

ORIGINAL RESEARCH**To evaluate the mucormycosis cases in post Covid-19 patients****¹Dr. Snehanshu Shukla, ²Dr. Ranvijay Singh, ³Dr. Gaurav Kumar**¹Associate Professor, ³Assistant Professor, Department of Microbiology, RDASMC, Ayodhya, Uttar Pradesh, India²Assistant Professor, Department of Blood Bank, RDASMC, Ayodhya, Uttar Pradesh, India**Correspondence:**

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Email:shuklasnehanshu@gmail.com**ABSTRACT****Aim:** To evaluate the mucormycosis cases in post Covid-19 patients.**Methods:** This cross-sectional observational study was carried out in the Department of Microbiology. Basic microbiological methods such as gram stain and KOH smear were used for the detection of MC in the received clinical specimen and morphology was seen in the microscope. Patients admitted in our hospital with a history of fever, cough, body ache and shortness of breath for 4-5 days with have positive report of nasopharyngeal/oropharyngeal swab for covid19 RT-PCR were included in the present study.**Results:** Age, sex and other demography details were collected before sample collection, the average age of the participants was 60.4 ± 7.5 years and the majority of participants were male 75%. Although, 45% participants belong to below 50 year age and 55% of participant belongs to above 50 year age. Out of n=50 specimens, total 9 specimen found positive for fungal smear i.e. n=6 sputum, n=3 nasal swabs and n=0 BAL specimens.**Conclusions:** The present study concluded that the cases of life threatening MC increase day by day in central India as post complication of covid-19 disease.**Keywords:** Mucormycosis, post Covid-19 disease patients**INTRODUCTION**

Coronavirus disease 2019 (Covid-19) is an infection caused by severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2). Since the first case was detected, in December 2019 in Wuhan, China, there have been various turns and twists in terms of its pathophysiology, diagnosis, management, sequelae and complications.¹ The Covid-19 symptom spectrum has expanded since the first days of the disease's presentation, which initially included only a dry cough and high grade fever, to additionally include various multisystem problems such as shortness of breath, anosmia, ageusia, diarrhoea, generalised malaise, acute cardiac injury and secondary infections. Early identification of these high-morbidity conditions is crucial for optimal treatment and improved outcomes. Otorhinolaryngology has been relevant to the coronavirus pandemic from the start, beginning with nasopharyngeal swab sampling for diagnosis to the declaration of anosmia as a typical symptom marker or the detection of virus isolates from the middle-ear cavity.² Olfactory nerve affection in coronavirus disease of the year 2019 (COVID-19) is well known. Anosmia and hyposmia have been reported by many COVID-19 patients worldwide.³ Yet, it seems that different cranial nerves are being affected by COVID-19 either directly in the context of the acute virus infection phase like the olfactory nerve or as a result of complications related to coronavirus. In this case series, different cranial nerves involved in 4 cases suffering mucormycosis as an opportunistic

fungal infection post COVID-19 infection are presented with a highlight on different anatomical and pathological explanations for such cranial nerve affection (Table 1). A formal written consent was obtained from all cases to publish their medical history, laboratory results, and imaging for radiological as well as clinical lesions.

The 2019 novel coronavirus (2019-nCoV) or severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) first reported in Wuhan, Hubei province in China, quickly spread to other parts of the world forming a global pandemic.⁴ The disease pattern of COVID-19 can range from mild to life-threatening pneumonia with associated bacterial and fungal coinfections.⁵ Due to the associated co morbidities (e.g., diabetes mellitus, chronic obstructive pulmonary disease) and immunocompromised conditions (e.g. corticosteroid therapy, ventilation, intensive care unit stay), these patients are prone to develop severe opportunistic infections. There are reports of the development of severe opportunistic infections such as oropharyngeal candidiasis, pneumocystis jiroveci pneumonia, pulmonary aspergillosis, bloodstream candida infections, etc., in patients affected with COVID-19 disease.^{6,7} There are also few isolated case reports of rhino-orbital mucormycosis in COVID-19 disease.⁴

Mucormycosis is a rare but severe fungal infection caused by the Mucorales species of phylum Zygomycota. Naturally, Mucorales occur in soil, their spores spread by air often contaminate foods, water, and clinical specimens. The *Mucor* sp., *Rhizopus* sp., *Asidia* and *Cunninghamella* are the main causative agent for MC in humans.⁹ Mucormycosis described as a potentially lethal infection amongst immune-compromised hosts, particularly in those with diabetes, leukemia, and lymphoma.¹⁰ During the fungal infection thrombosis and tissue necrosis are the major symptoms and require antifungal drug therapy and surgery to help remove the infected tissues. In this Covid19 era, the rate of MC cases rapidly growing in the Covid19 patients in India. Mucormycosis is difficult to diagnose which affects outcomes and results in a poor prognosis. Delay in diagnosis increase the mortality rate by about 35- 66%.¹²

MATERIALS AND METHODS

This cross-sectional observational study was carried out in the Department of Microbiology, after taking the approval of the protocol review committee and institutional ethics committee. The demographic details and clinical diagnosis were recorded from medical records. During the study period, our microbiology laboratory received various specimens such as nasal swabs, ET secretion, sputum, and tissues from our IPD departments such as ICU, and Covid19 ward for the detection of fungal infection in the specimens. Patients admitted in our hospital with a history of fever, cough, body ache and shortness of breath for 4-5 days with have positive report of nasopharyngeal/ oropharyngeal swab for covid19 RT-PCR were included in the present study. Wound swabs were rejected. If the specimens were transported to the laboratory in a sterile container and swabs, the aspirates were immediately performed direct microscopy, KOH smear preparation and gram's stain. Identification was done on the basis of morphology in the microscopy.

RESULTS

Total of n=50 suspected sputum; nasal swab and BAL samples from N=40 of participants were received in our microbiology laboratory during study period. Age, sex and other demography details were collected before sample collection, the average age of the participants was 60.4 ± 7.5 years and the majority of participants were male 75%. Although, 45% participants belong to below 50 year age and 55% of participant belongs to above 50 year age (Table 1).

Table 1: Demographic profile of participants

Characteristics	No. of participants	(%)
Age (years)		
Below 50	18	45%
Above 50	22	55%
Gender		
Male	34	85%
Female	06	15%

Table 2

Total stay in hospital (in days)	.	
Below 15 days	23	57.5%
Above 15 days	17	42.5%
Type of specimens (n=50)	.	
Sputum	18	45%
Nasal swab	14	35%
BAL	8	20%

Out of N= 40 participants, 80% males and 65% of females had a history of autoimmune disease; all the participants had a conformed RT-PCR positive report for Covid-19. Moreover, all the participants had a history of long hospital stay during the treatment of covid19, the average hospital stay of all the participants were about 15 days (Table 2). Moreover, our microbiology laboratory received multiple samples (sputum + nasal swab and BAL secretion from the same participants) from the 9 participants (Table 3).

Table 3: Distribution of positive specimens for mucormycosis (n = 9)

S. No.	Types of specimen				
	Age (Y)	Gender (M/F)	Sputum (n =6)	Nasal swab (n= 3)	BAL (n =0)
1.	59	M	Yes	No	No
2.	78	M	Yes	No	No
3.	77	M	Yes	No	No
4.	42	F	No	Yes	No
5.	55	F	Yes	No	No
6.	68	M	No	Yes	No
7.	45	M	No	Yes	No
8.	52	F	Yes	No	No
9.	34	F	Yes	No	No

Out of n=50 specimens, total 9 specimen found positive for fungal smear i.e. n=6 sputum, n=3 nasal swabs and n=0 BAL specimens (Table 3). Positive report for fungal smear were informed immediately to concern clinician. Received specimens directly examine by microbiologist before acceptance in the microbiology laboratory and further processed for fungal detection. Fungal smear (KOH wet mount) and gram staining perform for morphological analysis.

DISCUSSION

The Covid-19 infection caused by the novel SARS-CoV-2 has been associated with a wide range of disease patterns, ranging from a mild cough to life-threatening pneumonia.¹¹ A myriad of manifestations and complications have been documented, and new ones are emerging and being reported on with each passing day as we learn more about this novel Covid-19 pandemic. Although India has not been able to actively control and limits the

second wave of COVID-19, the number of new cases is now in decline. Despite this, emerging complications associated with COVID-19 are being reported with the fungal infection mucormycosis becoming a serious issue in India due to its unprecedented surge and high morbidity.^{11,12} The term MC collectively known “black mold” or “black fungus” in India is a fungal infection caused by the order of mucorales. Order: Mucorales is the group of the filamentous fungus, comprises about 40 pathogenic species which are further divided into¹³ genera. The genera of Mucorales are one of the best decomposers of organic materials and are often found in decaying organic materials such as rooted fruits and vegetables, plant litter, and animal manure.¹³ The *Mucor* sp., *Rhizopus* sp., *Asidia* and *Cunninghamella* are the main causative agent for MC in humans.¹⁴ Spores of the mucorales are highly prevalent in the air. Patients acquire the infection by inhalation, ingestion or traumatic inoculation of the spores from the environment.¹⁵ Other than environmental factors, uncontrolled diabetes mellitus, inappropriate steroid therapy, increased iron accumulation, and the damage caused by the COVID-19 virus may responsible for the MC.^{4,12,16} In our study we reported MC in 9 participants who were long stayed in hospital on oxygen support. All the MC positive participants belong to >60 years age and all had a weakened immune system. Mortality rate of MC is very high, early diagnosis is very essential to reduce the severe morbidity and mortality of patients.¹⁷ The standard approaches for the treatment of MC are usually based on the combination of antifungal therapy and surgical removal of involved tissues.¹⁸

CONCLUSION

The MC occurring in the post Covid-19 patients are a secondary infection and directly linked with the virus, poor glycemia control, widespread use of corticosteroids, and invasive ventilation. Therefore, early screening and diagnosis are much-needed to prevent is a life-threatening event cause by the black mold in post Covid-19 infection.

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