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Original Research Article

Correlation of Clinical, Computed Tomographic, and Intraoperative Findings in Chronic Rhinosinusitis

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Abstract

Background: Chronic rhinosinusitis (CRS) is a common inflammatory condition of the nasal cavity and paranasal sinuses persisting for more than 12 weeks and causing significant morbidity worldwide. Accurate diagnosis and precise delineation of disease extent are essential for effective management. With the advent of Functional Endoscopic Sinus Surgery (FESS), diagnostic nasal endoscopy and computed tomography (CT) of paranasal sinuses have become integral to preoperative evaluation. However, discrepancies between radiological findings and intraoperative observations still exist, particularly regarding anatomical variations and sinus involvement. Establishing a correlation between clinical, radiological, and operative findings is therefore crucial to optimize surgical planning and outcomes.

Material and Methods: This prospective observational study was conducted in the Department of Otorhinolaryngology at a tertiary care teaching hospital in Western India between May 2023 and August 2024. A total of 42 patients diagnosed with chronic rhinosinusitis and planned for endoscopic sinus surgery were included. All patients underwent detailed clinical evaluation, diagnostic nasal endoscopy, and CT scan of paranasal sinuses prior to surgery. CT findings were compared with intraoperative observations to assess diagnostic accuracy. Sensitivity, specificity, accuracy, and Cohen's kappa coefficient were calculated to evaluate agreement between CT and operative findings.

Results: Among the 42 patients, males predominated (54.76%), with the most affected age group being 31–40 years. Nasal obstruction was the most common symptom (92.85%). Maxillary sinus was the most frequently involved sinus on CT, followed by ethmoid sinuses. CT scan demonstrated high sensitivity for detecting sinus disease and osteomeatal complex obstruction, with substantial agreement for osteomeatal complex blockage and deviated nasal septum. However, lower sensitivity and agreement were observed for certain anatomical variations such as concha bullosa and Onodi cells.

Conclusion: CT scan of paranasal sinuses is a highly sensitive tool for evaluating CRS and guiding surgical management. When combined with clinical assessment and nasal endoscopy, it provides optimal preoperative planning and improves intraoperative safety.

Keywords: Chronic rhinosinusitis, CT scan, Nasal endoscopy, Functional endoscopic sinus surgery, Paranasal sinuses.

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Introduction

Chronic rhinosinusitis (CRS) is defined as inflammation of the nasal cavity and paranasal sinuses persisting for at least 12 consecutive weeks. It represents a significant health problem worldwide, affecting approximately 11–15% of the population and contributing to substantial healthcare burden and reduced quality of life. In India, CRS remains one of the most commonly encountered conditions in otorhinolaryngology practice. [1,2] The diagnosis of CRS is primarily based on clinical symptoms, supported by endoscopic findings and radiological evaluation. However, symptoms alone often fail to accurately reflect the extent and severity of the disease.

Anatomical variations of the nasal cavity and paranasal sinuses play a crucial role in impaired drainage and ventilation, predisposing individuals to chronic inflammation and recurrent infections. [3,4] The introduction of diagnostic nasal endoscopy and computed tomography (CT) has revolutionized the evaluation of sinonasal diseases. CT scan provides excellent visualization of bony anatomy, mucosal disease, and anatomical variants, serving as a roadmap for Functional Endoscopic Sinus Surgery (FESS). Despite its widespread use, variations exist between radiological and intraoperative findings.

Hence, this study was undertaken to correlate clinical, CT scan, and intraoperative findings in patients with chronic rhinosinusitis, to assess the diagnostic accuracy of CT imaging and to justify the necessity of combining these modalities for optimal management.

Materials and Methods

This prospective observational study was conducted in the Department of ENT at GMERS Medical College and Hospital, Gotri, Vadodara, over a period from May 2023 to August 2024. Ethical clearance was obtained from the institutional ethics committee prior to commencement of the study. Written informed consent was taken from all patients. A total of 42 patients diagnosed with chronic rhinosinusitis and planned for surgical intervention were included.

Patients of all age groups with clinically diagnosed CRS who underwent preoperative CT scan of paranasal sinuses and subsequently underwent endoscopic sinus surgery were included. Pregnant women, patients contraindicated for CT scan or anesthesia, those with sinonasal tumors, traumatic injuries, dental-origin sinusitis, or patients who did not undergo surgery were excluded from the study.

All patients underwent detailed history taking, clinical examination, diagnostic nasal endoscopy, and CT scan of paranasal sinuses. Intraoperative findings during FESS were documented and compared with CT findings. Statistical analysis was performed using sensitivity, specificity, accuracy, and Cohen's kappa coefficient to assess agreement between CT scan and operative findings.

Results

A total of 42 patients diagnosed with chronic rhinosinusitis and related sinonasal pathologies who underwent endoscopic sinus surgery were included in the study. All patients satisfied the inclusion and exclusion criteria and were evaluated clinically, radiologically, and intraoperatively.

Of the 42 patients, 23 (54.76%) were males and 19 (45.23%) were females, showing a male predominance with a male-to-female ratio of 1.21:1. The age of patients ranged from 15 to 85 years. The most commonly affected age group was 31–40 years (26.19%), followed by 41–50 years (19.05%). The mean age of presentation was 42 years. Based on clinical, radiological, and operative assessment, chronic rhinosinusitis (CRS) constituted the majority of cases (83.33%, n = 35). Other diagnoses included mucocele (7.14%), antrochoanal polyp (4.76%), and mucormycosis (4.76%).

The most common presenting symptom was nasal obstruction, reported by 92.85% of patients. This was followed by nasal discharge (59.52%), sneezing (40.47%), headache (23.80%), and disturbance of smell (23.80%). Nasal bleeding and eye swelling were least frequent, each occurring in 2.38% of cases. Most patients presented with multiple symptoms.

On anterior rhinoscopy and diagnostic nasal endoscopy, normal nasal mucosa was observed in 57.14% of patients, while 19.05% had congested mucosa and 19.05% had pale mucosa. Inferior turbinate hypertrophy was noted in 28.57%, and middle turbinate hypertrophy in 2.3%. Nasal polyps were identified in 71.43% of patients, with 33.33% showing bilateral polyposis and 38.10% unilateral involvement, the left side being more commonly affected.

CT scan evaluation revealed the maxillary sinus as the most commonly involved sinus, with bilateral involvement in 31 cases. Bilateral involvement of the anterior ethmoid and posterior ethmoid sinuses was observed in 69.04% of patients. The frontal sinus showed bilateral involvement in 57.14%, while the sphenoid sinus was involved bilaterally in 59.52% of cases. Overall, bilateral sinus disease was more prevalent than unilateral disease.

CT scan demonstrated high sensitivity for detecting deviated nasal septum (95.65%), with an overall accuracy of 80% and substantial agreement (κ = 0.6). Osteomeatal complex (OMC) blockage showed 100% sensitivity, 95% accuracy, and substantial agreement (κ = 0.8).

Sensitivity for detecting uncinate process abnormalities was 89%, with an accuracy of 83% and fair agreement (κ = 0.3.) Lower sensitivity was observed for inferior turbinate hypertrophy (50%), concha bullosa (33.33%), accessory maxillary ostia (50%), and Onodi cells (50%), though specificity and overall accuracy for these variations were high. Kappa agreement ranged from slight to moderate for these findings.

CT scan showed high sensitivity for sinus involvement, particularly for anterior ethmoid and frontal sinuses (100%), followed by maxillary sinus (96.96%), posterior ethmoid sinus (96.42%), and sphenoid sinus (90%). Specificity varied across

sinuses, ranging from 11.11% to 52.17%, with overall accuracy between 52.38% and 83%. Kappa values indicated low to moderate agreement between CT and operative findings across different sinuses.

Discussion

Chronic rhinosinusitis (CRS) is a prevalent inflammatory disorder with multifactorial etiology, and accurate preoperative assessment is essential for optimal surgical outcomes. With the evolution of Functional Endoscopic Sinus Surgery (FESS), diagnostic nasal endoscopy and computed tomography (CT) of paranasal sinuses have become indispensable tools. The present study evaluated the correlation between clinical, radiological, and intraoperative findings in patients undergoing endoscopic sinus surgery and compared the observations with previously published studies.

In the present study, a male predominance (54.76%) was observed, which is consistent with the findings reported by Rawat DS et al. (2013) [5], Dasgupta et al. (1997), and Zojaji et al. (2008) [6], all of whom documented higher prevalence of CRS among males. However, Vining et al. reported a female predominance in their study. The male predominance in most Indian studies may be attributed to increased occupational exposure, environmental pollutants, and healthcare-seeking behavior among males. [7]

The most commonly affected age group in this study was 31–40 years, with a mean age of 42 years. Similar age distribution was reported by Sheetal D et al. (2011) [8], who found maximum CRS cases between 20 and 40 years. Zojaji et al. (2008) reported a lower mean age of 33 years, whereas Rafael José Geminiani et al. documented a mean age of 40 years. The predominance in the working-age population may be related to higher exposure to allergens, infections, and environmental irritants. [9]

Regarding symptomatology, nasal obstruction was the most common presenting symptom (92.85%), followed by nasal discharge. These findings correlate well with studies by Rawat DS and Chadha V, who reported nasal obstruction in 86% of patients. In contrast, Sheetal D et al. (2011) observed headache as the most common symptom, which differed from the present study where headache was reported in only 23.8% of cases. This variation highlights the heterogeneity of CRS presentation across populations.

Diagnostic nasal endoscopy revealed nasal polyps in 71.43% of patients, which is comparable to findings by Rajendra Bohra et al., who reported polyps in 78.57% of their cases. Endoscopy proved valuable in identifying middle meatal pathology and mucosal disease, reinforcing its role as a complementary modality to CT scan in CRS evaluation. [10]

CT scan demonstrated high sensitivity in detecting sinus involvement, particularly in the maxillary, anterior ethmoid, posterior ethmoid, and frontal sinuses, which aligns with observations made in previous studies emphasizing CT as the gold standard imaging modality for CRS. The present study showed 100% sensitivity for anterior ethmoid and frontal sinuses, with slightly lower sensitivity for the sphenoid sinus, likely due to its complex anatomy, as also noted by earlier authors.

Correlation between CT and operative findings for anatomical variations showed substantial agreement for osteomeatal complex blockage ($\kappa = 0.8$) and deviated nasal septum ($\kappa = 0.6$), findings that are consistent with previously reported literature. However, lower sensitivity and agreement for concha bullosa, accessory maxillary ostia, and Onodi cells were also reported in earlier studies, suggesting that subtle anatomical variations may be underdetected on CT or influenced by interval changes before surgery. [11,12]

The present study was limited by a small sample size and single-center design, which may restrict generalizability. Additionally, interval medical treatment between CT imaging and surgery could have influenced intraoperative findings.

Conclusion

Chronic rhinosinusitis requires a comprehensive diagnostic approach for effective management. CT scan of paranasal sinuses remains a highly sensitive tool for evaluating disease extent and guiding surgical planning. Diagnostic nasal endoscopy complements CT imaging by providing real-time mucosal assessment. The present study demonstrates that CT scan shows excellent sensitivity, particularly for sinus involvement and osteomeatal complex obstruction, though variability exists in detecting certain anatomical variations. Combining clinical evaluation, nasal endoscopy, and CT imaging offers the most accurate preoperative assessment. Such an integrated approach enhances surgical safety, improves outcomes, and reduces intraoperative surprises. Further large-scale studies are recommended to strengthen these findings.

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