

Sinonasal anatomical variants and their incidence in chronic rhinosinusitis

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Abstract

Background: Chronic rhino sinusitis (CRS) is very common, affecting approximately 1/6th of the Indian population, impairing the quality of life and decreasing workplace productivity. The osteomeatal complex area is the key area for the pathogenesis of chronic rhinosinusitis. Anatomical variants when present will narrow this area which augment the pathological process of the sinonasal mucosa. CT examination of the paranasal sinuses provides not only a surgical road map for fess but also identifies significant anatomical abnormalities that need correction. The present study is to investigate the incidence of anatomical abnormalities of nose and paranasal sinuses in patients of chronic rhinosinusitis who did not responding to medical management. **Methods:** This cross-sectional observational study has been conducted on patients with chronic rhinosinusitis who attended the ENT OPD at Kamineni institute of medical sciences, Narketpally from August 2019 to August 2020. Patients who didn't respond to medical management were enrolled into this study and the incidence of anatomical abnormalities in them was assessed by Diagnostic nasal endoscopy(DNE) and Computed tomography scan of Paranasal sinuses(CT PNS). **Results:** 40 patients were accrued into the study. Deviated nasal septum(75%) was the most common anatomical variant encountered in our study followed by concha bullosa(30%) which is higher than the incidence in normal population. Paradoxical middle turbinate(5%) and pneumatize vomer(5%) were the least common variants. **Conclusion:** CT PNS is essential to identify the anatomical variations of osteomeatal complex area in patients with persistent symptoms who are not responding to adequate medical treatment. This study emphasizes identification of specific sinonasal anatomical abnormalities and their importance not just as an etiological factor for CRS, but also as a factor for non-resolution of disease. Incidence of DNS and concha bullosa was more than that of normal population in various studies. Incidence of multiple anatomical variations was more common in our study than a single anatomical variation. **Keywords:** Chronic rhinosinusitis, Concha bullosa, Deviated nasal septum, Osteomeatal complex, Sinonasal anatomical variants.

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INTRODUCTION

Chronic rhino sinusitis (CRS) is very common, affecting approximately 1/6th of the Indian population. The National

Institute of Allergy and Infectious Diseases (NIAID) estimated that 1 in 8 Indians suffer from CRS and this disease is more widespread than diabetes, asthma or coronary heart disease.¹ The term rhinosinusitis is characterized by inflammation of the ciliated respiratory mucosa of nose and paranasal sinuses. The osteomeatal complex, being the region for drainage of anterior sinuses, is the key area for the pathogenesis of chronic rhinosinusitis.^{2,3} If there is an anatomical variant that further narrows this key area, it may predispose the patient to infection and its possible recurrence and may result in chronic inflammatory changes in the mucosa³. The chronic nature and the debilitating symptoms of Chronic rhinosinusitis (CRS) impairs the quality of life, decreases workplace productivity and causes considerable costs.

Currently, CT scan is the most commonly used imaging technique for assessing Sino nasal pathologies especially rhinosinusitis. Stammberger and Hawke⁴ reported that CT examination of the paranasal sinuses will provide a surgical road map of the nose and paranasal sinuses to identify the presence of significant anatomic abnormalities – which might predispose the patient to chronic or recurrent acute attacks of rhinosinusitis. Anatomical abnormalities routinely evaluated in computed tomography (CT) images are deviation of the nasal septum(DNS), concha bullosa(CB), paradoxical middle turbinate(PMT), hypertrophic ethmoidal bulla, agger nasi cells, lateralized or hypertrophied uncinat process (UP), haller cells. Basic treatment is medical management and surgery is resorted in case of unabated disease(non responders). The present study is to investigate the incidence of anatomical abnormalities of nose and paranasal sinuses in patients of chronic rhinosinusitis who did not responding to medical management.

MATERIALS AND METHODS

This cross sectional observational study has been conducted on patients with chronic rhinosinusitis who attended the ENT OPD at Kamineni institute of medical sciences, Narketpally from August 2019 - August 2020. Patients with chronic rhinosinusitis who did not respond to medical treatment above the age of 10 yrs were selected and accrued into this study after ethics committee clearance., proper informed consent was taken from all of them. Patients with acute rhinosinusitis (symptoms less than 12 weeks), with previous history of sinonasal surgery and with comorbid conditions like diabetes mellitus and other immunosuppressive states were excluded from the study. Demographic data, clinical presentation, computed tomography (CT) of nose and paranasal sinuses with 3mm cuts in the axial, coronal and sagittal planes were recorded and analyzed. The presence of anatomical abnormalities and the extent of disease of the involved sinuses were noted. Mucosal thickening of 4 mm or more in the sinus cavity wall in the CT scan was taken as positive for sinusitis.

The mucosal disorders of the paranasal sinuses and the osteomeatal complex status were scored based on the Lund - Mackay staging system.

No opacification = 0; Partial opacification = 1; Full opacification = 2

RESULTS

There were a total of 78 patients with clinically proven chronic rhinosinusitis during the study period. Out of these 25 responded well to medical management, 9 patients had a history of previous sinonasal surgery. 4 patients had comorbid conditions. The rest (40) of them who were not

responding to adequate medical management were accrued into this study.

Most of the patients are in the age group of 11 to 30 years(47.5%). Based on the results of descriptive statistics on the research data, male preponderance was seen, male patients were 24(60%) and female patients were 16(40%). The incidence of presenting complaints, in order are nasal obstruction 38 (95%), nasal discharge 30 (75%) cases, post nasal drip 15 (37.5%), headache 12 (30%), Facial pressure 8 (20%) cases, fever 5 (10%), sneezing 3 (7.5%) cases, throat discomfort 2 (5%), snoring 2 (35%). Among anatomical abnormalities, CT scan evaluation revealed Deviated Nasal Septum (DNS) was the most common variation(75%) among patients, followed by Concha bullosa(30%). Least common variations found were Paradoxical Middle turbinate(5%), Haller cell(7.5%), and Pneumatization of vomerine bone(5%) (Table 3). Amongst the paranasal sinuses involved in sinus disease, maxillary sinus is involved in 38 cases(95%), anterior and posterior ethmoids in 32 (80%), frontal sinus in 23 cases(57.5%) and least involved is sphenoid sinus in 20 cases(50%). 22 patients(55%) had more than one anatomical abnormality while 13 patients(32.5%) had single anatomical abnormality.

Table 1: AGE WISE DISTRIBUTION

AGE GROUP	NUMBER OF PATIENTS (n = 40)
11-30	19
31-50	17
51-70	4

Table 2. GENDER WISE DISTRIBUTION

GENDER	NUMBER OF CASES (n = 40)
MALE	24 (60%)
FEMALE	16 (40%)

TABLE 3: SINONASAL ANATOMICAL VARIATIONS

ANATOMICAL VARIATION	FREQUENCY (n = 40)
DEVIATED NASAL SEPTUM	30 (75%)
CONCHA BULLOSA	12 (30%)
UNCINATE DEVIATION	3 (7.5%)
PARADOXICAL MIDDLE TURBINATE	2 (5%)
AGGER NASI CELLS	3 (7.5%)
ONODI CELLS	9 (22.5)
HALLER CELLS	3 (7.5%)
PNEUMATIZED VOMERINE BONE	2 (5%)

TABLE 4: DISTRIBUTION OF ANATOMICAL VARIANTS

NUMBER OF ANATOMICAL ABNORMALITIES	NUMBER OF CASES (n = 40)
1	13 (32.5%)
2	18 (45%)
3	1 (2.5%)
4	3 (7.5%)

DISCUSSION

Anatomical variations and pathological processes in the nose and paranasal sinuses have been studied by various authors. Local anatomic abnormalities including concha bullosa, deviated nasal septum (DNS), Haller cells, paradoxical middle turbinates, agger nasi cells and many others obstruct the middle meatus which stimulate changes in the mucosa and decreases the aeration of the paranasal sinuses which further affects the mucociliary transport patterns. All these factors significantly increase the potential for causing chronic rhinosinusitis. Recent advances in CT Scanning these variations apparent and CT scan of the nose and paranasal sinuses has become an important pre-requisite, providing a roadmap for FESS in patients of Chronic rhinosinusitis. In our study 75% of cases had deviated nasal septum (fig. 2). Similar finding was observed by Perez, *et al.*, who reported the prevalence of deviated nasal septum to be about 80%. Dua, *et al.*¹², Asruddin, *et al.*¹¹ and Stallmann, *et al.*⁸, found prevalence of 44%, 38% and 60% deviate nasal septum in their respective studies in CRS patients. Vinnakota Sriprakash²⁴ in his study found the incidence of DNS to be 30.9% in non-CRS patients, which clearly shows that incidence of DNS is more in CRS patients than normal population. Possibly DNS is not only a contributing factor for CRS but also a factor for non-responsiveness to medical treatment. Concha bullosa (fig. 1) was seen in 30% of the chronic rhinosinusitis cases in our study which is similar to as reported by Stallmann, *et al.*⁸, Maru, *et al.*⁹, Wani, *et al.*¹⁰ which is 36%, 30%, 28% respectively. Dua, *et al.*¹², Asruddin, *et al.*¹¹ and Llyod, *et al.*¹³ reported incidence of Concha bullosa as 16%, 15%, and 14% respectively which is lesser than our series. Perez-Pinas *et al.* reported higher prevalence of concha bullosa i.e. 73%, in normal population. Concha bullosa though present, when well pneumatized and properly draining without obstructing the osteomeatal complex is unlikely to cause CRS. Stammberger and Wolf¹⁴ quoted paradoxical curvature of the middle turbinate as an etiological factor for CRS by causing obliteration or alteration in nasal air flow dynamics. In our study it was found in 5% of the patients which is less compared to 15% of Llyod, *et al.*¹³ The small sample of this study might be the reason for lesser incidence of paradoxical middle turbinate, which otherwise seems to be associated with CRS.

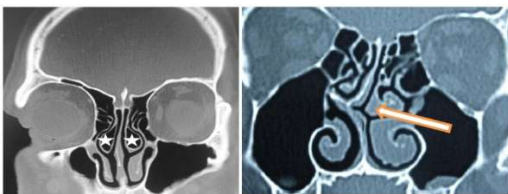


Figure 1: Bilateral concha bullosa(*); **Figure 2:** Deviated nasal septum with spur (arrow)

Hypertrophied uncinate process causes narrowing of the hiatus semilunaris and the ethmoid infundibulum. Hypertrophy of the uncinate process was observed in 7.5% of the cases which is less compared to the findings of Wani, *et al.*¹⁰ who reported it to be 21% in chronic rhino sinusitis cases. Sharma Shalini and Tiwari Gopal²⁵ found incidence of pneumatized uncinate process to be 4% in normal population. This is lesser than in our study, suggesting that abnormality of Uncinate process is a predisposing factor for non-resolution of chronic rhinosinusitis. Agger nasi cells lie just anterior to the anterosuperior attachment of the middle turbinate and frontal recess. The posterior wall of the cell forms anterior wall of frontal recess, well pneumatized agger nasi cells may block the drainage of frontal sinuses. These cells were observed in 7.5% of patients in our study. Similar results were observed by Liu X, *et al.*¹⁵, Dua, *et al.*¹² and Llyod, *et al.*¹³, who reported the prevalence of agger nasi cells as 7.8%, 8% and 8.5% in chronic rhinosinusitis cases. The prevalence is very less as compared to 98.5% by Bolger¹⁶, 88.5% by Maru¹⁸, 86.7% by Tonai and Baba¹⁷ and 48% by Asruddin, *et al.*¹¹. The prevalence of Haller cells in our study was 7.5%. This is less as compared to 16% reported by Llyod, *et al.*¹³ and 15% by Perez-Pinas, *et al.*²⁰ Liu X, *et al.*¹⁵ in his study reported the prevalence of about 1% of Haller cells in 297 chronic rhino sinusitis cases which is lesser than our findings. Identification of Onodi cell on CT scan, is important to avoid injury to optic nerve and carotid artery. Onodi cell was found in 9 (22.5%) patients in our study. Other studies have reported Onodi cell presence from 0% to 9%.^{21, 22}

CONCLUSION

Anatomical variations are observed to be one of the predominant etiologies for OMC block as well as sinusitis. This study emphasizes on identification of specific sinonasal anatomical abnormalities and their importance not just as a causative factor for CRS, but also as a factor for non-resolution of disease. Deviated nasal septum was the most common anatomical variation encountered in our study followed by concha bullosa. Incidence of multiple anatomical variations was more common in our study than a single anatomical variation. Importance of CT scan to identify the anatomical variations is emphasized in patients with persistent symptoms who are not responding to adequate medical treatment. Further studies with larger sample of patients are needed to confirm the outcomes.

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