

ORIGINAL ARTICLE

The Role of Computed Tomography in the Management of Chronic Rhinosinusitis

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ABSTRACT

Background: Chronic rhinosinusitis is a painful and debilitating condition that has been estimated to affect more than 10% to 15% of the world's population. Pharmacological treatments for chronic rhinosinusitis still present some problems: symptoms are chronic and do not subside even after treatment.

Objective: To evaluate the role of computed tomography in the management of chronic rhinosinusitis.

Material and Methods: This prospective, cross-sectional study was carried out at Fatima Memorial Hospital and General Hospital, Lahore, Pakistan from 1st October 2014 to 30th June 2015. A total of 50 patients with sinonasal symptoms who were selected for a computed tomography of the nose and paranasal sinuses were enrolled. Persons with head injury or malignancy treated through irradiation were not included. Computed tomography images were performed on a Toshiba 16-slice helical computed tomography with slice thickness of 3mm in coronal, axial and sagittal planes.

Results: The prevalence of deviated nasal septum was 32% while the inferior turbinate hypertrophy was 74%. Concha bullosa and nasal spur were seen in 22% of the specimens studied here. Ostiomeatal complex widening was noted in 70 % of the patients. Intraorbital involvement was found in 8% and intracranial spread was found in only 4% of the patients.

Conclusion: Computed tomography imaging offers valuable information required for new and persistent chronic rhinosinusitis diagnosis and management. It is a guide for the surgeons and is the most definitive way of confirming disease.

Keywords: Chronic rhinosinusitis, Computed tomography, Radiotherapy, Sinonasal, Osteomeatal

INTRODUCTION

Chronic rhinosinusitis (CRS) is an enduring and difficult disease affecting between 5-12 percent of the global community. This is in fact distinguished as a condition marked by inflammation of the nasal and sinus mucosa for not less than twelve consecutive weeks even in the face of standard treatment. Chronic rhinosinusitis is further classified into two subtypes: Chronic rhinosinusitis with nasal polyps and without nasal polyps, differentiated by involvement of multiple sinuses and their pathogenetic processes. It negatively affects the recipient's quality of life and consequently contributes to large costs of treatment as well as mortalities and low production.¹

Chronic rhinosinusitis is known to have complex aetiology and is attributed to local factors such as anatomical changes as a septum deviation or concha bullosa and system factors such as allergic rhinitis, immune system abnormalities and infection.^{2,3} It is characterised by nasal obstruction, mucopurulent nasal discharge, facial pain, and anosmia, which may be mild and severe at times or persistently progressive. Although different pharmacological treatments such as intranasal corticosteroids and antibiotics have been proved to be efficient for treating CRS, many patients were difficult to satisfactory control with drugs and need surgical management.⁴⁻⁷

Thus, computed tomography (CT) has a number of advantages over plain radiography showing the detailed picture of sinonasal anatomy in the area of the osteomeatal complex (OMC), ethmoid and sphenoid sinuses.⁸⁻¹¹ They describe mucosal thickening, opacification as well as anatomical changes which play a role in the development and persistence of CRS.¹²⁻¹⁴ To the otolaryngologist, it is important to understand those radiological imaging results that form part and parcel of the endoscopic approach.

The purpose of this study was to assess the role of CT imaging in the management of chronic rhinosinusitis. By analyzing CT findings in patients with CRS, this study aims to provide further evidence of the utility of CT as an indispensable tool for both diagnosis and surgical planning. This research also seeks to explore the frequency of anatomical variations, such as Concha

bullosa and septal deviation, and their impact on CRS management.

MATERIALS AND METHODS

This prospective, cross-sectional study was conducted in two tertiary care hospitals at Fatima Memorial Hospital and General Hospital, Lahore Pakistan. A total of 50 patients with clinically diagnosed sinonasal symptoms which fit the chronic rhinosinusitis picture were recruited. Participants had to be of any age, both sexes and had to have sinonasal symptoms exceeding 12 weeks duration. Also admitted in the case of the study were patients who were referred for a CT scan of the nose and paranasal sinuses.¹⁵ The exclusion criteria were followed in any patient who had sustained any facial or head injury, patients that had head and neck malignancies who received radiotherapy treatment, as well as any patient with an acute infection or prior sinus surgery. Clinical information included demographic details, presenting symptoms, and prior treatments. All patients underwent non-contrast CT scans using a Toshiba 16-slice CT scanner with 3 mm slice thickness, capturing coronal, axial, and sagittal views. Data were analyzed using SPSS version 20. The chi-square test was used to compare findings between patients, with significance set at $p < 0.05$.

RESULTS

The patients had a mean age of 34.2 years and 68% were males (Table 1). CT findings revealed that the maxillary sinuses were the most commonly affected, with 86% showing opacification followed by the ethmoid sinuses in 66%, sphenoid sinuses in 56%, and frontal sinuses in 46%. This multi-sinus involvement reflects the typical presentation of CRS, where inflammation affects multiple drainage pathways (Tables 2-3).

Anatomical variations were significant (statistically demonstrated in Table 4), with a deviated nasal septum (32%) and concha bullosa (16%) being the most common. These variations can obstruct sinus drainage and contribute to CRS. Nasal spurs (4%) and paradoxical middle turbinates (2%) were less frequent but also known contributors to sinus dysfunction (Table 4).

Widening of the osteomeatal complex, a key structure in sinus drainage, was observed in 70% of patients, with bilateral widening in 18% and unilateral widening evenly distributed on the right and left sides (26% each). Complications included intraorbital

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involvement in 8% of patients and intracranial extension in 4%, both of which are serious and require urgent intervention. Bony changes, indicating chronic infection, were seen in 12% of patients (Table 5).

Table 1: Descriptive statistics of the patients (n=50)

Gender	No.	%
Male	34	68.0
Female	16	32.0

Table 2: Frequency of sinus opacification (n=50)

Sinus	Normal	Opacified
Frontal	27 (54%)	23 (46%)
Ethmoid	16 (32%)	34 (68%)
Sphenoid	22 (44%)	28 (56%)
Maxillary	7 (14%)	43 (86%)

Table 3: Frequency of sinus side involvement (n=50)

Sinus	Absent	Both sides	Left	Right
Ethmoid	1 (2%)	19 (38%)	9 (18%)	5 (10%)
Sphenoid	-	18 (36%)	8 (16%)	2 (4%)
Maxillary	4 (6%)	9 (18%)	13 (26%)	13 (26%)

Table 4: Nasal septum deviation and inferior turbinate hypertrophy (n=50)

Condition	Absent	Left	Right	Both	Normal	Not demarcated
Nasal septum deviation	1 (2%)	7 (14%)	9 (18%)	-	33 (66%)	-
Inferior turbinate hypertrophy	5 (10%)	6 (12%)	6 (12%)	25 (50%)	7 (14%)	1 (2%)

Table 5: Bony changes, intraorbital and intracranial involvement (n=50)

Condition	No.	%
Bony changes	44 (88%)	6 (12%)
Intraorbital involvement	46 (92%)	4 (8%)
Intracranial involvement	48 (96%)	2 (4%)

DISCUSSION

Rhinosinusitis is a growing global health issue, with rising prevalence linked to the increasing rates of allergic rhinitis. The predominance of male patients in this study is consistent with previous findings, which also report a higher incidence of chronic rhinosinusitis (CRS) in men.¹⁵

The maxillary sinus was the most frequently involved in CRS, a finding corroborated by prior studies, highlighting its critical role in disease management.¹⁶ The ethmoidal sinus was the second most affected. The significant impact of CRS on quality of life underscores the need for heightened attention to this condition in public health strategies. Effective sinus drainage, dependent on the patency of the ostiomeatal complex, is essential for maintaining normal nasal physiology.¹⁷ While 26% of patients had a patent ostiomeatal complex, other contributing factors such as environmental and anatomical variations also play important roles in CRS pathogenesis.

Anatomical variations, which can alter airflow or obstruct the ostiomeatal complex, are key factors in CRS development.¹⁸ This study identified anatomical variations in 22% of patients, consistent with other studies. Concha bullosa, a common variation, has been implicated in CRS by some research, although findings are mixed. Mucosal thickening was seen in 86% of patients, reinforcing the role of CT in diagnosing CRS.¹⁹

Lopez et al¹⁰ demonstrated a strong correlation between CT scores and the severity of nasal obstruction and discharge in CRS patients (32), suggesting that CT can help predict symptom severity. Advances in functional endoscopic sinus surgery (FESS) have improved outcomes in patients with anatomical variations, reducing surgical complications.²⁰

Nasal septal deviation was observed in 32% of patients, similar to other reports indicating a prevalence of 20-31% in the general population¹⁰. Studies have suggested a possible link between septal deviation and CRS, although results are mixed. Our findings show a strong association between septal deviation

and CRS. Research by Brown et al. found nasal septal deviation in 81.7% of CRS patients, with variations common in both the right and left sides. This study supports the role of septal deviation in CRS.²¹

Concha bullosa has been associated with inflammatory sinus disease in some studies, with 73% of patients showing this variation, though 78% of patients without it also had sinus inflammation, indicating that multiple factors contribute to CRS.¹²

Our study statistically proved that computed tomography provides detailed visualization of sinus pathology, playing a crucial role in diagnosing sinus conditions and supporting clinical decision-making. Early and accurate diagnosis is essential to optimize patient care and prevent chronic conditions.³ By combining clinical assessment with radiological data, clinicians can minimize the need for invasive interventions and improve outcomes. Customizing treatment plans for each patient based on this information enhances the overall effectiveness of care.⁵

CONCLUSION

Computed tomography serves as a pivotal tool in the diagnostic process, offering precise visualization of sinus pathology and aiding in clinical decision-making. By integrating clinical evaluation with radiological findings, clinicians can tailor treatment approaches to individual patients, improving outcomes and reducing the need for invasive procedures. Ensuring prompt and accurate diagnosis is vital in preventing chronicity and enhancing patient care.

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