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# DIAGNOSTIC ACCURACY OF NASAL ENDOSCOPY AND CT IMAGING IN CHRONIC RHINOSINUSITIS: A PROSPECTIVE COMPARATIVE STUDY

Otorhinolaryngology

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## ABSTRACT

**Background** A frequent inflammatory condition of the nose and paranasal sinuses, chronic rhinosinusitis (CRS) has a major negative impact on quality of life. For efficient care and surgical planning, accurate preoperative evaluation is crucial. The two main diagnostic methods used to assess CRS are computed tomography of the paranasal sinuses (CT-PNS) and diagnostic nasal endoscopy (DNE). **Objective** To assess the diagnostic accuracy and correlation between diagnostic nasal endoscopy and CT imaging in patients with chronic rhinosinusitis. **Methods** This 18-month prospective observational study was carried out in the Department of Otorhinolaryngology at ESIC Medical College and PGIMSR, Kalaburagi, between June 2023 and December 2024. There were 86 patients with chronic rhinosinusitis who had been clinically diagnosed. All patients underwent detailed clinical evaluation, diagnostic nasal endoscopy, CT-PNS, and functional endoscopic sinus surgery (FESS). Sensitivity, specificity, and diagnostic accuracy were assessed by comparing intraoperative results with endoscopic and radiographic results. **Results** The majority of patients were between the ages of 21 and 40, with about equal numbers of men and women. The most frequent presenting symptoms were headache/facial discomfort and nasal obstruction. The most prevalent clinical sign was inferior turbinate hypertrophy. For uncinate process involvement, Haller cells, infundibulum, and maxillary sinus illness, CT imaging showed the highest sensitivity. High sensitivity for middle meatus abnormalities, uncinate process, hiatus semilunaris, bulla ethmoidalis, and agger nasi cells was demonstrated by diagnostic nasal endoscopy. While DNE offered superior visualisation of mucosal pathology and middle meatal disease, CT scans successfully defined the extent of sinus disease and structural changes. There was a strong association between intraoperative findings and both modalities.**Conclusion** CT-PNS and diagnostic nasal endoscopy are complementing methods for assessing chronic rhinosinusitis. CT imaging precisely determines the amount of disease and structural changes, whereas DNE is very useful for evaluating mucosal pathology and middle meatal disease. When these modalities are used together, CRS surgical planning and diagnostic precision are enhanced.

## KEYWORDS

Chronic Rhinosinusitis; Diagnostic Nasal Endoscopy; CT-PNS; Functional Endoscopic Sinus Surgery; Diagnostic Accuracy; Endoscopic Sinus Surgery.

## INTRODUCTION

Chronic rhinosinusitis (CRS) is a multifactorial inflammatory disease involving the mucosa of the nose and paranasal sinuses persisting for more than 12 weeks.[1] It is among the most common disorders encountered in otorhinolaryngology practice and contributes significantly to morbidity, healthcare expenditure, and reduction in quality of life.[2]

The diagnosis of CRS based solely on symptoms is often unreliable because of the complex anatomy of the sinonasal cavity and the overlap of symptoms with other nasal disorders. Objective confirmation using diagnostic modalities is therefore essential for accurate diagnosis and appropriate management.[3]

Diagnostic nasal endoscopy (DNE) allows direct visualization of the nasal cavity, middle meatus, osteomeatal complex, and mucosal abnormalities. It is a minimally invasive office-based procedure that provides valuable information regarding edema, purulent discharge, polyps, and anatomical variations.[4]

Computed tomography of the paranasal sinuses (CT-PNS) remains the gold standard radiological investigation for CRS. It provides excellent delineation of sinus anatomy, extent of disease, anatomical variations, and relationship of sinuses to surrounding structures. CT imaging also acts as a surgical roadmap during functional endoscopic sinus surgery (FESS).[5]

Although both DNE and CT-PNS are widely used in evaluation of CRS, controversy remains regarding their relative diagnostic utility and correlation with operative findings.[6] This study was therefore undertaken to evaluate the diagnostic accuracy of nasal endoscopy and CT imaging in chronic rhinosinusitis and to compare their findings with intraoperative observations.

### Objectives

1. To evaluate the correlation between diagnostic nasal endoscopy findings and CT-PNS findings in patients with chronic rhinosinusitis.
2. To assess the diagnostic accuracy of DNE and CT imaging using intraoperative findings as reference standard.
3. To analyze the role of DNE and CT-PNS in preoperative evaluation and surgical planning in CRS.

### Materials and Methods

#### Study Design

Prospective observational study.

#### Study Setting

Department of Otorhinolaryngology, ESIC Medical College and PGIMSR, Kalaburagi, Karnataka.

#### Study Duration

June 2023 to December 2024.

#### Sample Size

A total of 86 patients diagnosed with chronic rhinosinusitis were included in the study.

#### Inclusion Criteria

- Patients aged above 18 years.
- Patients diagnosed clinically with chronic rhinosinusitis persisting for more than 12 weeks.
- Patients willing to undergo diagnostic nasal endoscopy, CT-PNS, and surgical intervention.

#### Exclusion Criteria

- Acute rhinosinusitis.
- Sinonasal malignancy.
- Previous sinonasal surgery.
- Patients unfit for surgery.
- Patients unwilling to participate.

#### Methodology

Every patient had a thorough clinical examination and history taking.

Nasal blockage, headache/facial pain, nasal discharge, postnasal drip, anosmia, and sneezing were among the symptoms evaluated.

0-degree and 30-degree rigid nasal endoscopes were used for diagnostic nasal endoscopy. Mucosal oedema, discharge, polyps, middle meatal abnormalities, uncinate process changes, and anatomical variations were among the findings that were recorded.

Every patient had axial and coronal CT-PNS. Anatomical changes, sinus involvement, osteomeatal complex blockage, sinus opacification, and mucosal thickening were among the radiological abnormalities noted.

Following that, the patients had functional endoscopic sinus surgery (FESS). DNE and CT results were compared with intraoperative findings, which were regarded as the reference standard.

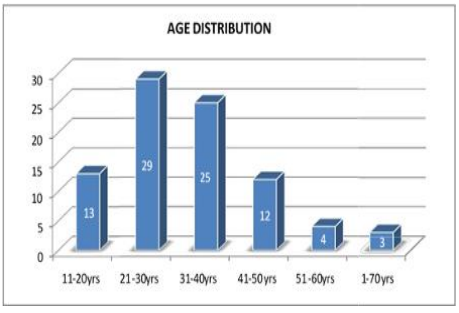
### Statistical Analysis

Data were entered and analyzed using appropriate statistical methods. Sensitivity, specificity, positive predictive value, negative predictive value, and diagnostic accuracy were calculated for DNE and CT-PNS using intraoperative findings as reference standard.

## Results

### Demographic Profile

Among the 86 patients included in the study, the majority belonged to the age group of 21–40 years (GRAPH 1). There was nearly equal gender distribution with 44 males and 42 females.




**GRAPH 1: AGE DISTRIBUTION**

### Clinical Presentation

The most common presenting **symptoms** were**(TABLE 1):**

- Nasal obstruction (82%)
- Headache/facial pain (82%)
- Nasal discharge (70%)

**TABLE 1: SYMPTOMS**

| Symptoms | No of patients | Percentage |
|---|---|---|
| Nasal obstruction | 71 | 82% |
| Nasal discharge | 60 | 70% |
| Headache/facial pain | 71 | 82% |
| Postnasal discharge | 39 | 45% |
| Sneezing | 22 | 25% |

The most common **clinical sign (TABLE 2)** observed was inferior turbinate hypertrophy followed by nasal polyps and pale nasal mucosa.

**TABLE 2: SIGNS**

| Signs | | No of patients | Percentage |
|---|---|---|---|
| Nasal mucosa | Normal | 59 | 51% |
| | Congested | 3 | 3% |
| | Pale | 24 | 21% |
| Inferior turbinate hypertrophy | | 35 | 60% |
| Nasal polyps | | 28 | 32% |
| Purulent discharge in middle meatus | | 21 | 24% |
| Sinus tenderness | | 15 | 17% |

### Diagnostic Nasal Endoscopy (DNE) Findings

**Diagnostic nasal endoscopy** demonstrated **high sensitivity (TABLE 3)** for:

- Middle meatus abnormalities
- Uncinate process disease
- Hiatus semilunaris involvement
- Bulla ethmoidalis changes
- Agger nasi cells

**DNE** showed **highestspecificity (TABLE 3)** for:

- Hiatus semilunaris
- Frontal recess
- Agger nasi cells
- Inferior meatus
- Inferior turbinate

**TABLE 3: CORRELATION OF DIAGNOSTIC ENDOSCOPY FINDINGS WITH OPERATIVE PROCEDURE**

| SL No. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Parameters | IM | IT | MM | MT | UP | HS | BE | SER | FR | ANC |
| Sensitivity [%] | 66.6 | 70 | 94 | 86.6 | 90.2 | 100 | 85.7 | 75 | 83.3 | 94.4 |
| Specificity [%] | 98.5 | 95.7 | 76 | 90.3 | 86.9 | 100 | 83.3 | 80 | 96.5 | 95.6 |
| PPV[%] | 80 | 70 | 90.3 | 89.6 | 93.8 | 100 | 80 | 50 | 93.7 | 94.4 |
| NPV[%] | 97.1 | 95.7 | 84.2 | 87.5 | 80 | 100 | 88.2 | 92.3 | 90.3 | 95.6 |
| Accuracy[ %] | 96 | 92.5 | 88.7 | 88.5 | 89.1 | 100 | 84.3 | 78.9 | 91.4 | 95.1 |
| Chi-square value( $\chi^2$ ) | 37.73 | 34.54 | 37.17 | 36.23 | 42.17 | 47 | 15.07 | 4.42 | 31 | 33.28 |
| p-value | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | 0.03 | <0.05 |

IM–inferiormeatus; IT–inferiorturbinate;MM–middlemeatus; MT–middleturbinate; UP– uncinate process; HS – hiatus semilunaris;BE – bulla ethmoidalis;SER–sphenoethmoidalrecess; FR–frontalrecess; PPV- positive predictive value; NPV- Negative predictive value; ANC- Agger Nasi Cell

### CT-PNS Findings

**CT imaging** demonstrated **highest sensitivity (TABLE 4)** for:

- Uncinate process involvement
- Haller cells
- Infundibulum
- Maxillary sinus disease

**CT scan** showed **highest specificity (TABLE 4)** for:

- Uncinate process
- Middle turbinate
- Inferior turbinate
- Bulla ethmoidalis

**TABLE 4: CORRELATION OF CT-FINDINGS WITH OPERATIVE FINDINGS**

| SL No. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Parameters | IM | IT | MM | MT | IN | UP | MS | HS | BE | AE | PE | SER | HC | FR |
| Sensitivity [%] | 90 | 96 | 95.3 | 86.6 | 98 | 100 | 97 | 97.1 | 96.1 | 87.5 | 88.8 | 80 | 100 | 96.6 |
| Specificity [%] | 78.9 | 91.6 | 46.3 | 98.5 | 82.3 | 100 | 73.6 | 88.2 | 90 | 77.1 | 80.5 | 87.8 | - | 76 |
| PPV[%] | 36 | 94.1 | 73.8 | 92.8 | 89.4 | 100 | 92.8 | 97.1 | 80.6 | 46.6 | 34.7 | 66.6 | 100 | 72.5 |
| NPV[%] | 98 | 94.2 | 86.3 | 97.2 | 96.5 | 100 | 87.5 | 88.2 | 98.1 | 96.4 | 98.4 | 93.5 | - | 97.2 |
| Accuracy[ %] | 80.4 | 94.1 | 76.4 | 96.5 | 91.8 | 100 | 91.8 | 95.3 | 91.8 | 79 | 81.4 | 86 | - | 84.2 |
| Chi-square value ($\chi^2$) | 20.37 | 66.65 | 26.61 | 66.04 | 59.50 | 86 | 48.85 | 62.62 | 58.40 | 23.95 | 19.81 | 35.15 | - | 38.55 |
| p-value | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | - | <0.05 |

CT–CT findings;OT– OT findings; IM–inferior meatus; IT–inferior turbinate;MM–middle meatus; MT–middle turbinate; IN – infundibulum; UP– uncinate process; HS – hiatus semilunaris;BE – bulla ethmoidalis; AE – anterior ethmoids; MS–maxillary sinus;PE –posterior ethmoids; SER–sphenoethmoidal recess; HC–haller cell; FR–frontal recess; PPV- positive predictive value; NPV- Negative predictive value

The most common **CT pattern** was **infundibular type** followed by **osteomeatal complex** type.

Maxillary sinus was the most commonly involved sinus.

### Operative Procedures

Out of 86 patients:
- 60 underwent unilateral procedures
- 26 underwent bilateral procedures

Middle meatal antrostomy (MMA) was the most commonly performed procedure and was performed in all patients.

### Correlation with Intra-operative Findings
There was a strong association between intraoperative observations and both DNE and CT-PNS results.

While CT imaging more successfully showed the degree of the disease and structural changes, DNE was more accurate in identifying mucosal disease and middle meatal pathology.

During FESS, CT-PNS functioned as an efficient surgical roadmap and offered superior assessment of deeper sinus involvement.

## DISCUSSION
Chronic rhinosinusitis remains a common condition encountered in ENT practice. Accurate diagnosis and assessment of disease extent are essential for optimal management and surgical planning.[7]

In the present study, the majority of patients belonged to the third decade of life, which is comparable with previous studies reported in literature. Male and female distribution was nearly equal.

Nasal obstruction and headache/facial pain were the most common symptoms, correlating with findings from other Indian and international studies.[8]

Diagnostic nasal endoscopy proved highly useful in evaluating mucosal disease and middle meatal pathology. It allowed direct visualization of edema, discharge, polyps, and anatomical abnormalities affecting the osteomeatal complex.[9]

CT-PNS demonstrated excellent delineation of sinus anatomy and disease extent. It was particularly valuable in identifying anatomical variations such as Haller cells, agger nasi cells, and uncinate process abnormalities.[10]

The present study demonstrated that DNE and CT-PNS are complementary rather than competing modalities. While DNE provides dynamic and real-time visualization of mucosal pathology, CT imaging offers superior assessment of deeper structures and extent of sinus involvement.[11]

The significant correlation observed between DNE, CT imaging, and intraoperative findings supports the combined use of both modalities in preoperative evaluation of CRS.[12]

CT imaging also played a crucial role in identifying anatomical variations and dangerous areas prior to surgery, thereby reducing operative complications.

## CONCLUSION
1. People in their third decade of life are typically affected by chronic rhinosinusitis.

2. The most frequent presenting symptoms were nasal obstruction and headache/facial discomfort

3. The most prevalent clinical sign was inferior turbinate hypertrophy.

4. Middle meatal disease and mucosal abnormalities are successfully detected by diagnostic nasal endoscopy.

5. Anatomical variations, sinus involvement, and disease extent are all accurately depicted by CT-PNS.

6. There was a strong correlation between intraoperative results and both DNE and CT-PNS.

7. CT imaging and diagnostic nasal endoscopy are complementing techniques for assessing CRS.

8. Using DNE and CT-PNS together enhances diagnostic precision and makes surgical planning more efficient.

### Ethical Clearance
Ethical clearance for the study was obtained from the Institutional Ethics Committee of ESIC Medical College and PGIMSR, Kalaburagi.

### Conflict of Interest
The authors declare no conflict of interest.

### Funding
No external funding was received for this study.

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