RELATIONSHIP OF CONCHA BULLOSA WITH OSTEOMEATAL UNIT BLOCKAGE. TOMOGRAPHIC STUDY IN 200 PATIENTS.

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ABSTRACT: - OBJECTIVE: To determine the prevalence of concha bullosa in patients suffering from chronic rhinosinusitis and to examine its possible relationship to osteomeatal unit blockage, the latter being a precursor for rhinosinusitis. **DESIGN**: A prospective study of prevalence of concha bullosa and blockage of ipsilateral osteomeatal unit was done on 200 computed tomography scans of patients with chronic rhinosinusitis. **RESULTS**: Of the 200 CT scans with Chronic Rhinosinusitis, the incidence of concha bullosa 34%. Of this, 31 cases (45.6%) were of extensive type, 21 cases (30.9%) were of bulbous type and 16 cases (23.5%) were of lamellar type. There was no statistically significant association between any type of concha bullosa with ipsilateral osteomeatal unit block either in right side or left side. **CONCLUSION:** There is no statistically significant relationship between presence of concha bullosa and ipsilateral osteomeatal unit blockage that leads to block in drainage of anterior group of paranasal sinuses. There is a significantly higher occurrence of the ostium of bulbous type of concha bullosa opening into the hiatus semilunaris.
KEY WORDS: rhinosinusitis; tomography; concha; maxillary sinus; ethmoid sinus; frontal sinus.

INTRODUCTION: Concha bullosa is the pneumatization of the concha and the most frequent variation of the sinonasal anatomy[1]. It is most commonly encountered in the middle concha. It is rarely found in the superior and inferior conchae. Bolger et al. have divided the pneumatization of the middle concha into three groups: lamellar type is the pneumatization of the vertical lamella of the concha; bulbous type is the pneumatization of the bulbous segment; pneumatization of both the lamellar and bulbous parts is called extensive concha bullosa[2]. The concha bullosa may be present unilaterally or bilaterally, very small or may attain a considerable size. The middle concha is formed by the medial part of the ethmoid bone. As it elongates in the nasal cavity, anterior-superior stabilization is provided by the cribriform plate, posterior and lateral stabilization is provided by

the lamina papyracea. The bony structure that allows attachment to the lamina papyracea is called the basal lamella. Basal lamella divides the ethmoid air cells into the anterior and posterior groups. Pneumatization of the middle concha is an extension of the normal pneumatization of the ethmoid air cells[1-3].

The osteomeatal unit is differently defined by several authors. In the present study, the concept developed by Stammberger & Kennedy[4] was adopted, defining osteomeatal unit as a functional unit of the anterior ethmoid complex representing the final common pathway for drainage and ventilation of the frontal, maxillary and anterior ethmoid cells. Yousem et al found that when the middle meatus, which is a part of the osteomeatal unit, was opacified, the maxillary and ethmoid sinuses showed inflammatory changes in 84% and 82% respectively[5].

A large concha bullosa may narrow the middle meatus from the medial side and thus may cause narrowing and blockage of the osteomeatal unit. This leads to block in the natural drainage of the ipsilateral anterior group of sinuses and causes sinusitis. While some studies suggest that the presence of concha bullosa may interfere with proper airflow, potentially predisposing to sinus disease, other studies have produced contradictory findings[2, 6, 7]. The purpose of this study was to determine the prevalence of concha bullosa in patients suffering from chronic rhinosinusitis and to examine its possible relationship to osteomeatal unit blockage, which is a precursor for rhinosinusitis.

It has been shown that mucosal thickening less than 4 mm in chronic rhinosinusitis is not normally of clinical importance, even though these patients may still have symptoms[8]. Hence, in our study, we have taken CT scan with 4 mm or more mucosal thickening as positive for chronic rhinosinusitis. Osteomeatal block is taken positive in case greyish opacity is noted in the osteomeatal unit area.

OBJECTIVES: To determine the prevalence of concha bullosa in patients suffering from chronic rhinosinusitis and to examine its possible relationship to osteomeatal unit blockage. This is a precursor for rhinosinusitis.

MATERIALS AND METHODS: This study was carried out at the Department of ENT and Head Neck Surgery, Navodaya Medical College, Raichur. Two hundred patients with clinical features of chronic rhinosinusitis not responding to medical management were subjected to Computed Tomography (CT) of the paranasal sinus region. This is a prospective study, conducted over a period of 1 year from 1st January 2012 to 31st December 2012. The CT scans were selected depending on the following inclusion/exclusion criteria:

INCLUSION CRITERIA:

1. Adult patients
2. Irrespective of socio-economic status.
3. Clinical diagnosis of Chronic Rhinosinusitis.
4. CT scan with 4 mm or more mucosal thickening in any of the paranasal sinus.

EXCLUSION CRITERIA:

1. History of previous sinus surgery.
2. History of benign tumours of sinonasal mucosa.
3. History of facial trauma.

All CT scans were obtained with GE Pro-Speed Plus 4 Slice Multidetector CT machine. After obtaining the scout projection, the area of scanning was defined to include the region from roof of frontal sinus up to the hard palate. Axial sections were performed with the patient in supine position and the plane of data acquisition parallel to hard palate. The sections were taken with slice thickness of 5 mm. Images were reconstructed at 4 mm intervals i.e. image overlap of 1 mm. Scanning parameters included 105 mA, 130 kV and tube rotation time of 1.5 seconds. Coronal sections were performed with the patients in prone position with extended neck and the plane perpendicular to axial plane. The scan parameters were same as in axial plane. Extended cephalic / caudal sections were done in a few patients to see extension of the disease process.

Patients' CT scans were evaluated to find any evidence of presence of concha bullosa. In a CT scan with Concha Bullosa, any evidence of blockage in ipsilateral osteomeatal unit was evaluated and documented. The collected data was subjected to statistical analysis. Software used for analysis is Epi info version 6 and the test applied is chi-square test.

ETHICAL CONSIDERATIONS: The study got clearance by the Institutional Ethical Committee before its commencement. Also, a written informed consent was taken from all the patients before participating in the study.

RESULTS: The patients were between 18 to 54 years of age (average age was 30.9 years). There were 106 males (53 %) and 94 females (47%).

Of the 200 CT scans with Chronic Rhinosinusitis picture, 8 CT scans showed right sided concha bullosa, 20 CT scans showed left sided concha bullosa and 20 CT scans showed bilateral concha bullosa. Thus, the incidence of concha bullosa in the present group of rhinosinusitis cases was a total of 68 cases (i.e. sides. The 20 CT scans showing bilateral concha bullosa were counted double as 40 cases/sides) (34%). Of the 68 cases of concha bullosa, 31 cases (45.6%) were of extensive type (Figure 1), 21 cases (30.9%) were of bulbous type (Figures 2, 3 and 4) and 16 cases (23.5%) were of lamellar type (Figure 5). Of the extensive type, 19 cases (61.3%) were present on left side and 12 cases (38.7%) were present on right side. Of the bulbous type, 16 cases (76.2%) were on left side and 5 cases (23.8%) were on right side. Of the lamellar type, 5 cases (31.3%) were on left side and 11 cases (68.7%) were on right side.

All the 3 types of concha bullosa had a varied pattern in the position of their ostium. Of the 31 cases with extensive type of pneumatization, 14 cases (45.16%) had ostium draining in frontal recess, 11 cases (35.48%) were having ostium adjacent to basal lamina and 6 cases (19.36%) were having ostium opening into hiatus semilunaris. Of the 21 cases of bulbous concha bullosa, 15 cases (71.43%) had their ostium opening into hiatus semilunaris, 5 cases (23.81%) were opening into the frontal recess and 1 case (4.76%) was opening adjacent to basal lamina. Of the 16 cases with lamellar concha bullosa, 6 cases (37.5%) opened into the frontal recess, 6 cases (37.5%) opened into area adjacent the basal lamina and 4 cases (25%) opened in to the hiatus semilunaris. There was highly significant association between type of concha bullosa and location of ostium ($p<0.005$). There was a significantly higher occurrence of the ostium of bulbous type of concha bullosa opening into the hiatus semilunaris compared to other type of lesions.

Of the 12 cases of extensive concha bullosa on the right side, 10 cases (83.3%) had associated ipsilateral osteomeatal unit blockage and 2 cases (16.7%) were free of ipsilateral

osteomeatal unit blockage. Of the 19 cases of extensive concha bullosa on the left side, 8 cases (42.1%) had associated ipsilateral osteomeatal unit blockage and 11 cases (57.9%) were free of ipsilateral osteomeatal unit blockage. Of the 5 cases of bulbous concha bullosa on the right side, 3 cases (60%) had associated ipsilateral osteomeatal unit blockage and 2 cases (40%) were free of ipsilateral osteomeatal unit blockage. Of the 16 cases of bulbous concha bullosa on the left side, 10 cases (62.5%) had associated ipsilateral osteomeatal unit blockage and 6 cases (37.5%) were free of ipsilateral osteomeatal unit blockage. Of the 11 cases of lamellar concha bullosa on the right side, 7 cases (63.6%) had associated ipsilateral osteomeatal unit blockage and 4 cases (36.4%) were free of ipsilateral osteomeatal unit blockage. Of the 5 cases of lamellar concha bullosa on the left side, 2 cases (40%) had associated ipsilateral osteomeatal unit blockage and 3 cases (60%) were free of ipsilateral osteomeatal unit blockage. There was no statistically significant association between any type of concha bullosa with osteomeatal unit block either in right side or left side. Even though there was more osteomeatal unit block in extensive type of concha bullosa compared to other types on the right side, it was statistically not significant (p=0.47). On the left side, osteomeatal block was more frequent with bulbous type compared to other types, but it was also not significant statistically (p=0.43).

DISCUSSION: Although the exact mechanism of concha bullosa 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[9]. This theory can explain the association between contralateral concha bullosa 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.[6] reported contralateral nasal septal deviation in 69.5% of patients with unilateral concha bullosa or dominant concha bullosa.

In our study, 68 cases (34%) had concha bullosa. Of the 68 cases of concha bullosa, 31 cases (45.6%) were of extensive type, 21 cases (30.9%) were of bulbous type and 16 cases (23.5%) were of lamellar type. However, the frequency of concha bullosa in the literature ranges from 14-53%[1]. This wide range of concha bullosa 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 pneumatised while Smith et al defined concha bullosa as the presence of pneumatization of any size within the superior, middle or inferior conchae[6,10]. However, Hatipoğlu et al classified pneumatization of the middle concha depending on the location of the pneumatization as lamellar, bulbous and extensive[11]. In his study, the incidence of concha bullosa was extensive type (46.95%), bulbous type (32.17%) and lamellar type (20.86%). In the study by Unlu et.al., the incidence of concha bullosa was extensive type (34.2%), bulbous type (20.63%) and lamellar type (45.23%)[12]. Tonai and Baba reported the incidence of concha bullosa as extensive type (52%), bulbous type (19%) and lamellar type (2%)[13]. Bolger et al. reported the incidence of concha bullosa as extensive type (15.7%), bulbous type (46.2%) and lamellar type (31.2%)[2]. Uygur et al. reported the incidence of concha bullosa as extensive type (10.8%), bulbous type (33.9%) and lamellar type (55.3%)[14]. The variances may be due to differences between the study groups, differences in pneumatization parameters and the analytical methods used.

In our study, there was no statistically significant association between any type of concha bullosa with osteomeatal unit block either in right side or left side. Even though there was more osteomeatal unit block in extensive type of concha bullosa compared to other types on the right side, it was statistically not significant (p=0.47). On the left side, osteomeatal block was more frequent with bulbous type compared to other types, but it was also not significant statistically (p=0.43). Some authors have reported that concha bullosa plays a role in recurrent sinusitis by compressing the uncinate process and obstructing or narrowing the infundibulum and the middle meatus[1,2,15,16,17]. Lloyd et al. have stated that when concha bullosa fills the space between the septum and the lateral nasal wall, there may be total obstruction of the middle meatus orifice[16,17]. Comparative studies involving asymptomatic patients and sinusitis patients have reported that concha bullosa is more frequently encountered in patients with sinusitis[16-18]. It is significant to note that the comparative studies which failed to show a significant association between the sinus disease and concha bullosa were performed only on the symptomatic groups[5,12]. Similarly, in our study cases consisted of patients with rhinosinusitis. There are studies pointing out that the size of concha bullosa is important for the presence of symptoms[14,15]. Yousem et al. have advocated that concha bullosa is not one of the causes of sinusitis yet the size has implications[5] . Stallman et al. have demonstrated no significant association between the concha bullosa size and sinusitis[6]. No consensus was achieved regarding this matter. We did not classify conchae bullosa by their sizes. Given that no agreement was reached on this matter, this may also be one of the causes why there were conflicting results from the studies. ENT specialists believe that especially bulbous type concha bullosa with large dimensions may have a role in sinus disease[3]. We studied the importance of concha bullosa location (lamellar, bullous and extensive) in relation osteomeatal block, which predisposes to rhinosinusitis. In the most extensive study on this topic by Ünlü et al., no significant relation was demonstrated between concha bullosa and osteomeatal unit blockage; however, when the bulbous-extensive type was compared with the lamellar type, a significant correlation was found regarding osteomeatal unit blockage[12]. They thus concluded that pneumatization of the inferior portion of the middle concha has a role in osteomeatal unit blockage. No significant difference was found between the bulbous and extensive types in their study[12].

CONCLUSION: There is no statistically significant relationship between presence of concha bullosa and ipsilateral osteomeatal unit blockage that leads to block in drainage of anterior group of paranasal sinuses. There is a significantly higher occurrence of the ostium of bulbous type of concha bullosa opening into the hiatus semilunaris. The limitation of our study was that our study group included only patients of rhinosinusitis and did not include any normal population.

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FIGURE 1: RIGHT SIDED EXTENSIVE CONCHA BULLOSA (arrow head).

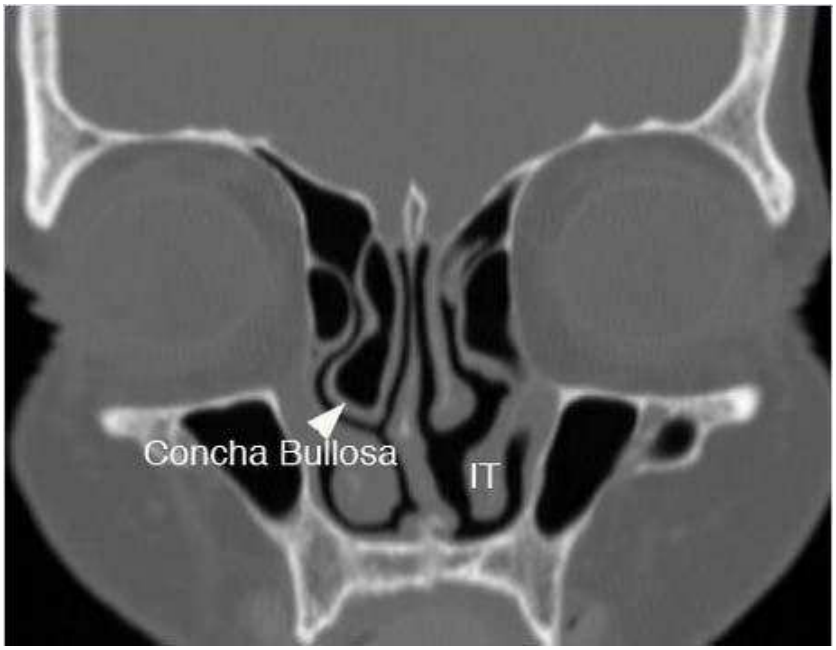

FIGURE 2: BILATERAL BULBOUS CONCHA BULLOSA (asterix) WITH NO OSTEOMEATAL UNIT BLOCK.

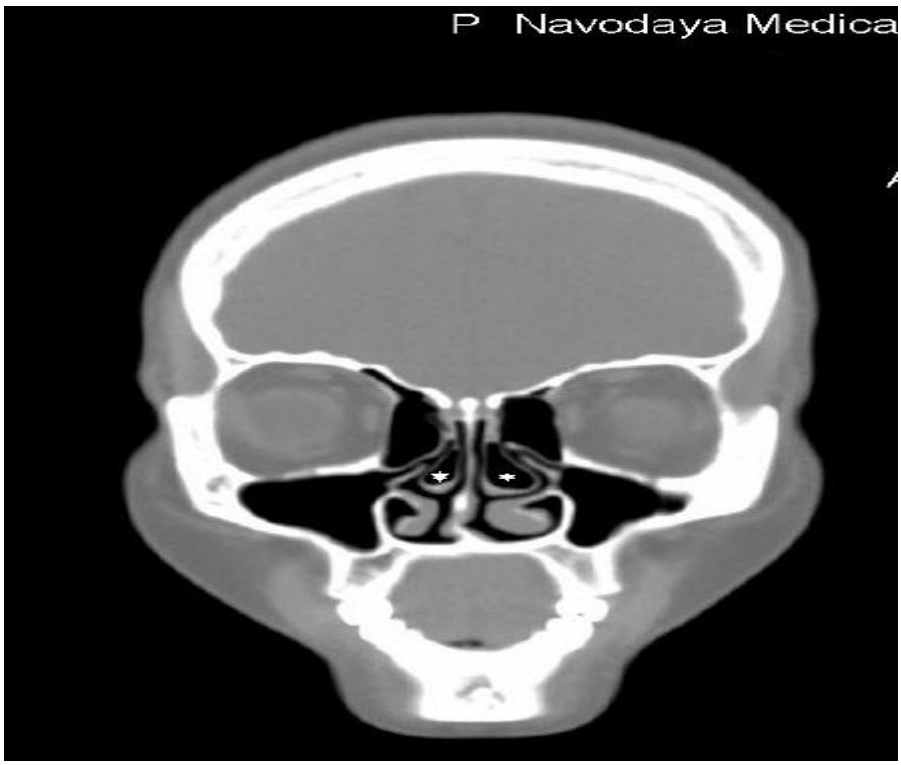

FIGURE 3: RIGHT SIDED BULBOUS CONCHA BULLOSA WITH NO OSTEOMEATAL UNIT BLOCK (arrow).

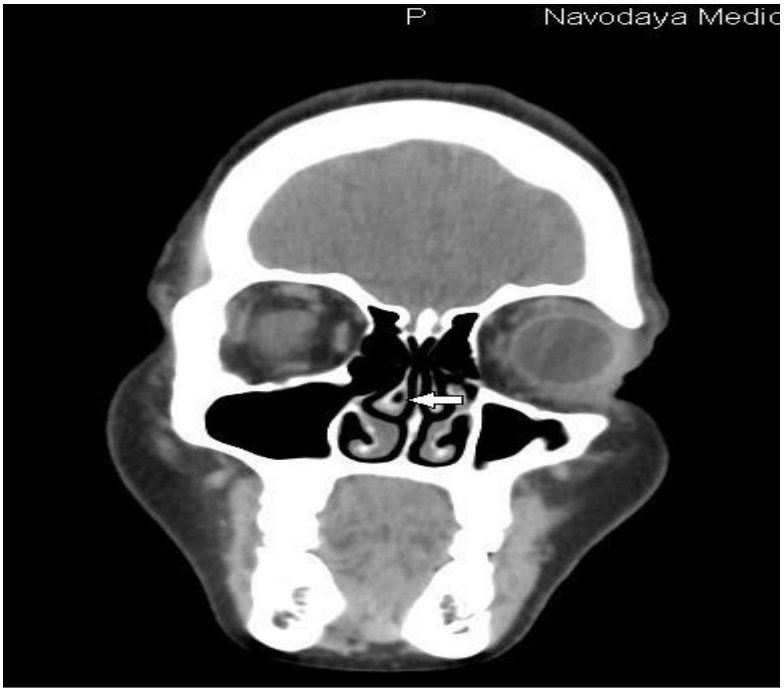

FIGURE 4: RIGHT SIDED BULBOUS CONCHA BULLOSA WITH IPSILATERAL OSTEOMEATAL UNIT BLOCK (arrow).

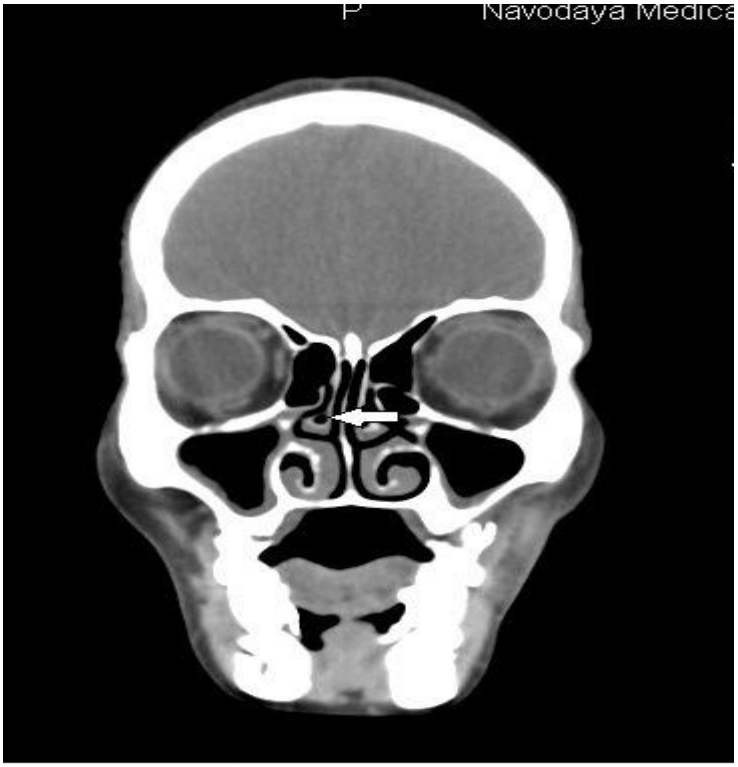

FIGURE 5: LEFT SIDED LAMELLAR CONCHA BULLOSA (arrow) WITH NO OSTEOMEATAL UNIT BLOCK. [IT-INFERIOR TURBINATE, MT-MIDDLE TURBINATE]