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IP International Journal of Comprehensive and Advanced Pharmacology

Journal homepage: https://www.ijcap.in/

Review Article

Mucormycosis (Black fungus): An alarming sign for COVID-19 patients

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ARTICLE INFO

Article history:
Received 14-06-2021
Accepted 09-09-2021
Available online 28-10-2021

Keywords:
Mucormycosis
Black fungus
Posaconazole
Isavuconazole

ABSTRACT

Mucormycosis (also known as zygomycosis) is a dangerous but uncommon fungal infection caused by a fungus known as mucormycetes. Mucormycosis can be caused by a variety of fungi. Mucormycetes are fungi that belong to the Mucorales scientific order. Molds can be found all over the place. Mucormycosis is a fungal infection that primarily affects persons who have health issues or who use medications that reduce the body's capacity to resist infections and illness. After inhaling fungal spores from the air, it most usually affects the sinuses or lungs. The majority of people are unaffected by these fungus. Breathing in mucormycete spores, on the other hand, can induce an infection in the lungs or sinuses, which can spread to other regions of the body in patients with compromised immune systems. It can also happen as a result of a cut, a burn, or another sort of skin injury. The fatality rate varied based on the patient's underlying condition, the type of fungus, and the affected body part (for example, the mortality rate was 46 percent among people with sinus infections, 76 percent for pulmonary infections, and 96 percent for disseminated mucormycosis). Antifungal medicines such as amphotericin-B, isavuconazole, posaconazole, and various combinations are used to inhibit the growth. Mucormycosis was studied for its spread, symptoms, treatment, prevention, and consequences.

1. Introduction

Mucormycosis, originally referred as zygomycosis, is a fungal disease caused by a variety of fungi in the Mucorales family. This family of fungi is widely distributed in the environment – in soil, for example – and is often connected with decaying organic matter like fruit and vegetables. Mucormycosis, or black fungus, is a rare but deadly condition. Mucormycetes, a type of molds, cause it, and it commonly affects the sinuses, lungs, skin, and brain. Mold spores can be inhaled or come into touch with them in a variety of places, including soil, rotting vegetables or bread, and compost piles. Mycetoma, chromoblastomycosis, and phaeohyphomycosis are three disorders caused by black fungi. Tumefaction, draining sinuses, and granules are all characteristics of mycetoma. These are dangerous infections that must always be treated surgically and medically.[1] Madurella mycetomatis is among the most common reasons of this disease all over the world. Fungus balls, which are a clump of hyphae that usually colonise a small cavity, such as a sinus or an ancient lung cavity, should not be confused with granules. Black fungus is a dangerous fungal infection that affects people who have recovered from a Coronavirus infection. It's worth noting that the Covid-19 infection has produced a perfect habitat for Mucorales spores to thrive and spread. With the use of immunosuppressants, the body

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https://doi.org/10.18231/j.ijcaap.2021.024

has poor oxygen saturation, high glucose, acidic medium and decreased white blood cell activity due to Covid-19 infection. A fungal infection can quickly spread in this situation. Because of the large diabetic population in India, it is 80 times higher.[2]

2. Types

2.1. Rhinocerebral mucormycosis

It's a sinus infection that has the potential to move to the brain. People with uncontrolled diabetes and those who have had a kidney transplant are more likely to develop this type of mucormycosis.[3–8]

2.2. Pulmonary mucormycosis

It's the most common type of mucormycosis among cancer patients and those who've had an organ or stem cell transplant.[6]

2.3. Gastrointestinal mucormycosis

It is more frequent 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 drugs that reduce the body's ability to fight pathogens and illness.[5]

2.4. Skin mucormycosis

When fungus enters the body through a skin break, it causes this condition (for example, after surgery, a burn, or other type of skin trauma). This is the most prevalent type of mucormycosis in healthy people.

2.5. Disseminated mucormycosis

It happens when an illness travels from one portion of the body to another via the bloodstream. The brain is the most usually affected organ; however other organs such as the spleen, heart, and skin can also be affected.[9]

3. How to spread

According to experts, the progression of mucormycosis is accelerated by sometimes excessive dosages of steroids such as dexamethasone, which is used to treat Covid-19. Diabetes lowers the efficacy of infection-fighting white blood cells, making it easier for a fungus to take hold in the air. "It looks that the immune system is failing to combat the fungus," says the researcher. Excessive steroid use can lead to full-blown diabetes in prediabetics. Immunosuppressant-treated Covid-19 patients are more susceptible to mucormycosis. Immunosuppressants are a life-saving medicine that prevents the body from attacking itself. Mucormycosis is a fungal infection that does not transmit from one person to another. Inhaling spores that grow in soil, on plants, and in rotting fruits and vegetables is the most typical way for people to become sick.[10]

4. Risk ratio

Anyone of any age can develop the virus. The fungus will come into contact with the majority of humans at some point during their life. However, if a person's immune system is impaired as a result of medicine or a health condition such as HIV, organ transplant, long-term use of steroids, diabetes, cancer, poor health, poor nutrition, COVID-19, etc., they are more prone to become ill.

5. Sign and symptoms of mucormycosis development

Mucormycosis symptoms differ depending on where the fungus is growing in your body. Fever, chest pain, breathing problems, congestion, swelling on the face, headache, tummy discomfort, nausea, diarrhoea, and a black lesion on the mouth are some of the symptoms that might occur. The infection can also travel through the blood to other parts of the body. Disseminated mucormycosis is the medical term for this condition. The fungus can then harm organs such as the spleen and heart. In severe circumstances, the person's mental condition may change or they may fall into a coma. It has the potential to be fatal.

6. Diagnosis

If the patient is suspected of having mucormycosis, a physical examination is required, as well as questions about the patient's medical history. To determine which fungus spores are frequently seen. If it appears that you have a lung or sinus infection, take a sample of the liquid from your nose or throat and send it to a lab for testing. They may also do a tissue biopsy, which involves the removal of a small portion of contaminated tissue for testing. An MRI or CT scan can confirm the existence of black fungus if the illness has spread to your brain or other organs.

7. Treatment

If a patient has been diagnosed with mucormycosis, treatment with prescription antifungal drugs should begin as soon as possible. These medications halt the fungus's growth, kill it, and bring the infection under control.[7]

7.1. Amphotericin-B

Mucormycosis has been successfully treated with amphotericin B. Based on efficacy and safety evidence, the liposomal formulation (AmBisome) is currently the medication of choice. Amphotericin B lipid formulations are used at a rate of 5 mg/kg/d. To treat mucormycosis, particularly CNS illness, some people have utilised doses as high as 7.5-10 mg/kg/d. Higher doses, on the other hand,

have been linked to up to 40% higher risks of nephrotoxicity without a corresponding mortality benefit.

7.2. Isavuconazole

In March 2015, isavuconazole (Cresemba) was approved by the FDA for the treatment of mucormycosis. Serum butylcholinesterase quickly converts the prodrug isavuconazonium sulphate to the active form, isavuconazole (ISZ). Because of the rarity of this disease, the efficacy of isavuconazole in the treatment of invasive mucormycosis has not been tested in randomised controlled trials. A noncomparative, single-arm, open-label, matched, case-control trial was used to approve this medicine (VITAL). Mucormycosis was found in 37 of the 149 patients studied, with proved (86%) or suspected (14%) mucormycosis. Twenty-one patients were given ISZ as a first-line treatment, whereas 11 were given ISZ as a salvage treatment after being intolerant to other antifungals. The Fungiscope Registry was used to match controls treated with amphotericin (67 percent liposomal, 12 percent lipid complex, 21 percent deoxycholate). Patients treated with isavuconazole and amphotericin showed identical day-42 weighted all-cause death rates of 33% and 41%, respectively. ISZ was given to patients for a median of 84 days versus 18 days for amphotericin, indicating better tolerability.[11]

7.3. Posaconazole

Another triazole antifungal, posaconazole, has been proven to be superior to fluconazole or itraconazole in the prevention of invasive mould infection (both aspergillosis and mucormycosis) in patients with hematologic malignancies and neutropenia or GVHD. To avoid one fungal infection, the number needed to treat (NNT) was 27, and to prevent one death, it was 35. Posaconazole is an off-label treatment for mucormycosis in patients who are resistant to amphotericin B. The introduction of a delayed-release tablet formulation has resolved issues with posaconazole oral suspension absorption, specifically decreased absorption in the presence of a proton pump inhibitor (PPI) or antimotility drug (eg, metoclopramide).[12]

7.4. Other agents

Other azoles, such as fluconazole and voriconazole, have little effect on Mucorales. Mucormycosis has been recorded in individuals receiving voriconazole prophylaxis, such as transplant recipients. The echinocandins are somewhat resistant to most Mucorales species in vitro, therefore they can't be employed alone to treat mucormycosis. A recent retrospective cohort analysis of combination liposomal amphotericin B (L-AmB) with posaconazole, L-AmB with echinocandins, and posaconazole with echinocandins found no mortality differences between monotherapy and combination treatment groups. In vitro interactions of isavuconazole with micafungin or amphotericin resulted in a variety of interactions, some concentration-dependent, against various Mucorales, ranging from antagonism to synergy.[13]

8. Complication

Mucormycosis can cause blood clots, blindness, nerve damage, and other complications. Without treatment, mucormycosis can be fatal. The actual fatality rate is unknown due to the infection's rarity. However, experts predict that 54 percent of mucormycosis patients die. Which portion of the body is harmed determines the chance of death.

9. Prevention

It's impossible to avoid inhaling spores. However, there are a few things you may do to reduce your risk of mucormycosis.

1. Avoid places where there is a lot of dust or soil, such as construction or excavation sites. Wear a face mask like a N95 if you have to be in these regions.
2. Stay away from contaminated water. Floodwater or water-damaged structures are examples of this, particularly after natural catastrophes such as hurricanes or floods.
3. Avoid activities that include dust and soil, such as gardening or yard labour, if you have a weaker immune system. If you can't avoid it, wear shoes, gloves, long pants, and long sleeves to protect your skin. As soon as possible, wash any cuts or scrapes with soap and water.[14]

10. Acknowledgement

All authors are grateful to KNIMT-FOP for providing to e-facility to conclude this study.

11. Conflict of Interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of this article.

12. Source of Funding

None.

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Cite this article: Srivastav RK, Vishwakarma VK, Srivastav SK, Prasad M, Mahmood T, Singh CS, Jha A. Mucormycosis (Black fungus): An alarming sign for COVID-19 patients. *IP Int J Comprehensive Adv Pharmacol* 2021;6(3):136-139.