



A pictorial review of Mucor mycosis: A threat in the COVID-19 pandemic

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ABSTRACT:

In the year 2019-20 the world faced a major crisis due to the rising cases of Covid-19. Coronavirus disease (COVID-19) is an infectious disease caused by the SARS-CoV-2 virus. You can learn more about the mucor mycosis patients that were mentioned in this review while Covid-19 was still being treated. Mucor mycosis (black fungus) is an infectious disease caused by a group of filamentous molds that belongs to the order of Mucorales and class Zygomycetes. There were 101 cases of this disease worldwide of which 82 cases were reported only from India and the remaining 19 were from other parts of the world. In the second wave of Corona, India witnessed 71% of mucor mycosis patient's cases from the entire population. It can also be noticed in DKA people (DIABETIC KETO ACIDOSIS) patients in addition to immunocompromised people. Patients suffering from diabetes and hyperglycemia tend to have an inflammatory state which provides an favorable environment for the growth of this disease. The purpose of this review is to enlighten readers about Mucor mycosis, a risk to Covid-19 patients.

Keywords: Mucor mycosis, coronavirus, hyperglycemia, black fungus

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INTRODUCTION

Coronavirus (COVID-19) is an infectious disease caused by the SARS-CoV-2 virus. When an infected person speaks, sneezes sings, or coughs, it can be transferred through their lips or nose in tiny liquid particles [1]. From larger respiratory droplets to tiny aerosols, these particles are diverse. Within a few months, SARS-CoV-2 spread to almost 150 countries globally. Several opportunistic bacterial and fungal illnesses, including Mucor mycosis, have been linked to the pandemic that was started by the coronavirus that causes severe acute respiratory syndrome. Mucor mycosis developed as a life-threatening complication of COVID-19 in India during the second wave [2]. It is a severe but rare fungal infection caused due to group of moldsmucoromycetes. Previous reports said that the major pathogens responsible for this infection are *Rhizopus spp.* and *Mucor spp.* [3]. After Aspergillosis and Candidiasis, it is the most prevalent invasive disease caused by the Zygomycetes class. Hypoxemia, a favourable environment, and hyperglycaemia reduce phagocytic activity are the main factors that encourage Mucorales spores to germinate in patients with Mucor mycosis linked to COVID-19. Even before the pandemic, mucor mycosis was evolving rapidly in India among patients with uncontrolled diabetes mellitus. Many case series of co-infection of Corona with Mucor mycosis have been reported [4]. More and more cases of mucor mycosis among patients with COVID-19 have been documented recently, mainly in India. Around 71% of the world's Mucor mycosis cases originated in India, of which nearly 25% were isolated to Gujarat. After candidiasis and aspergillosis, Mucor mycosis also known as the black fungus is the third most prevalent invasive mycosis. It is brought on by fungi of the zygomycetes class. Without invading, they populate a sizable number of patients. Mucor mycosis is still rare, even though pulmonary aspergillosis linked to COVID-19 is on the rise. Typically, 10 to 14 days following hospital admission, mucor mycosis manifests itself [5].

HISTORY

The infection known as Mucor mycosis is brought on by a group of filamentous molds from the Zygomycota phylum. The first case of Mucor mycosis may have been documented in 1855 by Friedrich Küchenmeister. Furbringer wrote the first description of lung disease and published it in 1876. Lichtheim identified two species, *Mucor corymbifera* and *Mucor rhizopodiformis*, in 1884 after determining how the

disease propagated to rabbits (later referred to as Rhizopus and Lichtheimia, respectively). Palatuf defined phacomycosis and zygomycosis as mucor mycosis in 1885. Three cases of severe sinus, brain, and ocular involvement occurred in 1943; all three cases had poorly controlled diabetes. Between 1970 and 2000, it was found that improving survival required a combination of medical and surgical therapy, notably with amphotericin B. Uncontrolled diabetes, neutropenia, hematological, and usage of immunosuppressants such as corticosteroids are risk factors that put patients at risk for developing Mucor mycosis [5]. Immunodeficiency, organ transplant, iron overload, post-pulmonary TB, and chronic renal disease are some other risk factors. This type of fungus typically grows on rotting produce, bread, soil, and dust [2].

MICROBIOLOGY OF MUCOR MYCOSIS:

Mucor mycosis is caused by fungi, which is part of the six families that make up the order Mucorales.

- 1.Mucoraceae
- 2.Cunninghamellaceae
- 3.Mortierellaceae
- 4.Saksenaceae
- 5.Syncephalastraceae
- 6.Thamnidiaceae

Macroscopic and microscopic morphological parameters, carbohydrate assimilation, and the highest temperature at which they may expand are used to identify the agents that cause Mucor mycosis [6].

Types of infections caused by Mucor mycosis:

Following are the infections caused by Mucor mycosis

1. Rhino-cerebral Mucor mycosis
2. Pulmonary Mucor mycosis
3. Cutaneous Mucor mycosis
4. Gastrointestinal Mucor mycosis
5. Disseminated Mucor mycosis

Table 1: Types and infections caused by mucor mycosis [7].

Types	Infections
Rhino-cerebral Mucor mycosis	There is a chance that a sinus infection will move to the brain. A kidney transplant recipient and someone with uncontrolled diabetes is both at risk.
Pulmonary Mucor mycosis	For those with cancer and those who have undergone an organ or cell transplant, it is the most prevalent type of Mucor mycosis.
CutaneousMucor mycosis	The most prevalent type of Mucor mycosis in healthy individuals occurs when fungus enters the body through a skin split (for instance, during surgery, a burn, or another type of skin trauma).
GastrointestinalMucor mycosis	The incidence of it is higher in young children than in adults, particularly in premature and low birth weight infants under one month of age who have received antibiotics, surgery, or medications that lower the body's resistance to infection.
DisseminatedMucor mycosis	Although the brain enters it is most frequently detected, it can also affect the spleen, heart, and skin.

TRANSMISSION:

It cannot spread from person to person through contact and is not contagious. The realm of nature contains this fungus. To spread the illness, spores from the environment can be eaten, inhaled, or immunized. Even though the majority of incidents are rare, outbreaks tied to healthcare have been linked to things like non-sterile medical equipment, adhesive bandages, wooden tongue depressors, hospital linens, negative pressure rooms, water leaks, poor air filtration, and building design.

The infection of Mucor mycosis decreases the number of T cells, CD4, CD8 cells, etc. It also decreases some body fluids such as white blood cells, worsens diabetes, worsens immune status due to the use of

medicines (decreases immunity), and high blood sugar levels. One-sided eye pain or headache may be one of the symptoms and signs of a fungal infection that starts in the nose or sinus and spreads to the brain. These symptoms and signs may also be accompanied by pain in the face, numbness, fever, loss of smell, a blocked nose, or a runny nose. The individual can seem to have sinusitis [7]. One side of the face could appear bloated, and the upper inside of the mouth or across the nose may have fast-growing "black lesions." Vision may be hazy and one eye may appear enlarged and bulging. When the lungs are affected, symptoms including fever, coughing up blood, pain in the chest, and difficulty breathing might happen [6]. When the digestive tract is affected, symptoms such as stomachache, nausea, vomiting, and bleeding may appear. Affected skin may appear as a dusky reddish tender patch with a darkening centre due to tissue death. There may be an ulcer, and it can be very painful. Fever, cough, chest pain, difficulty breathing, or coughing up blood, can occur when the lungs are involved.

TREATMENT:

The majority of patients receive Amphotericin B formulations. In addition to amphotericin B, Posaconazole is used to treat rhino-orbital cerebral Mucor mycosis. Isavuconazole may be used alone or in conjunction with amphotericin B as salvage therapy. It occasionally necessitates both surgical excision and intravenous antifungal therapy, requiring a multidisciplinary team approach in a facility environment [8]. The preferred medication is liposomal amphotericin B, and treatment should start quickly. Isavuconazole and Posaconazole are two more antifungals that have been mentioned for therapy. To manage Mucor mycosis in COVID-19 in India, the Directorate General of Health Services (DGHS) has published comprehensive management guidelines. The overall prognosis is influenced by a number of variables, such as the speed of identification and treatment, the location of the infection, etc. [9].

1. Use of Steroids and Immunosuppressants:

Today, a large variety of pharmaceutical medications are available to treat a number of dangerous disorders. These medications fall within the major drug classifications of steroids, corticosteroids, and immunosuppressants. The body's ductless glands naturally create steroids, which are the body's inborn hormones. They act as chemical messengers that allow the endocrine system to be regulated [10]. The steroid hormone cortisol, which is produced by the adrenal glands and supports healthy immunological and metabolic function, is structurally similar to corticosteroids. Moreover, it aids in controlling stress. By inhibiting inflammatory pathways, the artificial ingestion of corticosteroids inhibits the body's immunological response and increases vulnerability to numerous fungal infections. The followings are the symptoms of mucor mycosis [11],

Symptoms:

1. Fever
2. Cough
3. Vomiting
4. Headache
5. Shortness of breath
6. Red eye
7. Mental disbalance

CONCLUSION

A mucor mycosis is an uncommon form of invasive fungal infection that typically affects patients receiving treatment for iron excess, immunosuppression, or diabetes. It has recently been discovered in the bodies of SARS-CoV-2 infected patients who have a higher mortality rate. It has been noted that when sterile oxygen was in severely short supply, emergency industrial oxygen was given to rescue the patient, however, this resulted in the introduction of Mucor mycosis pathogens into immunocompromised patients, who now additionally suffer from black fungus in addition to COVID-19. Treatment and diagnosis for COVID-19 individuals thus become challenging. People who are taking an iron overload medication like Deferoxamine are more likely to develop black fungus. Based on location, the rhino-cerebral and pulmonary black fungus had the highest fatality rates of the six types.

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