

Awareness of Health Care Workers Regarding Mucormycosis/Black Fungus Associated with Global COVID - 19 Pandemic in Rajasthan Population : A Cross – sectional Survey

Abstract:

Introduction : Together with the ongoing serious Covid-19 second wave in India, a serious fungal infection, mucormycosis has been increasingly found in Covid-19 recovered patients. Current trends indicate that the surge is higher in patient with co-morbidities. Health care facilities need to strengthen their infection prevention and control (IPC) programmes to prevent healthcare-associated outbreaks.

Therefore, we conducted a cross-sectional survey of health-care workers in Rajasthan to assess their awareness of Mucormycosis as a result of the global COVID-19 pandemic, as well as to learn about the possible link between invasive fungal sinusitis (mucormycosis) and coronavirus disease, as well as how to prevent and manage it.

Methodology: A web based cross-sectional study was conducted using convenience sampling. A self-administered anonymous questionnaire was designed in English and sent to the study participants via link of Google form through social media platforms and email. Total of 378 HCPs responded to survey.

Results: Out of 378 HCPs, majority of them were female (68.8%) with age <30 years (73.3%) and of these respondents most were dentists (82.2%). In assessing awareness of mucormycosis, 66.7% of HCPs believed the cause of the high prevalence of mucormycosis during COVID-19 was due to the higher prevalence of diabetes, indiscriminate use of steroids, immunocompromised patients with co-morbidities, usage of unhygienic humidifiers & o2 lines and tubes. 57.9% of HCPs surveyed agreed that careful and supervised use of systemic steroids should be consistent with current practice and 62.2% of HCPs agree that we need dynamic surveillance and control of diabetes mellitus or pre-diabetes in our population.

Conclusion: First case of Covid-19-related Mucormycosis has now been found in Chile. Thus, it is important to recognise this infection at an early stage, so as to potentially reduce soft and hard tissue necrosis and severe complications and alert colleagues of this life-threatening infection.

Key-words: COVID-19 Second wave, Mucormycosis, Health care Professionals(HCPS),Diabetics

Introduction:

SARS COV-19 has affected millions of individuals worldwide, had a significant impact on how it spreads, and caused severe acute respiratory syndrome and a significant number of fatalities. [1]

While India has not been able to actively control and limit the second wave of COVID-19, the number of new cases is now declining. [2]

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Despite this, reports of COVID-19-related problems are surfacing, with mucormycosis—a fungal infection becoming a severe problem in India as a result of its unprecedented rise and high morbidity. [3]

Colloquially referred to as “black fungus”, mucormycosis commonly causes necrosis within the head and neck region including the nose, paranasal sinuses, orbits and facial bones, with a potential for intracranial spread. Given the sheer magnitude of the outbreak, the Indian Health Ministry has advised all states to declare mucormycosis an epidemic. [4]

As a result of a government of India directive, mucormycosis became a notifiable condition in various Indian states in May 2021. Better understanding of the illness burden, population characteristics, risk factors, clinical spectrum, and patient outcomes may result from this. [5]

Extensive angioinvasion, which causes vascular thrombosis and tissue necrosis, is a sign of mucormycosis infections [1]

Progressive tissue necrosis can occur at different anatomical sites depending on how fungal exposure takes place. This may happen as a result of inhalation, ingestion, direct contact or traumatic inoculation. It has an impact on various systems, including the gastrointestinal tract, respiratory system, and central nervous system. The nose is the most prevalent site for rhino-cerebral mucormycosis; however, the condition can also spread to the paranasal. [7] A number of risk factors, including the prolonged use of steroids, multivitamins containing antibiotics, and zinc, have been linked to their prevalence. [8] In addition, mucosal erosion brought on by vigorous steam inhalation or by using high flow oxygen has also been thought to be a factor in fungal colonisation.

Contamination from the use of industrial oxygen, low-quality oxygen cylinders, low-quality oxygen piping system and ordinary tap water ventilators are also being cited as causative factors. Furthermore, COVID has been linked to hyperglycaemia in some patients, which increases the risk of developing a fungal infection. [4] In order to prevent COVID-19-associated mucormycosis, it is important to monitor the use of systemic corticosteroids in treating severe instances and work toward improving glycaemic control in COVID-19 patients. Systemic corticosteroids and other

immunomodulating medications shouldn't be used as outpatient treatments for COVID-19 in mild or moderate cases. [4]

Hence, we conducted a cross-sectional survey of health care workers in Rajasthan to assess Awareness of Health care workers regarding Mucormycosis associated with global COVID - 19 pandemic and to know the possible association between invasive fungal sinusitis (mucormycosis) and coronavirus disease and its prevention & management.

2. Method:

2.1 Study Design and Setting:

This study was conducted as cross-sectional survey of health care workers in Rajasthan during Covid-19 second wave in India. The data utilized in this cross-sectional survey were collected using online based questionnaire through **google forms**. The window for survey completion ran 4 weeks 1st June 2021 - 1st July 2021 with a reminder email sent at the end of the first week. The language used to conduct the survey was English. The responses to all questions were mandatory. Before participation, purpose of the study was explained in English at the beginning of Online Survey. The respondents were given the opportunity to ask questions via a dedicated email address for the study. No incentives were offered for engaging in the survey.

Inclusion criteria: Physicians, Dentists, Postgraduate and Undergraduate Dental and Medical students.

Non-inclusion criteria: Incomplete data in any section of the questionnaire.

2.2 Study Sample: Based on the precision response rate of 50 percent, 5 percent allowable error and critical z value of 1.96 the sample for the survey was calculated to be 300. Accounting for non-response, drop out our final sample size was planned to be 350 completed questionnaires from participants. The survey was stopped when we received 378 completed questionnaires.

2.3 Survey Administration:

Potential participant recruitment was performed by sharing link of google form via social media platforms (E-Mail, Facebook, Instagram) and free messaging services (What's app) using convenience sampling technique. Initially, we

shared the survey link on social media platforms to our primary contacts. Further, chain-referral sampling method was employed by requesting primary participants to roll out survey further to incorporate greater number of participants. On receiving and clicking the link, participants would get auto directed to the informed consent page followed by the survey questionnaires.

2.4 Questionnaire Development

Review was conducted to identify key areas and a draft questionnaire was devised. The draft questionnaire was in English format and consist sections on socio-demographic, awareness, prevention of healthcare workers against mucormycosis. The questionnaires were kept short and simple so that it can be quick to complete and easy to follow. A 5-member interdisciplinary team consisting of administration professional, health psychologist, assessment professional, nursing faculty, and PG student analysing the survey then independently reviewed survey items.

An online pilot study was first done among 30 Healthcare workers to test the reliability and validity of the questionnaire. Suggestions and corrections by the team to improve understanding, content, and validity of questionnaire were constructively incorporated into a revised survey. The team also inspected the revised survey to assure face validity and to make sure questions were appropriate. Cronbach's alpha was used to assess the internal consistency reliability of questionnaire and was found to be good (0.82). The mean content validity ratio was 0.70 which was based on the opinion of five subject experts.

2.5 Survey Content

We developed a comprehensive survey to evaluate Awareness of Health care workers regarding Mucormycosis. The final survey consisted of 3 sections with total 15 questions.

Section 1- The first section on demographics included questions on age, gender and profession.

Section 2-The second section on awareness included questions regarding Diagnosis, sign & symptoms of mucormycosis.

Section 3- The third section on preventivemeasures included questions regarding covid -19 associated mucormycosis due to Higher prevalence of diabetics in our population& Indiscriminate use of steroids as part of treatment of COVID-19.

2.6 Statistical analysis

All the data collected were entered into a personal computer and subjected to analysis using Statistical Package for Social Sciences (SPSS) version 26 (IBM Corporation, New York, New York). Illustrative analysis was obtained in the study.

The study used descriptive statistics to explore the distribution of the item responses. Continuous variables were reported in range, mean, and standard deviation (SD). Pearson Chi-square test was employed to test the association between the demographic variables such as gender, and level of education with the items of the questionnaire.

3. Results

3.1 General Demographic Characteristics:

A total of 378 HCPs participated in survey, majority of them were female (68.8%) with age <30 years (73.3%)and of these respondents most were dentists (82.2%). The details of respondent's socio-demographic and professional characteristics are summarized in **Table 1**.

3.2 Awareness regarding mucormycosis associated with COVID – 19:

- In assessing awareness of mucormycosis, 66.7%of HCPs believed the cause of the high prevalence of mucormycosis during COVID-19 was due to the higher prevalence of diabetes, indiscriminate use of steroids, immunocompromised patients with co-morbidities, use of unhygienic humidifiers & o2 lines and tubes and57.9% believed that OTHER risk factors were also associated, such as voriconazole treatment, broad-spectrum antibiotics and monoclonal antibodies, **Overzealous** use of zinc tablets.
- Tissue necrosis caused by angioinvasion and vascular thrombosis, according to 66.7 percent of HCPs, is the hallmark of Mucormycosis.

- In our study, 66.9% of HCPs were aware of the oral signs/manifestations of mucormycosis, and 67.2 percent were aware of the warning signs and symptoms of Mucormycosis.
- In accordance to this survey, 56.3 percent of HCPs thought that the correct order of Mucormycosis progression is Nasal mucosa > Paranasal sinuses > Orbit > CNS, but only 18.8 percent agreed that MRI and CT scan were the gold standard in diagnosing oral mucormycosis. The details of respondent's awareness regarding mucormycosis are summarized in **Table 2**.

3.3 Preventive measures against mucormycosis:

- A total of 57.9% of HCPs surveyed believed that the careful and supervised administration of systemic steroids should be standard practise.
- 62.2% of HCPs agree that we need dynamic surveillance and control of diabetes mellitus or pre-diabetes in our population.
- In a pandemic, 69.6% of HCPs agree that strong aseptic precautions should be taken while delivering oxygen (or sterile water for humidifiers, with daily sterilised humidifier and tube changes).
- 69.8% agree HCPs and doctors treating COVID-19 should explain the warning signs and symptoms to patients and their families on discharge to encourage them to seek medical help as soon as possible.
- POSACONAZOLE ORALLY PROPHYLACTIC should be utilised for high-risk COVID-19 patients, according to 38.4 percent of Hcps. The details of respondent's awareness regarding prevention of mucormycosis are summarized in **Table 3**.

Table 1.

Questions	Responses	N		Percentage		
		N	%	P-value		
				Gender	Age	Profession
Gender	Female	260	68.8			
	Male	118	31.2			
Age	>50 years	8	2.1			
	21-30 years	277	73.3			
	31-40 years	69	18.3			
	41-50 years	24	6.3			
Profession	Dental Professional	313	82.8			
	Medical Professional	65	17.2			

Demographic Details
 Key: ** N= Number of Respondents, Chi-square test, *Statistical significance at p ≤0.05

Table 2
 Assessment of Awareness regarding mucormycosis associated with COVID – 19

Q1 – According to you, what may be reason for high prevalence of Mucormycosis during COVID-19?	A) Higher prevalence of diabetes /uncontrolled diabetes/ pre diabetes in our population	46	12.2	0.314	.000	0.198
	B) Indiscriminate use of steroids /Tocilizumab as part of treatment of COVID-19	47	12.4			
	C) Immunocompromised patients with co-morbidities	20	5.3			
	D) Unhygienic humidifiers, O2 lines & tubes	13	3.4			
	E) All of the above	252	66.7			
Q2 – Which of the following, are the OTHER risk factors associated with Mucormycosis?	A) Co-Morbidities – Post transplant /Malignancy	78	20.6	0.413	0.275	0.775
	B) Voriconazole therapy	18	4.8			
	C) Broad spectrum antibiotic / monoclonal antibodies	45	11.9			
	D) Overzealous use of zinc tablets	18	4.8			
	E) All of the above	219	57.9			

Q3 – Which of the following is the hallmark of Mucormycosis?	A) Tissue Gangrene	58	15.3	0.181	0.000	0.012
	B) Tissue necrosis resulting from angioinvasion & vascular thrombosis	251	66.4			
	C) Deep vein thrombosis	18	4.8			
	D) None of the above	51	13.5			
Q4 -Which of the following are the oral signs /manifestation of Mucormycosis?	A) Foul smelling, sticky mucous or black tinged discharge from oral orifice or nasal orifice	64	16.9	.115	.006	.259
	B) Dental pain with loosening of teeth and /or jaw involvement	36	9.5			
	C) Bone exposure & tissue necrosis (invasive lesion)	25	6.6			
	D) All of the above	253	66.9			
Q5 – What are the warning sign & symptoms of Mucormycosis?	A) Sinusitis -Nasal stiffness /crusting /congestion, nasal discharge (blackish / bloody)	60	15.9	.644	.000	.466
	B) Facial pain, facial oedema, dental pain	34	9.0			
	C) Pain in the eye or loss of vision	30	7.9			
	D) All of the above	254	67.2			
Q6 – According to you, which of the following depicts the correct order of progression of Mucormycosis?	A) Nasal mucosa > Orbit > Paranasal sinuses > CNS	79	20.9	.931	.082	.723
	B) Nasal mucosa > CNS > Orbit > Paranasal sinuses	44	11.6			
	C) Nasal mucosa > Paranasal sinuses > Orbit > CNS	213	56.3			
	D) Paranasal sinuses > Nasal mucosa > Orbit > CNS	42	11.1			
Q 7- Which of the following, is the Gold standard in diagnosis of Oral Mucormycosis?	A) Direct Microscopic Examination & culture / mucosal biopsy	184	48.7	.13	.001	.109
	B) MRI or CT Scan	71	18.8			
	C) Histopathological examination with special stains	95	25.1			
	D) None of the above	28	7.4			

: ** N= Number of Respondents, Chi-square test, *Statistical significance at p ≤0.05

TABLE -3

Assessment of preventive measures of HCP towards covid -19 associated mucormycosis

Questions	Responses	N	%	P-value		
				Gender	Age	Profession
Q1 – Do you think, there should be judicious and supervised use of systemic steroids in compliance with current preferred practice guidelines?	Agree	219	57.9	.658	.003	.245
	Partially agree	82	21.7			
	Partially disagree	47	12.4			
	Disagree	30	7.9			
Q2- Is there a need for aggressive monitoring and control of diabetes mellitus or pre -diabetes?	Agree	235	62.2	0.591	0.00	.021
	Partially agree	90	23.8			
	Partially disagree	35	9.3			
	Disagree	18	4.8			
Q3- Is it necessary to have strict aseptic precautions while administering oxygen (or sterile water for humidifiers daily changes of sterilized humidifiers and tubes) in pandemic times?	Agree	263	69.6	.105		0.052
	Partially agree	59	15.6			
	Partially disagree	38	10.1			
	Disagree	18	4.8			
Q 4- Should health care workers / COVID-19 treating doctors EXPLAIN to patients and the family members on discharge following treatment of COVID-19, the early signs & symptoms of Mucormycosis to prompt them to seek early medical attention?	Yes	264	69.8	.121		0.009
	No	35	9.3			
	Can't Say	49	13.0			
	Don't know	30	7.9			
Q5- Should prophylactic ORAL POSACONAZOLE be given in a high risk Covid -19 treated individuals?	Yes	145	38.4	.062		0.036
	NO	21	5.6			0.72
	Can't say	131	34.7			4
	Don't know	81	21.4			

Key: ** N= Number of Respondents, Chi-square test, *Statistical significance at p ≤0.05

Discussion:

In this study 66.7% HCPs believed that COVID-19 patients with diabetes mellitus who received steroids were liable to Mucormycosis and also the results of our study were adored another multicentric epidemiological study [9] where 65% of HCPs agreed for the same

The COVID-19 outbreak emphasises the need to understand the complex pathophysiology of diabetes and other diseases. The foremost common reason behind drug-induced hyperglycaemia is steroids. They exacerbate hyperglycaemia in patients with known diabetes mellitus (DM). Diabetes, when paired with the SARS COV-2 Virus and steroid therapy, appears to produce a vicious cycle of hyperglycaemia and immunosuppression, which may result in severe fungal colonization like mucormycosis. [4]

As a result, 62.2 % of HCPs in our poll agree that our population needs dynamic surveillance and control of diabetes or pre-diabetes.

In this study **57.9% of HCPs surveyed felt that, careful and supervised use of systemic steroids should be standard treatment.** During the second COVID-19 wave in India, unrestricted use of corticosteroids for even minor COVID-19 symptoms was a major accelerator for mucormycosis. Corticosteroids, which are commonly used to treat inflammation, have a significant impact on human homeostasis, for example, by boosting gluconeogenesis, which leads to higher blood glucose levels, increasing the risk of fungal infections. [9]

The condition is typically found throughout the COVID-19 healing period, implying that a number of variables contribute to fungal colonisation.[2] Other risk factors, such as voriconazole medication, broad-spectrum antibiotics, monoclonal antibodies, and overuse of zinc pills, were seen to be linked by 57.9% of HCPs.

To avoid future spread of COVID-19 and CAM, which are now ravaging India, immediate action should be done. To achieve this, several essential measures, such as using the correct terminology to define the disease and transparency in reporting cases across regions, must be initiated. Since CAM is not transmitted between humans, no tracking like COVID-19 is required; however, the actual incidence would help plan

appropriate health resource utilisation and prevention strategies. Identifying high-risk groups and addressing uncontrolled diabetes, which is the easiest to manage among numerous potential risk factors, can help prevent a future increase in CAM. However, in India, where the majority of the population lives in rural areas with little resources, measuring blood sugar for diabetes may not be a cost-effective alternative. As a result, the concept of MUSTARD (Mass Urine Sugar Testing to Assess and Regulate Diabetes) could come in handy. Urine-based testing is less expensive (5 cents), rapid, and simple for the general public to do [10]. Finally, widespread vaccination is a prerequisite for COVID-19 immunity, while mass surveillance is critical for combating CAM. The COVID-19 vaccination had been administered in the country for 391 million doses as of July 15, 2021 [11]. Government agencies are currently running large campaigns to combat vaccination apprehension, and the results are positive, with an increase in the number of people who have been vaccinated. Finally, characteristics in Indian patients with "Long COVID" who are also infected with CAM should be studied.

Conclusion:

Uncontrolled hyperglycaemia and overuse of steroids during COVID-19 are two of the key causes exacerbating the illness, prompting new guidelines on interdisciplinary mucormycosis care. As a result, early detection and treatment are critical for controlling the symptoms associated with these risk factors, such as pulmonary mucormycosis.

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