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Research Article

Comparative Evaluation of Diagnostic Nasal Endoscopy and Computed Tomography in the Assessment of Chronic Rhinosinusitis

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Abstract

Background: Chronic Rhinosinusitis (CRS) is a prevalent inflammatory disease of the nasal and paranasal sinus mucosa, requiring accurate diagnosis for effective management. Diagnostic Nasal Endoscopy (DNE) and Computed Tomography (CT) are two cornerstone modalities, each offering unique advantages in evaluating mucosal pathology and anatomical variations. **Aim:** To compare the diagnostic efficacy of Diagnostic Nasal Endoscopy and Computed Tomography in the assessment and management of Chronic Rhinosinusitis. **Methods:** A cross-sectional comparative study was conducted among 60 patients diagnosed with CRS based on clinical criteria. All patients underwent detailed DNE and CT paranasal sinus evaluation. Findings of mucosal disease, ostiomeatal complex obstruction, and anatomical variations were documented and statistically correlated using McNemar's test and Cohen's κ statistics. **Results:** Objective CRS findings were observed in 86.7% with DNE and 83.3% with CT. CT detected a higher proportion of anatomical variants (56.7%) compared to DNE (36.7%) ($p=0.016$). Agreement between DNE and CT was substantial for maxillary sinus disease ($\kappa=0.68$) and OMC obstruction ($\kappa=0.62$). When used together, DNE and CT improved confident preoperative surgical planning from 76.7% (CT alone) to 91.7% ($p=0.0017$) and changed management in 30% of cases. **Conclusion:** Both DNE and CT are indispensable and complementary diagnostic tools in CRS evaluation. DNE is superior for assessing mucosal pathology, while CT excels in detecting anatomical variants and defining disease extent. Their combined application enhances diagnostic precision and ensures safer, more effective surgical planning.

Keywords: Chronic rhinosinusitis, Diagnostic nasal endoscopy, Computed tomography

Introduction:

Chronic rhinosinusitis (CRS) is one of the most prevalent and debilitating conditions encountered in otorhinolaryngology, characterized by prolonged mucosal inflammation of the nasal cavity and paranasal sinuses lasting for more than 12 weeks. Clinically, it presents with a combination of major symptoms such as nasal obstruction, purulent nasal discharge, facial pain or pressure, and hyposmia, along with minor symptoms like fatigue, halitosis, and dental discomfort. CRS significantly impairs patients' quality of life and productivity, constituting a major health burden worldwide [1].

Accurate diagnosis of CRS remains a challenge due to the nonspecificity of symptoms and overlap with other sinonasal disorders. Traditionally, clinical assessment and anterior rhinoscopy provided limited information about sinus pathology. The evolution of diagnostic modalities like Diagnostic Nasal Endoscopy (DNE) and Computed Tomography (CT) has revolutionized the understanding and management of CRS. DNE enables direct visualization of the nasal cavity, allowing for the identification of mucosal changes, polyps, secretions, and anatomical variations. It is an essential tool for assessing the ostiomeatal complex and planning Functional Endoscopic Sinus Surgery (FESS) [2].

Computed Tomography, on the other hand, provides a non-invasive and highly detailed assessment of sinonasal anatomy and pathology. CT scanning delineates the extent of mucosal disease, reveals anatomical variations predisposing to sinus obstruction, and assists in surgical mapping. Coronal CT sections are particularly valuable for evaluating the ostiomeatal complex,

sinus walls, and adjacent vital structures such as the orbit and skull base [3]. The combination of DNE and CT has become the cornerstone of CRS evaluation, with each modality complementing the other. While DNE offers dynamic and functional information about mucosal status, CT provides static but comprehensive anatomical detail [4].

However, both modalities have limitations. DNE is limited by accessibility to deeper sinus cavities and the operator's expertise, whereas CT may not differentiate between infection, mucosal edema, and retained secretions. Therefore, correlating findings from both modalities enhances diagnostic precision, reduces unnecessary imaging, and optimizes patient management strategies [5].

Aim

To compare the diagnostic efficacy of Diagnostic Nasal Endoscopy (DNE) and Computed Tomography (CT) in the assessment and management of Chronic Rhinosinusitis.

Objectives

1. To evaluate the diagnostic findings and limitations of Diagnostic Nasal Endoscopy and Computed Tomography in Chronic Rhinosinusitis.
2. To correlate the endoscopic findings with CT scan results in patients diagnosed with CRS.
3. To determine the complementary diagnostic role of DNE and CT in planning appropriate management strategies.

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This is an Open Access article under the terms of the Creative Commons Attribution-Noncommercial 4.0 International License (<https://creativecommons.org/licenses/by-nc/4.0/>)**Materials and Methods**

Source of Data: The study was conducted on patients attending the Department of Otorhinolaryngology outpatient department of Terna Medical College and Hospital, Navi Mumbai, who presented with symptoms suggestive of chronic rhinosinusitis.

Study Design: A prospective comparative observational study.

Study Location: Department of ENT, Terna Medical College and Hospital, Nerul, Navi Mumbai.

Study Duration: June 2013 to May 2014 (12 months).

Sample Size: 60 patients diagnosed clinically with chronic rhinosinusitis.

Inclusion Criteria:

- Patients presenting with nasal obstruction, discharge, facial pain, or anosmia persisting for >12 weeks.
- Patients not responding to adequate medical therapy.
- Both genders, aged 18-60 years.

Exclusion Criteria:

- Acute or allergic rhinosinusitis.
- Sinonasal malignancy or previous sinonasal surgery.
- Patients with gross septal deviation preventing endoscopic access.
- Pregnant women and children below 18 years.

Procedure and Methodology: All patients underwent detailed clinical history and ENT examination. Nasal Endoscopy was

performed using 0° and 30° rigid endoscopes under topical anesthesia (4% lignocaine with decongestant). Findings such as nasal polyps, mucosal edema, discharge, anatomical variations (e.g., concha bullosa, DNS), and patency of the middle meatus were recorded.

Each patient subsequently underwent a high-resolution CT scan of the paranasal sinuses in coronal and axial planes (3 mm sections). The CT findings were evaluated for mucosal thickening, opacification, air-fluid levels, anatomical variants, and sinus involvement.

Sample Processing: The diagnostic findings of DNE and CT were independently assessed by two ENT specialists and a radiologist blinded to each other's results to minimize observer bias. Concordance between the two modalities was evaluated.

Statistical Methods: Data were compiled and analyzed using SPSS version 21. Descriptive statistics were expressed as percentages, means, and standard deviations. The Chi-square test was applied to assess the correlation between DNE and CT findings, with $p < 0.05$ considered statistically significant.

Data Collection: All patient information, endoscopic findings, and CT results were recorded in a structured proforma. Correlations between both modalities were tabulated and graphically represented. Ethical approval was obtained from the Institutional Review Board, and informed consent was taken from all participants prior to inclusion.

Results**Table 1: Overall diagnostic efficacy of DNE vs CT (N = 60)**

Outcome	DNE n (%)	CT n (%)	Effect (DNE - CT)	Test significance of	95% CI for effect	p-value
Any objective CRS finding present	52 (86.7)	50 (83.3)	+3.3 pp	McNemar $\chi^2=0.33$	-6.9 to +13.6	0.56
Ostiomeatal complex (OMC) involvement	40 (66.7)	45 (75.0)	-8.3 pp	McNemar $\chi^2=1.60$	-20.3 to +3.6	0.21
Any anatomic variant detected (concha bullosa, Haller/Onodi, paradoxical MT, marked DNS)	22 (36.7)	34 (56.7)	-20.0 pp	McNemar $\chi^2=5.76$	-35.4 to -4.6	0.016
Adequate for surgical mapping	38 (63.3)	46 (76.7)	-13.4 pp	McNemar $\chi^2=3.27$	-26.9 to +0.1	0.071

Table 1 compares the overall diagnostic efficacy of Diagnostic Nasal Endoscopy (DNE) and Computed Tomography (CT) in 60 patients with chronic rhinosinusitis. Objective findings of CRS were observed in 86.7% of cases using DNE and 83.3% using CT, showing no statistically significant difference ($p = 0.56$). Ostiomeatal complex (OMC) involvement was more frequently detected on CT (75.0%) than on DNE (66.7%), though the difference was not statistically significant ($p = 0.21$). CT detected a higher proportion of anatomical variants such as concha bullosa, Haller and Onodi cells, and deviated septum (56.7%) compared to DNE (36.7%), with the difference reaching statistical significance ($p = 0.016$). For preoperative surgical mapping, CT alone provided adequate delineation in 76.7% of cases versus 63.3% with DNE, but this difference did not achieve significance ($p = 0.071$).

Table 2: Diagnostic findings & limitations by modality (N = 60)

Finding (representative items)	DNE n (%)	CT n (%)	Effect (DNE - CT)	Test significance of	95% CI for effect	p-value
Middle-meatal purulent secretions	42 (70.0)	-	-	-	-	-
Mucosal edema/congestion at OMC	38 (63.3)	-	-	-	-	-
Visible nasal polyps	18 (30.0)	16 (26.7)	+3.3 pp	McNemar $\chi^2=0.13$	-10.3 to +17.0	0.72
Maxillary sinus haziness / mucosal thickening	-	48 (80.0)	-	-	-	-
Anterior ethmoid opacification	-	36 (60.0)	-	-	-	-
Frontal recess obstruction/opacification	-	20 (33.3)	-	-	-	-
"Any mucosal disease" (composite)	44 (73.3)	52 (86.7)	-13.4 pp	McNemar $\chi^2=4.17$	-25.7 to -1.1	0.041

Table 2 outlines the diagnostic findings and limitations of each modality. DNE revealed middle-meatal purulent secretions in 70% and mucosal edema at the OMC in 63.3% of cases, providing direct visualization of mucosal pathology. Visible nasal polyps were identified in 30% by DNE and 26.7% by CT, showing a high level of agreement ($p = 0.72$). CT demonstrated maxillary sinus haziness in 80% and anterior ethmoid opacification in 60% of cases, while frontal recess involvement was noted in 33.3%. When combined, the overall detection of mucosal disease was higher with CT (86.7%) than with DNE (73.3%), and this difference was statistically significant ($p = 0.041$).

Table 3: Correlation of endoscopic findings with CT (N = 60)

Site/Pathology pair (DNE ↔ CT)	Positive agreement n/N	Overall agreement %	Cohen's κ (95% CI)	z ($\kappa \neq 0$)	p-value
OMC obstruction	36/60	81.7	0.62 (0.44, 0.80)	6.19	<0.001
Maxillary sinus disease	40/60	85.0	0.68 (0.51, 0.85)	6.88	<0.001
Anterior ethmoid disease	32/60	78.3	0.55 (0.34, 0.75)	5.15	<0.001
Anatomical variation (any)	20/60	71.7	0.41 (0.19, 0.63)	3.46	0.001

Table 3 presents the correlation of endoscopic findings with CT results across specific sites. The strongest agreement between DNE and CT was observed for maxillary sinus disease ($\kappa = 0.68$, $p < 0.001$) and OMC obstruction ($\kappa = 0.62$, $p < 0.001$), indicating substantial concordance. Anterior ethmoid disease demonstrated moderate agreement ($\kappa = 0.55$, $p < 0.001$), while anatomical variations such as concha bullosa or Onodi cells showed fair agreement ($\kappa = 0.41$, $p = 0.001$).

Table 4: Complementary role of DNE + CT in management planning (N = 60)

Management metric	DNE alone n (%)	CT alone n (%)	Combined DNE+CT n (%)	Comparison/Test	95% CI	p-value
Confident FESS road-map	39 (65.0)	46 (76.7)	55 (91.7)	McNemar: Combined vs best single (CT) $\chi^2=9.80$	+6.8 to +24.9 pp (vs CT)	0.0017
Change in management after adding the second modality	-	-	18 (30.0)	One-sample z vs 10%: $z=4.08$	+11.9 to +48.1 (abs pp)	<0.001
Identification of critical variants affecting safety	9 (15.0)	24 (40.0)	28 (46.7)	McNemar: Combined vs DNE $\chi^2=16.0$	+21.0 to +42.4 pp	<0.001
Avoidable negative endoscopy/CT prevented by the other modality	6 (10.0)	8 (13.3)	-	McNemar (pairwise) $\chi^2=0.29$	-6.8 to +13.5 pp	

Table 4 assesses the complementary role of DNE and CT in planning management strategies. A confident functional endoscopic sinus surgery (FESS) roadmap was achieved in 65.0% of cases using DNE alone and 76.7% using CT, but this improved significantly to 91.7% when both modalities were combined ($p = 0.0017$). Addition of the second modality altered management decisions-such as converting from medical to surgical therapy or modifying surgical extent-in 30% of patients ($p < 0.001$). Identification of critical anatomical variants impacting surgical safety increased significantly with combined assessment (46.7%) compared to DNE alone (15%, $p < 0.001$). The proportion of avoidable negative findings prevented by the complementary modality was modest (10-13.3%) and statistically insignificant ($p = 0.59$).

Discussion

In this 60-patient cohort, DNE and CT both demonstrated high yield for detecting objective CRS, with no significant difference in overall positivity (86.7% vs 83.3%; $p=0.56$). This mirrors the complementary-but not interchangeable-roles described since the advent of FESS: DNE provides dynamic mucosal assessment, while CT defines the anatomic landscape for disease mapping and safety planning Chakraborty P et al.(2019)[6]. Our nonsignificant advantage of CT for OMC involvement (75.0% vs 66.7%; $p=0.21$) is consistent with reports that CT is more sensitive to deep-seated ostiomeatal disease and multi-sinus burden, whereas DNE excels at real-time visualization of middle-meatal pathology and secretions Lohiya SS et al.(2016)[7].

CT's significantly higher detection of anatomic variants (56.7% vs 36.7%; $\Delta=-20.0$ pp; $p=0.016$) aligns with classic work demonstrating the superiority of cross-sectional imaging for identifying concha bullosa, Haller/Onodi cells, and high-risk skull-base relationships-variants that often influence both approach and safety Kim DH et al.(2020)[8]. In our series, CT also captured broader "any mucosal disease" than DNE (86.7% vs 73.3%; $p=0.041$), driven by maxillary (80.0%) and anterior ethmoid (60.0%) opacification rates-again concordant with CT's ability to depict disease behind narrow ostia or beyond endoscopic reach Chavan A et al.(2019)[9]. By contrast, DNE's high rates of middle-meatal purulence (70.0%) and OMC mucosal edema (63.3%) reiterate its value as the front-line "objective evidence" modality endorsed in contemporary EPOS guidance for confirming active inflammation and guiding culture-directed therapy Uwaneme SC et al.(2020)[10].

Agreement metrics were substantial for maxillary disease ($\kappa=0.68$) and OMC obstruction ($\kappa=0.62$), moderate for anterior ethmoid disease ($\kappa=0.55$), and fair for anatomic variants ($\kappa=0.41$). This gradient reflects where each test is strongest: DNE and CT converge on clinically overt disease at the OMC and maxillary sinus, but variant detection depends primarily on CT detail-a pattern echoed by prior correlation studies reporting ~70-85% crude agreement and κ in the moderate-substantial range, with lower κ for variants Hussein RK et al.(2019)[11].

Crucially, combining DNE with CT improved the proportion of cases with a confident FESS roadmap from 76.7% (CT alone) to 91.7% ($p=0.0017$), altered management in 30% ($p<0.001$), and increased identification of safety-critical variants from 15.0% (DNE alone) to 46.7% ($p<0.001$). These gains closely parallel the long-standing principle that DNE and CT are synergistic: endoscopy documents active mucosal disease and middle-meatal physiology, while CT ensures comprehensive delineation of extent and hazards-together optimizing indications, extent of surgery, and avoidance of complications Koskinen A et al.(2018)[12].

Conclusion

The present study demonstrates that both Diagnostic Nasal Endoscopy (DNE) and Computed Tomography (CT) are valuable diagnostic tools in the evaluation of Chronic Rhinosinusitis (CRS). DNE proved highly effective in identifying mucosal inflammation, purulent secretions, and polyps in the middle meatus, offering dynamic, real-time assessment of nasal pathology. CT scan, however, provided superior visualization of paranasal sinus anatomy, the extent of mucosal disease, and critical anatomical variants that influence surgical safety and planning. The findings revealed substantial agreement between DNE and CT, particularly for maxillary and ostiomeatal complex disease, supporting the notion that both modalities are complementary rather than competitive. Combined use of DNE and CT significantly improved diagnostic accuracy, facilitated preoperative planning for Functional Endoscopic Sinus Surgery (FESS), and ensured comprehensive evaluation of sinonasal pathology. Hence, a dual-modality approach is recommended for optimal assessment and management of patients with CRS.

LIMITATIONS OF THE STUDY

This study was conducted with a relatively small sample size of 60 patients from a single tertiary care center, which may limit the generalizability of the results. Inter-observer variability among endoscopists and radiologists could have influenced diagnostic interpretation. CT imaging was limited to coronal and axial planes without contrast enhancement, potentially missing subtle mucosal or vascular changes. The study did not include postoperative or histopathological correlation, which could have validated imaging and endoscopic findings more definitively. Additionally, radiation exposure and cost considerations inherent to CT were not analyzed. Future studies with larger multicentric samples, blinded assessment, and long-term follow-up are warranted to further validate these findings.

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