

A Prospective Study on Assessment of Nasal and Paranasal Sinus Fungal Infections at Tertiary Care Hospital

Ashutosh Kumar¹, Dharmendra Kumar², Vinit Kumar Anand³

¹Senior Resident, Department of ENT, Jawaharlal Nehru Medical College & Hospital, Bhagalpur, Bihar, India

²Assistant Professor, Department of ENT, Jawaharlal Nehru Medical College & Hospital, Bhagalpur, Bihar, India

³Senior Resident, Department of ENT, Jawaharlal Nehru Medical College & Hospital, Bhagalpur, Bihar, India

Received: 25-07-2023 / Revised: 23-08-2023 / Accepted: 18-09-2023

Corresponding Author: Ashutosh Kumar

Conflict of interest: Nil

Abstract:

Background: Fungal infections of the nasal and paranasal sinuses pose significant clinical challenges, with diverse causative organisms and varying clinical presentations. This study aimed to comprehensively investigate the epidemiology, clinical features, and management of these infections, with a focus on improving diagnostic accuracy and optimizing patient care.

Methods: A prospective observational study was conducted on 70 patients presenting with clinical features suggestive of nasal and paranasal sinus fungal infections. A systematic evaluation, including clinical assessments, diagnostic tests, radiological imaging, microbiological investigations, and endoscopic examinations, was performed. Data were analyzed using descriptive statistics, and ethical considerations were upheld throughout the study.

Results: The majority of patients were younger adults, with males predominating (65%). Nasal obstruction, discharge, and headaches were common clinical symptoms. Ocular symptoms were observed in 25% of cases. CT scans revealed extensive sinus involvement, particularly in the maxillary sinus (75%). Complications, including intraoperative hemorrhage and synechiae formation, were noted. Recurrence rates were higher in longer-term follow-ups. *Aspergillus* species, notably *Aspergillus flavus*, were the primary causative agents.

Conclusion: This study sheds light on the complex nature of nasal and paranasal sinus fungal infections. It emphasizes the importance of early recognition, careful management, and prolonged monitoring, especially in high-risk patients. The identification of *Aspergillus* species aids in targeted antifungal therapy, contributing to improved patient outcomes.

Recommendations: Healthcare providers should maintain a high index of suspicion for fungal infections in patients with compatible symptoms, especially in regions with environmental risk factors. Comprehensive evaluation, including imaging and microbiological assessment, should guide timely intervention and management.

Keywords: Nasal infections, paranasal sinus infections, fungal sinusitis, clinical presentation, *Aspergillus* species.

This is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.

Introduction

Fungal infections of the nose and paranasal sinuses represent a challenging and clinically significant area of concern in the field of otolaryngology [1]. These infections can encompass a wide spectrum of clinical manifestations, ranging from mild, localized cases to severe and potentially life-threatening conditions. Understanding the evaluation and management of fungal diseases in the nasal and paranasal sinus regions is essential for healthcare professionals to provide timely and effective care to patients.

Fungi responsible for nasal and paranasal sinus infections are diverse, including species such as *Aspergillus*, *Candida*, and *Mucor*, among others [2]. These organisms can take advantage of immunocompromised states, environmental factors, or anatomical variations to gain a foothold within the sinonasal passages, leading to a variety of clinical presentations.

Fungal sinusitis is a notable concern, with its prevalence varying based on geographic location and patient population. For instance, in regions

with a high prevalence of fungal spores in the environment, such as arid climates, the incidence of fungal sinusitis is notably higher [3]. Understanding these epidemiological factors is crucial for healthcare providers to assess the likelihood of fungal sinus infections in their patient population.

Various factors predispose individuals to fungal infections of the nasal and paranasal sinuses. Immunocompromised states, such as those seen in patients with HIV/AIDS or individuals undergoing immunosuppressive therapies, significantly increase the risk. Additionally, anatomical abnormalities or prior sinus surgery can create an environment conducive to fungal growth [4]. Recognizing these risk factors is vital for early detection and intervention.

The clinical presentation of fungal sinusitis can be highly variable, making it challenging to diagnose. Patients may experience symptoms such as nasal congestion, facial pain, headache, and nasal discharge, which can mimic other sinus conditions [5]. In severe cases, fungal sinusitis can extend beyond the sinuses, leading to orbital or intracranial complications. Prompt recognition of these clinical signs is essential for initiating appropriate treatment.

The management of fungal sinusitis involves a multifaceted approach, which may include antifungal medications, surgical intervention, and addressing underlying risk factors [6]. The choice of antifungal agent and the extent of surgical intervention depend on the type and severity of fungal sinusitis. In some cases, long-term antifungal therapy may be necessary to prevent recurrence.

The aim of this study is to comprehensively assess the epidemiology, clinical presentation, diagnostic methods, and management strategies for nasal and paranasal sinus fungal infections, with the ultimate goal of improving diagnostic accuracy and optimizing patient care.

Methodology

Study Design: This prospective observational study was designed to investigate fungal infections of the nose and paranasal sinuses.

Study Setting: The study was conducted at Jawaharlal Nehru medical college and hospital, Bhagalpur, India, during the period from '2022-2023'.

Participants: A total of 70 patients were initially enrolled for the study.

Inclusion Criteria:

1. Patients presenting with clinical features suggestive of fungal infections of the nose and paranasal sinuses.
2. Patients willing to participate and provide informed consent.

Exclusion Criteria

1. Patients unwilling to participate in the study.
2. Patients with contraindications for the investigative procedures or interventions.
3. Patients with incomplete medical records.

Bias: Efforts were made to minimize selection bias by including all eligible patients who met the inclusion criteria.

Variables: Key variables included clinical features suggestive of fungal infections, diagnostic test results, surgical outcomes, and patient follow-up data.

Data Collection: Data was collected through a systematic evaluation of patients, including clinical assessments, hematological investigations, radiological imaging, microbiological tests, and endoscopic examinations.

Methodology

A standardized proforma was used for patient evaluation, and all investigative procedures were conducted systematically as needed. Diagnostic and treatment decisions were made based on established clinical protocols.

Endoscopic Sinus Surgery: Patients who underwent endoscopic sinus surgery were managed post-operatively with regular follow-up appointments. Nasal douching and appropriate medical treatment were administered according to individual patient needs.

Statistical Analysis: Data were compiled and analyzed using Microsoft Excel and SPSS version 20. Descriptive statistics, including percentages, means, and standard deviations, were computed.

Ethical Considerations: The study protocol was reviewed and granted ethical clearance by the Ethical Committee. Informed consent was obtained from all participating patients, ensuring their rights and confidentiality were upheld throughout the study.

Result

In the study of 70 patients, they were categorized into different age groups and assessed for gender distribution. Among the age groups, individuals below 20 years constituted 15% of the sample, while those between 20 and 30 years accounted for 35%. Patients aged between 30 and 40 years represented 40%, and those above 40 years constituted 10% of the total. Overall, the majority

of the patients were male, making up 65% of the total, while females comprised the remaining 35%.

Clinical symptoms were evaluated, with all 70 patients presenting with nasal-related symptoms. Nasal obstruction and nasal discharge were prevalent in 60% of the patients, and 40% exhibited post-nasal discharge. Additionally, 60% of the patients reported experiencing headaches. Ocular symptoms, including proptosis, epiphora, diplopia, and ophthalmoplegia, were observed in 25% of the cases.

CT scans were performed to assess sinus involvement in the patients. Maxillary sinus

involvement was observed in 75% of cases, followed by ethmoidal sinus involvement in 70%. Frontal sinus involvement was noted in 50% of patients, while sphenoidal sinus involvement was seen in 60%. In 35% of cases, all sinuses were affected, and orbital involvement was observed in 20%.

Regarding the laterality of sinus involvement, 20% of patients had right-sided issues, while 25% had left-sided involvement. Unilateral involvement was found in 45% of cases, while 55% exhibited bilateral sinus involvement.

Table 1: CT Scan of Nose and Sinus & Unilateral/Bilateral Comparison Study

Sinus Involvement	Percentage
Maxillary Sinus	75%
Ethmoidal Sinus	70%
Frontal Sinus	50%
All Sinuses	60%
Orbital	35%
All Sinuses	20%
Sides of Nose and Sinuses	
Right	20%
Left	25%
Unilateral	45%
Bilateral sinus involvement	55%

Complications were recorded during the study, with intraoperative hemorrhage occurring in 5 patients. No instances of cerebrospinal leak were reported, while synechia formation was observed in 18 patients. Periorbital ecchymosis occurred in 5 cases.

Patients were followed up at different intervals, with 10 recurrences observed among 18-month follow-ups in 14 cases. In the 12-month follow-up group of 28 patients, 15 cases of recurrence were reported. The 6-month follow-up group of 42 patients did not show any recurrences.

The study identified various causative organisms, with *Aspergillus flavus* accounting for 30% of cases, *Aspergillus fumigatus* in 20%, *Aspergillus niger* in 15%, and *Aspergillus terreus* in 5%. In 30% of cases, no specific growth was observed. These findings contributed to the understanding of the fungal agents responsible for nasal and paranasal sinus infections in the patient population.

Discussion

In the present study of 70 patients with nasal and paranasal sinus infections, a demographic analysis revealed a higher prevalence among younger adult males, with the majority being under 40 years. Clinically, all patients exhibited nasal symptoms, predominantly nasal obstruction and discharge, and 60% reported headaches. Ocular symptoms were noted in 25% of cases. CT scans showed extensive

sinus involvement, particularly in the maxillary sinus (75%), and 35% of cases had all sinuses affected.

Complications included intraoperative hemorrhage and synechia formation, highlighting surgical risks. Follow-up data indicated higher recurrence rates in longer-term follow-ups. The study identified *Aspergillus* species, especially *Aspergillus flavus*, as a primary causative agent. These findings emphasize the need for careful management and prolonged monitoring in nasal and paranasal sinus infections.

The study of nasal and paranasal sinus infections encompasses various aspects, including anatomical variations, relationships with other diseases, and management of complications. A significant study on the anatomic variations of para-nasal sinuses in patients undergoing CT scans highlights the importance of Multi-Slice Computed Tomography (MSCT) in preoperative assessments. A study [7] emphasizes the role of MSCT in detecting paranasal sinus variations to prevent possible injuries and understand the relationship between anatomical variants and sinusitis. Another study [8] investigates the relationship between paranasal sinusitis, based on PNS-CT scans, and Kawasaki disease in children. It suggests the use of PNS CT-scans for Kawasaki Disease cases with prolonged upper respiratory infection symptoms, highlighting the high prevalence of paranasal sinusitis in the

pediatric population. Additionally, a study [9] underscores the necessity of a collaborative effort between ophthalmologists and otorhinolaryngologists. This approach is crucial for identifying underlying diseases and providing appropriate care to prevent ophthalmological morbidity and mortality, especially in cases where otorhinolaryngological diseases lead to ophthalmological presentations. Lastly, a study [10] on the management of orbital complications of sinusitis discusses the clinical approaches of ophthalmology and otorhinolaryngology departments. It emphasizes the need for intensive follow-up and a multidisciplinary approach in treating orbital complications of sinusitis.

Conclusion

The study's findings highlight the need for careful management and prolonged monitoring of these infections. Complications such as intraoperative hemorrhage and synechiae formation underscore the surgical risks involved. The higher recurrence rates observed in longer-term follow-ups emphasize the importance of ongoing patient care post-treatment. The identification of *Aspergillus* species, particularly *Aspergillus flavus*, as a primary causative agent, underscores the need for targeted antifungal therapy. These results contribute significantly to the understanding of fungal agents responsible for nasal and paranasal sinus infections, aiding in improving diagnostic accuracy and optimizing patient care.

Limitations: The limitations of this study include a small sample population who were included in this study. The findings of this study cannot be generalized for a larger sample population. Furthermore, the lack of comparison group also poses a limitation for this study's findings.

Recommendations: Healthcare providers should maintain a high index of suspicion for fungal infections in patients with compatible symptoms, especially in regions with environmental risk factors. Comprehensive evaluation, including imaging and microbiological assessment, should guide timely intervention and management.

Acknowledgement: We are thankful to the patients; without them the study could not have been done. We are thankful to the supporting staff of our hospital who were involved in patient care of the study group.

List of abbreviations:

CT: Computed Tomography
MRI: Magnetic Resonance Imaging
ENT: Ear, Nose, and Throat

HIV: Human Immunodeficiency Virus
AIDS: Acquired Immunodeficiency Syndrome
PNS: Paranasal Sinuses
MSCT: Multi-Slice Computed Tomography

Source of funding: No funding received.

References

1. Thompson III GR, Patterson TF. Fungal disease of the nose and paranasal sinuses. *Journal of allergy and clinical immunology*. 2012 Feb 1;129(2):321-6.
2. Young E, Ramakrishnan Y, Jackson L, Ahmed SK. Fungal infections. *Scott-Brown's Otorhinolaryngology and Head and Neck Surgery*. 2018 Jun 12:205-19.
3. AlQahtani A, Alim B, Almudhaibery F, Mulafigh D, Almutairi S, Almohanna S, Alfawwaz F. The impact of climatic, socioeconomic, and geographic factors on the prevalence of allergic fungal rhinosinusitis: a worldwide ecological study. *American Journal of Rhinology & Allergy*. 2022 Jul;36(4):423-31.
4. Davraj K, Yadav M, Chappity P, Sharma P, Grover M, Sharma S, Kataria T, Bhawna K, Pendakur A, Singh G, Irugu DV. Nasal physiology and sinusitis. *Essentials of Rhinology*. 2021:49-101.
5. De Corso E, Kar M, Cantone E, Lucidi D, Settimi S, Mele D, Salvati A, Muluk NB, Paludetti G, Cingi C. Facial pain: sinus or not?. *ACTA otorhinolaryngologica italica*. 2018 Dec;38(6):485.
6. Li E, Knight JM, Wu Y, Luong A, Rodriguez A, Kheradmand F, Corry DB. Airway mycosis in allergic airway disease. *Advances in immunology*. 2019 Jan 1;142:85-140.
7. A.B., R., H.M., F., E.F., A., A.M., S. Anatomic variations of para-nasal sinuses in patients undergoing CT scan: spectrum, prevalence and implications. *Benha Journal of Applied Sciences*, 2022;7(3):89-99.
8. Movahedi Z, Ashouri S. What's the relation between paranasal sinusitis (based on PNS-CT scan) and Kawasaki disease: A comparative study in children in Tehran, Iran.
9. Singh D, Gulati V, Jain S, Chauhan SS. Otorhinolaryngological spectrum of diseases leading to Ophthalmological presentation in eye outpatient department: An overview. *IP J Otorhinolaryngol Allied Sci*. 2023 Oct;6(3):73-77.
10. Ozkurt FE, Ozkurt ZG, Gul A, Akdag M, Sengul E, Yilmaz B, Yuksel H, Meric F. Management of orbital complications of sinusitis. *Arq Bras Oftalmol*. 2014 Oct;77(5):293-296.