

Risk Factors of Black Fungus- A Review

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ARTICLE INFO

Article History:

Received: 05.06.2021

Revised: 10.07.2021

Accepted: 22.07.2021

Keywords:

Black fungus

Risk factors

Immune system

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ABSTRACT

Mucormycosis (Black fungus) is a rare deteriorating fungal infection and acquired predominantly by the inhalation of sporangio-spores. According to CDC, India has reported 8,480 cases of black fungus. Spores of black fungus are ubiquitous and were present everywhere in soil, leaf, compost piles and decaying organic matter at once. But, they have less virulence and mostly don't cause any infection. There are some risk factors which weaken the immune system and makes advantages for black fungus to infect humans. The main aim of this review is to overview the risk factors of black fungus which help the public and health care professionals for better prevention strategy.

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Introduction

Mucormycosis (Black fungus) is a rare deteriorating fungal infection and acquired predominantly by the inhalation of sporangio-spores. It has become a night mare in India. The largest order Mucorales are responsible for causing mucormycosis. Spores of black fungus are ubiquitous and were present everywhere in soil, leaf, compost piles and decaying organic matter at once [1]. But, they have less virulence and mostly don't cause any infection. According to Centres for Disease Control and prevention (CDC), India has reported 8,480 cases of black fungus. The case fatality rate of black fungus is 54%. However, the cases were reported in India well before covid-19 pandemic [2]. The infection could be seen rarely in organ transplant and cancer patients. The primary case was diagnosed by Friedrich Kuchenmeister in the year 1855 [3]. During covid-19 pandemic, the 1st case in India was reported at Gujarat in the year 2021. There are some risk factors which weaken the immune system and makes advantages for black fungus to infect humans. The main aim of this review is to overview the risk factors of black fungus which help the public and health care professionals for implementing the better prevention strategy.

Diabetes mellitus

Diabetes mellitus is the most common risk factor of black fungus. It leads to tremendous health

problem in India. Excess glucose in blood impairs the defence mechanism by suppressing cytokine production and phagocytises. The cytokine, IL-6 is mainly responsible to induce production of antibodies against pathogens.

Elevated levels of blood glucose causes dysfunction of compliment and Fc- γ receptors present on isolated monocytes. Thus, results in suppression of cytokine production. In India, 71% of cases infected with black fungus had a medical history of diabetes mellitus [4].

Diabetic ketoacidosis

People with diabetic ketoacidosis are also at higher risk of developing the black fungus infection. Excess ketones make our blood more acidic. It decreases binding of iron to the trans-ferritin. Free iron ions in blood increase the growth of black fungus [4].

Iron overload

People with haematological disorders (Thalassemia and Leukaemia) are more prone to develop iron overload. Irrational use of iron supplements is also one of the reasons behind the flare up of black fungus in India. Black fungus absorbs iron in the form of haem and free iron ions for cellular process and produce energy for their growth. Excess

amount of free iron ions suppresses the phagocytosis by destruction of haemostasis [5].

Zinc overload

All eukaryotic organisms need zinc for their cellular growth. During pandemic, demand for immunity boosters have increased and people are consuming zinc supplements. Prolong supplementation of zinc, more than recommended daily allowance (40 mg/day) causes zinc overload in the blood. Fungus secretes zinco-phores (zinc binding molecule) to absorb zinc for their growth and survival [5].

Steroids

Corticosteroids are anti-inflammatory drugs used to suppress undesirable inflammation and immune system reaction. Early and wrong administration of steroids leads to more risk than benefit. However prolonged use of steroids causes excess stimulation of glucocorticoid and mineralocorticoid receptors, results in immune suppression by segregating CD4+ T-lymphocytes. It leads to the flare up of black fungus infection [6].

Covid-19 infection

Number of black fungus cases was relatively low before the covid-19 pandemic. Prevalence was raised during the pandemic. SARS Cov-2 infection weakens the immune system and make vulnerable to opportunistic infections such as black fungus [7].

Unsterilized medical appliances

Unsterilized utensils and medical appliances may increase the risk of developing black fungus. Contaminated oxygen equipment and impure water in humidifier might flare up the infection. Dry nasal cavity in patients with long oxygen support allows fungus to invade into the body [8].

HIV

HIV is one of the reasons behind amid raise of black fungus in India. HIV, specifically target CD4+ cells to make copies by replication. Destruction of these T-cells, inhibit the immune response and opens the way for various secondary infections. Decline in T-cell count is an opportunity for black fungus to spread to various parts of the body [8].

Kawasaki disease (KD)

The incidence of KD has continued to increase over the last 20 years in Asian countries. People with KD, phagocyte cells (T-cells and B-cells) were declined and likely to get infected with black fungus. It triggers prolong self-directed immune response. Children whoever living with KD are at higher risk to get infected with black fungus [9].

Conclusion

Further studies are needed to theorize the presence of risk factors and susceptibility of infection. Risk of fungal infection is more in diabetic and covid-19 patients receiving excess supplements and steroids. Evidence based information may helps the public and health care practitioners to be vigilant about risk factors of secondary infections.

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