

Acute Invasive Fungal Sinusitis during COVID Era: A Retrospective Study

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Abstract

Introduction: Invasive fungal rhinosinusitis is a disease of the nose and the paranasal sinuses that typically affect immunocompromised patients in the acute fulminant form.

Purpose: The purpose of the study was to study the incidence of acute invasive fungal sinusitis at our institution during COVID era, to study the various clinical manifestations of acute invasive fungal sinusitis, and to study the outcomes of various surgical procedures done in the management of acute invasive fungal sinusitis.

Study Design: This was a retrospective study.

Methods: All the data collected from case records of the patients who were admitted and diagnosed as acute invasive fungal sinusitis were included in this study, regardless of previous COVID RT-PCR status. FESS, FESS with orbital decompression, medial maxillectomy, and modified Denker's operation were done to clear the disease. Specimens were sent for KOH mount, fungal culture and sensitivity, and histopathological examination. Antifungal therapy included parenteral liposomal amphotericin-B and oral posaconazole. Follow-up was done regularly for 3 months.

Results: A total of 46 patients were included in this study. Among them, 44 were diabetic and 23 had previous history of RT-PCR positive. Mycological analysis revealed *Mucor* in 19, *Rhizopus* in 11, and *Aspergillus* species in three patients. Sinonasal, orbital, cerebral, and palatine involvements were found in 38, 22, 9, and 6 patients, respectively. The most common reported symptoms were headache (38), facial pain (36), facial numbness (28), ophthalmoplegia, and visual loss (22). Surgical management included were FESS in 22, FESS with orbital decompression in five, medial maxillectomy in two, and modified Denker's operation in two patients. Recurrence was found in seven patients.

Conclusion: Clinical suspicion of acute invasive fungal sinusitis among COVID-19 patients and early management with antifungal therapy and surgical debridement is essential for better outcomes and higher survival.

Key words: COVID-19, Diabetes mellitus, Immuno compromised, Invasive fungal sinusitis, Mucormycosis

INTRODUCTION

Fungal sinusitis can be categorized into non-invasive fungal sinusitis and invasive fungal sinusitis. Non-invasive fungal sinusitis does not exhibit the penetration of mucosa by

hyphae; whereas, in invasive fungal sinusitis, hyphae do invade the mucosa. This opportunistic fungal infection causes angioinvasion and ischemic tissue necrosis. Hence, acute invasive fungal rhinosinusitis is considered the most aggressive form of sinusitis and can be life threatening, if left undiagnosed and untreated. It can be more commonly found in immunocompromised patients.^[1] Expansion into the sinus or intracranial compartments can lead to neurological impairments.

Fungal spores are copious in the atmosphere. Therefore, it is ready to cause morbidity in the nose and paranasal sinuses.^[2] These spores can lead to a pathological affection if the

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environment is suitable for their growth and active invasion of tissues. Normally, inhaled fungi form a part of the normal sino nasal flora, but they are significantly destroyed by the immunological system. However, in conditions such as prolonged antibiotics use, poor ventilation and moist environment, as well as immunocompromised patients, these immunological pathways may be disrupted, making fungal invasion more likely to make morbid infection of tissues. COVID-19, caused by severe acute respiratory syndrome coronavirus 2, is a primary acute respiratory disease which can lead to severe acute respiratory distress syndrome, multiple organ dysfunction, and even death.^[3] Therefore, identifying the risk factors and early diagnosis is critical for effective management and to develop prevention strategies.

Particular pathophysiologic features of COVID-19 that may allow secondary fungal disease, a propensity to cause respiratory infection, may upgrade the risk of invasive fungal rhinosinusitis. Moreover, the immune dysregulation associated with COVID-19, with reduced numbers of T lymphocytes, CD4+ and CD8+ T cells, may alter innate immunity.^[4] The treatment for invasive fungal rhinosinusitis consists of reversing the underlying immunosuppression, aggressive surgical debridement, and treatment with antifungals including amphotericin B and posaconazole.^[5]

Histopathological Evidence of hyphal invasion within sinus mucosa, submucosa, Blood vessels or bone and Radiologically confirmed sinusitis are the important criteria for diagnosing invasive fungal sinusitis.^[6]

Head-and-neck surgeons should be aware of the increasing prevalence of craniofacial mucormycosis as early diagnosis and prompt treatment are essential to improve the outcomes in terms of survival of the patient.^[7]

Even though Survival has improved dramatically, Mortality occur if the infection is not diagnosed and treated early. The prognosis is worse if the source of immunocompromise is not reversible.^[8]

MATERIALS AND METHODS

All the data collected from the case records of the patients, who were admitted and diagnosed as acute invasive fungal sinusitis were included in this study, irrespective of the age, COVID-19 status, previous history of COVID-19, and underlying comorbidities. All patients were appropriately managed with diagnostic nasal endoscopy and KOH mount and imaging studies. Surgical procedures such as FESS, FESS with orbital decompression, medial maxillectomy, or modified Denker's operation were done in relevant patients. Intraoperative specimen was sent for KOH mount, fungal

culture, and histopathological examination. Patients who were critically ill and not fit for surgical intervention were not taken up for surgery. All cases were treated with antifungals including parenteral liposomal amphotericin-B and oral posaconazole.

RESULTS

A total of 46 patients were included in the study. Among them, 44 were diabetic. Twenty-three patients had a previous history of COVID confirmed by positive RT-PCR. Mycological analysis revealed *Mucor* species in 19 patients, *Rhizopus* in 11 patients, and *Aspergillus* in three patients.

Sinonasal, orbital, cerebral, and palatine involvements were found in 38, 22, 9, and 6 patients, respectively. The most common reported symptoms were headache (38), facial pain (36), facial numbness (28), ophthalmoplegia, and visual loss (22). Surgical management included FESS in 22, FESS with orbital decompression in five, medial maxillectomy in two, and modified Denker's operation in two patients.

Recurrence was found in seven patients. Among them, three had a previous history of COVID with positive RT-PCR and four had no previous history of RT-PCR confirmed COVID.

DISCUSSION

The incidence of acute invasive fungal sinusitis^[8] among different age groups was analyzed [Figure 1]. It was found that there was one patient in the age group of 20–30 years without any comorbidities. In the age group of 30–40 years, one individual was affected. There were seven in the age group of 40–50 years, 12 in the age group of 50–60 years, 21 patients in the age group of 60–70 years, and four patients in the age group of 70–80 years. Hence, the most common age group affected is reported to be between 60 and 70 years of age followed by 50 and 60 years. It is

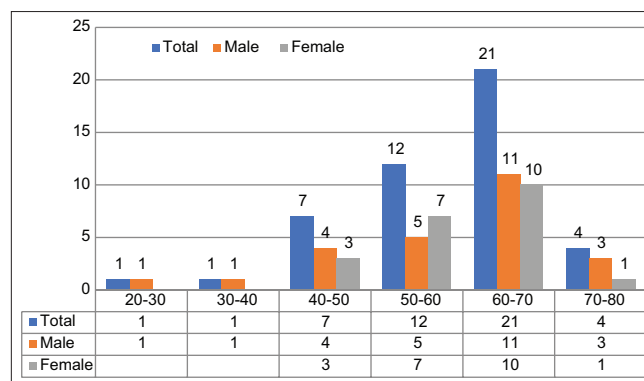


Figure 1: Distribution among age groups and sex

also found that a total of 25 males and 21 females were affected, indicating that the predilection of disease is slightly higher in males. Uncontrolled diabetes mellitus is the most commonly associated comorbid condition/high-risk factor, followed by systemic hypertension, prolonged oxygen therapy, coronary artery disease, chronic obstructive pulmonary disease, and chronic kidney disease [Figure 2]. Sinonasal region is found to be commonly followed by orbital, cerebral, and palatal involvement [Figure 3].

With relation to the sites of involvement by mucormycosis, rhinocerebral is the most common followed by pulmonary,

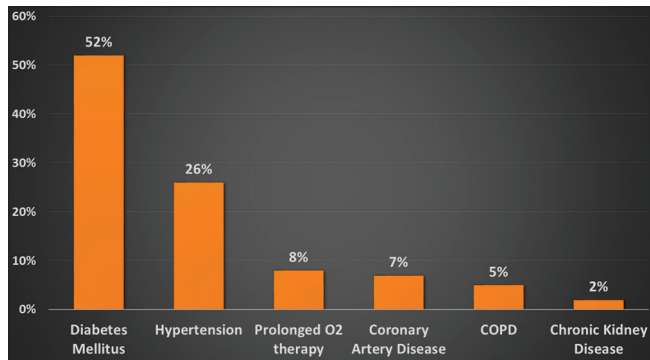


Figure 2: Comorbidities

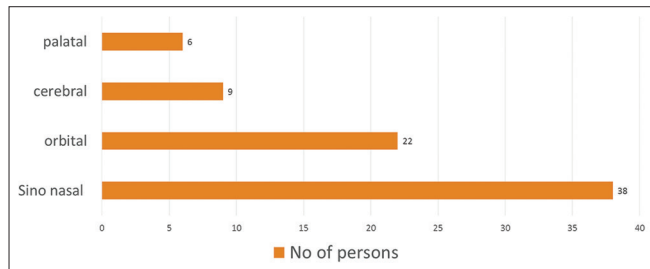


Figure 3: Sites involved

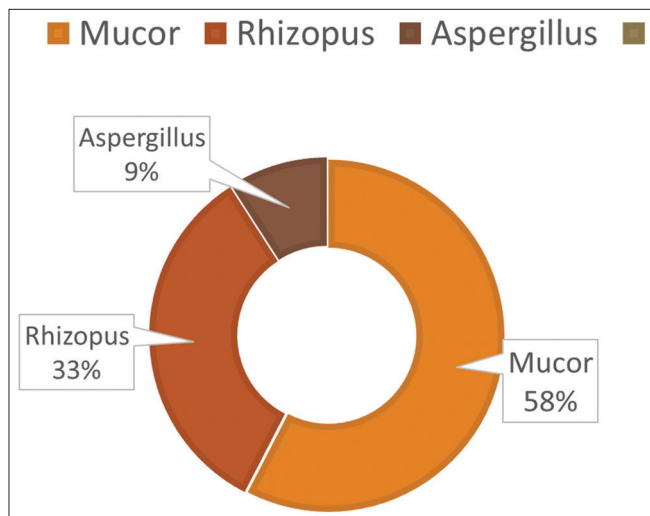


Figure 4: Mycological analysis

cutaneous, gastrointestinal, disseminated, and miscellaneous sites. Most of the patients were reported with symptoms suggestive of chronic rhinosinusitis [Figure 4], hence, care must be taken in eliciting the history and clinical examination for the prompt diagnosis and effective early intervention. *Mucor*, *Rhizopus*, and *Aspergillus* [Figure 5] being commonly encountered in the fungal culture and the histopathological examination indicating the angioinvasive and the tissue invasive properties of *Zygomycetes* species. Out of 46 patients, surgical intervention was done in 31 patients. Fifteen patients were not surgically intervened due to the patients' poor general condition. Out of

Table 1: Outcome of the patients who were surgically intervened and no surgical intervention

Outcome	Surgical intervention done	No surgical intervention done
Total number of patients	31	15
Fully cured	24	Nil
Death	Nil	11

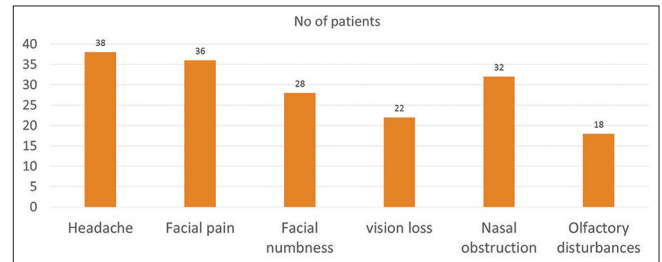


Figure 5: Clinical manifestations

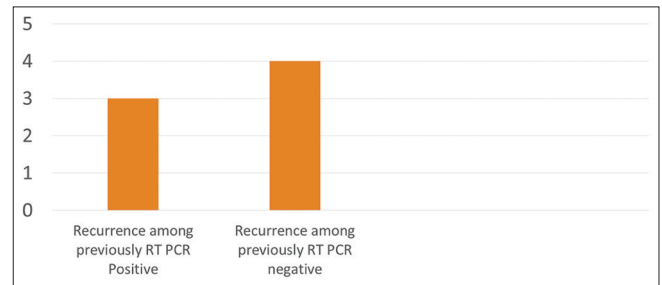


Figure 6: Recurrence

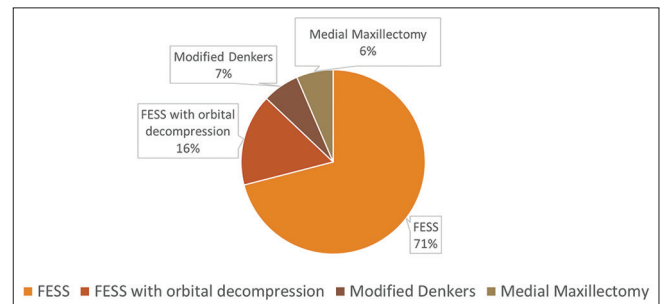


Figure 7: Surgical management

31 patients who have undergone surgeries, 24 patients were completely recovered and recurrence was found in seven patients [Figure 6] who were later presented/progressed with advanced disease and poor general condition due to associated comorbidities and severity of disease. Out of 15 patients who were not surgically intervened, 11 patients were died and four patients were lost to follow-up [Table 1].

The surgical Procedures include FESS in 22, FESS with orbital decompression in five, Medial Maxillectomy in two, and Modified Denker's operation in two patients [Figure 7].

Thus, early diagnosis and effective surgical and antifungal measures would result in better outcomes and survival. In this study, it was found that there was no significant correlation between the recurrence and the previous history of COVID status.

CONCLUSION

Clinical suspicion of acute invasive fungal sinusitis is necessary among COVID/non-COVID patients with uncontrolled diabetes mellitus or immunocompromised status.

Early management with antifungal therapy and surgical debridement is essential for better outcomes and higher survival.

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