

The Incidence of Concha Bullosa and Its Association with Chronic Rhinosinusitis Deviated Nasal Septum and Osteomeatal Complex Obstruction

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Objective: To determine the incidence of concha bullosa and its association with deviated nasal septum, obstruction of osteomeatal complex and chronic rhinosinusitis.

Design: Retrospective study.

Setting: Otorhinolaryngology, head and neck surgery department.

Method: Nine hundred thirty-one consecutive paranasal sinus CTs taken between 2008 and 2010 were reviewed; 347 cases of concha bullosa (CB) were identified. Those cases were reviewed radiologically for the presence and severity of deviated nasal septum, obstruction of the osteomeatal complex and sinus disease. The significance of associations was tested using chi-square or Fischer exact tests.

Result: Patient's age ranged from 8 to 84 years with a mean age of 32.6 years. Two hundred twenty-nine (66%) were females. Three hundred forty-seven (37.3%) had CB and 224 (64.6%) had deviated nasal septum with CB. No association between a unilateral or dominant CB and ipsilateral or contralateral DNS and ipsilateral or contralateral maxillary, ethmoid and sphenoid sinus involvement was found. Similarly, there was no association with disease in the ipsilateral or contralateral osteomeatal complex.

Conclusion: Although concha bullosa is a common occurrence in the nasal cavity, no statistically significant relationships between the presence of concha bullosa, deviated nasal septum, obstruction of osteomeatal complex and sinus disease was found.

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Middle meatal obstruction and subsequent rhinosinusitis could be due to concha bullosa, deviated nasal septum (DNS), Haller cells, paradoxical middle turbinates, agger nasi cells and many others. The most common anatomical variations after agger nasi cells are concha bullosa and deviated nasal septum¹. Concha bullosa is defined as pneumatization of the middle turbinate; it might present unilaterally or bilaterally, very small or may attain a considerable size¹⁻³. CB is

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best diagnosed radiographically by CT scan; it appears as an air space of the middle turbinate surrounded by an oval bony rim.

The incidence of positive CT findings for concha bullosa is varied from 14-53%, and the relationship of CB to paranasal sinus disease continues to be debated⁴. It is suggested that the enlarged concha may compress or deviate the uncinate process against the lateral wall of the nasal cavity or compress the middle meatus and narrow the ethmoidal infundibulum, thereby causing ipsilateral maxillary sinus disease. Similarly, the role of nasal septal deviation in the etiology of sinusitis remains unclear. It has been suggested that when a concha bullosa is present, the nasal septum is deviated with a convexity to the opposite side, narrowing the middle meatus and therefore resulting in obstructed drainage of the ipsilateral maxillary, anterior ethmoid and frontal sinuses.

Discussion continues regarding the relationships between these sinonasal anatomical variations and their link to sinus diseases. Some studies suggest significant relation between CB and sinus disease, while others have found little or no relation²⁻⁴.

The aim of the study is to determine the incidence of concha bullosa and its association with deviated nasal septum, obstruction of osteomeatal complex and chronic rhinosinusitis.

METHOD

Nine hundred thirty-one CT scans taken between January 2008 and December 2010 were reviewed.

The CT studies were taken because of sinonasal symptoms. The CT scans of patients with congenital deformities, previous surgery, trauma or malignancy of the nose, paranasal sinuses or maxillofacial region were excluded. Also patients with extensive or invasive fungal rhinosinusitis or dental pathologies were also excluded.

Three hundred forty-seven CB cases met the inclusion criteria and included in this study. Examinations were reviewed by rhinologist (the author) and by a radiologist. Any differences in opinions were resolved by consensus.

Frontal, ethmoid, sphenoid and maxillary sinuses were assessed separately for the presence of mucosal disease. Radiological detection of mucoperiosteal thickening and opacification of the sinuses were regarded as evidence of sinus disease. Mucous retention cysts were spared.

A concha bullosa was defined as being present when the middle turbinate was pneumatized. (Any degree of pneumatization of the middle turbinate was considered significant). A concha was assessed as being unilateral or bilateral; if bilateral conchae were present, they were assessed as being equal in size or one was designated as the dominant concha.

The nasal septum deviation was assessed: no deviation, mild, moderate or severe. DNS was considered significant if the septal spur was facing the middle meatus or if the septal deviation

narrowed the ipsilateral nasal airway. In S-shaped DNS, the most markedly deviated site was selected.

Osteomeatal complex (OMC) obstruction was considered present when there was mucosal thickening in the middle meatus. The prevalence of sinus disease was calculated based on the presence of disease either unilaterally or bilaterally in the four sinuses in each patient.

Data entry and analysis were done using SPSS version 19.

RESULT

Three hundred forty-seven (37.3%) had CB out of 931 screened CTs. Patient's age ranged from 8 to 84 years; the mean age was 32.6 years. Two hundred twenty-nine (66%) were females. One hundred ninety-three (55.6%) had bilateral CB while 154 (44.4%) had unilateral, of whom 71 (46.1%) had left side involvement and 83 (53.9%) had right side involvement. Seventeen (4.9%) patients had concha bullosa paradoxical curve of middle turbinate, of whom 6 (35.3%) had left side involvement, and 6 (35.3%) had right side involvement and 5 (29.4%) had bilateral involvement.

Two hundred seventy-eight (80.1%) had sinus disease, the moderate category being the most common, 121 (43.5%).

One hundred thirty-three (38.3%) patients had an obstructed OMC in which the obstruction was on the left in 33 (24.8%), on the right in 25 (18.8%) and bilateral in 75 (56.4%). One Hundred (75.2%) of the obstructed OMC had chronic rhinosinusitis and 33 (24.8%) did not have.

Two hundred fourteen did not have obstructed OMC, out of which 43 (20.2%) had chronic rhinosinusitis. Seventy-five patients had bilateral OMC obstruction, out of which 66 (88%) had chronic rhinosinusitis, of the 58 patients with a unilateral obstructed OMC, 60% had chronic rhinosinusitis.

Two hundred twenty-four (64.6%) had a deviated nasal septum, moderate were 122 (54.5%), mild were 98 (43.7%) and severe were 4 (1.8%). The side to which DNS was deviated was not recorded in 160 patients, but of those who were recorded 31 (48%) were deviated to the right, 18 (28%) were deviated to the left and 15 (24%) were S shaped.

There was no association between a unilateral or dominant CB and ipsilateral or contralateral maxillary, ethmoid and sphenoid sinus involvement. However, in the frontal sinus, more cases of ipsilateral sinus involvement than contralateral involvement, although this association would not be significant if a full Bonferroni correction is applied.

There was no association between unilateral or dominant CB and ipsilateral or contralateral DNS. Similarly, there was no association between unilateral or dominant CB and disease in the ipsilateral or contralateral osteomeatal complex. Out of 68 patients who had bilateral CB and an obstructed OMC, 36 (53%) had a bilaterally obstructed OMC compared to the 39 (60%) of the 65 patients with unilateral CB and an obstructed OMC.

DISCUSSION

In our study, 37.3% of patients had concha bullosa^{1,5-7}. The majority of CTs had bilateral CB (55.6%). However, the frequency of CB is varied, ranging from 15%, to 80%^{4,8-10}. This wide range of CB prevalence might be due in part to different criteria of diagnosis. Stallman defined concha bullosa as being present when more than 50% of the vertical height (measured from superior to inferior in the coronal plane) of the middle turbinate is pneumatized while Smith et al defined CB as the presence of pneumatization of any size within the superior, middle or inferior conchae^{6,11}. However, Hatipoğlu et al classified pneumatization of the middle concha depending on the location of the pneumatization as lamellar, bulbous and extensive¹².

The prevalence of sinusitis in general population in the USA was estimated to be 14%¹³. In this study, the prevalence of sinus disease was 80.1%; moderate was the most common and the maxillary and ethmoid sinuses are the most affected. Maxillary and ethmoid sinus involvement has been reported in asymptomatic patients using MRIs¹⁴⁻¹⁶. Both studies also noted that season affected sinus abnormalities, mainly in late fall and winter. A study of incidental paranasal sinus inflammatory changes in a Jordanian population found that 64.3% of patients had one or more abnormalities when MRIs were utilized¹⁷. Similar to our study, the maxillary and ethmoid sinuses were the most commonly involved.

It was suggested by some that abnormalities of the concha could predispose patients to obstruction of the sinuses and chronic sinusitis; others concluded that there is no correlation between the presence of concha bullosa and sinusitis^{2,6,7,13,18,19}. Previous studies, which supported the validity of a relationship, have typically included a majority of patients with pre-existing chronic sinusitis.

In our study, because we did not evaluate patients without CB in a case-control design, we could not determine whether an association between CB and sinus disease exists. However, no association between a unilateral or dominant CB and ipsilateral or contralateral maxillary, ethmoid and sphenoid sinus involvement was found. Although there were more cases of ipsilateral sinus involvement than contralateral involvement with ipsilateral CB in frontal sinus, this association would not be significant if a full Bonferroni correction is applied.

While other studies have suggested an association between septal deviation and the presence of concha bullosa, the presence of septal deviations was usually associated with the presence of dominant or large concha bullosa^{2,3,5,6}. However, in our study, no association was found between a unilateral or dominant CB and ipsilateral or contralateral DNS. Hatipoglu et al found that there was an association between the degree of deviation and the presence of sinusitis²⁰. Nevertheless, a meta-analysis failed to confirm a definite relationship between these two factors, which is similar to the current study²¹.

The osteomeatal complex is defined as a functional unit of the anterior ethmoid complex; it is the final common pathway for drainage and ventilation of the frontal, maxillary and anterior ethmoid sinuses²². Endoscopic surgery aims at removing the obstruction of the main drainage pathway, usually the osteomeatal complex, based on the concept that such obstruction perpetuates the sinus disease²³⁻²⁵. In our study, 38.3% of patients with CB had an obstructed OMC, of whom

75.8% had chronic rhinosinusitis and 24.2% did not have. The patients whose OMC was not obstructed, 20.2% had chronic rhinosinusitis. Patients with bilateral OMC obstruction had a significantly higher incidence of chronic rhinosinusitis (88%) compared to patients with unilateral OMC obstruction (60%).

Nourai et al in a review of CT scans of patients with rhinosinusitis found that obstructed OMC was an independent risk factor for the disease, CB was not¹⁹. On the other hand, Caughey et al concluded that CB, as well as septal deviations and infraorbital ethmoid cells contributed to the narrowing of the OMC, and therefore were associated with mucosal disease²⁶.

In a comparative investigation of patients with and without sinus disease using CT scans, the findings of Calhoun et al were indicative of an association of CB and sinus disease²⁷. In contrast, Unlü et al studied both the effects of CB on the distribution of opacification within the paranasal sinuses as well as the relationships between CB and osteomeatal complex disease; their results showed that CB does not necessarily have influence on the distribution of mucosal changes in paranasal sinuses²⁸. Furthermore, in the presence of OMC disease, no statistically significant difference was found between patients with CB and those without. However, when the types of CB were considered, OMC disease was found to be more frequent if the pneumatization was localized to the inferior half of the middle turbinate, such as in bulbous and extensive types of CB. Therefore, our results and other studies does not prove any association between CB and chronic rhinosinusitis or sinus disease, while other studies propose an association that is far from well defined. Consequently, a large case-control design would be helpful in affirming or denying proposed associations.

CONCLUSION

We found no definitive relationship between the presence of concha bullosa and nasal septal deviation or concha bullosa and osteomeatal complex obstruction and the development of sinusitis. The result suggests a relationship between frontal sinus involvement and CB but not for other sinuses.

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