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Invasiveness of black-fungal (Mucormycosis) disease among patients suffering from COVID-19: Review

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Abstract

A collection of moldy filamentous belonging to the orders Zygomycetes additionally Mucorales produce the infection known as mucormycosis. A frequent name for mucormycosis is "black fungus disease." This infection primarily affects diabetics and people with impaired immune systems. Inhaling mold containing industrial oxygen increases the risk of mucormycosis while COVID-19 infection lowers patients' immunity. The main goal of this review is to supply a thorough synopsis of COVID-19, recognize the essential fungal agent, and illustrate the Invasiveness and morbid manifestation as complications of COVID-19. During 2023, a thorough literature search was conducted using keywords like "Mucormycosis", "Blackfungus," "Mucorales," and "Zygomycetes," in search engines including PubMed, Google Scholars, Research Gate, and SCOPUS. If not properly detected, the rare invasive fungal infection known as mucormycosis has a greater fatality rate. Mucorales frequently attack the endothelial cells in vascular tissue. Depending on anatomical localization, mucormycosis can be classified into six different categories; disseminated, miscellaneous, gastrointestinal, pulmonary, cutaneous, and rhino-cerebral. In conclusion; In the review of available literature, we present a summary of the key variables that influence the Black-Fungus (Mucormycosis) development in novel COVID-19 patients.

Keywords: Invasiveness, Mucormycosis, Complications, Black-Fungal, COVID-19

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Introduction

The word “coronavirus” comes from the Greek word korn, meaning “tag: crown” or “wreath,” and was first used to describe a virus among spike-like projections [1]. An epidemic of a new virus that began in early December 2019 from Wuhan, Hubei Province, China, caused by a coronavirus (CoV) known as “novel coronavirus 2019” or Coronavirus Disease 2019 “COVID-19” from the World Health Organization (WHO) [2].

COVID-19 is a pathogenic virus, as most coronaviruses cause infection in the respiratory and systemic systems. Coronavirus can enter the body and cause severe acute respiratory syndrome (SARS) through its receptors that are located in various organs such as the heart and lungs. Kidneys and gastrointestinal tract, making it easier for the virus to enter target cells. CoV entry into the host cell is initiated by binding to a glycoprotein [3].

A novel Coronavirus disease 2019 (COVID-19) caused by a new type of coronavirus was discovered for the first time during the disease outbreak in 2019. The disease is caused by a new strain of coronaviruses, and this virus is related to the Coronaviridae family of viruses and causes Severe Acute Respiratory Syndrome (SARS) [4]. The Wuhan strain was known to be a new strain of the beta coronavirus with a genetic similarity of 70% with the SARS virus, and it was believed that the origin of the virus was from snakes, but many prominent researchers differ in this belief. And because this virus is 96% similar to bat viruses, it is widely believed to be of bat origin [5].

Coronaviruses (CoVs) are a family of viruses where there is no coronavirus for other humans. Humans can infect domestic animals, light birds, mice, and various other wild animals in the organ, disease, injury, and central nervous system, [6; 7] Encapsulated coronaviruses contain viruses on the simple microcontroller genomes and primers learned from coronaviruses [8].

Abroad domains of signs and complexity have emerged during a current COVID-19 pandemic, demonstrating a varied illness pattern from mild to life-threatening pneumonia with concomitant bacterial and fungal co-infections [9].

The order Mucorales causes mucormycosis most frequently. These organisms are common in nature, and rotting fruit and stale bread are excellent places to find their spores. Worldwide, Mucor infections are common, although they are almost exclusively limited to people who have an underlying risk factor, such as burns, leukemias, or acidotic conditions like diabetes mellitus [10]. Rhinocerebral mucormycosis, the most common clinical type, is brought on by the sporangiospores' germination in the nasal passages and the hyphae's invasion of the blood arteries, which leads to thrombosis, infarction, and necrosis. Following inhalation of the sporangiospores and invasion of the lung parenchyma and vasculature, thoracic mucormycosis develops [11].

Rhino-cerebral mucormycosis, the most prevalent type of the condition, which can be fatal in less than a week, is caused by an infection that starts in the sinuses or nasal mucosa and spreads to the orbits, palate, and brain. Numerous cases are seen since the illness is so severe [10].

Material and Methods

The Selection Papers Elements recommended reporting for Reviews followed the whole approach of presenting this Systematic Reviews depending on previous publishing studies. During 2023 the seeking terms "COVID-19" and "Black Fungi" were used by the writers to independently seek news channels and PubMed research.

Keywords were confirmed according to the coinciding system related to the medicine. This review was done depending on the researchers of previous studies among the articles that were present in the search.

Because it was a systematic evaluation of previously published studies, no informed consent nor ethical approval was necessary for this study. Additionally, neither animal nor human participated in this review study. So, obtaining an ethics approval was not necessary.

Result

Symptoms and mode of transmission

The clinical symptoms of this disease are similar to the symptoms of Middle East Respiratory Syndromes (MERS) and SARS [12], and the period incubation of the causative virus is 4 to 7 days and may reach 14 days in some cases [13]. Symptoms of this disease range from prevalent symptoms suchlike high fever, shortness of breath, and dry cough in addition to secondary symptoms such as diarrhea and intestinal inflammation, and may reach heart failure [14].

The virus can spread from one person to another through tiny droplets of droplets that fly from the nose or mouth when someone coughs or sneezes; when this droplet is inhaled by another person or touches a surface where it has settled and then touches his eyes, nose, or mouth, the infection may spread to her; or By handling contaminated objects, shaking hands, being around infected animals, or consuming raw meat [15].

It is impossible to spread mucormycosis illness from one person to another because it is not contagious. People get sick when they come into contact with fungus spores in the environment. The spores will enter the sinuses or lungs if inhaled. A fungal infection may develop on the skin If the body is bitten, scratched, or burned where the fungus penetrates and [16].

The infection will then travel through the bloodstream to several organs, primarily the heart, spleen, eye, and brain. Mucormycosis outbreaks have taken place in the past, despite the fact that the majority of cases are sporadic. Adhesive bandages, wooden tongue depressors, hospital linens, negative pressure areas, water leaks, insufficient air filtering,

and non-sterile medical equipment have all been linked to mucormycosis outbreeding. Community-onset outbreaks have also been linked to natural events [16].

Symptoms begin to show up two to three days after a person recovers from the COVID-19 infection, also known as mucormycosis or black fungus. This fungal infection starts in the sinus and spreads to the eyes within two to four days after the patient has been free of Covid-19. In the next 24 hours, the black fungus will spread to the brain. According to the CDC, the signs and symptoms of mucormycosis depend on where the infection is located in the body. One-sided facial edema, coughing, nasal or sinus inflammation, fever, and rapidly worsening black lesions on the nasal bridge or upper interior of the mouth are the main symptoms of rhinocerebral (sinus and brain) mucormycosis. The symptoms of pulmonary lung mycosis include fever, shortness of breath, coughing, and pressure in the chest. improved results [16].

Complications and Risk Factors

The most common complications of COVID-19, according to [17] are; Acute respiratory distress syndrome, acute respiratory failure, pneumonia, secondary bacterial infection, acute cardiac injury, acute liver injury, acute kidney injury, septic shock, disseminated intravascular coagulation, venous thromboembolism, multisystem inflammatory syndrome in children, and fatigue. Severe COVID-19 risk factors are older age (65), diabetes, cardiovascular disease, obesity, cancer, chronic obstructive pulmonary disease, and chronic kidney disease [18].

The phylum Zygomycota includes a group of molds that include filaments and are responsible for angioinvasion, and tissue necrosis. People are exposed to these molds through the eating of contaminated food, inhalation of mold spores, or inoculation of damaged skin or wounds. Due to the black lesions they leave behind after infection, mucormycosis is sometimes known as the "black fungus" [19]. Result from a number of factors, including the inability of the human immune system to effectively remove the infection, the aggressive nature of the infection, mucormycosis has an extremely high death rate of more than 50% [20]. Patients with a compromised immune system are more susceptible, as are those with diabetic ketoacidosis, long-term antibiotic usage, and/or steroid use [21].

Oversensitive to Infections with Mucormycosis

The person who has a strong immune system, black fungus rarely affects them. People with low immunity levels are particularly susceptible to the fungus. The cause of the sickness and the high patient mortality rate in intensive care units may be traced back to this. Patients with suppressed immunity who have COVID-19 are particularly vulnerable to infection in the present scenario. The list of recently increasing black fungus instances now includes

COVID-19 patients who also have cancer, diabetes, heart disease, kidney illness, or who are using COVID steroids [16].

Clinical Aspects of Black Fungi with COVID-19

Clinical aspects (Manifestation) of mucormycosis can be classified based on the manifestation site. It is recorded as cutaneous mucormtcosis, gastrointestinal, pulmonary, rhino-cerebral-orbital, and disseminated mucormycosis, as clarified in Figure 1. and Table 1.

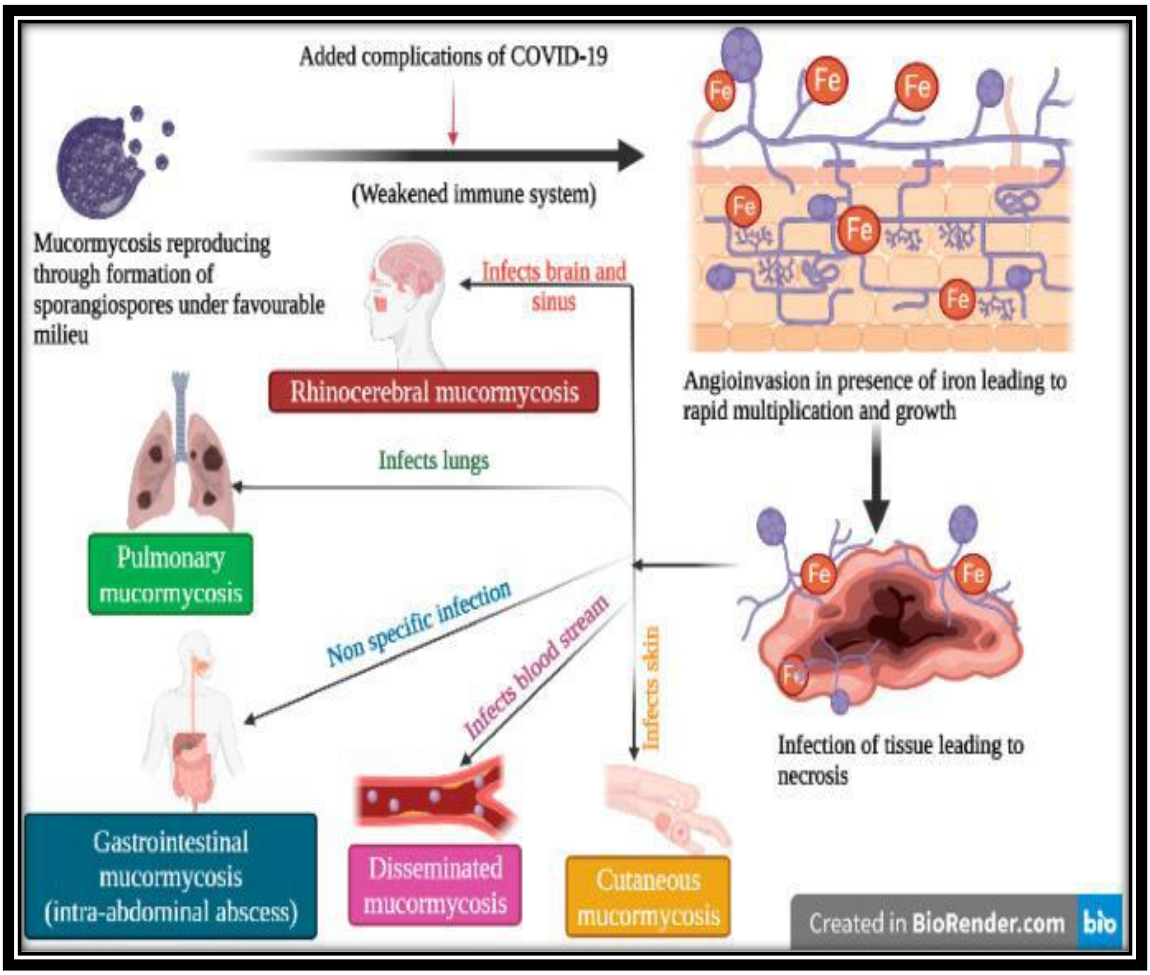

Figure 1.

Patients with Mucormycosis post (COVID-19) complication [22].

Table 1.

Some Invasiveness of Mucormycosis (black-fungi) and their clinical aspects among patients with COVID-19.

Kinds	Invasiveness	Clinical aspects	References
Cutaneous Mucormycosis	Immediate insert of skin via thermal burn	Ulcers on the skin and the infected area can turn Black color Lesions on the skin. Redness, and swelling around ulcers.	[23]
Gastrointestinal mucormycosis	Consumption of tainted breads, milk, and homeopathy manufacturing result in colon, Appendix and colon stomach affected.	Cecal, Appendiceal, Gastric perforation, with fever, abdominal pain, nausea and diarrhea	[19; 22]
Pulmonary Mucormycosis	Invasion the blood vessels via fungal infection	Occlusion of bronchial airways, infestation the tracheal of the lung, Fever and unproductive cough	[24]
Rhino-orbital cerebral	Sporangiospores inhalation result in invade the sinus and brain tissue	Sinusitis, headache blurry vision, facial pain	[25]
Disseminated Mucormycosis	The infection distributes via the bloodstream to different organs of the body	Generally, influence the brain, however also other organs suchlike the heart, spleen and skin.	[26]

Discussion

From this review study clarified that Mucormycosis is an emerging trouble in individuals with COVID-19; additionally, the recovery cases and implicate a poor alarms. Cutaneous mucormycosis results from burns or trauma in the skin. Black discoloration and surrounding edema at the site of infection lead to gangrene in oversensitive hosts. Sophisticated gradually, lesions appear on the skin as in **Figure 2.A.** [27].

Gastrointestinal Mucormycosis is mostly involved in malnutrition patients. The symptoms range from simple colonization of stomach ulcers to infiltrative illness with venous invasion. It can be classified into three categories: vascular invasion, infiltration, and colonization as in **Figure 2.B.** [28].

Solitary Pulmonary mucormycosis is intricate to diagnose and radiological imaging is requisite as several symptoms may overlap with pulmonary features of COVID-19 However, characteristics are particularly of pulmonary mucormycosis such as tissue infarction and hemoptysis. Pulmonary mucormycosis is commonly perceived with neutropenic patients as in **Figure 2.C.** [29].

Rhino-orbital-cerebral Mucormycosis (ROCM) rarely causes infection, especially in oversensitive patients; it is distinguished via immediate infestation with remarkable tissue necrosis of neighboring structures followed by prompt development, and angio-invasion from the nasal, sinus mucosa to the brain, and orbit. Rhino-orbital condition that must be observed and treated instantly to evade morbidity and mortality as in Figure **2.D.** [30].

Disseminated mucormycosis is an invasive mold and often fatal which is commonly takes place among strictly immune-compromised patients such as hematological maliciousness as in **Figure 2.E.** [26].

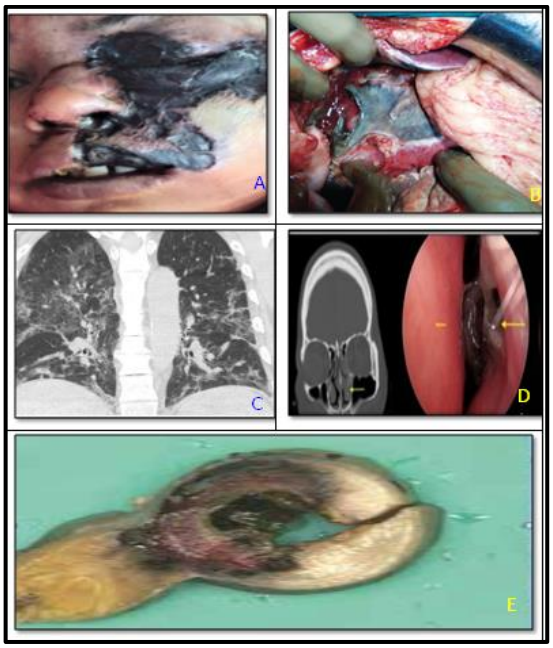

Figure 2.

A. Patients suffering from Mucormycoses in the skin on their face result in the necrotizing lesion. [31]. **B.** Patients suffering from Mucormycoses on the pyloric end of the stomach result in necrotizing gastric lesions [28]. **C.** Patients suffering from pulmonary Mucormycoses [30]. **D.** Patients suffering from inflammatory & necrotic spread outside the sinuses due to Mucormycoses [25]. **E.** Patients suffering from multifocal hemorrhagic necrosis on the partial jejunectomy [26].

Conclusions

With a few notable exceptions, this systematic review found that Mucormycosis (Black Fungus) is an unusual type of invasive fungal infection that typically influences immunocompromised. It has recently been discovered in the bodies with a novel Coronavirus 2019 (COVID-19), particularly with weakened immune systems from COVID-19-infected patients who have a higher mortality rate. Based on location, the rhino-cerebral and pulmonary forms of the six different types of black fungus have the highest patient fatality rates. As a result of the pandemic, there are an increasing number of seriously ill individuals who are infected with COVID-19 and have mucormycosis. Mucorales are abundant in the environment, therefore even though they are not continuous from one person to another, it may be found anywhere. Mucormycosis has a high mortality rate and has been observed in other parts of the world.

Abbreviations

Not applicable

Declarations

Ethics approval and consent to participate

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Competing Interests

The author declares that the research was conducted without any commercial or financial relationships that could be construed as a potential conflict of interest.

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