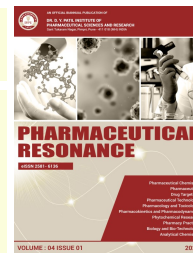




REVIEW ARTICLE

A REVIEW ON PROGRESS AND CHALLENGES OF EPIDEMICS FUNGAL INFECTION



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ABSTRACT : Since the pandemic there are serious concerns about COVID -19 patient's cases and cases of post COVID-19 recovery which is affected by Epidemic Fungal Infections. In this article recent information about different types of fungi which is found in post COVID-19 recovery patients which include Black fungus, White fungus, Yellow fungus and recently found Green fungus. This paper compiles the data about detail information about fungus with their causes, symptoms & precaution.

Keywords : *Black Fungus, Blue Fungus, Yellow fungus.*

India has had high rates of COVID-19, with more than 27 million confirmed cases since January 2020. In addition, the World Health Organization (WHO) has declared the B.1.617 SARS-CoV-2 virus variation in India to be a "variant of global concern."

Since the pandemic, there have been serious concerns about the rise in Covid-19 cases, as well as a number of fungal infections in post COVID-19 recovery patients. People infected by COVID-19 are killed by the Rhino-orbital Mucormycosis i.e. black fungus [1], invasive aspergillous a severe form of Whitefungus [2] and more dangerous Yellow fungus[3] from the environment during patients post COVID-19 recovery. The fungal infection is spreading in India where the new crown is rampant.

According to Government data till 25th May 2021, 9000 above sever cases of Black fungus and White fungus are reported in Six Indian States such as Karnataka, Uttarakhand, Telangana, Madhya Pradesh, Andhra Pradesh, Maharashtra and other states, from that severity of cases is found in Gujarat , Maharashtra ,Bihar [4]. First case of Yellow fungus reported from Ghaziabad in Utter Pradesh[2]. According to a report published in the 'Times of India,' the Indian government has urged states to declare the Black Fungus disease a 'epidemic' under the Epidemic Diseases Act 1897 by May 20, 2021.

After a new type of fungal infection was discovered in recovering COVID-19 patients, India's Health Ministry has asked pharmaceutical companies to increase production and distribution of antifungal medications[4].

The primary reason to development of fungal infection in COVID -19 patients are a perfect environment of low oxygen (hypoxia), high glucose (diabetes, new-onset hyperglycemia, steroid-induced hyperglycemia) which lower the body's immune defences[1]. SARS- CoV-2 medication, steroid medication appear to help prevent some of the harm that can occur when the body's immune system goes into overdrive to fight the coronavirus by reducing inflammation in the lungs but side by they leads to immunosuppression and rise the blood sugar level in both diabetics and non-diabetic Covid-19 patients[5]. Acidic medium (metabolic acidosis, diabetic ketoacidosis), high iron levels (increased ferritins), and impaired phagocytic activity of white blood cells, also prolonged hospitalization with or without mechanical ventilators, improperly sterilized medical equipment and lack of personal hygiene are the other risk factors, appears to be helping Mucorales spores to germinate in persons with COVID-19 [1, 2]. Humidity level below 30 to 40 percent and exposure to moisture can promote the growth of fungus[6].

Black and yellow fungus infection affects sinuses, air pockets located behind the forehead, nose, and cheekbones, in between the eyes and teeth, spreads to brain, lungs, unnecessary rashes and burning sensation to skin[5]. Yellow fungus Infections cause pus leakage and slow healing of wounds. In serious cases, they can also cause devastating symptoms such as organ failure and acute tissue death. White fungus

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affects the esophagus and cause difficulty in swallowing food. White patches are also commonly found in the mouth [2]. Patients suffering from the fungal infection typically have symptoms of a fungal infection include a stuffy and bleeding nose, eye swelling and pain, drooping eyelids, blurred vision and lastly vision loss, breathing difficulties and coughing blood. Around the nose, there could be blackening or discoloration patches of skin. Late hospitalization and treatments leads to direct loss of vision and require to surgically removing eyes to stop the infection reaching to the brain, according to data created by Center of Disease Control and Prevention (CDC) [5]. The patients who found to be infected should be examined clearly with a fungus culture test of their phlegm or mucus to detect fungal infection in their body. The key of early diagnosis is to suspect the degree of potential immunosuppressive diseases. Identify the signs and symptoms, supportive imaging, histopathology and culture of the involve tissues.

Black Fungus

Rhizopus arrhizus and mucor formally known Zygomycetes which are responsible for Mucormycosis i.e. black fungus. Set of Mucormycetes are common soil pathogens that can be found in soil, plants, manure, rotting organic debris such as bread, hay, and vegetation. Mucormycosis appears as blackish necrotic eschars on mucosal and cutaneous surfaces, thus it is commonly referred to as "black fungus." It associates most prevalent symptoms like rhino-orbital-cerebral (sinus and brain), followed by skin, cutaneous, gastric, and pulmonary (lungs) like severe clinical diseases. Inhalation, respirations are the most prevalent method of infection; however it can also be spread through skin, skin wound and subcutaneous inoculation [7]. Early aggressive surgical debridement of infected tissues, as well as injection of amphotericin B deoxycholate (AmB) or liposomal amphotericin B, is often required for the treatment of mucormycosis (L-AmB), showing affecting efforts to tackle the black fungus infection, according to Center of Disease Control and Prevention. CT (computerised tomography) and MRI (magnetic resonance imaging) scanning techniques are used for the confirmation of presence of black fungus [8]. Mucormycosis is not a contagious. But mucormycosis is more common in people who have significantly impaired immune systems. It includes diabetes, cancer, HIV, skin injury, surgery [9].

Fig. 1 is the photo of typical morphology of hyphenated aspergillosis (Periodic acid Schiff (PAS) staining, 200 magnifications). The hyphae of Aspergillus are 3-5 μm wide, septum regular. Regularly bifurcated [10]. It is published by the European Union of Medical Mycology.

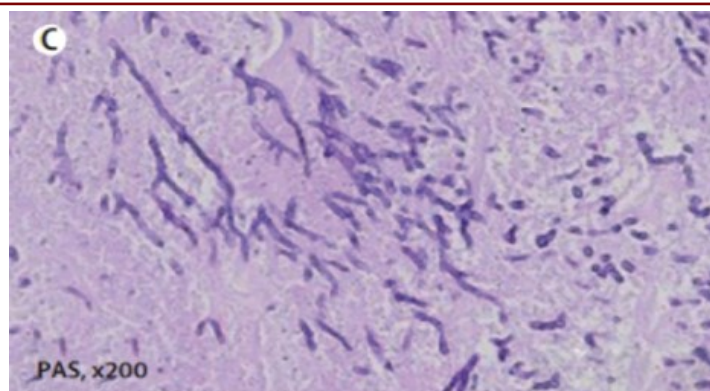


Fig 1: Morphology of hyphenated aspergillosis.

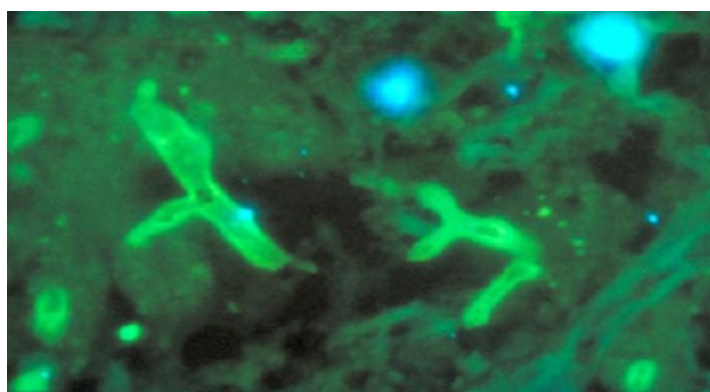


Fig 2: fluorescence antigen stained Rhizopus arrhizoides.

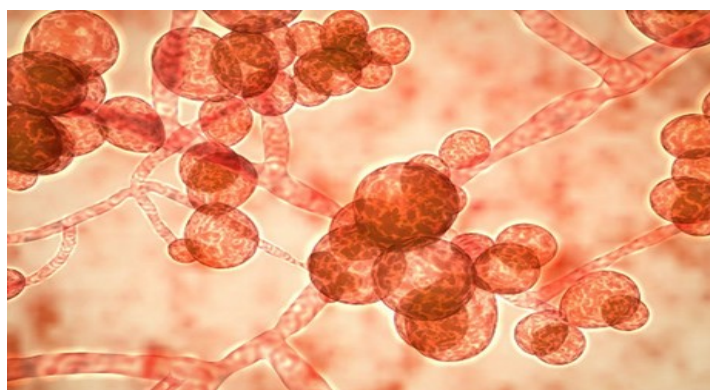


Fig 3: Candida auris causes serious multidrug-resistant infection .



Fig 4: Yellow Fungus

Fig. 2 is the fluorescence antigen stained *Rhizopus arrhizoides* was selected from the CDC public health image library (Phil) [11]. Fluorescence can be viewed under fluorescence microscope by staining tissue samples with fluorescent antigen.

White Fungus

This is the Photo of *Candida auris* causes serious multidrug-resistant infection in hospitalization patients (Fig. 3). Which is hospitalized in May in Patna and Bihar, he was the middle-age patient suffering from Covid-19. *Candida auris* (*C. auris*) is one of the world's most feared hospital microorganisms, having been discovered just over a decade ago.

Candida fungi are divided into two types: *auris* and *albicans*, both of which can be lethal to humans. This bloodstream infection is the most commonly seen pathogen in critical-care units around the world, with a 70 percent fatality rate. *Candida* is a type of microbe that can be found on a variety of surfaces, including shower curtains, computer displays, doctor's stethoscopes, and train carriage railings. Some fungal illnesses have symptoms that are similar to Covid-19, including as fever, cough, and shortness of breath. Symptoms of superficial *Candida* infections include a white-colored thrush in the nose, mouth, lungs, and stomach, as well as in the nail beds, thus the name "white fungus". Also when fungus attacks private parts, there is a white color discharge and thus it is name as white fungus. A drop in blood pressure, fever, abdominal pain, and urinary tract infections are common symptoms of a more invasive form of infection, in which the insect penetrates into the bloodstream. The respiratory system, the central nervous system, and internal organs, as well as the skin, can all be infected by *C. auris* [12]. It is also found that patient with HIV/AIDS are at a much higher risk of contracting such fungus.

Yellow Fungus

The yellow colour pus that is formed in the area wounded by the fungus, people are calling it as a "Yellow Fungus" (Fig. 3). Yellow fungus is a fungus that spreads through polluted settings or when a patient inhales mold from the environment. It can also be spread by eating infected or expired food. The transmission of the virus is aided by unsanitary circumstances, inadequate hygiene, and a high amount of humidity. Yellow fungus isn't contagious; it can't transfer from one person to another. In terms of how it spreads, it differs from both black and white fungal infections. The yellow fungus assaults the body's internal organs and disrupts key physical processes, whereas the black fungus spreads quickly and causes facial disfigurement. Weight loss, fatigue, and a loss of appetite or no appetite are among

symptoms of yellow fungus, also called as mucor septic. Other signs and symptoms include pus formation and leakage, as well as sunken eyes. Wound healing is slowed and extended as a result of the yellow fungus. In severe situations, it can lead to starvation, organ failure, and necrosis. Yellow fungus causes far more serious damage, because it spreads throughout the body, causing additional internal damage. As a result, people should begin observing its symptoms from the first day and seek medical advice [13, 14].

Green Fungus

June 16, 2021, "Green fungus" infection was detected in a Covid-19 survivor in Madhya Pradesh's Indore, possibly the first such instance in the country, according to doctors. According to Hindustan Times sources, the 34-year-old was flown to Mumbai's Hinduja Hospital for treatment after recovering from Covid-19. It is found that he had a 90% lung infection with aspergillosis infection in his sinuses, lungs and blood. Green fungus was discovered in his lungs during the diagnosis, which is distinct from Mucormycosis or Black Fungus. This could be the country's first case of green fungus. Institute of medical science mentioned that the patient made a full recovery. However, he began to experience nosebleeds and a high fever. He had also gotten extremely weak as a result of his weight reduction [15].

Aspergillosis is a fungal infection caused by the common mold *Aspergillus*, which can be found both indoors and out. Aspergillosis is caused by inhaling tiny *Aspergillus* spores from the environment. Most people can inhale *Aspergillus* spores without becoming ill, but those with compromised immune systems or lung illnesses are at a higher risk of developing health problems [15].

People with cystic fibrosis or asthma are more likely to develop allergic bronchopulmonary aspergillosis (ABPA). People with other lung disorders, such as tuberculosis, are more likely to develop aspergillomas. Also known as a "fungus ball." People with other lung disorders, such as tuberculosis, chronic obstructive pulmonary disease (COPD), or sarcoidosis, are more likely to develop chronic pulmonary aspergillosis. People with weakened immune systems, such as those who have undergone a stem cell or organ transplant, are undergoing cancer chemotherapy, or are taking high doses of corticosteroids, are susceptible to invasive aspergillosis. Among hospitalized patients with severe influenza, invasive aspergillosis has been reported [15].

Wheezing, shortness of breath, cough, and fever are all signs of allergic bronchopulmonary aspergillosis (ABPA), which are comparable to asthma symptoms.

Stuffiness, a runny nose, a headache, and a loss of smell are all symptoms of allergic Aspergillus sinusitis. Cough, bloody cough, and shortness of breath are all symptoms of an aspergilloma, or "fungus ball." People with chronic pulmonary aspergillosis experience weight loss, coughing up blood, exhaustion, and shortness of breath¹⁵.

Conclusion:

Because of black fungus, white fungus and yellow fungus are such a novel ailment; there isn't much knowledge on it yet. It is, however, preferable to safeguard your health by adopting cautious precautions. Individuals with weakened immune systems and other pre-existing disorders are more susceptible to fungal infections.

Diabetes patients should keep their blood sugar levels under control. They should also maintain hygienic and sanitary conditions in their surroundings. Ensure that all surfaces are disinfected. Remove any food that has gone bad or is stale. Individuals should monitor the humidity levels in their rooms and homes. Individuals who require oxygen should ensure that the oxygen is properly filtered and that the water filter is clean and changed on a regular basis. Medication and steroid use should be maintained to a minimum.

Apart from that, experts advise that people avoid unsafe surroundings and follow proper standards such as wearing masks on a regular basis and exercising social distancing. If they must go outside, they should dress in clothing that protects their skin from contamination.

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