Cumhuriyet Dental Journal, 25(Suppl): 19-23, 2022
DOI: https://doi.org/10.7126/cumudj.1026813

Cumhuriyet Dental Journal

| cdj.cumhuriyet.edu.tr | Founded: 1998 Available online, ISSN: 1302-5805 Publisher: Sivas Cumhuriyet Üniversitesi

Examination of the Relationship Between Concha Bullosa with Nasal Septum Deviation and Maxillary Sinus Pathologies Using Cone-Beam Computed Tomography#

Elif Meltem Aslan Öztürk[1,a], Eda Didem Yalçın[2,b]

[1]*Department of Dentomaxillofacial Radiology, Faculty of Dentistry, Gaziantep University, Gaziantep, Turkey*
[2]*Department of Dentomaxillofacial Radiology Faculty of Dentistry, Dokuz Eylül University, Izmir, Turkey*
**Corresponding author*

Research Article

Acknowledgment
#This study was presented as an oral presentation at the "Sivas Cumhuriyet University 1st International Dentistry Congress" held between 23-25 November 2021.

History

Received: 10/12/2021
Accepted: 12/01/2022

ABSTRACT

Objective: To evaluate the relationship between concha bullosa (CB) and nasal septum deviation (NSD) with maxillary sinus pathologies with cone-beam computed tomography (CBCT).

Materials and Methods: The whole face CBCT data of 700 (383 male and 317 female) patients aged between 6-92 years who applied to Gaziantep University Faculty of Dentistry Department of Dentomaxillofacial Radiology for any reason between 2017-2019 was evaluated retrospectively. CB, NSD and maxillary sinus pathologies were investigated on the images.

Results: NSD was found as 64.3%, concha bullosa as 27.9% on the right, 24.1% on the left, and maxillary sinus pathologies were 48.6% on the right and 44.4% on the left. While NSD was towards the left, the absence of right concha bullosa was found to be significant. No significant relationship was observed between the presence of CB and maxillary sinus pathologies. There was no significant relationship between NSD and maxillary sinus pathologies.

Conclusions: There was a significant relationship between the presence of CB and NSD, but the presence of CB had no effect on maxillary sinus pathologies. CBCT is an important diagnostic tool in the evaluation of the anatomical variations of the osteomeatal complex and three-dimensional examination of maxillary sinus.

Keywords: Concha bullosa, nasal septum deviation, maxillary sinus pathologies, cone-beam computed tomography.

[a] *aslan.meltem5@gmail.com* *https://orcid.org/0000-0002-1737-9585* [b] *didemyalcn@gmail.com* *https://orcid.org/0000-0001-8970-7579*

How to Cite: Aslan Öztürk EM, Yalçın ED. Examination of the Relationship Between Concha Bullosa with Nasal Septum Deviation and Maxillary Sinus Pathologies Using Cone-Beam Computed Tomography. Cumhuriyet Dental Journal, 25(Suppl):19-23.

Introduction

Concha bullosa (CB) is the pneumatization of the middle turbinate, which normally does not contain air. It is possible for the upper and lower turbinates to be pneumatized, but this is very rare.[1] CB is the most common anatomical variation in the region of the osteomeatal complex (OMC), and although the exact cause of its formation is unknown, it is thought that the course of airflow in the nasal cavity has an important role in its formation.[2] The nasal septum is formed by the union of the septal cartilage and the vomer.[3] The causes of nasal septum deviation (NSD) include intrauterine, perinatal and postnatal traumas, developmental defects, growth anomalies of facial structures, congenital deformities, finger sucking, mouth breathing and pressure applied to the palate with the tongue.[4,5] The presence of CB may cause a broad-based curvature of the nasal septum. Anatomical variations can narrow or block the OMC.[6, 7] Anatomical variations of the OMC predispose to infection. This causes focal symptoms in some patients and accordingly maxillary sinus pathologies may occur.[8] The maxillary sinuses are the largest of the four paranasal sinuses located lateral to the nasal cavity, connected to the ostium and the nasal cavity, and are in close anatomical relationship with the maxillary teeth.[9] Apical surgery, removal of impacted teeth in the posterior maxilla, application of dental implants, endoscopic sinus surgery carries the risk of affecting sinus integrity during other oral surgical procedures and surgical procedures

involving the paranasal sinuses such as rhinoplasty and may therefore cause pathological changes in the sinus.[10] Some osteomeatal obstructions, allergies, odontogenic infections, as well as concha bullosa and nasal septum deviation can cause maxillary sinus pathologies.[11] NSD and CB can cause headache by obstructing or compressing the nasal airway. These are often treated with surgical procedures. Very large CB may compress the uncinate process and obstruct the infundibulum. This is a major risk factor for ethmoid and maxillary sinus diseases. It is important to detect variations before hand in order to prevent possible complications in patients who are planned for endoscopic surgery.[12]

Cone-beam computed tomography (CBCT) is one of the most preferred imaging systems to evaluate the anatomical structure of the head and neck region. According to computed tomography; CBCT is recommended for three-dimensional imaging of the maxillary sinuses and nasal cavity due to its advantages such as lower radiation dose, higher image quality, and less metal artifact caused by dental restorations.[13]

The aim of this study is to retrospectively examine CB and NSD with maxillary sinus pathologies on CBCT images and evaluate the relationship between them.

Materials and methods

Before the study, the ethical approval was obtained from Clinical Researches Ethics Committee of Gaziantep University (Protocol No: 2020/358). In this study, CBCT images of asymptomatic patients aged 6-92 years who underwent CBCT for any reason with the Planmeca Promax 3D (Helsinki, Oy, Finland) CBCT device between 2017-2020 in Gaziantep University Faculty of Dentistry Department of Dentomaxillofacial Radiology were used. Multiplanar images were obtained from 16×9, 16×16 FOV (field of view) with 0.4 mm^3 voxel size and 1 mm slice thickness. Romexis Viewer (Planmeca, Helsinki, Finland) software was used to evaluate the images in the coronal, sagittal and axial planes. Inclusion criteria were CBCT images in which the paranasal sinuses could be examined in the study area and no distortion, magnification, artifact, and foreign bodies were seen. Exclusion criteria; syndrome and facial growth disorder, presence of metabolic disease involving the bone, presence of cyst, tumor and fracture line in the examination area, presence of cyst affecting the maxillary sinuses, tumor and trauma in the maxillofacial region, odontogenic infection.

Image Analysis

Romexis software (Helsinki, Oy, Finlandiya) was used to analyze the images. On CBCT images, the presence of nasal septum deviation, concha bullosa and maxillary sinus pathology were investigated (Figure 1). Maxillary sinus pathologies were categorized as localized mucosal thickening, generalized mucosal thickening, polypoidal mucosal thickening, partial opacification and total opacification (Figure 2). All data were evaluated as right and left.

Statistical Analysis

The kappa statistics was applied to calculate the inter-observer and intra-observer agreement. The Chi-square test was used to examine the relationships among the categorical variables. SPSS software version 22.0 (IBM Corp, Armonk, NY) was used to analyze the data. Statistical significance was accepted as $p < 0.05$.

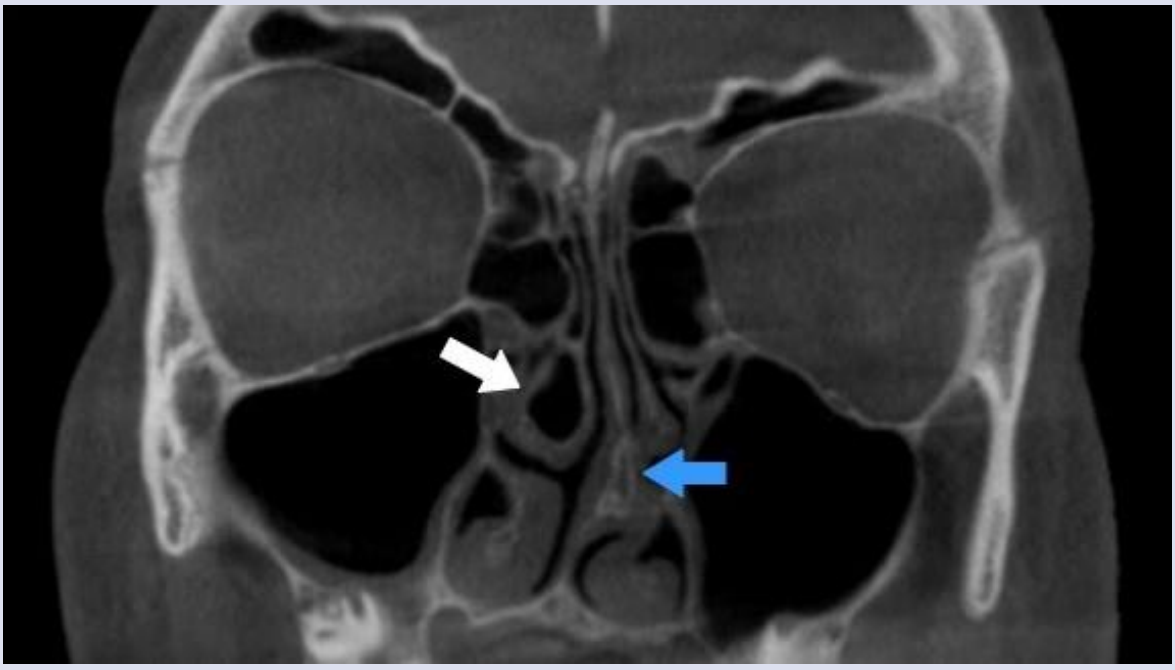

Figure 1. Coronal CBCT image; right concha bullosa (white arrow) and nasal septum deviation to the left (blue arrow).

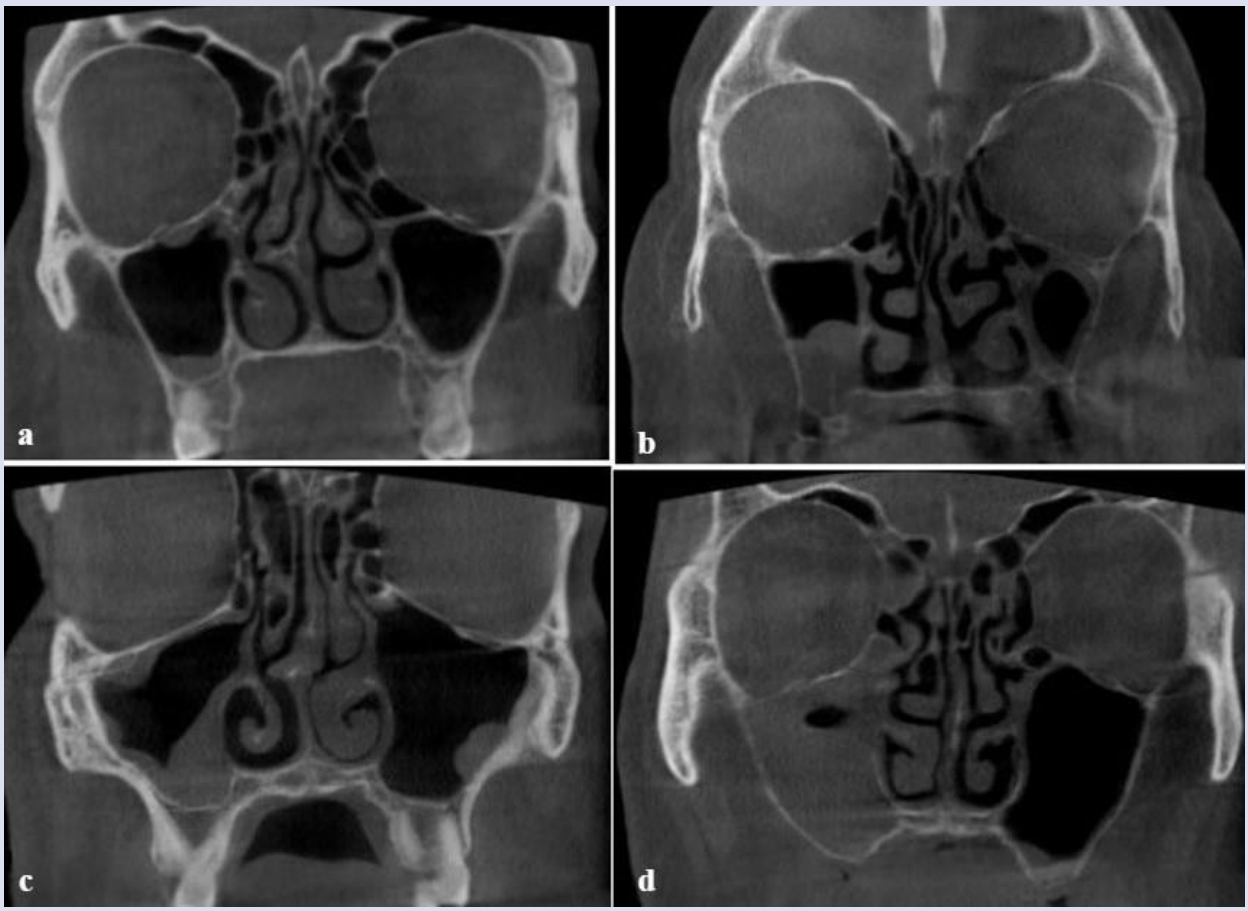

Figure 2. Maxillary sinus pathologies on coronal CBCT images; a. Localized mucosal thickening in the right maxillary sinus, b. Partial opacification in the right maxillary sinus and generalized mucosal thickening in the left maxillary sinus, c. Partial opacification in the right maxillary sinus and polypoidal mucosal thickening in the left maxillary sinus, d. total opacification in the right maxillary sinus.

Results

All evaluations were performed by two dentomaxillofacial radiologists, one is research assistant (EMAO), the other with eight year experience (EDY). Evaluations of two observerswere repeated with an interval of 2 weeks, and the intra and inter-observer reliability coefficient for all the assessments was found to be excellent (0.93 and 0.88, respectively). A total of 700 CBCT images of 383 (54.7%) males and 317 (45.3%) females, aged 6-92 years (with a mean age of 44±18) were investigated. In the analyzed images; NSD was detected with a rate of 64.3%. The direction of NSD was observed as 28.6% on the right and 35.7% on the left. CB was 27.9% on the right, 24.1% on the left, and maxillary sinus pathology was observed with a rate of 48.6% on the right and 44.4% on the left (Table 1). The most common maxillary sinus pathology is localized mucosal thickening with a rate of 27.4% on the right and 24.4% on the left and the least common maxillary sinus pathology is generalized mucosal thickening with a rate of 1.6% on the right and 1.3% on the left. When the relationship with gender is examined; the absence of right CB was found to be significant in males ($p < 0.05$). In addition, it was observed that the presence of right and left maxillary sinus pathology was significant in males ($p < 0.001$) (Table 2). It was determined that the NSD was to the left, while the absence of the right CB was significantly higher ($p < 0.05$) (Table 3). No significant correlation was observed between the presence of CB and maxillary sinus pathology ($p > 0.05$) (Table 4).

Table 1. The frequency of concha bullosa, nasal septum deviation and maxillary sinus pathologies.

Variables	Present N (%)	Absent N (%)
Nasal Septum Deviation	450 (64.3)	250 (35.7)
Right Concha Bullosa	195 (27.9)	505 (72.1)
Right Maxillary Sinus Pathology	340 (48.6)	360 (51.4)
Left Concha Bullosa	169 (24.1)	531 (75.9)
Left Maxillary Sinus Pathologies	311 (44.4)	389 (55.6)

Table 2. Distribution of concha bullosa and maxillary sinus pathologies by gender.

		Female		Male		P
		Present N (%)	Absent N (%)	Present N (%)	Absent N (%)	
Right	Concha Bullosa	101 (14.4)	216 (30.9)	94 (13.4)	289 (41.3)	0.032*
	Maxillary Sinus Pathologies	117 (16.7)	200 (28.6)	223 (31.9)	160 (22.9)	0.001*
Left	Concha Bullosa	86 (12.3)	231 (33.0)	83 (11.9)	300 (42.9)	0.093
	Maxillary Sinus Pathologies	109 (15.6)	208 (29.7)	202 (28.9)	181 (25.9)	0.001*

Chi-square test; *p < 0.05

Table 3. Correlations between side of nasal septum deviation and concha bullosa.

Side of Nasal Septum Deviation	Right Concha Bullosa		P	Left Concha Bullosa		P
	Present N (%)	Absent N (%)		Present N (%)	Absent N (%)	
Right	54 (7.7)	146 (20.9)		53 (7.6)	147 (21.0)	
Left	58 (8.3)	192 (27.4)	0.042*	55 (7.9)	195 (27.9)	0.871
Absent	83 (11.9)	167 (23.)		61 (8.7)	189 (27.0)	

Chi-square test; *p < 0.05

Table 4. Correlations between concha bullosa and maxillary sinus pathologies.

Right Maxillary Sinus Pathologies	Right Concha Bullosa		P	Left Maxillary Sinus Pathologies	Left Concha Bullosa		P
	Present N (%)	Absent N (%)			Present N (%)	Absent N (%)	
Present N (%)	92 (13.1)	248 (35.4)	0.647	Present N (%)	71 (10.1)	240 (34.3)	0.468
Absent N (%)	103 (14.7)	257 (36.7)		Absent N (%)	98 (14.0)	291 (41.6)	

Chi-square test; *p < 0.05

Discussion

Anatomical variations in the OMC predispose to infection and cause focal symptoms in some patients. NSD and CB cause obstruction of the OMC by altering the normal airflow and mucus drainage pathways. Maxillary sinusitis occurs due to this obstruction.[14,15]

When comparing panoramic radiography and CBCT in the evaluation of maxillary sinus and nasal cavity anatomy, CBCT provides valuable information in the examination of sinonasal bone anatomy with its success in three-dimensional imaging. Compared to computed tomography, the isotropic voxel in CBCT prevents distortion in multiplanar reconstruction images, and it is an important advantage that the radiation dose is less than computed tomography.[16]

In the study by Shokri *et al.*[17], CBCT images of 250 patients were scanned to evaluate the anatomical variations of the nasal cavity and ethmoid sinuses; CB was observed in 34.8%, nasal septum deviation was determined in 90.4%. A significant relationship was found between the presence of CB and NSD. In the study conducted by Khojastepour *et al.*[18], CBCT images of 281 patients who requested rhinoplasty were examined for the presence of OMC variations and mucosal thickening; CB was detected in 67.3%, NSD in 49.5% and mucosal thickening in 60.7%. The presence of mucosal thickening was also found to be significant in males. In addition, there is no significant relationship was stated between the presence of CB and NSD and mucosal thickening. In the study conducted by Köse *et al.*[19], CBCT images of 200 patients were examined in terms of NSD, CB, OMC, odontogenic lesions related to the maxillary sinus and mucosal thickening; CB was detected to be 50%, NSD was 59.5%, and mucosal thickening was 56%. No statistically significant correlation was observed between CB, NSD and mucosal thickening. In addition, no significant difference was found between gender and CB, NSD and mucosal thickening. In present study, NSD was determined 64.3%, CB 26% and maxillary sinus pathology 46.5%, and a relationship was found between CB and NSD. However, no significant relationship was observed between CB and maxillary sinus pathology, and between NSD and maxillary sinus pathology. Considering the gender, it was stated that the presence of maxillary sinus pathology was significant in males in our study. It is thought that this difference is due to the difference in the distribution of anatomical variations that cause maxillary sinus pathology between genders. The reason for the differences between these studies; may be due to sample size and anatomical differences between races. In this regard, it is recommended to conduct multicenter studies in different populations to examine the relationship between the surrounding anatomical variations and the maxillary sinus.

Conclusions

In conclusion, there was a significant relationship between the presence of CB and NSD, but the presence of CB had no effect on maxillary sinus pathologies. CBCT is an important diagnostic tool in the three-dimensional evaluation of the anatomical variations of the OMC and the maxillary sinus. Due to the anatomical proximity of the

maxillary sinus and nasal cavity, anatomical variations such as CB and NSD may be a predisposing factor in the development and recurrence of maxillary sinus pathologies, and detecting their presence may significantly affect the prognosis. Radiological evaluation of these variations before surgical interventions for the maxillary sinus and nasal cavity will reduce possible complications of surgery.

Funding

No funding resource is associated with this study.

Conflict of Interest

The authors declare that they have no conflict of interest

Ethical Approval

This retrospective study was approved by Ethical Committee of Gaziantep University (Decision No: 2020/358) and conducted in the Dentomaxillofacial Radiology Department of Gaziantep University, Faculty of Dentistry.

Informed Consent

Formal consent is not required.

References

1. Pittore B, Al Safi W, Jarvis S. Concha bullosa of the inferior turbinate: an unusual cause of nasal obstruction. Acta Otorhinolaryngol Ital 2011;31(1):47.
2. Uygur K, Tüz M, Doğru H. The correlation between septal deviation and concha bullosa. Int J Otorhinolaryngol Head Neck Surg 2003;129(1):33-36.
3. Beale TJ, Madani G, Morley SJ. Imaging of the paranasal sinuses and nasal cavity: normal anatomy and clinically relevant anatomical variants. In Seminars in Ultrasound, CT and MRI. 2009, Elsevier.
4. Al-Qudah M. The relationship between anatomical variations of the sino-nasal region and chronic sinusitis extension in children. Int J Pediatr Otorhinolaryngol 2008;72(6):817-821.
5. Aktas D. The relationship between the concha bullosa, nasal septal deviation and sinusitis. Rhinology 2003;41(2):103-106.
6. Tomomatsu N. Aperture width of the osteomeatal complex as a predictor of successful treatment of odontogenic maxillary sinusitis. Int J Oral Maxillofac Surg 2014;43(11):1386-1390.
7. Bell G, Joshi B, Macleod R. Maxillary sinus disease: diagnosis and treatment. Br Dent J 2011;210(3):113-118.
8. Mamatha H. Variations of ostiomeatal complex and its applied anatomy: a CT scan study. Indian J Sci Technol 2010;3(8):904-907.
9. Renton T, Durham J, Hill C. Oral surgery II: Part 2. The maxillary sinus (antrum) and oral surgery. Br Dent J 2017;223(7):483-493.
10. Hasegawa T. Risk factors associated with oroantral perforation during surgical removal of maxillary third molar teeth. Oral Maxillofac Surg 2016;20(4):369-375.
11. Kretzschmar DP, Kretzschmar CJL. Rhinosinusitis: review from a dental perspective. Oral Surg Oral Med Oral Pathol Oral Radiol 2003;96(2):128-135.
12. Paksoy M. The role of concha bullosa in nasal pathologies. Kulak Burun Bogaz Ihtis Derg 2008;18(4):238-241.
13. Raghav M. Prevalence of incidental maxillary sinus pathologies in dental patients on cone-beam computed tomographic images. Contemp Clin Dent 2014;5(3):361.
14. Arslan H. Anatomic variations of the paranasal sinuses: CT examination for endoscopic sinus surgery. Auris Nasus Larynx 1999;26(1):39-48.
15. San T, Erdoğan B, Taşel B. Konka bülloza tipleri ile sinonazal patolojiler arasındaki ilişki. Göztepe Tıp Dergisi 2013;28(3):132-135.
16. Farman AG, Scarfe WC. The basics of maxillofacial cone beam computed tomography. in Seminars in Orthodontics. 2009, Elsevier.
17. Shokri A, Faradmal MJ, Hekmat B. Correlations between anatomical variations of the nasal cavity and ethmoidal sinuses on cone-beam computed tomography scans. Imaging Sci Dent 2019;49(2):103-113.
18. Khojastepour L, Mirhadi S, Mesbahi SA. Anatomical variations of ostiomeatal complex in CBCT of patients seeking rhinoplasty. Int J Dent 2015;16(1):42.
19. Köse E, Canger EM, Bulut DG. Cone Beam Computed Tomographic Analysis of Paranasal Variations, Osteomeatal Complex Disease, Odontogenic Lesion and Their Effect on Maxillary Sinus. Meandros Med Dent J 2018;19(4):310.