AETIOLOGICAL ROLE OF CONCHA BULLOSA IN PARANASAL SINUSES INFLAMMATORY DISEASES

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ABSTRACT

BACKGROUND

The approach to patients with chronic rhinosinusitis has been changed with arrival of endoscopic functional surgery of paranasal sinuses and nasal cavity. Computed tomography has become indispensable to surgical planning since it allows a detailed study of the whole structure of this region. Paranasal sinuses and nasal cavity anatomical variants are usual findings with estimated prevalence of 65% on CT scans. Concha bullosa is a result of pneumatisation of the osseous plate of the middle turbinate due to ethmoidal extension is one of the commonest variant. It may occur at several degrees from that affecting only the bulbous portion (distal) or lamellar portion (proximal) or true variation where there is pneumatisation of both portions. It has been postulated that the enlarged middle turbinate has a negative influence on sinus ventilation and mucociliary clearance in ostiomeatal unit.

Objective of the study is:

1. To estimate incidence of concha bullosa, its types, laterality and pathology within.
2. To evaluate contribution of concha bullosa in pathogenesis of inflammatory sinus disease.
3. To estimate incidence of associated anatomical variations.

MATERIALS AND METHODS

Study included 100 patients from Department of ENT, Gandhi hospital, Secunderabad. 50 patients with sinusitis who underwent endoscopic sinus surgery were included into study group. 50 patients who had nonsinogenic pain were included into control group. CT scan and endoscopic preoperative findings were noted and evaluated using Fisher test.

RESULTS AND CONCLUSIONS

This study showed incidence of concha bullosa as 43% with male preponderance and higher incidence among middle aged (20-40 years). Intralamellar type of concha bullosa was commonest in the study. Right laterality was commonly seen among concha bullosa patients. Absence of inferior turbinate hypertrophy was strongly associated with presence of concha bullosa. Maxillary and ethmoid sinusitis were the associated sinus inflammation noticed in the study. Study also showed low recurrence rate in patients who underwent conchoplasty.

KEYWORDS

Concha Bullosa, Maxillary Sinusitis, Ethmoid Sinusitis, Concha Bullosa Reduction Procedure.

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BACKGROUND

Concha bullosa is of the commonly occurring anatomical variant in nose and paranasal sinus region. Some authors insist that concha bullosa plays a role in recurrent sinusitis by compressing the uncinate process and obstructing or narrowing the infundibulum and the middle meatus.[1]

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It has been stated that when concha bullosa fills the space between the septum and the lateral nasal wall, there may be total obstruction of the middle meatus orifice. Concha bullosa is the pneumatisation of the middle turbinate and is one of the most common variations of the sinonasal anatomy. A 14% - 53.6% frequency of concha bullosa was reported by various studies. Pneumatisation of the middle turbinate regardless of the amount and the location was defined as concha bullosa.[2,3]

Bolger et al[4] Have Classified Pneumatisation of the Middle Turbinate Based on the Location as Follows

a. Lamellar concha bullosa.
b. Bulbous concha.
c. Extensive or true concha.

The most frequent site of origin is the frontal recess. Pneumatisation may also originate in the agger nasi.

Concha bullosa reduction procedures: Types:

1. Conchoplasty.
2. Partial turbinectomy.
3. Lateral turbinectomy.
4. Crushing.

MATERIALS AND METHODS

Source of data collection: Collection of data is from the Department of ENT, Gandhi Hospital, Secunderabad, during the period of 3 years from May 2012 to April 2015.

Inclusion Criteria

Study group- Patients of age more than 10 years with 12 weeks or more of signs and symptoms of chronic rhinosinusitis.

Control Group

Patients with age more than 10 years and with a history of sinogenic headache or facial pain of more than a week were included in the control group.

Exclusion Criteria

Patients with acute sinusitis, nasal allergies, nasal mass, previous history of sinonasal surgeries and age <10 years were excluded.

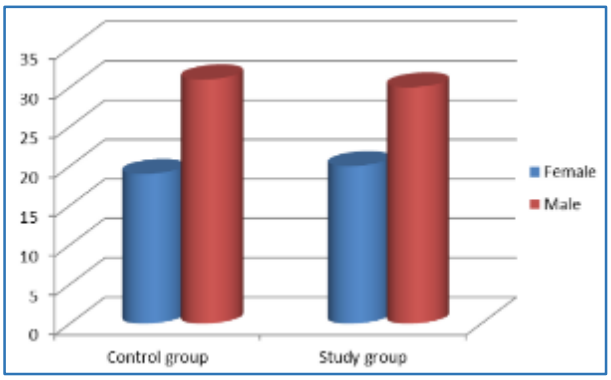
Method of Study

50 patients who were diagnosed to have chronic rhinosinusitis clinically, which was confirmed with CT scan and were posted for functional endoscopic sinus surgery were included in the study group and 50 patients who presented with nonsinogenic facial pain or headache and were evaluated with CT scan of paranasal sinus region were included in control group. Subjects were selected randomly. Data was collected in a pretested proforma for both control and study group who met the objectives of the study. Patients of study group who underwent functional endoscopic sinus surgery where anatomical variations were collected were followed up and their improvement was clinically assessed.

OBSERVATIONS AND RESULTS

Sex	Female	Male	Total
Control group	19	31	50
Study group	20	30	50
Total	**39**	**61**	**100**

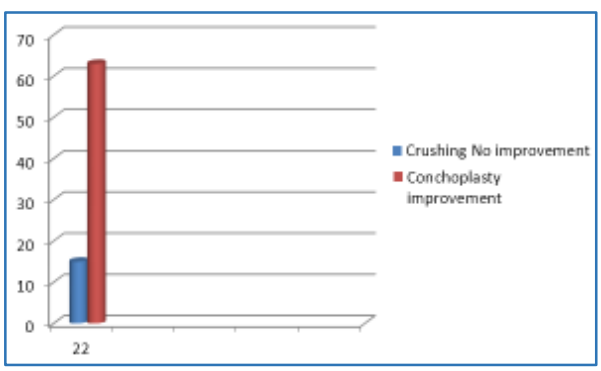
Table 1. Sex Distribution



Graph 1. Sex Distribution

Age Group in Years	Control Group	Study Group	Total
11-20 yrs.	6	12	18
21-30 yrs.	16	17	33
31-40 yrs.	20	12	32
41-50 yrs.	4	8	12
>50 yrs.	4	1	5
Total	**50**	**50**	**100**

Table 2. Age Distribution



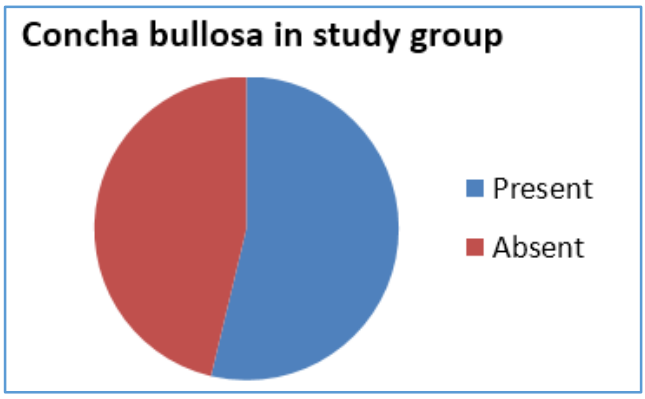
Graph 2. Age Distribution

Concha Bullosa		
	Present	**Absent**
Control group	16 (37%)	34
Study group	27 (63%)	23
Total	**43**	**57**

Table 3. Incidence of Concha Bullosa in Study and Control Group

P value: 0.0428, significant.

There was a significant association between presence of concha bullosa in study and control group. The incidence of concha bullosa in study group was higher than control group.



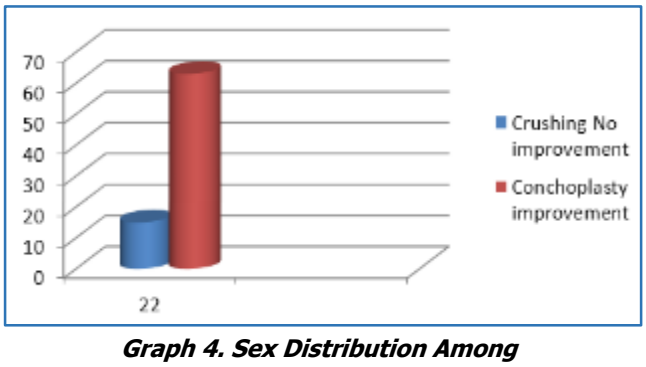
Graph 3. Incidence of Concha Bullosa in Study Group

Sex	Control Group	Study Group	Total
Male	11	15	26
Female	5	12	17
Total	16	27	43

Table 4. Sex Distribution Among Concha Bullosa Patients

P value: 0.9, not significant.

There was no statistical significant association between sex distribution and presence of concha bullosa highlighting that the higher incidence of concha bullosa among means was by chance.



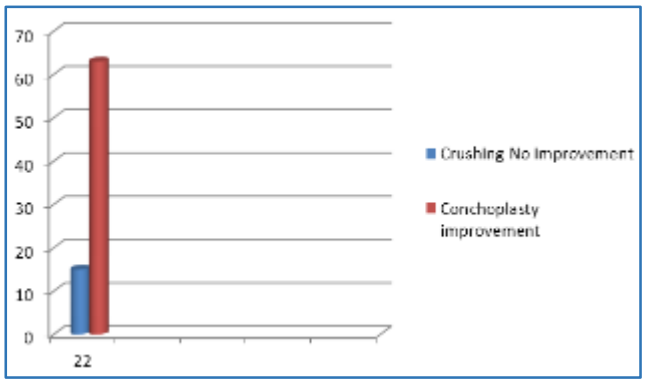
Graph 4. Sex Distribution Among Concha Bullosa Patients

Age Groups in Years	Control Group	Study Group	Total
11-20 yrs.	5	4	9
21-30 yrs.	3	9	12
31-40 yrs.	4	11	15
41-50 yrs.	4	2	6
>50 yrs.	0	1	1
Total	**16**	**27**	**43**

Table 5. Age Distribution Among Concha Bullosa Patients

P value: 0.61, not significant

A non-significant association was observed between age groups and presence of concha bullosa in the study.

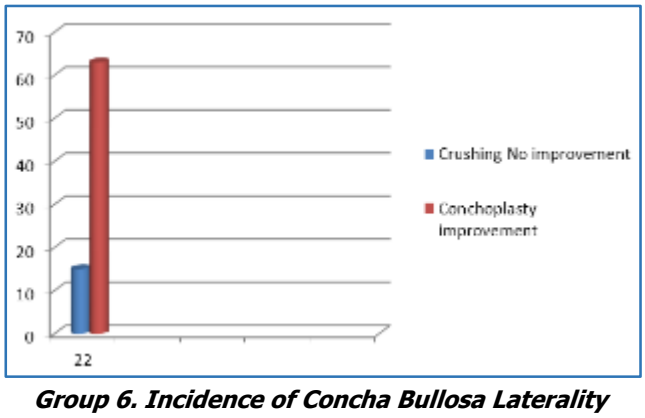


Graph 5. Age Distribution Among Concha Bullosa Patients

Concha Bullosa Laterality	Control Group	Study Group	Total
Bilateral	5	6	11
Right	7	13	20
Left	4	8	12
Total	**16**	**27**	**43**

Table 6. Incidence of Concha Bullosa Laterality

The incidence of right laterality of concha bullosa was higher in both study and control group. Bilateral concha bullosa lowest incidence.

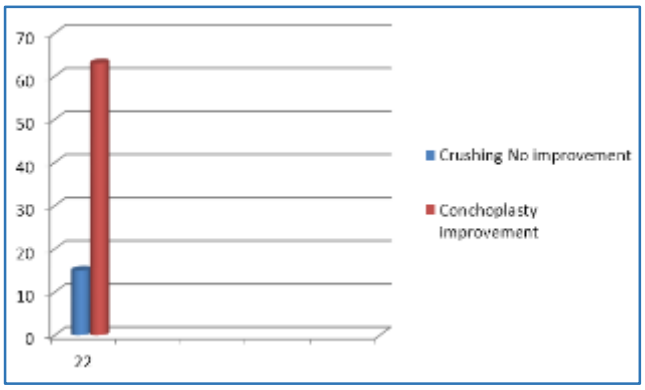


Group 6. Incidence of Concha Bullosa Laterality

Type	Control Group	Study Group
Interlamellar	11	14
Bulbous	8	11
True	0	3

Table 7. Incidence of Types of Concha Bullosa

Interlamellar type of concha bullosa was the commonest variant in the study followed by bulbous and true variety.

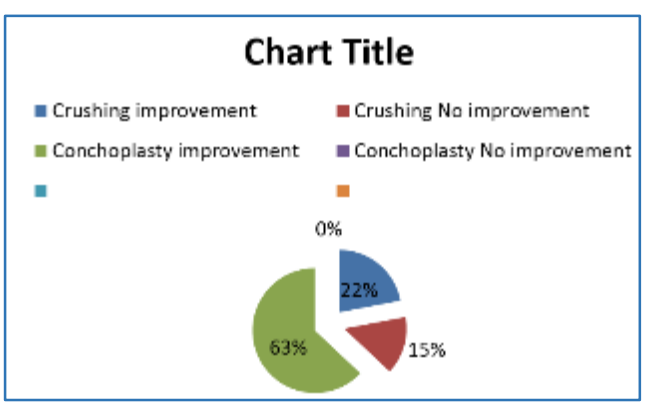


Graph 7. Incidence of Types of Concha Bullosa

Pathology Within Concha Bullosa	Number
Absent	20
B/L oedematous mucosa	1
U/L oedematous mucosa	2
U/L mucoid discharge	2
B/L mucoid discharge	1
U/L pus	1
Total	**27**

Table 8. Incidence of Pathology Within Concha Bullosa

Majority of these didn't show pathology within concha bullosa. All the 7 patients who showed pathology were among subjects of the study group. Oedematous mucosa and mucoid discharge was the commonest pathology noted.



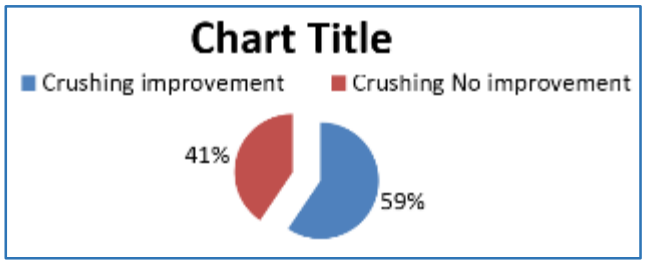
Graph 8. Incidence of Pathology Within Concha Bullosa

Concha Bullosa	Hypertrophied inferior turbinate		
	Present	**Absent**	**Total**
Present	2	41	43
Absent	29	28	57
Total	**31**	**69**	**100**

Table 9. Concha Bullosa and Hypertrophied Inferior Turbinate

P value: 0.0001, significant.

There was a strong association noted between presences of concha bullosa and absence of hypertrophied inferior turbinate. The postulated reason maybe that pneumatisation of middle turbinate is compensatory to wide nasal cavity created on the contralateral side of deviated nasal septum.



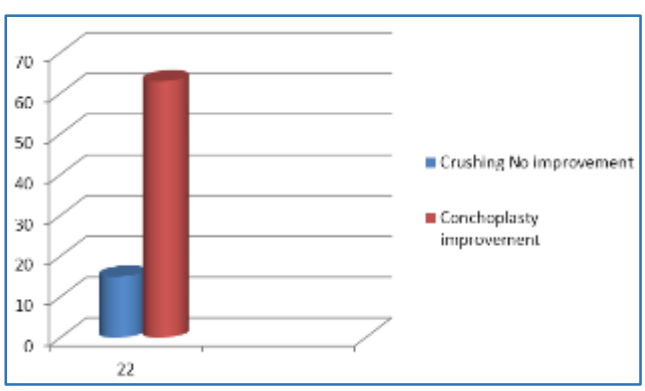
Graph 9. Concha Bullosa and Hypertrophy Inferior Turbinate

	Control Group	Study Group	Total
Septum deviated (All were deviated to contralateral side)	15	27	42
Septum central	1	0	1
Total	**16**	**27**	**43**

Table 10. Concha Bullosa and Nasal Septum

P value: 0.37, not significant.

A non-significant association was observed between septum deviation and presence of concha bullosa. Deviated nasal septum and concha bullosa are 2 incidental coexisting anomaly.



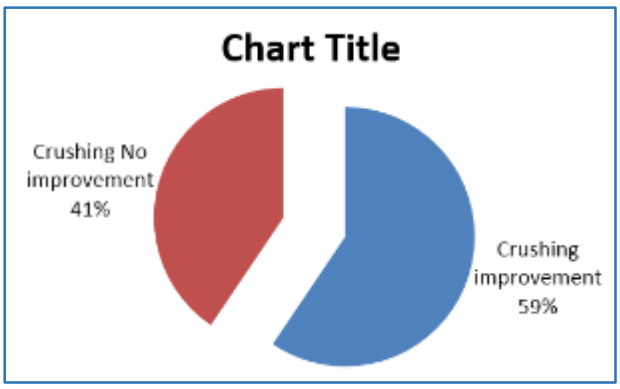
Graph 10. Concha Bullosa and Nasal Septum

Concha Bullosa	Maxillary Sinusitis				Total
	Present		**Absent**		
	Control Group	Study Group	Control Group	Study Group	
Present	4	26	12	1	43
Absent	6	21	28	2	57
Total	**10**	**47**	**40**	**3**	**100**

Table 11. Concha Bullosa and Maxillary Sinusitis

P value: 0.0407, significant.

A significant association was present between maxillary sinusitis and concha bullosa. Highlighting the concha bullosa maybe one of the cost for maxillary sinusitis.



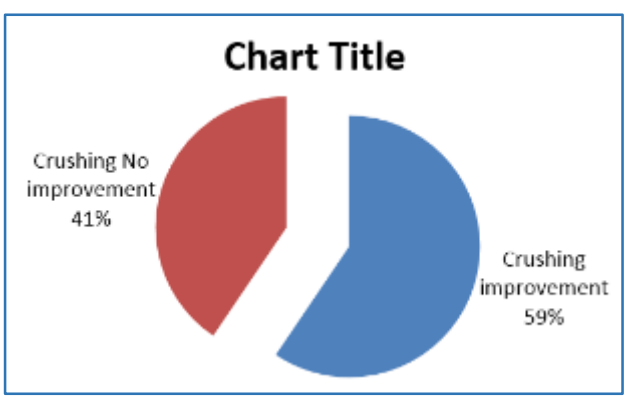
Graph 11. Concha Bullosa and Maxillary Sinusitis

Concha Bullosa	Ethmoid Sinusitis				Total
	Present		Absent		
	Control Group	Study Group	Control Group	Study Group	
Present	2	21	14	6	43
Absent	4	12	30	11	57
Total	**6**	**33**	**44**	**17**	**100**

Table 12. Concha Bullosa and Ethmoid Sinusitis

P value: 0.013, significant.

A significant association was noted between ethmoid sinusitis and concha bullosa. Concha bullosa narrows anterior and middle portion of middle meatus, hence blocking the drainage of anterior ethmoid air sense.



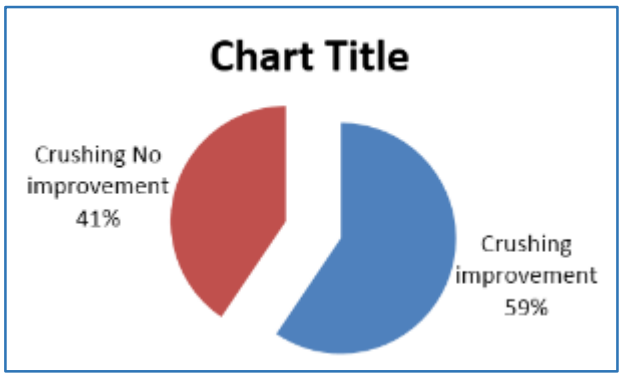
Graph 12. Concha Bullosa and Ethmoid Sinusitis

Concha Bullosa	Frontal Sinusitis				Total
	Present		Absent		
	Control Group	Study Group	Control Group	Study Group	
Present	0	6	16	21	43
Absent	4	5	30	18	57
Total	**4**	**11**	**46**	**39**	**100**

Table 13. Concha Bullosa and Frontal Sinusitis

P value: 0.57, not significant.

There was no significant association between frontal sinusitis and concha bullosa.

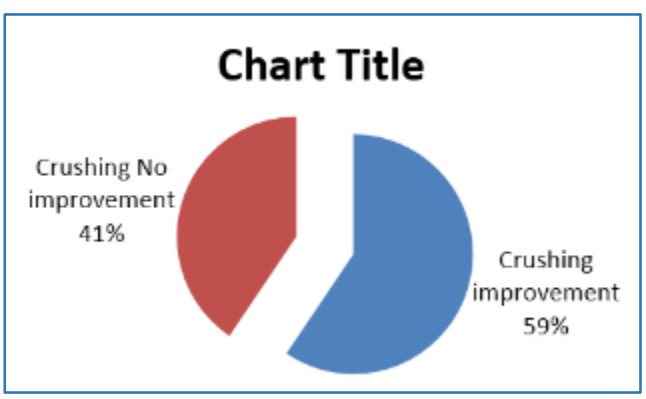


Graph 13. Concha Bullosa and Frontal Sinusitis

Concha Bullosa	Sphenoid Sinusitis				Total
	Present		Absent		
	Control Group	Study Group	Control Group	Study Group	
Present	0	0	16	27	43
Absent	2	3	32	20	57
Total	**2**	**3**	**48**	**47**	**100**

Table 14. Concha Bullosa and Sphenoid Sinusitis

No significant association was noted between sphenoid sinusitis and concha bullosa. The result is expected as sphenoid sinus drains into sphenoethmoidal recess.

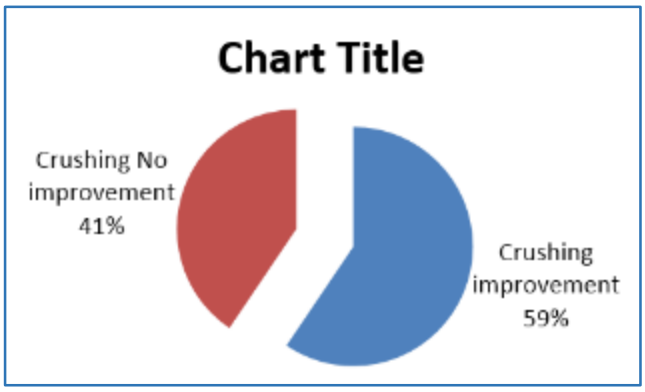


Graph 14. Concha Bullosa and Sphenoid Sinusitis

Concha Bullosa Surgical Treatment	Number	Percentage
Improved	23	85%
No improvement	4	15%
Total	**27**	**100%**

Table 15. Concha Bullosa Surgical Reduction

Among 27 patients who underwent surgical reduction of concha bullosa, 4 patients had recurrence, 3 among them had nasal adhesions between middle turbinate and nasal septum. 1 patient had recurrent middle turbinate hypertrophy.

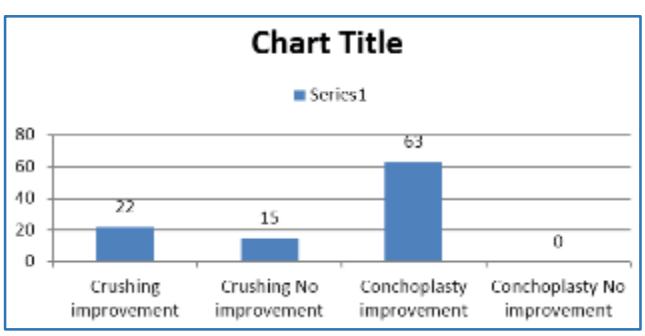


Graph 15. Concha Bullosa Surgical Reduction

Surgical Correction		Number	Percentage
Crushing	Improvement	6	22%
	No improvement	4	15%
Conchoplasty	Improvement	17	63%
	No improvement	0	0
	Total	**27**	**100%**

Table 16. Types of Surgical Correction of Concha Bullosa

All patients who underwent conchoplasty had no recurrence of sinusitis after following them up for a minimum period of 6 months. 4 patients with recurrent disease were those who underwent crushing.



Graph 16. Types of Surgical Correction of Concha Bullosa

DISCUSSION

Chronic rhinosinusitis is diagnosed by surgeons mainly based on clinical presentation. CT scan is considered as the gold standard investigation for evaluation of these patients. Our study showed an incidence of 43% of concha bullosa. There is wide discrepancy ranging from 15% to 53.6% in the reported incidence of concha bullosa. The overall incidence of inflammatory sinus disease with concha bullosa was higher in symptomatic (study group) patients than asymptomatic patients (control group) with a P value of 0.0001, which signifies a strong statistical association.

Bolger et al divided concha bullosa into lamellar cells, bulbar cells and true concha bullosa and reported incidence of 46.2%, 31.2% and 15.7%, respectively.[3,4] Our study showed an incidence of 58%, 44% and 7% of interlamellar, bullous and true type, respectively. Our study showed higher incidence of concha bullosa in middle age group between 21-40 years of age. Stammberger[5] et al states that pneumatisation process apparently begins in middle age in some patients when there may be a renewed spurt of growth activity. This concept is unfortunately difficult to prove since there are few patients who have been followed with tomography over several decades.[6]

In our study, the incidence of concha bullosa among male patients was higher, but is statistically insignificant. Deviated nasal septum to contralateral side of dominant concha bullosa was noted in majority of cases in our study, but the P value is 0.37 signifying their association to be by chance. Stammberger proposed 2 hypothesis to the development of concha bullosa ("e vacuo") for the expansion of the middle turbinate, therefore, resulting in concha bullosa formation. Alternatively, both concha bullosa and DNS are two incidental coexisting pathologies.[7] The absence hypertrophied inferior turbinate in presence of concha bullosa was noted in all patients, but two in our study with a P value of 0.0001. Hence, it can be postulated that pneumatisation of middle turbinate can be compensatory to the wider nasal cavity on the contralateral side of deviated septum in the absence of compensatory inferior turbinate hypertrophy.[8] The two patients in whom inferior turbinate hypertrophy was seen had interlamellar type of concha bullosa.

Our study did not show any significant association with other anatomical variants. Our study showed a statistically significant association between presence of concha bullosa and maxillary sinusitis and anterior ethmoidal sinusitis with a P value of 0.047 and 0.013, respectively.

Maru et al showed an association between sinusitis and concha bullosa in his studies especially with pneumatisation involving anterior end of middle turbinate.[9] Various pathology was noticed within concha bullosa, 3 patients has oedematous mucosa, 3 patients had mucoid discharge and 1 patient had pus within concha bullosa cell. 27 patients underwent concha bullosa reduction surgery. Among them, 6 patients underwent concha bullosa reduction by crushing and 16 patients by conchoplasty. 4 patients who had recurrence of sinusitis were those who underwent crushing procedure. 3 patients returned to us with postoperative nasal adhesions between middle turbinate and nasal septum and 1 patient with recurrent middle turbinate enlargement. Studies by Kieff DA,[10] Busaba NY has shown that the chance of reformation and recurrent sinus disease is higher in patients who undergo concha bullosa reduction by crushing.[11]

16 patients in control group with nonsinogenic headache has concha bullosa. Sinus headache are attributed to inflammatory disease of the sinus mucosa or ostium.[12] In 1948, H.G. Wolff first recognised that the sinus headaches may occur in the absence of inflammatory sinusitis maybe due to contact between strategic "trigger points" in the sinonasal passages.[13] Since this time, there have been sporadic reports of headache and facial pain due to an enlarged middle turbinate most commonly due to

pneumatisation (concha bullosa) can contact the septum or lateral nasal wall and give headaches referred to the ophthalmic division of the trigeminal nerve, the main sensory innervation of the anterior middle turbinate. This explains the presence of concha bullosa in patients with nonsinogenic headache.[14,15]

CONCLUSION

The incidence of concha bullosa in the study is 43% with male preponderance. The incidence of concha bullosa among the age group between 21-40 years is higher. Interlamellar type of concha bullosa is common followed by bulbous and true type. Concha bullosa has a higher incidence of occurrence on the right side followed by left and bilateral. Deviated nasal septum is the commonly associated anatomical variant, but did not show statistical association. Absence of hypertrophied inferior turbinate is noticed in majority of the patients with concha bullosa and also showed a strong statistical association. Hence, it can be postulated that middle turbinate pneumatisation maybe compensatory to wide nasal cavity created by deviated nasal septum in the absence of compensatory inferior turbinate hypertrophy. Enlarged middle turbinate increases the mucosal contact area in the middle meatus predisposing to sinus inflammation of those draining to middle meatus. Our study showed a strong association between maxillary and ethmoid sinus inflammation and concha bullosa. Incidence of occurrence of sinus disease with concha bullosa was statistically higher among study group than control group. Patients who underwent conchoplasty did not show any recurrence of symptoms postoperatively. 4 out of 6 patients who underwent crushing method for concha bullosa reduction showed recurrence of symptoms.

Based on Above-Mentioned Results, It Can Be Concluded That

1. Concha bullosa is one of the cause for maxillary and ethmoid sinus inflammation.
2. Compensatory middle turbinate pneumatisation maybe a result of wide nasal cavity due to deviated nasal septum in absence of compensatory hypertrophied inferior turbinate.
3. Conchoplasty is a preferred method of concha bullosa reduction compared to crushing.

REFERENCES

1. Kennedy DW, Zenreich J, Rosenbaum AE, et al. Functional endoscopic sinus surgery: Theory and diagnostic evaluation. Arch Otolaryngol Head Neck Surg 1985;111(9):576-582.
2. Zinreich SJ, Kennedy DW, Rosenbaum AE, et al. Paranasal sinuses: CT imaging requirements for endoscopic surgery. Radiology 1987;163(3):709-775.
3. Rice DH. Basic surgical techniques and variations of endoscopic sinus surgery. Otolaryngol Clin North Am 1989;22(4):713-726.
4. Bolger WE, Butzin CA, Parsons DS. Paranasal sinus bony anatomic variations and mucosal abnormalities: CT analysis for endoscopic sinus surgery. Laryngoscope 1991;101(1 Pt 1):56-64.
5. Stammberger H. Functional endoscopic sinus surgery: the Messerklinger technique. Philadelphia: BC Decker 1991:161-169.
6. Lloyd GAS, Lund VJ, Scadding GK. Computerised tomography in the preoperative evaluation of functional endoscopic sinus surgery. Journal of Laryngology and Otology 1991;105:181-185.
7. Calhoun KH, Waggenspack GA, Simpson CB, et al. CT evaluation of the paranasal sinuses in symptomatic and asymptomatic populations. Otolaryngol Head Neck Surg 1991;104(4):480-483.
8. Laine FJ, Smoker WR. The ostiomeatal unit and endoscopic surgery: anatomy, variations and imaging findings in inflammatory diseases. AJR Am J Roentgenol 1992;159(4):849-857.
9. Maru YK, Gupta V. Anatomical variations of the bone in sinonasal CT. Indian Journal of Otoloaryngol and Head Neck Surgery 2001;53(2):123-128.
10. Keiff DA, Busaba NY. Reformation of concha bullosa following treatment by crushing surgical technique: implication for balloon sinuplasty. Laryngoscope 2009;119(12):2454-2456.
11. Nayak S. Radiologic anatomy of the paranasal air sinuses. Seminars in Ultrasound CT and MRI 1999;20(6):354-378.
12. Mafee MF, Chow JM, Meyers R. Functional endoscopic sinus surgery: anatomy CT screening indications and complications. American Journal of Radiology 1993;160:735-744.
13. Goldsmith AJ, Gerald ZD, Arsen S, et al. Middle turbinate headache syndrome. American Journal of Rhinology 1993;7(1):17-23.
14. Bradoo R. Anatomical principles of endoscopic sinus surgery: a step by step approach. 1st edn. Jaypee Brothers Medical Publishers 2005:31-98.
15. Bhandary SK, Kamath SDP. Study of relationship of concha bullosa to nasal septal deviation and sinusitis. Indian Journal of Otolaryngology and Head and Neck Surgery 2009;61(3):227-229.