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The Role of Diagnostic Nasal Endoscopy and Computed Tomography Scan of Nose and PNS in the Assessment of Chronic Rhinosinusitis: A Retrospective Comparative Study at a Tertiary Care Institute in Tripura

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ABSTRACT

Background: Chronic rhinosinusitis (CRS) affects a significant population worldwide, imposing a huge impact on the human economy as well as on quality of life. The diagnosis of chronic rhinosinusitis done primarily based on findings of diagnostic nasal endoscopy (DNE) or a computed tomography (CT) scan. It is particularly important to define a cost-effective, reliable and easily available diagnostic tool for a country like India where resources are limited and not evenly distributed. Hence, this study has been conducted with the aim of assessing the efficacy of DNE in comparison with CT scan of PNS for evaluating CRS.
Methods: This retrospective comparative study was carried out in the Department of ENT, AGMC & GBP Hospital, Agartala, India, for 1 year. 80 participants fulfilling the diagnostic symptom criteria of CRS underwent CT scan of their noses and paranasal sinuses (PNS) and DNE. Standard Lund–Mackay and Lund–Kennedy scores were awarded to all participants based on the CT and DNE. A comparative analysis was done.
Results: In this study, 55% cases were males and 45% females, most common symptom was a nasal obstruction (87.5%). According to scoring system 92% patients were diagnosed on CT scan and 84% patients were diagnosed on nasal endoscopy. Diagnosis of 8% and 16% were missed with the individual findings of CT scan and nasal endoscopy respectively. So, by considering CT scan as gold standard diagnostic procedure, the accuracy of nasal endoscopy was calculated. The sensitivity of nasal endoscopy is 88,56%. Therefore, the probability of diagnosing CRS when it is present is 88.56%. The specificity is 62%. Therefore, nasal endoscopy has an ability of 62% cases to exclude the disease.
Conclusion: Nasal endoscopy may be used as an early diagnostic tool in the clinical assessment of suspected CRS patients (based on the diagnostic symptom criteria). DNE helps to directly visualized the pathology along with tissue morphology. Therefore, it may be considered even superior to CT scan of the nose and paranasal sinuses. However, computed tomography has its own role to play in diagnosis and management of such patients.

Keywords: Chronic rhinosinusitis (CRS), Diagnostic nasal endoscopy (DNE), Computed tomography (CT), Lund-Kennedy endoscopy score, Lund-Mackay CT score.

INTRODUCTION

Chronic rhinosinusitis (CRS) can be defined broadly as a chronic (>12 weeks duration) inflammatory condition of the nose and paranasal sinus mucosa may be associated with or without nasal polyposis [1]. CRS affects a significant population worldwide, imposing a huge toll on the human economy as well as on quality of life [2]. India is a country where almost 15% of the population is suffering from chronic rhinosinusitis [3]. There have been several amendments in diagnostic criteria for CRS, and the most updated and widely followed recent recommendations for CRS by the American Academy of Otolaryngology–Head and Neck Surgery (AAO-HNS) include both subjective and objective parameters of more than a 12-week duration. The subjective component considers two or more of the four main symptoms (anterior and/or posterior mucopurulent discharge, nasal stuffiness, pressure-fullness-pain in face, and hyposmia), and the objective component includes inflammation, which is characterized by one or more of the following: purulent character of mucus/edema present in middle meatus or the ethmoid area, nasal polyps (NPs) or polyps in middle meatus, and/or radiological imaging showing inflamed paranasal sinuses (PNS) [4,5].

To evaluate the objective components of CRS diagnosis, diagnostic nasal endoscopy (DNE) and the computed tomography (CT) scan play a significant role. The available literature that compares the two modalities on the diagnosing of CRS offers variable opinions [6,7]. DNE enable clear visualisation of all the structures of the middle meatus and of the osteomeatal complex an ability to accurately access these areas for evidence of localised disease, or for the anatomical defects that compromise ventilation and mucociliary clearance. The limitations of DNE includes inability to see the extent of the disease within the ethmoidal sinus, difficulty in identifying disease in constricted middle meatus and the presence of the hidden air space such as posterior ethmoidal cells [8]. Computerised Tomography (CT) provides essential preoperative information for the assessment of patients undergoing functional endoscopic sinus surgery. It has high sensitivity and provide objective findings regarding the condition of the paranasal sinuses and has a ability to differentiate presence of fluid and polyps. This study aims to compare the effectiveness of CT and nasal endoscopy findings for evaluation of CRS patients.

MATERIALS & METHODS

This retrospective comparative study was conducted in the Department of ENT, AGMC & GBPH, from September 2023 to August 2024. 80 patients who attended ENT OPD and suffering from at least two of the symptoms of chronic rhinosinusitis mentioned above and not responding to four weeks of medical treatment were selected.

Inclusion criteria -

- Patients of 18 to 60 years of age.
- Patients with symptoms of chronic rhinosinusitis not responding to four weeks of medical treatment.
- Patients willing for investigation and given their consent.

Exclusion criteria -

- Patients those were below 18 and above 60 years of age.
- Patients who were not willing to give their consent.

- Patients with previous facial trauma or major nasal surgeries.
- Paranasal sinus malignancy, cystic fibrosis, fungal sinusitis, autoimmune disease, bronchial asthma, or an immune-compromised state.
- Pregnant females who cannot undergo radiation.

METHODOLOGY

All participants underwent DNE and CT of the nose and PNS. Topical decongestant with lignocaine 4% was used before the DNE (using 0°/30° rigid nasal endoscope) and the procedure was carried out by using the standard three pass techniques as per the standard procedure. Within 7 days of performing diagnostic nasal endoscopy non-contrast CT of the nose and PNS and axial, coronal, and sagittal reconstruction images were obtained.

Nasal endoscopic findings were noted and quantified by The Lund-Kennedy scoring system with respect to three parameters: (1) nasal mucosal edema (0 = absent, 1 = mild to moderate, 2 = polypoid degeneration), (2) secretion (0 = absent, 1 = hyaline, 2 = thick or mucopurulent or both), (3) polyp (0 = absent, 1 = middle meatus only, 2 = nasal cavity extension) [1]. Evaluation was carried out on a bilateral basis, with the final score equivalent to points added from the right and left sides. By this scoring system, patients with score ≥2 were defined as diagnosis of chronic rhinosinusitis.

CT PNS findings were noted and quantified by the Lund- Mackay scoring. Involvement of the PNS (frontal, anterior, and posterior ethmoids, sphenoid and maxillary) was evaluated on the basis of opacity and was scored as 0, 1, or 2 for nil, partial, or complete opacification, respectively. The osteomeatal complex was graded as 1 (no obstruction) or 2 (obstruction present). Bilateral evaluation was done for all, with the final score equivalent of points added from the right and left sides, which fell in a range from 0 to 24. By this scoring system, patients with score ≥4 was defined as diagnosis of chronic rhinosinusitis [9].

STATISTICAL ANALYSIS

Data was collected and then statistical calculation for sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV) was calculated to evaluate the accuracy of diagnostic nasal endoscopy and CT paranasal sinuses in diagnosing CRS. SPSS version 29.0 was used for the analysis.

RESULT

The present study was conducted on 80 patients in department of ENT, at our institute. Each patient had undergone diagnostic nasal endoscopy and CT PNS. Out of 80 participants, 44 (55%) were male and 36 (45%) were female. The age range for the participants was 18-60 years. A majority study population belongs to the age group of 31-40 years 35% and 41-50 years 30% (Table 1). The mean age of involvement was 32.54 year.

Table 1: Age distribution.

Age group (years)	Frequency	Percentage (%)
18-30	16	20
31-40	28	28
41-50	24	30
51-60	12	15

Most common symptom experienced was nasal obstruction 70 (87.5%) followed by nasal discharge in 58 (72.50%) patients. Hyposmia affected 30 (37.50%) patients and facial pain / headache was a complaint of 48 (60%) patients (Table 2).

Table 2. Distribution of presenting complaints.

Clinical Symptoms	Frequency	Percentage (%)
Nasal obstruction	70	87.5
Nasal discharge	58	72.50
Facial pain	48	60
Hyposmia	30	37.50

Most common sign seen was edematous nasal mucosa 61%, followed by sinus tenderness 43%, nasal discharge 29%, middle turbinate hypertrophy 27%, inferior turbinate hypertrophy 23%, polyp 21%.

Endoscopy evaluation results of study subjects - On endoscopic evaluation, 12 (15%) participants had no significant findings and the remaining 68 (85%) had varying combinations of findings. Edematous mucosa was found in 45% patients, among them 15% had mild edema and 30% had severe edema. Discharge in middle meatus was found in 51% patients, among them 13% had discharge on right side, 21% had discharge on left side and 19% had bilateral discharge. 19% had clear/thin discharge and 33% had purulent discharge. Polyps were found in 31% patients, among them 7% had right side, 9% had left side and 17% had bilateral polyps. 7% had polyp up to middle meatus and 25% had polyp beyond middle meatus. Based Lund-Kennedy scoring system, 12 (15%) patients scored <2, 47 (59%) patients scored between 2-4, 12 (15%) patients scored between 5-8, 9 (11%) patients scored between 9-12 (Fig 1). The mean score was 3.48 ± 2.32 (mean ± SD). Hence, out of 80 patients who were diagnosed with CRS based on subjective parameters (symptom criteria), only 68 (85%) had endoscopic objective criteria as well, to confirm CRS.

Different anatomical variations found on nasal endoscopy were deviated nasal septum 81%, concha bullosa 31%, paradoxical middle turbinate 27%, pneumatized uncinate process 19%, pneumatized bulla ethmoidalis 7%, and accessory maxillary ostium 25%, and Agger nasi cells 37%.

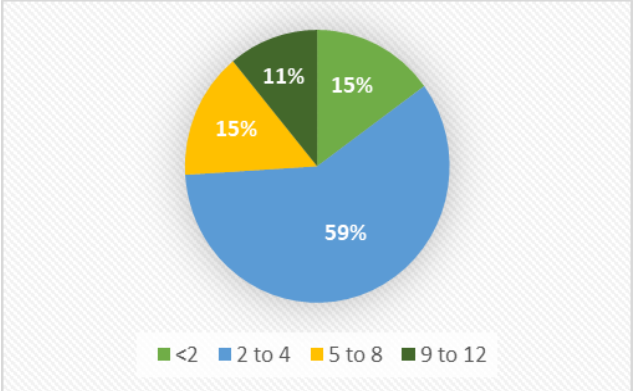

Fig 1: Lund-Kennedy score of study subjects.

CT evaluation results of study subjects - Among 80 patients who underwent CT PNS, 67% had maxillary sinus opacification, 63% had anterior ethmoid sinus opacification, 41% had posterior ethmoid sinus opacification, 15% had sphenoid sinus opacification, 25% had frontal sinus opacification, 60% had osteomeatal complex opacification. Based on Lund-Mackay scoring system, 8 (10%) patients scored <4, 10 (12%) patients scored 4, 24 (30%) patients scored between 5-8, 16 (20%) patients scored between 9-12, 12 (15%) patients scored between 13-16, 5 (6%) patients scored between 17-20 and 5 (6%) patients scored between 21- 24 (Fig 2). The Mean Lund–MacKay CT score was 9.69 ± 6.99 (mean ± SD). Hence, out of 80 patients who were diagnosed with CRS based on subjective parameters (symptom criteria), 72 (90%) had CT objective criteria as well, to confirm CRS.

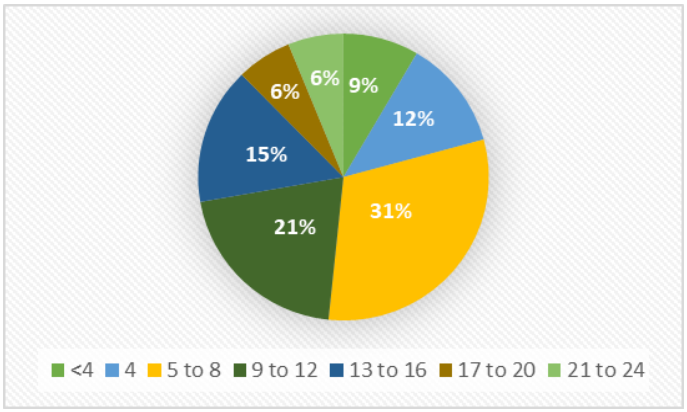

Fig 2: Distribution of Lund–MacKay scores of study subjects.

Different Anatomical variations found on CT PNS were deviated nasal septum 81%, polyp 35%, concha bullosa 33%, paradoxical middle turbinate 29%, pneumatized uncinate process 21%, pneumatized bulla ethmoidalis 5%, accessory maxillary ostium 15%, Agger nasi cells 41%, Haller cells 9%, Onodi cells 7%.

Comparative assessment of CT and endoscopy - On comparison of nasal endoscopy and CT scan findings, septal deviation, concha bullosa, paradoxical middle turbinate, pneumatized uncinate process, Pneumatized Bulla Ethmoidalis, accessory maxillary ostium, Agger nasi cells, and polyps were found in NE and CT both, while Haller cells and Onodi cells were only diagnosed by CT scan.

According to scoring system 90% patients were diagnosed on CT scan and 85% patients were diagnosed on nasal endoscopy. 10% and 15% were missed on CT scan and nasal endoscopy respectively. Considering CT to be more accurate and the gold standard for objective diagnosis of CRS, the sensitivity of nasal endoscopy is 90.88% i.e., the probability of diagnosing CRS when it is present is 90.88%. The specificity is 62% i.e., NE has 62% ability to exclude the disease. The positive predictive value and negative predictive value of endoscopy was 92.85% and 69.25% respectively. The results of this study suggested that endoscopy, as a diagnostic modality for CRS in comparison with CT, had 88.25% diagnostic accuracy (Fig 3).

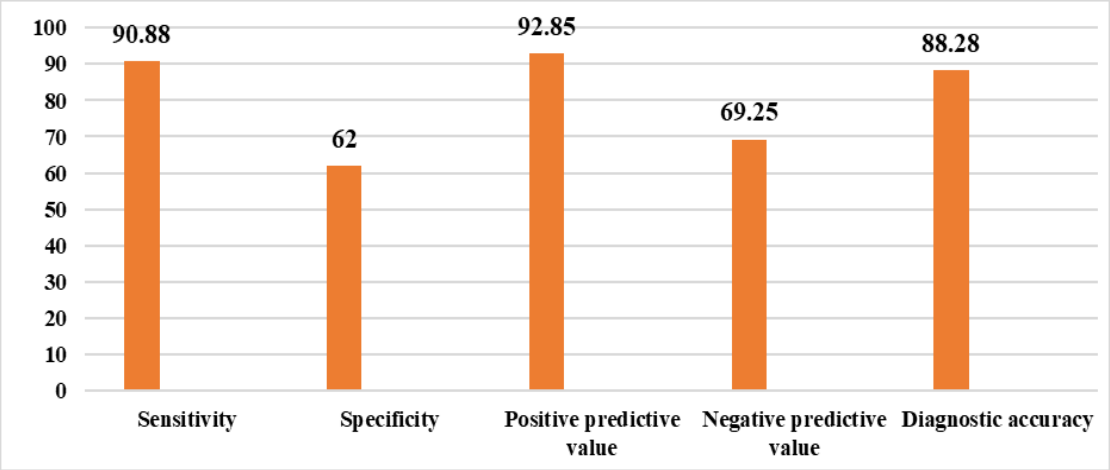

Fig 3: Sensitivity, specificity, positive predictive value, and negative predictive value of endoscopy, taking CT as the gold standard.

DISCUSSION

The current study was conducted to identify the effectiveness of CT scan and DNE of the nose and paranasal sinuses in the diagnosis of CRS. Nasal endoscopy can find nasal and sinus pathology that might be missed with routine speculum and nasopharyngeal examination and it serves as objective diagnostic tool. CT PNS is an important diagnostic tool for examining sinonasal disease especially in inaccessible and hidden areas during nasal endoscopy. It is important for managing clinical decisions and planning surgical management.

In our study the most common age group of involvement was 31-40 years and the mean age was 32.54. In a study conducted by Deosthale et al the most common age group was 20-40 years and mean age was 35.48 and in the study of Srivastava et al the most common age group was 21-30 years [10,11]. In our study, 55% of the patients were males which is similar to a study by Lohiya et al [12]. In our study, most common symptom was nasal obstruction 70 (87.5%) followed by nasal discharge in 58 (72.50%) which is similar to Lohiya et al in which, most common symptoms were nasal obstruction 95% followed by nasal discharge 66% and in the study of Deosthale et al in which most common symptoms were headache 77.04% followed by nasal obstruction 75.04% [10,12]. In our study, most common sign was edematous nasal mucosa 61%, followed by sinus tenderness 43%. In the study by Tegnoor et al most common sign was sinus tenderness 86% and in the study by Deosthale et al most common sign was inferior turbinate hypertrophy and 2nd most common sign was edematous nasal mucosa 45.08% [10,13].

In our study most common diagnostic nasal endoscopic findings were edematous mucosa in 45% patients followed by discharge in middle meatus in 51% patients and polyps in 31% patients. Chronic rhinosinusitis was diagnosed in 85% of patients by nasal endoscopy in our study. In the study by Lohiya et al most common DNE findings were discharge in middle meatus 47%, followed by edematous mucosa 39%, and polyp27% and chronic rhinosinusitis was diagnosed in 87% of patients by nasal endoscopy [12].

In our study most common diagnostic CT findings were maxillary sinus opacification in 67% patients followed by anterior ethmoid sinus opacification in 63%, posterior

ethmoid sinus opacification in 41%, 25% had frontal sinus opacification in 25%, sphenoid sinus opacification in 15% and 60% had osteomeatal complex opacification. Chronic rhinosinusitis was diagnosed in 90% of patients by CT PNS in our study. In the study conducted by Lohiya et al in which positive CT findings were maxillary sinus opacification 62.25%, anterior ethmoid sinus opacification 54.5%, posterior ethmoid sinus opacification 32.25%, sphenoid sinus opacification 19.75%, frontal sinus opacification 24.5%, osteomeatal complex opacification 60.5% and chronic rhinosinusitis was diagnosed in 93% of patients by CT PNS [12].

Both CT PNS and nasal endoscopy has its own limitations, limited visualization is associated with nasal endoscopy in patients with polyp, septal deviations, or turbinate hypertrophy and sinus like sphenoid, posterior ethmoids and frontal recess. CT scan is costlier and with hazards of exposure of radiation.

CONCLUSION

We observed that nasal endoscopy has distinct advantages over CT for assessment of localised changes like polyps, pathological secretions, and the condition of nasal mucosa while CT gives a better idea of the condition of paranasal sinuses and the osteomeatal complex. Nasal endoscopy should be performed in all patients who meet diagnostic criteria of chronic rhinosinusitis as an early diagnostic tool as it has an advantage of being non-invasive, no hazard of radiation, cost effective, less time consuming and is an OPD based procedure. In a few cases where it is not possible to pass the endoscope beyond a certain point due to the presence of gross pathologies like a severe deviated septum, in this case CT scan helps in further management by diagnosing the extent of disease. Endoscopy is superior to CT for identifying mucosal changes. CT PNS is the road-Map for surgery in sinus diseases. Both diagnostic nasal endoscopy and CT PNS are important for preoperative evaluation for detecting sinonasal pathologies and both are complementary to each other.

Declaration by Authors

Ethical Approval and Consent to Participate: All written informed consent for medical and surgical procedures were obtained from the patient. All ethical principles for medical research studies established by our institution have been followed.

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

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