Journal of Population Therapeutics & Clinical Pharmacology

RESEARCH ARTICLE
DOI: 10.53555/jptcp.v29i03.4006

# COMPARATIVE STUDY OF COMPUTED TOMOGRAPHIC SCAN AND INTRAOPERATIVE ENDOSCOPIC FINDINGS OF ANATOMICAL VARIATIONS OF OSTEOMEATAL COMPLEX IN PATIENTS WITH CHRONIC RHINOSINUSITIS

**Dr Shruti Satish[1], Dr. Aishwarya M.[2], Abhishek S[3], Dr P Krishna Prasad[4*]**

[1]Shri Atal Bihari Vajpayee medical college and research Center, Senior resident, Department of ENT, shrutisatish19@gmail.com, 9500527503
[2]Assistant Professor, Dr. Chandramma Dayananda Sagar Institute of Medical Education and Research, Harohalli, Karnataka, email: aish.amnair@gmail.com, Ph: 8105067515
[3]HCG hospitals, Fellow in head and neck oncology, abhisubodhai@gmail.com, 9611165338
[4*]National cancer institute, Consultant oncosurgeon, drkrishnas007@gmail.com, 7680824199

***Corresponding author:** Dr P Krishna Prasad
*National cancer institute, Consultant oncosurgeon, drkrishnas007@gmail.com, 7680824199

**Abstract**

**Background:** Anatomical abnormalities around the osteomeatal complex may have a negative impact on frontal, maxillary, and anterior ethmoidal air cell drainage and ventilation, leading to chronic sinusitis. The capacity to precisely treat even very small abnormalities in the osteomeatal complex that obstruct the frontal, ethmoid, and maxillary sinuses' mucociliary clearance is the cornerstone of functional endoscopic sinus surgery. In addition to being effective diagnostic tools for sinus disease, CT and nasal endoscopy may precisely reach this region to look for signs of a specific illness or any anatomical abnormality that would impair mucociliary clearance and breathing. The purpose of these investigations is to determine the mucosal abnormalities and bony anatomic variations of the paranasal sinus and assess the possible pathogenicity of these findings in patients undergoing evaluation for sinusitis.

**Methods:** This was a prospective study carried out between November 2016 and November 2018 among 55 patients 15-70 years of age who were diagnosed with chronic rhino sinusitis on the basis of a detailed history and physical examination and did not respond to three weeks of medical treatment. A direct endoscopy and computed tomography scan were done for these patients. Intraoperative endoscopic surgery findings were compared with pre-operative CT scan findings.

**Results:** Deviated nasal septum was the most common variation observed, most commonly in the 41-50 year age group with a female preponderance. The agreement between the CT scan and endoscopic operative findings was very good for concha bullosa, paradoxical middle turbinate and medialised uncinate. Good agreement was observed for deviated nasal septum, Agger nasi and Haller cells, while there was a moderate agreement for mucosal thickening in OMC.

**Conclusion:** Concha bullosa, Haller cells, Agger nasi, and deviated nasal septum were the most prevalent structural variations of the nose and PNS that predispose to sinusitis in order of frequency. The results of the CT scan and the endoscopic surgical discoveries of different anatomical variances

agreed rather well. Therefore, in order to perform a safe and successful endoscopic sinus surgery, the current study reiterates the need for an accurate radiological assessment of each patient.

**Keywords:** Anatomical Variants of Nose and Osteomeatal Complex, Chronic Sinusitis.

## INTRODUCTION

Notwithstanding the debate regarding the contribution of anatomic variations of the osteomeatal complex to the development of rhinosinusitis, knowledge of the prevalence of these variations may be useful when performing paranasal sinus surgeries like rhinoplasty and FESS (Functional Endoscopic Sinus Surgery).[1,2]

If there are problems with the bones around the osteomeatal complex, they might make it harder for air cells in the front, maxillary, and anterior ethmoidal areas to drain and breathe, which can lead to chronic sinusitis.

In the last several decades, sinus illness has been effectively diagnosed using both CT and nasal endoscopy. The aim of this study was to identify the paranasal sinus mucosal abnormalities and changes in its bone anatomy and to evaluate the potential pathogenicity of these findings in individuals who are being evaluated for sinusitis.

Due to its ability to give a superior perspective and precise information about the sinuses, particularly their bony structure and crucial regions like the osteomeatal complex that are predisposed to sinusitis, CT imaging has become a vital diagnostic tool. When it comes to giving a road map before endoscopic sinus surgery, it is quite helpful.[3] Areas like the ostiomeatal complex and anterior ethmoid cells that are difficult to see on standard x-ray films can be distinguished with a CT scan.

However, since diagnostic nasal endoscopy provides for good visualisation of the middle meatus-which anterior or posterior rhinoscopy cannot diagnose-it is the principal means of diagnosing all anatomic abnormalities and other pathogenic aspects of the lateral nasal wall. Moreover, endoscopic management of the therapy's effects is conceivable, and surgery may be done if necessary.[4] However, the limitations of nasal endoscopy includes the inability to identify disease in hidden areas that are grossly constricted by an anatomical variation or in a hidden space for example, a grossly deviated septum or the posterior ethmoids behind the basal lamella.[5]

The capacity to precisely treat even very small abnormalities in the osteomeatal complex that obstruct the frontal, ethmoid, and maxillary sinuses' mucociliary clearance is the cornerstone of functional endoscopic sinus surgery. This region may be precisely accessed using a CT scan and nasal endoscopy to look for signs of a specific illness or any anatomical flaw that can impair mucociliary clearance and breathing.

CRS (Chronic Rhinosinusitis) that is recalcitrant at medical therapy is the most common indication for surgery. Surgery for CRS is directed to relieving obstruction in the OMC, thus improving drainage and ventilation in the sinuses, with the goal of restoring mucociliary function.

The aim of the study was to link the morphological differences observed on endoscopic examination and in CT scans of the paranasal sinuses with the occurrence of anatomical changes in the sinonasal region.

## MATERIALS & METHODS

This prospective study included 55 patients, aged 15 to 70, who had been diagnosed with chronic rhino sinusitis after a thorough history and physical examination and who had not improved after three weeks of therapy. The study was conducted between November 2016 and November 2018. A direct endoscopy and computed tomography scan were done for these patients. Intraoperative endoscopic surgery findings were compared with pre-operative CT scan findings. The study excluded patients with a history of significant nasal surgery, persistent granulomatous illness, paranasal sinus

malignancy, clinical evidence of dental-originated sinusitis, and past face trauma. Quantitative parameters such as age of the patient and duration of the symptom were expressed as mean, standard deviation, median and interquartile range. The agreement between the two diagnostic methods was estimated by kappa statistics as well as sensitivity, specificity and predictive value. Differences in the proportions were tested for statistical significance by the chi square test of significance or Fischer's exact test. Similarly, differences in the mean values were tested for significance by a paired t-test or Wilcoxin's test.

## RESULTS

The majority of the subjects, 54.45%, were male and 45.45% were female. The majority of the subjects (41.81%) were 41-50 years old, followed by 29.10% in 31-40 years old, 20% in 51-60 years old, 5.45% in 21-30 years old, and only 3.64% in 61-70 years old. 25 out of 25 female subjects (100%) and 23 out of 30 male subjects (76.66%) had DNS. 10 out of 25 female subjects (40%) and 9 out of 30 male subjects (30%) had concha bullosa. 6 out of 25 female subjects (24%) and 5 out of 30 male subjects (16.66%) had Agger nasi. 5 out of 25 female subjects (20%) and 11 out of 30 male subjects (36.66%) had Haller cells. 7 out of 25 female subjects (28%) and 23 out of 30 male subjects (13.33%) had mucosal thickening in OMC. 3 out of 25 female subjects (12%) and 1 out of 30 male subjects (3.33%) had medialized uncinate. A statistically significant difference between the genders was found only for DNS.

| | **Female** | **Male** | **P-Value** |
|---|---|---|---|
| DNS | 25 | 23 | 0.012 |
| Concha bullosa | 10 | 9 | 0.571 |
| Agger nasi | 6 | 5 | 0.521 |
| Haller cells | 5 | 11 | 0.237 |
| Mucosal thickening in OMC | 7 | 4 | 0.198 |
| Paradoxical middle turbinate | 3 | 1 | 0.320 |
| Medialised uncinate | 0 | 1 | -- |

***Table 1: Distribution of Finding According to Gender***

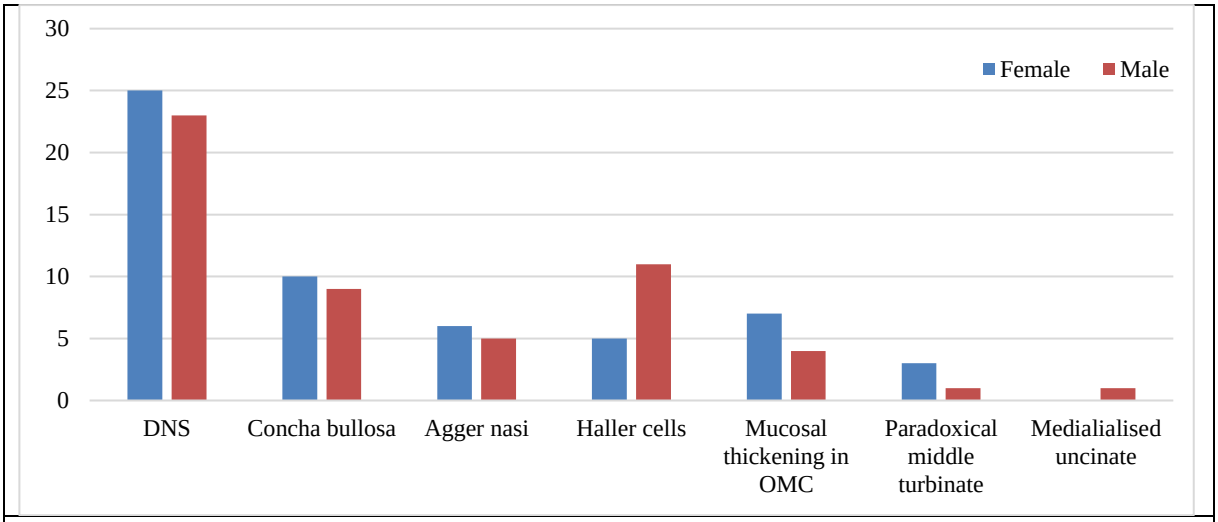


***Figure 1: Graph Showing Distribution of Finding According to Gender***

The distribution of the anatomical variations with respect to the various age groups is as shown in Table 2. There was a statistically significant difference only for DNS between the age groups.

| | **Age Group** | | | | | **P-Value** |
|---|---|---|---|---|---|---|
| | **21-30 yrs.** | **31-40 yrs.** | **41-50 yrs.** | **51-60 yrs.** | **61-70 yrs.** | |
| DNS | 3 | 14 | 23 | 7 | 1 | 0.019 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Concha bullosa | 1 | 3 | 10 | 5 | 0 | 0.378 |
| Agger nasi | 0 | 3 | 7 | 1 | 0 | 0.456 |
| Haller cells | 2 | 2 | 8 | 4 | 0 | 0.227 |
| Mucosal thickening in OMC | 1 | 2 | 5 | 3 | 0 | 0.772 |
| Paradoxical middle turbinate | 0 | 2 | 0 | 2 | 0 | -- |
| Medialised uncinated process | 0 | 0 | 0 | 0 | 1 | -- |
| ***Table 2: Distribution of Finding According to Age Group*** | | | | | | |

The comparison of anatomic variations between CT and endoscopy is as shown in Table 3.

| **Sl. No** | **Anatomic Variations** | **CT Findings** | **Endoscopic Findings** |
|---|---|---|---|
| 1 | DNS | 48 | 45 |
| 2 | Concha bullosa | 19 | 19 |
| 3 | Agger nasi | 11 | 11 |
| 4 | Haller cells | 13 | 16 |
| 5 | Edematous omc | 4 | 11 |
| 6 | Paradoxical middle turbinate | 4 | 4 |
| 7 | Medialised middle turbinate | 1 | 1 |
| ***Table 3: Comparison of Anatomic Variations between CT and Endoscopy*** | | | |

Cohen Kappa's agreement between CT scans and endoscopic operative findings of various anatomical variations are as shown in Table 4.

| ***Anatomical Variations*** | **Cohen Kappa's Agreement** | **95% Confident Interval** | **Comments** |
|---|---|---|---|
| Deviated Nasal Septum | 0.792 | 0.569 to 1.00 | Good agreement |
| Concha Bullosa | 1.00 | 1.00 to 1.00 | Very good agreement |
| Agger nasi | 0.8779 | 0.713 to 1.00 | Good agreement |
| Haller cells | 0.8601 | 0.708 to 1.00 | Good agreement |
| Mucosal thickening in OMC | 0.478 | 0.169 to 0.786 | Moderate agreement |
| Paradoxical middle turbinate | 1.00 | 1.00 to 1.00 | Very good agreement |
| Medialised uncinate | 1.00 | 1.00 to 1.00 | Very good agreement |
| ***Table 4: Cohen Kappa's Agreement between CT Scan and Endoscopic Operative Findings of Various Anatomical Variations*** | | | |

As evident from the table

- Concha bullosa, paradoxical middle turbinate, and medialized uncinate showed very good agreement.
- Deviated Nasal Septum, Agger nasi and Haller cells showed good agreement.
- Mucosal thickening in OMC showed moderate agreement.

## DISCUSSION

The availability of high-resolution CT and improvements in endoscopic instrumentation, coupled with an increased understanding of mucociliary drainage patterns and the pathophysiology of paranasal sinus inflammatory disease, enable the clinician to have a precise understanding of nasal sinus anatomy and its variation in this region.[6,7]

While excellent results have been reported in the literature, given the close relation of the PNS to important structures such as the orbit and skull base, if complications occur in surgery, they are usually dangerous and harmful. This necessitated a detailed study of the incidence of anatomical variants around the sinonasal area.

Anatomical changes were shown to be prevalent in 81% of instances of chronic rhinosinusitis, according to Liu et al.[8] Araújo Neto et al. found that the OMC of the CRS subjects had comparatively

fewer structural changes, measuring 65%.[9] Pérez-Piñas et al. also noted that anatomical differences were similarly prevalent in patients with chronic sinusitis.[10]

In order to ascertain whether patient symptoms in conjunction with nasal endoscopy could reliably predict CRS on CT in 92 consecutive patients referred for sinonasal symptoms, Rosbe et al.[6] prospectively compared the outcomes of nasal endoscopy, CT scanning, and a symptom questionnaire. They discovered that CT scans compatible with CRS were obtained in 91% of individuals who had favourable endoscopic results. 100% of individuals with nasal obstruction as their primary symptom and a positive nasal endoscopy result had CT results that were compatible with CRS.

Stankiewicz and Chow[11] examined the association between symptom history, nasal endoscopy, and CT results in a study including 78 individuals who met the current symptom-based diagnosis of CRS. Thirteen of the thirty-seven individuals with positive CT results also had negative endoscopic outcomes. In comparison to CT data, endoscopy had a 46% sensitivity, 86% specificity, 74% PPV, and 64% NPV.

The results of a negative endoscopy were more strongly correlated with CT findings, with a 78% correlation either revealing no sinus illness or being negative. The study also observed a high specificity of endoscopy in comparison with CT results and a low concordance between subjective symptom-based criteria for CRS and findings on CT and endoscopy.

**Deviated Nasal Septum**

48 patients (87.27%) had a deviated nasal septum, which was higher than the 65.2% of patients reported by Gupta et al.[12] the 55.7% reported in a study by Maru and Gupta[13] and the 44% reported by Dua et al.[14]

However, 45 individuals (81.8%) had a deviated nasal septum during endoscopy and FESS (Functional Endoscopic Sinus Surgery). Even though a septal deviation alone does not imply disease, a significant deviation may push the middle turbinate laterally, narrowing the osteomeatal complex.

**Concha Bullosa**

In 19 patients (34.5%), concha bullosa was discovered by CT scan, and in the same number of patients, it was verified during surgery. The incidence of concha bullosa in our study was less than in other studies. It was 49.3 % in the study by Fadda et al.[15] 42.6% by Maru and Gupta,[13] and 53.6% by Bolger et al.[16]

**Agger Nasi Cells**

Agger nasi cells were present in 9 patients (16.36%). The incidence in our study is lower compared to other previous studies, i.e., 80% by Leunig et al[17] 88.5% by Maru and Gupta, 68.8% by Gupta et al.[12] and 40% by Dua et al. [14] During FESS (endoscopic examination), the same number of patients had agger nasi cells.

**Haller's Cell**

In 13% (23.63%) of patients, Haller's cells were visible on CT scans. This was less than what Maru and Gupta[13] had reported (36%), but it was higher than the observations made by Gupta et al. (3.62%).[12] During FESS, 16 patients (29.09) were found to have haller cells.

**Paradoxical Curvature of Middle Turbinate**

Four patients (7.27%) had a middle turbinate curvature that was asymmetrical. The incidence was less than Bolger et al.(16) (27%), Tonai and Baba[18] (9.8%) and Gupta et al.[13] (1.44%). This finding was confirmed during FESS.

**Uncinate Process**

In one case (1.8%), a medially curved uncinated process was discovered. The infundibulum and the anterior ethmoid frontal recess are two areas where sinus ventilation may be hampered by a bent or curved uncinate process. Incidence was lower than that of Fadda et al. [15] (22.8%) (9.8%) by Maru and Gupta[13] and (2.5%) by Bolger et al.[16] Gupta et al. during FESS confirmed this finding.

**Edematous Osteomeatal Complex**

Edematous tissue in OMC was found in 11 patients (50%). This finding was more prominent on endoscopy as compared to CT, most likely due to the time lag between CT and endoscopy during which the patient is normally started on a course of antibiotics, anti-histamines and steroid sprays.

## CONCLUSION

Concha bullosa, Haller cells, Agger nasi, and deviated nasal septum were the most prevalent structural variations of the nose and PNS that predispose to sinusitis in order of frequency. The results of the CT scan and the endoscopic surgical discoveries of different anatomical variances agreed rather well. Therefore, in order to perform a safe and successful endoscopic sinus surgery, the current study reiterates the need for an accurate radiological assessment of each patient.

## REFERENCES

1. Araujo SA, Martins P, Souza AS, Baracat EC, Nanni L. The role of ostiomeatal complex anatomical variants in chronic rhinosinusitis. Radiol Bras 2004;14:1-9.
2. Alkire B, Bhattacharyya N. An assessment of sinonasal anatomic variants potentially associated with recurrent acute rhinosinusitis. The Laryngoscope 2010;120(3):631-4.
3. Gwaltney JM, Philips CD, Miller RD, Riker DK. Computed tomography study of the common cold. N Engl J Med 1994;330:25-30.
4. Buljcik-Cupić MM, Savović SN; Endonasal endoscopy and computerized tomography in diagnosis of the middle nasal meatus pathology. Med Pregl 2007;60(7-8):327-32.
5. Saxena R, Kanodia V, Srivastava M. Role of CT paranasal sinuses and diagnostic nasal endoscopy in the treatment modification of chronic rhinosinusitis. Gujarat Journal of Otorhinolaryngology and Head & Neck Surgery 2010;7(1):7.
6. Rosbe K, Jones K. Usefulness of patient symptoms and nasal endoscopy in the diagnosis of chronic sinusitis. Am J Rhinol 1998;12(3):167-71.
7. Stankiewicz J, Chow J. Nasal endoscopy and the definition and diagnosis of chronic rhinosinusitis. Otolaryngology-Head and Neck Surgery 2002;126(6):623-7.
8. Liu X, Han D, Zhou B. Relationship between anatomic variants of nasal sinus and chronic sinusitis. Zhonghua Er Bi Yan Hou Ke Za Zhi 1998;33(3):149-52.
9. Araujo SA, Martins P, Souza AS, Baracat EC, Nanni L. The role of ostiomeatal complex anatomical variants in chronic rhinosinusitis. Radiol Bras 2004;14:1-9.
10. Pérez-Piñas I, Sabaté J, Carmona A, Catalina-Herrera C, Jiménez-Castellanos J. Anatomical variations in the human paranasal sinus region studied by CT. Journal of Anatomy 2000;197(2):221-7.
11. Stankiewicz J, Chow J. Nasal Endoscopy and the Definition and Diagnosis of Chronic Rhinosinusitis. Otolaryngology–Head and Neck Surgery 2002;126(6):623-7.
12. Gupta A, Gupta B, Gupta N, Tripathi N. Computerized tomography of paranasal sinuses: a roadmap to endoscopic surgery. Clin Rhinol Int J 2012;5(1):1-10.
13. Maru YK, Gupta Y. Nasal endoscopy versus other diagnostic tools in sinonasal diseases. Indian Journal of Otolaryngology and Head & Neck Surgery 2014;68(2):202-6.
14. Dua K, Chopra H, Khurana AS, Munjal M. CT scan variations in chronic sinusitis. Indian J Radiol Imag 2005;15(3):315-20.
15. Fadda GL, Rosso S, Aversa S, Petrelli A, Ondolo C, Succo G. Multiparametric statistical correlations between paranasal sinus anatomic variations and chronic rhinosinusitis. Acta Otorhinolaryngol Ital 2012;32(4):244-51.

16. Bolger W, Butzin C, Parsons D. Paranasal sinus bony anatomic variations and mucosal abnormalities. The Laryngoscope 1991;101(1):56-64.
17. Leunig A, Sommer F, Betz C, Sommer B. Anatomic variations of the sinuses: multiplanar computed tomography analysis in 641 patients. Skull Base 2009;19(S 02):A097.
18. Tonai A. Anatomic variants of the bone in sinonasal CT. Acta Otolaryngol 2019;525:9-13.