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Mucormycosis: An infection caused by a black fungus

Ali A Alsudani *

Environmental Research and Pollution Prevention Unit, College of Science, University of Al-Qadisiyah, Iraq.

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Abstract

The filamentous fungus that causes Mucormycosis is a newly discovered angiogenic infection that is found in large quantities and is a member of the Zygomycete class's Mucorales order. In patients undergoing hematopoietic and allogeneic stem cell transplantation, after candidiasis and aspergillosis, mucormycosis has become the third most common invasive mycosis. Breathing in sporangiospores is a daily need. The remarkably low frequency of Mucorales members in nasal mucus indicates that airborne contamination is either minimal or mucociliary transport removes spores from airway mucus. In this review research, new approaches to assessing the relationships among the host, the fungus, and antifungal drugs are provided. Aerosols and other novel delivery methods might also aid in the treatment of mucormycosis.

Keywords: Mucormycosis; Black fungus; Taxonomy; Treatments

1. Introduction

Following the COVID-19 pandemic, fungi belonging to the Mucorales order in the Zygomycetes class gave rise to the potentially lethal invasive fungal illness known as mucormycosis[1]. Mucormycosis symptoms can vary greatly, from a localized sickness to widespread infection, the third most common invasive fungal infection is mucormycosis, followed by candidiasis and aspergillosis, Mucorales are angioinvasive, acute diseases that frequently cause over 60% of mortality in immunocompromised individuals, it is the cause of 8.3%–13% of fungal infections in hematological patients that are found during autopsy [2,3]. A person may get mucormycosis should they come into contact with surrounding fungal spores, for instance, breathing in spores might cause lung or sinus infections, certain types of mucormycosis are more common in patients taking drugs that lessen the immune system's ability to combat infection and disease, as well as in those who already have medical issues, mucormycosis may also appear if a cut, scrape, burn, or other type of skin damage allows the fungus to spread throughout the skin[4,5].

2. Prevention

After recovering from the coronavirus, patients should keep an eye on their health for at least two weeks, take these steps to ensure that they do not become infected with the Black Fungus, use a mask and wear plenty of clothing while working with dirt, moss, or manure in dusty environments, one needs to control hyperglycemia, monitor your blood sugar levels following your release from COVID-19, must use caution while deciding when and how much steroid to take, keep humidifiers filled with clean water while undergoing oxygen treatment, use cautiously when using antibiotics and antifungals[6,7]. Preventing mucormycosis in the COVID-19 era necessitates managing co-morbidities (especially diabetes), maintaining hygiene and sanitation, and using steroids sparingly[8].

* Corresponding author: Ali A Alsudani

3. Pathogenesis

Spores of Mucorales cause inflammation in healthy hosts. The most prevalent underlying causes of mucormycosis are linked to deficiencies or dysfunctions in phagocyte activity, illegal drug usage, and skin and soft tissue infections that usually occur before infection. In patients, the fungus grows aggressively due to a number of its characteristics, one of these characteristics is that these fungi are naturally thermotolerant[9,10]. These fungi's capacity for quick growth and cell wall modification also aids in their resistance to harsh conditions, the peculiar sensitivity of this fungus infection that has spread to iron-overloaded animals demonstrates the importance of iron acquisition in the development of mucormycosis, therapeutically, interventional techniques that might decrease free iron availability to Mucorales are intriguing because of the role that iron availability plays in the pathophysiology of mucormycosis[11,12]. In animal models, the administration of more recent iron chelators without xenosiderophore characteristics has demonstrated protective benefits. But neutropenic patients could be the only ones experiencing ineffectiveness[13].

4. Classification of the Zygomycota

Referred to are current evaluations according to nuclear ribosomal sequence data, of the phylogeny of the phylum Zygomycota, which are currently being updated because of modifications to the classification[14]. Only a handful of the twelve clades that were found were connected to the nine Zygomycota orders that are currently known, we have provided a thorough phylogenetic classification of the kingdom Fungi concerning recent molecular phylogenetic studies, the groups that were previously categorized as Chytridiomycota and Zygomycota have seen the most significant alterations in classification when compared to previous studies[15].

5. Epidemiology:

These organisms have the potential to cause extensive, gastrointestinal, cutaneous, respiratory, or rhinocerebral infections in susceptible individuals, these infections typically present with a variety of clinical symptoms that are linked to certain underlying diseases. These fungi are found in a range of ecological niches, but their low pathogenicity in human hosts is demonstrated by the low prevalence of disease brought on by zygomycetes[16]. Unlike the fungi, which are said to be widely distributed, human illness is limited to those who are traumatized, have diabetes mellitus, or are gravely disabled, these diseases are prevalent worldwide, and the respiratory system is the route by which agents of zygomycosis enter the body; sporangiospores will most likely fall in nasal turbinates and be inhaled into the lung alveoli [17]. Sporangiospores are immediately injected into the skin that has been damaged or impeded when it comes to initial cutaneous mucormycosis; after that, they may multiply and spread, although not as frequent as Aspergillus infections linked to hospitals, nosocomial mucormycosis outbreaks have occasionally been connected to remodeling or construction projects in addition to polluted ventilation systems, use of contaminated biomedical equipment or surgical splints and dressings that are not sterile has been linked to clusters of nosocomial cutaneous infections caused by *Rhizopus* spp[18,19].

6. Signs and Symptoms:

The location of the fungus' growth within the body determines the symptoms of mucormycosis if you believe that any of your symptoms could be associated with mucormycosis, make contact with your physician, the manifestations of mucormycosis differ according to the body area where the fungus is growing[20]. According to reports, invasive mucormycosis most frequently occurs in the sinuses (39 %), lungs (24 %), and skin (19 %)[21]. Depending on the sickness kind and the place of infection, different mortality rates applied, the researchers found that 76 % of patients with lung infections died 96% of patients had disseminated infections and 85% had gastrointestinal disorders[22]. Among these symptoms, one of the most significant symmetrical facial edema, headache, sinus or congestion in the nose, black sores on the mouth's upper interior or nasal bridge that worsen quickly, and high fever; additional symptoms of a fever include coughing, chest pain, stomach ache, vomiting, nausea, and intestinal hemorrhaging[23].

7. Diagnosis

The diagnosis of mucormycosis is challenging, but to lower mortality, treatment should begin right away, It is commonly known that when Mucorales infections are present, the 1,3 beta-D glucan detection test yields negative results, despite the lack of appropriately powered studies investigating 1,3 beta-D glucan in diverse kinds of mucormycosis, for the diagnosis of mucormycosis, there isn't a circulating antigen detection test (such as the detection of galactomannan for invasive aspergillosis)[24]. In contrast, mixed Aspergillus and Mucorales infections as well as invasive aspergillosis the most common differential diagnosis can be ruled out with the use of these two tests[25]. For a definitive diagnosis of

mucormycosis, histological proof or a culture that is positive from a sample removed from the infection location is frequently needed, more evidence of an invasive infection than of colonization can be found in specimens from sterile body sites[26]. The detection techniques based on DNA exhibit potential, but they're not quite standardized or commercially available[27].

8. Treatments

A doctor's prescription is required for the dangerous ailment known as mucormycosis for an antifungal drug is necessary, for patients with mucormycosis to have better results, early identification, prompt diagnosis, and prompt administration of an appropriate antifungal drug are essential, Lipid-based amphotericin B formulations are frequently employed as first treatment[28]. Isavuconazole, posaconazole, and amphotericin B are mostly ineffective against mucormycosis, the administration of these drugs can be done intravenously or orally, other drugs like echinocandins, voriconazole, and fluconazole don't work against the fungus that causes mucormycosis, Aspergillus treatments such as voriconazole are ineffective against mucormycosis, moreover, there is proof that voriconazole exposure prior associated with a higher incidence of mucormycosis in some people[29,30]. Infections in the skin, gastrointestinal tract, and rhinocerebral region frequently necessitate surgically removing infected tissue, or debridement, when possible, efforts should be made to manage the underlying immunocompromising illness, although their efficacy is uncertain, several treatments, such as hyperbaric oxygen therapy, have proven helpful in some circumstances[31,32].

9. Conclusion

Mucormycosis is a rare fungal disease with a high fatality rate that spreads quickly. Most epidemiological studies on mucormycosis that are now available are retrospective and narrow. The current review article focuses on the most recent aspects of the condition in question, such as therapy and causation. Based on the facts presented above, we can conclude that, while mucormycosis is lethal to humans, it is also treatable with proper precautions, care, and therapy. In the future, we will be able to overcome it.

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