted on 30 patients, 23 male and 7 female; their mean age was 31.2 years chosen randomly from ENT Outpatient Clinic in Zagazig University Hospitals.

Inclusion criteria: Patients with symptoms of headache, nasal obstruction or other symptoms of chronic rhinosinusitis for whom CT paranasal sinuses is indicated, age ≥ 12 years, and both sexes were included.

Exclusion criteria: Age < 12 years. Patients with history of malignant lesions in nose or paranasal sinuses. Sinonasal or maxillofacial trauma and/or surgical intervention. Patients who had undergone prior surgical procedures were not included since CT bone scans may show altered bone structures in these patients. Pregnancy. Adults showing signs of developmental abnormalities on imaging studies, and those with growth and development-altering systemic disorders, as well as those with head and neck syndromes.

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Ethical Consent:

An approval of the study was obtained from Zagazig University Academic and Ethical Committee. Every patient signed an informed written consent for acceptance of participation in the study. This work has been carried out in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki) for studies involving humans.

The following were applied to all patients:

▪**Full history taking stressing on:**

1- Personal history of age and sex.

2- Main complaint: Rhinosinusitis was diagnosed on the basis of the major criteria of the Task Force on Chronic Rhinosinusitis[8] in the form of stuffy nose, runny nose, headache, diminished or absent sense of smell, a tight feeling in the face, and pain or pressure in the face.

3- History of present illness: onset, course and duration, severity, side and whether nasal discharge was anterior, posterior or both. The color and character of the discharge were also asked about.

4- Past history: having a previous nasal surgery, previous lacrimal surgery or trauma.

▪**General examination:**

General examination including: head and neck examination.

▪**Full ENT examination:**

Muco-pus, enlarged turbinates, congested mucosa, tenacious mucous in MM, and a deviated nasal septum are all symptoms of chronic sinusitis that can be seen with traditional anterior rhinoscopy and nasal endoscopy.

▪**Computerized tomography study on the nose and paranasal sinuses:**

All patients had axial and coronal CT scans of 3 mm slice thickness analysed, spanning from the frontal sinus wall to the sphenoid sinus wall. No nasal decongestants were used prior to CT. Both the voltage and current of the scan varied from 120 to 160 kVp and 60 to 300 mA, respectively. Research was analyzed using the "bone window". Coronal view CT scan on the nose and paranasal sinuses had been achieved by lying patient prone with the neck hyperextended and a lateral computed radiograph obtained. The scanner bed and gantry are then tilted to set the scanning plane perpendicular to the bony palate.

- **Presence of concha bullosa** was considered when there is pneumatization of any size in the middle turbinate. Patients were divided into 2 groups according to presence of concha bullosa: Concha bullosa patients make up group **I**, whereas people without the condition make up group **II** (patients without concha bullosa). Concha bullosa was then classified according to the side as right, left or bilateral and according to degree of pneumatization into lamellar (pneumatization of vertical part), bulbous (bulbous part pneumatization) or extensive (both bulbous and vertical parts pneumatization) according to **Bolger *et al.*** [9], when bilateral CB was found, we evaluated their sizes to see which one was larger and designated that one as the dominant one.
- The ostiums of the conchae bullosa were categorised into three groups: those that drained into the frontal recess, those that drained into the hiatus semilunaris, and those that drained into air cells close to the basal lamina.
- **Nasal septal deviation** (NSD**)** was diagnosed if deviation is greater than 4mm from the midline according to **Smith *et al.*** [10]. Deviation was defined as right or left.
- The convexity of the septal curvature characterised the direction of nasal deviation. On coronal CT images, the nasal deviation angle was calculated by finding the deviation of the septum from the midline. The crista galli to palatum line was used to denote the midline of the body. According to the degree of deviation, patients were classified as having a low (9°), moderate (between 9° and 15°), or high degree of deviation.
- **Sinus disease:** was taken into account when mucosal thickening measured 3 mm or higher. Mucosal alterations, from mild thickening to complete opacification of the sinuses on CT, were taken to be indicative of sinus inflammatory illness. Mild parasinusitis involved less than one-third of the sinus, while moderate involved one-third to two-thirds, and severe involved more than two-thirds of the sinus. All four sinuses—the ethmoidal, maxillary, frontal, and sphenoid—were evaluated bilaterally and given their own grades. Sinusitis was classified as right, left, or bilateral depending on which side it affected. When assessing the severity of maxillary sinusitis, we employed a three-point scale (mild: 1/3, moderate: 1/3-2/3, and severe: >2/3 of the maxillary sinus) for each side.
- Also evaluated was whether or not the air passage between the nasal septum and a concha (the dominant concha) was maintained.

Statistical analysis

In order to analyze the data acquired, Statistical Package of Social Sciences (SPSS) version 20 was used to execute it on a computer. In order to convey the findings, tables and graphs were employed. The quantitative data was presented in the form of the mean (M), median, standard deviation, (SD) and confidence intervals. The information was presented using qualitative statistics such as frequency and percentage. The student's t test (T) was used to assess the data while dealing with quantitative independent variables. Pearson Chi-Square and Chi-Square for Linear Trend (X^2) were used to assess qualitatively independent data. The significance of a P value of 0.05 or less was determined.

RESULTS

Fourteen patients (56%) group (I) were aged 15-30 while two patients (40%) group (II) were aged 15-30. Comparing the two groups according to age and age group, there was no significant variance (Table **1).**

Table (1): Analyzing the age differences between the two groups.

	Group I with CB (N=25)	Group II without CB (N=5)	*P Value
Age (Year, M± SD)	29.6 ± 11.3	32.8 ± 12.8	t= 0.56, *P=0.57
15-30	14 (56%)	2 (40%)	**P= 0.81
31-40	5 (20%)	1 (20%)	
41-52	6 (24%)	2 (40%)	

Nineteen patients (76%) group (I) were males while four patients (80%) group (II) were females. Gender did not differ significantly between groups (Table **2**).

Table (2): Analyzing the gender differences between the two groups.

Gender	Group I with CB (N=25)	Group II without CB (N=5)	*P Value
Male Female	19 (76%) 6 (24%)	4 (80%) 1 (20%)	1

Most unilateral CB were bulbous (36%), most bilateral dominant right were lammellar (12%), while most bilateral dominant left were extensive (Table **3**).

Table (3): Type of CB of the patients with CB.

	With CB	
	N	%
Unilateral		
Lammellar	2	8%
Bulbous	9	36%
Extensive	5	20%
Bilateral dominant right		
Lammellar	3	12%
Bulbous	1	4%
Extensive	1	4%
Bilateral dominent left		
Lammellar	1	4%
Bulbous	1	4%
Extensive	2	8%

Nasal septal deviation was found in twenty three patients (92%) group I, while it was found in four patients (80%) of group II. NSD did not differ significantly between both groups (Table **4)**.

Table (4): Comparison between both groups regarding to presence or absence of NSD.

	Group I with CB (N=25)	Group II without CB (N=5)	*P Value
Without NSD	2 (8%)	1 (20%)	**P= 0.43
With NSD	23 (92%)	4 (80%)	

Thirteen patients (52%) group I presented with right NSD, while two patents (40%) group II presented with left NSD**.** Side of NSD did not differ significantly between both groups (Table **5)**.

Table (5): Comparison between both groups regarding to side of NSD.

Side of NSD	Group I with CB (N=25)	Group II without CB (N=5)	*P Value
Right	13 (52%)	1 (20%)	**P=0.4
Left	7 (28%)	2 (40%)	
Bilateral	3 (12%)	1 (20%)	
None	2 (8%)	1 (20%)	

Twenty-two patients (88%) group I had preserved air channel, while three patients (12%) of them had obliterated air channel (Table **6**).

Table (6): Comparison between both groups regarding to air channel preservation.

Air channel preservation	Group I with CB (N=25)	Group II without CB (N=5)
Preserved	22 (88%)	-
Obliterated	3 (12%)	-

Twenty-two patients (96%) with NSD had preserved air channel and while only one patient (4%) had obliterated air channel (Table **7**).

Table (7): Air channel preservation among patients with NSD.

Air channel preservation	With NSD (N=23)
Preserved	22 (96%)
Obliterated	1 (4%)

The most commonly affected sinus in both group (maxillary sinusitis found in twenty patients 80%) followed by ethmoid sinusitis and sphenoid sinusitis. There was no significant difference between both groups with and without CB regarding to sinus affected (Table **8**).

Table (8): Comparison between both groups regarding to sinus affected.

Sinus affected	Group I with CB (N=25)	Group II without CB (N=5)	P Value
Frontal	**7 (28%)**	**0**	**0.3**
Maxillary	**20 (80%)**	**5 (100%)**	**0.55**
Ethmoid	**18 (72%)**	**3 (60%)**	**0.62**
Sphenoid	**3 (12%)**	**1 (20%)**	**0.53**

This table showed that side of concha and side of NSD did not show any significant difference between groups **(**Table **9)**.

Table (9): Side of concha in relation to side of NSD.

Side of NSD	Unilateral Right (n=8)	Unilateral Left (n=8)	Bilateral Dominant Right (n=5)	Bilateral Dominant Left (n=4)	*P value
Right	**3 (37.5%)**	**7 (87.5%)**	**2 (40%)**	**1(25%)**	**Fisher exact *P=0.31**
Left	**3 (37.5%)**	**1 (12.5%)**	**2 (40%)**	**1 (25%)**	
Bilateral	**1 (12.5%)**	**0 (0%)**	**0 (0%)**	**2 (50%)**	
None	**1 (12.5%)**	**0 (0%)**	**1 (20%)**	**0 (0%)**	

During calculation of the correlation between Side of concha and side of NSD. There was no significant relation between side of concha and side of NSD (bilateral NSD was excluded from the correlation) **(**Table **10)**.

Table (10): Side of concha in relation to side of NSD.

Side of concha	Side of NSD		*P value
	Right NSD	Left NSD	
Right (13 patients)	6	7	NS
Left (10 patients)	6	4	NS

DISCUSSION

The CB's precise mechanism is unknown, however it is thought that the nasal cavity's airflow pattern plays a significant influence. According to the "evacuo" theory, NSD and CB have the following dynamic[(11)]. It is widely believed that osteomeatal obstructions may impede ventilation and mucociliary clearance from the sinuses, predisposing affected patients to sinonasal disease[(12)].

The nasal septum is the partition between the two nasal passages. It is the quadrangular cartilage that forms the anterior cartilaginous part. The septum is made of bone and includes the maxillary crest, vomer, and ethmoid perpendicular plate. The nasal passageways and septum are symmetrical and in their usual positions. Congenital or acquired nasal septal deviation (NSD) is characterized by a deflection of the septum to one side. The prevalence of non-specific delirium varies between 40% and 45%[(13)].

In this analysis, 77% of participants were male and 23% were female, with a mean age of 31±2 years among all participants. None of the demographic variables, including age, age range, and gender, differed significantly between the groups.

In our study, we defined CB as any degree of pneumatization of the middle turbinate, and this definition agree with **Bolger *et al.***[(9)] and **Gökhan *et al.***[(14)] definition, and disagree with **Zinreich *et al.***[(2)] who have neglected to include specimens of tiny size or lamellar type conchae bullosa in their analyses. This may shed light on discrepancies in research linking concha bullosa to either NSD or sinusitis.

Regarding types of CB, that most unilateral CB were bulbous (45%), most bilateral dominant right was also bulbous (20%) while most bilateral dominant left were extensive.

In the current study, 90% of patients had NSD. This is to some extent in agreement with Stallman's 65% **Stallman *et al.***[(15)] and **Sazgar *et al.***[(16)] 62.9% prevalence.

Regarding number of NSD, there was no significant difference between both groups with and without CB. Regarding side of NSD, it did not differ significantly between groups. Also, regarding to air channel preservation, 88% of patients with CB had preserved air channel and 12% of them had obliterated air channel. Regarding air channel preservation among patients with NSD, 96% of patients with NSD had preserved air channel and 4% of them had obliterated air channel. Which came in agreement with **Javadrashid *et al.***[(17)], our CT examination revealed no statistically significant link between concha bullosa and NSD.

In this area, the existing statistics are contentious. Some researchers have linked concha bullosa to NSD, but others haven't discovered any greater risk of septal deviation in these patients[(10)].

In agreement with our study, **Hamdan *et al.***[(18)] failed to show that CB was caused by a deviated nasal septum.

Kucybała *et al.*[(7)] showed that NSD was detected in 79.9% (n=171) of CT scans 50.3% (n=86) of the time it was on the right side, while 49.7% (n=84) of the time it was on the left side.

In our study, there was no significant difference between both groups regarding to sinus affected with and without CB. Also, when comparing patients with and without NSD, there was no discernible difference in the degree to which their sinuses were impacted.

Tunçyürek *et al.*[12] demonstrated that there was evidence of maxillary rhinosinusitis in 45.1% of individuals. Twenty-eight patients (17.3%), ethmoid sinuses in forty-eight patients (29.6%), and sphenoid sinuses in twenty-six patients (16%) had additional sinus involvement. Rhinosinusitis that spreads to the sinuses' ethmoids is more common in people with CB (p=0.04). In instances with substantial type CB, rhinosinusitis was more common (55.5 percent).

Tiwari and Goyal[19] show that in 38 of the instances analysed, there was an air column between the medial side of the concha bullosa and the surrounding DNS, while in 3 cases, the air column was lost (p =0.0001). Maxillary sinus involvement was highest (85%), followed by anterior ethmoid sinus (73.3%), and sphenoid sinus involvement was lowest (5%).

CONCLUSION

To sum up, we found that CT-imaged concha bullosa, regardless of its size or shape, does not increase the likelihood of sinusitis or NSD. In addition, it is possible that CB is more common in noses that are not deviated in any way. Therefore, detecting Concha bullosa, especially extensive type CB, is more important than knowing deviance in the preoperative evaluation.

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