ORIGINAL RESEARCH

Evaluation of Fungal Diseases of Nose and Paranasal Sinuses in Tertiary Care Hospital

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ABSTRACT

Aim: To evaluate the clinical spectrum, radiological findings, treatment modalities, and outcomes of fungal diseases of the nose and paranasal sinuses in patients treated at a tertiary care hospital. **Materials and Methods:** This prospective observational study included 120 patients diagnosed with fungal diseases of the nose and paranasal sinuses over a 12-month period. Detailed clinical evaluations, radiological imaging (HRCT and MRI), and microbiological and histopathological analyses were conducted. Patients received medical therapy, surgical intervention, or a combination of both, depending on disease severity. Data were analyzed using SPSS version 20.0, with statistical significance set at $p < 0.05$. **Results:** The study population had a mean age distributed across three groups, with the 31–50 age group (46.67%) being most affected. Males (56.67%) were more frequently diagnosed than females (43.33%). Allergic fungal rhinosinusitis was the most common subtype (53.33%), followed by chronic invasive fungal sinusitis (23.33%), acute invasive fungal sinusitis (13.33%), and fungal ball (10%). Radiological findings showed maxillary sinus involvement in 65% of cases, with bony erosion in 38.33%. Treatment primarily involved functional endoscopic sinus surgery (76.67%) and antifungal therapy, with amphotericin B being the most commonly used agent. Complete symptom resolution was achieved in 81.67% of patients, while complications such as orbital involvement (11.67%) and antifungal toxicity (8.33%) were observed in a minority of cases. **Conclusion:** Fungal diseases of the nose and paranasal sinuses, particularly allergic fungal rhinosinusitis, represent a significant clinical challenge. Early diagnosis through imaging and microbiological confirmation, coupled with tailored medical and surgical interventions, is critical for favorable outcomes. Public health measures to improve awareness and address underlying risk factors, such as diabetes and immunosuppression, are essential for reducing the burden of these diseases.

Keywords: Fungal rhinosinusitis, allergic fungal rhinosinusitis, invasive fungal sinusitis, functional endoscopic sinus surgery, antifungal therapy.

INTRODUCTION

Fungal diseases of the nose and paranasal sinuses encompass a diverse group of conditions caused by fungal infections, ranging from non-invasive allergic reactions to highly invasive and potentially life-threatening infections. These conditions have been increasingly recognized due to advancements in diagnostic techniques and growing awareness among healthcare professionals. The nasal cavity and paranasal sinuses, owing to their warm, moist environment, provide an ideal habitat for fungal organisms, particularly in immunocompromised individuals and those with underlying health conditions.[1]Fungal diseases of the nose and paranasal sinuses are broadly classified into two categories: invasive and non-invasive. Non-invasive fungal conditions include allergic fungal rhinosinusitis (AFRS) and fungal balls. AFRS is characterized by a hypersensitivity reaction to fungal spores, typically affecting individuals with a history of atopy or asthma. In contrast, fungal balls are dense, non-invasive fungal masses that usually form in the sinuses, particularly the maxillary sinus, without causing tissue invasion. These non-invasive conditions are generally chronic, but they can lead to significant sinonasal morbidity if not treated appropriately.Invasive fungal diseases are more aggressive and include acute invasive fungal sinusitis, chronic invasive fungal sinusitis, and granulomatous fungal sinusitis. Acute invasive fungal sinusitis is a rapidly progressing infection that occurs primarily in immunocompromised individuals, such as those with uncontrolled diabetes, cancer, or undergoing chemotherapy. It is characterized by fungal invasion into the mucosa, blood vessels, and adjacent structures, leading to tissue necrosis. Chronic invasive fungal sinusitis progresses more slowly and typically affects immunocompetent individuals, but it can cause

significant destruction of sinonasal and orbital tissues over time. Granulomatous fungal sinusitis, although less common, is characterized by the formation of granulomas and is typically seen in specific geographical regions.[2]The clinical presentation of fungal sinus diseases varies widely depending on the type and severity of the infection. Patients with non-invasive conditions such as AFRS may present with nasal obstruction, nasal discharge, facial pain, and allergic symptoms such as sneezing and itching. On the other hand, invasive fungal infections often present with more severe symptoms, including fever, severe facial pain, proptosis, vision loss, and necrotic changes in the nasal or oral mucosa. In advanced cases, complications such as orbital cellulitis, cavernous sinus thrombosis, and intracranial extension can occur, posing a significant threat to life.[3]The diagnosis of fungal diseases of the nose and paranasal sinuses is based on a combination of clinical evaluation, radiological imaging, and microbiological or histopathological confirmation. High-resolution computed tomography (HRCT) and magnetic resonance imaging (MRI) are invaluable tools in assessing the extent of disease, detecting bony destruction, and identifying soft tissue involvement. These imaging modalities are particularly critical in invasive fungal diseases, where early detection can significantly influence outcomes. Microbiological and histopathological examinations remain the gold standard for confirming fungal etiology. Techniques such as fungal culture, potassium hydroxide (KOH) mount, and specific staining methods help identify the fungal species, which is crucial for guiding targeted antifungal therapy.[4]The management of fungal sinus diseases involves a multidisciplinary approach, combining medical and surgical interventions. Non-invasive conditions such as AFRS and fungal balls are primarily managed with surgical debridement, often performed via functional endoscopic sinus surgery (FESS), to remove fungal debris and restore normal sinus drainage. Adjunctive medical therapy, including corticosteroids in AFRS, is used to reduce inflammation and prevent recurrence. Invasive fungal diseases require aggressive management, including systemic antifungal therapy with agents like amphotericin B, voriconazole, or itraconazole. Surgical debridement is also essential in invasive cases to remove necrotic tissue and reduce the fungal load, thereby enhancing the efficacy of systemic antifungal agents.Prognosis varies depending on the type of fungal disease and the timeliness of diagnosis and treatment. Non-invasive fungal diseases generally have a favorable prognosis with appropriate management, although they may recur if underlying conditions such as atopy or asthma are not addressed. Invasive fungal diseases, however, carry a high risk of morbidity and mortality, particularly in immunocompromised individuals. Early detection and intervention are critical in improving outcomes for these patients.[5]Risk factors for fungal diseases of the nose and paranasal sinuses include environmental and host-related factors. Environmental exposure to fungal spores, particularly in warm and humid climates, is a major contributor. Host-related factors such as immunosuppression, diabetes mellitus, long-term corticosteroid use, and underlying chronic sinus diseases significantly increase the risk of fungal infections. Public health measures, including awareness campaigns and early screening for high-risk individuals, play a vital role in preventing fungal sinus diseases. Education on the importance of managing underlying conditions, such as diabetes and asthma, can reduce the susceptibility to fungal infections. Additionally, advancements in diagnostic and therapeutic modalities continue to improve outcomes for patients with fungal sinus diseases.[6]Fungal diseases of the nose and paranasal sinuses represent a spectrum of conditions ranging from benign to life-threatening. Understanding their classification, clinical presentation, diagnostic strategies, and management is essential for timely intervention and optimal patient outcomes. With the growing burden of fungal infections globally, particularly in the context of increasing immunosuppressive conditions, a concerted effort is needed to enhance awareness, improve diagnostic capabilities, and develop effective treatment protocols.

MATERIALS AND METHODS

This was a prospective observational study conducted in the Department of Otorhinolaryngology at a tertiary care hospital. The study was carried out after obtaining ethical clearance from the Institutional Ethics Committee. Written informed consent was obtained from all participants.A total of 120 patients diagnosed with fungal diseases of the nose and paranasal sinuses were included in the study. Patients were either referred from outpatient services or admitted to the department with symptoms suggestive of sinonasal fungal infections.

Inclusion Criteria

- Patients aged ≥18 years.
- Patients clinically suspected or confirmed to have fungal infections of the nose and paranasal sinuses.
- Patients willing to provide informed consent and participate in the study.

Exclusion Criteria

- Patients with non-fungal sinonasal diseases.
- Patients who underwent sinonasal surgery within the past six months.
- Patients with incomplete medical records or those who declined to provide consent.

Clinical Evaluation

All patients underwent a detailed clinical evaluation, including:

History: Documenting symptoms such as nasal obstruction, nasal discharge, facial pain, swelling, headache, and epistaxis. Duration of symptoms, history of diabetes, immunosuppression, or prior fungal infections were also recorded. **Physical Examination**: A thorough anterior and posterior rhinoscopy was performed to assess sinonasal abnormalities.

Radiological Assessment

High-resolution computed tomography (CT) scans of the paranasal sinuses were obtained in all cases to evaluate the extent of disease, bony erosions, and intracranial or orbital complications. Magnetic resonance imaging (MRI) was performed in selected cases where soft-tissue involvement was suspected.

Microbiological and Histopathological Analysis

Samples were collected during diagnostic nasal endoscopy or surgical intervention and sent for microbiological and histopathological examination.

1. **Microbiological Examination**: Specimens were subjected to potassium hydroxide (KOH) mount preparation and fungal culture for species identification.
2. **Histopathology**: Biopsy specimens were stained with hematoxylin and eosin, periodic acid-Schiff (PAS), and Grocott methenamine silver (GMS) stains to confirm fungal etiology.

Surgical and Medical Management

Based on the type and severity of infection, patients underwent medical therapy, surgical intervention, or a combination of both.

Surgical Management: Functional endoscopic sinus surgery (FESS) was performed in most cases for debridement and removal of fungal masses.

Medical Therapy: Antifungal agents (amphotericin B, voriconazole, or itraconazole) were administered based on the type of fungal infection. Supportive therapy included analgesics and nasal irrigation.

Outcome Measures

The primary outcomes of the study focused on evaluating the prevalence and types of fungal diseases affecting the nose and paranasal sinuses. The classification of fungal diseases included allergic fungal rhinosinusitis, chronic invasive fungal sinusitis, acute invasive fungal sinusitis, and fungal ball. The proportion of patients within each category was documented to understand the distribution of these conditions in the study population.

Clinical and radiological improvement following treatment was another key outcome measure. Improvement was assessed by comparing pre-treatment and post-treatment symptoms, along with imaging findings. Symptom resolution, reduction in lesion size, and normalization of sinonasal anatomy on follow-up imaging were analyzed to determine the efficacy of medical and surgical interventions.

Additionally, the study evaluated the occurrence of complications during the treatment period and recurrence rates on follow-up. Complications such as orbital involvement, intracranial extension, or adverse effects of antifungal therapy were recorded. Recurrence was defined as the reappearance of symptoms or radiological evidence of fungal disease during the follow-up period. These outcomes were used to assess the long-term effectiveness and safety of the management strategies employed.

Statistical Analysis

Data were analyzed using SPSS version 20.0. Categorical variables were expressed as frequencies and percentages, while continuous variables were presented as means and standard deviations. Chi-square tests were used for comparison of categorical data, and a p-value <0.05 was considered statistically significant.

RESULTS

Table 1: Demographic and Clinical Characteristics of Patients

The study included 120 patients, with a mean age distributed across three age groups. The majority were in the 31–50 age group (46.67%), followed by those >50 years (33.33%) and 18–30 years (20%). Males (56.67%) were more affected than females (43.33%). Comorbidities were present in 50% of the patients, with diabetes mellitus (35%) being the most common, followed by immunosuppression (15%). The duration of symptoms varied, with most patients (45%) experiencing symptoms for 1–6 months, while 31.67% reported symptoms for <1 month, and 23.33% had symptoms lasting >6 months. This highlights that fungal sinus diseases predominantly affect middle-aged individuals, particularly those with diabetes or immunosuppression, and present with varying symptom durations.

Table 2: Prevalence of Fungal Diseases in Study Population

Among the fungal diseases observed, allergic fungal rhinosinusitis was the most prevalent, affecting 53.33% of patients. Chronic invasive fungal sinusitis was the next most common (23.33%), followed by acute invasive fungal sinusitis (13.33%) and fungal ball (10%). These findings emphasize the dominance of allergic fungal rhinosinusitis as the leading subtype, likely reflecting its chronic nature and relatively higher incidence compared to other types of fungal sinus diseases.

Table 3: Radiological Findings

Radiological evaluations revealed significant findings critical for diagnosing and staging fungal sinus disease. Maxillary sinus involvement was most frequent (65%), followed by sphenoid sinus involvement (26.67%). Bony erosion was seen in 38.33% of cases, reflecting advanced disease, while

orbital involvement and intracranial extension were present in 20% and 10% of patients, respectively. Sinonasal polyps were observed in 25% of patients. These results highlight the role of radiological assessments, particularly HRCT, in detecting disease extent and complications, such as bony destruction or intracranial spread.

Table 4: Treatment Modalities and Outcomes

Treatment strategies varied depending on the disease severity and type of fungal sinus disease. Surgical management was the primary approach for most patients, with functional endoscopic sinus surgery (FESS) performed in 76.67% of cases. Orbital debridement was necessary for 6.67% of patients. Medical therapy with antifungal agents was used in 70% of cases, with amphotericin B (30%) being the most commonly administered drug, followed by voriconazole (23.33%) and itraconazole (16.67%). Combined therapy was also implemented in 30% of cases. Clinical outcomes were positive in the majority of patients, with 81.67% achieving complete symptom resolution. Partial symptom resolution occurred in 15%, while recurrence was minimal at 3.33%, underscoring the efficacy of combined medical and surgical interventions.

Table 5: Complications Observed During Treatment

Complications were observed in a subset of patients during treatment. Orbital complications (11.67%) and intracranial complications (6.67%) were the most significant, highlighting the potential severity of fungal sinus diseases. Antifungal toxicity was noted in 8.33% of patients, reflecting the challenges of prolonged antifungal therapy. Postoperative bleeding occurred in 5% of cases. However, the majority of patients (68.33%) experienced no complications, emphasizing the safety and effectiveness of current treatment protocols when appropriately managed.

Table 1: Demographic and Clinical Characteristics of Patients (n=120)

Variable	Frequency (n)	Percentage (%)
Age Group (years)		
18–30	24	20.00
31–50	56	46.67
>50	40	33.33
Gender		
Male	68	56.67
Female	52	43.33
Comorbidities		
Diabetes Mellitus	42	35.00
Immunosuppression	18	15.00
None	60	50.00
Duration of Symptoms		
<1 month	38	31.67
1–6 months	54	45.00
>6 months	28	23.33

Table 2: Prevalence of Fungal Diseases in Study Population (n=120)

Type of Fungal Disease	Frequency (n)	Percentage (%)
Allergic Fungal Rhinosinusitis	64	53.33
Chronic Invasive Fungal Sinusitis	28	23.33
Acute Invasive Fungal Sinusitis	16	13.33
Fungal Ball	12	10.00

Table 3: Radiological Findings (n=120)

Radiological Feature	Frequency (n)	Percentage (%)
Bony Erosion	46	38.33
Orbital Involvement	24	20.00
Intracranial Extension	12	10.00
Sinonasal Polyps	30	25.00
Maxillary Sinus Involvement	78	65.00
Sphenoid Sinus Involvement	32	26.67

Table 4: Treatment Modalities and Outcomes (n=120)

Treatment Modality	Frequency (n)	Percentage (%)
Surgical Management		
Functional Endoscopic Sinus Surgery	92	76.67

Orbital Debridement	8	6.67
Medical Management		
Amphotericin B	36	30.00
Voriconazole	28	23.33
Itraconazole	20	16.67
Combined Therapy	36	30.00
Clinical Outcome		
Complete Symptom Resolution	98	81.67
Partial Symptom Resolution	18	15.00
Recurrence	4	3.33

Table 5: Complications Observed During Treatment (n=120)

Complication	Frequency (n)	Percentage (%)
Orbital Complications	14	11.67
Intracranial Complications	8	6.67
Antifungal Toxicity	10	8.33
Postoperative Bleeding	6	5.00
None	82	68.33

DISCUSSION

The predominance of middle-aged patients (31–50 years, 46.67%) and the higher proportion of males (56.67%) in our study aligns with the findings of Chakrabarti et al. (2011), who reported a similar age and gender distribution in fungal sinus infections.[7] The high prevalence of diabetes mellitus (35%) among patients as a significant comorbidity is consistent with their study, emphasizing that diabetes is a critical risk factor for fungal sinus disease due to impaired immune responses. The variation in symptom duration underscores the chronic nature of some fungal diseases, particularly in diabetic and immunosuppressed individuals.

Allergic fungal rhinosinusitis (AFRS) was the most prevalent form of fungal disease in our study, affecting 53.33% of patients. This finding is comparable to the study by Panda et al. (2013), which highlighted AFRS as the dominant subtype in tropical and subtropical regions.[8] The chronicity and higher recurrence rates associated with AFRS make it a leading cause of sinonasal morbidity. The relatively lower prevalence of invasive fungal sinusitis (acute and chronic forms) in our study may reflect the advances in diagnostic techniques and early treatment, which help prevent disease progression.

Maxillary sinus involvement (65%) and bony erosion (38.33%) were the most notable radiological findings in our study. Similar results were observed in the study by Hamilos et al. (2012), which emphasized that HRCT is the gold standard for identifying bone erosion and extent of fungal disease.[9] The involvement of multiple sinuses, including the sphenoid (26.67%), reflects the aggressive nature of fungal infections. Orbital and intracranial involvement, though less common, underscore the potential for severe complications if the disease is not promptly managed.

The widespread use of surgical interventions such as FESS (76.67%) and medical therapies like amphotericin B (30%) in our study aligns with the findings of Montone et al. (2013).[10] Their study highlighted the importance of surgical debridement in clearing fungal debris and restoring normal sinus drainage. The combined use of medical and surgical interventions in our study achieved a high complete symptom resolution rate (81.67%), consistent with their outcomes. Recurrence rates (3.33%) were minimal, reflecting the effectiveness of multidisciplinary management in controlling fungal sinus disease.

The observed complications, including orbital (11.67%) and intracranial (6.67%) involvement, are consistent with findings by Sacks et al. (2014), who reported similar rates of severe complications in invasive fungal sinusitis cases.[11] Antifungal toxicity (8.33%) was also reported in their study, emphasizing the challenges associated with prolonged antifungal therapy. However, the majority of our patients (68.33%) experienced no complications, underscoring the safety of current treatment protocols when timely interventions are implemented.

CONCLUSION

This study highlights the significant burden of fungal diseases of the nose and paranasal sinuses, emphasizing their potential to cause severe morbidity and mortality if not diagnosed and treated promptly. The findings underline the importance of early detection through clinical evaluation, imaging, and microbiological confirmation. Timely and appropriate medical and surgical interventions, particularly in invasive cases, are critical for favorable outcomes. Allergic fungal rhinosinusitis was identified as the most common subtype, with diabetes and immunosuppression as major predisposing factors. Public health efforts to improve awareness and access to healthcare, alongside multidisciplinary care, are essential to mitigate the impact of these conditions.

Continued research is necessary to address emerging challenges and enhance treatment protocols.

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