Section: Community Medicine

Original Research Article

A STUDY ON SOCIO-DEMOGRAPHIC PROFILE AND RISK FACTORS ASSOCIATED WITH MUCORMYCOSIS AMONG PATIENTS ADMITTED IN A TERTIARY CARE CENTRE AT MYSURU, KARNATAKA

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Abstract

Background: Mucormycosis is a rare fungal infection that occurs in individuals with immune-compromised conditions such as uncontrolled diabetes, immunosuppressive or corticosteroid therapy and HIV malnutrition. Due to the angio-invasive nature of this fungi, patients with Mucormycosis have a poor prognosis. There are increasing case reports of mucormycosis in people with coronavirus disease 2019 (COVID-19), especially in India. The objective is to identify the socio-demographic factors associated with Mucormycosis, study the risk factors associated with Mucormycosis, and examine the in-hospital outcome of the disease. **Materials and Methods:** A Retrospective study was conducted among inpatients diagnosed with mucormycosis from April 2021 to June 2021 in a tertiary care hospital in Mysore, Karnata. A semi-structured questionnaire was used to collect information from the patients or their relatives. **Result:** The most critical risk factor for mucor mycosis was a known history of COVID infection (88.5%). The most common comorbidity found among the patients was diabetes mellitus (55%). There is a significant difference in the mean age (p=0.012), compliance to medication (p-value 0.007) and presence of diabetic ketoacidosis (p-value <0.001) between survivors and non-survivors of mucormycosis. **Conclusion:** COVID-19 has contributed to the upsurge in mucormycosis cases, with diabetes mellitus being the most critical risk factor. Patients who were compliant with diabetic medication were less prone to mucor infection compared to the noncompliant group.

INTRODUCTION

Mucormycosis (previously called zygomycosis) is a rare but angio-invasive severe infection caused by a group of fungi called mucormycetes. This is not a contagious disease; it cannot be spread from one person to another.[1] This infection mainly affects immune-compromised people or patients already infected with other diseases.

Clinical presentation is classified according to the organ involvement. It can be rhino-orbital cerebral (ROCM), pulmonary, cutaneous, gastrointestinal, or disseminated. The ROCM type is India's most common form of disease, followed by the pulmonary and cutaneous types.[2] India contributed to approximately 71% of the global cases of mucormycosis in patients with COVID-19 based on published literature from December 2019 to the start of April 2021. Many Indian states and union territories, including Rajasthan, Telangana, Odisha, Karnataka, Tamil Nadu, Gujarat and Chandigarh, have declared black fungus an epidemic during the pandemic.[3]

The most common causes attributed to the rise of mucormycosis in COVID-19 patients are uncontrolled diabetes, the excessive use of corticosteroids for immunosuppression, long-term stays in the intensive care unit, prolonged

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neutropenia and history of organ transplantation.[4,5] Uncontrolled diabetes is common in India, and a majority of patients do not have regular testing of blood sugar levels.[6]

This study aims to study the socio-demographic factors associated with mucormycosis and the association of various risk factors.

MATERIALS AND METHODS

All cases of Mucormycosis admitted to the Mucormycosis ward, KR Hospital, from April 2021 to June 2021, were taken for the study after obtaining their consent.

A history of previous COVID infection and other co-morbidities were obtained from the medical records and the attendees. Socio-demographic factors were collected mainly from the attendees and patients.

Some patients who had already been discharged from the ward were contacted over the phone for missing details. Patients who did not give consent for the study were excluded from the study.

Analysis was done using the SPSS trial version. Descriptive statistics like frequency and percentage are used to measure the socio-demographic variable. The association between various factors and treatment outcomes was assessed using a chi-square test.

RESULTS

Sixty-one patients with mucormycosis who were admitted to our hospital from April 2021 to June 2021 were included in this study. There were 43 males and 18 females (sex ratio of 2.4:1). Mean age of the patients was 50.38 ±10.7 (range 21 years- 71 years). The various socio-demographic factors of the patients are shown in Table 1. Out of 61 51(86.4%) survived and got discharged from hospital and 10(13.6%) died during the hospital stay.There is a significant difference between the age of the patients between survivors and non-survivors, with a higher mean age among non-survivors (53.6±16.3, P value 0.012). The most important risk factor we assessed in our study was a history of COVID-19 infection in the past. Of 61 patients, 54(88.5%) had a history of COVID-19 infection. 23% of the patients were asymptomatic, and most who developed mucormycosis had mild to moderate symptoms.

According to the severity and guidelines, the treatment provided to patients with COVID infection includes antibiotics, steroids, anticoagulants, vitamin C, zinc, and immune modulators. In this study, 32 patients (55.7%) took steroids, and 49 patients took antibiotics during their treatment. The duration of treatment and type of steroid used for the patients are given in Table 2. The use of NIV support and a history of ICU stay during COVID treatment has a significant association with the outcome of Mucormycosis patients.

The most common co-morbidity found among the patients was diabetes mellitus. 55% of them reported diabetes mellitus, and 17% reported a history of hypertension. 78.7% of the patients had an uncontrolled sugar level. Among the diabetic patients, 83.6% were compliant with medication (Figure 3 and Table 3). All non-survivors had a history of diabetes, and there was a significant difference between the two groups in compliance with medication (p-value 0.007) and the presence of diabetic ketoacidosis (p-value <0.001).

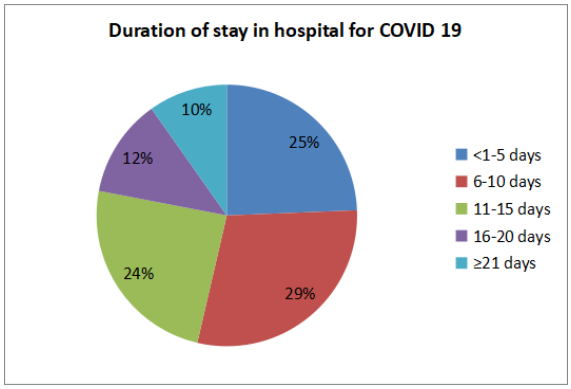

Figure 1: Duration of stay in hospital for COVID treatment among patients admitted with mucormycosis

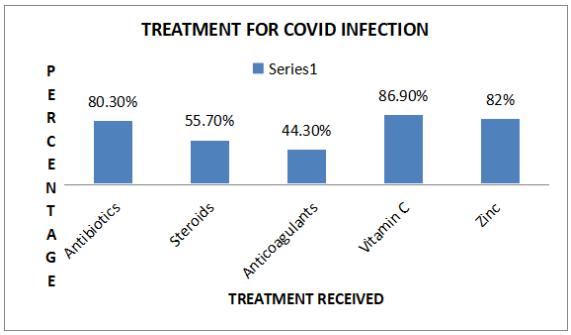

Figure 2: Percentage of mucormycosis patients received various type of treatments.

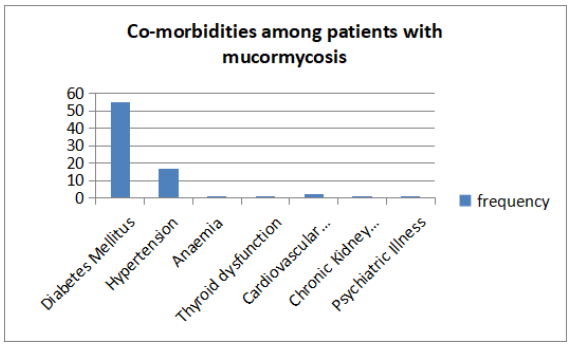

Figure 3: Co morbidity in patients with mucormycosis

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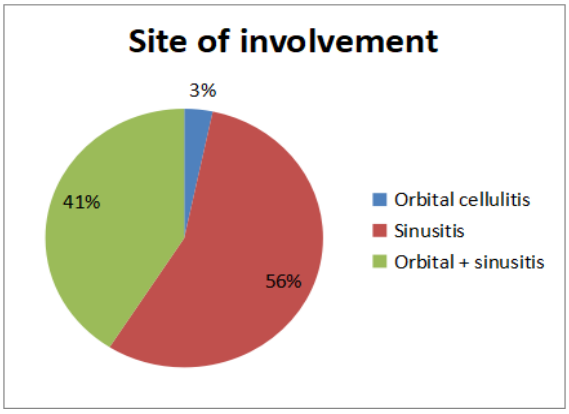

Figure 4: Site of involvement in Mucormycosis

[Table 4] shows the duration of the COVID-19 infection and mucormycosis and the clinical features of mucormycosis. The most common symptoms and the first reported symptoms were headaches and peri-orbital oedema. Table 5 lists common investigation findings, such as blood ferritin, random blood sugar, and neutrophil-lymphocyte ratio. All the investigations showed similar reports between survivors and non-survivors. The neutrophil-lymphocyte ratio was elevated in most patients (85.24%).

Table 1: socio demographic factors associated with mucormycosis in survivors and non survivors

Variables	Survivors	Non-survivors	p value
Age			0.012
21-30	1 (2%)	2 (20%)	
31-40	8 (15%)	0 (0%)	
41-50	17(33.3%)	1 (10%)	
51-60	19(37.3%)	3(30%)	
>60	6 (11.8%)	4 (40%)	
Mean age	49.7±9.3	53.6±16.3	
Sex			0.471
Male	35(68.6%)	8 (80.0%)	
Female	16(31.4%)	2 (20.0%)	
Education level			
Illiterate	10(19.6%)	2(20.0%)	0.229
Primary School	11(21.6%)	1 (10%)	
High School	20(39.2%)	4 (40%)	
PUC	3 (5.9%)	3 (30%)	
Graduate & above	6 (13.8%)	0 (0)	
Socioeconomic class			
Lower class	5 (9.8%)	2 (20%)	0.803
Lower middle class	20(39.2%)	3 (30%)	
Middle class	16(31.4%)	4 (40.0%)	
Upper middle class	9 (17.6%)	1 (10.0%)	
Upper class	1 (2.0%)	0 (0)	
History of COVID			0.873
No	6(11.8%)	1(10.0%)	
yes	45(88.2%)	9(90.0%)	
Severity of COVID-19 illness			0.140
Asymptomatic	13(25.5%)	1(10%)	
Mild	19(37.3%)	2 (20.0%)	
Moderate	15(29.4%)	4 (40%)	
Severe	4 (7.8%)	3 (30%)	

Table 2: Treatment of COVID 19 infection among Mucormycosis patients

Treatment	Survivors	Non survivors	P value
Duration of steroid 7-10 days >10 days	 20(71.4%) 8(28.5%)	 6(85.7%) 1(14.3%)	0.478
Type of steroid MP DEXA	 13 (25.5%) 15 (29.4%)	 2(20.0%) 5(50.0%)	0.443
Duration of antibiotics			
Required o2	21(75.0%)	7(25.0%)	0.094
Duration of oxygen support			
Route of oxygen			
NIV SUPPORT	3(6.0%)	3(30.0%)	0.021
Icu stay	3(30.0%)	2(20.0%)	0.027

Table 3: History of diabetes mellitus and treatment details of survivors and non-survivors

H/o DM	45(88.2%)	10(100%)	0.253
Duration of DM ≤10 years >10 years	 39(86.7%) 6(13.3%)	 7(70.0%) 3(30.0%)	0.299
Treatment of DM OHA INSULIN	 34(66.7%) 11(21.6%)	 7(70.0%) 2(20.0%)	0.098

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Compliant to treatment	45(100%)	6(60.0%)	0.007
H/O DKA	3(5.9%)	6(60.0%)	<0.001

Table 4: Symptoms of Mucormycosis

Symptoms	Number of patients reported the symptoms	Number of patients reported as the first symptom
Headache	28 (45.9%)	15 (24.6%)
Peri-orbital oedema	34 (55.7%)	14 (23%)
Eye Pain	23 (37.7%)	8 (13.1%)
Facial Puffiness	23 (37.7%)	7 (11.5%)
Loss of sensation on face	11 (18%)	0
Discoloration in face	4 (6.6%)	0
Facial pain	5(8.2%)	5 (8.2%)
Double Vision	4 (6.6%)	0
Loss of vision	5 (8.2%)	0
Nasal Obstruction	12 (19.7%)	4 (6.5%)
Toothache	3 (4.9%)	3 (4.9%)
Loosening of Teeth	18 (29.5%)	2 (3.3%)
Nasal discharge	11 (18%)	0
Eye discharge	2 (3.2%)	2 (3.2%)
Altered sensorium	1 (1.6%)	0
Eye lid drooping	1 (1.6%)	1 (1.6%)

Table 5: Laboratory findings between survivors and non survivors

	Survivors (mean±SD)	Non survivors(mean±SD)	P value
RBS	354.29±126.53	362.20 ± 107.98	0.392
HBA1C	11.12±2.66	10.70± 1.70	0.836
FERRITIN	712.27± 431.89	671.00± 348.61	0.983
N/L RATIO	9.39± 7.74	10.18±8.73	0.773

DISCUSSION

In this study, we mainly assessed the sociodemographic factors associated with Mucormycosis and the risk factors causing the development of mucormycosis. Of 61, 54 patients (88.5%) had a history of COVID-19 infection pointing towards a COVID-associated mucormycosis. The infection can be sub clinical in the remaining seven patients, which is not diagnosed. However, three consecutive case series on mucormycosis have been reported from a single tertiary-care centre in India: 129 cases over ten years (1990–1999), 178 cases during the subsequent five years (2000–2004), and then 75 cases in 18 months during 2006–2007 which shows an already existing upsurge of mucormycosis cases.[7,8]

To treat COVID-19 infection, 55.7% of the patients received steroids. A recent systematic review conducted until April 9, 2021, by John et al. reported the findings of 41 confirmed mucormycosis cases in people with COVID-19, with 88% receiving corticosteroids.[9] Out of 51 survivors, 28(54.9%) had a history of steroid intake, whereas out of 10 non-survivors, 7(70%) were treated with steroids. According to the WHO guidelines, the optimal duration for steroids in severe cases of COVID is 7-10 days.[10,11] In this study, 71.4% of survivors and 85.7% of non-survivors are given steroids for the optimal duration.

In a 2019 nationwide multi-centre study of 388 confirmed or suspected cases of mucormycosis in India prior to COVID-19, Prakash et al. found that 18% had DKA and 57% of patients had uncontrolled DM. The presence of DM significantly increases the odds of contracting the disease by 7.5-fold (Odds ratio 7.55, P <0.001), as shown in a prospective Indian study prior to the COVID-19 pandemic.[12] Similar results showed in our results that history of diabetes mellitus, treatment taken, and compliance to medication have significant associations with prognoses of mucormycosis. (p-value = 0.005, 0.013, 0.004 respectively).

No studies have compared patients with mucormycosis in non-diabetic COVID-19 who did not receive steroids versus COVID-19 patients who received steroids and developed mucormycosis, so it is difficult to establish a causal effect relationship between COVID-19 and mucormycosis about corticosteroids.[13]

The major drawbacks in managing mucormycosis in India are a gap in the treatment protocol and patients' financial constraints, as they cannot afford liposomal Amphotericin B. Early diagnosis of invasive mucormycosis is vital for timely therapeutic intervention, improved survival, and reduced morbidity.[14]

CONCLUSION

There was a rapid rise in mucormycosis cases worldwide following the COVID-19 pandemic. The most common symptoms of mucormycosis were peri-orbital oedema, headache, eye pain and facial puffiness. The underlying causes for the upsurge in cases can be a state of immunosuppression, including diabetes mellitus, long-term

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corticosteroids and the use of oxygen therapy. In our study, non-compliance with diabetic treatment and the presence of diabetic ketoacidosis were the significant risk factors associated with the outcome of mucormycosis patients. Diagnosis of mucormycosis remains challenging. Although the molecular methods are improving, histopathology, direct examination, and culture remain essential tools. Early diagnosis and treatment can reduce the mortality as well as morbidity associated with ROCM associated with COVID-19.

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