

Risk Factors for Mucormycosis in COVID-19 Positive Patients in a Tertiary Care Hospital of Central India: A Cross Sectional Study

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Abstract: *Background:* India is experiencing a detrimental surge of COVID-19 cases during its second wave. Along with COVID-19, India is also experiencing an outbreak of mucormycosis, a deadly fungal infection, which is affecting thousands of COVID-19 patients. Also known as black fungus, this disease is caused by opportunistic fungi in the Mucorales family, which is commonly found in the ecosystem and often associated with rotting organic matter. Humans can be infected by inhaling and consuming spores in food or drugs, or contaminating wounds with spore. This study aimed to determine the patient demographics, risk factors including comorbidities, and medications used to treat COVID-19. *Methods:* A cross sectional descriptive study conducted on 120 study subjects at a tertiary care hospital in Central India and the study subjects were all patients of more than 40 years age admitted in June and July 2021 months with mucormycosis in history of COVID-19 positive patients, and the data collected were analyzed using SPSS IBM version 21.0. *Results:* Study participants belonged to the age more than 40 years. Out of 120 participants 92 were Male and 28 were Female, with a mean age of 56.3 years. The major risk factors included steroid use (96.7%), diabetics 61.2% patients. *Conclusions:* Corticosteroids and DM are the most important predisposing factors in the development of COVID-19-associated mucormycosis. COVID-19 patients must be followed up beyond recovery.

Keywords: Black fungus, COVID-19, mucormycosis, pandemic, steroid

1. Introduction

The COVID-19 pandemic, along with steroid as a therapeutic armamentarium, in association with diabetes, and irrational use of antibiotics make the land fertile for fungal growth, as evidenced by the recent surge of mucormycosis which mostly entangles the sinuses, orbits and brain [1,2].

The term mucormycosis was coined by American pathologist R. D. Baker. In 1885, German pathologist Paltauf reported the first case of mucormycosis in humans. In 1943, Gregory et al. described the first case of rhino-orbital cerebral mucormycosis associated with diabetes [3e6]. Mucormycosis, depending on organ/s involved, is further sub classified as, rhino-orbital-cerebral mucormycosis (ROCM) which is most commonly observed, followed by cutaneous, pulmonary, disseminated, renal and gastrointestinal [7]. Following Aspergillus, Mucorales fungi are the next most common pathogens in subjects with haematological malignancy, haematopoietic stem cell transplantation, solid organ transplantation and are increasingly being recognized in individuals with diabetes mellitus [7]. Strikingly, outbreaks have been observed earlier, following natural disasters [8]. The association between COVID-19 and mucormycosis is already established but presence of two important confounders, diabetes and indiscriminate use of steroids, make it difficult in establishing the exact cause and effect relationship. SARS-CoV-2 virus itself has been implicated in disruption of cell mediated immune response leading to invasion, tissue necrosis and thrombosis by mucormycosis [9]. Factors on which mucor growth may depend, like mask reuse, oxygen therapy, overuse of zinc, poor oral hygiene, addictions, environmental factors, specific habits like gardening, occupational exposures at construction sites, exposure to farm animals, pets and probable symbiotic relationship with COVID-19 virus need further detailed studies [10]. Wide

array of mucormycosis associated neurological symptoms like headache, proptosis, ptosis, double vision, diminution of vision, facial pain, deviation of angle of mouth, facial numbness, focal weakness, altered sensorium and seizure stem from involvement of specific neuroanatomical substrate/s by this deadly fungus [11e14]. Indian subcontinent has witnessed a sudden and alarming surge in the number of mucormycosis cases in patients of COVID-19.

At the time of writing this paper, considerable numbers of cases of mucormycosis have been reported, making it a health problem of epidemic proportions. Given that the current pandemic continues to be a significant public health issue globally, there needs to be study the high risk factors for mucormycosis in COVID-19 patients, since both conditions in combination may lead to significant morbidity and mortality.

Aim and objective

To study the high risk factors for mucormycosis in COVID-19 patients

2. Material and Methods

Table 1: Distribution of study subjects according to age

Age range	Frequency	Percentage
Age between 45-50 years	33	27.5
Age between 51-55 years	46	38.34
Age between 56-60 years	23	19.17
Age between 61-65 years	7	5.83
Age >65 years	11	9.16
Total	120	100.0

Table 1 shows the distribution of study subjects according to age. Majority of the study participants (79; 65.84%) were belonging to age group of 45-55 years followed by 19.17% in 56-60 years age group. mean age of 56.3 years

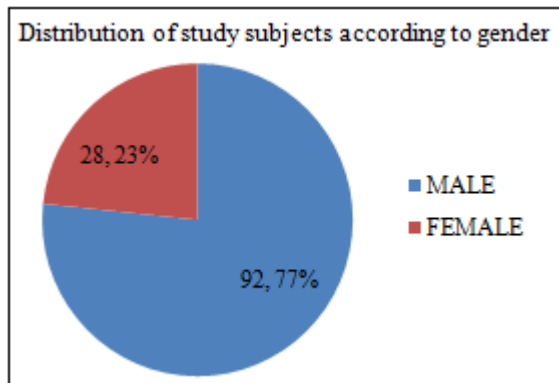


Figure 1

Fig. 1 shows the distribution according to gender. Majority of the study participants were male i.e. 92; 77%

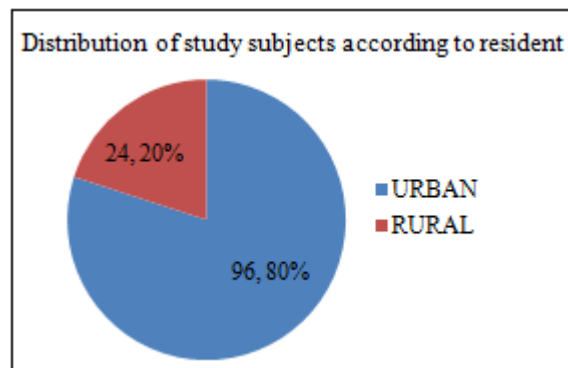


Figure 2

Fig. 2 shows the distribution according to resident. 96 (80%) study participants were live in urban area.

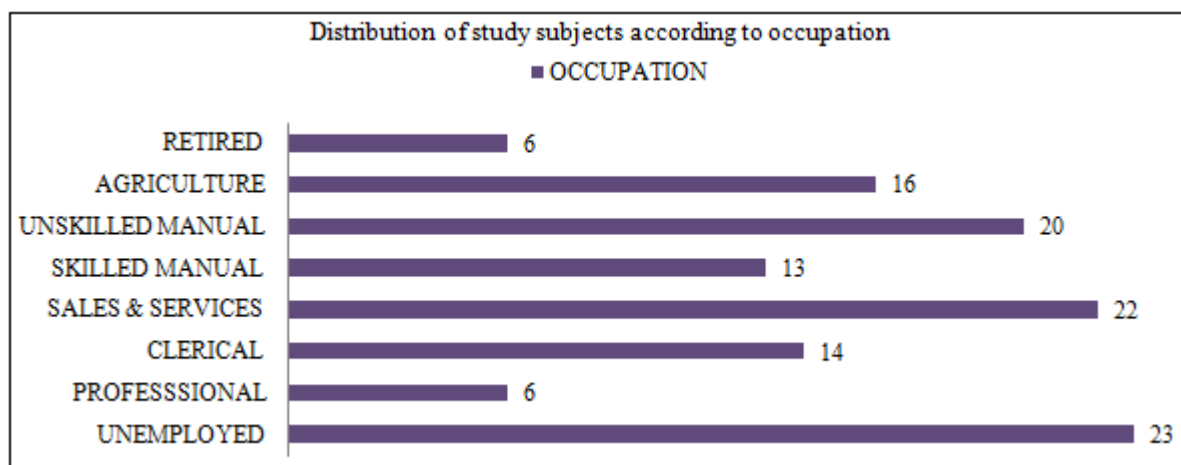


Figure 3

Fig. 3 shows distribution according to occupation. Majority of the study participants (23) were unemployed. 22, 20 and 16 participants were work in the sales and services, unskilled manual and agricultural respectively.

Table 2: Distribution of subjects based on Educational qualification

Educational qualification	Frequency	Percentage
Literate	3	2.5
Primary School Certificate	4	3.34
Middle School Certificate	18	15
High School Certificate	36	30
Graduate or Post Graduate	32	35.83
Professional	16	13.33
Total	120	100.0

Table 2 shows majority of the study participants (43, 35.83%) educated up to Graduate or Post Graduate, followed by 36 (30%) up to high school.

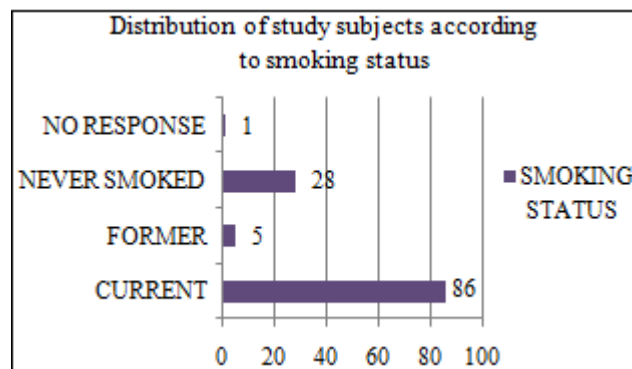


Figure 4

Fig 4 shows that 86 (71.66%) study participants were current smokers and 28 (23.33%) were life time abstainer.

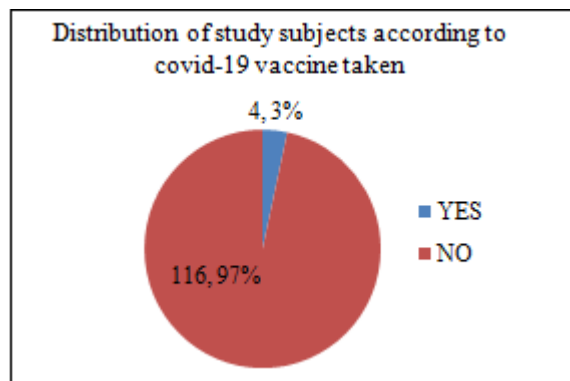


Figure 5

Fig. 5 shows that COVID-19 Vaccines were taken by about 116 (97%) study participants.

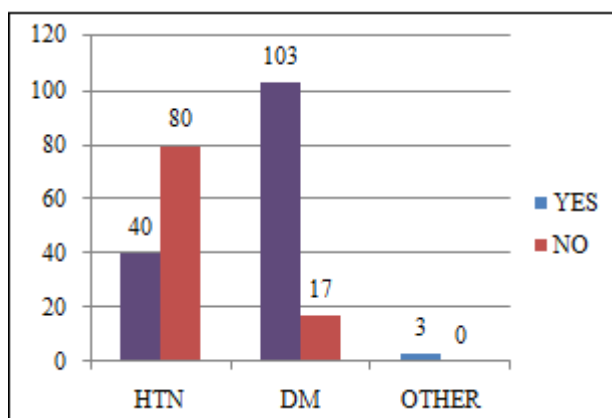


Figure 6: Distribution of study subjects according to comorbidity

Fig. 6 shows that majority i.e. 103 study participants were diabetic, 40 participants were hypertensive, 14 participants had both diabetic and hypertension: and 3 participants were having hypothyroid and cancer.

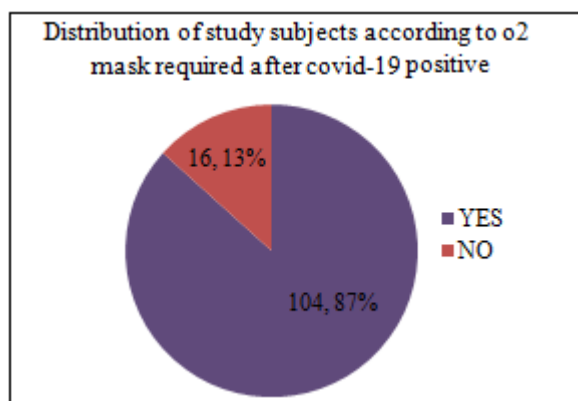


Figure 7

Figure 7: Shows about 104 (87%) participants were required oxygen mask after COVID-19 positive

3. Conclusion

- The mean time interval between diagnosis of COVID-19 and clinical presentations of mucormycosis was 8 and 11 days, respectively.

- As evidenced previously, uncontrolled DM documented as the prevailing risk factor implicated in mucormycosis development. In our study, 85.84% of CAM cases had DM when mucormycosis diagnosed.
- The presence of DM along with other COVID-19-associated medications such as steroids, oxygen therapy and antiviral drugs and complications could be important risk factors for mucormycosis.
- The findings of this study showed that clinicians should be more alert about mucormycosis especially during the first to second week after COVID-19 in diabetic and immunocompromised patients. Poor control of DM seems to be important predisposing factor.

4. Recommendations

Given the acuteness and aggressiveness of the infection, a timely diagnosis for prompt antifungal therapy is highly recommended in order to decrease the rate of disability and mortality.

5. Limitations

- Limited sample size preventing a subgroup analysis.
- Absence of a control group for comparing clinical, imaging features, therapeutic interventions, comparison of all COVID-19 clinical and laboratory factors between those affected and not affected by mucormycosis.

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