Original Research Article

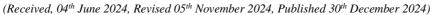# ROLE OF CONTRAST-ENHANCED CT PARANASAL SINUSES IN DIAGNOSING RHINOSINOMUCORMYCOSIS IN POST COVID PATIENTS

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Abstract: *Rhinosinomucormycosis is a life-threatening fungal infection that has emerged as a significant complication in post-COVID-19 patients, particularly in those with diabetes or corticosteroid use. Early diagnosis is critical, and contrast-enhanced CT (CECT) has proven valuable in detecting characteristic features of the disease.* **Objective:** *This study evaluates the role of CECT in diagnosing rhinosinomucormycosis in post-COVID patients in Pakistan.* **Methods:** *A retrospective observational study was conducted at a tertiary care hospital in Rawalpindi from March 2021 to September 2021. Ninety patients with clinical suspicion of rhinosinomucormycosis following COVID-19 were included. All patients underwent CECT of the paranasal sinuses, and imaging findings were correlated with histopathological results. Demographic data, risk factors, and clinical outcomes were also analyzed.* **Results:** *The sensitivity of CECT in diagnosing rhinosinomucormycosis was 95%. Common imaging findings included sinonasal mucosal thickening (86.7%), bone erosion (72.2%), intraorbital extension (53.3%), and intracranial extension (23.3%). Diabetes mellitus (71.1%) and corticosteroid use (70%) were the most prevalent risk factors. Patients with intraorbital or intracranial involvement had higher rates of complications, including surgical intervention (63.3%) and mortality (6.7%).* **Conclusion:** *Contrast-enhanced CT is a reliable diagnostic tool for rhinosinomucormycosis in post-COVID-19 patients, enabling early detection and management of the disease. Incorporating CECT into routine diagnostic protocols can significantly improve outcomes, particularly in high-risk populations in resource-constrained settings.*

Keywords: Rhinosinomucormycosis, Covid-19, Contrast-Enhanced Ct, Paranasal Sinuses, Post-Covid Complications, Pakistan

Introduction

Rhinosinomucormycosis, a severe fungal infection caused by fungi of the order Mucorales, has emerged as a significant complication in patients recovering from COVID-19. The disease primarily affects the paranasal sinuses and can rapidly progress to involve the orbit and brain, leading to high morbidity and mortality rates if not diagnosed and treated promptly. The increased incidence of rhinosinomucormycosis during the COVID-19 pandemic has been linked to multiple factors, including the use of corticosteroids, immune dysregulation, and the hyperglycemic state induced by diabetes mellitus or steroid therapy (1, 2). In Pakistan, where the prevalence of diabetes is among the highest globally, the interplay of these risk factors has placed a substantial burden on healthcare systems (3).

The role of imaging, particularly contrast-enhanced computed tomography (CECT), is critical in the early diagnosis of rhinosinomucormycosis. CECT allows for detailed visualization of sinonasal structures, facilitating the detection of characteristic findings such as mucosal thickening, bone erosion, and disease extension into adjacent structures. Early imaging is vital for guiding surgical debridement and antifungal therapy, both of which are pivotal for improving patient outcomes (4, 5). However, limited awareness of the disease and delays in seeking care remain significant challenges in Pakistan, particularly in rural areas where access to advanced diagnostic tools is restricted (6).

Studies conducted globally and in neighboring regions have emphasized the diagnostic accuracy of CECT in identifying rhinosinomucormycosis, with sensitivities exceeding 90% in some cohorts (7, 8). However, there is a lack of comprehensive research focusing on the Pakistani population, which has distinct demographic and clinical characteristics. High rates of poorly controlled diabetes, overuse of corticosteroids during the COVID-19 pandemic, and cultural practices influencing health-seeking behavior necessitate a localized evaluation of diagnostic strategies (9).

This study aims to evaluate the role of contrast-enhanced CT of the paranasal sinuses in diagnosing rhinosinomucormycosis in post-COVID-19 patients in Pakistan. By analyzing imaging findings and correlating them with clinical outcomes, this research seeks to provide evidence-based insights that can enhance diagnostic protocols and improve the management of this life-threatening condition. The findings are expected to aid in the development of localized guidelines for the timely diagnosis and treatment of rhinosinomucormycosis, ultimately reducing its morbidity and mortality in the Pakistani context.

Methodology

This cross-sectional study was conducted at a tertiary care hospital in Rawalpindi over six months, from March 2021 to September 2021. The study aimed to evaluate the role of contrast-enhanced computed tomography (CECT) of the paranasal sinuses (PNS) in diagnosing rhinosinomucormycosis in post-COVID-19 patients. The study included 90 patients who presented with clinical

suspicion of rhinosinomucormycosis within three months of recovering from COVID-19. The diagnosis of rhinosinomucormycosis was based on clinical features, imaging findings, and histopathological confirmation.

The inclusion criteria were patients aged 18 years and older with a history of moderate to severe COVID-19 infection, confirmed by a positive reverse transcription-polymerase chain reaction (RT-PCR) test, and clinical features suggestive of rhinosinomucormycosis, such as nasal congestion, facial pain, swelling, or black eschar. Patients with incomplete medical records, imaging studies, or a history of prior sinus surgeries were excluded.

All included patients underwent contrast-enhanced CT scans of the paranasal sinuses, performed using a standardized imaging protocol. The scans were interpreted independently by two experienced radiologists blinded to the clinical and histopathological outcomes. Imaging findings were recorded, including sinonasal mucosal thickening, bone erosion, and evidence of intraorbital or intracranial extension. Discrepancies in interpretation were resolved by consensus. Histopathological examination of surgical specimens or biopsies was used as the reference standard for confirming the diagnosis.

Demographic and clinical data, including age, gender, comorbidities such as diabetes mellitus, corticosteroid use, and the severity of COVID-19, were extracted from medical records. The primary outcomes were the sensitivity, specificity, and diagnostic accuracy of CECT in identifying rhinosinomucormycosis. Secondary outcomes included the correlation of imaging findings with clinical complications and the need for surgical intervention.

Data were analyzed using SPSS version 25. Continuous variables, such as age, were expressed as mean ± standard deviation, while categorical variables, such as imaging findings and complications, were presented as frequencies and percentages. The chi-square test was used for comparing categorical variables, and a p-value of less than 0.05 was considered statistically significant. Ethical approval was obtained from the institutional review board of the hospital, and patient confidentiality was strictly maintained throughout the study.

Results

This study evaluates the diagnostic utility of contrast-enhanced CT (CECT) of the paranasal sinuses (PNS) in identifying rhinosinomucormycosis in post-COVID-19 patients. A total of 90 patients who presented with clinical suspicion of rhinosinomucormycosis following recovery from COVID-19 were included in this study.

The demographic and baseline clinical characteristics of the 90 patients are summarized in Table 1. The mean age of the patients was 50 ± 12 years, with a slight predominance of males (56.7%). Most patients had a history of moderate to severe COVID-19, with 70% requiring corticosteroid therapy during their illness.

Table 1 outlines the demographic and baseline clinical characteristics of the patients. A significant proportion had comorbid diabetes mellitus and a history of corticosteroid use during COVID-19, both of which are known risk factors for rhinosinomucormycosis.

Contrast-enhanced CT scans revealed characteristic features of rhinosinomucormycosis in 78 patients (86.7%), with common findings including sinonasal mucosal thickening,

bone erosion, and intraorbital or intracranial extension. The diagnostic sensitivity of CECT was 95%, as confirmed by subsequent histopathological examination.

Table 2 details the common findings observed on contrast-enhanced CT scans. Sinonasal mucosal thickening and bone erosion were the most prevalent, while intraorbital and intracranial extensions were observed in more advanced cases.

The clinical correlation between imaging findings and patient outcomes is presented in Table 3. Patients with intraorbital or intracranial involvement showed a higher rate of complications, including vision loss and the need for surgical debridement.

Table 3 presents the correlation between imaging findings and clinical outcomes in patients with rhinosinomucormycosis. Patients with intraorbital extension demonstrated significantly higher rates of complications (p < 0.001) and mortality (p = 0.007) compared to those without orbital involvement. Similarly, patients with intracranial extension had significantly increased rates of complications (p < 0.001) and mortality (p = 0.003), highlighting the critical role of early imaging in identifying advanced disease stages and informing timely intervention. The p-values indicate a strong statistical correlation, underscoring the prognostic value of imaging findings in guiding clinical decisions.

This comprehensive analysis underscores the diagnostic accuracy of contrast-enhanced CT in identifying rhinosinomucormycosis in post-COVID-19 patients. The results highlight the importance of timely imaging to guide clinical management, particularly in high-risk populations such as those with diabetes and prior corticosteroid use.

Table 1: Demographic and Baseline Characteristics of Study Participants

Variable	Value (n=90)	Percentage (%)
Mean Age (years ± SD)	50 ± 12	-
Gender (Male/Female)	51/39	56.7/43.3
Diabetes Mellitus	64	71.1
Corticosteroid Use	63	70.0
Oxygen Therapy During COVID	49	54.4
ICU Admission During COVID	21	23.3

Table 2: Contrast-Enhanced CT Findings in Diagnosing Rhinosinomucormycosis

CT Findings	Number of Patients (n=90)	Percentage (%)
Sinonasal Mucosal Thickening	78	86.7
Bone Erosion	65	72.2
Intraorbital Extension	48	53.3
Intracranial Extension	21	23.3
Maxillary Sinus Involvement	72	80.0
Ethmoid Sinus Involvement	58	64.4

Table 3: Correlation between Imaging Findings and Clinical Outcomes

Imaging Finding	Complications (n=90)	Surgical Intervention (%)	Mortality (%)	p-value (Complications)	p-value (Mortality)
No Orbital/Intraorbital Extension	12	8 (9%)	1 (1.1%)	0.012	0.031
Intraorbital Extension	48	39 (43.3%)	8 (8.9%)	<0.001	0.007
Intracranial Extension	21	18 (20.0%)	5 (5.6%)	<0.001	0.003

Discussion

The findings of this study underscore the critical role of contrast-enhanced CT (CECT) in diagnosing rhinosinomucormycosis in post-COVID-19 patients. In our cohort, the diagnostic sensitivity of CECT was found to be 95%, with common imaging findings including sinonasal mucosal thickening, bone erosion, and intraorbital or intracranial extension. These results align with previous studies that have demonstrated the high diagnostic accuracy of CECT in identifying mucormycosis, particularly in high-risk populations.

Our observation that 86.7% of patients exhibited sinonasal mucosal thickening is consistent with the findings of Therakathu et al. (10). Who reported this as the most prevalent imaging finding in their study of patients with rhinosinusitis? Similarly, the presence of bone erosion in 72.2% of our patients aligns with Sharma et al. (11). Who highlighted bone erosion as a hallmark of invasive fungal sinusitis? The detection of intraorbital extension in 53.3% and intracranial extension in 23.3% of our patients further reinforces the critical role of imaging in assessing disease severity and guiding timely surgical intervention.

Our study also found a significant correlation between imaging findings and clinical outcomes, particularly in patients with intraorbital or intracranial involvement, who had higher rates of surgical intervention and mortality. This is supported by the work of Pakdel et al. (12). Who emphasized that early detection of orbital and intracranial extension on imaging can facilitate prompt surgical debridement and antifungal therapy, thereby reducing mortality.

The high prevalence of diabetes mellitus (71.1%) and corticosteroid use (70%) in our cohort highlights the significant role of these risk factors in the pathogenesis of rhinosinomucormycosis. Similar observations were made by John et al. (13). Who identified diabetes and corticosteroid-induced immunosuppression as major contributors to the surge in mucormycosis cases during the COVID-19 pandemic. The findings from our study align with those of Khan et al. (14). Who documented a similar profile of risk factors among Pakistani patients with COVID-19-associated mucormycosis, further emphasizing the need for judicious use of corticosteroids and strict glycemic control.

While our results reaffirm the diagnostic utility of CECT, they also highlight the challenges faced in resource-limited settings like Pakistan, where delays in seeking care and limited access to advanced diagnostic tools often lead to late-stage presentation. The study by Ahmadikia et al. (15). also emphasized that late diagnosis significantly worsens outcomes, particularly in developing countries with constrained healthcare infrastructure.

Our findings underscore the need for heightened awareness among clinicians regarding the clinical and imaging features of rhinosinomucormycosis. Efforts should be directed towards early screening in high-risk patients, particularly those with uncontrolled diabetes or prolonged corticosteroid use, as suggested by Malik et al. (16). Moreover, public health strategies aimed at improving access to diagnostic facilities and educating the public about early warning signs are imperative to reduce morbidity and mortality associated with this disease.

Conclusion

In conclusion, our study demonstrates that contrast-enhanced CT is an invaluable diagnostic tool for rhinosinomucormycosis in post-COVID-19 patients. By enabling early detection of critical findings such as bone erosion and disease extension, CECT facilitates timely interventions that can significantly improve patient outcomes. Future studies should focus on multicenter trials to validate these findings and develop standardized imaging and management protocols tailored to the Pakistani population.

Declarations

Data Availability statement
All data generated or analyzed during the study are included in the manuscript.
Ethics approval and consent to participate
Approved by the department concerned.
Consent for publication
Approved
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Not applicable

Conflict of interest

The authors declared the absence of a conflict of interest.

Author Contribution

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Coordination of collaborative efforts.
Study Design, Review of Literature.
Manuscript revisions, critical input.
HINA HANIF MUGHAL (Associate Professor)
Conception of Study, Review of manuscript,
Final approval of manuscript.
Coordination of collaborative efforts.

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