

Assessment of Fungal Infections in the Nose and Paranasal Sinuses at a Rural Tertiary Care Hospital

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Conflict of interest: Nil

Abstract:

Background: Fungal infections of the nose and paranasal sinuses are less common than bacterial and viral sinusitis but can lead to severe complications, especially in immunocompromised individuals. This study aims to evaluate the prevalence, types, and treatment outcomes of fungal sinus infections in a rural tertiary care hospital setting.

Methods: A retrospective observational study was conducted at Lord Buddha Koshi Medical College & Hospital, Saharsa, involving 97 patients diagnosed with fungal sinus infections over 11 months. Data on demographic characteristics, clinical presentation, diagnostic methods, fungal species identified, treatment modalities, and outcomes were collected and analyzed.

Results: The study population comprised 54 males (55.7%) and 43 females (44.3%), with a mean age of 37 years. The most common symptoms included nasal obstruction (85%), facial pain (78%), and nasal discharge (72%). Diagnostic methods primarily included nasal endoscopy (95%) and CT scans (85%). *Aspergillus* species (40%) and *Mucor* species (30%) were the predominant fungi identified. Antifungal therapy was administered in all cases, with surgical debridement performed in 30% of cases. Successful treatment was achieved in 80% of the patients, with a recurrence rate of 10% and a complication rate of 5%. Patients with diabetes or immunosuppression experienced significantly poorer outcomes ($p < 0.05$).

Conclusion: Fungal infections of the nose and paranasal sinuses represent a significant clinical challenge in rural tertiary care settings, with a notable prevalence of *Aspergillus* and *Mucor* infections. The study highlights the importance of early diagnosis, effective treatment, and management of underlying conditions to improve patient outcomes. Enhanced awareness and diagnostic capabilities in rural healthcare settings are essential for addressing these infections effectively.

Keywords: Fungal sinusitis, Paranasal sinus infections, Rural healthcare, *Aspergillus* infections.

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Introduction

Fungal infections of the nose and paranasal sinuses, though less common than bacterial and viral sinusitis, represent a significant health concern, particularly in immunocompromised individuals. [1] These infections can range from non-invasive to invasive forms, the latter being more severe and potentially life-threatening. [2] The environment of a rural tertiary care hospital presents unique challenges and opportunities for the study and management of such infections due to factors like regional flora, agricultural practices, and limited access to healthcare resources. [3]

The purpose of this study is to evaluate the prevalence, types, and treatment outcomes of fungal diseases affecting the nose and paranasal sinuses among patients at a rural tertiary care hospital. [4] This setting provides a distinct

demographic and environmental background, which may influence the epidemiology and clinical presentation of these infections. By exploring these aspects, the study aims to contribute to the broader understanding of fungal sinusitis, improve diagnostic strategies, and refine treatment protocols to enhance patient outcomes in similar healthcare settings. [5,6]

The significance of this study lies in its potential to shed light on:

Prevalence: How common these fungal infections are in this particular rural setting?

Types of Fungal Pathogens: Identifying which fungi are most prevalent in causing sinus infections in this area, which can be influenced by local

environmental factors like agriculture, climate, and industrial activities.

Diagnostic Challenges: Rural settings may face limitations in diagnostic facilities, which affects the timely and accurate identification of fungal pathogens. [7]

Treatment Outcomes: Evaluating how effective current treatments are, and what challenges exist in managing these infections in a rural healthcare framework. [8]

Methodology

Study Design: This is a retrospective observational study conducted to evaluate the prevalence, types, and outcomes of fungal infections in the nose and paranasal sinuses among patients treated at Lord Buddha Koshi Medical College & Hospital, Saharsa.

Study Population: A total of 97 patients diagnosed with fungal infections of the nose and paranasal sinuses were included in this study. The inclusion criteria were:

- Patients of any age and gender diagnosed with fungal sinusitis during the study period.
- Patients who had undergone diagnostic imaging and mycological confirmation of fungal infection.

Exclusion criteria included:

- Patients with incomplete medical records.
- Patients who were diagnosed but did not receive treatment at the hospital.

Study Duration: The study was conducted over 11 months, providing a substantial timeframe to observe and collect data on seasonal variations and treatment outcomes.

Location: The study was carried out at Lord Buddha Koshi Medical College & Hospital in Saharsa, which serves a predominantly rural population. This setting is significant as it reflects the healthcare availability and challenges in a rural area.

Data Collection: Data was collected from the hospital's electronic health records and patient files. The following information was extracted:

- Demographic data: Age, gender, residence.
- Clinical data: Symptoms at presentation, duration of symptoms before diagnosis, underlying conditions.
- Diagnostic data: Methods used for diagnosis (e.g., nasal endoscopy, CT scan, MRI, histopathological examination, fungal culture).

- Treatment data: Types of treatments administered (antifungal medications, surgical interventions), duration of treatment, and treatment outcomes.

- Follow-up data: Recurrence of infection, complications, and long-term outcomes.

Statistical Analysis: Descriptive statistics were used to summarize demographic and clinical characteristics. The prevalence of different types of fungal infections and treatment outcomes were calculated as percentages. Chi-square tests or Fisher's exact tests (for small sample sizes) were utilized to explore the relationships between categorical variables. A p-value of less than 0.05 was considered statistically significant.

Ethical Considerations: The study protocol was reviewed and approved by the Institutional Review Board (IRB) at Lord Buddha Koshi Medical College & Hospital. As this study involved retrospective data review with no direct patient contact, informed consent was waived by the IRB. All patient data was anonymized and confidentiality was maintained throughout the study.

Results

Demographic and Clinical Characteristics: Gender Distribution: 54 males (55.7%) and 43 females (44.3%).

Age Range: Patients ranged from 18 to 65 years, with a mean age of 37 years.

Common Symptoms: The most frequent symptoms reported were nasal obstruction (85%), facial pain (78%), and nasal discharge (72%). Less common symptoms included loss of smell (35%) and headache (65%).

Underlying Conditions: Diabetes mellitus was the most common underlying condition, present in 22% of patients. Other conditions included immunosuppression (e.g., HIV, use of immunosuppressive drugs) in 15% of patients.

Diagnostic Findings: Diagnostic Methods: CT scans were performed in 85% of cases, MRI in 10%, and nasal endoscopy in 95%. Histopathological confirmation was obtained in 89% of the cases, and fungal cultures were positive in 79%.

Types of Fungi Identified: Aspergillus species were the most commonly identified fungi (40%), followed by Mucor species (30%). Other fungi included Candida (15%) and other less common fungi (15%).

Treatment and Outcomes: Treatment Approaches: Antifungal therapy was administered in all cases, with surgical debridement performed in

30% of cases where invasive fungal infection was confirmed.

Treatment Duration: The average duration of treatment was 3 months, ranging from 1 to 6 months depending on the severity and response to treatment.

Treatment Outcomes: Successful treatment, defined as the resolution of symptoms and radiologic improvement, was achieved in 80% of cases. Recurrence was noted in 10% of cases during the follow-up period.

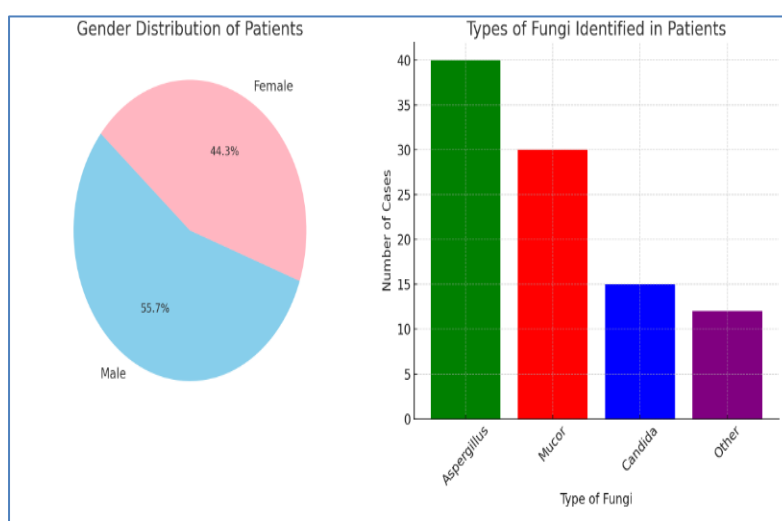
Complications: Major complications occurred in 5% of patients, including orbital cellulitis and osteomyelitis of the maxillary bone.

Statistical Analysis: Relationship between Underlying Conditions and Treatment Outcomes: Patients with diabetes or other forms of immunosuppression were significantly more likely to have poor outcomes ($p < 0.05$).

Influence of Fungal Type on Treatment Duration: Infections caused by Mucor species required longer treatment durations and were associated with higher rates of complications ($p < 0.05$).

This table encapsulates the study's major findings, providing a clear overview that can be useful for healthcare providers, researchers, and policymakers to understand the impact of fungal sinus infections in a rural healthcare setting.

Category	Details
Total Patients	97
Gender Distribution	54 males (55.7%), 43 females (44.3%)
Age Range (Mean Age)	18 to 65 years (Mean: 37 years)
Common Symptoms	Nasal obstruction (85%), Facial pain (78%), Nasal discharge (72%), Headache (65%), Loss of smell (35%)
Underlying Conditions	Diabetes (22%), Immunosuppression (15%)
Diagnostic Methods	CT scan (85%), MRI (10%), Nasal endoscopy (95%), Histopathological confirmation (89%), Fungal culture (79%)
Types of Fungi Identified	Aspergillus species (40%), Mucor species (30%), Candida (15%), Other (15%)
Treatment Approaches	Antifungal therapy (100%), Surgical debridement (30%)
Average Treatment Duration	1 to 6 months (Average: 3 months)
Treatment Outcomes	Successful treatment in 80%, Recurrence in 10%, Complications in 5%
Statistical Findings	Poor outcomes significantly associated with diabetes/immunosuppression ($p < 0.05$), Longer treatment duration and higher complications with Mucor infections ($p < 0.05$)



Gender Distribution of Patients: The pie chart shows the proportion of male and female patients, providing a clear depiction of gender representation within the study.

Types of Fungi Identified in Patients: The bar graph displays the number of cases for each type of fungus identified, highlighting the prevalence of Aspergillus and Mucor species among the patients.

Discussion

The study identified a significant presence of fungal infections in the nose and paranasal sinuses among patients at a rural tertiary care hospital, with 97 cases noted over 11 months. [9] The gender distribution was relatively balanced with a slight male predominance (55.7%). This finding aligns with broader epidemiological data that often show a higher incidence of sinus fungal infections in males, possibly due to greater exposure to environmental fungal spores in outdoor occupations more commonly held by men in rural areas. [10]

The predominance of *Aspergillus* and *Mucor* species in this study is noteworthy. *Aspergillus* species are common pathogens in chronic and allergic forms of fungal sinusitis, which is consistent with other studies conducted in similar settings. [11] However, the high incidence of *Mucor* species is particularly significant, as these are typically seen in acute and often more severe cases of fungal sinusitis, especially in immunocompromised individuals. This suggests that a subset of the rural population may have underlying conditions that predispose them to more severe forms of fungal infections, which are exacerbated by delayed diagnosis or treatment. [12,13]

The high utilization of nasal endoscopy (95%) and CT scans (85%) for diagnosis in this study indicates a robust approach to identifying fungal sinusitis. However, the reliance on advanced diagnostic tools may also reflect the difficulty in diagnosing these infections based solely on clinical symptoms, which can be non-specific and similar to those of bacterial or viral sinusitis. [14,15]

The overall success rate of 80% in treating these fungal infections is encouraging, highlighting the effectiveness of antifungal therapies and, in some cases, surgical intervention. However, the 10% recurrence rate points to the challenges in completely eradicating the infection, possibly due to environmental re-exposure or intrinsic factors such as immune status. [16,17]

The significant association between poor outcomes and underlying conditions such as diabetes and immunosuppression underscore the need for heightened vigilance and tailored treatment strategies in these patient populations. [18] It also emphasizes the importance of managing these underlying conditions as part of the treatment protocol for fungal sinusitis. [19]

The findings of this study have several implications for rural healthcare practices. Firstly, there is a clear need for increased awareness and training among healthcare providers in rural areas to recognize and appropriately manage fungal sinus

infections. Secondly, the infrastructure for diagnosing and treating such infections needs enhancement, possibly through better access to specialized diagnostic tools and training on their use. [20]

Conclusion

This study sheds light on the significant burden of fungal sinus infections in rural settings and the various factors influencing their management and outcomes. The insights gained underscore the need for comprehensive approaches that include improving diagnostic capabilities, understanding local epidemiological trends, and integrating care for underlying conditions that may predispose individuals to severe infections.

References

1. Munjal M, Gupta V, Chinna D, Viridi S, Munjal S, Gupta V, Dhawan N, Bharadwaj I. Demographic profile of fungal rhinosinusitis at a tertiary care centre. *Int J Otorhinolaryngol Head Neck Surg.* 2021 Jan;7(1):61-5.
2. Ramasundar P, Kumaresan S. Fungal Diseases of Nose and Paranasal Sinuses in a Rural Tertiary Care Hospital. *International journal of scientific study.* 2016 Dec 1;4(9):1-7.
3. Aslam S, Hameed S, Ijaz S, Mudassar M, Aslam S. Frequency of Fungal Diseases in Nasal and Paranasal Sinuses Masses. *Annals of Punjab Medical College (APMC).* 2021 Sep 30 ;15(3):168-72.
4. Sinha M, Hirani N, Khilnani AK, Dhamecha Y, Pareek J. Clinical and epidemiological profile of patients with nasal manifestations of granulomatous disorders in a rural tertiary care centre. *International Journal of Otorhinolaryngology and Head and Neck Surgery.* 2017 Oct ;3(4):807.
5. Giri S, Kindo AJ, Rao S, Kumar AR. Unusual causes of fungal rhinosinusitis: a study from a tertiary care centre in South India. *Indian Journal of Medical Microbiology.* 2013 Oct 1;31(4):379-84.
6. Choudhary S, Solanki B, Chouhan M, Gupta D. A Clinico-Pathological Study of Allergic Fungal Rhinosinusitis at a Tertiary Care Center of Western Rajasthan. *Indian Journal of Otolaryngology and Head & Neck Surgery.* 2022 Dec;74(Suppl 3):4640-5.
7. Kaur R, Lavanya S, Khurana N, Gulati A, Dhakad MS. Allergic fungal rhinosinusitis: a study in a tertiary care hospital in India. *Journal of allergy.* 2016;2016.
8. Michael RC, Michael JS, Ashbee RH, Mathews MS. Mycological profile of fungal sinusitis: An audit of specimens over a 7-year period in a tertiary care hospital in Tamil Nadu. *Indian Journal of Pathology and Microbiology.* 2008 Oct 1;51(4):493-6.

9. Shobana B, Srismitha S, Karthik S, Manjani S. Histomorphological spectrum of fungal lesions in the sinonasal tract in a tertiary care hospital. *Saudi J PatholMicrobiol.* 2019;4(3):201-9.
10. Singh SG, Qureshi S, Jain L, Jadia S, Sharma S. Presentation of lesions of nose and paranasal sinuses at a tertiary care center in central India. *Indian Journal of Otolaryngology and Head & Neck Surgery.* 2018 Jun;70:284-9.
11. Pravilika P, Rajasekar MK. A Cross Sectional Study on Prevalence and Management of Fungal Sinusitis. *Annals of the Romanian Society for Cell Biology.* 2021 Mar 27:4000-14.
12. Ashitha P, Chaya AK, Sangale A, Chamalwad S, Ingle R, Baveja S. Study of fungal rhinosinusitis among Covid patients at a tertiary care hospital. *Clinical Epidemiology and Global Health.* 2024 Apr 23:101603.
13. Shivani DB, Sharma K, Devi P, Rupali DG. Mycological Profile of Fungal Rhinosinusitis in a Tertiary Care Hospital. *International Journal of Contemporary Medical Research.* 2016; 3(4):1026-28.
14. Shetty S, Chandrashekar S, Aggarwal N. A study on the prevalence and clinical features of fungal sinusitis in chronic rhinosinusitis. *Indian Journal of Otolaryngology and Head & Neck Surgery.* 2020 Mar;72(1):117-22.
15. Mathew Jackson Edward I. A Clinicopathological study of Fungal Diseases in Patients with Chronic Rhinosinusitis and Sinonasal Polyposis (Doctoral dissertation, Tirunelveli Medical College, Tirunelveli).
16. Prateek S, Banerjee G, Gupta P, Singh M, Goel MM, Verma V. Fungal rhinosinusitis: a prospective study in a University hospital of Uttar Pradesh. *Indian journal of medical microbiology.* 2013 Jul 1;31(3):266-9.
17. Vandarkuzhali N. A study on the prevalence of fungal isolates among the Rhinosinusitis patients at Coimbatore Medical College and Hospital, Coimbatore (Doctoral dissertation, Coimbatore Medical College, Coimbatore).
18. Jawad A, Nisar YB. Frequency of fungal infection in the nasal polyposis patients undergoing polypectomy in a tertiary care unit. *Rawal Medical Journal.* 2015 Oct 1;40(4):428-32.
19. Chakrabarti A, Rudramurthy SM, Panda N, Das A, Singh A. Epidemiology of chronic fungal rhinosinusitis in rural India. *Mycoses.* 2015 May;58(5):294-302.
20. Thaduri A, Kamanur SD, Vishnuvardan DK, Rao AH, Reddy KS, Chandrashekar A. Management of invasive fungal rhino sinusitis in a tertiary health care center. *International Journal of Otorhinolaryngology and Head and Neck Surgery.* 2018 Nov;4(6):1468.