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Relation of Concha Bullosa and Chronic Sinusitis: Our Experiences at a Tertiary Care Teaching of Eastern India

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ABSTRACT

Background: Chronic sinusitis is an important health issue often seen in daily clinical practice. Concha bullosa is an anatomical variation found in patients which leads to chronic sinusitis. Concha bullosa is hypertrophied pneumatized middle turbinate which obstructs the drainage of the anterior group of paranasal sinuses into the stomatal complex and nasal cavity.

Objective: To study the role of concha bullosa in patients with chronic sinusitis.

Materials and Methods: This is a prospective cross-sectional study. This study was done between December 2019 to February 2021 at a tertiary care teaching hospital in eastern India.

Result: There were 118 patients with middle turbinate concha bullosa were detected. The mean age of the patients in this study was 32 years with an age range from 1 to 70 years. There were 67 males and 51 females with a male to female ratio of 1.3:1. Out of 118 concha bullosa, 54 (45.76%) were found on the right side, 41(34.74%) on the left side, and 23 on both sides (19.49%). Out of the 118 cases of concha bullosa, lamellar type was found in 36 cases (30.50%), bulbous type in 44 cases (37.28%) and extensive in 38 cases (32.20%).

Conclusion: The middle turbinate is considered a possible causative factor for chronic sinusitis.

Keywords: Chronic sinusitis, middle turbinate concha bullosa, osteomeatal complex, deviated nasal septum, paranasal sinus, computed tomography.

INTRODUCTION

There are numerous anatomical variations found in the sinonasal tract and often detected in computed tomography (CT) scans of the paranasal sinus (PNS). Concha bullosa is often asymptomatic and found incidentally by CT scan. Concha bullosa is hypertrophied pneumatization of the concha and the most common anatomical variation found in the sinonasal anatomy.¹ Middle turbinate concha bullosa is commonly encountered inside the nasal cavity. It is rarely seen in the inferior and superior turbinate. Sometimes over pneumatized middle turbinate results in nasal obstruction, contact headache deviated nasal septum, and chronic sinusitis.² The concha bullosa may be unilateral or bilateral and can be classified into three types as per the site of pneumatization. They are lamellar type (vertical lamella of middle turbinate pneumatization), bulbous type (an inferior portion of middle turbinate pneumatization), and extensive

type (vertical lamella and inferior part of the middle turbinate).³ The concha bullosa can cause mechanical obstruction and interfere in the drainage pathway of the paranasal sinuses leading to sinusitis.⁴ The exact understanding of the anatomical variations of the concha bullosa helps plan appropriate treatment. The exact role of the middle turbinate concha bullosa for causing chronic sinusitis is always in question and there is dissensus on the relationship between the sinus pathology such as chronic sinusitis and middle turbinate concha bullosa. Although the incidence of middle turbinate pneumatization or concha bullosa has been described in the literature, however to our knowledge, no study has been evaluated middle turbinate concha bullosa and its relations to chronic sinusitis in this region. In worldwide, there are also very few research works done on pneumatization and anatomical variation of the middle turbinate concha bullosa resulting in chronic sinusitis. We sought to analyze the incidence of concha bullosa and its

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manifestations including chronic sinusitis at a tertiary care teaching hospital in eastern India.

MATERIALS AND METHODS

This is a prospective cross-sectional study done at a tertiary care teaching hospital between December 2019 to February 2021. This study was approved by the Institutional ethical committee (IEC) with reference number IEC/IMS/ SOA/65/12.10.2019. All participants gave written consent for this study. One hundred eighteen patients were endoscopically and radiologically diagnosed as having middle turbinate concha bullosa. All these participants were evaluated with diagnostic nasal endoscopy and CT scan of the nose and paranasal sinuses. In this study, the presence of the middle turbinate concha bullosa, sinusitis, deviated nasal septum, and bulla ethmoidal of the participants were confirmed by diagnostic nasal endoscopy and CT scan of the paranasal sinuses. Patients diagnosed with acute sinusitis, malignancy of the sinonasal tract, and previously undergone nasal or sinus surgery (endoscopic or open) were excluded from this study.

STATISTICAL ANALYSIS

All the statistical analyses were done by using SPSS software version 23.0 (IBM Corporation, 2015, USA).

RESULT

There were 118 patients enrolled in this study with a diagnosis of middle turbinate concha bullosa. Out of 118 patients, there were 67 males and 51 females with a male to female ratio of 1.3:1. The majority of the patients of middle turbinate concha bullosa were found in the age group 21 to 30 years followed by the age group of 11 to 20 years and least in the age group more than 60 years (Table.1). The most common symptom was nasal obstruction (77.96%) followed by headache (49.15%) and hyposmia (43.22%) (Table. 2). The common anatomical variants seen with middle turbinate concha bullosa have deviated nasal septum (40.67%) followed by enlarged bulla ethmoidal (32.20%) (Table. 2). Out of the 118 patients of middle turbinate concha bullosa, 72 (61.01%) showed sinusitis in CT scans of the paranasal sinuses. Out of 118 patients with concha bullosa, 54 (45.76%) were found on the right side, 41 (34.74%) on the left side, and 23 (19.49%) were found on both sides (Fig.1) of the nasal cavity (Table.3). The most common type of concha bullosa was bulbous type (37.28%) followed by extensive (32.20%) and lamellar type (30.50%) (Table.4). Out of 72 patients with chronic sinusitis (Fig.2, 33 had both DNS and concha bullosa. The concha bullosa was significantly found on the opposite side of DNS (38 patients) than on the same side to

DNS (10 patients) in the study group with a p-value <0.001. There was an air column between the medial aspect of concha bullosa and adjacent DNS in 41 cases while there was no air column in 7 cases with a p value <0.001 which is significant (Chi-square test). The most common paranasal sinus involved was maxillary sinus, followed by anterior ethmoid sinus and sphenoid sinus was least commonly involved (Table.2).

DISCUSSION

Sinonasal diseases are serious illnesses of the human being that hampers the daily life of a person and result in morbidity and mortality.⁵ Preoperative assessment of the osteomeatal complex is important for providing effective treatment of the sinonasal disease. The osteomeatal complex is the part of the middle meatus where the frontal, maxillary and ethmoidal sinus drain.⁶ Any pathology in osteomeatal complex obstruct the drainage of the anterior group of paranasal sinuses which result in sinusitis.⁶ Currently diagnostic nasal endoscopy and computed tomography (CT) scan are the methods of choice for preoperative evaluation of the osteomeatal complex in the sinonasal tract.⁷ There are many authors who have done a study on the relationship between the anatomical variations of the sinonasal tract and incidence of the sinusitis. The presence of Haller cells has been reported to vary from 2 to 45% and few reports have shown a statistically significant relationship between the medium or large Haller cells and sinusitis.⁸ However, it is thought that the presence of a Haller cell is not related to sinusitis.⁹ The presence of agger nasi cells has been reported to vary from 3 to 100% and its presence has been strongly associated with frontal sinusitis.⁹ The incidence of Onodi cells varies from 3.4 to 51%. Although the presence of the Onodi cells is not associated with sinusitis, its presence does not pose an increased incidence of surgical complications.¹⁰ In the medical literature, there are anatomical variations of the sinonasal tract such as middle turbinate concha bullosa about chronic sinusitis are not adequately discussed. Concha bullosa refers to the hypertrophied and pneumatized turbinates. Pneumatization of the middle turbinate is usually called concha bullosa. Large middle turbinate concha bullosa often impinges to the osteomeatal complex and hamper the drainage to the anterior groups of sinuses such as maxillary, frontal, and ethmoidal sinuses and result in sinusitis. Concha bullosa is the commonest variation of the sinonasal tract in routine clinical practice. The incidence of the middle turbinate concha bullosa in CT scan of the paranasal sinus varies from 14% to 53% and the relationship of the concha bullosa to the paranasal sinus disease such as sinusitis continues to be debated.¹¹ Pneumatization of the middle turbinate concha is often occurs via the anterior ethmoidal cells. The pneumatization of the middle turbinate by the posterior ethmoidal air cells or both anterior and posterior air cells is also reported. The concha bullosa ostium mostly drains into the frontal recess and less commonly into the adjacent air

cells through the basal lamina and into the hiatus semilunaris.¹² The middle turbinate is a part of the ethmoidal labyrinth and it has several functions. It provides a baffle that deflects inspired air superiorly towards the olfactory fossa, gives moisture to the inspired air, laminates nasal air flow and direct expired air into the middle meatus, and helps in the aeration of the paranasal sinuses. The middle turbinate concha bullosa is a common anatomical variant of the nasal cavity near the osteomeatal complex and is implicated as an etiology for chronic sinusitis.

Stammerger suggested two hypotheses for the origin of the middle turbinate concha bullosa.¹³ First hypothesis suggests, DNS gives a large contralateral concave nasal space (e vacuo) for hypertrophy of the middle turbinate leading to concha bullosa development. The second hypothesis tells, concha bullosa of the middle turbinate and deviated nasal septum are two incidental coexisting features.¹³ This study is opposing the e vacuo hypothesis as concha bullosa was not statistically more likely to result in DNS to the opposite side and there is no statistical relationship between one side or both concha bullosa with DNS. One study stated a statistically significant relationship between the DNS and one side but not both sides concha bullosa.¹⁴ In this study, deviated nasal septum is associated with middle turbinate concha bullosa. There were 40.67% cases of the concha bullosa associated with a deviated nasal septum in this study.

In literature, there is a slight preponderance of female sex of the chronic rhinosinusitis with anatomical changes of the sinonasal part with female to the male ratio between 55 to 60% against 40 to 45%.¹⁵ Middle turbinate hypertrophy or concha bullosa can be found in all age ranges, most probably reflects its embryological development from ethmoidal air cells. However, its clinical presentations occur at different age groups later on by influences of the allergic manifestations, trauma, environmental effect, etc. In this study, the concha bullosa was more common in the male sex in comparison to females. In this study, the concha bullosa is common in the age group of 21 to 30 years. Unilateral middle turbinate concha bullosa is commoner than bilateral concha bullosa.¹⁶ In this study, unilateral middle turbinate concha bullosa is more common than bilateral. Right side concha bullosa was found in 45.76% of cases and left side concha bullosa in 34.74% of cases in this study. Bilateral middle turbinate concha bullosa was found in 19.49% of cases in this study.

Middle turbinate concha bullosa commonly affects approximately 35% of the population.¹⁷ Concha bullosa is the commonest anatomical variation found nearby the osteomeatal complex and often refers to the middle turbinate concha bullosa. The pneumatization of the middle turbinate occurs due to variations of the ethmoidal air cell systems development. The pneumatization of the middle turbinate is between 13 to 53.6%.¹⁸ It has been thought as an etiological factor for caus-

ing recurrent sinusitis. The mechanism for causing sinusitis by concha bullosa remains unknown. In concha bullosa, the mucociliary transport is usually towards the conchal ostium found on the anterosuperior aspect of the middle turbinate. The concha bullosa has deleterious nasal physiology which results in obstruction of the osteomeatal complex. Because of Bernoulli's effect on airflow in region close approximation of the mucosal surface, dryness occurs with impaired mucociliary clearance and negative effect on the ventilation of the paranasal sinuses leading to the local inflammatory process. Large concha bullosa directly impinge to the maxillary sinus ostium and result in chronic rhinosinusitis and many others could be small concha bullosa and considered physiologically insignificant. One study showed that the size, not the simple presence of the normal variations is a critical factor.¹⁹ Most of the concha bullosa is asymptomatic. There is a strong association between the concha bullosa and sinusitis in this study. Concha bullosa is a common anatomical variation found in the general population. It may be found in one or both nostrils. Middle turbinate may or may not be associated with the deviated nasal septum. The pneumatization of the middle turbinate is divided into three types such as bulbous, lamellar, and extensive type. In bulbous type, pneumatization occurs at the bulbous segment of the middle turbinate. In the lamellar type of concha bullosa, pneumatization occurs at the vertical lamella of the middle turbinate whereas, in the extensive type of concha bullosa, pneumatization occurs at the vertical and bulbous portion of the middle turbinate. In our study, bulbous type of middle turbinate concha bullosa was seen in 37.28% cases, extensive types were seen in 38.20% cases and lamellar type was found in 30.50% cases.

Current data suggests that concha bullosa cannot result in chronic sinusitis solely by inducing the changes in the mucosal linings and that blockage of osteomeatal complex may be associated with the pathogenesis of sinusitis. This obstruction is usually anticipated in the case of large/giant concha bullosa.²⁰ Large concha bullosa is a feature of bulbous and extensive rather than lamellar types.²¹ Presence of an air column between the deviated nasal septum and concha bullosa excludes the etiological role of concha bullosa in nasal septal deviation.²² In this study, the commonest symptom was nasal obstruction (77.96%). The deviated nasal septum was associated in 40.67% of cases and chronic sinusitis in 61.01% of cases.

CT scan of the sinonasal area is an important technique for assessment of the concha bullosa of the middle turbinate, other anatomical changes of the nose and paranasal sinuses along with sinusitis.²³ Coronal view of CT scan of the nasal cavity and paranasal sinuses are often used by the clinicians because of its mimicking with the surgical findings. In this study, all cases of the concha bullosa of the middle turbinate were evaluated by a CT scan of the nose and para-

nasal sinuses. The diagnostic nasal endoscopic examination will confirm the CT scan findings. There are three passes to completely evaluate the nasal cavity including anatomical variations. Any anatomical variations of the nasal cavity are easily diagnosed in a short time in the outpatient department. So preoperative CT scans of the paranasal sinuses and diagnostic endoscopy are very valuable for effective diagnosis and followed by treatment. The treatment options of all these cases were endoscopic sinus surgery for sinusitis and middle turbinate canthoplasty for concha bullosa.²⁴

CONCLUSION

Concha bullosa of the middle turbinate is a common anatomical variation found in the nasal cavity. It is frequently associated with pathology adjacent to the osteomeatal complex such as chronic sinusitis. Chronic sinusitis is a fairly common disease affecting the most commonly the age group between 21 and 30 years. It is best diagnosed by imaging such as a CT scan of the paranasal sinus. The coronal CT scan of the paranasal sinuses is a useful preoperative investigation that accurately defines the microanatomy of the osteomeatal complex and its relationship with middle turbinate concha bullosa. Functional endoscopic sinus surgery is an ideal technique to control chronic sinusitis and restore the function of the ostium and middle turbinate. The above study concluded that concha bullosa plays a major role in the development of chronic sinusitis. The knowledge about anatomical variations of the sinonasal tract has a clinical significance as it reduces the chance of surgical complications. Further studies of anatomical variations with clinical manifestations are required.

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Authors Contribution:

1. Prof. Santosh Kumar Swain: Concept, designing of Manuscript, data collection and Analysis of Data; 2. Dr. Satyabrata Acharya: Collection of Data; 3. Dr. Swaha Panda: Tabulation of data and drafting.; 4. Dr. Ruchi Bhuyan: Data collection and drafting.

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Figure 1: CT scan of the paranasal sinus (coronal cuts) showing bilateral middle turbinate concha bullosa.

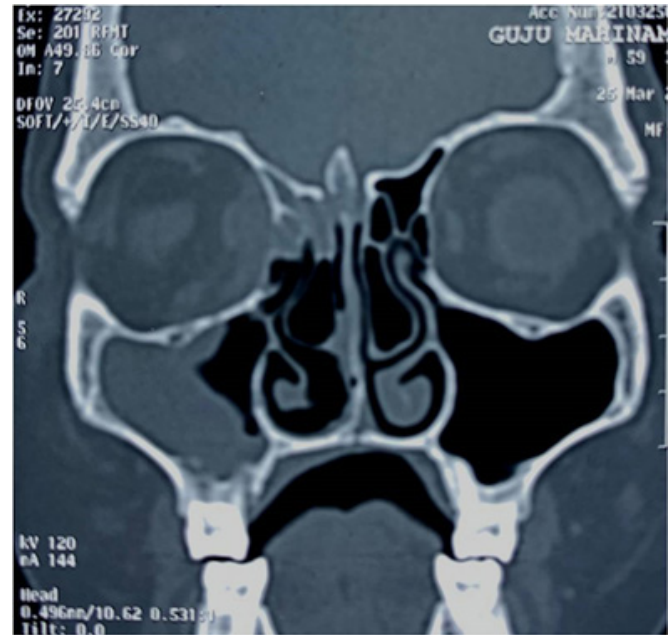


Figure 2: CT scan of the paranasal sinus (coronal cuts) showing middle turbinate concha bullosa along with right side maxillary sinusitis.

Table 1: Age and sex distribution among the study population

Age ranges	Male	Female	Total
1-10	7	5	12
11-20	13	10	23
21-30	18	12	30
31-40	11	10	21
41-50	10	6	16
51-60	6	3	9
61-70	2	5	7
Total	67	51	118

Table 2: Clinical associations and anatomical variants with middle turbinate concha bullosa (n=118)

Clinical associations	Number of patients	Percentage (%)
Nasal obstruction	92	77.96
Headache/facial pain	58	49.15
Hyposmia	51	43.22
Deviated nasal obstruction	48	40.67
Bulla ethmoidal	38	32.20
Chronic sinusitis (Maxillary:38,ethmoid:25,sphenoid:9)	72	61.01

Table 3: Laterality of the concha bullosa

Laterality	Number	Percentage (%)
Right side	54	45.76
Left side	41	34.74
Bilateral	23	19.49

Table 4: Types of concha bullosa

Types	Number	Percentage (%)
Lamellar	36	30.50
Bulbous	44	37.28
Extensive	38	32.20