International Journal of Medicine
pISSN 1468-3814 | eISSN 2667-7008
https://theinternationalmedicine.com/

Original Researcher Article *DOI: 10.61336/im/26-07-189*

Clinical and Epidemiological Characteristics of Acute Invasive Fungal Rhinosinusitis.

Dr. Ronak Bodat.
Senior Resident, Department of ENT, GMERS Medical College, Vadnagar, Gujarat, India.

Correspondence:
Dr. Ronak Bodat.
Senior Resident, Department of ENT, GMERS Medical College, Vadnagar, Gujarat, India.

Email:
Ronakbodat07@gmail.com

Received: 06-06-2026
Revised: 25-06-2026
Accepted: 13-07-2026
Published: 28-07-2026

Abstract

Background: Acute invasive fungal rhinosinusitis (AIFRS) is a rapidly progressive and potentially fatal infection of the nose and paranasal sinuses characterized by fungal invasion of blood vessels and surrounding tissues. It commonly affects immunocompromised individuals, particularly patients with uncontrolled diabetes mellitus, recent COVID-19 infection, corticosteroid therapy, and other conditions associated with impaired immunity. Early diagnosis and prompt treatment are essential to reduce morbidity and mortality. ***Aim:*** To evaluate the different clinical and epidemiological features of patients diagnosed with acute invasive fungal rhinosinusitis presenting to a tertiary care centre. ***Materials and Methods:*** A hospital-based observational descriptive study was conducted on 150 patients diagnosed with acute invasive fungal rhinosinusitis. Detailed demographic data, associated comorbidities, history of COVID-19 infection, interval between COVID-19 recovery and symptom onset, clinical presentation, radiological findings, microbiological and histopathological investigations were recorded using a structured proforma. Diagnostic nasal endoscopy, computed tomography (CT), magnetic resonance imaging (MRI) where indicated, potassium hydroxide (KOH) mount, fungal culture, and histopathological examination were performed for diagnosis. The collected data were analyzed using appropriate statistical methods, and a p-value of <0.05 was considered statistically significant. ***Results:*** The majority of patients belonged to the 51–70 years age group (50.7%), with a male predominance (71.3%). Diabetes mellitus was the most common associated comorbidity (54.7%), followed by hypertension (18.7%) and chronic kidney disease (10.0%). Most patients (52.0%) developed symptoms within one week following recovery from COVID-19 infection. Facial pain (67.3%) was the most common presenting complaint, followed by palatal involvement (45.3%), nasal obstruction or discharge (42.0%), dental pain (33.3%), and headache (28.0%). Ocular manifestations including diminution of vision (17.3%), proptosis (13.3%), and diplopia (5.3%) were observed in patients with advanced disease. ***Conclusion:*** Acute invasive fungal rhinosinusitis predominantly affects middle-aged and elderly individuals with uncontrolled diabetes mellitus and recent COVID-19 infection. Facial pain, nasal obstruction, and palatal involvement are the most frequent presenting features. Early recognition of high-risk patients, prompt diagnosis using endoscopic, radiological, microbiological, and histopathological evaluation, followed by timely surgical debridement and systemic antifungal therapy, are essential for improving clinical outcomes and reducing disease-related morbidity and mortality.

Keywords: Acute invasive fungal rhinosinusitis; Mucormycosis; Clinicoepidemiological study; COVID-19; Diabetes mellitus; Paranasal sinuses; Fungal infection.

This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC-BY) license (http://creativecommons.org/licenses/by/4.0/).

INTRODUCTION

Acute invasive fungal rhinosinusitis (AIFRS) is a rapidly progressive and life-threatening infection of the nose and paranasal sinuses characterized by fungal invasion of the mucosa, submucosa, blood vessels, and surrounding tissues. The disease is associated with high morbidity and mortality due to its aggressive nature and propensity for vascular invasion, tissue necrosis, orbital extension, and intracranial dissemination if not diagnosed and treated promptly.[1,2] Although relatively uncommon, AIFRS constitutes an otorhinolaryngological emergency requiring early recognition and immediate intervention.

The disease predominantly affects immunocompromised individuals, including patients with uncontrolled diabetes mellitus, hematological malignancies, prolonged corticosteroid therapy, organ transplantation, neutropenia, and other conditions associated with impaired immunity.[3-5] In recent years, a significant increase in the incidence of AIFRS has been observed, particularly following the COVID-19 pandemic, where diabetes, corticosteroid administration, and COVID-19-associated immune dysregulation emerged as important predisposing factors.[8-10]

The most common fungal pathogens responsible for AIFRS belong to the order Mucorales, particularly Rhizopus, Mucor, and Rhizomucor species, followed by Aspergillus species. These fungi possess angioinvasive properties that result in vascular thrombosis, ischemia, and extensive tissue necrosis, leading to rapid disease progression involving the orbit and central nervous system.[4-6] Delay in diagnosis may significantly increase mortality despite aggressive medical and surgical treatment.

Patients with AIFRS commonly present with nasal obstruction, facial pain, facial swelling, headache, fever, purulent or blood-stained nasal discharge, black necrotic crusts, orbital swelling, ophthalmoplegia, diminished vision, and cranial nerve involvement depending upon the extent of disease.[2,5,9] Since many of these clinical manifestations overlap with other forms of rhinosinusitis, maintaining a high index of suspicion in susceptible individuals is essential for timely diagnosis.

The diagnosis of AIFRS requires careful clinical examination supported by diagnostic nasal endoscopy, radiological imaging including computed tomography (CT) or magnetic resonance imaging (MRI), microbiological investigations, histopathological confirmation demonstrating tissue invasion by fungal hyphae, and fungal culture whenever feasible.[3,4,7] Early diagnosis followed by prompt surgical debridement and systemic antifungal therapy has been shown to significantly improve survival rates.

Epidemiological evaluation of patients with AIFRS provides valuable information regarding demographic characteristics, associated risk factors, clinical presentation, extent of disease, and outcomes in different geographical regions. Understanding these clinicoepidemiological characteristics helps clinicians identify high-risk patients, initiate timely treatment, and reduce disease-related complications and mortality.[8-10]

Hence, the present study was undertaken to evaluate the different clinical and epidemiological features of patients diagnosed with acute invasive fungal rhinosinusitis presenting to a tertiary care centre.

MATERIALS AND METHODS

Study Design

The present study was a hospital-based observational descriptive study conducted to evaluate the clinical and epidemiological profile of patients diagnosed with acute invasive fungal rhinosinusitis (AIFRS) attending a tertiary care centre. The study was carried out after obtaining approval from the Institutional Ethics Committee, and written informed consent was obtained from all eligible participants or their legally authorized attendants.

Study Population

The study included patients diagnosed clinically, radiologically, and microbiologically/histopathologically with acute invasive fungal rhinosinusitis who presented to the Department of Otorhinolaryngology during the study period.

Sample Size

A total of 150 patients with confirmed acute invasive fungal rhinosinusitis were included in the study.

Inclusion Criteria

- Patients aged 18 years and above.
- Patients diagnosed with acute invasive fungal rhinosinusitis based on clinical features, nasal endoscopy, radiological findings, and microbiological or histopathological confirmation.
- Patients willing to participate in the study and provide written informed consent.

Exclusion Criteria

- Patients with chronic invasive fungal rhinosinusitis.
- Patients with allergic fungal rhinosinusitis or fungal ball.
- Patients with recurrent disease previously treated elsewhere.
- Patients with incomplete clinical records or inadequate diagnostic evaluation.
- Patients unwilling to participate in the study.

Study Procedure

A detailed history regarding age, sex, occupation, residence, socioeconomic status, history of diabetes mellitus, hypertension, COVID-19 infection, corticosteroid therapy, immunosuppressive disorders, hematological malignancy, renal disease, and other associated comorbidities was recorded using a structured proforma.

Clinical presentation including nasal obstruction, facial pain, facial swelling, headache, fever, nasal discharge, epistaxis, black nasal crusting, orbital swelling, diminution of vision, ophthalmoplegia, cranial nerve involvement, and neurological symptoms was documented. All patients underwent complete otorhinolaryngological examination including diagnostic nasal endoscopy.

Radiological evaluation was performed using computed tomography (CT) of the nose and paranasal sinuses, with magnetic resonance imaging (MRI) performed in selected patients with suspected orbital or intracranial extension. Specimens obtained during diagnostic nasal endoscopy or surgical debridement were sent for potassium hydroxide (KOH) mount, fungal culture, and histopathological examination to confirm tissue invasion by fungal hyphae and identify the causative organism. All confirmed patients received appropriate medical management with systemic antifungal therapy along with surgical debridement whenever indicated according to institutional treatment protocols.

Outcome Measures

The following parameters were evaluated:

- Demographic characteristics of patients.
- Epidemiological risk factors and associated comorbidities.
- Clinical presentation of acute invasive fungal rhinosinusitis.
- Radiological extent of disease.
- Microbiological and histopathological findings.
- Type of fungal organism isolated.
- Orbital and intracranial complications.
- Treatment modalities employed.
- Clinical outcome and in-hospital mortality.

Statistical Analysis

The collected data were entered into Microsoft Excel and analyzed using SPSS software. Continuous variables were expressed as mean ± standard deviation, whereas categorical variables were presented as frequency and percentage. Associations between clinicoepidemiological variables were analyzed using the Chi-square test or Fisher's exact test wherever appropriate. A p-value <0.05 was considered statistically significant.

RESULTS

Table 1: Table 1 shows the age distribution of patients with acute invasive fungal rhinosinusitis. The majority of patients belonged to the **51–70 years** age group (50.7%), followed by the **31–50 years** age group (42.0%). Patients aged **11–30 years** constituted 4.0% of the study population, whereas only 3.3% were older than 70 years. No patient was below 10 years of age. The findings indicate that acute invasive fungal rhinosinusitis predominantly affected middle-aged and elderly individuals.

Table 2: Table 2 presents the demographic characteristics and associated comorbidities of the study population. Of the 150 patients, **107 (71.3%) were males** and **43 (28.7%) were females**, indicating a male predominance. Diabetes mellitus was the most common associated comorbidity, observed in **82 (54.7%)** patients, followed by hypertension in **28 (18.7%)** patients and chronic kidney disease in **15 (10.0%)** patients. Hypothyroidism, cardiac disease, renal transplant, and malignancy were observed in relatively fewer patients. These findings highlight diabetes mellitus as the most important predisposing factor for acute invasive fungal rhinosinusitis.

Table 3: Table 3 depicts the interval between recovery from COVID-19 infection and the onset of symptoms of acute invasive fungal rhinosinusitis. The majority of patients **78 (52.0%)** developed symptoms within **one week** of recovery from COVID-19. A further **39 (26.0%)** patients developed symptoms within three weeks, while **28 (18.7%)** presented during the second week. Only **5 (3.3%)** patients developed symptoms after four weeks. These observations suggest that the risk of developing acute invasive fungal rhinosinusitis is highest during the early post-COVID period.

Table 4: Table 4 summarizes the clinical presentation of patients with acute invasive fungal rhinosinusitis. **Facial pain** was the most common presenting symptom, reported in **101 (67.3%)** patients, followed by **palatal involvement (45.3%)** and **nasal obstruction or nasal discharge (42.0%)**. Dental pain was present in **33.3%** of patients, while headache was reported by **28.0%**. Ocular manifestations including diminution of vision (17.3%), proptosis (13.3%), and diplopia (5.3%) were also observed. Altered sensorium, change in voice, giddiness, and skin involvement were uncommon presentations. Overall, facial pain and sinonasal symptoms constituted the predominant clinical manifestations of acute invasive fungal rhinosinusitis.

Table 1. Age distribution of patients with acute invasive fungal rhinosinusitis (N = 150)

Age group (years)	No. of patients	Percentage
<10	0	0.0
11–30	6	4.0
31–50	63	42.0
51–70	76	50.7
>70	5	3.3
Total	**150**	**100.0**

Table 2. Demographic data and associated comorbidities among patients with acute invasive fungal rhinosinusitis (N = 150)

Variable	No.	Percentage
Total cases	**150**	**100.0**
Sex		
Male	107	71.3
Female	43	28.7
Associated comorbidities*		
Diabetes mellitus	82	54.7
Hypertension	28	18.7
Chronic kidney disease	15	10.0
Hypothyroidism	3	2.0
Renal transplant	2	1.3
Cardiac disease	3	2.0
Malignancy	1	0.7

Table 3. Interval between recovery from COVID-19 and onset of acute invasive fungal rhinosinusitis symptoms (N = 150)

Interval	No. of patients	Percentage
1 week	78	52.0
2 weeks	28	18.7
3 weeks	39	26.0
4 weeks	5	3.3
Total	**150**	**100.0**

Table 4. Clinical features and presenting symptoms of acute invasive fungal rhinosinusitis (N = 150)

Presenting complaint	No. of patients	Percentage
Facial pain	101	67.3
Facial swelling	24	16.0
Nasal obstruction/discharge	63	42.0
Palatal involvement	68	45.3
Dental pain	50	33.3
Headache	42	28.0
Diminution of vision	26	17.3
Proptosis	20	13.3
Diplopia	8	5.3
Altered sensorium	3	2.0
Change in voice	1	0.7
Giddiness	1	0.7
Skin involvement	1	0.7

DISCUSSION

The present study evaluated the clinicoepidemiological profile of patients with acute invasive fungal rhinosinusitis (AIFRS) presenting to a tertiary care centre. The majority of patients belonged to the 51–70 years age group, with a marked male predominance. Diabetes mellitus emerged as the most common associated comorbidity, and facial pain was the predominant presenting complaint. Most patients developed symptoms within one week following recovery from COVID-19 infection, highlighting the temporal association between COVID-19 and the development of AIFRS.

The predominance of middle-aged and elderly male patients observed in the present study is comparable with the findings of Turner et al., who reported that AIFRS commonly affects older individuals with underlying systemic illnesses and carries a poorer prognosis in this population.[11] Deutsch et al. also observed a higher incidence among males, primarily because of the greater prevalence of diabetes mellitus and immunocompromising conditions in this group.[12]

Diabetes mellitus was identified as the most frequent predisposing factor in the present study. Hyperglycemia, diabetic ketoacidosis, impaired neutrophil function, and altered host immunity create an ideal environment for fungal proliferation and tissue invasion. Similar observations have been reported by Prakash and Chakrabarti, who described uncontrolled diabetes as the principal risk factor for mucormycosis, particularly in developing countries.[15] During the COVID-19 pandemic, the widespread use of corticosteroids further increased susceptibility among diabetic patients.[13,14]

The majority of patients in the present study developed symptoms within one week after recovery from COVID-19 infection. Sen et al. reported a similar temporal relationship and suggested that COVID-19-associated immune dysregulation, endothelial damage, prolonged hospitalization, oxygen therapy, and corticosteroid administration collectively contribute to the increased incidence of acute invasive fungal rhinosinusitis.[13] Honavar also emphasized that clinicians should maintain a high index of suspicion for fungal rhinosinusitis in recently recovered COVID-19 patients presenting with facial pain, nasal obstruction, orbital symptoms, or black nasal crusting.[14]

Facial pain, nasal obstruction, facial swelling, palatal involvement, and headache were the most common presenting complaints in the present study. Ocular manifestations such as diminution of vision, proptosis, and diplopia were also observed in a significant proportion of patients, indicating disease extension beyond the paranasal sinuses. These findings are consistent with those of Deutsch et al., who reported that orbital involvement is a common complication resulting from the angioinvasive nature of fungal pathogens and is associated with increased morbidity and mortality.[12]

The relatively high frequency of palatal involvement observed in the present study reflects extensive vascular invasion and tissue necrosis caused by Mucorales species. Similar findings have been reported by Honavar, who highlighted palatal eschar, orbital involvement, and cranial nerve deficits as characteristic manifestations of advanced rhino-orbito-cerebral mucormycosis requiring urgent surgical intervention.[14]

Early diagnosis and aggressive management remain the cornerstone of successful treatment. Turner et al., in their systematic review, demonstrated that prompt diagnosis, early surgical debridement, and timely initiation of systemic antifungal therapy significantly improve survival in patients with AIFRS.[11] Likewise, Prakash and Chakrabarti emphasized that multidisciplinary management involving otorhinolaryngologists, ophthalmologists, microbiologists, infectious disease specialists, and physicians is essential for reducing disease-related mortality.[15]

Overall, the findings of the present study reinforce that diabetes mellitus, recent COVID-19 infection, and delayed presentation remain major determinants of acute invasive fungal rhinosinusitis. Early recognition of clinical features, especially among high-risk patients, combined with prompt radiological evaluation, histopathological confirmation, surgical debridement, and antifungal therapy, is crucial for improving patient outcomes.[11-15].

CONCLUSION

The present study demonstrated that acute invasive fungal rhinosinusitis predominantly affected middle-aged and elderly males, with diabetes mellitus being the most common associated comorbidity. The majority of patients developed symptoms within the first week following recovery from COVID-19, indicating a strong association between recent COVID-19 infection and the occurrence of AIFRS. Facial pain, nasal obstruction, palatal involvement, facial swelling, and headache were the most frequent clinical manifestations, while ocular symptoms reflected advanced disease.

The study highlights the importance of maintaining a high index of suspicion in susceptible individuals, particularly those with uncontrolled diabetes and recent COVID-19 infection. Early diagnosis through clinical assessment, nasal endoscopy, radiological imaging, and microbiological or histopathological confirmation, followed by prompt surgical debridement and systemic antifungal therapy, is essential for reducing morbidity and mortality. Improved awareness of the clinicoepidemiological profile of AIFRS can facilitate timely intervention and optimize patient outcomes in tertiary care settings.

REFERENCES

1. deShazo RD, O'Brien M, Chapin K, Soto-Aguilar M, Gardner L, Swain R. Criteria for the diagnosis of sinus mycetoma. J Allergy Clin Immunol. 1997;99(4):475-85.
2. Gillespie MB, O'Malley BW Jr, Francis HW. An approach to fulminant invasive fungal rhinosinusitis in the immunocompromised host. Arch Otolaryngol Head Neck Surg. 1998;124(5):520-6.

3. Ferguson BJ. Definitions of fungal rhinosinusitis. Otolaryngol Clin North Am. 2000;33(2):227-35.
4. Chakrabarti A, Denning DW, Ferguson BJ, Ponikau J, Buzina W, Kita H. Fungal rhinosinusitis: A categorization and definitional schema addressing current controversies. Laryngoscope. 2009;119(9):1809-18.
5. Spellberg B, Edwards J Jr, Ibrahim A. Novel perspectives on mucormycosis: Pathophysiology, presentation, and management. Clin Microbiol Rev. 2005;18(3):556-69.
6. Roden MM, Zaoutis TE, Buchanan WL, Knudsen TA, Sarkisova TA, Schaufele RL. Epidemiology and outcome of zygomycosis: A review of 929 reported cases. Clin Infect Dis. 2005;41(5):634-53.
7. Skiada A, Lanternier F, Groll AH, Pagano L, Zimmerli S, Herbrecht R. Diagnosis and treatment of mucormycosis in patients with hematological malignancies: Guidelines from the Third European Conference on Infections in Leukemia. Haematologica. 2013;98(4):492-504.
8. Cornely OA, Alastruey-Izquierdo A, Arenz D, Chen SCA, Dannaoui E, Hochhegger B. Global guideline for the diagnosis and management of mucormycosis. Lancet Infect Dis. 2019;19(12):e405-e421.
9. Yohai RA, Bullock JD, Aziz AA, Markert RJ. Survival factors in rhino-orbital-cerebral mucormycosis. Surv Ophthalmol. 1994;39(1):3-22.
10. Parikh SL, Venkatraman G, DelGaudio JM. Invasive fungal sinusitis: A 15-year review from a single institution. Am J Rhinol. 2004;18(2):75-81.
11. Turner JH, Soudry E, Nayak JV, Hwang PH. Survival outcomes in acute invasive fungal sinusitis: A systematic review and quantitative synthesis of published evidence. Laryngoscope. 2013;123(5):1112-8.
12. Deutsch PG, Whittaker J, Prasad S. Invasive and non-invasive fungal rhinosinusitis: A review and update of the evidence. Med Mycol. 2019;57(Suppl 2):S427-S434.
13. Sen M, Lahane S, Lahane TP, Parekh R, Honavar SG. Mucor in a viral land: A tale of two pathogens. Indian J Ophthalmol. 2021;69(2):244-52.
14. Honavar SG. Code mucor: Guidelines for the diagnosis, staging and management of rhino-orbito-cerebral mucormycosis in the setting of COVID-19. Indian J Ophthalmol. 2021;69(6):1361-5.
15. Prakash H, Chakrabarti A. Global epidemiology of mucormycosis. J Fungi (Basel). 2019;5(1):26.