

Rapid Rise in Mucormycosis - Possible Causes and Review

Shakthi K*

CardioNeuroSciences, Centre All India Institute of Medical Sciences, Ansari Nagar New Delhi, India

Introduction

Mucormycosis is a life-threatening fungal infection in immune compromised patients with diabetes, post-transplant, retroviral disease, and those who are on long-term immunosuppression for various chronic diseases. The fungi interact with the endothelial cells which cause vascular invasion leading to infarction and necrosis of the host tissue. The most common presentation of mucor is rhino-orbito-cerebral. The incidence of this fulminant disease has been increasing rapidly for the past couple of years in India, especially in patients post-COVID infection within several weeks after recovering from COVID. The rapid rise in cases especially in patients with COVID and those recovering from COVID raises many questions among the physicians and some of them are discussed in this article.

Epidemiology

Mucormycosis has been reported in all age groups, from months to 87 years of age. It is more commonly reported in men. The important risk factors are hematologic malignancies, diabetes mellitus, and treatment with glucocorticoids, hematogenic stem cell transplantation, solid organ transplantation, injection, burns, trauma, and malnutrition. The infective agent causing the rhinocerebral mucormycosis is fungi of the class Phycmycetes, order Mucorales, and the family Mucoraceae. These fungi include *Rhizopus*, *Mucor*, *Absidia*, *Cunninghamella*, genera, and *Apophysomyces elegans* [1].

Pathophysiology

Mucormycosis generally invades the host through the inhaled spores, which get deposited in the para nasal sinuses and lungs. The less common routes of entry being direct skin inoculation and ingestion. The fungal hyphae invade the blood vessels and grow which leads to ischemia and tissue necrosis. The ubiquitous nature of the organism explains the possibility of its presence in the decaying vegetation and the soil. They grow rapidly and release airborne spores [2]. *Rhizopus* organisms have an enzyme ketone reductase which helps to grow in an environment with high glucose and those that are acidic [3]. Healthy individuals do not have high glucose in their blood and the serum is not acidic, hence the fungus growth is inhibited.

Mucormycosis and COVID 19

There is a recent increase in the number of mucormycosis in India and the majorities are associated with COVID 19. There are various theories proposed for the rapid rise in the number of these cases. This is attributed to various following causes.

Uncontrolled Diabetes Mellitus: The cases are seen most commonly in patients with uncontrolled diabetes mellitus with most of the patients having HbA1C levels of almost double the normal.

Steroid use: Almost all the patients who have recovered from COVID would have received a course of steroids which predisposes them to any kind of infections, including fungal.

COVID induced micro thrombosis: COVID may lead to a hyper coagulable state which leads to the formation of micro thrombi leading to tissue death which predisposes to the fungal invasion.

High ferritin levels: The fungi grow in an environment that has high iron and ferritin levels.

Zinc use: Metals play an important role in fungal pathogenesis. Though our knowledge about the utilization of many metals is limited, iron and zinc are acquired by fungi during infections.

Antibiotic use: Antibiotics are thought to be a major risk factor for fungal infections. Use of antibiotics in COVID patients might predispose to invasive fungal infections

Steam inhalation: During the cover pandemic, a lot of people believed that regular steam inhalation will be protecting them from COVID infection and started using steam inhalation regularly.

Humidifiers used in oxygen: The humidifiers used in oxygen are not being well maintained and the hygiene theory may be predisposing to fungal growth.

But the major question which arises here is, though the above risk factors have been there from the beginning of COVID treatment in India, why has there been a sudden rise of cases in the past two months? Several questions need to be answered by further research.

- Is it the new strain of COVID that is altering the normal flora in the upper respiratory tract predisposing to fungal invasion?
- Or is it facilitating the fungus to grow by altering the receptors?
- Is COVID-related micro thrombi formation forming a base for fungal growth?
- Are the supplements like zinc during COVID to boost immunity facilitating the fungus to grow?
- Are the humidifiers used for oxygen the source of fungal growth in the initial period?
- The practice like excess steam inhalation by some patients during COVID is providing a moist environment for the fungal invasion?
- How are the children getting affected?
- There are several cases reported in the past 2-3 months in patients who never had COVID. Is there any other explanation for the recent increase in cases or did all these people have a subclinical infection and should they be tested for COVID antibodies?

***Corresponding author:** Shakthi K, CardioNeuroSciences, Centre All India Institute of Medical Sciences, Ansari Nagar New Delhi, India, E-mail: drshakthikjs@gmail.com

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Clinical features

Rhino Orbito Cerebral mucormycosis: The patients present with various manifestations such as fever, nasal congestion, rhinorrhoea, nasal ulceration or necrosis, sinusitis, headache, eyelid swelling, proptosis, diplopia, ophthalmoplegia, blurring of vision, vision loss, facial sensory disturbances, facial swelling, facial weakness. The mucormycosis can affect various other organs such as gastrointestinal tract, kidneys, skin, lungs and brain alone.

Diagnosis

The diagnosis is by the histopathology of the tissue and the culture which grows the fungi. Thenasal endoscopy should be done to look for the tissue necrosis and to collect the specimen.

Several radiologic manifestations in addition to clinical features should lead the physician to a high degree of suspicion and pursue invasive tests to confirm the diagnosis [4]. CT is preferred over MRI as it can be done quickly and is more sensitive to detect bony erosions. Some small scale studies promise the utility of PCR based technique in the diagnosis [5].

Treatment

Treatment is aimed at surgical debridement of the involved tissues and antifungal therapy. Aggressive surgical debridement should be done as soon as the diagnosis is confirmed as the removal of the necrotic tissues helps partially in preventing rapid spread. The drug of choice is amphotericin. Lipid formulation should be used to prevent nephrotoxicity. The dosage range is 5-10 mg/kg. Usually patients need to be treated for a duration of 3 weeks. However doses can be altered based on the clinical response of the patient. Isavuconazole and posaconazole have been used as step down therapy. The dose of isavuconazole is 200mg twice a day for 3 days followed by once a day [6]. The dose of posaconazole is 300mg twice a day on day one followed

by once a day. There is no evidence to support the benefit of using either of the two with amphotericin as combination therapy. Early initiation of antifungal therapy is recommended to prevent mortality.

Prognosis

Mucormycosis is associated with a high mortality rate if not diagnosed and treated early. Overall mortality with rhino orbito cerebral mucormycosis is 25-62%. With pulmonary and disseminated mucormycosis, the mortality rate is 87% and almost 100% respectively.

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Conflict of Interest:

Author declares no conflict of interest.

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