

Mucormycosis - an opportunistic disease in the COVID-19 (SARS-CoV-2) pandemic: Lessons from shreds of evidence

Bedanta Roy^{1*}, Sumitabha Ghosh²

***Corresponding author:**

¹Dr. Bedanta Roy, Ph.D., Senior Lecturer, Department of Physiology

Email: bedanta.roy@gmail.com [\[ORCID\]](#)

²Prof. Dr. Sumitabha Ghosh, Ph.D., Professor and Head, Department of Physiology [\[ORCID\]](#)

^{1,2}Faculty of Medicine, Quest International University, No. 227, Plaza Teh Teng Seng (Level 2), Jalan Raja Permaisuri Bainun, 30250 Ipoh, Perak Darul Ridzuan, Malaysia

Information about the article:

Published online: July 18, 2021.

Publisher

Quest International University (QIU), No.227, Plaza Teh Teng Seng (Level 2), Jalan Raja Permaisuri Bainun, 30250 Ipoh, Perak Darul Ridzuan, Malaysia

e-ISSN: 2636-9478

© The Author(s). 2021

Content licensing: [CC BY 4.0](#)

Mucormycosis, earlier known as zygomycosis, is a rare fatal fungal infection with a high mortality rate (46–96%). A group of ubiquitous environmental moulds called mucormycetes is the causative organism, which is commonly present in the soil and decomposing organic substances. [1] Mucormycosis mainly affects the uncontrolled diabetic persons or cancer patients undergoing immunosuppressive chemotherapy and those treated with corticosteroids. In the affected individuals, spores germinate into hyphae, spreading at the tissue level, which includes blood vessels causing hemorrhagic infarction.

Mucormycosis is commonly known as “black fungus” because of the dark colour of the affected necrotic tissue in the victim. This is an opportunistic fungal infection which rapidly spreads to the sinus, eyes, lungs, brain, nerves and other body tissues including the skin. Late diagnosis, delay in medical and surgical intervention causes a high fatality. [2] Common signs and symptoms are sinus pain, ocular pain, headache, toothache, one-sided nasal congestion and swelling or numbness. Loss of eyelid, blindness and blurred vision has also been reported. [3]

Clinical syndromes associated with mucormycosis

Rhino-orbito-cerebral and pulmonary mucormycosis are the commonly found clinical syndromes. The rhino-orbito-cerebral forms start from the sinuses spreading in the associated tissues, resulting in facial deformity, cranial nerve palsies, loss of sight, and invade the central nervous system. Early detection is vital to save the life. Unfortunately, for the patients admitted at an advanced stage, choices are limited and often involves removal of one or both eyes to curb the fungal spread.

Mucormycosis surge in COVID-19 pandemic

Reports on mucormycosis has shown a rapidly increasing trend. A systematic review on mucormycosis in COVID-19 patients based on the collected data until May 13, 2021, revealed that out of 101 cases, a vast majority was reported from India (82 cases) compared to the rest of the world (19 cases) with a mortality rate of 30.7%. In both the active and recovered groups of SARS-CoV-2 infection, males (78.9%) were the predominant victims. In 88.9% of cases, the nose and sinuses were affected, followed by rhino-orbital tissues. 80% of these COVID-19 infected patients were diabetics, and 76.3% were treated with corticosteroids. Irrational use of antibiotics and the presence of mucor spores in the hospital environment were

also blamed for the disease. [4] On May 23, BBC reported a surge in the number of rhino-orbito-cerebral mucormycosis cases; 9000 patients alone were infected in India. [5] The surge of cases of this rare disease during the COVID-19 pandemic was well connected and thrown a massive challenge to the healthcare system. [6] A few days later, Aljazeera reported, as of June 8, 2021, India recorded 28,252 mucormycosis cases from 28 states, where 86.0% had a history of COVID-19 infection and 62.3% suffered from diabetes. [7]

This spike in the numbers of mucormycosis cases during the second wave of the pandemic in India is frightening and serves as a warning bell for the rest of the world. An estimated 65 million Indian adults suffer from diabetes, [8] a comorbid condition for the black fungus disease. The hot and humid climate in India is a growth-promoting factor for the Mucorales species. The countries with similar climates, higher diabetics burden and bleeding with COVID-19 waves possess a significant risk for this opportunistic fungal infection. Contamination from humidifiers during prolonged ventilation also poses an additional risk factor for the hospitalized inpatients. [9]

Relation of SARS-CoV-2 infections and Mucormycosis

Dexamethasone at a dosage of 6 mg OD for up to 10 days has been recommended for hospitalised COVID-19 patients with oxygen support or mechanical ventilation. [10] However, glucocorticoids do not play any significant role in patients who do not require supplementary oxygen. Unfortunately, glucocorticoids were misused in India, sometimes in higher doses and durations, to treat mild COVID-19 symptoms and administered to the patients who didn't require oxygen support. This indiscriminate pharmacologic measure was the final nail in the coffin inviting mucormycosis by immunosuppression and increased blood glucose level for prediabetes and diabetes. Biochemical evidence showed a majority of COVID-19-associated mucormycosis patients had elevated blood glucose levels. [4] The other possible factors were organ transplantation and poor hospital hygiene. [11]

In India, during the second wave of COVID-19, oxygen shortage was reported, and extensive antibiotic usage was observed to treat mild and moderate cases despite knowing the ineffectiveness of such measures. Lack of oxygen causes hypoxia intensifying tissue damage, and antibiotics may suppress normal bacterial flora promoting fungal growth in the sinuses. Antibiotic misuse was also observed in the first wave of COVID-19 with an excess of 216 million doses. [12]

Available treatment option

Immediate surgical debridement and administration of antifungal drugs save the life of the affected patients. Amphotericin B, as a lipid formulation, is a treatment option. [13] The Indian Health Ministry recently issued evidence-based guidelines for the management of

mucormycosis. [14]

Measures required to control mucormycosis

1. Rational use of steroids and antibiotics to manage the COVID-19 patients
2. Limiting over-the-counter use of the drugs
3. Adequate supplies of Amphotericin B in the hospitals [As an increase in demand for amphotericin B in India caused an acute shortage]
4. Promoting affordable treatment options can save lives.
5. Increase in the testing facilities for black fungus, as early diagnosis is essential to stop the spread of the infection.
6. Close monitoring and control of blood glucose for the Covid infected diabetic patients.
7. Recovered diabetic COVID-19 patients are needed to be communicated and assessed for the Mucormycosis infection.
8. Avoiding environments where exposure to Mucorales may happen.
9. National campaigns for the awareness of health care providers and common people.
10. Finally, controlling the COVID-19 pandemic by movement control order or lockdown measures, vaccination drives, social distancing, and sanitisation will automatically bring down the rate of black fungus infection.

Strengthening the healthcare system's infrastructure cannot be the sole solution to stop the mucormycosis infection; vital cooperation is needed from the public. It is a tough challenge to combat opportunistic fungal infection for the low and middle-income countries, but taking proper measures like controlling blood glucose, early diagnosis, and rational use of steroids and antibiotics may rein this disease outbreak.

Regards,

Dr. Bedanta Roy, Ph.D. Senior Lecturer, Department of Physiology, Faculty of Medicine, QIU
Editor-in-Chief, Quest International Journal of Medical and Health Sciences

Prof. Dr. Sumitabha Ghosh, Ph.D. Professor and HOD, Department of Physiology, Faculty of Medicine, QIU
Editorial Board Member, Quest International Journal of Medical and Health Sciences

18.7.2021

Keywords

COVID-19, diabetes, infection, Mucormycosis, steroids

Competing interests

None declared.

Publisher's Note

QIU remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

The publisher shall not be legally responsible for any types of loss, actions, claims, proceedings, demand or costs or damages whatsoever or howsoever caused arising directly or indirectly in connection with or arising out of the use of this material.

References

- Roden MM, Zaoutis TE, Buchanan WL, Knudsen TA, Sarkisova TA, Schaufele RL, et al. Epidemiology and Outcome of Zygomycosis: A Review of 929 Reported Cases. *Clinical Infectious Diseases*. 2005;41(5):634–53.
<http://dx.doi.org/10.1086/432579>
- Jeong W, Keighley C, Wolfe R, Lee WL, Slavin MA, Kong DCM, et al. The epidemiology and clinical manifestations of mucormycosis: a systematic review and meta-analysis of case reports. *Clinical Microbiology and Infection*. 2019;25(1):26–34.
<http://dx.doi.org/10.1016/j.cmi.2018.07.011>
- Mehta S, Pandey A. Rhino-Orbital Mucormycosis Associated With COVID-19. *Cureus*. 2020 Sep 30.
<http://dx.doi.org/10.7759/cureus.10726>
- Singh AK, Singh R, Joshi SR, Misra A. Mucormycosis in COVID-19: A systematic review of cases reported worldwide and in India. *Diabetes & Metabolic Syndrome: Clinical Research & Reviews*. 2021;15(4):102146.
<http://dx.doi.org/10.1016/j.dsx.2021.05.019>
- Biswas S. Black fungus: India reports nearly 9,000 cases of rare infection. *BBC News*. 23 May 2021. Accessed on 25 May 2021 Available online from www.bbc.com/news/world-asia-india-57217246
- Daria S, Asaduzzaman Md, Shahriar M, Islam MdR. The massive attack of COVID-19 in India is a big concern for Bangladesh: The key focus should be given on the interconnection between the countries. *Int J Health Plann Mgmt*. 2021 May 19.
<http://dx.doi.org/10.1002/hpm.3245>
- Kuchay B. Coronavirus pandemic. Black fungus' new scare in India as second COVID wave ebbs. *ALJAZEERA News*. [Online 2021] [cited 1 July 2021] Available from: <https://www.aljazeera.com/news/2021/6/8/black-fungus-new-scare-in-india-as-second-covid-wave-ebbs>
- Nanditha A, Ma RCW, Ramachandran A, Snehalatha C, Chan JCN, Chia KS, et al. Diabetes in Asia and the Pacific: Implications for the Global Epidemic. *Dia Care*. 2016;39(3):472–85.
<http://dx.doi.org/10.2337/dc15-1536>
- Suryanarayanan TS, Shaanker RU. Science The Wire COVID-19 and black fungus: what is mucormycosis? [Online 2021] [cited 1 July 2021] Available from <https://science.thewire.in/the-sciences/covid-19-and-black-fungus-what-is-mucormycosis/>
- Dexamethasone in Hospitalized Patients with Covid-19. *N Engl J Med*. 2021;384(8):693–704.
<http://dx.doi.org/10.1056/NEJMoa2021436>
- Mint Black fungus: govt shares do's and don'ts amid rise in mucormycosis cases in covid patients. [Online 2021] [cited 1 July 2021] Available from <https://www.livemint.com/science/health/black-fungus-govt-shares-do-s-and-don-ts-amid-rise-in-mucormycosis-cases-in-covid-patients-11621002697776.html>
- Sulis G, Batomen B, Kotwani A, Pai M, Gandra S. Sales of antibiotics and hydroxychloroquine in India during the COVID-19 epidemic: An interrupted time series analysis. Knight GM, editor. *PLoS Med*. 2021;18(7):e1003682.
<https://doi.org/10.1371/journal.pmed.1003682>
- Boucher HW, Groll AH, Chiou CC, Walsh TJ. Newer Systemic Antifungal Agents. *Drugs*. 2004;64(18):1997–2020.
<http://dx.doi.org/10.2165/00003495-200464180-00001>
- Ministry of Health and Family Welfare; Government of India. Evidence based advisory in the time of COVID-19: screening, diagnosis & management of mucormycosis. [Online 2021] [cited 1 July 2021] Available from https://www.icmr.gov.in/pdf/covid/techdoc/Mucormycosis_ADVISORY_FROM_ICMR_In_COVID19_time.pdf