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A hospital based retrospective observational assessment of the emerging cases of mucormycosis in post COVID-19 disease patients

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Abstract
Aim: The aim of the present study to determine the emerging cases of mucormycosis in post COVID-19 disease patients.
Materials and Methods: This retrospective observational study was carried out in the Department of Microbiology with Collaboration with Department of DVL, Mamata Medical College, Khammam for the period of 18 months. 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.
Results: During study period our microbiology lab received N = 30 suspected clinical specimens from N = 20 post COVID-19 patients for MC diagnosis over one month period. Out of N = 30 specimens, n=5 were positive for MC by gram and KOH smear method and we saw filamentous fungi by conventional microscopic method.
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: Retrospective observational, emerging cases, mucormycosis

Introduction

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is besieging the world for more than a year since its declaration by the World Health Organization as a pandemic in March 2020. Its effect on central nervous system has been reported along many studies and reviews either through affecting vascular system in different ways leading to strokes [1] or through retrograde extension to the brain through the olfactory nerve [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 mildtolife-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 Cunningham ella 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 [19]. 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 COVID-19 era, the rate of MC cases rapidly growing in the COVID-19 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

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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.

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 COVID-19 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 COVID-19 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 = 30 suspected sputum; nasal swab and BAL samples from N = 20 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 63.4±9.5 years and the majority of participants were male 80%). Although, 40% participants belong to 41-60 year age and 60% of participant belongs to 61-80 year age (Table 1).

Table 1: Demographic profile of participants

Characteristics	No. of Participants	(%)
Age (years)		
40-60	8	40%
61 above	12	60%
Gender		
Male	16	80%
Female	04	20%
Past history of Disease (Immuno-compromised)		
Male	18	90%
Female	02	10%
Positive RT-PCR report of nasopharyngeal/ oropharyngeal swab for COVID-19		
Male	13	65%
Female	07	35%
Total stay in hospital (in days)	.	
10-20 days	12	60%
> 20 days	8	40%
Type of specimens (n=30)	.	
Sputum	13	43%
Nasal swab	11	36%
BAL	6	21%

Out of N = 20 participants, 85% males and 62% 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 COVID-19, 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 five participants (Table 2).

Table 2: Distribution of Participants (N = 20) and specimens (N = 30)

Types of specimen Sputum				
Age (Y)	**Gender (M/F)**	**Sputum**	**Nasal swab**	**BAL**
45*	M	Yes	No	Yes
57*	M	No	Yes	No
67	F	Yes	No	No
62	M	Yes	Yes	No
50*	F	Yes	No	No
76	M	Yes	Yes	Yes
54*	M	No	No	No
72	M	No	No	Yes
71	M	Yes	Yes	No
54*	M	No	No	No

64	F	Yes	No	No
71	M	Yes	No	Yes
66	M	Yes	Yes	No
58*	M	No	Yes	No
61	M	Yes	No	No
72	F	No	Yes	No
68	M	Yes	No	Yes
48*	M	Yes	No	No
53*	F	Yes	No	No
63	M	Yes	No	No

Where, (*= < 60 years age participants), (Yes = sample received) and (No = sample not received)

Table 3: Distribution of positive specimens for mucormycosis (N = 5)

Types of specimen Sputum				
Age (Y)	**Gender (M/F)**	**Sputum (N = 5)**	**Nasal swab (N = 3)**	**BAL (N = 5)**
62	M	Yes	Yes	No
71	M	Yes	Yes	No
66	M	Yes	No	No
48*	M	Yes	No	No
53*	F	Yes	No	No

Out of N = 30 specimens, total 5 specimen found positive for fungal smear i.e. N = 3 sputum, N = 2 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 Although India has not been able to actively control and limit 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 unprecedent 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 20 pathogenic species which are further divided into [13] 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 Cunningham ella 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 N=5 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. Mortility rate of MC is very high, early diagnosis is very essential to reduce the sever morbidity and mortility 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.

Conflict of Interest

Not available

Financial Support

Not available

Reference

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