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# Black Fungus in India (A Review Article)

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**ABSTRACT:** Mucormycosis or Black fungus is the most severe but rare form of fungal attack. Before the outbreak of the COVID 19, it was a rare disease but after this, it has become a major concern especially for India. Black fungus is very difficult to control and also cause some serious damage. If it gets into any of the four sinuses it will ultimately lead into the brain and as in most cases, death is obvious. In some cases, doctors have to remove jaws or eyes to stop the further spread of the disease. Immunocompromised people are under real threat because of this fungal attack and that's why we are seeing a lot of mucormycosis cases after the COVID 19 outbreak because it suppresses the immune system and let the black fungus attack the patients. The Black fungus was present in the environment for quite a long time but it got serious when patients with uncontrolled blood sugar levels got infected by a coronavirus. The treatment of mucormycosis is quite rare by medicine and mostly it requires surgery, which is quite harsh.

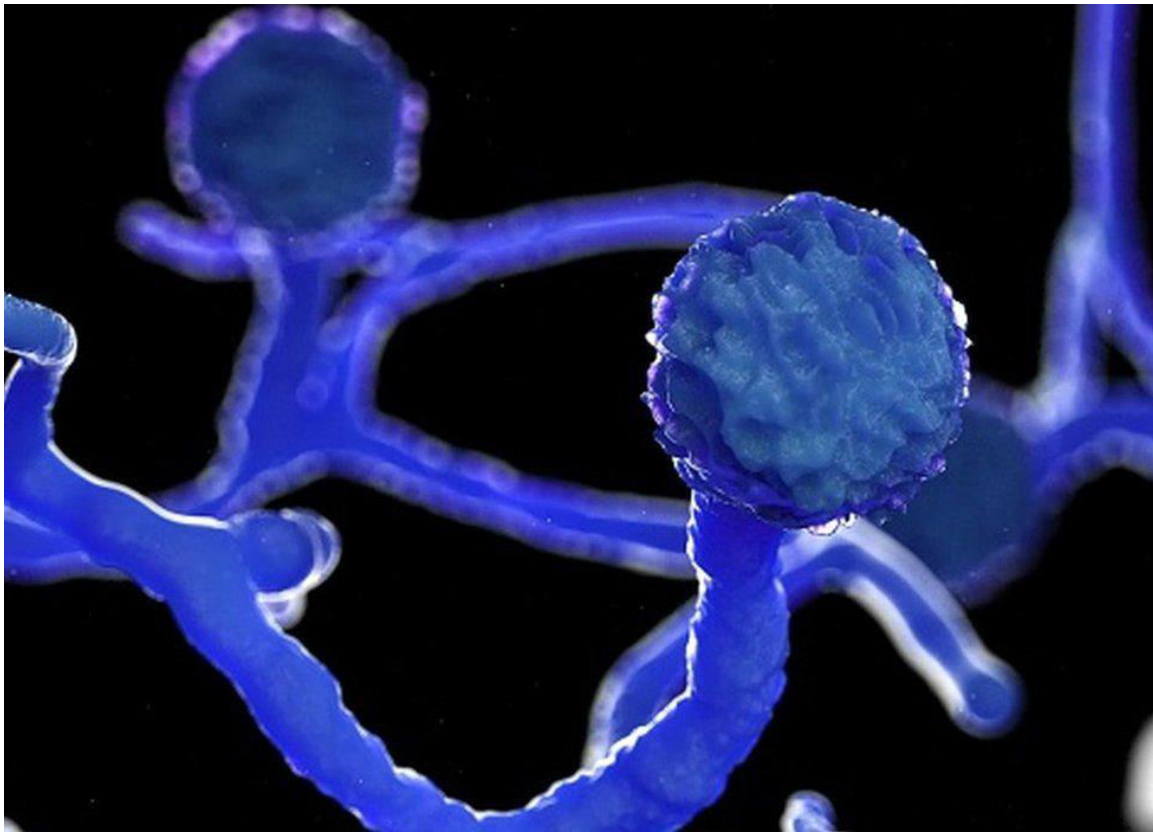
**KEYWORDS:** Mucormycosis, immunocompromised, sinuses

## I. INTRODUCTION

India was facing the deadliest wave of the COVID 19 variant that is the Delta variant when in May 2021 a new disease known as Mucormycosis or Black Fungus begin to affect people adversely with thousands of patients suffering from it who were dealing with coronavirus or previously dealt with it. Normally it is a very rare fungal attack but also severe if it is left untreated it has a fatality rate of 50% or above. People with reduced immune system activity have a higher risk of getting Mucormycosis as they also have a higher risk of getting infected with the coronavirus. The fungus forms its colonies in the blood vessels of the patient which can cause the unnatural death of tissues and cells and can cause a shortage of oxygen supply. It mainly affects sinuses and ultimately leads to the brain. India has reported 45,374 cases of this rare and dangerous infection, called mucormycosis and more than 4300 people has died because of mucormycosis. As the number of infected patients increasing the Government of India has given licenses to five companies to manufacture antifungal drugs.

COVID 19 is related to Black fungus because it also suppresses the immune system of the human body and when the immune system of the COVID 19 affected patient is not working it increases the risk of fungal attack on the patients. Mucormycosis attacks patients after almost 14 days of their recovery from COVID 19 in the start it seems simple but it gets alarming with time.

**Key Words:** Mucormycosis, COVID 19, Delta variant, Antifungal



Picture Credit: Getty Image

## II. METHODOLOGY

We researched the reports and articles from different websites like Pubmed, Google Scholar and NCBI etc. We also researched from the stats and figures given by Government officials.

**Keywords:** NCBI, PubMed, Google Scholar

### Explanation

The Black fungus we are familiar with in scientific terms is known as Mucormycosis. It is quite a serious but rare fungal infection that we do not see quite often and were not very much familiar with it before COVID 19 outbreak. This spreads because of exposure to the Mucor moulds ( It is the microbial genus of approximately 40 different species of moulds in the family of Mucoraceae ).

They are mostly spread by the inhalation process or by impure/contaminated food like rotten eggs, vegetables and fruits or by the contamination of open wounds. This fungus can also be residing in soils, decomposing organic matter and animal manure. When this type of fungus is present in animal manure, soil and the decomposing organic matter it does not usually affect humans and it also does not travel from human to human but some people are at risk of it and those are immunocompromised, Diabetic, having continuous high level of blood glucose, ketoacidosis because of diabetes(because of the low level of insulin, in response to it the body switches itself to burning fatty acids, which produces acidic ketone bodies ) malignancy( cancer ), organ transplantation, a very high load of iron( accumulation of iron in the body ), Use of steroids for a long time, taking a lot of immunosuppressants( drugs that inhibits the immune activity of the body) and it also occurs because of HIV/AIDS but a little bit.

Symptoms of black fungus attack sometimes look very simple but they can prove fatal or sometimes organ damaging. Symptoms this fungus shows depends on the place of infection, it mostly infects the nose, eyes( most commonly) brain and sinuses. The symptoms it shows are runny nose, one-sided facial swelling and pain, pyrexia( fever ), blurred vision, headaches, bulging of eyes or displacement of eyes and can also result in tissue death.





Picture Credit: Hindustan Times

Now let us have a look at what coronavirus is, it is a SARS CoV 2 virus. It is enveloped, positive single-stranded large RNA viruses that infect humans, but also a wide range of animals. 1996 was the first time when we got to know about what coronavirus is when the two scientists named Tyrell and Bynoe cultivated the viruses from the patients suffering from common colds. When you look at their structure they are circular virions with a core-shell and surface projection similar to a solar corona they were termed coronavirus ( Latin: Corona = Crown). It has four subfamilies named Alpha, Beta, Gamma and last one Delta. Alpha and beta are known to be originated from Mammals such as Bats and gamma and Delta variants are supposed to originate from pigs and birds. Beta type variant of coronavirus is the most severe that can infect humans.

It spreads like most of the other viruses spreads, mostly it starts with the droplets of sneeze, cough or breath from the infected person or if the infected person touches you. The virus could be in the air and you inhale it in or on the surface you touch. As you touch your face or nose or eyes with the infected hand the virus gets passage to the mucus membrane in your throat and within 2 to 14 days your immune system will respond with symptoms like pyrexia ( fever ), cough, shortness of breath or difficulty in breathing, tiredness, body aches, headache, congestion( stiffness in the nasal or breathing pathway ) or a runny nose, loss of taste and smell, nausea or vomiting and diarrhoea.

The Virus will move down the respiratory tract in that passage we have airways of the mouth, nose, throat and lungs. The lower airways (the portion of the larynx below the vocal folds, trachea, bronchi and bronchioles) have more ACE2 (Angiotensin-converting enzyme 2 is an enzyme attached to the membrane of cells located in the intestines, kidney, testis, gallbladder, and heart. ACE2 lowers blood pressure by catalyzing the hydrolysis of angiotensin II into angiotensin) receptors than the rest of your respiratory tract. That's why coronavirus goes deeper than the viruses like the common cold. This will inflame the lungs and will make it tough to breathe which can lead to pneumonia, an infection of the tiny air sacs (called alveoli) in your lungs where the blood exchanges oxygen and carbon dioxide.

### III. RELATION BETWEEN COVID 19 AND MUCORMYCOSIS

Now we will have a look what is the relationship between COVID 19 and Black fungus, as we know Black fungus and COVID 19 mostly attacks those people who are immune-suppressed and diabetic. Black fungus is seen in those patients who got recovered from COVID 19 after 2-14 days of recovery. COVID 19 weakens the immune system of the body as in the case of HIV/AIDS so that's why patients recovering from COVID 19 has a higher Black Fungal attack risk. Any Virus during the replication cycle in the human host suppress the immune system of the body so that the immune system can not clear other bacteria or fungi this can last for few days or a long term effect as in the case of HIV/AIDS same procedure is followed by COVID 19 virus which leads to Black Fungus attack. Another reason is when the patients of COVID 19 took Steroid treatments, this also suppress the immune system of the body and as a result, we see an increase in the risk of patients getting Mucormycosis ( Black Fungus ). Another risk that could be involved here is that the oxygen support we give to people having severe COVID 19 infection can cause drying of the nasal cavity and further increase the risk of infection.

### Why India is Getting affected by Black Fungus

The Black fungus spread in those people who are immunocompromised or diabetic patients have diabetic ketoacidosis and those who had cancer and India has the largest population of diabetic persons which is around 40 million. Even before the start of COVID 19, India had the highest number of cases of Black fungus reported but this increase after the outbreak of coronavirus. This could be because of the weather, sanitary conditions or as India have such a tremendous amount of people who has uncontrolled diabetes.

Why there is a shoot up in the cases after the coronavirus outbreak, so some reasons given by the doctors are;

1. There is an increase in the use of steroids in India for treating coronavirus, doctors intentionally or unintentionally shifts their patients to steroids like dexamethasone and methylprednisolone even in the early stages of viral infection and patients can also buy steroids from the medical stores even without the prescription of any doctor. Steroids suppress the immune system and let the fungus attack. The Steroid also increases the blood glucose level if you have diabetes. In 40% of the cases, mucormycosis( black fungus ) attack on sinuses and erode it and ultimately lead into the brain. The symptoms during these days are headache, one-sided facial swelling and pain, pyrexia( fever ) and blurred vision.
2. As we know India has about 40 million people who have uncontrolled diabetes. High blood glucose levels suppress the immune system and increase the chances of bacterial and fungal attacks. That's why even before the outbreak of COVID 19 India had a higher number of black fungus infections. People with either type 1 or type 2 diabetes and could not manage to control their blood glucose level has a higher risk of getting infected but there is a little bit of hope for those people who has their blood glucose level under control.
3. Lung damage could be another reason that can increase the risk of fungal infection.
4. Unsantitary conditions to some extent are also responsible for it, like using ventilator without proper cleaning process could be one of the reasons of infection transfer but that need to be studied further.



Picture Credits: Getty Images

### Problems Faced while dealing with Mucormycosis

As we know India is a large population with having a lot of uncontrolled diabetic patients. Let's have a look at the problem which India is facing to treat this fungal attack

1. There is a very small number of specialist doctors and hospitals for this disease. They are getting a massive amount of referrals and that is why it is putting pressure on those hospitals and doctors. In India, equipped hospitals and well-trained doctors are also not available in every part of the country that too is a massive problem for them.
2. Shortage of antifungal drugs is also a reason because India was not ready for such a fungal attack and this puts a burden on the manufacturers to produce antifungal drugs
3. India has a population of 1.366 billion which is also a hurdle for medical care staff because it is not an easy task for them to deal with such a tremendous number of people.



4. Uncontrolled diabetes is also causing a problem for doctors as there are 40 million patients with diabetes are currently present, they are at higher risk of getting infected than anyone else
5. Massive use of steroids is also an alarming situation for doctors and paramedic staff. Some doctors or patients sometimes own their on use steroids to treat the coronavirus which results in decreasing the immune activity of the body

#### IV. TREATMENT

1. First of all if the patient is a diabetic patient to hr/she has to maintain the blood glucose level and if the patient is also taking steroids then he/she has to quit it
2. Surgery is required to remove the part of the body which is infected with black fungus as it can spread to the other parts of the body. In most cases, the black fungus infects the sinuses and enters the brain. In some cases, the eye or jaw bone has to be removed to stop the further spread of the fungus.
3. There is a powerful intravenous( to be delivered in vein ) drug known as amphotericin B which can be useful to treat the fungal attack but it is currently in shortage because of several infected people

**Key Words:** Mucor moulds, immunocompromised, diabetes, ketoacidosis, malignancy, HIV/AIDS, SARS CoV 2 virus, RNA virus, nausea, vomiting, diarrhoea, body aches, ACE2 (Angiotensin-converting enzyme 2), alveoli, hydrolysis, replication, steroid, dexamethasone and methylprednisolone.

#### V. END DISCUSSION

Black fungus is quite a rare but dangerous fungal attack, it attacks people who are immunocompromised and have uncontrolled blood glucose levels. Doctors are not quite sure about it, that what are the reasons that's why the black fungus is spreading so fastly in India but it is believed that it is because of the high dosage of steroids or even in small doses but for longer time period excessive while treating coronavirus. Doctors also called diabetes one of the reasons for its spread because diabetes lowers the immune activity of the body. We have a drug named amphotericin B used for this fungal attack but its production is quite low in India and is not effective in every case ultimate treatment is surgery which even involves the removal of eyes or jaws. As in this time, we are not very much aware of the real reasons for black fungus attack and also does not have any proper medication available that's why precaution is the best form of defence here. Took precautionary measures and keep everyone safe.

KeyWords: Uncontrolled blood glucose level, jaws, amphotericin B

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