



## Covid Associated Mucormycosis in India

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**Received:** October 26, 2021

**Published:** November 19, 2021

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Mucormycosis or 'Black Fungus' is an angioinvasive disease caused by saprophytic fungi of the order Mucorales. The spores of this fungus are ubiquitous in the atmosphere. Healthy individuals continue to breathe in the air without getting affected. During the second phase of COVID pandemic, the word 'black fungus' became a dreaded household term in India.

Over the last three decades the incident cases of mucormycosis have shown a rising trend in India, but the exponential growth of cases during the second wave of covid pandemic was unprecedented.

Before the covid-19 pandemic, mucormycosis was 80 times more prevalent in India than in developed countries [1]. Mucormycosis was declared a notifiable disease in India in May, 2021 following the surge in cases.

The sites commonly involved are rhino-orbital cerebral regions, whereas, the primary gastrointestinal mucormycosis is a rare manifestation of mucormycosis, that can present itself with symptoms similar to other gastrointestinal diseases. Gastrointestinal mucormycosis is a common manifestation of mucormycosis in infants and carries a high mortality rate. Besides these, pulmonary, cutaneous, renal, and disseminated mucormycosis cases have been diagnosed. In India, rhino-cerebral-orbital mucormycosis is very common presentation followed by pulmonary and cutaneous sites. Isolated renal mucormycosis in an immunocompetent host is a unique entity in India [2].

The risk factors for mucormycosis are diabetes mellitus, solid organ transplant, hematological malignancy, kidney disease, post pulmonary TB and trauma.

The diagnosis of this disease is made by KOH mount, cytology, histopathology, culture studies and molecular studies. Special stains like Periodic acid Schiff and Grocott methanamine silver in cytology and histopathology cases, confirm the diagnosis.

Typical findings on microscopy/histopathology are non-septate/pauci-septate, ribbon-like hyphae (at least 6-16  $\mu\text{m}$  wide). Vessel occlusion was invariably present in these cases. Culture Routine media at 30°C and 37°C have typical findings of cottony white or greyish black colonies [3].

The acute angle branching is characteristic of Aspergillus infection and the wide angle branching of Mucormycosis. In tissue, the hyphae appear ribbon-like with an irregular pattern of branching. Hyphae can artefactually seem to have septae because tissue can fold over itself during processing, which can create artificial lines that can be confused with septations. Similarly, the historically described 90° branching angle of Mucorales in tissue, versus 45° branching angle of septate moulds, can be difficult to identify in tissue due to interstitial pressures exerted on the fungi by the tissue and alterations in tissue architecture during processing. Thus the wider and irregular (ribbon-like) nature of the hyphae are more reliable distinguishing characteristics than septations and angle of branching [4].

The facilities for establishing the diagnosis of Mucormycosis in India is possible in tertiary care centers only. These centres are largely located in metropolitan cities and large urban areas. COVID associated Mucormycosis (CAM) cases were diagnosed at tertiary care centers in India during the second wave of the pandemic. In resource limited settings like India, it is likely that a significant number of patients with CAM were missed due to low clinical suspicion and unavailability of investigations. Making mucormycosis a notifi-

able disease will be helpful in reporting each and every case being diagnosed and just the tip of iceberg. It will also help in providing the information on epidemiology, clinical features and outcome of the disease. The mortality due to CAM during the second phase of COVID pandemic was significant. Since the disease has an angioinvasive nature, it is prudent to make the diagnosis at an earlier stage to reduce the mortality. That will be possible only if the diagnostic facilities are available at all the secondary care institutes if not at the primary care setting in India.

Making the advanced investigations like MRI and CT scans, microbiology and pathology services available to secondary level hospitals in India may not be possible at present. However, a roadmap has to be developed for the same. We should have a planned and well equipped Health infrastructure to tackle future outbreaks of mucormycosis or any other near fatal fungal infection.

It is suggested that clinicians and lab technicians working at secondary level hospitals should be trained in understanding the different presentations of mucormycosis and handling the laboratory samples for microbiological and pathological investigations. The clinical laboratories in the secondary care hospitals can be linked with the tertiary care centers so that the tissue samples can be transported for making a laboratory diagnosis.

In conclusion, the rise in the number of cases, the emergence of new risk factors and causative agents, and the challenges in managing the disease are important concerns with mucormycosis or 'Black fungus' in India.

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**Volume 3 Issue 12 December 2021**

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