



Evaluation of the Prevalence of Concha Bullosa in Cone-Beam Computed Tomography Images

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Abstract

Background: The ostiomeatal complex (OMC) is not a separate anatomical structure although it is a functional unit of structures, including the middle meatus, uncinat process, infundibulum, maxillary sinus ostium, ethmoidal bulla, anterior ethmoid sinus ostium, and frontal recess. Concha bullosa is the pneumatization of the concha, which is one of the most common anatomical variations in the middle turbinate.

Methods: This study was conducted using the cone-beam computed tomography (CBCT) images of 172 patients in the archives of the Department of Oral and Maxillofacial Radiology, Dentistry School, Ahvaz Jundishapur. Patient information including age and gender, presence or absence of concha bullosa, the involved side (left or right), and its type (i.e., extensive, lamellar, and bulbous) were collected in the information form. Finally, the chi-square test (with SPSS, version 22) was used to analyze the data, and *P* value less than 0.05 was considered statistically significant.

Results: Patients with and without concha bullosa were 39.1 and 41.7 years, respectively, but it was no significant difference in terms of age (*P*=0.321). Out of 52 patients with concha bullosa, 19 (36.5%) cases were males and 33 (63.5%) of them were females. The prevalence of concha bullosa was higher for the bilateral side (20 patients, 38.5%, *P*=0.000). The prevalence of bulbous and lamellar-shape was nearly the same (32.7% and 30.8%, respectively). Eventually, the extensive shape with 36.5% was more frequent for the shape of concha bullosa (*P*=0.000).

Conclusions: The prevalence of concha bullosa was high. There was no significant difference in terms of age (*P*=0.321) and gender (*P*=0.058) of patients with concha bullosa. The extensive type and the bilateral appearance of concha bullosa were more significant (*P*=0.000).

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Background

The ostiomeatal complex (OMC) or ostiomeatal unit is not a separate anatomical structure although it is a functional unit of structures, including the middle meatus, uncinat process, infundibulum, maxillary sinus ostium, ethmoidal bulla, anterior ethmoid sinus ostium, and frontal recess (1).

Concha bullosa is the pneumatization of the concha, which is one of the most prevalent anatomical variations in the form of pneumatization in the bone of one of the turbinates (Concha) which often manifests itself as the middle turbinate. This anatomical condition can be unilateral or bilateral (2).

Conventional radiographic techniques have a limited value in showing OMC. Computed tomography (CT) is a method of choice for assessing the morphology of the OMC (3). With the recent introduction of cone-beam computed tomography (CBCT), dentists and ear, nose, and throat (ENT) specialists have been better able to diagnose anatomical abnormalities and pathological

Highlights

- ▶ The prevalence of concha bullosa was high.
- ▶ There was no significant difference in terms of age and gender of patients with concha bullosa.
- ▶ The extensive type and the bilateral appearance of concha bullosa were more significant.

conditions in the structure of the nasal cavity and the surrounding paranasal sinuses (4). CBCT images provide a high-precision dimension and have a lower dose of radiation and metal artifacts compared to multi-detector computed tomography (MDCT) images. CBCT images have a good quality for viewing and examining paranasal sinuses even at the lowest radiation dose.

The presence of septal deviation and concha bullosa plays a role in the development and spread of chronic sinusitis and prevent mucosal outflow (5). This finding is also associated with frontal and temporal headaches (6). The frequency of concha bullosa has been reported from about 20% to more than 95% in some studies (7,8).

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The fluctuating frequency of concha bullosa in different studies can be due to racial differences and the size of the study population. CBCT is an appropriate assessment method for studying the anatomical variations of the OMC and has led to early diagnosis and appropriate treatment following early diagnosis (9). Accordingly, the present study examined the prevalence of concha bullosa in CBCT images in people who referred to Ahvaz Jundishapur University of Medical Sciences.

Materials and Methods

In this descriptive cross-sectional study, the study population was selected by the convenience sampling method, including people referring to the Dental Radiology Department of Ahvaz Jundishapur University of Medical Sciences between August 2018 and August 2019. The study sample consisted of 172 patients in the age range of 10-70 years (2), collected from the archive. CBCT images were produced by NewTom VGI (Verona, Italy) under 110 kVp, 0.65-3.29 mA, and with an exposure time of 3.6-5.4 seconds. All images were evaluated by NNT Viewer software (NewTom, Verona, Italy), version 3.00. The images were independently evaluated by two maxillofacial radiologists although consensus was reached in different cases.

All patients within the age range 10-70 years and having a proper quality image were considered in this study. The patients with a previous history of rhinoplasty, and/or malignant and benign diseases (polyposis masses) in the sinus nasal area were extruded from the study (3).

All CT images on the monitor (Philips 202EL2SB, 20 inches) in the axial section were examined for the presence and type of the pneumatization of the middle concha (concha bullosa) by oral and maxillofacial radiologists. Concha bullosa types were divided into three groups of bulbous (The pneumatization of the onion-shaped part of the middle concha, Figure 1A), lamellar (The pneumatization of the lamellar (base) part of the middle concha, Figure 1B), and extensive (The pneumatization of both the lamellar and bulbous parts of the middle conical, Figure 1C) according to (3). Descriptive statistics such as the mean, standard deviation, and the frequency and the percentage table were used to present the data. In addition, the Chi-square test and independent t-test were performed by SPSS (version 22) and a *P* value less than 0.05 was considered statistically significant.

Results

The collected data were analyzed statistically from all 172 patients, 52 (30.2%) cases had concha bullosa while 120 (69.8%) of them did not have concha bullosa; Therefore, the prevalence of concha bullosa in these patients was 30.2%. According to the data in Table 1, the mean age in patients with and without concha bullosa was 39.1 and 41.7 years, respectively. Patients with concha bullosa were younger compared to those without concha bullosa, but it

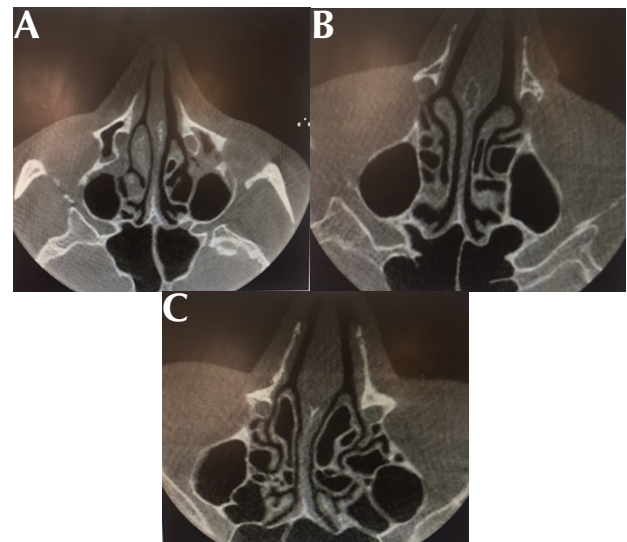


Figure 1. (A) Bulbous-Type, (B) Lamellar-Type and (C) Extensive-Type Concha Bullosa in CBCT Axial Section. Note. CBCT: Cone-beam computed tomography.

was no significant difference ($P=0.321$) between the two groups regarding age (Table 1).

As shown in Table 2, out of 172 studied patients, 75 (56.4%) cases were males and 97 (43.6%) of them were females. Out of 52 patients with concha bullosa, 19 (36.5%) and 33 (63.5%) cases were males and females, respectively, indicating a higher prevalence of concha bullosa in women. Of the 120 patients with no concha bullosa, 56 (46.7%) and 64 (53.3%) of them were males and females, respectively. Chi-square test results showed no significant difference in terms of gender between patients with and without concha bullosa ($P>0.05$).

The data on the frequency of the side of different types of concha bullosa are provided in Table 3. The prevalence of concha bullosa was higher for the bilateral side (20 patients, 38.5%, $P=0.000$). Based on the results, the prevalence of bulbous- and lamellar-shape was approximately the same (32.7% and 30.8%, respectively). Finally, the extensive shape with 36.5% was more frequent for the shape of concha bullosa ($P=0.000$).

Discussion and Conclusion

Concha bullosa, which is one of the most common anatomical variations, often manifests itself as pneumatization inside the bone of one of the turbinates (Concha), often the middle turbinate. This anatomical condition can be of unilateral or bilateral type (2).

Conventional radiographic techniques have limited values in examining this site. CT is a method of choice for assessing the morphology of the OMC (3). The recent introduction of CBCT has facilitated the diagnosis of anatomical abnormalities and pathological conditions in the structure of the nasal cavity and the surrounding paranasal sinuses for dentists and ENT specialists (4). CBCT images provide a high-detail, high-precision

Table 1. Prevalence of Concha Bullosa in Age-Based Cone-Beam Computed Tomography Radiographs

	With Concha Bullosa		Without Concha Bullosa		Total		P Value
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	
Age	39.1	15.3	41.7	15.9	40.9	15.7	0.321

Table 2. Frequency for the Gender of Different Types of Concha Bullosa

		With Concha Bullosa			Total	P Value
		Bulbous-Shape	Lamellar-Shape	Extensive-Shape		
Gender	Female	Number	15	9	9	0.058
		Percent	28.9	17.3	17.3	
	Male	Number	2	7	10	
		Percent	3.8	13.5	19.2	

Table 3. Frequency for the Side of Different Types of Concha Bullosa

		The Side of Concha Bullosa			Total	P Value
		Bulbous-Shape	Lamellar-Shape	Extensive-Shape		
Right	Number	7	5	4	16	0.000
	Percent	13.5	9.6	7.7	30.8	
Left	Number	6	4	6	16	
	Percent	11.5	7.7	11.5	30.7	
Left & Right	Number	4	7	9	20	
	Percent	7.7	13.5	17.3	38.5	

view and have lower radiation doses and metal artifacts compared to MDCT images. CBCT images are of good quality for viewing and assessing paranasal sinuses even at the lowest radiation dose. This descriptive cross-sectional study was performed retrospectively using the CBCT images of 172 patients, including 75 males and 97 females. After examining the images, concha bullosa was observed in 30.2% of patients, which was more in women than men, but there was no significant difference in this regard. The age of people with concha bullosa was lower compared to those without concha bullosa although there was no significant difference in this respect. Concha bullosa cells were more bilateral and extensive and there was a significant difference in this regard.

Abesi et al (8) in their study in Iran concluded that concha bullosa was one of the most common variations of paranasal sinuses mostly reported bilaterally in images, which is consistent with the bilateral prevalence in the present study.

In addition, Hatipoğlu et al (3) reported a prevalence of 70.58% for concha bullosa while the prevalence of concha bullosa in the present study was 30.2%. In the above-mentioned study, 76 patients with the symptoms of sinusitis and headache were included, while the presence of clinical symptoms was not considered in this study and the difference in prevalence is probably due to differences in the type of samples.

Smith et al (10) found a concha bullosa prevalence of 67.5%, which is higher than that of the present study. This

difference can be attributed to the higher sample size and the racial differences of the studied populations.

Based on the results of Kucybała et al (11), the prevalence of concha bullosa was 42.1%, which is almost consistent with the result of the present study (30.2%), which can be due to the almost identical sample size and the applied sampling method.

In their study, Budu et al (2) reported a higher prevalence of concha bullosa in women than men, which corroborates with the finding of the present study. They also concluded that concha bullosa was the most common finding (63.67%) among patients with the pathological findings of OMC. The samples of the present study were evaluated from the archive without considering the pathological symptoms, which could indicate a difference in the prevalence percentage obtained in the above-mentioned study.

Hatipoğlu et al (3) showed the prevalence of concha bullosa frequently on the right while in the present study, it was frequently of bilateral type. They reported the most common type of concha bullosa, which is in line with the result of the present study.

Based on the report by Kalabalık et al (12), the prevalence of concha bullosa in Turkey in 2018 was 52.8% and it was frequently of bilateral type. Among unilateral cases, the most common form of concha bullosa was the lamellar type. In the present study, subjects with concha bullosa were frequently of bilateral and extensive type.

In some studies (3,10,11), CT scan images were used

for examinations. In a recent study, CBCT images were used, which in addition to providing images with the same quality as CT, imposes a lower dose on the patient, which is one of the strengths of the research.

Our analyses revealed that the prevalence of concha bullosa was significantly high and there was no significant difference among the patients in terms of gender. Concha bullosa cells were frequently of extensive-shaped, bilateral type. According to our analysis, there was a significant relationship between concha bullosa and the site of involvement and the appearance of concha bullosa. People with concha bullosa were younger than those without concha bullosa, but there was no significant difference in this regard.

Conflict of Interest Disclosures

The authors declare that they have no conflict of interests.

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Ethical Statement

This study was approved by the Research Ethics Committee of Ahvaz Jundishapur University of Medical Sciences (Code: IR.AJUMS.REC.1398.480).

Authors' Contribution

Design of the work: NS, BS. Data collection: NS, ZS. Data analysis and interpretation: NS, BS. Drafting the article: NS, BS, and ZS. Critical revision of the article: NS and BS.

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