

Review on Mucormycosis/ Black Fungus

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Abstract:- This review article will provide an introduction to mucormycosis, a novel infection brought on by the pervasive filamentous fungus belonging to the Zygomycete class. Following candidiasis and aspergillosis, mucormycosis has emerged as the most common invasive mycosis in patients receiving haematological and allogeneic stem cell transplants. According to study, a black fungus infection can infect human organs and travel throughout the body via the bloodstream.

Keywords:- Mucormycosis, Black Fungus, Monoclonal Antibodies, Immune-Compromised.

I. INTRODUCTION

Mucormycosis, generally referred to as black fungus, is a dangerous fungal illness that most commonly affects immunosuppressed individuals and manifests as fulminant fungal sinusitis. In India, a rare parasitic disease called mucormycosis has emerged as a new scourge related to the Corona Virus Disease 2019 (COVID-19) pandemic. The assemblage of moulds known as mucoromycetes causes mucormycosis. The risk factors for mucormycosis include immune-compromised conditions like diabetes, long-term steroid use, and people on immunosuppressant medications. (1) The second wave of the COVID-19 pandemic has likewise welcomed the famous mucormycosis in the ongoing situation. India has declared mucormycosis as a notifiable illness in May 2021, as the quantity of COVID-19-related mucormycosis cases has expanded quickly. (1) In San Francisco, the prevalence of mucormycosis is typically low—less than 2 cases per million people each year—but it is currently 80 times more prominent in India. Premature newborns as well as people of any age may be affected. It's possible that the mucormycosis case Friedrich Küchenmeister wrote about in 1855 was the first recorded instance. Both the 2011 Missouri tornado and the 2004 tsunami in the Indian Ocean have been linked to the sickness. An link between mucormycosis and COVID-19 has been discovered during the COVID-19 epidemic. This connection may potentially be associated to COVID-19 glucocorticoid medication and is thought to be related to lowered immune function during the course of the illness. Particularly in India, there was an increase in cases. (2)

The moulds known as mucoromycetes cause the parasitic disease mucormycosis, also known as zygomycosis. The organisms survive in the soil, waste, decaying plants, and leaves throughout the climate. The creature is placements and evidence of the growth of the alleged "black growth" or

mucormycosis. It is suggested that the use of steroids, monoclonal antibodies, and postponed hospitalisation in the management of COVID-19 has significantly reduced resistance in COVID-19-affected individuals and may have served as a catalyst for the emergence of parasite contaminations. Another theory holds that the problem may be related to improper sanitization techniques, such as using non-sterile water to humidify oxygen. On the other hand, it is yet unknown if the COVID19 condition itself causes an immunocompromised and diabetic-like state. The discussion and identification of the most common risk factor for mucormycosis, examinations, and the board of mucormycosis generally spread so that people are regularly exposed to its spores, are the main foci of this survey. (3) The disease primarily influences the cerebrum, sinuses, and lungs. The brain, sinuses, and lungs are the main areas affected by the illness. Dispersed, rhino-cerebral, pneumonic and cutaneous, as well as renal mucormycosis, are among the several forms of mucormycosis. The weakest populations affected by contagious contaminations include those who use steroids, have diabetes, are immunocompromised, have haematological malignancies, or have undergone powerful organ transplants. It has recently been discovered that COVID-19 and mucormycosis are closely related. Early detection of the disease at the critical stage of consideration and monitoring glucose levels can help in the fight against mucormycosis. The ongoing debate about how to address the COVID-19 contamination is one of the risk factors for mucormycosis in COVID-19 patients. (4)

II. MUCORMYCOSIS

The third most typical invasive fungal infection is mucormycosis, which is followed by aspergillosis and candidiasis. It constitutes 8.3–13% of all fungi found at autopsies in people with haemophilia. The most often found taxa include Mucor, Rhizopus, Rhizomucor, Absidia, Apophysomyces, Cunninghamella, and Saksenaia. Mortierella wolfi and Syncephalastrum racemosum may pose a risk to humans. There are five main types of infection: cutaneous, gastrointestinal, disseminated, and rhino-orbito-cerebral. Mucorales can infect a human host by inhalation, ingestion, or percutaneous inoculation. Patients who have at least one of the following immunocompromising conditions are more likely to develop mucormycosis: haematological malignancies, neutropenia, high-dose corticosteroid use, diabetes mellitus, diabetic ketoacidosis, organ transplantation, deferoxamine medication, trauma, and burns. Patients with immune competence hardly ever get mucormycosis. (2,5) According to study, a black fungus

infection can infect human organs and travel throughout the body via the bloodstream.

➤ Mechanism of action

Most people regularly come into contact with Mucorales without getting sick. The most common ways that mucormycosis is transmitted are through inhalation, consumption of tainted food, and contact with mould spores of the Mucorales type through open wounds. It cannot be passed from person to person.

Uncertainty surrounds the precise method via which diabetics are predisposed. In-vivo, a high sugar level by itself does not allow the fungus to develop, but acidosis by itself does. High sugar intake is typically accompanied with elevated iron levels, which is known to increase the risk of getting mucormycosis. Siderophores on *Rhizopus* species collect the iron eliminated from persons using deferoxamine and use it to proliferate. (6)

➤ Pathogenesis of mucormycosis

The fungi's spores often disperse via the air and enter people through inhalation, inoculation in some areas, like skin lesions, and oral route in the gastrointestinal tract. Regardless of the point of entry, the progression of the fungus includes crucial steps such as spore inoculation, evading phagocytosis by neutrophils and macrophages, hyphae germination, growing in response to host conditions such as iron overloads and ketoacidosis, attaching to the endothelium using receptors, and damaging the endothelium via endocytosis, as demonstrated in Multi-organ dysfunction is a result of this disorder. (7)

➤ Types of mucormycosis-

- Cutaneous Mucormycosis (Skin)
 - Rhinocerebral Mucormycosis (Sinus & Brain)
 - Pulmonary Mucormycosis (Lung)
 - Gastro-intestinal Mucormycosis
 - Disseminated Mucormycosis
- **Pulmonary mucormycosis (lung)**- Patients with cancer, those who have had organ or stem cell transplants, and cancer patients are more likely to experience it.
 - **Rhino-cerebral mucormycosis (sinus and brain)**- The infection in the sinuses has the potential to travel to the brain. Patients with uncontrolled diabetes and those who have had kidney transplants are more likely to experience this.
 - **Gastro-intestinal mucormycosis**- It is common among young children especially low birth weight and premature infants age less than 1 month, who have had surgery or on medications that lower the body's ability to fight illness. (8)
 - **Cutaneous mucormycosis (skin)**- When fungus infiltrate the body through damaged skin, it causes a skin infection (due to surgery, severe burn or any type of skin injury). This is the most typical among those with healthy immune systems. (8)
 - **Disseminated mucormycosis**- Although the illness most frequently affects the brain, it can also damage other

bodily parts and organs like the heart, spleen, and skin as it spreads through the bloodstream. (8)

➤ Causes

After inhaling fungus spores from the environment, people get mucormycosis, which can lead to sinus, lungs, or brain infections. A skin infection is brought on by fungus, which enters via the damaged skin as a result of any kind of skin injury. Every day, the majority of us come into touch with minute fungus spores, making it nearly difficult to avoid mucormycetes. The majority of people are not typically harmed by these fungus. In contrast, mucormycetes fungus spores can induce an infection that can spread to other organs and sections of the body in persons with compromised immune systems. *Rhizomucor*, *Mucor*, *Rhizopus*, *Cunninghamella bertholletiae*, *Saksenaea*, *Syncephalastrum*, *Apophysomyces*, and *Absidia fungi* species commonly Cause the infection.

➤ Sign and symptoms

The location of the fungus in your body will affect the mucormycosis symptoms you experience. They may include:

- Fever
- Cough
- Chest pain
- Shortness of breath
- Swelling on one side of your face
- Headache
- Sinus congestion
- Black lesions on the bridge of your nose or the inside of your mouth
- Belly pain
- Nausea and vomiting
- Gastro-intestinal bleeding
- Blood in your stool
- Diarrhoea (10)

The region of your skin that is infected may appear enlarged or blister red. It could become dark, feel warm, or hurt. The infection can also travel through your blood to various bodily areas. These are referred to as diffuse mucormycosis. When this occurs, the fungus can harm your heart and spleen, among other organs. In extreme circumstances, you can have mental changes or fall into a coma. (8)

➤ Testing and Diagnosis

- A doctor may suggest laboratory and imaging tests to find signs of mucormycosis based on a patient's medical history, physical examination, symptoms, and infection sites.
- The tests listed below can aid in identifying a fungus infection. (11)
- A laboratory examination of a respiratory system fluid sample.
- Gathering tissue samples for biopsies.
- Imaging studies, such as a CT scan of your sinuses, lungs, or other body regions, depending on where the infection is thought to be located.

III. TREATMENT ON MUCORMYCOSIS

Mucormycosis is a serious condition that calls for a doctor's prescription for antifungal medicine. Amphotericin B, posaconazole, and isavuconazole are not effective against the majority of mucoromycetes. (12) These drugs are given intravenously (posaconazole, isavuconazole, and amphotericin B) or orally (posaconazole, isavuconazole). The fungi that cause mucormycosis are resistant to other drugs such as echinocandins, fluconazole, and voriconazole. There is some evidence that preexposure to the Aspergillus drug voriconazole may be associated with an increased incidence of mucormycosis in some people. However, voriconazole is ineffective against mucormycetes. (10,12)

➤ *Surgery*

Particularly in situations of cutaneous, gastrointestinal, and rhino-cerebral infections, debridement or removal of infected tissue is frequently necessary. Control of the underlying immunodepressant illness should be pursued whenever practical. While the effectiveness of other treatments, such as hyperbaric oxygen therapy, is unknown, they have been helpful in some circumstances.

IV. CURRENT PERSPECTIVE

Patients with illnesses like HIV/AIDS, cancer, chemotherapy, kidney disease, organ transplant, steroid abuse, and Covid-19 positivity must take mucormycosis.

V. FUTURE PERSPECTIVE

If the international medical community works together to create prospective data registries, enhance tools for molecular or antigen-based methods for early diagnosis and isolate fingerprinting, standardise animal models for the evaluation of new drugs, and perform proteomic analysis during early colonisation and infection to identify potentially virulent strength, advancements in mucormycosis treatment may only be possible. (13)

VI. CONCLUSION

Mucormycosis is a new infection that commonly affects immunocompromised people, and the fatality rate even with normal treatment is still too high. Major developments have lately been made into how Mucorales produces disease and lives in the host, despite the fact that research into the pathophysiology of mucormycosis is still regarded to be in its infancy. The majority of the research has been on the mechanisms of fungal iron uptake, molecular mechanisms of adhesion/invasion, spore size and sex loci, and the involvement of innate and adaptive immunity in host defence against Mucorales. Despite the fact that many alleged virulence features remain unstudied and offer intriguing study topics, promising novel therapies and potential diagnostic markers have recently been discovered. The main obstacle to turning these promising technologies—or any new technologies—into treatments and/or diagnostics is the lack

of interest on the part of pharmaceutical companies in conditions with modest potential for market growth.

Therefore, novel, promising treatments and diagnostic advancements for rare diseases that pose a hazard to the public must be supported via procedures for federally financed research. (14)

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