ORIGINAL ARTICLE

KNOWLEDGE ATTITUDE AND PRACTICES OF COVID-19 ASSOCIATED MUCORMYCOSIS AMONGST DENTAL PRACTITIONERS IN INDIA – A CROSS SECTIONAL STUDY

Dr. Janhavi Modi, Dr. Shreyas Hemchandra Gupte, Dr. Thomson Mariadasan Dcruz, Dr. Nitin Bapu Jadhav, Dr. Firdos Sirajuddin Mazgaonkar, Dr. Drishti Pradip Shah

Department of Oral & Maxillofacial Surgery

Y.M.T Dental College and Hospital, Kharghar, Navi Mumbai

Address for Correspondence:

Dr. Janhavi Modi (MDS)

Assistant Professor,Department of Oral & Maxillofacial Surgery

Y.M.T Dental College and Hospital, Kharghar, Navi Mumbai

Email ID janvmodi@gmail.com

ABSTRACT

Background: The SARS COV-2 virus outbreak led to a pandemic last year wreaking havoc all over the world. With the next wave waiting to strike India, a steep increase in the incidence of Covid – 19 associated Mucormycosis cases in recent times amongst the Indian population showing a mortality rate of 30-70% has been noted. Most patients show signs and symptoms pertaining to the oral cavity and peri-oral structures. Therefore, the need for the dental fraternity to be aware about its clinical presentation and pathophysiology plays a crucial role in early diagnosis of Mucorales infection.

Material and Methods: A cross sectional study was conducted amongst dental practitioners across India. 703 responders responded to a questionnaire that consisted of 15 questions, which were divided into subheadings of Knowledge, Attitude and Practices having 5 questions each.

Results: On statistical analysis of question-wise data received, out of a total of 15 questions, majority of the questions showed highly statistical significance between BDS and MDS responders.The questionnaire was divided into three categories Knowledge, Attitude and Practices. The number of responses were evaluated by a scoring system for each respondent and compared for knowledge attitude and practices. The number of years into practice and qualification were compared. Knowledge Attitude and a sum of Knowledge, attitude and practices amongst BDS and MDS respondents showed statistical significance ($p>0.05$) and with increase in number of years into dental practice there was no statistical difference seen amongst the sub groups.

Conclusion: The need for prompt, accurate and effective treatment in today's trying times cannot be overlooked. This study primarily focuses on critical and timely management of the deadly disease. However, knowledge about current consensus, pathophysiology, occurrence and incidence can further help the medical fraternity through the challenging times of this epidemic and pandemic.

KEYWORDS: covid-19 associated mucormycosis, mucormycosis,

INTRODUCTION

With the rise in Covid -19 claiming more than a million lives worldwide,[1] India faces yet another disastrously emergent condition waiting to storm into the current situation. India, after being deemed the World's capital of Diabetes,[2] continues to remain on the horns of dilemma in battling the paramount issues related to it, moreover the arrival of covid-19 and administration of corticosteroids only made this a perfect recipe for another cataclysmic outcome.[3]

Mucormycotina or Mucormycosis is a potentially infectious saprophytic fungal infection, resulting in a fatal triad of angioinvasion, mycotic thrombosis and ischemic necrosis of the tissues which could also be vision-threatening.[4] Incidence of mucormycosis varies from 0.005 to 1.7 per million population and the global case fatality rate is as high as 46%.[4] It shows six different clinical forms namely: rhinocerebral, pulmonary, disseminated, gastrointestinal, cutaneous, and other rare forms.[5]

Information and awareness regarding CAM has been provided to the population via various channels like social media, tele information and the internet. However, the assessment of knowledge and awareness amongst Indian dental practitioners is still of great importance. With the steep increase in number of reported cases all over India the need for the dental fraternity to be aware about the clinical presentation and pathophysiology, plays a crucial role in early diagnosis and prompt treatment of CAM. Hence, the objective of this study was to assess the knowledge, awareness and practices in the diagnosis and management of CAM amongst dental practitioners in India. This questionnaire was prepared on the basis of the current CDC guidelines published for diagnosis and management of Mucormycosis.[6]

MATERIAL AND METHODS

This survey was conducted at a teaching institute in Navi Mumbai, Maharashtra. The survey was circulated through online platforms and was sent to 1500 potential responders which included dental practitioners all over India having a BDS or MDS degree of all specialities. The period of survey was from 24th May to 1st June, 2021, and a total of 703 responders, consented and completed the survey. The questionnaire consisted of socio demographic questions, qualification, number of years into dental practice and 15 questions based on the current guidelines published by CDC. The questionnaire included questions that highlighted the possible aetiology, pathophysiology, methods of diagnosis and protocol for management of CAM. The institutional Ethics Committee (IEC) reviewed and approved the study related documents (148/IRB/YMTDC2021). A convenient sampling method was used for the collection of the data and was presented in the form of percentages. The sub groups were classified on the basis of gender, age, profession, state of India and number of years into dental practice. The collected data was analysed with IBM SPSS Statistics for Windows, version 23.0.(Armonk, NY: IBM Corp). To find the significant difference between the bivariate samples in Independent groups (BDS & MDS) the Mann-Whitney U test was used. The multivariate analysis (< 5 yrs, 5-10 yrs,10-15 yrs & > 15 yrs) was done by, the Kruskal Walli's test followed by the Mann-Whitney. The significance in categorical data was found by using Pearson Chi-Square test. In the above statistical tool the probability value at $p < 0.01$ was considered Highly Significant and $0.01 \leq p \leq 0.050$ was considered as significant level.

RESULTS

A total of 703 dental practitioners from across India responded to the survey. A majority of the responders were from the age group of 20-30 years (n=397)(Fig.1). Approximately 59.6% (n = 419) (Fig.2) of the responders were females, 59.3% dental practitioners were MDS (n = 417) (Fig. 3). Majority of the responders were from the state of Maharashtra. To describe about the data; descriptive statistics, frequency analysis, percentage analysis was done. Qualification in terms of BDS and MDS was evaluated for each question and amongst a total of 703 responses, 59.3% (417) were MDS and 40.7% (286) were BDS. On statistical analysis of question-wise data received, out of a total of 15 questions, majority of the questions showed highly statistical

Table I. Question-wise statistical analysis for BDS vs MDS – Question no. 2

| | | | Qualification | | Total |
			B.D.S.	M.D.S.	
2. Is Mucormycosis the same as CAPA (Covid-19 associated Pulmonary Aspergillosis)?	Don't Know	Count	100	59	159
		%	24.0%	20.6%	22.6%
	Maybe	Count	86	31	117
		%	20.6%	10.8%	16.6%
	No	Count	194	174	368
		%	46.5%	60.8%	52.3%
	Yes	Count	37	22	59
		%	8.9%	7.7%	8.4%
Total		Count	417	286	703
		%	100.0%	100.0%	100.0%

	Value	df	p-value
Pearson Chi-Square	17.525[a]	3	.001
Likelihood Ratio	17.984	3	.000
N of Valid Cases	703		

Table II. Question-wise statistical analysis for BDS vs MDS – Question no. 3

| | | | Qualification | | Total |
			B.D.S.	M.D.S.	
3. What according to you is the clinical hallmark in diagnosing Mucormycosis	Any one or All of the above	Count	342	257	599
		%	82.0%	89.9%	85.2%
	Blackish or bloody nasal discharge	Count	27	12	39
		%	6.5%	4.2%	5.5%
	Impaired vision or loss of vision	Count	22	3	25
		%	5.3%	1.0%	3.6%
	Unexplained mobility in teeth/Multiple draining abscesses with inflammed gingiva	Count	26	14	40
		%	6.2%	4.9%	5.7%
Total		Count	417	286	703
		%	100.0%	100.0%	100.0%

	Value	df	p-value
Pearson Chi-Square	11.872[a]	3	.008
Likelihood Ratio	13.436	3	.004
N of Valid Cases	703		

Table III. Question-wise statistical analysis for BDS vs MDS – Question no. 4

| | | | Qualification | | Total |
			B.D.S.	M.D.S.	
4.Blackening of the Palate in Mucormycosis is also referred to as?	All of the above	Count	191	159	350
		%	45.8%	55.6%	49.8%
	Black fungal infection	Count	110	42	152
		%	26.4%	14.7%	21.6%
	Eschar	Count	50	53	103
		%	12.0%	18.5%	14.7%
	Tissue necrosis	Count	66	32	98
		%	15.8%	11.2%	13.9%
Total		Count	417	286	703
		%	100.0%	100.0%	100.0%

	Value	df	p-value
Pearson Chi-Square	21.568[a]	3	.0005
Likelihood Ratio	22.035	3	.000
N of Valid Cases	703		

Table IV. Question-wise statistical analysis for BDS vs MDS – Question no. 5

			Qualification		Total
			B.D.S.	M.D.S.	
5. Which is the radiographical investigation of choice which aids in the diagnosis of Mucormycosis?	Contrast Enhanced Computed Tomography	Count	202	140	342
		%	48.4%	49.0%	48.6%
	Contrast Enhanced Magnetic Resonance Imaging	Count	130	74	204
		%	31.2%	25.9%	29.0%
	Gadolinium Enhanced Magnetic Resonance Imaging	Count	60	65	125
		%	14.4%	22.7%	17.8%
	Orthopantamogram	Count	25	7	32
		%	6.0%	2.4%	4.6%
Total		Count	417	286	703
		%	100.0%	100.0%	100.0%

	Value	df	p-value
Pearson Chi-Square	12.977[a]	3	.005
Likelihood Ratio	13.260	3	.004
N of Valid Cases	703		

Table V. Question-wise statistical analysis for BDS vs MDS – Question no. 7

			Qualification		Total
			B.D.S.	M.D.S.	
7. Treatment of Mucormycosis :	Can be done by effective medicinal management only	Count	32	9	41
		%	7.7%	3.1%	5.8%
	Can be done in a clinic/ dental setup	Count	2	0	2
		%	.5%	0.0%	.3%
	Depends on extent of the disease	Count	164	52	216
		%	39.3%	18.2%	30.7%
	Requires a Multidisciplinary approach	Count	219	225	444
		%	52.5%	78.7%	63.2%
Total		Count	417	286	703
		%	100.0%	100.0%	100.0%

	Value	df	p-value
Pearson Chi-Square	50.396[a]	3	.0005
Likelihood Ratio	52.986	3	.000
N of Valid Cases	703		

Table VI. Question-wise statistical analysis for BDS vs MDS – Question no. 8

			Qualification		Total
			B.D.S.	M.D.S.	
8. What is the 'Drug of Choice' in treatment of Mucormycosis?	A combination of a and b	Count	177	151	328
		%	42.4%	52.8%	46.7%
	A combination of a and c	Count	60	23	83
		%	14.4%	8.0%	11.8%
	Amphotericin B lipid complex and/or liposomal Amphotericin B and/or Amphoterecin B Deoxycholate	Count	173	110	283
		%	41.5%	38.5%	40.3%
	Isavuconazole and/or Posaconazole oral suspension	Count	5	0	5
		%	1.2%	0.0%	.7%
	Itraconazole	Count	2	2	4
		%	.5%	.7%	.6%
Total		Count	417	286	703
		%	100.0%	100.0%	100.0%

	Value	df	p-value
Pearson Chi-Square	13.642[a]	4	.009
Likelihood Ratio	15.672	4	.003
N of Valid Cases	703		

Table VII. Question-wise statistical analysis for BDS vs MDS – Question no. 9

			Qualification		Total
			B.D.S.	M.D.S.	
9. What is the most common complication of Deoxycholate Amphotericin B?	Anaphylaxis	Count	35	14	49
		%	8.4%	4.9%	7.0%
	Confusion	Count	44	13	57
		%	10.6%	4.5%	8.1%
	Nephrotoxicity	Count	268	222	490
		%	64.3%	77.6%	69.7%
	Ototoxicity	Count	70	37	107
		%	16.8%	12.9%	15.2%
Total		Count	417	286	703
		%	100.0%	100.0%	100.0%

	Value	df	p-value
Pearson Chi-Square	16.518[a]	3	.001
Likelihood Ratio	17.222	3	.001
N of Valid Cases	703		

Table VIII. Question-wise statistical analysis for BDS vs MDS – Question no. 10

			Qualification		Total
			B.D.S.	M.D.S.	
10. What according to you should be the sequence / algorithm for management of Mucormycosis ?	Diagnosis > Surgical debridement > Medicinal management	Count	65	67	132
		%	15.6%	23.4%	18.8%
	Diagnosis > Medicinal management	Count	12	1	13
		%	2.9%	.3%	1.8%
	Diagnosis > Medicinal management > Surgical debridement> Continue medicinal management	Count	202	136	338
		%	48.4%	47.6%	48.1%
	Empirical anti-fungal treatment > Diagnosis > Surgical debridement > Medicinal management	Count	138	82	220
		%	33.1%	28.7%	31.3%
Total		Count	417	286	703
		%	100.0%	100.0%	100.0%

	Value	df	p-value
Pearson Chi-Square	12.503[a]	3	.006
Likelihood Ratio	13.830	3	.003
N of Valid Cases	703		

Table IX. Question-wise statistical analysis for BDS vs MDS – Question no. 13

			Qualification		Total
			B.D.S.	M.D.S.	
13. Radiographic features of Mucormycosis include	Bone involvement in maxillary canine and premolar region	Count	21	8	29
		%	5.0%	2.8%	4.1%
	both a and b	Count	304	252	556
		%	72.9%	88.1%	79.1%
	none of the above	Count	23	2	25
		%	5.5%	.7%	3.6%
	Obliteration of maxillary sinus/ thickening of maxillary sinus lining	Count	69	24	93
		%	16.5%	8.4%	13.2%
Total		Count	417	286	703
		%	100.0%	100.0%	100.0%

	Value	df	p-value
Pearson Chi-Square	26.618[a]	3	.0005
Likelihood Ratio	29.790	3	.000
N of Valid Cases	703		

Table X. Question-wise statistical analysis for BDS vs MDS – Question no. 14

			Qualification		Total
			B.D.S.	M.D.S.	
14. Pathophysiology of Mucormycosis	All of the above	Count	309	245	554
		%	74.1%	85.7%	78.8%
	Angioinvasion	Count	18	19	37
		%	4.3%	6.6%	5.3%
	Thrombosis	Count	16	4	20
		%	3.8%	1.4%	2.8%
	Tissue necrosis	Count	74	18	92
		%	17.7%	6.3%	13.1%
Total		Count	417	286	703
		%	100.0%	100.0%	100.0%

	Value	df	p-value
Pearson Chi-Square	25.170[a]	3	.0005
Likelihood Ratio	27.177	3	.000
N of Valid Cases	703		

Table XI. Question-wise statistical analysis for BDS vs MDS – Question no. 15

			Qualification		Total
			B.D.S.	M.D.S.	
15. Is Mucormycosis contagious?	Don't know	Count	21	9	30
		%	5.0%	3.1%	4.3%
	Maybe	Count	51	28	79
		%	12.2%	9.8%	11.2%
	No	Count	274	224	498
		%	65.7%	78.3%	70.8%
	Yes	Count	71	25	96
		%	17.0%	8.7%	13.7%
Total		Count	417	286	703
		%	100.0%	100.0%	100.0%

	Value	df	p-value
Pearson Chi-Square	14.656[a]	3	.002
Likelihood Ratio	15.179	3	.002
N of Valid Cases	703		

Table XII. Question-wise statistical analysis for BDS vs MDS – Question no. 11

			Qualification		Total
			B.D.S.	M.D.S.	
11. Is there a role of Anticoagulants (LMWH) in prevention of thrombosis in Mucormycosis?	Don't know	Count	134	71	205
		%	32.1%	24.8%	29.2%
	Maybe	Count	129	97	226
		%	30.9%	33.9%	32.1%
	No	Count	41	45	86
		%	9.8%	15.7%	12.2%
	Yes	Count	113	73	186
		%	27.1%	25.5%	26.5%
Total		Count	417	286	703
		%	100.0%	100.0%	100.0%

	Value	df	p-value
Pearson Chi-Square	8.567[a]	3	.036
Likelihood Ratio	8.526	3	.036
N of Valid Cases	703		

Table XIII. Question-wise analysis for Years of Practice – Question no. 1

			No. of years in practice				Total
			< 5 yrs	5 - 10 yrs	11 - 15 yrs	> 15 yrs	
1. What according to you has led to a rise in Mucormycosis infections in recent times?	All of the above	Count	335	107	73	90	605
		%	83.3%	87.0%	89.0%	93.8%	86.1%
	Duration of hospital stay / ICU stay for treatment of Covid -19	Count	2	4	0	0	6
		%	.5%	3.3%	0.0%	0.0%	.9%
	Injudicious use of steroids in treatment of Covid-19 infections.	Count	46	10	8	2	66
		%	11.4%	8.1%	9.8%	2.1%	9.4%
	Presence of co-morbidities like diabetes mellitus.	Count	19	2	1	4	26
		%	4.7%	1.6%	1.2%	4.2%	3.7%
Total		Count	402	123	82	96	703
		%	100.0%	100.0%	100.0%	100.0%	100.0%

	Value	df	p-value
Pearson Chi-Square	22.990[a]	9	.006
Likelihood Ratio	24.318	9	.004
N of Valid Cases	703		

Table XIV. Question-wise analysis for Years of Practice – Question no. 7

			No. of years in practice				Total
			< 5 yrs	5 - 10 yrs	11 - 15 yrs	> 15 yrs	
7. Treatment of Mucormycosis :	Can be done by effective medicinal management only	Count	36	3	2	0	41
		%	9.0%	2.4%	2.4%	0.0%	5.8%
	Can be done in a clinic/ dental setup	Count	2	0	0	0	2
		%	.5%	0.0%	0.0%	0.0%	.3%
	Depends on extent of the disease	Count	148	33	14	21	216
		%	36.8%	26.8%	17.1%	21.9%	30.7%
	Requires a Multidisciplinary approach	Count	216	87	66	75	444
		%	53.7%	70.7%	80.5%	78.1%	63.2%
Total		Count	402	123	82	96	703
		%	100.0%	100.0%	100.0%	100.0%	100.0%

	Value	df	p-value
Pearson Chi-Square	44.826[a]	9	.0005
Likelihood Ratio	52.036	9	.000
N of Valid Cases	703		

Table XV. Question-wise analysis for Years of Practice – Question no. 11

			No. of years in practice				Total
			< 5 yrs	5 - 10 yrs	11 - 15 yrs	> 15 yrs	
11. Is there a role of Anticoagulants (LMWH) in prevention of thrombosis in Mucormycosis?	Don't know	Count	121	36	14	34	205
		%	30.1%	29.3%	17.1%	35.4%	29.2%
	Maybe	Count	125	36	29	36	226
		%	31.1%	29.3%	35.4%	37.5%	32.1%
	No	Count	40	17	13	16	86
		%	10.0%	13.8%	15.9%	16.7%	12.2%
	Yes	Count	116	34	26	10	186
		%	28.9%	27.6%	31.7%	10.4%	26.5%
Total		Count	402	123	82	96	703
		%	100.0%	100.0%	100.0%	100.0%	100.0%

	Value	df	p-value
Pearson Chi-Square	22.611[a]	9	.007
Likelihood Ratio	25.827	9	.002
N of Valid Cases	703		

Table XVI. Question-wise analysis for Years of Practice – Question no. 15

			No. of years in practice				Total
			< 5 yrs	5 - 10 yrs	11 - 15 yrs	> 15 yrs	
15. Is Mucormycosis contagious?	Don't know	Count	18	5	3	4	30
		%	4.5%	4.1%	3.7%	4.2%	4.3%
	Maybe	Count	51	14	6	8	79
		%	12.7%	11.4%	7.3%	8.3%	11.2%
	No	Count	259	92	67	80	498
		%	64.4%	74.8%	81.7%	83.3%	70.8%
	Yes	Count	74	12	6	4	96
		%	18.4%	9.8%	7.3%	4.2%	13.7%
Total		Count	402	123	82	96	703
		%	100.0%	100.0%	100.0%	100.0%	100.0%

	Value	df	p-value
Pearson Chi-Square	25.570[a]	9	.002
Likelihood Ratio	28.045	9	.001
N of Valid Cases	703		

Table XVII. Question-wise analysis for Years of Practice – Question no. 3

			No. of years in practice				Total
			< 5 yrs	5 - 10 yrs	11 - 15 yrs	> 15 yrs	
3. What according to you is the clinical hallmark in diagnosing Mucormycosis	Any one or All of the above	Count	324	108	75	92	599
		%	80.6%	87.8%	91.5%	95.8%	85.2%
	Blackish or bloody nasal discharge	Count	32	3	3	1	39
		%	8.0%	2.4%	3.7%	1.0%	5.5%
	Impaired vision or loss of vision	Count	19	4	1	1	25
		%	4.7%	3.3%	1.2%	1.0%	3.6%
	Unexplained mobility in teeth/Multiple draining abscesses with inflammed gingiva	Count	27	8	3	2	40
		%	6.7%	6.5%	3.7%	2.1%	5.7%
Total		Count	402	123	82	96	703
		%	100.0%	100.0%	100.0%	100.0%	100.0%

	Value	df	p-value
Pearson Chi-Square	21.373[a]	9	.011
Likelihood Ratio	24.969	9	.003
N of Valid Cases	703		

Table XVIII . Question-wise analysis for Years of Practice – Question no. 4

			No. of years in practice				Total
			< 5 yrs	5 - 10 yrs	11 - 15 yrs	> 15 yrs	
4.Blackening of the Palate in Mucormycosis is also referred to as?	All of the above	Count	182	65	44	59	350
		%	45.3%	52.8%	53.7%	61.5%	49.8%
	Black fungal infection	Count	91	28	13	20	152
		%	22.6%	22.8%	15.9%	20.8%	21.6%
	Eschar	Count	59	20	14	10	103
		%	14.7%	16.3%	17.1%	10.4%	14.7%
	Tissue necrosis	Count	70	10	11	7	98
		%	17.4%	8.1%	13.4%	7.3%	13.9%
Total		Count	402	123	82	96	703
		%	100.0%	100.0%	100.0%	100.0%	100.0%

	Value	df	p-value
Pearson Chi-Square	17.542[a]	9	.041
Likelihood Ratio	18.556	9	.029
N of Valid Cases	703		

Table XIX . Question-wise analysis for Years of Practice – Question no. 6

			No. of years in practice				Total
			< 5 yrs	5 - 10 yrs	11 - 15 yrs	> 15 yrs	
6. Which of the following diagnostic modalities is confirmatory for Mucormycosis?	All of the above	Count	209	49	41	57	356
		%	52.0%	39.8%	50.0%	59.4%	50.6%
	Direct microscopy and culture	Count	110	34	25	18	187
		%	27.4%	27.6%	30.5%	18.8%	26.6%
	Histopathology	Count	74	38	16	21	149
		%	18.4%	30.9%	19.5%	21.9%	21.2%
	PCR	Count	9	2	0	0	11
		%	2.2%	1.6%	0.0%	0.0%	1.6%
Total		Count	402	123	82	96	703
		%	100.0%	100.0%	100.0%	100.0%	100.0%

	Value	df	p-value
Pearson Chi-Square	18.279[a]	9	.032
Likelihood Ratio	20.699	9	.014
N of Valid Cases	703		

Table XX . Question-wise analysis for Years of Practice – Question no. 10

			No. of years in practice				Total
			< 5 yrs	5 - 10 yrs	11 - 15 yrs	> 15 yrs	
10. What according to you should be the sequence / algorithm for management of Mucormycosis ?	Diagnosis > Surgical debridement > Medicinal management	Count	59	33	17	23	132
		%	14.7%	26.8%	20.7%	24.0%	18.8%
	Diagnosis > Medicinal management	Count	11	2	0	0	13
		%	2.7%	1.6%	0.0%	0.0%	1.8%
	Diagnosis > Medicinal management > Surgical debridement> Continue medicinal management	Count	205	54	38	41	338
		%	51.0%	43.9%	46.3%	42.7%	48.1%
	Empirical anti-fungal treatment > Diagnosis > Surgical debridement > Medicinal management	Count	127	34	27	32	220
		%	31.6%	27.6%	32.9%	33.3%	31.3%
Total		Count	402	123	82	96	703
		%	100.0%	100.0%	100.0%	100.0%	100.0%

	Value	df	p-value
Pearson Chi-Square	16.940[a]	9	.050
Likelihood Ratio	19.726	9	.020
N of Valid Cases	703		

Table XXI . Question-wise analysis for Years of Practice – Question no. 14

			No. of years in practice				Total
			< 5 yrs	5 - 10 yrs	11 - 15 yrs	> 15 yrs	
14. Pathophysiology of Mucormycosis	All of the above	Count	299	106	67	82	554
		%	74.4%	86.2%	81.7%	85.4%	78.8%
	Angioinvasion	Count	26	5	1	5	37
		%	6.5%	4.1%	1.2%	5.2%	5.3%
	Thrombosis	Count	17	1	1	1	20
		%	4.2%	.8%	1.2%	1.0%	2.8%
	Tissue necrosis	Count	60	11	13	8	92
		%	14.9%	8.9%	15.9%	8.3%	13.1%
Total		Count	402	123	82	96	703
		%	100.0%	100.0%	100.0%	100.0%	100.0%

	Value	df	p-value
Pearson Chi-Square	17.600[a]	9	.040
Likelihood Ratio	19.984	9	.018
N of Valid Cases	703		

Table XXII. Statistical analysis for K,A,P And K+A+P for BDS vs MDS.

Qualification		N	Mean Rank	Sum of Ranks
K	BDS	417	311.19	129765.00
	MDS	286	411.51	117691.00
	Total	703		
A	BDS	417	317.82	132531.00
	MDS	286	401.84	114925.00
	Total	703		
P	BDS	417	333.64	139128.50
	MDS	286	378.77	108327.50
	Total	703		
KAP	BDS	417	303.45	126539.00
	MDS	286	422.79	120917.00
	Total	703		

	Mann-Whitney U	Z	p-value
K	42612.000	-6.638	.0005
A	45378.000	-5.633	.0005
P	51975.500	-3.041	.002
KAP	39386.000	-7.737	.0005

Table XXIII. Statistical analysis for K,A,P And K+A+P for Years of practice.

No. of years in practice		N	Mean Rank
K	< 5 yrs	402	313.12
	5 - 10 yrs	123	387.97
	11 - 15 yrs	82	405.90
	> 15 yrs	96	422.68
	Total	703	
A	< 5 yrs	402	331.91
	5 - 10 yrs	123	356.35
	11 - 15 yrs	82	406.77
	> 15 yrs	96	383.77
	Total	703	
P	< 5 yrs	402	342.34
	5 - 10 yrs	123	344.54
	11 - 15 yrs	82	357.02
	> 15 yrs	96	397.72
	Total	703	
KAP	< 5 yrs	402	314.44
	5 - 10 yrs	123	373.15
	11 - 15 yrs	82	411.29
	> 15 yrs	96	431.52
	Total	703	

	Chi-Square	df	p-value
K	38.313	3	.0005
A	13.448	3	.004
P	6.618	3	.085
KAP	37.602	3	.0005

Fig 1. Age Distribution.

- 20-30
- 31-40
- 41-50
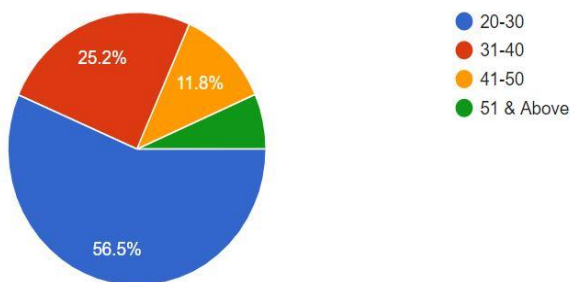- 51 & Above

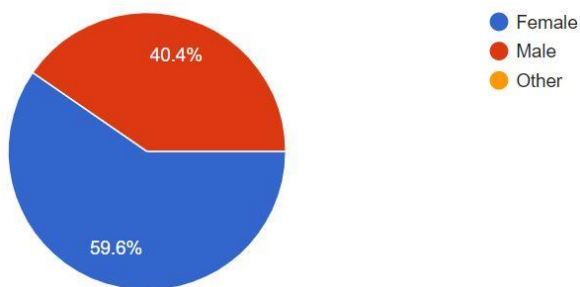Fig 2. Gender Distribution.

- Female
- Male
- Other

Fig 3. Distribution according to Qualification.

- B.D.S.
- M.D.S.
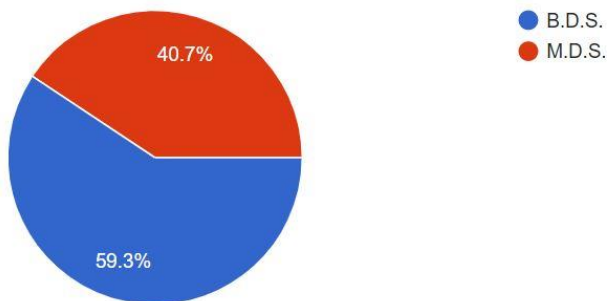
Fig 4. Responses to Question 2

2. Is Mucormycosis the same as CAPA (Covid-19 associated Pulmonary Aspergillosis)?
703 responses

- Yes
- No
- Maybe
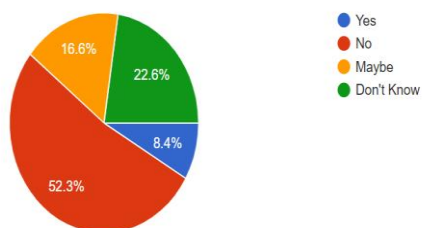- Don't Know

Fig. 5 Responses to Question 9

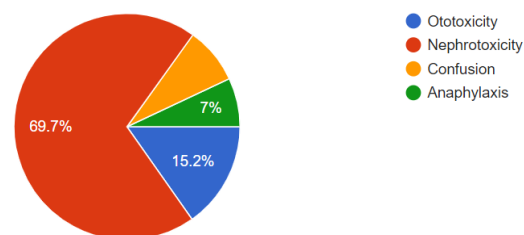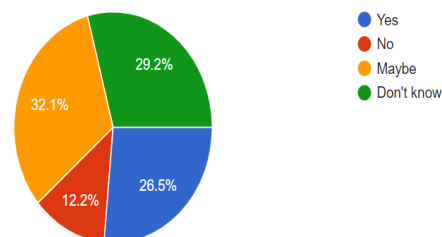9. What is the most common complication of Deoxycholate Amphoterecin B?
703 responses

- Ototxicity
- Nephrotoxicity
- Confusion
- Anaphylaxis

Fig. 6 Responses to Question 11

11. Is there a role of Anticoagulants (LMWH) in prevention of thrombosis in Mucormycosis?
703 responses

- Yes
- No
- Maybe
- Don't know

significance between BDS and MDS responders i.e 11 of 15 questions (Tables I-XI), whereas statistical significance was seen in only one question (TableXII) among BDS and MDS participants.

Out of a total of 703 responses, 57.2 % responses were from dental practitioners practicing for less than 5 years, 17.5% were practicing since 6-10 years, 11.7% from 11-15 years, and 13.7% were practicing since 16 years or above. On statistical analysis of question-wise data received, out of 15 questions, 4 questions showed a highly statistical significance (Tables XIII-XVI) and 5 questions showed statistical significance(Tables XVII-XXI).

The questionnaire was divided into three categories Knowledge(K), Attitude(A) and Practices(P). The number of responses were evaluated by a scoring system for each respondent and compared for K, A and P. The number of years into practice and qualification were compared. When the sum of K, A and P was taken individually and a sum of all the categories was combined, there was a highly statistical significance obtained under all the four categories, when BDS and MDS responses were compared (Table XXII). When intra group comparison was done for K, A and P, according to the number of years into practice, there was highly statistical significance seen in K, A, P and a cumulative sum of KAP(K+A+P), between >5 years and 11-15 years. An increase in the number of years into dental practice i.e. 11-15 years and 16 years & above, showed no statistical significance (Table XXIII). Hence, Knowledge, Attitude and Practices about CAM showed no significant difference with advancing age and number of years into dental practice.

DISCUSSION

As India is reeling under the impact of the next wave of the Covid-19 pandemic, CAM has now become a cause of worry for people across the country. As reported by BBC world, 29 states of India had declared the disease an epidemic. An average of 9,000 -12,000 cases have been reported and increasing over 2021 and 2022 with Gujarat and Maharashtra having more than 50% of reported cases.[7,8] The list of states that had declared Mucormycosis a notified

disease under the Epidemic Diseases Act, 1897 included Telangana, Odisha, Rajasthan, Karnataka, Tamil Nadu, Uttarakhand Bihar, Madhya Pradesh, Gujarat, Maharashtra, Andhra Pradesh.[9] The Task Force Unit formed by each state published technical guidelines on diagnosis and treatment of CAM. Covid-19 Virus Outbreak Control And Prevention State Cell, Health & Family Welfare Department, Government Of Kerala stated that India contributes to 40% of the global burden of Mucormycosis with an estimated prevalence of 140 cases per million population.[10]

The outbreak of COVID 19 continues across India and Globally. With the rising number of cases in China and South Korea, fear of the 4th COVID wave hitting India looms. As per reports by India TV, situations in both China and Japan are getting worse. Keeping in mind the previous patterns of the COVID wave, experts in India believe that the coming 40 days can be extremely serious for the country. [11]

The results of the study showed that majority of responders were able to differentiate between CAM and CAPA. (Fig.4) Covid 19 Associated Aspergillosis is also a fungal infection; but the causative agent is from the Order Eurotiales. Invasive pulmonary aspergillosis (IPA), chronic pulmonary aspergillosis (CPA), allergic bronchopulmonary aspergillosis (ABPA), chronic rhinosinusitis, fungal asthma, and Aspergillus bronchitis are all caused by Aspergillus fumigatus, which is ubiquitous in the environment and causes a wide range of infections in humans.[12] Although, testing the level of this differentiation amongst responders are beyond the limits of this study and warrant further investigation as CAPA has the potential of following the same footsteps as CAM.

MDS responders showed greater knowledge of CAPA not being related to CAM except for sharing Covid 19 as a link for immunocompromised state. Amphotericin B has been widely used since decades to deal with serious fungal infections. Nephrotoxicity has been a key factor in limiting the use of this potent antifungal since the dawn of its clinical use. Permanent structural nephrotoxic alterations might be caused by reduced renal blood flow and recurrent ischemia.[13] Majority of the responders, irrespective of their

qualification or years in clinical practice, were aware about this potential complication.(Fig.5)

Low Molecular Weight Heparin therapy was employed in the treatment of COVID-19 patients to prevent microthrombus formation and reduce the risk of organ damage.[14] In the current literature there is no evidence of application of LMWH in prevention of thrombosis in patients suffering from Mucormycosis infection. However, amongst our study participants, 32.1% responders were of the opinion that there may be some role of LMWH in prevention of thrombosis in CAM, 29.2% responders had no idea about the use of LMWH in CAM, 26.5 % responders thought there is a positive role and only 12.2% responders said there is no role of LMWH in prevention of microthrombus formation in CAM. The knowledge about pathophysiology of Mucormycosis infection was better in MDS responders (85.7%) compared to BDS responders (74.1%). (Fig 6)Maximum correct responses were from responders with 5-10 years of clinical practice. The nearly universal occurrence of severe angioinvasion with resulting arterial thrombosis and tissue necrosis is a characteristic of Mucormycosis infections.[15]

In our study we aimed to evaluate the K A P amongst dental practitioners across the Indian sub-continent and irrespective of qualification and clinical experience the responses we received were majorly correct. On statistical evaluation, we found that though MDS graduates showed marginally better positive response compared to BDS graduates, they showed no significant difference with increase in years of dental practice.

India has been battling the effects of Covid-19 pandemic like the rest of the world but the epidemic of CAM has added a tremendous stress on the already exhausted medical healthcare. According to Union Health Minister as many as 28,252 cases of Mucormycosis or black fungus have been reported from 28 states and Union Territories, with a majority of them having been reported in Maharashtra and Gujarat as of 7th June 2021.[16] In such a dreadful situation, the dental fraternity can and possibly should play a main role in early diagnosis of these patients. The results of our study

thus, positively reflect the awareness and preparedness among Indian Dental practitioners to treat the current and upcoming unforeseen situations promptly and efficiently.

CONCLUSION

The rising incidence of Covid 19, has been challenging, and as we continue to achieve stability over the current situation, the new imminent threat of Mucormycosis has shown an increased level of distress amidst the lashing fourth wave. With the possibility of a new wave right around the corner, the need for vigilance in early diagnosis and management of these life threatening conditions is indispensible. Keeping in mind the aim of our study, our findings suggest that there may be an infinitesimal difference amongst BDS and MDS professionals. However, with the advancing age and increase in number of years into practice we found no significant difference in the Knowledge, Attitude and Practices. This study primarily focuses on critical and timely management of the deadly disease, however, knowledge about current consensus, pathophysiology, occurrence and incidence can further help the medical fraternity through the challenging times of this epidemic and pandemic.

ETHICAL APPROVAL:

The research protocol was approved by the Human Research Ethics Committee

FUNDING:

No funding

DISCLOSURE OF INTEREST:

The authors declare that they have no competing interests.

REFERENCES

1. Garg D, Muthu V, Sehgal IS, Ramachandran R, Kaur H, Bhalla A, Puri GD, Chakrabarti A, Agarwal R. Coronavirus disease (Covid-19) associated mucormycosis (CAM): case report and systematic review of literature. Mycopathologia. 2021 Feb 5:1-0.

2. Pandey SK, Sharma V. World diabetes day 2018: battling the emerging epidemic of diabetic retinopathy. Indian journal of ophthalmology. 2018 Nov;66(11):1652.

3. Post COVID-19 Mucormycosis - from the Frying Pan into the Fire [Internet]. [cited 04 Julie 2021]. Available at: https://www.japi.org/x27464c4/post-covid-19-mucormycosis-from-the-frying-pan-into-the-fire

4. Balasopoulou A, Kokkinos P, Pagoulatos D, Plotas P, Makri OE, Georgakopoulos CD et al. Symposium Recent advances and challenges in the management of retinoblastoma Globe-saving Treatments. BMC Ophthalmol. 2017;17(1):1.

5. Mohammadi A, Mehdizadeh A, Ghasemi-Rad M, Habibpour H, Esmaeli A. Pulmonary mucormycosis in patients with diabetic ketoacidosis: a case report and review of literature. Tuberk Toraks. 2012 Jan 1;60(1):66-9.

6. ICMR. Evidence Based Advisory in the Time of Covid-19. 2021;19:1.

7. Soutik Biswas. Black Fungus: India reports nearly 9,000 cases of rare infection. BBC News. 2021 May 13. Available from: https://www.bbc.com/news/world-asia-india-57217246, accessed on June 5,2021.

8. Maryn Mckenna. Why Deadly 'Black Fungus' Is Ravaging COVID Patients In India. Scientific American. 2021 May 28. Available from: https://www.scientificamerican.com/article/why-deadly-black-fungus-is-ravaging-covid-patients-in-india/#, accessed on June 20, 2021.

9. Susmita Pakrasi. Black fungus declared as notified disease in these states. Hindustan Times 2021 May 25. Available on: https://www.hindustantimes.com/india-news/black-fungus-declared-as-notified-disease-in-these-states-101621930175465.html, accessed on June 7, 2021

10. https://dhs.kerala.gov.in/wp-content/uploads/2021/04/Guidelines-Treatment-Protocol-April-2021-merged.pdf

11. Edited by: India Desk. India to witness 4th COVID wave in Jan 2023? Expert says number of cases will jump in next 40 days. Available at: https://www.indiatvnews.com/health/india-to-witness-4th-covid-wave-in-jan-2023-expert-says-number-of-cases-will-jump-in-next-40-days-2022-12-29-834993. accessed on January 7, 2023.

12. Arastehfar A, Carvalho A, van de Veerdonk FL, Jenks JD, Koehler P, Krause R, et al. COVID-19 associated pulmonary aspergillosis (CAPA)—from immunology to treatment. J Fungi. 2020;6(2):1–17.

13. Peter B, Briggs P. Amphotericin Consequences. Society. 1995;(2).

14. Li DM, Shang PP, Zhu L, De Hoog GS. Rhino-orbital-cerebral mycosis and cavernous thrombosis. Eur J Inflamm. 2014;12(1):1–10.

15. Spellberg B, Edwards J, Ibrahim A. Novel perspectives on mucormycosis: Pathophysiology, presentation, and management. Clin Microbiol Rev. 2005;18(3):556–69.

16. Meghna Sen. Black Fungus: These 2 states account for nearly 42% of India`s 28,252 mucormycosis cases. Mint. 2021 Jun 07. Available at: https://www.livemint.com/news/india/black-fungus-28-states-see-28-252-mucormycosis-cases-maharashtra-gujarat-among-worst-hit-states-11623069135171.html, accessed on June 27, 2021.

17. Langade D, Modi P D, Sidhwa Y F, et al. (September 08, 2016) Burnout Syndrome Among Medical Practitioners Across India: A Questionnaire-Based Survey. Cureus 8(9): e771. DOI 10.7759/cureus.771

18. Modi P D, Nair G, Uppe A, et al. (April 02, 2020) COVID-19 Awareness Among Healthcare Students and Professionals in Mumbai Metropolitan Region: A Questionnaire-Based Survey. Cureus 12(4): e7514. doi:10.7759/cureus.7514

19. Modi PD, Kumar P, Solanki R, Modi J, Chandramani S, Gill N. Hand hygiene practices among Indian medical undergraduates: a questionnaire-based survey. Cureus. 2017 Jul;9(7).