

AN EXTENDED STUDY ON CONCHA BULLOSA SUBTYPES KONKA BÜLLOZA ALT TIPLERİ ÜZERİNE GENİŞLETİLMİŞ BİR ÇALIŞMA

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Geliş Tarihi / Received: 05.11.2020
Kabul Tarihi / Accepted: 11.11.2020

Araştırma Makalesi/Research Article
DOI: 10.38065/euroasiaorg.356

ABSTRACT

To determine the concha bullosa subtypes and their possible associations with chronic sinusitis, osteomeatal complex obstruction, mucosal thickening and other sinonasal anatomic variations, in a large group of patients with concha bullosa.

This retrospective study was conducted between January 2019 and March 2020 in two different institutions. The paranasal CT sections and medical records of 850 patients (1700 sides) were evaluated, and the association of concha bullosa subtypes with other sinonasal variations like chronic sinusitis, osteometal complex obstruction and mucosal thickening was investigated.

Concha bullosa was observed in 430 (25.2%) of 1700 sides. Of 430 bullous conchas, 160 were bilateral (37%), 245 were on the right (56.9%), 185 were on the left (43.1%). Extensive type in 202 sides, bulbous type in 118 sides and lamellar type in 100 sides were observed. A significant association of extensive type concha bullosa with chronic sinusitis (p: 0.025), osteometal complex obstruction (p: 0.043) and septum deviation was found (p: 0.013). Additionally, a significant association of lamellar type concha bullosa with female gender (p: 0.021) and of bulbous type concha bullosa with osteomeatal complex obstruction (p: 0.038) was evident. The most frequent anatomical variation was septal deviation, found in (73.1%) 256 of 350 patients with concha bullosa.

The frequency of chronic sinusitis, osteomeatal complex obstruction and septal deviation were significantly higher in extensive type concha bullosa than in the other subtypes. Familiarity of surgeons and radiologists with concha bullosa subtypes might be important for determining the treatment algorithm during endoscopic sinus surgery.

Keywords: Chronic sinusitis; concha bullosa subtype; osteomeatal complex; paranasal sinus tomography; sinonasal variation.

ÖZET

Konka bülloza alt tiplerinin; kronik sinüzit, osteomeatal kompleks obstrüksiyonu, mukozal kalınlaşma ve diğer sinonazal anatomik varyasyonlarla olası ilişkilerini geniş bir hasta grubunda incelemek.

Bu retrospektif çalışma Ocak 2019 ile Mart 2020 tarihleri arasında gerçekleştirildi. 850 hastanın (1700 taraf) paranazal BT kesitleri ve tıbbi kayıtları değerlendirildi ve tespit edilen konka bulloza alt tiplerinin kronik sinüzit, osteometal kompleks tıkanıklığı ve mukozal kalınlaşma gibi diğer sinonazal varyasyonlarla ilişkisi araştırıldı.

Konka bülloza, 1700 tek taraflı kesidin 430'unda (% 25.2) gözlendi. 430 bülloz konka'nın 160'ı bilateral (% 37) izlenirken, 245'i sağda (% 56.9), 185'i solda (% 43.1) izlendi. Ekstensif, bülböz ve lamellar konka sayıları sırasıyla 202, 118 ve 100 bulunmuştur. Ekstensif konka bülloza ile kronik sinüzit (p: 0,025), osteometal kompleks obstrüksiyon (p: 0,043) ve septum deviasyonu (p: 0,013) arasında anlamlı bir ilişki bulundu. Ek olarak, lamellar tip konka bülloza ile kadın cinsiyet (p: 0.021) arasında anlamlı bir ilişki izlenirken bülböz konka bülloza ile osteomeatal kompleks obstrüksiyonu (p: 0.038) arasında anlamlı bir ilişki belirlendi. Konka büllozası olan hastalarda ek olarak en sık görülen anatomik varyasyon 256 hastada bulunan septal deviasyondu.

Yaygın tip konka bülloza'da kronik sinüzit, osteomeatal kompleks tıkanıklığı ve septal deviasyon sıklığı diğer alt tiplere göre anlamlı olarak daha yüksekti. Cerrahların ve radyologların konka bülloza alt tiplerine aşinalıkları, endoskopik sinüs cerrahisi sırasında tedavi algoritmasının belirlenmesinde önemli olabilir.

Anahtar Kelimeler: Kronik sinüzit; konka bülloza alt tipi; osteomeatal kompleks; paranazal sinüs tomografi; sinonazal varyasyon.

1. INTRODUCTION

Concha bullosa (CB) is a bilateral or unilateral pneumatization disorder commonly seen in the middle concha but can also be observed in the lower and upper concha (Zinreich, 1993). The incidence of CB was reported between 13% and 53.6% in the prior literature (Maru, 2000-Bharathi, 2010-Bolger, 1993).

Chronic sinusitis (CS) is a chronic disease that lasts at least 12 weeks and is characterized by nasal congestion, decreased smell, runny nose and nasal discharge, and pressure and pain on the face. One of the characteristic significations of chronic sinusitis is the obstruction of osteomeatal complex (OMCO) in paranasal computed tomography (CT). Osteomeatal complex (OMC) consists of ethmoid infundibulum, uncinate process, hiatus semilunaris, frontal recess, anterior ethmoid cells and maxillary sinus ostium and serves as a common drainage pathway for frontal, maxillary and anterior ethmoid sinuses (Earwaker, 1993). A possible obstruction in OMC can affect all these structures (Stammberger, 1988).

CB is usually asymptomatic, but sometimes it can obstruct OMC, impair sinus drainage and sinus ventilation, thereby can cause sinusitis. CB can be categorized as three groups by reference to the region of the aeration disorder. Aeration disorder occurring in the vertical part of the turbinate is referred to as lamellar type of CB, aeration disorder occurring in the lower part of the turbinate is referred to as bulbous type, and the aeration disorder occurring together both in the vertical part and lower region of the turbinate is referred to as extensive type of CB. CB can cause symptoms like headache, facial pain, facial congestion, nasal congestion, cessation of nasal breathing and smelling, and postnasal discharge by blocking OMC and sinus drainage (Stammberger, 1988).

Mucosal thickening (MT) of the sinus tissue can occur in any inflammation. Thickening up to 1-2 mm can be seen in 63% of the people with no complaint; but the mucosal thickening over 4 mm may be associated with symptomatic sinusitis (Capelli, 2016).

The studies focusing on the association between CB and sinonasal anomalies are available in the previous literature, however, to the best of our knowledge, no studies thus far have investigated the associations of CB considering the subtypes in detail (Tiwari, 2019-Turner, 1991-Yousem, 2010, Lam 1995). Our retrospective investigation aimed at determining the association of each CB subtype with chronic sinusitis, OMC, MT and other sinonasal anatomical variations.

2. MATERIAL AND METHODS

This is a retrospective study conducted using the medical archives of Ankara Yenimahalle Government Hospital and İstanbul Kartal Lutfi Kırdar City Hospital between January 2019 and March 2020.

Patients admitted to outpatient clinic with the complaints of headache, facial pain, facial congestion, nasal congestion, cessation of nasal breathing and smelling and postnasal discharge were included in the study.

The medical records and the paranasal CT sections of 850 patients were evaluated retrospectively. Excluded from the study were the patients under the age of 18 years, the patients with a history of sinonasal/facial surgery, paranasal sinus malignances and any sinonasal congenital anomalies.

In this study, a 140 kV and 200 mU multi-plane CT was used (GE bright speed 16 section, Chicago, Illinois, USA). The cross-sectional thickness was 0.65 mm and the image area was 20X20 cm.

This study was performed in line with the principles of the Declaration of Helsinki. Approval was granted by the Ethics Committee of Yildirim Beyazıt University (2020/ No 126).

CB traced coronal scans were differentiated according to the CB subtype observed in the section and examined in detail by reference to the presence of chronic sinusitis, OMCO, MT and any additional anatomical variation.

The CB subtypes were classified as extensive, bulbous and lamellar based on the classification of Bolger (Bolger, 1993). In addition to the CB types, the signs of OMCO and MT over 4 mm inside the sinuses were examined in the sections. These findings were accepted as chronic sinusitis findings. In addition, additional anatomical sinonasal variations and accompanying CB subtypes were noted. The association of concha bullosa subtypes with other sinonasal variations like chronic sinusitis, osteometal complex obstruction and mucosal thickening was investigated.

2.1. Statistical Analysis

All analyses were performed on SPSS 15.0 software for Windows (SPSS Inc., Chicago, IL, USA). The distribution pattern of the data was investigated using Kolmogorov-Smirnov test with Lilliefors correction was used. Data are given as median (minimum - maximum) for continuous variables and frequency (percentage) for categorical variables. Non-normally distributed variables were compared with the Mann Whitney U test. Categorical variables were evaluated by using Chi-square tests. Two-tailed p-values of less than 0.05 were considered statistically significant. Results were evaluated at 95% confidence interval.

3. RESULTS

3.1 Age, gender and side characteristics of the study

CB was detected in 430 (35%) of 1700 PNS-CT sections from 350 of 850 patients. The mean age of the patients with CB was 37.25 ± 8.42 (range: 18-65) years. Of 350 patients with CB, 224 were female (64%) and 126 (36%) were male. The frequency of lamellar type CB was significantly higher in females than in males ($p= 0.021$). The frequencies of lamellar and extensive CB were significantly higher on the right sides compared to the left sides. Of 430 CB scans (in total of one side and bilateral), 245 were on the right side (56.9%), 185 were on the left side (43.1%). Of 240 patients, 80 (22.8%) had bilateral CB.

3.2 Frequency of the CB subtypes

In all sections, 202 Extensive (46.9%), 118 bulbous (27.4%) and 100 lamellar (23.2%) CBs were observed.

3.3 Other sinonasal variations seen with CB

As additional sinonasal variations, 22 mucopyoceles, 31 nasal polypsis, 13 inverted papillomas, and 256 (73.1%) septum deviations were observed. The most common additional anatomic variation was septum deviation accompanying CB (Table.1).. A significant association of extensive CB with septal deviation was evident ($p= 0.013$)

3.4 Correlation of CB subtypes with CS, OMCO and MT

Chronic sinusitis accompanied 254 (59%); OMCO accompanied 180 (41.8%) and MT accompanied 73 (16.9%) of CBs. Of 254 CBs accompanied CS, 138 were extensive, 62 were bulbous and 54 were lamellar type. The frequency of CS was statistically higher in the extensive type CB ($p=0.025$), compared to the other types.

Of 180 CBs accompanied OMCO, 85 were extensive, 60 were bulbous and 25 were lamellar type. A statistically significant association of OMCO was evident with extensive ($p=0.043$) and bulbous type CB ($p=0.038$).

In addition, 24 of the 73 CBs accompanying MT were extensive, 29 were bulbous and 20 were lamellar. MT was not significantly associated with any subtype of CB (Table 2).

4. DISCUSSION

The osteo-meatal complex is formed by the structures of the lateral nasal wall including ethmoid infundibulum, uncinate process, hiatus semilunaris, frontal recess, anterior ethmoid cells, maxillary sinus ostium and middle turbinate (Zinreich, 1990). This region is important for the drainage of the frontal, maxillary and anterior ethmoid sinuses. Anatomical variations in this area are important factors for inflammatory sinus pathologies. The most common anatomic variation of the osteomeatal region is CB, the pneumatization disorder causing sinonasal inflammation in the middle turbinate (Ünlü, 1994). Therefore, a detailed investigation of CB subtypes might provide information about this anatomical variation. CB can be diagnosed by detecting a partial or complete air space within the oval bone ring upon visual examination of coronal CT sections. In this study, the variety of CB subtypes and the associations of CB subtypes with the other sinonasal anatomic variations like MT, CS and OMCO were investigated. Compiling data of medical records of the patients along with reviewing CT findings, we found that the mean age of the patients 37.25 ± 8.42 years. Unlike previous publications and females in our study population were more likely to have CB (64% vs 36%) (Bolger, 1991-Lam, 1995-Nadas, 1995). In addition, the frequency of lamellar type CB showed a gender difference, being more likely to present in females. However, other CB subtypes showed no gender difference.

In the prior literature, the incidence of CB has been reported between 13% and 53.6% (Maru, 2000-Bharathi, 2010-Bolger, 1993). In our study, this incidence was found to be 35%. In a CT scan study by Kalaiarasi et al., (Kalaiarasi, 2018) 49% extensive, 28% bulbous, 22% lamellar CBs were detected. Unlike this publication, our study included much more CBs from more patients from two different institutions (430 CBs from 350 patients) and we detected 202 extensive (47%), 118 bulbous (28%) and 100(25%) lamellar type CBs.

The incidence of bilateral CB was reported quite higher as 54.7% by Dewaraja et al. (Dewaraja, 2019). In our study, we found the incidence of bilateral CB lower as 22.8%. Moreover, our evidence showed that lamellar and extensive type CBs were more likely to present on the right side.

Among our study population, 22 patients had mucopyoceles compressing the surrounding tissues and narrowing the orbital region. Physicians should pay attention to this variation since it can infect surrounding tissues, especially the orbit. Septum deviation was observed in 256 patients (73.1%) as the most common additional sinonasal variation in patients. Our results showed that septal deviation commonly coexists with CB, consistent with the prior literature (Sazgar, 2008- Javadrashid, 2014-Hamdan, 2001). Additionally, we found a significant association between the extensive type CB and septum deviation.

Chronic sinusitis is another clinic entity that might be associated with CB. According to our analysis, a significant association was observed between extensive type CB and chronic sinusitis. Moreover, extensive type CB was associated with OMCO. OMCO was more common in patients with extensive type CB, compared to those with bulbous and lamellar type CB. However, there was no significant association between CB subtypes and MT (thickness over 4mm) (Capelli, 2017).

There exist many studies investigating the association of CB with sinusitis and other anatomical structures, but the number of studies focusing on the association of the subtypes of CB with CS, MT, OMCO, and/ or other anatomical variations is quite limited (Stallman, 2004- Fadda, 2012- Aramani, 2014). Although provides the associations of CB subtypes with many sinonasal anatomic variations, this study had a certain limitation that endoscopic examination of the patients was not applicable because of the retrospective nature of the study. Further prospective- multicenter studies including endoscopic examination results of the patients are needed.

5. REFERENCES

1. Aramani A, Karadi RN, Kumar S. A study of anatomical variations of osteomeatal complex in chronic rhinosinusitis patient-CT findings. *J Clin Diagn Res* 2014;8:01–04
2. Bharathi MB, Mamtha H, Prasanna LC. Variations of ostiomeatal complex and its applied anatomy: a CT scan study. *Indian J Sci Technol* 2010;3:904–907
3. Bolger WE, Butzin CA, Parson DS. Paranasal sinus bony anatomic variations and mucosal abnormalities; CT analysis for endoscopic sinus surgery. *Laryngoscope* 1991;101:56–64
4. Capelli M, Gatti P. Radiological Study of Maxillary Sinus using CBCT: Relationship between Mucosal Thickening and Common Anatomic Variants in Chronic Rhinosinusitis. *J Clin Diagn Re* 2016;10:7-10
5. Devaraja K, Doreswamy SM, Pujary K, et al. Anatomical Variations of the Nose and Paranasal Sinuses: A Computed Tomographic Study. *Indian J Otolaryngol Head Neck Surg* 2019;71:2231-2240
6. Earwaker J. Anatomic variants in sinonasal CT. *Radiographics* 1993;13:381–415
7. Fadda GL, Rosso S, Aversa S, et al. Multiparametric statistical correlations between paranasal sinus anatomic variations and chronic rhinosinusitis. *Acta Otorhinolaryngol Ital* 2012;32:244–251
8. Hamdan AL, Bizri AR, Jaber M, et al. Nasoseptal variation in relation to sinusitis: A computerized tomographic evaluation. *J Med Liban* 2001;49:2–5
9. Javadrashid R, Naderpour M, Asghari S, et al. Concha bullosa, nasal septal deviation and paranasal sinusitis; A computed tomographic evaluation. *B-ENT* 2014;10:291–298
10. Kalaiarasi R, Ramakrishnan V, Poyyamoli S. Anatomical Variations of the Middle Turbinate Concha Bullosa and its Relationship with Chronic Sinusitis: A Prospective Radiologic Study. *Int Arch Otorhinolaryngol* 2018;2:297–302
11. Lam WWM, Liang EY, Woo KS, et al. The Etiological Role of Concha Bullosa in Chronic Sinusitis. *Eur Radiol* 1995; 6: 550-52.
12. Maru YK, Gupta Y. Concha bullosa: frequency and appearance on sinonasal CT. *Indian J Otolaryngol Head Neck Surg* 2000;52: 40–44
13. Nadas S, Duvoisin B, Landry M, et al. Concha bullosa: Frequency and appearances on CT and correlations with sinus disease in 308 patients with chronic sinusitis. *Neuroradiology* 1995;37:234-37
14. Sazgar AA, Massah J, Sadeghi M, et al. The incidence of concha bullosa and the correlation with nasal septal deviation. *B-ENT* 2008;4:87-91
15. Stallman JS, Lobo JN, Som PM. The incidence of concha bullosa and its relationship to nasal septal deviation and paranasal sinus disease. *AJNR Am J Neuroradiol* 2004;25:1613–1618
16. Stammberger H, Wolf G. Headaches and sinus diseases: the endoscopic approach. *Ann Otol Rhinol Laryngol* 1988;97:3–23

17. Tiwari R, Goyal R. Role of Concha Bullosa in Chronic Rhinosinusitis. *Indian J Otolaryngol Head Neck Surg* 2019; 71:128-131
18. Turner AL (1927) Disease of the nose, throat and ear for practitioners and students, 2nd edn. John Wright and Sons, Bristol, p 17 (quoted by—Bolger WE, Butzin CA, Parson DS (1991)
19. Unlü HH, Akyar S, Caylan R, et al. Concha bullosa. *J Otolaryngol* 1994;23:23-27
20. Yousem DM. Imaging of sinonasal inflammatory disease. *Radiology* 1993Aug; 19(2):303–3014(quoted by Vincent TES, Gendeh B S. The association of concha bullosa and deviated nasal septum with chronic rhinosinusitis in functional endoscopic sinus surgery patients:Med J Malaysia Vol 65No 2 June 2010;105-111)
21. Zinreich J. Imaging of inflammatory sinus disease. *Otolaryngol Clin North Am* 1993;26:535–547
22. Zinreich SJ. Paranasal sinus imaging. *Otolaryngol Head Neck Surg* 1990;103:863–868.

Figure 1: Concha bullosa(CB) subtypes in coronal sections in paranasal sinus tomography
 a:Bulbous CB, b:Lamellar CB, c:Extensive CB.



Table.1: Distrubution of other anatomic formations seen with concha bullosa.

Anatomical variations and pathological situations seen with CB	Number (of 350 patients)	Percentage
Septum deviation	256	%73.1%
Nasal polyposis	31	%8.8
Conchal muco/pyocele	22	%6.2
Inverted papillom	13	%3.7
Haller cell	61	%17.4
Onodi cell	50	%14.2
Agger nasi cell	113	%32.2

Table 2: The relation between subtypes of CB and incidence of sinusitis, obstruction of OMC and MT.

CB subtypes	Chronic Sinusitis N (%)	P value	Obstruction in OMC N (%)	P value	Mucosal Thickening N (%)	P value
Extensive CB (n:202)	138 (68.3%)	0.025	85 (32.1 %)	0.043	24 (11.8%)	0.079
Bulbose CB (n:118)	62 (52.5%)	0.064	60 (50.8 %)	0.038	29 (24.5%)	0.074
Lamellar CB (n:100)	54 (54%)	0.058	25 (25 %)	0.075	20 (20%)	0.086
Total	254		170		73	