

### Black Fungus

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Mucormycosis informally called 'black fungus' is a rare fungal infection, with a very high mortality rate of around 54%<sup>1</sup>. Covid-19 associated mucormycosis is not very common, but in recent months, India observed thousands of cases of mucormycosis in Covid-19 patients. Now the prevalence of mucormycosis in India is about 80 times higher than the prevalence in developed countries<sup>2</sup>. Pakistan and Russia are also experiencing a surge. In the second week of June 2021, the devastating aggression of Covid-19 seems to decline a little in India. But in Bangladesh, particularly in the western border districts the picture was very fragile with rapidly increasing numbers of Covid-19 cases. Even few sporadic cases of Covid-19 associated mucormycosis have been identified in Bangladesh.

Mucormycosis (zygomycosis) comprises several different invasive fungal infections with the order mucorales. The responsible genera include *Rhizopus*, *Mucor*, *Lichtheimia* (formerly *Absidia*) and *Rhizomucor*. *Saksena*, *Cunninghamella*, *Apophysomyces* etc. are less common causative agents<sup>3</sup>. Total 10 genera and 27 species of the order mucorales are involved in human disease. All species of these genera produce same disease and appear morphologically identical in tissues. These groups of fungi are present throughout the environment, rich in soil and decaying organic matter, such as leaves, compost piles, and animal dung<sup>4</sup>. The majority of mucormycosis is associated with *Rhizopus* spp. Humans acquire the infection mainly by inhalation of sporangiospores but acquisition of disease by ingestion of contaminated food or traumatic inoculation is also possible<sup>5</sup>.

Individuals with low phagocytes (neutropenia) or have impaired phagocytic function are at greater risk of mucormycosis. In case of hyperglycemia and low pH (diabetes mellitus and diabetic

ketoacidosis), phagocytes become dysfunctional with impaired chemotaxis and defective intracellular killing ability and thus prone to acquire mucormycosis. The risk increases manifold with the concomitant use of steroid. Patients with increased iron load are also susceptible<sup>6</sup>. In addition to these, all types of cancer patients, patients with solid organ transplant or stem cell transplant, patients using corticosteroid for long, injectable drug abuser, patients with burns, wounds or surgery and prematurity and low birth weight neonates are at increased risk of mucormycosis<sup>7</sup>.

Mucormycosis is an opportunistic infection and patients with moderate to severe Covid-19 are more susceptible to it<sup>8</sup>. High dose corticosteroids and tocilizumab used to treat severe cases of Covid-19 might have played an important role in acquiring mucormycosis<sup>9</sup>. According to the statements of the treating physicians of 'black fungus' in India, the cause of the endemic situation of mucormycosis may have contributed by contamination in the pipe lines, face masks, cylinders and humidifiers used for oxygen. In addition to these, low oxygen (hypoxia in Covid-19), uncontrolled diabetes, high iron levels, immunosuppression by steroids, as well as prolonged hospitalization and mechanical ventilation have facilitated 'black fungus epidemic'. Although some of these hypothesis are yet to be established.

Presentations of mucormycosis depend on which part or organ system of the body is affected. It is mainly categorized into five main types according to the presentation and part of the body involved, namely rhinocerebral, pulmonary, gastrointestinal, cutaneous and disseminated mucormycosis<sup>10</sup>. Rhinocerebral and pulmonary mucormycosis are prevalent in Covid-19 patients<sup>11</sup>. Rhinocerebral mucormycosis is the commonest and classic presentation of the

disease.

Initially symptoms and signs may include one-sided eye pain or headache or pain in the face, numbness, fever, loss of smell and runny nose or blocked nose. The face becomes swollen on one side and rapidly progressing "black lesions" appears across the nose and upper inside of oral cavity. The involved eye may become swollen and bulged with ocular palsy and blurred vision<sup>12</sup>. Fever, cough, chest pain, dyspnea and hemoptysis may occur if the lungs are involved. Abdominal pain, nausea, vomiting and gastrointestinal bleeding can occur in case of intestinal involvement. In case of disseminated disease involving the brain, there may be psychosis and other neurological symptoms, even coma<sup>13</sup>.

Provisional diagnosis is based on the history, physical examination, and evaluation of the patient's risk factors for mucormycosis, but a confirmatory diagnosis is challenging. So, culture (to identify species) and histopathology both are required. Presence of a fungal infection can be confirmed quickly by a touch preparation of skin biopsy<sup>3</sup>. Other supportive tests include a complete blood count, iron levels, blood glucose, bicarbonate, and electrolytes<sup>14</sup>. Imaging is usually performed to see the extent of involvement. CT scan of the lung, sinuses and brain are usually required<sup>15</sup>. Sometimes MRI is also indicated.

An aggressive treatment approach should be initiated immediately for mucormycosis. Most of the patient will need surgical interventions and medical treatments simultaneously. Intravenous Amphotericin B is the standard treatment and the liposomal preparation is preferred in case of CNS involvement. A combination of liposomal Amphotericin B and an Echinocandin may improve survival of the patient. Recombinant cytokines, hyperbaric oxygen, and/or granulocyte transfusions are considered as adjunct therapy for selected cases. Benefits of using iron chelator are still under evaluation<sup>16</sup>.

Patients with mucormycosis can experience

serious complications like blindness, osteomyelitis, pulmonary and gastrointestinal hemorrhages, meningitis, cavernous sinus thrombosis, brain abscess, cavitory lesions in organs, secondary bacterial infections and death. Prognosis depends on overall health, rapidity of diagnosis and effective treatment. Loss of vision, limbs and organ dysfunction is not uncommon in survivors<sup>17</sup>.

Emergence of Covid-19 associated mucormycosis at an epidemic level in India has complicated the pandemic situation of Covid-19 manifolds. Bangladesh shares a very large land border as well as intimate social and commercial relationship with this country that makes our country in an impending danger of Covid-19 associated mucormycosis outbreak. Management of this invasive fungal infection would be very challenging in Bangladesh regarding medical resources and cost. Early diagnosis as well as measures to prevent contamination, control of blood sugar, justified and limited use of steroids and antibiotics in Covid-19 patients appears to be the main objectives in preventing an outbreak of mucormycosis.

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## References:

1. Roden MM, Zaoutis TE, Buchanan WL, Knudsen TA, Sarkisova TA, Schaufele RL et al. "Epidemiology and outcome of zygomycosis: a review of 929 reported cases". Clin Infect Dis. 2005 Sep 1;41(5):634-653.
2. Revannavar SM, Supriya PS, Laxminarayana S, Vineeth VK. "COVID-19 triggering mucormycosis in a susceptible patient: a new phenomenon in the developing world?" BMJ Case Rep. 27 April 2021;14(4)
3. Grossman ME, Fox LP, Kovarik C, Rosenbach M. " Subcutaneous and deep mycoses: Zygomycosis/Mucormycosis". Cutaneous Manifestations of Infection in the Immunocom-

promised Host (2nd ed.). Springer. 2012; 51–58.  
First time used

4. Richardson M. "The ecology of the Zygomycetes and its impact on environmental exposure". *Clin Microbiol Infect*. 2009 Oct;15Suppl 5:2-9.
5. Ribes JA, Vanover-Sams CL, Baker DJ. "Zygomycetes in human disease". *Clin Microbiol Rev*. 2000 Apr; 13(2):236-301.
6. Ashraf S, Ibrahim, Brad Spellberg, Thomas J. Walsh, Dimitrios P. Kontoyiannis. "Pathogenesis of Mucormycosis". *Clin Infect Dis*. 2012 Feb; 54(1):S16–S22.
7. "Mucormycosis – People at Risk & Prevention". [www.cdc.gov](http://www.cdc.gov). May 28, 2019.
8. S. Mrittika L, Sumeet PL, Tatyrao P, Ragini GH Santosh. "Mucor in a Viral Land: A Tale of Two Pathogens". *Indian J Ophthalmol*. 2021 Feb;69(2):244-252.
9. Garg D, Muthu V, Sehgal IS, Ramachandran R, Kaur H, Bhalla A, et al. "Coronavirus Disease (Covid-19) Associated Mucormycosis (CAM): Case Report and Systematic Review of Literature". *Mycopathologia*. 2021 May; 186(2): 289-298.

ture". *Mycopathologia*. 2021 May; 186(2): 289-298.

10. "About Mucormycosis". [www.cdc.gov](http://www.cdc.gov). May 25, 2021.
11. Mehta S, Pandey A. "Rhino-Orbital Mucormycosis Associated With COVID-19". *Cureus*. 2020; 12(9): e10726.
12. McDonald, Philip J. "Mucormycosis (Zygomycosis) Clinical Presentation: History and Physical Examination". [emedicine.medscape.com](http://emedicine.medscape.com). May 28, 2021.
13. "Symptoms of Mucormycosis". [www.cdc.gov](http://www.cdc.gov). May 25, 2021.
14. D. Eric, L. Michaela. "Special Issue: Mucorales and Mucormycosis". *J Fungi (Basel)*. 2020 March; 6(1):6.
15. "Diagnosis and Testing of Mucormycosis". [www.cdc.gov](http://www.cdc.gov). January 14, 2021.
16. Brad Spellberg, Ashraf S. Ibrahim. "Recent Advances in the Treatment of Mucormycosis". *Curr Infect Dis Rep*. 2010; 12(6): 423–429.
17. "Mucormycosis (Zygomycosis)". [www.medicinenet.com](http://www.medicinenet.com). Oct 5, 2021.