Emergence of a medley of invasive fungal infections amidst the coronavirus disease 2019 (COVID-19) pandemic in India

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To the Editor—The coronavirus disease (COVID-19) outbreak caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has affected the whole world while disrupting global health. Even with the second wave of the pandemic now abating slowly but steadily, cases of fungal infections among COVID-19 patients and those who have recovered are imposing an extra burden. While the country was already reporting a staggering number of ‘black fungus’ (mucormycosis) among COVID-19 victims, reports of the emergence of ‘white fungus’ and subsequently a case of ‘yellow fungus’ and most recently ‘green fungus’ have sparked further tension.

Mucormycosis, caused by Mucorales, a type of mold present in damp environments like soil or compost, is a rare and lethal fungal infection commonly affecting immunocompromised individuals. It is characterized by tissue necrosis and targets the sinuses, lungs, brain, and skin. A study on mucormycosis cases found an overall mortality rate to be 54%, which may be even higher when including underlying comorbidities and coinfection with COVID-19.2

Candida auris, an Ascomycetes yeast, also called ‘white fungus’ is an emerging global threat that has multiple cases reported in India amid the COVID-19 pandemic. This nosocomial infection particularly infects patients with low immunity in the intensive care unit. C. auris transmission in hospitals during the COVID-19 pandemic in India poses a high risk due to their limited facilities for fungal identification and antifungal susceptibility testing.3 Owing to its multidrug resistance and rapid transmissibility in hospital settings, it is also called a “superbug fungus” that causes bloodstream infections with a high mortality rate.

Aspergillus flavus, belonging to the Aspergillus family, is suspected to be the ‘yellow fungus,’ due to its yellow-colored mold. This thermotolerant fungus generally affects the lungs of immunocompromised individuals. Symptoms of coinfection with aspergillosis and COVID-19 include fever, chest pain, cough, hemoptysis, and breathlessness.4 The ‘green fungus’ is also caused by a member of the Aspergillus family. Most aspergilli detected are azole resistant, which can lead to challenges in the management and impending broader antifungal resistance.

Steroids are commonly used in treating patients with moderate or severe COVID-19 by countering the systemic inflammatory response.5 However, the use of steroids decreases the overall immune response of the patient making them more vulnerable to secondary infections like that of a fungal etiology. The increased use of zinc supplementation in COVID-19 patients has also been highlighted as a possible contributor to the surge in invasive fungal infections.6 To make matters worse, as a result of the deteriorating healthcare infrastructure and resources caused by the ongoing COVID-19 pandemic, many patients are self-medicating without proper knowledge with over-the-counter, easily accessible drugs and many patients are using oxygen therapy without proper hygiene. These factors have become reoccurring concerns, particularly in India, because they are among the most common preventable causes of COVID-19 patients developing super-added fungal infections. In addition, fungi tend to manifest more commonly in individuals with uncontrolled diabetes.7 India has ~77 million diabetic patients, and augmented by widespread non-compliance to medication, this vulnerability poses another serious concern.8 Contaminated water used in humidifiers for oxygen therapy, industrial oxygen, unsterilized medical equipment, prolonged use of the same masks, and tubing are also strongly believed to cause fungal infections.9 The unhygienic environment and poor living standards in the slums and rural areas of India likely play a role in this fungal outbreak. The climate of South Asia, with high temperature and humidity, is also thought to contribute to the favorable growth of these fungi.10

The demand for antifungal medications has risen because of fungal infections in COVID-19 patients. A severe shortage of the amphotericin B, which is the first-line treatment of choice for mucormycosis, has developed, increasing mortality and further panic. The fear of being unable to attain the required medications has caused people to hoard drugs, further contributing to the shortage. This dearth of antifungal medication has created a black market for drugs that were already too expensive for most people to afford.

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With the emergence of candidiasis and aspergillosis cases, the paucity of antifungal drugs has been further aggravated. India’s continuous battle with COVID-19 has resulted in hospitals running out of beds, ventilators, and oxygen cylinders, which has continued to strain the healthcare budget and infrastructure. Additionally, treating most invasive fungal infections is challenging because it requires multidisciplinary expertise. In an overwhelmed healthcare system, finding surgical facilities with postoperative care for patients suffering from fungal and COVID-19 coinfection can pose another logistical nightmare. However, the crisis could be averted with the help of the recommendations listed in Table 1.

With cases of fungal and COVID-19 coinfections still being recorded all over India, it is imperative to exercise caution and to continue to adhere to preventive guidelines. Physicians should be cognizant of the likelihood of invasive secondary fungal infections in patients with COVID-19 infection, especially in those who have pre-existing risk factors. Physicians should be able to detect and treat these infections early to help reduce mortality and morbidity. It is also beneficial to address the fungal infections by name and by the implicated causative organism rather than color to avoid confusion and altercations among the general public and physicians to help with an accurate diagnosis, treatment, and prognosis.

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References

1. Green fungus: what we know so far about this new infection. Economic Times website. https://economictimes.indiatimes.com/news/india/green-fungus-what-we-know-so-far-about-this-new-ailment/articleshow/83596313.cms. Accessed August 21, 2021.
2. Roden MM, Zaoutis TE, Buchanan WL, et al. Epidemiology and outcome of zygomycosis: A review of 929 reported cases. Clin Infect Dis 2005;41:634–653.
3. Ghosh S, Patelia S, Hasan MM, Ghosh A, Jain S, Patel T. Drug-resistant white fungus: another catastrophic fungus emergence amidst COVID-19 in India. Pathog Glob Health 2021. doi: 10.1080/20477724.2021.1960762.
4. Types of fungal diseases. Centers for Disease Control and Prevention website. https://www.cdc.gov/fungal/diseases/index.html. Accessed August 21, 2021.
5. Essar MY, Khan H, Babar MS, et al. Mucormycosis, conflicts and COVID-19: a deadly recipe for the fragile health system of Afghanistan. Int J Health Plann Manag 2021. doi: 10.1002/HPM.3292.
6. Gandra S, Ram S, Levitz SM. The “black fungus” in India: the emerging synthetic of COVID-19–associated mucormycosis. Ann Intern Med 2021;174:1301–1302.
7. Rocha ICN, Hasan MM, Goyal S, et al. COVID-19 and mucormycosis syndrome: double health threat to a collapsing healthcare system in India. Trop Med Int Health 2021;26:1016–1018.
8. Guariguata L, Whiting DR, Hambleton I, Beagley J, Linnenkamp U, Shaw JE. Global estimates of diabetes prevalence for 2013 and projections for 2035. Diabetes Res Clin Pract 2014;103:137–149.
9. Gupta A, Sharma A, Chakrabarti A. The emergence of post–COVID-19 mucormycosis in India: can we prevent it? Indian J Ophtalmol 2021;69:1645–1647.
10. Ghazi BK, Rackimuthu S, Wara UU, et al. Rampant increase in cases of mucormycosis in India and Pakistan: a serious cause for concern during the ongoing COVID-19 pandemic. Am J Trop Med Hyg 2021. doi: 10.4269/AJTMH.21-0608.