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Mucormycosis: An Emerging Threat among Covid-19 Patients in India

Sudhir Kumar Prajapati[1], Moon Moon Sathpathy[1], Esha Sinha[1], Arpita Sain[1], Richa Sarkar[1], Venu Gore[1]
[1]PhD Scholar, ICAR-Indian Veterinary Research Institute, Izatnagar, Bareilly-243 122, Uttar Pradesh, India

Abstract: Mucormycosis moulds are more likely to affect patients who have hyperglycemia, ketoacidosis, solid organ or bone marrow transplantation, liver cirrhosis, or neutropenia. Accurate diagnosis and timely treatment are essential for managing the diseases; this may require the use of antifungal medications in addition to surgical involvement with the affected tissues. Apart from the well-established and conventional first-line therapy of posaconazole or amphotericin B-based medications, a plethora of novel medicines possessing antibacterial action against Mucorales are under investigation.

Introduction

India has been greatly impacted by the global pandemic Covid-19, which was brought on by the "Severe Acute Respiratory Syndrome Coronavirus-2 (SARS-CoV-2)". On January 30, 2020, the first COVID-19 case was reported in Kerala, India. By May 2020, the majority of instances-roughly one lakh cases every day-had been reported for the year (Andrews *et al.*, 2020). India has been severely affected by the COVID-19 global pandemic, which was sparked by the "Severe Acute Respiratory Syndrome Corona Virus-2 (SARS-CoV-2)". Following that, the second wave started in March 2021 and had a lot more active cases than the first wave because there weren't enough hospital beds, oxygen cylinders, medications, vaccines, or supplies of vaccines. Covid-19 is associated with a number of illnesses, such as diabetes, heart disease, and immune system problems. Its effects range widely, from moderate to severe to even life-threatening (Gandhi *et al.*, 2020; Apicella *et al.*, 2020).

Mucormycosis or black fungus

Mucormycosis is also referred to as "black fungus" due to the black coloration caused by the necrosis of infected skin tissue. Fungal infections of the "mucormycosis" class are the least prevalent, after aspergillosis and candidiasis. According to Mohindra *et al.* (2007), the species of Mucoraceae include Rhizopus arrhizus, Rhizopus pusillus, Absidia elegans, and Mucor racemosus. Patients having a history of COVID-19 were shown to have a higher prevalence of mycormycosis with a rather severe course when they got systemic corticosteroid therapy.

Clinical pathogenesis

Mucormycetes mould has the capacity to infiltrate vulnerable hosts through the nostrils, mouth, or burned/ruptured skin, causing infections in the rhino-orbito-cerebral, gastrointestinal, or cutaneous wounds (Mohindra *et al.*, 2007). Additionally, it may cause vascular thrombosis and tissue necrosis (Rapidis, 2009). Angiotensin-converting enzyme 2 (ACE 2), which is present in pancreatic beta cells, the lungs, the kidney, and the small intestine, is attached to a spike protein on the envelope of SARS coronavirus 2 that allows it to enter the body (Bourgonje *et al.*, 2020). The pathophysiology of diabetes mellitus patients in ketoacidosis also demonstrated that an acidic pH (7.3–6.8) and hyperglycemia cause iron to be released from binding proteins, which raises the level of free iron in the blood. *Rhizopus arrhizu* and *Rhizopus oryzae*, two mucormycosis moulds that flourish on this free iron (Ibrahim *et al.*, 2012)

Signs and symptoms

Major signs and symptoms of Mucormycosis during or after Covid-19 medication include fever, headache, and reddish

swollen skin around the eyes and above the nose (Gupta, 2021). In addition, patients complained of altered vision, eye edoema, ocular pain, facial edoema, and shortness of breath.

Diagnosis

Based on a detailed clinical evaluation, a full patient history, specialised testing, and the identification of certain symptoms, mucormycosis is a very difficult diagnosis and a difficult undertaking for doctors. Aspergillosis can be identified with a galactomannan antigen test, however mucormycosis does not react to any antigen detection assays. (Ribes *et al.*, 2000). Using the histology of diseased tissue, mucorales can be identified from Aspergillus or other hyaline moulds by their non-pigmented, wide (5–20 m), thin-walled, ribbon-like hyphae. Specimen culture is a key strategy since it can develop quickly at temperatures between 24 and 37°C in a matter of 24-48 hours. The tissue culture approach permits genus and species-level identification (Walsh *et al.*, 2012). Early diagnosis and tracking of mucormycosis, which is challenging to identify by histopathological examination, is possible using quantitative polymerase chain reaction detection of circulating DNA in serum (Milon *et al.*, 2016).

Treatment

The presence of multiple risk factors in patients with COVID-19, along with the additional immunosuppression caused by systemic corticosteroids, predispose the occurrence of mucormycosis, which could negate the mortality benefits offered by systemic corticosteroids in this patient population (Kow *et al.*, 2020). Common risk factors include the presence of diabetes mellitus, particularly with ketoacidosis. Intravenous amphotericin B is the medicine of choice for initial therapy of mucormycosis; a lipid formulation of amphotericin B (liposomal amphotericin B or amphotericin B lipid) is preferred to lower the risk of nephrotoxicity (Mistro *et al.*, 2012). While amphotericin B is widely considered the first-lineagent for the treatment of mucormycosis. For individuals who have responded to amphotericin B, step-down therapy with posaconazole or isavuconazole is utilised (Vehreschild *et al.*, 2013).

All risk factors for Mucormycosis infection need to be eliminated or controlled in order to treat the infection properly. Three days prior to the diagnosis of mucormycosis, blood samples can be used to detect Mucorales DNA using a polymerase chain reaction (PCR) approach demonstrated (Million *et al.*, 2013).

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