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Original Research Article

Comparative analysis of nasal endoscopic and radiological findings in chronic rhinosinusitis patients

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ABSTRACT

Background: Chronic rhinosinusitis (CRS) is a complex inflammatory disorder causing significant reduction in quality of life and interfere in day to day activity. Accurate diagnosis is crucial for effective management, typically involving nasal endoscopy and CT imaging to assess the extent of sinus involvement.
Methods: This prospective observational study was conducted at Jaipur national university institute of medical sciences and research centre from July 2022 to May 2024. It included 75 patients diagnosed with CRS. Subjective quantification of disease was done using SNOT-22 scoring system. Diagnostic evaluations were performed using nasal endoscopy and CT scans, with findings scored according to the Lund-Kennedy and Lund-MacKay systems.
Results: The study highlighted a strong correlation between endoscopic and CT findings, with Pearson correlation coefficients of 0.892 and 0.909 for endoscopic vs. SNOT-22 scores and CT vs. SNOT-22 scores, respectively. Discrepancies between the two diagnostic tools were also noted, emphasizing their complementary roles in CRS management.
Conclusions: Integrating nasal endoscopy and CT imaging provides a robust framework for diagnosing and managing CRS, allowing for a detailed assessment of both mucosal and anatomical changes. The combined use of these tools enhances the ability to tailor treatment plans effectively.

Keywords: CRS, Nasal endoscopy, CT imaging, Diagnostic accuracy, Lund-Kennedy, Lund-MacKay, SNOT-22

INTRODUCTION

Chronic rhinosinusitis (CRS) represents a pervasive and multifactorial inflammatory disorder of the nasal and paranasal sinuses, affecting millions globally with considerable morbidity and a significant impact on quality of life. The complexity of CRS, characterized by persistent mucosal inflammation, necessitates precise diagnostic strategies to tailor effective treatment plans. Traditionally, the diagnosis and evaluation of CRS involve a combination of symptom assessment, endoscopic examination, and imaging techniques, primarily computed tomography (CT).[1]

Nasal endoscopy and CT imaging are cornerstone diagnostic tools that offer complementary perspectives in the management of CRS. Nasal endoscopy provides direct visualization of the nasal cavity and sinus openings, allowing for the assessment of mucosal health, polyp presence, and osteomeatal complex patency. Conversely, CT scans offer detailed images of the sinus anatomy, detecting subtle changes in the sinus structure and extent of disease that are not visible endoscopically. The integration of these diagnostic modalities is advocated by both the European position paper on rhinosinusitis and nasal polyps (EPOS) and the American rhinologic society, highlighting their critical roles in comprehensive CRS management.[2,3]

Despite the established utility of these tools, there exists variability in the correlation between endoscopic findings and radiological imaging, which can influence clinical decision-making. For instance, endoscopic signs of inflammation may not always correspond with the extent of disease observed in CT images, and vice versa. This discordance poses challenges in accurately defining disease severity, predicting treatment outcomes, and conducting preoperative planning.[4]

The comparative analysis of nasal endoscopic and radiological findings serves as an essential step towards understanding the intricate pathology of CRS and refining diagnostic accuracy. By systematically evaluating the relationship and discrepancies between these diagnostic modalities, clinicians can better stratify patient treatment pathways, anticipate surgical needs, and optimize management strategies.[5]

This article aims to provide a comprehensive review of the comparative efficacy of nasal endoscopy versus radiological imaging in diagnosing CRS, drawing on recent advances in imaging techniques and endoscopic technology.

By elucidating the specific roles and limitations of each modality, the study seeks to enhance diagnostic protocols and improve therapeutic outcomes for CRS patients.[6,7]

METHODS

Study design and setting

This hospital-based prospective observational study was conducted at the department of otorhinolaryngology in collaboration with the department of radiology at Jaipur national university institute of medical sciences and research centre, Jaipur.

The study spanned from July 2022 to May 2024, involving patients fulfilling the diagnostic criteria for CRS.

Study population

A total of 75 patients aged above 18 years, diagnosed with CRS based on predefined criteria, were enrolled in the study.

Inclusion criteria

The inclusion criteria included all patients with CRS who visited the outpatient department (OPD).

Exclusion criteria

Patients below 18 years, patients with previous nasal surgeries, patients with facial anomalies or pregnant and t hose who did not give informed consent were excluded from study.

Data collection methods

The institutional ethics committee approved the study protocol. After obtaining informed consent, a detailed history and socio-demographic data were collected using a structured proforma. Patients underwent clinical and radiological evaluations, including SNOT22 scoring system, diagnostic nasal endoscopy (DNE), CT scan of nose and PNS.

Diagnostic criteria

CRS was diagnosed based on the European position paper on rhinosinusitis and nasal polyps and the American academy of otolaryngology-head and neck surgery guidelines. The criteria included having two or more of the following symptoms for over 12 weeks: Nasal obstruction/congestion, nasal discharge (anterior/posterior nasal drip), facial pain/pressure and reduced sense of smell.

Endoscopic procedure

Rigid nasal endoscopy was performed under local anesthesia with 4.0% lidocaine. A 0- and 30-degree 4 mm diameter endoscope was used. Endoscopic findings were scored using the Lund-Kennedy grading system, assessing polyps, secretion, and nasal mucosal edema.

Radiological assessment

CT scans were performed using a 384-slice CT scanner, with 1.5 mm thin slices in the coronal, sagittal, and axial planes. The Lund-MacKay System was utilized for evaluating the CT scans, categorizing sinus involvement into six sections (maxillary, anterior and posterior ethmoid, sphenoid, frontal sinuses, and osteomeatal complex). The degree of sinus involvement was graded from 0 (full lucency) to 2 (total opacity).

Quality control

To ensure the accuracy of data collection, staff were trained and the data collection process was standardized. Data completeness and consistency were regularly monitored. Separate, blinded assessors evaluated the CT and endoscopic findings to minimize bias.

Statistical analysis

Data analysis was performed using the statistical package for social sciences (SPSS), version 23. Categorical data were expressed as proportions and percentages, while quantitative data were summarized as means±standard deviation (SD).

Associations were tested using Chi-square tests, and group comparisons were made using Student’s t test. A pvalue of less than 0.05 was considered statistically significant.

RESULTS

CRS with right dominant nasal obstruction (DNS) was the most frequent specific diagnosis, affecting 44 (58.6%) of the study group CRS. Other diagnosis, including CRS without nasal polyposis (13.3%), CRS with nasal polyposis (10.7%), CRS with ITH (41.33%), allergic fungal rhinosinusitis (5.4%), CRS with allergic rhinitis (13.3%) and CRS with right chronic dacrocysitis (2.7%), were less frequent affecting the patients.

Table 1: Distribution of studied patients based on diagnosis.

Diagnosis	N	Percentage (%)
CRS with DNS	44	58.6
CRS without nasal polyposis	10	13.3
CRS with nasal polyposis	8	10.7
CRS with ITH	31	41.33
Allergic fungal rhinosinusitis	2	5.4
CRS with chronic dacryocystitis	2	2.7
CRS with bronchial asthma	1	1.3
CRS with allergic rhinitis	10	13.3
CRS with COM/SOM	3	4
CRS with other diagnosis	3	4

The majority of patients fell into the severe category (>50), comprising 46 (61.3%) of the total population. Additionally, a significant portion of patients were classified as having a moderate grade (21-50), representing 26 (34.7%) of the cohort. Only a small proportion of patients were categorized as having a mild grade (0-20), constituting 3 (4.0%) of the studied population. The mean SNOT22 score was calculated to be 61.4±22.3, indicating a considerable burden of sinonasal symptoms among the patients included in the study.

Table 2: Distribution of studied patients based on SNOT22 grade.

SNOT22 grade	N	Percentage (%)
Mild (0-20)	3	4.0
Moderate (21-50)	26	34.7
Severe (>50)	46	61.3
Mean score	61.4±22.3	

The table showed scores for polyps, discharge, and edema in each nostril (right and left). For polyps, most patients (around 85-88%) had no polyps (score 0) in either nostril, with no statistically significant difference between sides (p=0.362). Discharge scores showed a similar pattern, with the majority of patients having a score of 2 (most discharge) in both nostrils. However, edema scores showed a trend towards more edema on the left side (score 0: 5.3% vs 14.7%, p=0.092). The mean score for both sides was around 3.

Table 3: The Lund-Kennedy endoscopic scoring method.

Sinus	Score	Right (n=75) (%)	Left, (n=75) (%)	P value
Polyp	0	64 (85.3)	66 (88.0)	0.362
	1	4 (5.3)	6 (8.0)	
	2	7 (9.3)	3 (4.0)	
Discharge	0	6 (8.0)	4 (5.3)	0.682
	1	23 (30.7)	27 (36.0)	
	2	46 (61.3)	44 (58.7)	
Edema	0	4 (5.3)	11 (14.7)	0.092
	1	42 (56.0)	32 (42.7)	
	2	29 (38.7)	32 (42.7)	
Mean score		3.12±1.3	2.97±1.2	0.464

The prevalence of scores varied across sinuses; for instance, in the maxillary sinus, the majority of patients scored a 2 (80.0% on the right, 78.7% on the left), indicating extensive involvement. Similarly, in the anterior and posterior ethmoid sinuses, score 2 was predominant. However, no significant differences in scores between the right and left sides were observed across all sinuses, as indicated by the non-significant (p>0.05). Moreover, the mean scores for the right and left sides were comparable, reinforcing the symmetrical involvement of sinuses.

Table 4: The Lund-Mackay CT staging system for sinusitis based on CT scan findings.

Sinus	Score	Right, (n=75) (%)	Left, (n=75) (%)	P value
Maxillary sinus	0	8 (10.7)	6 (8.0)	0.662
	1	7 (9.3)	10 (13.3)	
	2	60 (80)	59 (78.7)	
Anterior ethmoid	0	12 (16)	8 (10.7)	0.583
	1	27 (36)	31 (41.3)	
	2	36 (48)	36 (48.0)	
Posterior ethmoid	0	21 (28)	15 (20.0)	0.435
	1	35 (46.7)	42 (56.0)	
	2	19 (25.3)	18 (24.0)	
Sphenoid	0	37 (49.3)	33 (44.0)	0.755
	1	16 (21.3)	16 (21.3)	
	2	22 (29.3)	26 (34.7)	
Frontal	0	37 (49.3)	34 (45.3)	0.771
	1	20 (26.7)	24 (32.0)	
	2	18 (24.0)	17 (22.7)	
OMC complex	0	28 (37.3)	35 (46.7)	0.246
	2	47 (62.7)	40 (53.3)	
Mean score		6.78±2.1	6.86±2.1	0.815

A strong positive correlation was observed between SNOT22 score and both the endoscopic score (r=0.892, p<0.01) and CT score (r=0.909, p<0.01), suggesting that as sinonasal symptom severity increased, endoscopic and CT findings tended to worsen. Similarly, a high positive correlation was found between the endoscopic score and CT score (r=0.876, p<0.01), indicating that as endoscopic findings became more severe, CT findings also tended to be more pronounced. These correlations were statistically significant at the 0.01 level (2-tailed), based on a sample size of 75 patients for each variable.

Table 5: Pearson's correlation coefficient.

Correlations		SNOT22 score	Endoscopic score	CT score
SNOT22 score	Pearson correlation	1	0.892**	0.909**
	P value		0.000	0.000
	Number of patients	75 (100.0%)	75 (100.0%)	75 (100.0%)
Endoscopic score	Pearson correlation	0.892**	1	0.876**
	P value	0.000		0.000
	Number of patients	75 (100.0%)	75 (100.0%)	75 (100.0%)
CT score	Pearson correlation	0.909**	0.876**	1
	P value	0.000	0.000	
	Number of patients	75 (100.0%)	75 (100.0%)	75 (100.0%)

**Correlation is significant at the 0.01 level (2-tailed).

Among the patients, the most common approach was conservative management followed by surgery, with 42 patients, constituting 56.0% of the total population. Upfront bilateral functional endoscopic sinus surgery (B/L FESS surgery) was also a prevalent treatment strategy, accounting for 34.7% of the patients, involving 26 individuals. A smaller portion of patients, 9.3%, underwent solely Conservative management without surgery, totalling 7 patients.

Table 6: Distribution of studied patients based on treatment strategy.

Treatment strategy	N	Percentage (%)
B/L FESS surgery	26	34.7
Conservative treatment	7	9.3
Conservative treatment followed by surgery	42	56.0

For patients planned for conservative treatment (n=7), the mean SNOT22 score was 39.00 with a standard deviation of 14.64. Endoscopic scores and CT scores were 4.14±1.21 and 9.86±1.77, respectively. In contrast, for patients planned for conservative treatment followed by surgery (n=42), the mean SNOT22 score increased to 49.33±13.00. Endoscopic and CT scores also increased to 5.02±1.26 and 11.76±2.69, respectively. Similarly, for patients planned for functional endoscopic sinus surgery (FESS) (n=26), the mean SNOT22 score was substantially higher at 86.92±9.05. Endoscopic and CT scores were markedly elevated at 8.35±1.52 and 17.73±2.54, respectively. There was statistically significant difference in scores among 3 management groups (p<0.05).

Before surgery, mean SNOT22 score was notably high at 77.74 with a SD=19.50. However, postoperatively, mean SNOT22 score dramatically decreased to 6.57 with SD=2.06. Similarly, Lund-Kennedy score, which evaluates severity of sinus disease based on endoscopic findings, showed significant improvement post-op. Before surgery, mean Lund-Kennedy score was 7.60 with a standard deviation of 2.02. After surgery, mean Lund-Kennedy score decreased to 1.23 with SD=0.97.

Table 7: Compare all 3 scoring systems on the basis of the treatment plan.

Variables	Patients who plan for conservative treatment, (n=7)	Patients who plan for conservative followed by surgery, (n=42)	Patients who plan for FESS, (n=26)	P value
SNOT22 score	39.00±14.64	49.33±13.00	86.92±9.05	<0.001
Endoscopic score	4.14±1.21	5.02±1.26	8.35±1.52	<0.001
CT score	9.86±1.77	11.76±2.69	17.73±2.54	<0.001

Table 8: Comparison between pre and post-operative scores on follow-up after surgery.

Variables		Mean	SD
SNOT22	Pre-operative	77.74	19.50
	Post-operative	6.57	2.06
Lund Kennedy score	Pre-operative	7.60	2.02
	Post- operative	1.23	0.97

DISCUSSION

The results from our comparative analysis of nasal endoscopic and radiological findings in patients with CRS underscore the complementary nature of these diagnostic modalities, echoing the complex and multifaceted nature of CRS as highlighted by the EPOS and the American rhinologic society. The study affirms the critical roles that both nasal endoscopy and CT play in the comprehensive management of CRS, each contributing uniquely to the diagnostic and therapeutic landscapes.[8,9]

Our findings reveal significant discrepancies between nasal endoscopic scores and CT scores, illustrating the challenges in correlating clinical presentations with radiological findings. Such disparities are significant, as they often affect the clinical decision-making process, especially concerning the severity assessment and subsequent treatment planning. For instance, while nasal endoscopy is indispensable for direct mucosal observation, it occasionally underestimates the extent of deeper sinus involvement which is more thoroughly visualized by CT imaging. This observation is particularly critical in cases where surgical intervention is considered based on the extent of anatomical involvement illustrated by CT scans.[10,11]

The Pearson correlation coefficients between SNOT-22 scores, endoscopic scores, and CT scores (0.892 and 0.909, respectively) demonstrate a strong correlation, suggesting that while the tools are used for different diagnostic purposes, they similarly reflect the disease severity from a symptomatic and anatomical perspective. This inter-modality correlation supports the use of these tools in tandem to achieve a more comprehensive understanding of the disease state, rather than relying on a single modality for diagnostic conclusions.[12]

Moreover, our study highlights the utility of the Lund-Kennedy and Lund-Mackay scoring systems in standardizing the assessment of CRS. These scoring systems provide a structured method to quantify disease severity and monitor treatment outcomes, facilitating a standardized approach across different healthcare settings. However, the variability observed in scoring between the right and left sinuses, and the non-significant p values in some comparisons, suggest the need for cautious interpretation of unilateral findings and advocate for a bilateral assessment approach during diagnostic evaluations.[13]

Interestingly, the study also points to the potential of integrating diagnostic findings with clinical symptoms to better tailor individual treatment plans. For instance, patients with higher SNOT-22 scores generally exhibited more severe findings in both endoscopic and CT evaluations, indicating a direct relationship between symptom burden and visible disease pathology. This correlation underscores the importance of a multidimensional assessment strategy in CRS, considering both subjective symptoms and objective findings to optimize patient management.[15]

Overall, the integral use of both nasal endoscopy and CT imaging enhances the diagnostic accuracy and treatment planning in CRS. The study advocates for an integrated diagnostic approach that combines both modalities, complemented by a standardized scoring system, to improve the precision of CRS management. Future research should aim to refine these diagnostic tools further and explore the potential of emerging technologies such as 3D imaging and machine learning algorithms to enhance the visualization and interpretation of sinus pathology. These advancements could lead to even more tailored and effective treatment strategies, ultimately improving patient outcomes in CRS management.

Limitations

The sample size is a limitation of the current study; a larger sample size would have brought many other facets of the specific role of CT and DNE, and their further merits, and demerits if any**.** There has also been a failure to present the data on sinus opacification of individual sinuses, pre- and postoperatively and to document the prevalence of anatomical abnormalities, asymptomatic mucoceles, and osteitic changes in the CT images.

CONCLUSION

This study underscores the significant utility of integrating nasal endoscopy and CT in the diagnosis and management of CRS, revealing a strong correlation between clinical symptoms and imaging findings. By combining both modalities, clinicians can achieve a more comprehensive assessment of CRS, enhancing diagnostic accuracy and optimizing treatment strategies. Our findings support the continuation and expansion of using these complementary diagnostic tools in routine clinical practice to better address the multifactorial nature of CRS and improve patient outcomes.

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