



REVIEW ARTICLE

An insight into the mucormycosis: “The black fungus” mutilating COVID-19 patients

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ABSTRACT

COVID-19-associated mucormycosis (CAM) is an uncommon but possibly lethal fungal illness that has surfaced as a possible COVID-19 consequence. The infection is caused by a Mucorales family fungus that is often found in the environment. COVID-19 individuals who have uncontrolled diabetes, long-term steroid use, or mechanical ventilation are at a higher risk of developing mucormycosis. Mucormycosis can be ophthalmic, gastrointestinal, sinus orbital, cutaneous, or pulmonary, with symptoms differing depending on the kind and site of the infection. The epidemiology of CAM is unknown, but there have been reports of a rise in the prevalence in some parts of the world, including India and Iran. Herbal treatment has been proposed as an adjunctive treatment to conventional treatment, but further studies are required to assess its efficacy. Early detection and treatment are essential to enhancing patient outcomes, and health-care practitioners should be mindful of the risk factors for CAM. Further research is needed to better comprehend the pathophysiology, epidemiology, and management of this newly discovered fungal infection.

KEYWORDS: Causes of mucormycosis, COVID-19-associated mucormycosis, Symptoms of mucormycosis, Treatment of mucormycosis, Types of mucormycosis

INTRODUCTION

Black fungus (or mucormycosis) is a rare but serious fungal infection that primarily affects individuals with weakened immune systems. In recent times, there has been a spike in cases of black fungus among people who have recovered from or are currently suffering from COVID-19. The infection is believed to occur as a result of prolonged use of steroids in COVID-19 patients, which can suppress the immune system and make the body more vulnerable to fungal infections. COVID-19 and black fungus have become a cause for concern, especially in India, where there have been a large number of reported cases of the disease.^[1] An uncommon but dangerous fungal infection known as mucormycosis is brought on by a class of moulds called mucormycetes. These moulds can be found on a variety of surfaces, in soil, and decaying organic waste. By describing a patient with a serious nose infection, a French doctor by

the name of Paul Jules Tillaux published the first case of mucormycosis in the scientific literature in 1885. Over the years, a number of underlying medical problems, including uncontrolled diabetes, cancer, organ transplantation, and the use of immunosuppressive drugs, have been linked to mucormycosis. The nose and sinuses are where the illness usually begins, but it can also spread to the skin, lungs, and brain. In recent years, mucormycosis has become more common, particularly in India where it has been observed in numerous COVID-19 patients. Although the precise causes of this increase are not fully known, it is thought to be connected to COVID-19 patients' increasing use of steroids and other immunosuppressive drugs. Mucormycosis is a dangerous infection that needs to be identified and treated

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Access this article online

Website:

<http://isfcppharmaspire.com>

DOI:

10.56933/Pharmaspire.2023.15104

Date of Submission: 11 April 2023

Date of Revision: 24 April 2023

Date of Acceptance: 25 April 2023

right away. Antifungal drugs are normally used as treatment, and occasionally surgery is used to remove affected tissue. Although recovery from mucormycosis depends on the patient's underlying health and the severity of the infection, many patients are able to recover with early diagnosis and treatment.^[1] It is important to seek prompt medical attention if you experience symptoms such as headache, facial pain, or nasal or sinus congestion. Early diagnosis and treatment can greatly improve outcomes and prevent potentially serious complication. The ongoing COVID-19 epidemic has had a tremendous global impact, threatening the health, and lives of millions of people.^[2] The increased risk of opportunistic infections, such as mucormycosis, an uncommon but potentially fatal fungal infection, is one of the severe repercussions of this viral disease. Mucormycosis, sometimes known as "black fungus," has recently been identified in COVID-19 patients, bringing terrible health effects and a high fatality rate. This fungal illness is caused by exposure to fungal spores prevalent in the environment and affects people who have weaker immune systems or other health problems. In this post, we will look at mucormycosis, its symptoms, causes, and therapies, as well as the importance of early detection and appropriate care in improving the prognosis and survival of COVID-19 patients.^[3]

COVID-19-ASSOCIATED MUCORMYCOSIS (CAM)

Mucormycosis is a rare fungal infection caused by an opportunistic group of filamentous moulds called mucormycetes classified under Mucorales. Mucormycosis is previously known as Zygomycosis. Mucormycosis is a rare but serious infection caused by a group of molds called mucormycetes. The infection can affect any part of the body, but most commonly occurs in the sinuses, lungs, and brain. Post-COVID-19-induced mucormycosis is a new phenomenon that has been observed in some COVID-19 patients. It is believed to be caused by an immune system weakened by the virus, which makes the body more susceptible to fungal infections. Symptoms of mucormycosis include fever, headache, facial pain, and black lesions on the skin.^[4-7]

CAUSES OF CAM

CAM, popularly known as "black fungus," is a rare but possibly fatal fungal infection in COVID-19 patients. Many factors enhance the likelihood of having this fungal infection, including:

DIABETICS PATIENTS

Diabetics are at a higher risk of acquiring mucormycosis due to a compromised immune system and excessive quantities of sugar in their bodies, which can stimulate fungal growth.

HIGH DOSE STEROIDS OR ANY DOSE FOR MORE THAN 2–3 WEEKS

Steroid use for an extended period of time, especially in high doses, can depress the immune system, making it easier for fungal spores to enter the body and cause illness. Steroids are routinely used to decrease inflammation and improve lung function in severe COVID-19 cases.

MECHANICAL VENTILATION

Those on mechanical ventilation, particularly for 2–3 weeks: COVID-19 patients who require mechanical ventilation are more likely to develop mucormycosis. Mechanical ventilation can cause respiratory tract damage and make it easier for fungal spores to enter the body.

ELEVATED CYTOKINES (IL6)

COVID-19 infection can trigger an overzealous immune response, resulting in elevated levels of cytokines such as IL6. This can impair the immune system and raise the risk of fungal diseases like mucormycosis.

ELEVATED FERRITIN LEVEL

COVID-19 infection can result in elevated ferritin levels, a protein that stores iron in the body. Elevated ferritin levels can stimulate fungal development and raise the chance of developing mucormycosis.

In addition, to these above-mentioned characteristics; recent research suggests that zinc may play an important role in the development of mucormycosis. Zinc is an essential mineral that aids in immunological function. COVID-19 individuals with zinc deficiency may be more susceptible to mucormycosis due to a compromised immune system. Maintaining proper zinc levels in COVID-19 patients may thus help to lower the chance of developing this lethal fungal illness.^[4-7]

TYPES OF MUCORMYCOSIS

Mucormycosis is a rare but deadly fungal infection caused by contact with fungal spores found in nature. The illness can affect different sections of the body, and there are distinct forms of mucormycosis depending on where the infection is located and how severe it is. Types of mucormycosis is shown in figure 1.

OCULAR MUCORMYCOSIS

This kind of mucormycosis affects the eyes and can cause vision loss or blindness. It frequently affects persons with uncontrolled diabetes, particularly those who have suffered

an eye injury or surgery. The infection can spread quickly to adjacent tissues, including the brain, resulting in serious consequences such as meningitis and cerebral abscess. Ocular mucormycosis accounts for around 4% of all documented instances of mucormycosis, according to a study published in the Journal of Ophthalmic Inflammation and Infection.^[8]

GASTROINTESTINAL MUCORMYCOSIS

This kind of mucormycosis affects the digestive system, including the stomach, intestines, and liver. It might result in stomach pain, nausea, vomiting, and bleeding. Gastrointestinal mucormycosis is uncommon but common in immunocompromised patients, especially those with hematological malignancies. An instance of gastrointestinal mucormycosis in a patient with acute myeloid leukemia was documented in a case report published in the Journal of Gastrointestinal Cancer.^[9-15]

SINUS ORBITAL MUCORMYCOSIS

Sinus orbital mucormycosis infects the sinuses and can spread to the eyes, causing vision loss or possibly blindness. It frequently affects persons with uncontrolled diabetes, particularly those who have undergone a nasal injury or surgery. Sinus orbital mucormycosis is a rare but possibly dangerous infection that must be treated as soon as possible.^[16-19]

CUTANEOUS MUCORMYCOSIS

Cutaneous mucormycosis is a kind of mucormycosis that affects the skin and can result in a painful and necrotic

wound. It frequently happens in patients with compromised immune systems, such as those suffering from HIV/AIDS or cancer. Cutaneous mucormycosis is the most frequent type of mucormycosis, accounting for roughly 34% of all reported cases. Five occurrences of cutaneous mucormycosis in immunocompromised patients were documented in a case series published in the Journal of Clinical and Diagnostic Research.^[20-23]

PULMONARY MUCORMYCOSIS

This type of mucormycosis affects the lungs and can cause fever, coughing, chest pain, and breathing difficulties. It is more common in those with low immune systems or those who have been exposed to mouldy conditions for an extended period of time. Pulmonary mucormycosis is a rare but potentially dangerous infection that must be treated as soon as possible. A case report published in the Journal of Clinical and Diagnostic Research described lung mucormycosis in a leukemia patient.^[24-29]

SYMPTOMS

Nasal congestion or blockage is a common symptom of sinus or nasal mucormycosis. A typical symptom of rhinocerebral mucormycosis is bloody discharge from the nose. Other symptoms include periorbital cellulitis and face edema which are two common presenting signs of rhino-orbital-cerebral mucormycosis. Ocular involvement may result in symptoms such as hazy vision, diplopia, and retro-orbital pain. A characteristic symptom of mucormycosis is the emergence of black necrotic tissue in the nasal cavity

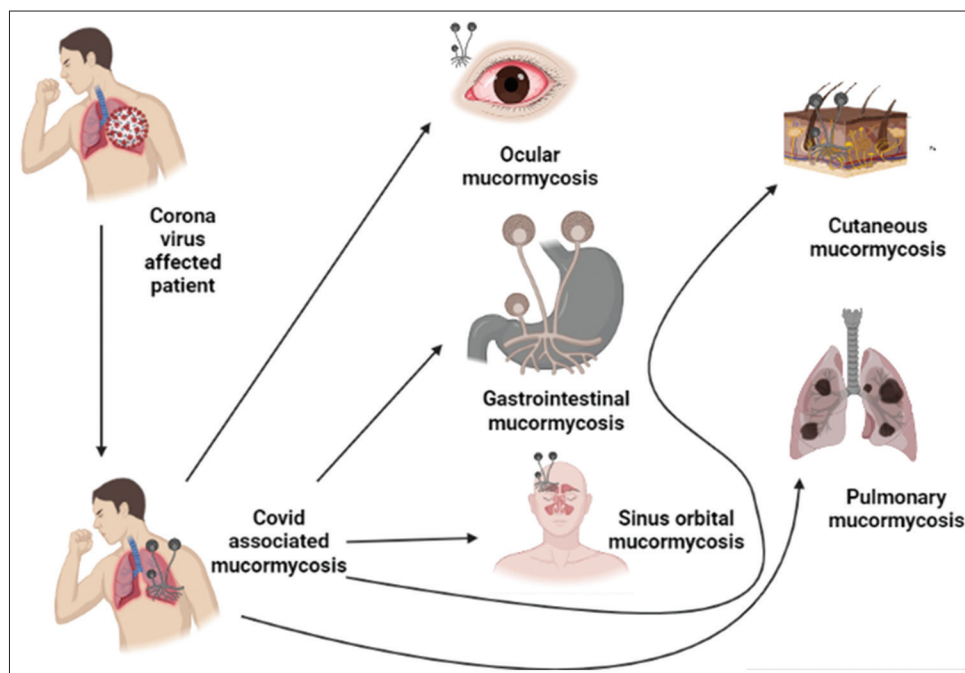


Figure 1: Types of Mucormycosis



Figure 2: Global Distribution of Covid-19 Associated Mucormycosis

or on the face. Facial numbness or tingling can occur when the trigeminal nerve is involved. Patients with intracranial disease extension may have headache. Chest discomfort and dyspnea are symptoms of pulmonary mucormycosis. Cough is a common sign of pulmonary mucormycosis. Dyspnea and shortness of breath can occur in people with pulmonary disease involvement. Abdominal pain or discomfort: Gastrointestinal mucormycosis can cause abdominal pain, nausea, and vomiting.^[30]

EPIDEMIOLOGY OF CAM

Because CAM was only recently identified as a possible consequence of COVID-19, there is minimal evidence on its global spread. Nonetheless, cases of CAM have been reported from all over the world, including India, Iran, the United States, Mexico, Brazil, and Egypt.

During the second wave of the COVID-19 pandemic, there has been an increase in instances of CAM in India, notably among people with uncontrolled diabetes and those undergoing steroid treatment. Some countries, such as Iran, have observed a surge in mucormycosis among COVID-19 patients. It is crucial to highlight that the global transmission of CAM may be influenced by a variety of factors, including the fungus's prevalence in the environment, patient risk factors, and the usage of specific drugs in COVID-19 treatment is shown in figure 23.^[31-34]

HERBAL TREATMENT FOR MUCORMYCOSIS

Treatment involves both maintenance of personal hygiene and oral hygiene. The herbal therapy includes use of drugs such as Danta dhavana, Pratisarana, Jivha nirlekhana, Gandoosha, Kavala, Pratimarsha nasya, Dhoopana karma, Anjana, and Rasayana drugs. Other medicines that can be used according to the Dosha Vikalpa and Rogi Bala

in Mucormycosis are Panchanimba Gulika, Panchanimba Churna, and Gandhaka Rasayana.

The use of Laghu Ahara, Agni Dipaka medicines, and other herbal remedies plays a key role in the prevention of post-COVID problems such as Tankana Sphatika, yashada, shirisha, Panchavalkala, and other herbs are beneficial in the production of eye drops. According to Ayurveda literature, Rakataja Krimi is compared to the pathophysiology of mucormycosis, and krimihara chikitsa is employed to prevent the spread of this disease. Since the liver is in charge of producing immunoglobulins, the body's major defense mechanism components. As a result, the medications Yakritashodhaka and Raktaprasadaka are also employed in treatment. Kapha pitta nashaka and Vata Avirodhi Chikitsa are important in the treatment of black fungus. Shirovirechana's Shodhana with Vidanga Taila/Shigru Taila and Vairechanika Dhooma is quite beneficial.^[35,36]

CONCLUSION

In the current situation of COVID-19, immunosuppressant has been a major tool to combat the severity of hyperinflammation or viral load in COVID-19 patient, in consequence to it significantly increases the risk to get infected with mucormycosis infection. The risk to get infected with mucormycosis increases sharply with patients having uncontrolled diabetes and leukemia as well as ketoacidosis.

Finally, CAM is an uncommon but potentially fatal fungal infection that can emerge in COVID-19 patients who have certain risk factors, such as uncontrolled diabetes, long-term steroid usage, and mechanical ventilation. Mucormycosis comes in a variety of forms, including ophthalmic, gastrointestinal, sinus orbital, cutaneous, and pulmonary. CAM symptoms differ based on the type of infection and the fungus's location in the body.

The epidemiology of CAM is unknown, but there have been reports of a rise in prevalence in some parts of the world, including India and Iran. Herbal treatment of mucormycosis has been proposed as an adjunct therapy to conventional treatment, but further research is needed to determine its efficacy.

Health-care practitioners must be aware of the potential risk factors for CAM and follow patients for infection signs. Early detection and treatment are critical for improving patient outcomes. More study is needed to better understand the pathophysiology, epidemiology, and treatment of CAM as the COVID-19 pandemic progresses.

ACKNOWLEDGMENTS

The authors are grateful to the ISF College of Pharmacy for providing the necessary infrastructure to complete this review on time.

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