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RESEARCH ARTICLE

CROSS SECTIONAL STUDY AMONG HEALTH CARE STUDENTS DURING COVID-19 4TH WAVE FOR THE AWARENESS OF MUCORMYCOSIS ASSOCIATED WITH THE PANDEMIC

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Abstract

Objectives: to observe and analyze data about the awareness of Mucormycosis (black fungi) infection associated with some cases of COVID-19 after recovery and factors related to it, targeting population Medical health care students in Hail university and Imam Abdulrahman Bin Faisal University, Kingdom of Saudi Arabia.

Methods: surveillance cross sectional study, data were collected from 15th of October 2021 till 28th of February 2022. Study population Male and Females / adults / Medical health care students in Hail university and Imam Abdulrahman Bin Faisal University, Kingdom of Saudi Arabia, using questionnaires, statistical analysis was done by SPSS 22.

Results: 216 responses to the questioner. The study finding showed that(62%) from Hail university and (38%) were from Imam Abdulrahman Bin Faisal University. As for gender (66.7%) were female and (33.3%) were males ,also results showed that from Medicine college (59.7%) ,(18.5%) from Applied medical college,(7.9%) pharmacy ,(6%) students from public health college,(4.2%) nursing and (3.7%) from Dentistry college. Regarding COVID-19 status and vaccination (90.3%) were vaccinated by 2 doses and (74.1%) were not infected by COVID-19 . About the awareness about Mucormycosisand knowing about the type of infection ,causative agent and contagiousness (63%) not knowing the type of infection ,(43.5%) thinking it's a contagious disease while (74.1%) consider it as fungal disease .(45.4%) answered it's a mucor mold type of fungi and (39.8%) answered its belong to genus mucor . About factors that can play a role in infection asage , gender , race , environment and lifestyle (78.7%) agreed that these factors play an important role in infection ,(37.5%) explained that giving name black fungi infection is due to the color of the lesion while (26.9%) giving the reason that due to color of the fungi or because it can lead to death .About lesions and which part of the body do you think mostly affected results showed Rhinocerebral (46.3%), followed by (25.5%) in the eyes ,(15.3%) in the ears and(13%) in the brain .(48.1%) agreed that patients with COVID-19 infection could be more susceptible to mucormycosis infection . (59.3%) given the reason that having history of weak immunity with COVID-19 infection can lead to mucormycosis secondary infection while (23.1%) believe that protocol of treatment used in COVID-19 infection may be the cause and (10.1%) think that patients with

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COVID-19 associated with history of diabetes mellitus lead to black fungi infection. (56%) of the results showed that participants think that vaccination can prevent black fungi infection ,(42.1%) agreed that black fungi can be treatable by antifungal drugs with surgical interference,(36.6%) answered that it can be treat by antifungal drugs only ,(12.5%) think that it can be treated with antibiotics and (8.8%) considered that black fungi not treatable .(79.2%) believed that mucormycosis infection can lead to death.

Conclusion: awareness is the golden key to manage any emerging public health problem specially among health care provider in all specialties, Spreading the knowledge and updates among society of Medical health care students about mucormycosis causative agent, factors lead to infection specially during the COVID-19 pandemic ,suggested treatment and management of such case can help in controlling , preventions . know how to deal with Post COVID-19 situation and prepare for it.

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Introduction:-

Mucormycosis is an emerging invasive fungal disease associated with diabetes mellitus, lack of immunity and patients with large dose, prolonged steroids therapy. Black fungal infection cases during COVID-19 pandemic 3rd wave were showed in India, Bangladesh and other countries [13]. Inhalation of *Mucor* spores , contaminated wound or ingestion of food contaminated by spores can cause the infection among the risk group of patients [3-14,18].

Mucor fungi lives in soil, dead leaves , compost and wood , it can be transmitted by direct contact with spores or mechanically move by air . Mucormycosis can be associated with different clinical symptoms depend on the organ affected , the favorable condition allow the spores to grow as hypoxia, high glucose in blood ,metabolic acidosis, inflammation or low activity of white blood cells [16].

Some COVID-19 patients were treated by steroids and/ or suffering from diabetes, and due to decline of CD4, CD8 and T cell count that can lead to be more susceptible to get infected by fungi [19,20].This cross sectional study aimed to investigate the awareness of black fungi infection associated with COVID-19 among medical health care students in Hail university and Imam Abdulrahman Bin Faisal University and the knowledge of medical health care students about the factors , risk groups and how to manage.

Material And Methods:-

Study Design:

Surveillance cross sectional study.

Study population:

Male and Females / adults / Medical health care students in Hail university and Imam Abdulrahman Bin Faisal University, Kingdom of Saudi Arabia

Sample collection and strategies:

Data collection was by using standardizing Questionnaires distribution

Soft and hard copies of questionnaires distributed to groups of adult's males and females medical health care students in Northern and Eastern region of KSA and on social media.

Study sampling:

A total of 216 participated in this study.

Statistical Analysis:
Data analysis was performed using statistical Package for social Sciences SPSS (version 22) program at significance of > 0.05 and Microsoft Excel-2016 software.

Ethical Consent:
Informed Consent was addressed during this study.

Results:-

The study finding shows that (62%) from Hail university and (38%) were from Imam Abdulrahman Bin Faisal University. For gender (66.7%) were female and (33.3%) were males ,also results showed that from Medicine college (59.7%) ,(18.5%) from Applied medical college,(7.9%) pharmacy ,(6%) students from public health college,(4.2%) nursing and (3.7%) from Dentistry college as showed in (Table 1).

Table 1:- University ,Gender and College.

University					
Valid		Frequency	Percent	Valid Percent	Cumulative Percent
	Imam Abdulrahman Bin Faisal University	82	38	38	38
	University of Hail	134	62.0	62.0	100.0
	Total	216	100.0	100.0	
Gender					
Valid		Frequency	Percent	Valid Percent	Cumulative Percent
	Female	144	66.7	66.7	66.7
	Male	72	33.3	33.3	100.0
	Total	216	100.0	100.0	

College					
Valid		Frequency	Percent	Valid Percent	Cumulative Percent
	Applied medicine	40	18.5	18.5	18.5
	Dentistry	8	3.7	3.7	22.2
	Medicine	129	59.7	59.7	81.9
	Nursing	9	4.2	4.2	86.1
	Pharmacy	17	7.9	7.9	94.0
	Public health	13	6.0	6.0	100.0
	Total	216	100.0	100.0	

Regarding COVID-19 status and vaccination (90.3%) were vaccinated by 2 doses, (4.2%) vaccinated with 3rd dose,(3.7%) not vaccinated and (1.9%) only vaccinated by 1st dose as showed in(figure 1). (74.1%) were not infected by COVID-19 while (23.1%) were infected and (2.8%) were admixture as showed in (Table 2).

Fig 1:- vaccination status

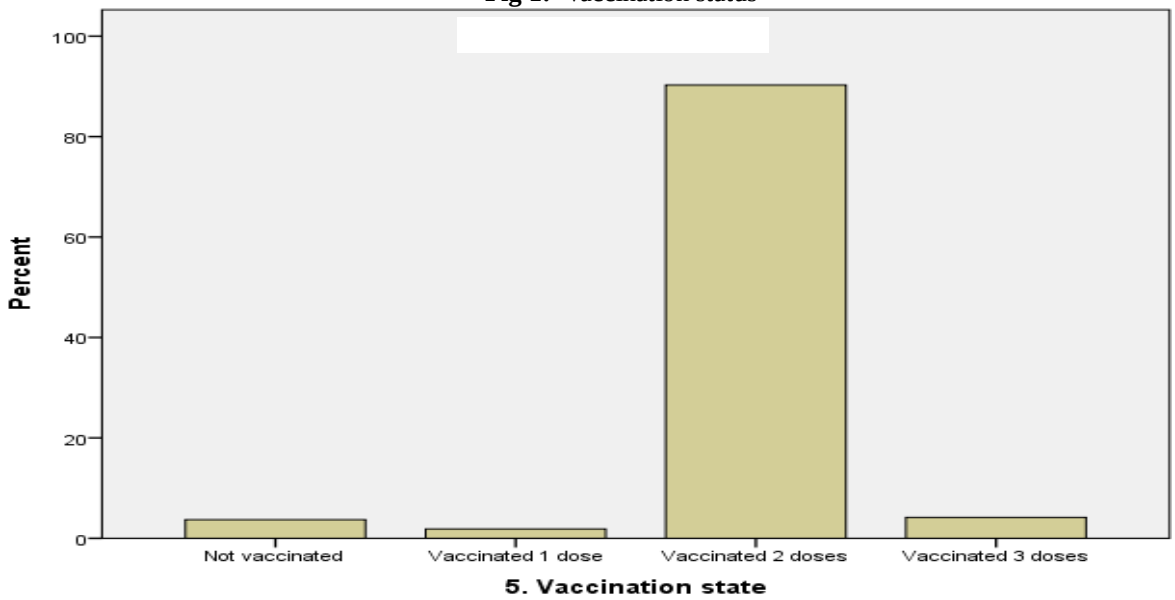


Table 2:- Infection with Covid-19.

Valid		Frequency	Percent	Valid Percent	Cumulative Percent
	Admixture	6	2.8	2.8	2.8
	No	160	74.1	74.1	76.9
	Yes	50	23.1	23.1	100.0
	Total	216	100.0	100.0	

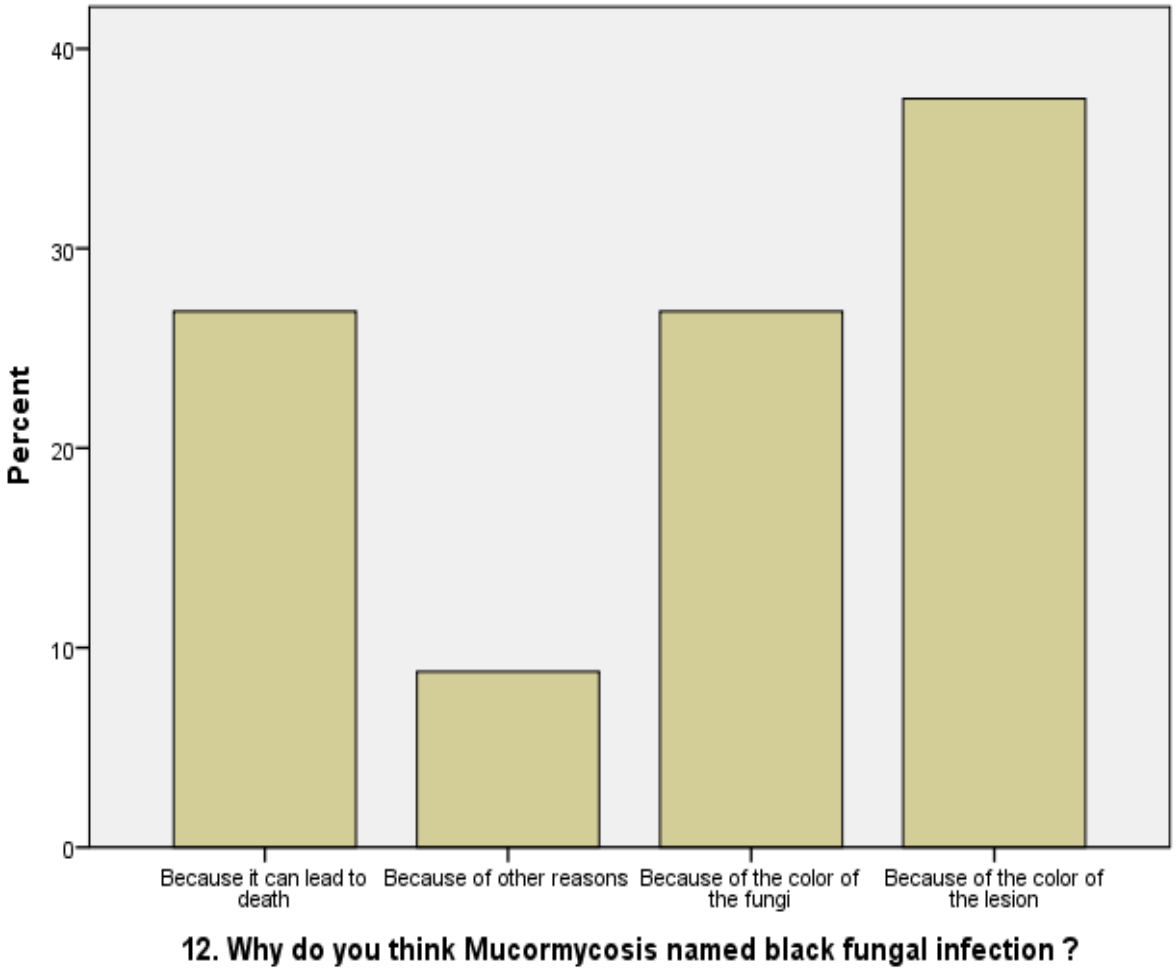
About the awareness about Mucormycosis and knowing about the type of infection, causative agent and contagiousness (63%) not knowing the type of infection, (43.5%) thinking it's a contagious disease, (36.1%) do not know if it'sacontagiousdisease, (20.4%) didn't consider mucormycosis as contagious disease, while (74.1%) identify it as fungal infection. (45.4%) defined it asmucor mold type of fungi and (39.8%) classified it to genus mucoras showed in (Table 3) .

Table 3:- contagiousness, causativeagent, Type and ClassificationMucormycosis is a contagious disease.

Valid		Frequency	Percent	Valid Percent	Cumulative Percent
	I don't know	78	36.1	36.1	36.1
	No	44	20.4	20.4	56.5
	Yes	94	43.5	43.5	100.0
	Total	216	100.0	100.0	
The causative agent of Mucormycosis					
Valid		Frequency	Percent	Valid Percent	Cumulative Percent
	Bacteria	16	7.4	7.4	7.4
	Fungi	160	74.1	74.1	81.5
	Parasite	10	4.6	4.6	86.1
	Virus	30	13.9	13.9	100.0
	Total	216	100.0	100.0	
Type of fungi					
Valid		Frequency	Percent	Valid Percent	Cumulative Percent
	Dimorphic	23	10.6	10.6	10.6
	Mold	52	24.1	24.1	34.7
	Mucor Mold	98	45.4	45.4	80.1
	Yeast	43	19.9	19.9	100.0
	Total	216	100.0	100.0	
Genus of Mucor Mold causes the infection					

Valid		Frequency	Percent	Valid Percent	Cumulative Percent
	Aspergillus	28	13.0	13.0	13.0
	Mucor	86	39.8	39.8	52.8
	Mucor&Rhizopus	63	29.2	29.2	81.9
	Rhizopus	39	18.1	18.1	100.0
	Total	216	100.0	100.0	

Factors that can play a role in infection asage,gender,race, environment and lifestyle (78.7%) agreed that these factors play an important role in infection, (37.5%) explained that giving name black fungi infection is due to the color of the lesion while (26.9%) giving the reason that due to color of the fungi or because it can lead to death as showed in (Figure 2).



Reasons of naming black fungal infection

About lesions and which part of the body do you think mostly affected resultsshowedRhinocerebral (46.3%), followed by (25.5%) in the eyes, (15.3%) in the ears and (13%) in the brain .(48.1%) agreed that patients with COVID-19 infection could be more susceptible to mucormycosis infection . (59.3%) given the reason that having history of weak immunity with COVID-19 infection can lead to mucormycosis secondary infection while (23.1%) believe that protocol of treatment used in COVID-19 infection may be the cause and (10.1%) think that patients with COVID-19 associated with history of diabetes mellitus lead to black fungi infection. (56%) of the results showed that participants think that vaccination can prevent black fungi infection, (42.1%) agreed that black fungi can be treatable by antifungal drugs with surgical interference, (36.6%) answered that it can be treat by antifungal drugs only, (12.5%) think that it can be treated with antibiotics and (8.8%) considered that black fungi nottreatable. (79.2%) believed that mucormycosis infection can lead to death as showedin (Table 4).

Table 4:- Infected parts of the body, susceptibility, factors associated with COVID-19patients and treatmentParts of the body the infection usually appears first.

Valid		Frequency	Percent	Valid Percent	Cumulative Percent
	Brain	28	13.0	13.0	13.0
	Ears	33	15.3	15.3	28.2
	Eyes	55	25.5	25.5	53.7
	Rhinocerebral	100	46.3	46.3	100.0
	Total	216	100.0	100.0	
Patients infected with Covid-19 are more susceptible to be infected by black fungi					
Valid		Frequency	Percent	Valid Percent	Cumulative Percent
	I don't know	85	39.4	39.4	39.4
	No , no relation	27	12.5	12.5	51.9
	Yes , they are more susceptible	104	48.1	48.1	100.0
	Total	216	100.0	100.0	
Black fungi is associated with Covid-19					
Valid		Frequency	Percent	Valid Percent	Cumulative Percent
	Because Covid-19 patients have history of diabetes mellitus	22	10.2	10.2	10.2
	Because Covid-19 patients have history of weak immunity	128	59.3	59.3	69.4
	Because of the age of Covid-19 patients	16	7.4	7.4	76.9
	Because of the treatment used with Covid-19	50	23.1	23.1	100.0
	Total	216	100.0	100.0	
Covid-19 vaccination can prevent infection with black fungi					
Valid		Frequency	Percent	Valid Percent	Cumulative Percent
	No , it has no role	95	44.0	44.0	44.0
	Yes , it can play a role in preventing the infection	121	56.0	56.0	100.0
	Total	216	100.0	100.0	
Black fungal infection can be treated					
Valid		Frequency	Percent	Valid Percent	Cumulative Percent
	No , it cannot be treated	19	8.8	8.8	8.8
	Yes , it can be treated by antifungal drugs only	79	36.6	36.6	45.4
	Yes , it can be treated by antifungal drugs with surgical interference	91	42.1	42.1	87.5

	Yes , it can be treated with antibiotics	27	12.5	12.5	100.0
	Total	216	100.0	100.0	
Black fungal infection is life threatening					
Valid		Frequency	Percent	Valid Percent	Cumulative Percent
	No , it cannot cause death	45	20.8	20.8	20.8
	Yes , it can lead to death	171	79.2	79.2	100.0
	Total	216	100.0	100.0	

Discussion:-

Assessing the awareness and level of knowledge among medical care students may have a good impact to health care providers in general as it can help in taking some measurements toward the continue updates during the COVid-19 pandemic.

Recently studies in different countries has been made to asses and evaluate the knowledge and awareness of communicable disease emerging [5,6].

[15] reported that female medical care worker scored more in participating and have adequate knowledge comparing to male which also showed in the present study.In agreement with the present study [11,8] reported that medicine students and doctors were found more aware and better knowledge of black fungal infection comparing with other medical health care providers. In according to results in the present study, Globally mucormycosis infection around the world usually found more in tropical, warm and humid countries and the etiological agents mostly *Rhizopus*spp and *Mucor*spp as mentioned by [17],the most common form is rhinocerebralmucormycosis also associated with eyes and face lesions [12],several studies reported the relationship between COVID-19 and mucourmycosis which is probably due to the weak immune response as a result of decrease in T lymphocytes CD4+ and CD8+ [1-7,10] and other factors that increasing the risk as diabetes mellitus reported by [2,9] proven that administration of corticosteroids with COVID -19 patients on mechanical ventilation could lead to increase the risk of mucormycosis. For treatment of mucormycosis as mentioned by [4,17] antifungal drugs with surgical removal of necrotic tissue and surroundinghealthy tissue can lead to control and prevent the spreading of mucormycosisinfection. The present study showed that the medical health care participants were not fully aware of mucormycosis causative agent, factors helping infection, methods of treatment and managements.

Conclusion:-

Awareness is the golden key to manage any emerging public health problem specially among health care provider in all specialties, Spreading the knowledge and updates among society of Medical health care students aboutmucormycosis causative agent, factors lead to infection specially during the COVID-19 pandemic, suggested treatment and management of such case can help in controlling andpreventions. knowing how to deal with Post COVID-19 situation specially risk groups education for precautions and prophylaxis.

Recommendation:-

More investigations should be done for the relation between COVID-19 patients and Mucormycosis associated fungal infection. Awareness campaigns showed be made to increase the knowledge about post COVID-19 situation especially Diabeticpatients, weak immunity and blood diseases groups. campaigns shouldbe targeting Health care providers and society for the life style and healthy habits ofpost COVID-19 recovery patients.

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