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The relationship between the concha bullosa, nasal septal deviation and sinusitis*

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SUMMARY

Objectives: *To evaluate the possible relationship between concha bullosa, nasal septal deviation and sinusitis.*

Patients and methods: *Paranasal sinus computed tomography scans of patients suffering from rhinosinusitis were examined. Fifty-four patients with concha bullosa were included in the study. The relationship between concha bullosa, nasal septal deviation and sinusitis was investigated.*

Results: *A statistically significant relationship between unilateral concha bullosa and nasal septal deviation was found ($p<0.01$). The relationships of unilateral and bilateral concha bullosa with sinusitis, and bilateral concha bullosa with nasal septal deviation were not statistically significant ($p>0.05$).*

Conclusion: *In order to define the relation between the concha bullosa, nasal septal deviation and sinusitis, more detailed investigations are needed.*

Key words: concha bullosa, nasal septal deviation, sinusitis

INTRODUCTION

Each of the nasal structures has its specific function. While the septum provides support for the nasal structures and regulates nasal passage, a well developed middle concha warms and humidifies the inspired air, directs it to the olfactory epithelium, provides lamination and aerates the sinuses (Cannon, 1994; Blaugrund, 1989). The middle concha arises from the ethmoidal fold of the lateral nasal wall. At about the third month of fetal development, anterior and middle ethmoidal air cells begin to develop as evaginations from the nasal cavity into the middle meatus of the nose (Blaugrund, 1989). The middle concha may begin to be pneumatized at this point by the posterior ethmoid air cells too (Cannon, 1994). Partial or total pneumatization of the middle concha is termed as concha bullosa. The middle concha might exhibit lamellar aeration in the vertical portion and bullous or totally extensive aeration in the curved distal portion (Calhoun et al., 1991; Stammberger, 1991; Unlu et al., 1994).

Although the nasal septum and the middle concha have close developmental timing, concha bullosa appears later. The exact reason of pneumatization of the middle concha is not known (Unlu et al., 1994). Traumas, including intrauterine fetal, perinatal and following delivery, developmental defects, growth anomalies of maxilla and other facial structures, congenital deformities, shedding of incisors, finger sucking, applying pressure with the tongue to the palate, breathing through the mouth are among the causes of nasal septal deviation. Traumas, especially before the complete ossification of the vomer and maxillary crest, could damage these structures (Blaugrund, 1989). The incidence of nasal septal deviation is lower in neonates than in adults and additional concha bullosa is not seen. With increasing age, the incidence of deviation also increases and concha bullosa becomes apparent after the age of 7-8 and continues its development even after the adolescent period (Blaugrund, 1989; Unlu et al., 1994).

Nasal septal deviation, especially together with concha bullosa or conchal hypertrophy, disturbs nasal physiology. It could narrow the middle meatus by pushing the concha laterally. Besides nasal obstruction, it exerts pressure to neighboring structures. This, in turn, affects the drainage pathways, disturbs mucosal ciliary function by contact and leads to obstruction and secondary nasal infections. If the deviated septum contacts the hypertrophic conchae or concha bullosa, and narrows the middle meatus, it can cause infection in all sinuses by disturbing the normal mucus drainage.

The aim of this study was to retrospectively evaluate the relationship between concha bullosa, nasal septum deviation and sinusitis.

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MATERIAL AND METHODS

Paranasal sinus CT scans of 142 patients with headache, nasal and postnasal drainage, nasal obstruction complaints were retrospectively evaluated. The patients had chronic and/or recurrent acute rhinosinusitis and who were unresponsive to appropriate medical therapy were enrolled in this study. CT examinations were carried out in the coronal plane with 5 mm slice thickness and 5 mm intervals on either a GE ProSpeed Helical Scanner or Philips Secura CT machines. Any evidence of mucosal changes, ranging from minimal mucosal thickening to total sinus opacification detected on CT was considered as abnormal. Fifty-four patients who had concha bullosa were included in the study. The degree of pneumatization, the relationship between nasal septum deviation, which was located at the level of bulla ethmoidalis, and sinusitis, unilateral or bilateral occurrence were evaluated by the Pearson Chi Square test. Since the differentiation between bullous and extensive concha is difficult, but their consequences are similar, these two entities were regarded as variants and evaluated as one group.

FINDINGS

The mean age of the 54 patients (25 females, 29 males) was 34.1±2.1 years (range 13-64 years). Concha bullosa was unilateral in 36 (68.5 %) and bilateral in 18 (31.5 %) patients. Of these, 42% was lamellar and 58% was bullous or extensive. Nasal septal deviation was present in 9 of 18 (50%) patients with bilateral concha bullosa, and in 32 of 36 (88.8%) patients with unilateral concha bullosa. There was a statistically significant relationship between the bullous-extensive, unilateral concha bullosa and septal deviation with the Pearson Chi Square test ($p<0.01$). Also, the septal deviation was greater towards the lamellar side in patients where the bullosa was on one side bullous-extensive and the other side lamellar (Figure 1). Nasal septal deviation was not seen in patients with bilateral concha bullosa with similar pneumatization (Figure 2). Figure 3 shows unilateral concha bullosa and nasal septal deviation. Nasal septal deviation was present in 41 (75.9%) patients, the majority of whom had unilateral concha bullosa. The

Figure 2. Coronal paranasal CT slice demonstrating bilateral concha bullosa of similar pneumatization and a normal nasal septum.

Figure 1. Coronal paranasal CT slice showing bilateral concha bullosa (lamellar on the right, extensive on the left) and nasal septal deviation to the right. Also sinusitis in the maxillary sinus and anterior ethmoid cells are seen on the right.

Figure 3. Coronal paranasal CT slice demonstrating unilateral concha bullosa on the right and septal deviation to the left in a left sided maxillary and ethmoid sinusitis case.

Table 1. The distribution of nasal septal deviation according to unilateral or bilateral concha bullosa.

Nasal septal deviation	Unilateral concha bullosa		Bilateral concha bullosa		Total	
	n	%	n	%	n	%
Yes	32	59.2	9	16.7	41	75.9
No	4	7.4	9	16.7	13	24.1
Total	36	66.6	18	33.4	54	100

detailed relationship between concha bullosa and nasal septal deviation is presented in Table 1.

Sinusitis was observed in 29 of 54 patients by CT. Sinusitis was present in 24% (6 of 23) of the lamellar type and in 75% (23 of 31) of the bullous-extensive type concha bullosa cases. Eighteen of these 29 patients had unilateral, while 11 had bilateral concha bullosa. There was no significant difference between the unilateral and bilateral concha bullosa cases from the point of sinusitis with the Pearson Chi Square test ($p>0.05$). All of the cases had unilateral concha bullosa, and maxillary or both maxillary and ethmoidal opacities were observed at the same side of the deviated nasal septum and at the opposite side of unilateral concha bullosa.

DISCUSSION

Computerized tomographic imaging of the nasal and paranasal regions has become an indispensable tool for the endoscopic sinonasal surgery (ESS). A detailed examination of the nasal cavity and paranasal sinuses is now possible with CT. Nasal septal deviation and concha bullosa with inferior concha surgery are now being performed to improve the physiology of the nasal cavity and paranasal sinuses. In a significant number of concha bullosa cases, an altered normal airflow is present and the mucous drainage pathways and the mucosa within the middle meatus become edematous. There may also be an obstruction of the ostiomeatal unit with associated maxillary or ethmoidal dissease (Cannon, 1994; Blaugrund, 1989). It has been shown that the correction of the nasal septal deviation alone is not sufficient to treat sinus disease.

The rate of anatomic variation in nasal structures is reported to be between 64.9 – 86% (Bolger et al., 1991). Nasal septum deviation and concha bullosa are among the most frequent anatomic variations (Arslan et al., 1999). The incidence of concha bullosa is between 13.2 and 72.2% (Zinreich et al., 1987; Zinreich et al., 1988; Clark et al., 1989; Bolger et al., 1991; Calhoun et al., 1991; Meloni et al., 1992; Arslan et al., 1999). This rate was reported to be between 13.2 and 50% in healthy people (Bolger et al., 1991; Cannon, 1994) and between 33.8 and 72.6% in symptomatic cases (Bolger et al., 1991). In the literature there are some reports stating a higher incidence of concha bullosa in symptomatic cases and this higher incidence is thought to be related to sinusitis (Lloyd, 1990; Calhoun et al., 1991; Cannon, 1994). In these studies it was stated that concha bullosa changes the normal airflow and mucus drainage and these lead to mucosal edema, obstruction of the ostiomeatal unit and in the end sinusitis (Shechtman et al., 1993). There are also some studies showing no difference in anatomical variations between healthy and diseased persons (Jones et al., 1997). It has also been suggested that concha bullosa has no important mucosal consequences in paranasal sinuses, does not cause sinusitis alone, and does not create a risk for sinusitis if it does not cause obstruction (Nguyen et al., 1993; Unlu et al., 1994). In concordance with these studies, in the current study maxillary and/or ethmoidal sinusitis was observed at the opposite side of concha bullosa and at the same side of the deviated nasal septum in most of the cases. At this point, the type of concha bullosa becomes an important factor. Concha bullosa could be lamellar, bullous or extensive. Their incidences were reported as 45-46%, 21-31% and 16-34%, respectively (Bolger et al., 1991; Unlu et al., 1994). Lamellar concha bullosa is seen as a normal anatomical variation. Obstruction and pressure to surrounding structures are frequent in the bullous and extensive types (Unlu et al., 1994), which could lead to chronic sinusitis by disturbing ventilation and mucociliary activity in the middle meatus (Alhoun et al., 1991; Bolger et al., 1991; Cannon, 1994). If this highly encountered pathology causes sinusitis directly, it can be assumed that sinusitis is seen more frequently in concha bullosa cases. Thus it could be more specifically said that concha bullosa can lead to sinusitis if it is prominently large (bullous and extensive) in practice. Although we examined only a small group, our study supports this hypothesis. Sinusitis was present in 24% of lamellar, and in 75% of bullous – extensive concha bullosa cases in our study group. Although Unlu et al. (1994) reported no statistically significant difference between cases with and without concha bullosa in regard to ostiomeatal complex disease. Zinreich et al. (1988) also did not find an increase in the incidence of ostiomeatal complex dissease when concha bullosa was present. There was no significant difference between unilateral and bilateral concha bullosa cases from the point of sinusitis in the current study.

Concha bullosa could be unilateral or bilateral. The incidences of bilateral and unilateral concha bullosa were reported to be between 16 - 45% and 34 - 45%, respectively (Kennedy and Zinreich, 1988; Clark et al., 1989; Calhoun et al., 1991). While most authors reported a similar incidence for unilateral and bilateral concha bullosa (Clark et al., 1989; Calhoun et al., 1991; Cannon, 1994), some other authors reported a higher incidence for bilateral concha bullosa (Kennedy and Zinreich, 1988; Unlu et al., 1994). We found 36 (68.5%) unilateral and 18 (31.5%) bilateral concha bullosa in our study.

Nasal septal deviation is a frequent anatomical variation. The septal deviation rate reported in the literature is between 18.8-57.6% (Blaugrund, 1989). In our study, the nasal septum was deviated in 41 (75.1) cases. Besides, some studies indicated a relationship between concha bullosa and septal deviation due to a frequent association of bilateral concha bullosa in devia-

tion cases (Stammberger, 1991; Unlu et al., 1994), while other studies suggested that lamellar concha bullosa should be regarded as a normal variation and there is no significant relationship with nasal septum deviation and a higher incidence of deviation in cases with bullous and extensive concha bullosa (Bolger et al., 1991). In our study, we found no significant relationship between lamellar concha bullosa and deviation, and a quite higher rate (75%) of bullous - extensive concha bullosa and deviation coexistence. Our results support the findings of Bolger et al. (1991).

In conclusion, it is important to reveal the reasons of concha bullosa development due to a high coincidence of sinusitis and nasal septal deviation, especially in patients with bullous–extensive concha bullosa. It is also possible to suggest that concha bullosa develops independent of nasal septal deviation. For that reason detailed, longitudinal, prospective studies beginning from infancy to adulthood should be done in order to determine whether concha bullosa develops in the cavity enlarged by nasal septum deviation or independent from a deviation.

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