



# Covid-19 associated mucormycosis in India: epidemiology, clinical features, diagnosis and management

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**Abstract:** Fungi belonging to the order Mucorales can cause mucormycosis, an uncommon but aggressive opportunistic fungal infection. An unexpected increase in COVID-19-associated mucormycosis (CAM) was documented during the second wave of the COVID-19 pandemic in India (2021), especially in patients with diabetes mellitus and those on systemic corticosteroids. With a focus on the Indian situation during the COVID-19 pandemic, this paper highlights the epidemiology, risk factors, clinical symptoms, diagnostic techniques, therapeutic options, outcomes, and preventative measures associated with mucormycosis. To lower morbidity and mortality related to this potentially fatal illness, early identification, timely antifungal medication, surgical intervention, and management of underlying risk factors are essential.

**Key Words:** Mucormycosis, COVID-19, Black fungus, Diabetes mellitus, Corticosteroids, India.

## 1. INTRODUCTION:

Mucormycosis, commonly referred to as black fungus disease, is a rare but potentially fatal fungal infection caused by a group of molds known as mucormycetes (also called zygomycosis), belonging to the subphylum Mucoromycotina. These fungi are widely distributed in soil, compost, decomposing organic materials, animal feces, and air. Although humans frequently encounter fungal spores, infection occurs primarily in individuals with weakened immune systems. Vulnerable groups include individuals with uncontrolled diabetes mellitus, HIV/AIDS, neutropenia, malignancies, transplant recipients, metabolic acidosis, malnutrition, premature infants, and those on long-term corticosteroid therapy. Mucormycosis most commonly affects the sinuses, lungs, skin, gastrointestinal tract, or brain. During the COVID-19 pandemic in India, a dramatic increase in mucormycosis cases was strongly linked to COVID-19 infection, uncontrolled diabetes, and inappropriate steroid use.

## 2. RISK FACTORS AND PATHOGENESIS

Mucormycosis primarily affects individuals with compromised immunity. Key risk factors include:

- **Uncontrolled diabetes mellitus**, especially with diabetic ketoacidosis, creating an acidic and glucose-rich environment supporting fungal growth.
- **Prolonged corticosteroid use**, which increases blood sugar levels and suppresses immunity.
- **Hematological malignancies, organ or stem cell transplantation, and neutropenia**, reducing host defense mechanisms.
- **Iron overload, metabolic acidosis, poor nutrition**, or trauma leading to cutaneous infection.

In COVID-19 patients, hypoxia, immune dysregulation, steroid overuse, and poor glycemic control collectively contribute to susceptibility. Angio-invasion by mucormycetes results in vascular thrombosis, tissue necrosis, and rapid spread.

## 3. CLINICAL MANIFESTATIONS

Symptoms vary depending on the site of infection:



### **Rhinocerebral mucormycosis**

Most common in COVID-19 cases. Symptoms include unilateral facial pain or swelling, nasal congestion, headache, fever, and black necrotic lesions. Advanced disease may cause visual loss, ophthalmoplegia, seizures, or altered mental status.

### **Pulmonary mucormycosis**

Characterized by fever, cough, chest pain, dyspnea, and hemoptysis. Common in neutropenic or severe COVID-19 patients.

### **Cutaneous mucormycosis**

Appears as painful lesions, blisters, ulcers, redness, swelling, and black eschar formation.

### **Gastrointestinal mucormycosis**

Presents with abdominal pain, vomiting, diarrhea, and GI bleeding; often seen in malnourished individuals.

### **Disseminated mucormycosis**

Occurs when infection spreads to multiple organs and is associated with very high mortality.

## **4. DIAGNOSIS**

Accurate and early diagnosis is essential. Diagnostic methods include:

- **KOH mount microscopy** for rapid detection.
- **Histopathology** showing broad, non-septate hyphae with angio-invasion (confirmatory).
- **Fungal culture** and species identification for epidemiological purposes.
- **CT/MRI imaging** for assessment of disease extent and surgical planning.

Diagnosis must not delay immediate treatment.

## **5. TREATMENT AND MANAGEMENT:**

Mucormycosis treatment requires rapid, multidisciplinary intervention:

- **Liposomal Amphotericin B** is the first-line antifungal therapy.
- **Posaconazole or isavuconazole** may be used when amphotericin B is contraindicated or as step-down therapy.
- **Surgical debridement** of necrotic tissues is often essential and may involve removal of affected sinuses, jaw tissue, or eye.
- **Supportive care**, including strict blood glucose management, correction of metabolic acidosis, and reducing immunosuppressive therapy.

Early intervention improves survival significantly.

## **6. EPIDEMIOLOGY AND DISEASE BURDEN IN INDIA:**

Global mucormycosis incidence ranges from **0.005 to 1.7 cases per million**, but India reports nearly **140 cases per million**, almost **80 times higher** than developed nations.

During the COVID-19 pandemic:

- Over **45,000 cases** of CAM were reported in India.
- More than **4,300 deaths** occurred.
- Highest numbers were reported from Maharashtra and Gujarat.
- Most cases presented **12–18 days after COVID-19 recovery**.

Underreporting remains likely due to limited diagnostic access in rural areas.

## **7. PROGNOSIS AND COMPLICATIONS:**

Mucormycosis has a high morbidity and mortality rate despite advances in treatment.

Common complications include:

- Permanent vision loss
- Cranial nerve palsies
- Vascular thrombosis
- Extensive tissue necrosis
- Multi-organ failure in disseminated cases

Case fatality is approximately **50%**, varying by infection site and treatment speed. Outcomes are better when diagnosis is early and infection remains localized.



## 8. PREVENTION AND INFECTION CONTROL:

Prevention of CAM focuses on:

- **Optimal blood sugar control** in diabetic and COVID-19 patients.
- **Judicious steroid use** only when clinically required.
- Avoidance of **unnecessary antibiotics or immunomodulators**.
- Hospital-level infection control including sterile humidifiers, proper disinfection, and good ventilation.
- Public awareness campaigns for early symptom recognition.

Early intervention reduces the risk of severe complications and mortality.

## 9. CONCLUSION:

The surge in mucormycosis during COVID-19 in India highlights the interaction between infection, diabetes, and healthcare practices. COVID-19-associated mucormycosis remains a major public health challenge requiring improved clinical vigilance, rational steroid use, better diabetes management, and strengthened healthcare infrastructure. Timely diagnosis and aggressive treatment are essential to lower morbidity and prevent fatal outcomes.

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