

# The Role of Concha Bullosa in the Pathogenesis of Chronic Otitis Media\*

M. Zafer UĞUZ MD<sup>1</sup>, Kazım ÖNAL MD<sup>1</sup>, Ali DENİZ MD<sup>1</sup>, Seçil ARSLANOĞLU MD<sup>1</sup>

## ÖZET

**Objectives:** To search for the incidence of concha bullosa in patients with chronic otitis media and find whether it is a predisposition. **Material and Method:** This is a prospective study carried out in patients with chronic otitis media (COM) and the control group who admitted to 1st Otorhinolaryngology Clinic of İzmir Atatürk Training and Research Hospital, between April 2000-June 2001. 156 individuals (78 controls, 78 patients) were included in the study. The patient group was evaluated with temporal and paranasal sinus computed tomography (CT) scans whereas the control group was evaluated with paranasal sinus CT scans. Concha bullosa rates were noted for both groups. The site of the concha bullosa was assessed. The results of the Valsalva maneuvers in cases with/without concha bullosa in the patient and the control group were compared. **Results:** Thirty-nine (50%) of the 78 patients with COM had concha bullosa. In patients with chronic otitis media on the right side, concha bullosa was on the same side in 4 (5.1%) patients, on the opposite side in 2 (2.6%) patients and bilateral in 8 (10.3%) patients. In patients with (COM) on the left side, 4 (5.1%) had concha bullosa on the same side, 4 (5.1%) had on the opposite side and 5 (6.4%) had it bilaterally. Valsalva maneuver was negative in 42.3% of the patient and 20.5% of the control group. **Conclusions:** Concha bullosa is agreed to have an important role in paranasal sinus infections. The impact of paranasal sinus infections on middle ear diseases is well known. Consequently, concha bullosa is a factor of predisposition for the middle ear infections.

## Anahtar Kelimeler

Konka bülloza  
Kronik otitis media  
Kronik sinüzit

## Key Words

Concha bullosa  
Chronic otitis media  
Chronic sinusitis

## Kronik Otitis Media Patogenezinde Konka Bullozanın Rolü

**Amaç:** Kronik otitis mediasi olan hastalarda konka bülloza insidansını aramak ve otitis medianın predispozisyon yaratıp yaratmadığını araştırmak. **Gereç ve Yöntem:** Nisan 2000-Haziran 2001 tarihleri arasında İzmir Atatürk Eğitim ve Araştırma Hastanesi 1. KBB Kliniği'ne başvuran kronik otitis medialis hastalarla, kontrol grubu üzerinde sürdürülmüş prospektif bir çalışmadır. Çalışmaya 78'i hasta, 78'i kontrol olmak üzere 156 birey dahil edilmiştir. Hasta grubu temporal ve paranasal sinüs tomografileri ile değerlendirilirken, kontrol grubu paranasal sinüs tomografisi ile araştırılmıştır. Her iki grup için konka bülloza oranları ve konka büllozanın hangi tarafta olduğu belirlenmiştir. Her iki grupta konka büllozası olan ve olmayanlarda Valsalva manevrası sonuçları karşılaştırılmıştır. **Bulgular:** Kronik otitis medialis hastaların 4'ünde (%5.1) aynı tarafta, 2'sinde (%2.6) karşı tarafta, 8'inde (%10.3) her iki tarafta konka bülloza mevcuttu. Sol kronik otitis medialis hastaların

<sup>1</sup> First Department of Otorhinolaryngology, İzmir Atatürk Training and Research Hospital  
İzmir

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4'ünde (%5.1) aynı tarafta, 4'ünde (%5.1) karşı tarafta ve 5'inde (%6.4) bilateral konka bülloza mevcuttu. Valsalva manevrası hastaların %42.3'ünde, kontrol grubunun %20.5'inde negatifti. **Sonuç:** Konka büllozanın paranasal sinüs enfeksiyonlarının gelişmesinde önemli rolü olduğu üzerinde görüş birliği mevcuttur. Paranasal sinüs enfeksiyonlarının orta kulak hastalıkları üzerine etkisi de iyi bilinmektedir. Sonuç olarak konka büllozanın orta kulak enfeksiyonları için predispozan bir faktör olduğunu söyleyebiliriz.

## INTRODUCTION

Chronic otitis media is one of the infectious diseases seen widely.<sup>1,2</sup> Eustachian tube dysfunction has a significant influence on the pathogenesis of otitis media.<sup>3,4</sup> Many patients with middle ear diseases have eustachian tube dysfunction beforehand.<sup>5</sup> Mostly, there are ventilation disorders in the middle ear due to eustachian tube dysfunction in chronic otitis media.<sup>6</sup>

Concha bullosa is an anatomic variation that is encountered very often. Any abnormality which results in narrowing of the ostiomeatal complex (OMC) increases the risk of infection, especially in the anterior group of paranasal sinuses.<sup>7,8,9,10</sup> Infected materials from the paranasal sinuses drain into the middle meatus and then to the nasopharynx and cause edema, congestion and inflammation around the orifice of the eustachian tube and in the levator and salpingopharyngeal folds. As a result, intrinsic organic obstruction in tubal orifice occurs and middle ear ventilation is impaired.<sup>3,11,12</sup>

Staphylococcus aureus, pseudomonas aeruginosa, peptostreptococci, streptococci and bacteroides species are the microorganisms most frequently encountered in chronic sinusitis.<sup>8</sup> Similarly, Pseudomonas aeruginosa, proteus mirabilis, staphylococcus aureus, staphylococcus epidermidis, peptostreptococci, peptococci and bacteroides species are most commonly isolated microorganisms in chronic otitis media.<sup>4</sup>

## MATERIAL AND METHODS

This study was performed on 78 patients with (COM) and 78 healthy subjects (control group) who admitted to the 1st Otorhinolaryngology Service of İzmir Atatürk Training and Research Hospital, between April 2000-June 2001.

Otoscopic and anterior rhinoscopic examination, Valsalva maneuver, audiologic tests, temporal

and paranasal computed tomography (CT) scans were carried out in patients with chronic otitis media.

The patients of the control group with normal tympanic membranes were evaluated by anterior rhinoscopy, Valsalva maneuver and paranasal sinus CT scans.

Temporal bone CT images were obtained in the axial plane, parallel to the orbitomeatal line from the termination of mastoid cells cranially, to the mastoid tip caudally, of 2 mm thick sections at 2 mm intervals (table advancement distance). The radiation dose was 120 kV and 140 mA and they were evaluated in bone algorithm, and in some cases with soft tissue algorithm.

Paranasal sinus CT scans were performed in the coronal plane, from the anterior wall of the frontal sinus to the posterior wall of the sphenoid sinus, with 5 mm thick sections and 5 mm of table advancement distance. They were performed with a dose of 120 kV and 110 mA and were assessed using bone and soft tissue algorithms.

CT scans were obtained with HITACHI W950SR.

Fischer and chi-squared test were used in the statistical analysis.

## RESULTS

The study population consisted of 156 individuals (78 patients and 78 from the control group) of which 69 were men and 87 women. Patients age ranged from 10 years to 85 years (mean 35) whereas the control group age ranged from 8 years to 70 years (mean 34). In the patient group female/male ratio was approximately 2/1 while it was 1/1.5 for the control group.

COM was right-sided in 25 patients (32%), left-sided in 29 patients (37.2%) and bilateral in 24 patients (30.8%).

**Table 1. Concha bullosa rates in patients with chronic otitis media**

	Right	Left	Bilateral	TOTAL
Right COM	5.1%	2.6%	10.3%	18%
Left COM	5.1%	5.1%	6.4%	16.6%
Bilateral COM	1.3%	3.8%	10.3%	15.6%
TOTAL	11.5%	11.5%	27%	50%

COM: Chronic otitis media

**Table 2. Results of the Valsalva maneuver in the patient group with/without concha bullosa**

Patient group	Valsalva (+)	Valsalva (-)	TOTAL
Concha bullosa (+)	17 (43.6%)	22 (56.4%)	39 (100%)
Concha bullosa (-)	28 (71.8%)	11 (28.2%)	39 (100%)
TOTAL	45 (57.7%)	33 (42.3%)	78 (100%)

**Table 3. Results of the Valsalva maneuver in the control group**

Control group	Valsalva (+)	Valsalva (-)	TOTAL
Concha bullosa (+)	11 (14.1%)	11 (14.1%)	22 (27.6%)
Concha bullosa (-)	5 (6.6%)	51 (65.4%)	56 (71.8%)
TOTAL	16 (20.5%)	62 (79.5%)	78 (100%)

CT scans obtained in coronal planes in 78 patients with COM revealed concha bullosa in 39 patients (50%) of which 21 (27%) were bilateral, 18 (23%) were unilateral. The unilateral ones were on the right in 9 (11.5%) and on the left in 9 (11.5%) patients. Among the patients with COM on the right side 4 had concha bullosa ipsilaterally, while 2 (2.6%) had contralaterally and 8 (10.3%) had bilaterally. In patients with COM on the left side concha bullosa was on the same side in 4 (5.1%), on the opposite side in 4 (5.1%) and bilateral in 5 (6.4%) patients. In patients with bilateral chronic otitis media 8 (10.3%) had concha bullosa bilaterally, 1 (1.3%) had on the right side and 3 (3.8%) had on the left side (**Table 2**).

Valsalva maneuvers were negative in 33 (42.3%) patients who had chronic otitis media. In this group concha bullosa was present in 22 patients (**Table 2**).

In the control group 22 patients (28.2%) had concha bullosa. Concha bullosae were right-sided in 5

patients (6.4%), left-sided in 7 patients (8.9%) and bilateral in 10 patients (12.8%). Valsalva maneuvers were negative in 16 individuals (20.5%) of which 11 had concha bullosa (14.1%) while the remaining 5 had no concha bullosae (6.4%) (**Table 3**).

The comparison of concha bullosae and the results of Valsalva maneuvers in the patient and control groups are shown in **Table 4**.

Concha bullosa types defined by CT scan and their ratios in the patients with COM and in the control group are shown in **Table 5**.

Association between chronic sinusitis and concha bullosa in patients with COM is shown in **Table 6**.

Biopsies from the middle turbinates of the control group were compared with the materials taken out from the patients in whom lateral lamina resections were performed due to concha bullosa.

The histopathologic examination of the specimen

**Table 4. Comparison of the data from the patient and control group**

	Concha bullosa (+)	Concha bullosa (-)	Valsalva (-)	Valsalva (+)	TOTAL
Patient group	39 (50%)	39 (50%)	33 (42.3%)	45 (57.7%)	78 (100%)
Control group	22 (28.2%)	56 (71.8%)	16 (20.5%)	62 (77.6%)	78 (100%)
TOTAL	61 (39.1%)	95 (60.9%)	49 (31.4%)	107 (67.1%)	156 (100%)

**Table 5. Ratios for the types of concha bullosa in the patient and the control group**

	Vertical lamellar	Bullbous	Extensive
Control group	36.4%	40.9%	22.7%
Patient group	51.3%	38.5%	10.2%
TOTAL	43.8%	39.7%	16.5%

**Table 6. Association of concha bullosa and chronic sinusitis**

Patient group	Chronic sinusitis (+)	Chronic sinusitis (-)
Concha bullosa (+)	23 (58.9%)	16 (41.1%)
Concha bullosa (-)	7 (17.9%)	32 (82.1%)

taken from the healthy turbinates revealed seromucous glands and occasional vascular structures in the lamina propria located beneath the pseudostratified respiratory epithelium (**Figure 2**).

In the histopathologic examination of the specimen from the concha bullosa manifest increase in vascular structures and seromucous glands in lamina propria beneath the pseudostratified respiratory epithelium is observed.

The pathologic findings and differences were noteworthy in both of the groups.

## DISCUSSION

CT is one of the important diagnostic tests in determining the mucosal pathologies and anatomic variations of the bony structures of paranasal sinuses. OMC has a significant role in the inflammatory diseases of paranasal sinuses. All the abnormalities which result in narrowing or obstruction of OMC (mucosal or conchal hypertrophy, septal deviations, polyps, tumors, foreign bodies, anatomic variations mainly the concha bullosa) block the ventilation of the sinuses,

drainage of secretions, and induce the development of anaerobic milieu and mucociliary function disorders, therefore create appropriate medium for the generation of microorganisms in the sinuses.<sup>8</sup>

Chronic sinusitis is characterized by accumulation of mucus and disturbance of mucociliary activity due to ostial obstruction rather than an infectious process. According to Kennedy, chronic sinusitis is primarily a disorder of obstruction and colonization of bacteria secondarily.<sup>13</sup> Likewise, in chronic otitis media colonization of bacteria secondary to impairment in the middle ear pneumatization due to eustachian tube obstruction occurs rather than primary bacterial colonization.<sup>3,6,11,12</sup>

Ventilation of the middle concha and particularly the fact that the large concha bullosa might exert pressure on the uncinat process, obstruct the infundibulum and middle meatus, and act as a predisposition for sinusitis have been shown in many studies.<sup>7,8,9,10</sup>

Zinreich et al. have shown that 79% of the patients with concha bullosa had OMC disease.<sup>14</sup>

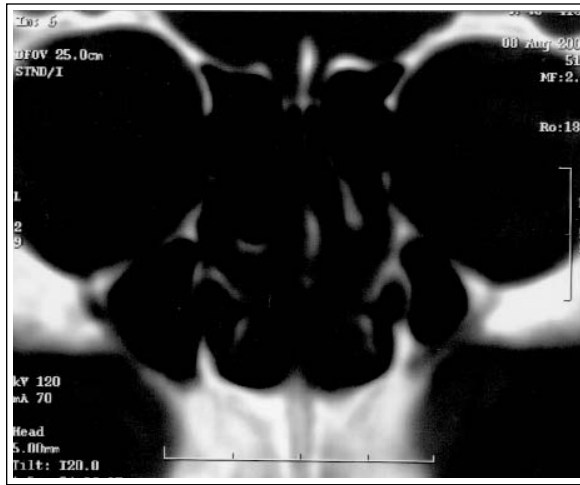


FIGURE 1a. Vertical type.



FIGURE 1b. Bulbous type.



FIGURE 1c. Extensive type.

In this study, 58.9% of the patients with COM and concha bullosa had OMC disease and mucosal changes in paranasal sinuses whereas patients with COM who had no concha bullosae 17.9% had OMC disease and mucosal changes in the paranasal sinuses. We found no pathology in OMC and in the paranasal sinus mucosa in 41.1% of the patients with concha bullosa and in 82.1% of patients without concha bullosae. The incidence of OMC disease and mucosal changes in paranasal sinuses was statistically higher in patients with concha bullosa compared with patients who had no concha bullosae ( $p < 0.01$ ) (Table 6).

Lloyd et al. showed asymptomatic sinus infections

on CT in 11 patients of 14 who had this anomaly. They also found that among the anatomic variants only concha bullosa is associated with high incidence of paranasal sinus infections (85%).<sup>10</sup>

Eustachian tube has a strategic role for the middle ear infections whereas OMC is significant for paranasal sinus infections. In COM usually there is a ventilation disorder in the middle ear due to eustachian tube obstruction/dysfunction.<sup>3,5,6,11,15</sup> In this study we found that Valsalva maneuver was negative in 33 (42.3%) patients of 78 patients with COM. Of these 33 patients 22 had (66.6%) concha bullosa while 11 (33.4%) had no concha bullosae (Table 2). Statistical analysis revealed that the incidence of negative Valsalva in COM patients with concha bullosa was significantly higher than those who had no concha bullosae ( $p < 0.05$ ).

It has been shown that OM with effusion is present in 23% of the patients with chronic sinusitis. The role of paranasal sinus infections in middle ear diseases has been proven by several studies, and there is an indirect relationship between COM and chronic sinusitis.<sup>11,12</sup> Moreover, the most frequently isolated microorganisms from both the infections of the middle ear and the paranasal sinuses are *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Peptostreptococci* and *Bacteroides* species.<sup>4,8</sup>

A great majority of patients with anatomic varia-

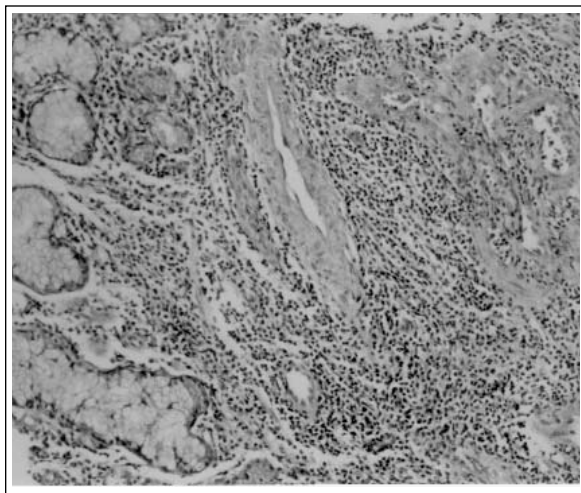


FIGURE 2. Healthy conchal tissue.

tions on the lateral nasal wall has been diagnosed as tubal dysfunction previously. In the development of recurrent otitis media due to eustachian tube dysfunction and subsequent otitis media with effusion purulent posterior rhinorrhea has been held responsible.<sup>11</sup> We found asymptomatic chronic sinusitis in 30 patients (38.5%) among the patient group. In these patients we found that eustachian tube dysfunction has been developed as a result of edema and inflammation at the eustachian tube orifice due to postnasal drainage, and Valsalva maneuver was negative in 33 (42.3%) patients of 78 patients with COM.

Zinreich et al. showed concha bullosae in 34% of the cases which were evaluated by paranasal sinus CT.<sup>14</sup> Lloyd et al. found the ratio of concha bullosa as 14% for the control group.<sup>10</sup> In this study, we accepted every middle turbinate of any type and pneumatization as concha bullosa and took those into consideration. In the current study, total number of concha bullosae among 156 patients was 61 (39.1%). Thirty-nine of them (63.9%) were from the patient group with COM, 22 were from the control group (36.1%). The difference between the incidence of concha bullosa in the patient and control group was statistically significant ( $p < 0.05$ ).

Concha bullosa was present in 18% of patients with right-sided COM, 16.6% of patients with left-sided COM and 15.4% of patients with bilateral COM. There was not a statistically signifi-

cant difference ( $p < 0.05$ ) between the patients for the incidence of concha bullosa.

Moreover, there was no correlation between the location of COM and the site of concha bullosa and the difference was not significant statistically ( $p < 0.05$ ).

Zinreich et al. showed 45% bilateral, 55% unilateral concha bullosae.<sup>14</sup> The incidence of concha bullosa between the patient and the control group showed no statistically significant difference between bilateral and unilateral location nor between the sites of the concha bullosae in unilateral cases ( $p < 0.05$ ).

In cases of the patient and control group the incidence of negative Valsalva maneuver was higher and the difference was significant statistically ( $p < 0.05$ ).

## CONCLUSION

Eustachian tube dysfunction is present in the majority of the patients with COM. Nasal and paranasal pathologies cause eustachian dysfunction directly or indirectly.

The incidence of concha bullosa in patients with COM was significantly higher when compared statistically with the incidence of concha bullosa in the control group. Negative Valsalva incidence was higher in patients with concha bullosa for the patient and the control group.

Concha bullosa is a factor of predisposition for paranasal sinus infections and consequently the middle ear infections. The effective treatment of all diseases require primarily the management of the etiologic factors if they are already known. Therefore concha bullosa must be searched in patients with COM and if it is found turbinoplasty must be performed prior to COM surgery.

### Correspondence Address:

Dr. M. Zafer Uguz  
108/25 Sok. No:4/5 35350 Esenyali, Izmir  
Tel: 0232 231 62 52, 0232 285 10 31  
Fax: 0232 243 48 48  
e-mail: mzuguz@hotmail.com

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