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Nasal Endoscopy and Computed Tomography Findings in Patients of Chronic Rhinosinusitis - A Correlation Study

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Abstract: Background: Chronic rhinosinusitis (CRS) is a common inflammatory condition affecting the nasal cavity and paranasal sinuses, significantly impairing quality of life. Accurate diagnosis is essential for effective management and prevention of complications. Diagnostic nasal endoscopy (DNE) and computed tomography (CT) are essential tools in its evaluation. Correlating findings from these two modalities is crucial for comprehensive evaluation and appropriate treatment planning in patients with CRS. **Aim:** To correlate computed tomographic findings with endoscopic findings in patients of chronic rhinosinusitis. **Materials and Methods**: A cross-sectional observational study was conducted on 170 patients diagnosed with CRS. The patients above 15 years fulfilling inclusion criteria were included. Each patient underwent detailed clinical evaluation, diagnostic nasal endoscopy, and CT scan of paranasal sinuses. Data was analyzed using SPSS software, and correlation was assessed using Spearman's correlation coefficient. **Results:** Significant correlation was observed between endoscopic and CT findings in mucosal edema, polyps, and middle meatal obstruction ($p < 0.05$). A statistically significant correlation was found between endoscopic and CT findings for septum ($r=1.000$, $p=0.01$), turbinate hypertrophy, ethmoid bulla, and osteomeatal complex on both sides. A strong correlation was also observed for left osteomeatal complex ($r=0.995$, $p=0.001$). CT scan showed superior detection of anatomical variations and sinus involvement, while endoscopy better identified mucosal changes and secretions. **Conclusion**: There is a strong and statistically significant correlation between diagnostic nasal endoscopy and CT findings in CRS. Both modalities are complementary, and their combined use provides accurate diagnosis and better management planning.

Keywords: Chronic rhinosinusitis, Diagnostic nasal endoscopy, Computed tomography, Osteomeatal complex, Correlation.

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INTRODUCTION

The nasal cavity and paranasal sinuses form an integral part of the upper respiratory tract and play a vital role in respiration, humidification, filtration of inspired air, and voice resonance [1]. The osteomeatal complex (OMC) represents a key anatomical region responsible for the drainage of the maxillary, frontal, and anterior ethmoid sinuses. It comprises structures such as the middle meatus, uncinate process, ethmoid infundibulum, and hiatus semilunaris [2]. Due to its narrow configuration, even minimal mucosal edema or anatomical variation can obstruct this region, leading to impaired sinus ventilation and subsequent inflammation [3]. Thus, the osteomeatal complex is considered the "key area" in the pathogenesis and management of chronic rhinosinusitis.

Chronic rhinosinusitis (CRS) is defined as persistent inflammation of the nasal and paranasal sinus mucosa lasting for more than 12 weeks despite adequate medical therapy [4]. According to the American Academy of Otolaryngology Head and Neck Surgery guidelines, diagnosis requires the presence of at least two symptoms like nasal obstruction, nasal discharge, facial pain or pressure, or reduction in sense of smell along with objective evidence on nasal endoscopy or imaging [5].

Anatomical variations such as deviated nasal septum, concha bullosa, paradoxical middle turbinate, haller cells, and agger nasi cells may further compromise sinus ventilation and drainage. These variations are commonly identified on computed tomography and are important in both diagnosis and surgical planning [6]. Patients with CRS commonly present with nasal obstruction, nasal discharge, facial pain, postnasal drip, and reduced sense of smell. These symptoms often persist for prolonged periods and significantly affect the patient's quality of life [5].

Accurate diagnosis of CRS requires both clinical evaluation and objective confirmation. Diagnostic nasal endoscopy (DNE) allows direct visualization of the nasal cavity and osteomeatal complex, helping identify mucosal edema, discharge, polyps, and anatomical variations [4]. Computed tomography (CT) of the paranasal sinuses is considered the gold standard imaging modality for evaluating CRS. It provides detailed information about sinus anatomy, extent of disease, and anatomical variations, and plays a crucial role in surgical planning [1]. Several studies have demonstrated that nasal endoscopy and CT scan findings complement each other in the evaluation of CRS. While CT provides detailed anatomical information, endoscopy offers real-time assessment of mucosal pathology [7].

However, the degree of correlation between these modalities may vary across populations and clinical settings. In resource-limited areas, reliance on endoscopy alone may be necessary, whereas CT scanning may not always be readily accessible. Therefore, the present study was undertaken to evaluate and correlate the findings of diagnostic nasal endoscopy with computed tomographic findings in patients with chronic rhinosinusitis.

MATERIALS AND METHODS

The present study was a hospital-based, cross-sectional, observational, descriptive study designed to evaluate and correlate diagnostic nasal endoscopic findings with computed tomographic findings in patients clinically diagnosed with chronic rhinosinusitis (CRS). A cross-sectional design was selected as it allows simultaneous assessment of findings obtained from two diagnostic modalities; diagnostic nasal endoscopy (DNE) and computed tomography (CT) of the paranasal sinuses within the same cohort, without intervention or follow-up bias.

The study was conducted in the Department of Otorhinolaryngology and Head & Neck Surgery, at tertiary care teaching hospital, Bhopal, Madhya Pradesh. The study was carried amongst 170 chronic rhinosinusitis patients from May 2024 to December 2025. Patients of both sexes aged **15 years and above** who fulfilled the inclusion criteria were enrolled consecutively after obtaining informed consent. Patients with acute rhinosinusitis (symptoms <12 weeks), with history of previous nasal or sinus surgery, with suspected sinonasal neoplasms, fungal sinusitis, or granulomatous diseases and patients with craniofacial trauma or congenital nasal deformities were excluded.

A **purposive (convenience) sampling technique** was employed. All eligible patients presenting to the ENT department during the study period who met the inclusion criteria and consented to participate were recruited until the desired sample size was achieved. Prior to commencement, the study protocol was submitted to the Institutional Ethics Committee for review and approval. Ethical clearance was obtained from Institutional Ethics Committee.

Data Collection: All eligible patients underwent a systematic evaluation including detailed history, clinical examination, diagnostic nasal endoscopy, and computed tomography scan of the paranasal sinuses. Findings were recorded in a predesigned proforma.

1. Diagnostic Nasal Endoscopy (DNE):

All patients underwent rigid nasal endoscopy using a 0° and 30° Hopkins rod endoscope (Karl Storz, Germany) of 4 mm diameter after adequate nasal preparation. Nasal mucosa was decongested with 4% lignocaine with 1:100,000 adrenaline spray and topical anesthetic for patient comfort. The Messerklinger technique was followed to systematically examine the nasal cavity and osteomeatal complex. The following findings were assessed:

- Appearance of nasal mucosa (edematous, pale, congested, polypoidal)
- Presence of purulent discharge or crusts in the middle meatus
- Polyp formation and grading
- Anatomical variations (deviated septum, concha bullosa, paradoxical middle turbinate, accessory ostia, etc.)
- Status of osteomeatal complex patency

Findings were scored using the Lund-Kennedy Endoscopic Scoring System. Each nasal cavity was assessed for polyps (0-2), discharge (0-2), and edema (0-2), giving a total possible score of 0-12 for both sides combined. All examinations were performed by the same observer to minimize inter-observer variability. Endoscopic photographs were taken when necessary for documentation.

2. Computed Tomography (CT) of Paranasal Sinuses

All patients underwent non-contrast computed tomography scan of paranasal sinuses. Scanning was performed using Siemens Somatom or equivalent 64-slice CT scanner with the following parameters:

- Slice thickness: 2-3 mm
- Scanning planes: Axial and coronal views
- Field of view: 12-15 cm

- Window settings: Bone (2,000 HU) and soft tissue (400 HU)

CT images were analyzed in both coronal and axial planes for mucosal thickening, sinus opacification, air-fluid levels, and anatomical variants. The severity of sinus disease was scored using the Lund-Mackay Scoring System, assigning: 0 = no opacification; 1 = partial opacification; 2 = complete opacification

Each sinus (maxillary, anterior ethmoid, posterior ethmoid, sphenoid, frontal) on both sides, and the osteomeatal complex, were evaluated, giving a maximum possible score of 24. All CT scans were interpreted by a single radiologist who was blinded to the endoscopic findings to reduce observer bias.

3. Correlation of Endoscopic and CT Findings: The endoscopic scores and CT scores were tabulated and compared to determine the degree of correlation. Parameters evaluated included:

- Presence of mucosal edema or thickening
- Purulent discharge vs sinus opacification
- Polyps vs sinus blockage
- Osteomeatal complex obstruction

Data Collection Tool

A structured data collection proforma was used to record demographic data, clinical findings, endoscopic scores, CT findings, and final correlation. The proforma ensured uniformity and completeness of data recording. Each patient was assigned a unique identification number to maintain confidentiality. Independent variables include age, gender, and duration of symptoms, presence of allergy or asthma, and anatomical variations. Dependent variables include nasal endoscopic findings (Lund-Kennedy score), CT findings (Lund-Mackay score), and correlation between the two modalities.

Statistical Analysis

All collected data was entered into a Microsoft Excel sheet and later analyzed using Statistical Package for the Social Sciences (SPSS) version 26.0 (IBM Corp., Armonk, NY). Descriptive statistics such as mean, standard deviation, and percentage were calculated for demographic and clinical parameters. The correlation between endoscopic and CT findings was analyzed using the Spearman's correlation coefficient. A p-value of <0.05 was considered statistically significant. Categorical data was analyzed using the Chi-square test where applicable.

RESULTS

Total 170 rhinosinusitis patients were selected for the study. Out of 170 patients, 98 were male and 72 were female which shows male predominance. Nasal obstruction & nasal discharge emerged as the most common major complaints. Nasal obstruction & nasal discharge were found among 77 & 93 patients respectively. Facial pain & hyposmia as minor complaints were there among 80 & 90 patients respectively. The majority of patients belonged to the young and middle-aged group, with most cases clustering between 21 to 50 years of age. Mean age was 38.78 ± 12.90 years. Mean duration of illness was 3.25 ± 1.56 years. Mean SNOT 22 score was 54.11 ± 2.63. Mean Lund Mackay score was 11.28 ± 1.89. Mean Lund Kennedy Score was 6.93±1.42.

Right inferior turbinate was found hypertrophied among all 170 patients in nasal endoscopy. Right middle turbinate had paradoxical curve among 31 (11.2%) patients and was hypertrophied among 139 (74.7%) patients. Right ethmoid bulla was normal among 119 (70%) patients and large among 51 (30%) patients. Right osteomeatal complex was normal among 28 (16.5%) patients. It was partially blocked among 113 (66.5%) and blocked among 29 (17.1%) patients. (Figure 1)

Left inferior turbinate was found hypertrophied among all 170 patients in nasal endoscopy. Left middle turbinate was hypertrophied among all 170 patients. Left ethmoid bulla was normal among 132 (77.6%) patients and large among 38 (22.4%) patients. Left osteomeatal complex was normal among 12 (7.1%) patients. It was partially blocked among 104 (61.2%) and blocked among 54 (31.8%) patients. (Figure 2)

Figure 3 reveals nasal CT findings on right side of nose among rhinosinusitis patients. Right inferior turbinate was also found hypertrophied among all 170 patients in CT. Right middle turbinate had paradoxical curve among 31 (11.2%) patients and was hypertrophied among 139 (74.7%) patients. Right ethmoid bulla was normal among 119 (70%) patients and large among 51 (30%) patients. Right osteomeatal complex was normal among 28 (16.5%) patients. It was also partially blocked among 113 (66.5%) and blocked among 29 (17.1%) patients in CT. (Figure 3)

Figure 4 reveals nasal CT findings on left side of nose among rhinosinusitis patients. Left inferior turbinate was also found hypertrophied among all 170 patients in CT. Left middle turbinate was hypertrophied among all 170 patients. Left ethmoid bulla was normal among 132 (77.6%) patients and large among 38 (22.4%) patients. Left osteomeatal complex was normal among 12 (7.1%) patients. It was also partially blocked among 104 (61.2%) and blocked among 54 (31.8%) patients in CT. (Figure 4)

Table 1 reveals nasal septum findings in nasal endoscopy & CT. Septum was deviated among 126 (74.1%) patients in both nasal endoscopy and CT. Spur was present in 15 (8.8%) patients in both nasal endoscopy and CT. Septum was found normal among 17 (10.0%) and it was mild deviated among 12 (7.1%)

patients in both endoscopy and CT. A significant correlation was observed between endoscopic findings and CT scan results. (P=0.01)

Table 2 reveals correlation of type of septum between nasal endoscopy and CT. Most of patients, 56 (32.9%) and 55 (32.4%) had type 3 & type 4 nasal septum in nasal endoscopy. While in CT also type 4 septum was most prevalent 40 (23.5%) followed by type 3, 15 (8.8%) patients. There was statistically significant correlation found between nasal endoscopy and CT in respect to nasal septum. (r=0.253) (P=0.001)

Table 3 reveals correlation of right middle turbinate, right bulla, right osteomeatal complex, left bulla, left osteomeatal complex between nasal endoscopy and CT. A significant correlation was observed between endoscopic findings and CT scan results with respect to right middle turbinate, right bulla, right osteomeatal complex, left bulla, and left osteomeatal complex. (r=1.000) (P=0.01)

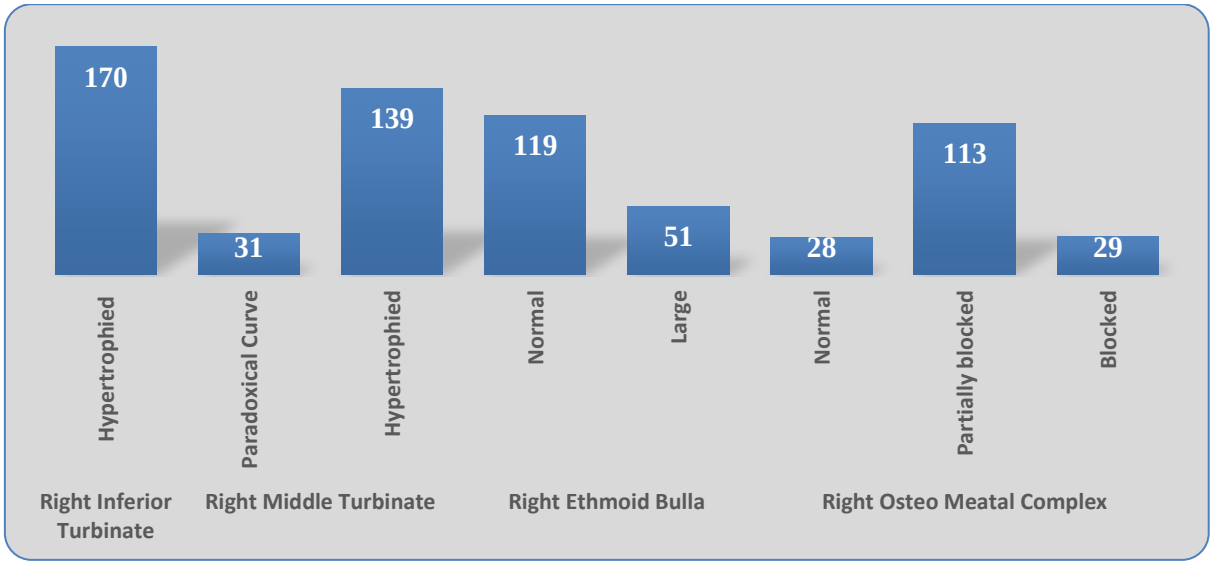

Figure-1: Nasal Endoscopy findings on right side of nose among rhinosinusitis patients

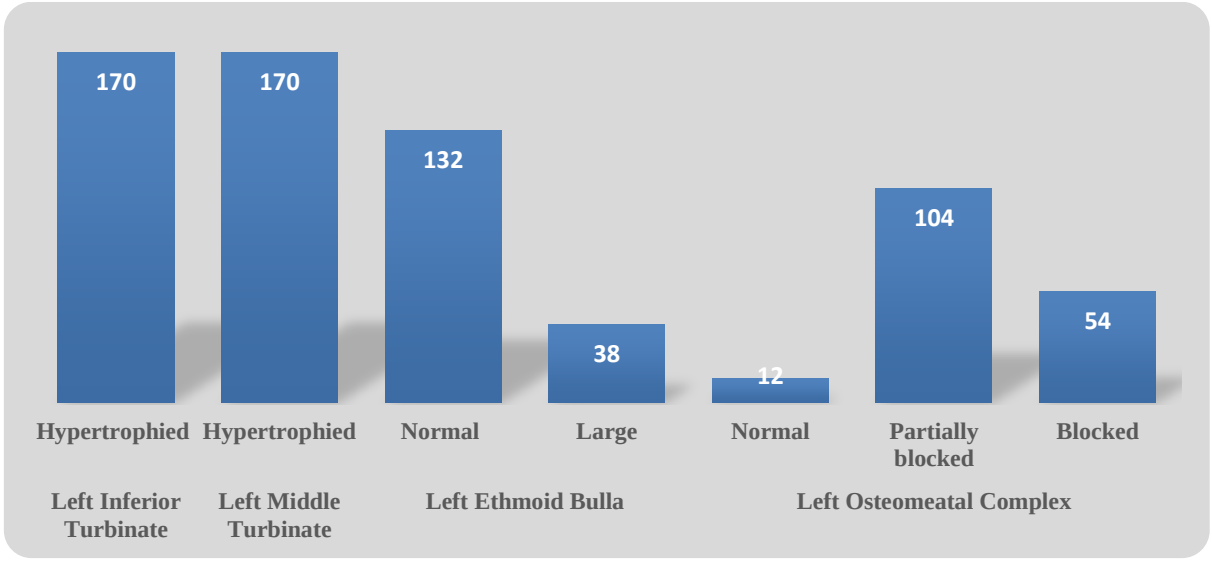

Figure-2: Nasal Endoscopy findings on left side of nose among rhinosinusitis patients

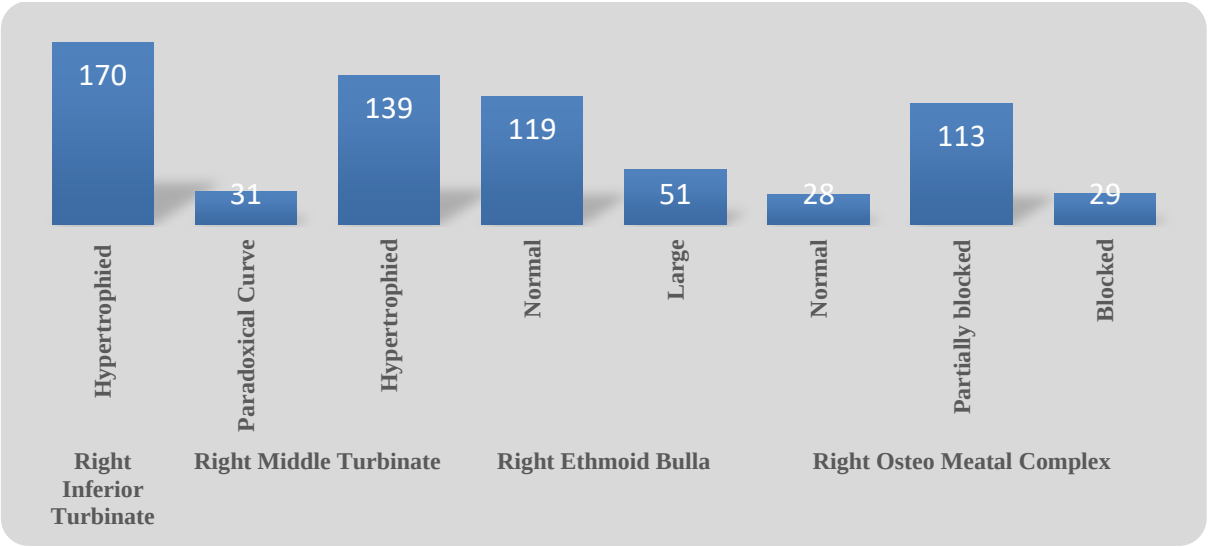

Figure-3: CT findings on right side of nose among rhinosinusitis patients

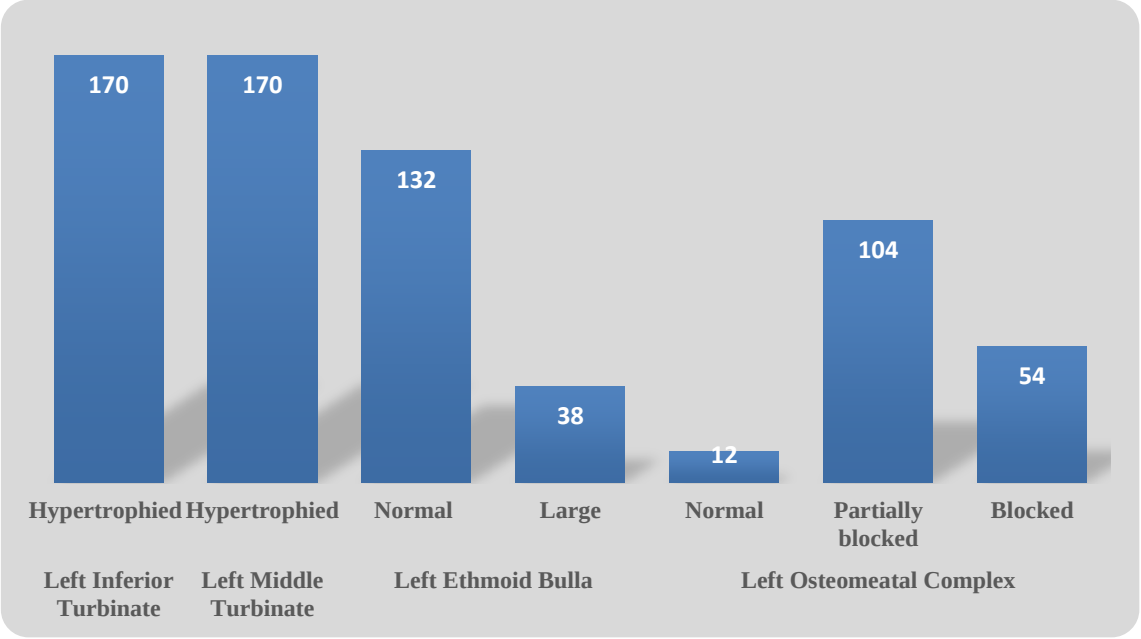

Figure-4: CT finding on left side of nose among rhinosinusitis patients

Table-1: Correlation of septum between nasal endoscopy and CT

Septum	Nasal Endoscopy	CT
	N (%)	N (%)
Deviated	126(74.1%)	126(74.1%)
Spur Present	15(8.8%)	15(8.8%)
Normal	17(10.0%)	17(10.0%)
Mild Deviation	12(7.1%)	12(7.1%)
Spearman's Correlation Coefficient	**1.000**	
Significance 'P' Value	**0.01(S)**	

Table-2: Correlation of type of septum between nasal endoscopy and CT

Type of septum	Nasal Endoscopy	CT
	N (%)	N (%)
Type 1	1[0.6%]	0[0.0%]
Type 2	0(0.0%)	0(0.0%)
Type3	56(32.9%)	15(8.8%)
Type 4	55(32.4%)	40(23.5%)
Type 5	23(13.5%)	4(2.4%)
Type6	1(0.6%)	5(2.9%)
Type 7	5(2.9%)	9(5.3%)
Spearman's Correlation Coefficient	0.253	
Significance 'P' Value	0.001(HS)	

Table-4: Correlation between Endoscopy and CT Findings

Parameter	Spearman's Correlation (r)	p-value
Right Middle Turbinate	1.000	0.01(S)
Right Bulla	1.000	0.01(S)
Right Osteomeatal Complex	1.000	0.01(S)
Left Bulla	1.000	0.01(S)
Left Osteomeatal Complex	0.995	0.001(HS)

DISCUSSION

The present study was undertaken to evaluate and correlate diagnostic nasal endoscopy findings with computed tomographic findings in patients with chronic rhinosinusitis (CRS). A total of 170 patients were included, and detailed clinicoradiological correlation was performed. The findings of the present study highlight the significant role of both modalities in the evaluation and management of CRS. Furthermore, the study reinforces the concept that CRS is a multifactorial disease where anatomical, inflammatory, and environmental factors interplay, necessitating a combined diagnostic approach. The integration of clinical, endoscopic, and radiological findings improves diagnostic accuracy and treatment planning.

Endoscopy proved highly effective in detecting mucosal changes, secretions, and polyps. However, its limitation lies in inability to assess deeper sinus structures. CT scan, on the other hand, provided comprehensive visualization of sinus involvement and anatomical variations.

Demographic Distribution

The demographic distribution in the present study showed that 98 (57.6%) were males and 72 (42.4%) were females, indicating a male predominance. Similar findings were reported by Goyal *et al.* [8] and Raman *et al.*, [9] where males constituted 81.4% and 66.7% of cases respectively. This finding is also consistent with Quan *et al.* [10] and Nathan *et al.*, [11] who reported higher male preponderance among CRS patients. The higher incidence among males may be attributed to increased exposure to environmental pollutants, occupational hazards such as dust and chemicals, smoking habits, and outdoor activities, all of which contribute to chronic mucosal irritation and inflammation. However, in contrast, study by Nair S [12] observed a female predominance in which 60% were females and 39.2% were males, suggesting that hormonal influences, healthcare-seeking behavior, and regional variations may influence gender distribution. This discrepancy highlights that CRS is a multifactorial disease and demographic patterns may not be universally consistent.

Age-wise distribution revealed that the majority of patients in the present study belonged to the 21-40 years age group, with the highest proportion in 31-40 years category, followed by 21-30 years. The mean age of the study population was 38.78 ± 12.90 years. Similar age distribution has been reported by Mundra *et al.*, [13] Ramchandra *et al.*, [14] and Killu *et al.* [15] who observed peak incidence in the third and fourth decades of life.

Clinical Presentation

In the present study, nasal discharge and nasal obstruction were the most common major complaints. Among minor complaints, hyposmia (52.9%) and facial pain (47.1%) were frequently reported. These findings are comparable to studies by Kagathara *et al.* [16] and Quan *et al.*, [10] who reported nasal discharge and nasal congestion as predominant symptoms. Similarly, Raman *et al.* [9] and Nathan *et al.* [11] also observed nasal obstruction as the most common presenting complaints. In contrast Bhattacharya and Lee [17] reported that the most frequently occurring symptoms in the patients was facial pain or pressure in 100% patients, followed by mucopurulent discharge (75.7%), nasal obstruction (69.3%) and hyposmia (55.4%).

Nasal Endoscopy Findings

Nasal endoscopy in the present study revealed that inferior turbinate hypertrophy was present in 100% of patients bilaterally. This finding suggests chronic mucosal inflammation and compensatory hypertrophy, which contributes significantly to nasal obstruction and impaired airflow. Middle turbinate abnormalities were also highly prevalent. Hypertrophy of the middle turbinate was observed in 74.7% of patients on the right side and 100% on the left side, while paradoxical middle turbinate was noted in 11.2% of cases. These anatomical variations play a crucial role in narrowing the middle meatus and obstructing the osteomeatal complex (OMC), thereby impairing sinus drainage and ventilation. Similar findings were reported by Killu *et al.* [15] and Goyal *et al.* [8] who identified turbinate hypertrophy as a common endoscopic finding in CRS.

Ethmoid bulla enlargement was observed in right and left of patients. This is comparable to Mundra *et al.*, [13] who reported that prominent bulla ethmoidalis contributes to osteomeatal complex obstruction and disease progression. Osteomeatal complex (OMC) obstruction was one of the most important findings in this study. A majority of patients showed partial blockage (right: 66.5%, left: 61.2%), while complete blockage was observed in 17.1% on the right side and 31.8% on the left side. These findings are consistent with Nangia *et al.* [18] and Quan *et al.* [10].

CT Scan Findings

CT findings in the present study closely mirrored the nasal endoscopic findings, reinforcing the reliability of both modalities. Inferior turbinate hypertrophy was observed in all of patients bilaterally, while middle turbinate hypertrophy and paradoxical curvature showed identical distribution to endoscopic findings reinforcing the reliability of both modalities.

Middle turbinate hypertrophy and paradoxical curvature showed identical distribution as seen on endoscopy, indicating strong agreement between the two modalities. CT scan, however, provided superior visualization of deeper anatomical structures, sinus cavities, and bony landmarks, which are not always accessible through endoscopy. It also aids in identifying potential surgical risks, thereby improving operative safety. Ethmoid bulla enlargement and OMC obstruction on CT also showed similar patterns as observed in endoscopy. These findings are consistent with studies by Goyal *et al.* [8] and Nathan *et al.* [11] who reported that CT scan provides detailed anatomical visualization and closely correlates with endoscopic findings.

Nasal Septum Findings

In the present study, septal deviation was observed in 74.1% of patients, with identical findings on both nasal endoscopy and CT scan. Spur formation was seen in 8.8% of patients. These findings are comparable to Goyal *et al.* [8] and Ramchandra *et al.*, [14] who reported septal deviation in approximately 60-70% of CRS cases. The high prevalence of septal deviation supports the hypothesis proposed by Mundra *et al.*, [13] that altered airflow dynamics and impaired mucociliary clearance due to septal deviation contribute significantly to the development of CRS. Deviated septum can lead to narrowing of the osteomeatal complex and predispose to sinus obstruction. Regarding the type of septum, Type 3 and Type 4 deviations were most common in both endoscopy and CT findings. A statistically significant correlation (P=0.001) was observed between the two modalities, indicating reliable assessment of septal variations. Recognition of the type and severity of septal deviation is important for surgical planning, as correction of septal deformity can significantly improve sinus ventilation and overall treatment outcomes.

Correlation between Nasal Endoscopy and CT Findings

Deviated septum can lead to narrowing of the osteomeatal complex and predispose to sinus obstruction. Several parameters such as inferior turbinate hypertrophy, middle turbinate hypertrophy, ethmoid bulla enlargement, and osteomeatal complex obstruction showed near perfect correlation (Spearman's coefficient=1.000, P=0.01). Similarly, septal findings also demonstrated significant correlation (P=0.01), while type of septum showed moderate but statistically significant correlation (r=0.253, P=0.001). Left osteomeatal complex showed near-perfect correlation (r=0.995, P=0.001). This strong agreement validates the diagnostic reliability of nasal endoscopy as an initial evaluation tool. It also suggests that in selected cases, endoscopy may reduce the need for immediate CT imaging, thereby minimizing radiation exposure and cost. These findings are in agreement with Kagathara *et al.*, [16] Quan *et al.* [10] and Nathan *et al.* [11] who reported strong positive correlations between endoscopic and CT findings. Goyal *et al.* [8] and Nangia *et al.* [18] also demonstrated high sensitivity and specificity of nasal endoscopy compared to CT.

The near-perfect correlation observed in the present study suggests that diagnostic nasal endoscopy is a highly reliable, cost-effective, and minimally invasive diagnostic tool for CRS. However, CT scan remains indispensable for detailed anatomical assessment, evaluation of disease extent, identification of anatomical variations, and preoperative planning for surgical intervention. The combined use of both modalities ensures a holistic understanding of CRS, enabling accurate diagnosis, better disease mapping, and improved surgical outcomes.

CONCLUSION

The present study concludes that there is a strong and statistically significant correlation between diagnostic nasal endoscopy and computed tomography findings in

patients with chronic rhinosinusitis. Diagnostic nasal endoscopy proved to be highly effective in identifying mucosal changes, turbinate hypertrophy, and osteomeatal complex obstruction, while computed tomography provided superior visualization of bony structures, sinus involvement, and anatomical variations. Thus, both modalities serve distinct yet complementary roles in the evaluation of chronic rhinosinusitis.

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