



# CUTANEOUS MUCORMYCOSIS AFTER COVID-19 RECOVERY: A REVIEW

Shraddha B Amate\*<sup>1</sup>, Rohini S Dongare<sup>2</sup>, Tejas U Amrute<sup>3</sup>

H.S.B.P.VT'S, GOI College of Pharmacy, Kashti, Ahmednagar,  
Maharashtra, India, 414701.

Email – [shraddhaamate2018@gmail.com](mailto:shraddhaamate2018@gmail.com)

## ABSTRACT:

The huge majority of cases reported throughout the world as mucormycosis are infection caused by fungi belonging to the order Mucorales. Cutaneous mucormycosis is increasing fungal contamination because of opportunistic fungi of phylum Glomeromycota. Around 19% of the mucormycosis are cutaneous form and the related mortality of cutaneous mucormycosis occurs about 16%. There are two types of cutaneous mucormycosis first is primary cutaneous mucormycosis (PCM) and second is secondary cutaneous mucormycosis (SCM). Secondary cutaneous mucormycosis is more frequent than primary cutaneous mucormycosis. Most patient with cutaneous mucormycosis have underlying conditions such as diabetes mellitus or solid organ transplantation, haematological malignancies, but a large proportion of them are immunocompetent. After sinusitis and pulmonary cutaneous mucormycosis is the most common clinical presentation. Inadequate production of insulin, Burns or Trauma, Operations, Direct vaccination, Haematological malignancies etc. are the risk factors for cutaneous mucormycosis. Trauma is a critical mode of obtaining the disorder. The disease may be very invasive regionally and penetrate from the cutaneous and subcutaneous tissue into the adjoining fat, muscle, bone and fascia. The prognosis of cutaneous mucormycosis is frequently hard due to the nonspecific findings of the infection. The clinician must have an excessive degree of suspicion and use all available diagnostic tools, because untimely diagnosis leads to an improved outcome. The treatment of cutaneous mucormycosis is multimodal and includes surgical debridement. Antifungal drugs used in cutaneous mucormycosis is Isavuconazole, Amphotericin B, Posaconazole etc. Posaconazole is the most affective azole with true in-vitro interest towards the Mucorales.

## KEYWORDS:

Cutaneous mucormycosis, COVID-19, Mucormycetes, Mucorales, Immunocompetent, Trauma.

## INTRODUCTION:

After COVID-19 recovery mucormycosis or zygomycosis is an opportunistic fungal infection induced by means of fungi of the class mucormycetes or zygomycetes, which are classified into two orders, Entomophthorales and Mucorales. The most typical manifestation of Mucormycosis is a rhinocerebral form (39%), however mucormycosis has many different clinical signs and symptoms which included gastrointestinal, pulmonary, disseminated and cutaneous. Around 19% of the mucormycosis or zygomycosis are cutaneous form and the related mortality of cutaneous mucormycosis occurs is about 16%. Cutaneous mucormycosis is further divided into primary cutaneous mucormycosis and secondary cutaneous mucormycosis. Cutaneous mucormycosis occurs in COVID-19 recovery patients after fungal spores have

penetrated through any damage to the protective skin because of operations, cuts, wound, burns, insect bite, laceration, abrasion, or intravenous injection.

**Table.1.Taxonomic classification of cutaneous mucormycosis fungus.**

1.	<b>Kingdom</b>	Fungi
2.	<b>Phylum</b>	Glomeromycota
3.	<b>Subphylum</b>	Mucormycotina
4.	<b>Class</b>	Mucormycetes
5.	<b>Family</b>	Mucoraceae
6.	<b>Genuss/species</b>	Rhizopus Mucor Rhizomucor Apophysomyces

## Epidemiology:

The pervasiveness of cutaneous mucormycosis is rise in recent time of COVID-19 pandemic. In current years massive wide variety of publications may additionally replicate the increased attention in the phase of healer of this infection also in publication bias, but there are additionally facts which assist a genuine increase in the incidence of mucormycosis ,mainly in sufferers with haematological malignancies. maximum number of patient which caused by cutaneous mucormycosis have underlying conditions like inadequate production of insulin, haematological malignancies, but a maximum proportion among them are immunocompetent. Primary cutaneous mucormycosis usually obtained by direct vaccination, Contaminated bandages, surgery, burns, car accidents and insulin injection sites. The basic principal danger factors are uncontrolled diabetes and ketoacidosis, however more recently, haematological malignancies and allogenic hematopoietic stem cell transplantation have become more recurrent. In cutaneous mucormycosis, penetrating wounds are the most common mechanism for patients to be vaccinated, and needles are a known source of infection; a review of cutaneous mucormycosis cases published from 1940 to 2010 found that most people had previously, there have been traumatic events that destroy the skin barrier, and 35% of infections are caused by penetrating wounds such as needles or sharp objects.

## Classification:

### 1.primary cutaneous mucormycosis



**Fig.1.Primary cutaneous mucormycosis (PCM).**

Primary cutaneous mucormycosis is an uncommon disorder triggered through saprophytic fungi of the order Mucorales. Primary cases can be considered on immunocompetent patients, regularly due to injuries, while in immunocompromised patients (those with a diabetes mellitus).Clinical aspects of main primary cutaneous mucormycosis are necrosis, observed by the way of ulceration, commonly associated to the suitable prognosis.

## 2.Secondary cutaneous mucormycosis



**Fig.2. Secondary cutaneous mucormycosis (SCM).**

Secondary cutaneous mucormycosis is more frequent than primary cutaneous mucormycosis. Secondary cutaneous mucormycosis is generally a complication and extension of the rhinocerebral variety that begins as an orbital fistula and progresses to a necrotic lesion with a terrible prognosis. The analysis is made with the aid of an identification of the fungus by means of direct KOH examination, culture, and biopsy.

### Pathophysiology:

- Primary -Organisms are direct inoculated into disrupted integument; trauma or burns.
- Secondary - haematogenous seeding from disseminated diseases.

### Symptoms :

- Burning sensation to the skin.
- Swelling around wound.
- Skin start to decay.
- Warmth.
- Skin colour of infected area changes in black.
- Pain.
- Skin appears like blisters otherwise ulcers.
- Excessive redness.

### Causes:

Cutaneous mucormycosis is an opportunistic fungal infection caused by fungi of phylum Glomeromycota. Cutaneous mucormycosis can cause due to fungi enter the body through a break in the skin such as after surgery, a burn, other type of skin trauma. People which having weakened immune system can also suffer by cutaneous mucormycosis. Cutaneous Mucormycosis is commonly acquired by way of direct inoculation through trauma.

### Causes of cutaneous mucormycosis in COVID-19 patient:

People with pre-existing medical condition or those taking immunosuppressant medicinal drugs to combat of lethal environmental pathogens are most likely to develop fungal infections. As the patient who are suffering from COVID-19 with or without risk factors or who are suffering from diabetic conditions or who are under the immunosuppressant therapy may also have the risk of development of fungal infection.

### Risk factors:

- Inadequate production of insulin.
- Haematological malignancies.
- Direct vaccination.
- Surgery.



- Burns/Trauma.
- Contaminated bandages.
- Insulin injection sites.

## Why this cutaneous mucormycosis is spreading in INDIA after COVID-19 recovery?

COVID-19 virus is understood to decrease the general immunity of a person, giving upward push to many secondary bacterial and fungal infections. INDIA is the diabetes capital of the world, Covid and diabetes as a combination is becoming a lethal gateway to this organisation of moulds called mucormycetes. Use of steroids in mild Covid infections with hypoxia(SPO2 beneath 94)makes then an vital a part of therapy. Steroids suppress immunity, leading to black fungal infection.

### Diagnosis:

To improve the result early diagnosis of Mucormycosis is necessary. A necrotic wound in an immunocompromised person should increase suspicion of mucormycosis. In an affected person who has sustained a trauma, even though person is immunocompetent, mucormycosis need to be blanketed with inside the differential diagnosis, in particular if there are necrotic elements, if the wound continues to increase no matter broad-spectrum antibiotic treatment, or if a mould is determined at the wound edges. The medical findings of cutaneous mucormycosis are non-particular. Early recognize of the fungus is critical to set up activate antifungal therapy. Early detection may be completed through direct KOH microscopy study, looking at the non-septated, hyaline, hyphae, 5 micro meters extensive and 20 to 50 micro meters long, with abnormal branching at proper angles, especially on the outer edge of the lesion .A molecular and erp checks need to be performed. The biopsy have to be taken from the middle of the lesion, which include subcutaneous fat. Histopathology is extra beneficial in primary cutaneous mucormycosis. Ordinary findings are infractions, edema, thrombosis, necrosis, and an inflammatory response that contains plasma cells and eosinophils. Molecular diagnostic new tools have been developed to provide precise identification of the fungus, still this technology is not available for most patient. These tests target the 18s ribosomal DNA and are highly specific with no cross reactivity with other filamentous fungi. Most of the microscopic characteristics are nonspecific and a distinctive diagnosis with other filamentous fungi must be entertained.

Mucorales in tissue samples and scientific isolate with excessive specificity presents identify by Real-time PCR. Nevertheless, extra sensitivity has been mentioned in clean frozen specimens than in formalin-constant, paraffin embedded tissues. This Real-time PCR has 100% specificity and offers consequences in two to few hours. Other strategies defined are Real-time PCR followed through excessive decision meta evaluation.

### Treatment:

In COVID-19 pandemic when we have cutaneous mucormycosis infection, we need to get hospitalize. At the side of systemic antifungal remedy extensive surgical debridement is the same old remedy of cutaneous mucormycosis. Surgical debridement includes entire resection of necrotic and inflamed tissue, regularly with a cut-off reputedly uninfected tissue . Cutaneous mucormycosis has less death rate. In instances of mucormycosis of the face, the surgery can be disfiguring, necessitating plastic renewal. The fundamental antifungal drug used withinside the remedy of mucormycosis is amphotericin B Antifungal drugs used in cutaneous mucormycosis is Isavuconazole, Amphotericin B , Posaconazole etc. Posaconazole is the most effective azole with true in vitro interest towards the Mucorales. First line remedy is monotherapy with amphotericin.

Table.2.Diagnosis,treatment and outcome of cutaneous mucormycosis patients.

Sr. No	Specimen source	Positive culture	Positive PCR	Positive Histopathology	IMT classification	Surgery	Survival days 180
1	Tissue	No	Yes	Yes	Proven	Debridement	Yes
2	Tissue	ND	Yes	Yes	Proven	(L) Hip disarticulation	No
3	Tissue	Yes	No	Yes	Proven	Debridement and VAC	Yes
4	Tissue	No	Yes	Yes	Proven	Debridement and VAC	Yes
5	Tissue	Yes	Yes	Yes	Proven	Debridement and VAC	Died 7 days after diagnosis

### Preventions:

- Control excessive blood sugar and reveal blood glucose level post COVID-19 discharge.
- Use steroid as in line with proscribed dosage and duration. Use sterile water for humidifiers at some point of oxygen remedy use.
- Avoid going to dusty place or production sites, put on N95 masks if no longer capable of keep away from going to region with a number of dust.
- Clean the pores and skin injuries with warm water, and antiseptic liquid to keep away from having pores and skin infection.
- Maintain personal hygiene.
- Use antibiotic or antifungals accurately.
- Watch out caution signs and symptoms of black fungus disease that need instant medical treatment and do not delay in case of, case of any warning signs and symptoms.
- Maintain overall cleanliness around patients.

### CONCLUSION:

Cutaneous mucormycosis is the most ordinary form of mucormycosis. If some patients become recover from COVID-19, those patients have a risk of cutaneous mucormycosis. Posaconazole, Isavuconazole, Amphotericin B these are drugs used in treatment of cutaneous mucormycosis. In summary, a excessive index of suspicion and early and aggressive management, utilizing all to be had modalities, may enhance the final results of cutaneous mucormycosis.

### RESULT:

After COVID-19 recovery cutaneous mucormycosis is the most common form of mucormycosis caused by fungi of class mucormycetes. Secondary cutaneous mucormycosis is more frequent than primary cutaneous mucormycosis. INDIA is the diabetes capital of the world, therefore cases of cutaneous mucormycosis are increasing in INDIA.

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