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Original Research Article

Understanding mucormycosis: A questionnaire-based study on dentists knowledge, awareness, and attitude in Uttarakhand

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ABSTRACT

Background: Mucormycosis is a potentially fatal opportunistic fungal illness that is brought on by molds from the Zygomycetes class, specifically the Mucorales order. It predominantly affects individuals with diabetes and compromised immune systems. In India, the number of COVID-19 cases has significantly increased recently. The unexpected surge in mucormycosis cases has prompted several Indian states and union territories to designate the disease an epidemic, placing further strain on the already overworked healthcare system.

Aim: To evaluate Uttarakhand dentists' attitude, knowledge, and awareness of mucormycosis.

Materials and Methods: A study assessing dentists in Uttarakhand's knowledge, understanding, and attitudes regarding mucormycosis was carried out between May and June of 2024. The fourteen online survey was distributed to recent graduates, postgraduate (MDS) students, MDS faculty members employed as academic staff in dental colleges, and local private practitioners.

Results: In this research, 218 dentists took part and the average scores for knowledge and awareness among participants were 58.03% and 85.9%, respectively.

Conclusion: Enhancing dentists' knowledge and perspectives on mucormycosis, a recently identified public health concern, is essential. Standard care for mucormycosis must include early detection, risk factor minimization, and underlying condition management. Patients with predisposed circumstances require a high degree of suspicion, which healthcare providers must maintain to diagnose the disease quickly. This emphasizes how crucial an interdisciplinary team approach is to the diagnosis and care of those afflicted with this condition.

1. Introduction

Zygomycosis, another name for mucormycosis, is a rare but spreading fungal infection with a high morbidity and fatality rate that affects people all over the world. The term "mucormycosis," which was first used by American pathologist R. D. Baker, refers to a disorder characterized by angioinvasion, thrombosis, and tissue necrosis that progresses quickly.[1]

Its commonly mislabeled as "black fungus." However, this phrase is a misnomer, as it actually relates to a separate genus of fungi known as dematiaceous fungi. The COVID-19 pandemic has caused a significant increase in the incidence of mucormycosis. A number of countries, including Austria, Brazil, Egypt, France, India, Iran, Italy and the United States, have documented cases of COVID-19-associated mucormycosis (CAM).[2]

According to recent systematic review, 0.3% of COVID-19 coinfections include CAM.[3]

Mucormycosis infection in humans can appear in either a superficial or visceral form. The superficial form typically

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affects the external ear, fingernails, and skin, presenting with abscesses, skin swelling, necrosis, dry ulcers, and eschars. The visceral form, on the other hand, manifests as rhino-orbito-cerebral, pulmonary, or gastrointestinal types.[4] Common dental symptoms include sinusitis, blackish discoloration on the bridge of the nose or palate, nasal congestion, blackish or bloody nasal discharge, loose teeth, one-sided facial pain, numbness or swelling, toothache, and localized pain in the cheekbone area.[5]

According to a recent comprehensive study, 0.3% of COVID-19 coinfections are caused by COVID-associated mucormycosis (CAM). Mucormycosis has historically been common in India; as of 2019, the country's case rate was almost 70 times greater than that of affluent nations. It is estimated that India experiences about 140 cases of mucormycosis per million people.[6,7]

Dentists play a vital role in controlling the spread of mucormycosis and are crucial for early detection. Preventive interventions and early detection can significantly lower the infection's morbidity and death rate. Consequently, it is imperative that dentists possess adequate information and understanding regarding the issue.[8]

Thus, the purpose of this study was to evaluate Uttarakhand dentists' attitude, knowledge, and awareness of mucormycosis.

2. Materials and Methods

2.1. Informed consent and ethical clearance

Informed consent for using the questionnaire was obtained via email from the manuscript.[1] Participants were informed that their involvement in the survey was entirely voluntary. They were free to discontinue participation at any moment, and sending in the questionnaire served as their agreement to do so.

2.2. Study design

The study evaluated dentists' knowledge, attitudes, and practices about mucormycosis by a cross-sectional, open, pre-validated, anonymous survey.

2.3. Study participants

BDS graduates, postgraduate (MDS) students, MDS faculty members employed as instructors in Uttarakhand's dental colleges, and local private practitioners are all included in this study.

2.4. Method and computation of sample size

The sample size was calculated using the following formula:

$$Sample\ size = \frac{Z^2_{1-\alpha/2}\, p(1-p)}{d^2}$$

The sample size was determined using the formula, with a 95% confidence interval and a population size of 211, using a purposive sampling strategy.

2.5. Methodology

The cross-sectional study aimed to evaluate registered dentists in Uttarakhand's knowledge, awareness, and attitudes regarding mucormycosis over the period of two months (May and June). A self-administered questionnaire with 14 English questions that was created especially for this study was used. A "Google Form" link was used to collect data online, and it was sent via email, text messaging, and social media sites like WhatsApp.

2.6. Statistical analysis

With significance set at $p<0.05$, data were analyzed using the SPSS 22.0 statistical software (SPSS Inc., Chicago, IL). We employed descriptive statistics to ascertain the share of every category in each group. The chi-square test was used in inferential statistics to evaluate proportions.

3. Results

3.1. Study characteristics related to demographics

The research included 218 dentists, of whom 88 (40.3%) had an MDS degree and 130 (59.6%) had a BDS degree.

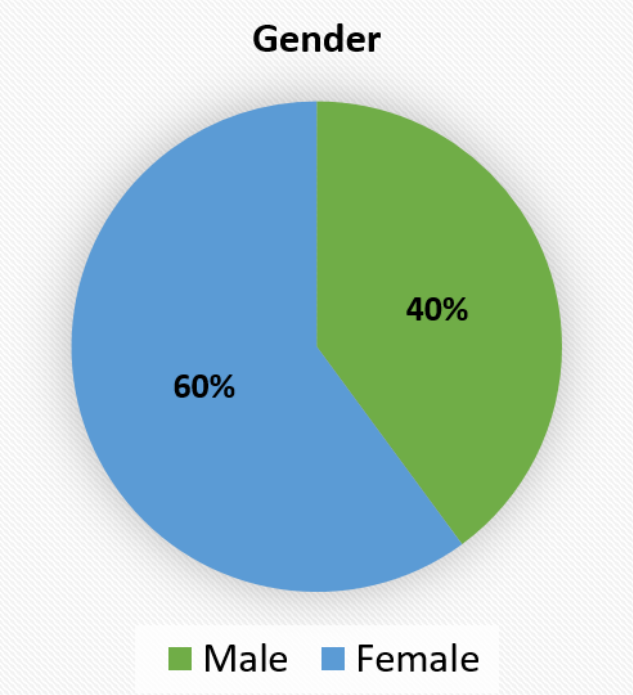
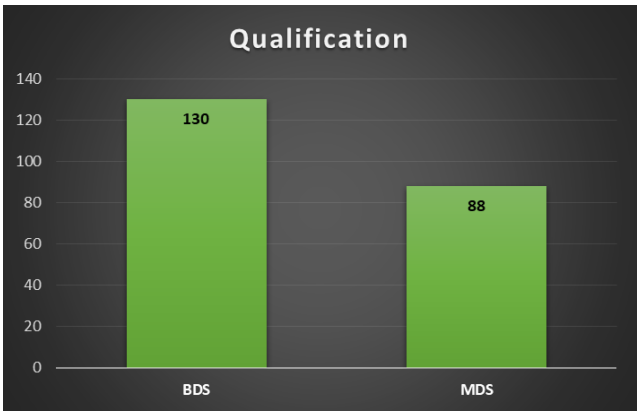


Chart 1: Percentage of males and females participating in the study

Table 1: Assessment of awareness level

Questions	Frequency (N = 210)	Percentag (%)
Q1: Is mucormycosis a contagious disease?		
Yes	76	34.9
No	142	65.1
Q2: What is the mode of transmission of mucormycosis?		
Fungus enters the skin through scrapes, burns, or other type of skin injury.	22	10.1
Inhalation of spores from the air.	20	9.2
Through contact with fungal spores in the environment.	19	8.7
All of the above.	157	72.0
Q3: Important predisposing factor of mucormycosis?		
Immunosuppression by Steroids	13	6.0
Prolonged ICU Stay.	2	.9
Uncontrolled Diabetes Mellitus	16	7.3
All of the above	187	85.8
Q4: Clinical features of mucormycosis are?		
Black-coloured discolouration over the neck.	18	8.3
Blood filled or blackish nasal discharge.	78	35.8
Loss of vision.	27	12.4
Pain or loosening of the teeth.	36	16.5
Pain, numbness and swelling on one side of the face.	39	17.9
All of the above	20	9.2



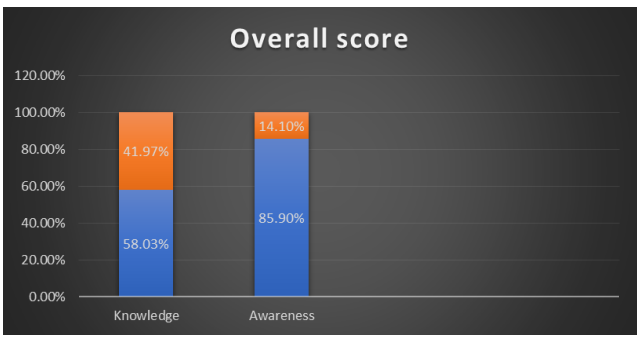
Graph 1: Frequency of graduates and post-graduates participating in the study

3.2. *Participant's knowledge approval*

The overall mean knowledge score of the participants was 58.03% (Graph 2). The questionnaire had four specific questions designed to assess the respondents' comprehension of mucormycosis. 142 respondents (65.1%) to this question acknowledged that mucormycosis is not a disease that spreads easily (Table 1). Furthermore, 72% of respondents correctly identified the mucormycosis method of transmission. In terms of risk factors, uncontrolled diabetes mellitus, immunosuppression brought on by steroids, and extended hospitalizations in the intensive care unit were identified by 85.8% (187 participants) as significant variables (Table 1). Furthermore, 9.2% correctly recognized every clinical characteristic of mucormycosis (Table 1).

3.3. *Participant's awareness approval*

Regarding their awareness of mucormycosis, 67.4% of participants regarded it as a very dangerous condition, while 32.6% viewed it as moderately dangerous. Nevertheless, 97.7% recognized it as a serious health issue. To prevent the disease, 99.1% believed that public education about mucormycosis is crucial. When considering the dentist's role in educating others, 173 participants (79.4%) viewed it as highly significant, 43 (19.7%) saw it as moderately significant, and 2 (0.9%) considered it not significant (Table 2). The overall mean awareness score was approximately 85.9% (Graph 2).



Graph 2: Overall score of knowledge and awareness

Table 2: Assessment of awareness level

	Frequency	Percentage	P value (Chi-square test)
Q5. How do you perceive mucormycosis?			
Very dangerous	147	67.4	
Moderately dangerous	71	32.6	0.0001*
Total	218	100.0	
Q6. Do you know mucormycosis is a serious health issue?			
Yes	213	97.7	
No	5	2.3	0.0001*
Total	218	100.0	
Q7. Is it important to educate the people about mucormycosis to prevent the disease?			
Yes	216	99.1	
No	2	0.9	0.0001*
Total	218	100.0	
Q8. What do you think about the dentist's role in teaching others about mucormycosis?			
Highly significant	173	79.4	
Moderately significant	43	19.7	0.0001*
Not significant at all	2	.9	
Total	218	100.0	

3.4. Participant's attitude appraisal

Among the participants, 72.5% believed that dentists should be the primary providers of treatment for mucormycosis cases. Of the 218 participants, 101 dentists (46.4%) were knowledgeable about the correct diagnostic methods for mucormycosis, and 87 dentists (39.9%) were aware of the appropriate treatment options. Additionally, 92.2% were willing to treat patients who had recovered from mucormycosis, and 89.4% recommended considering the patients' unique long-term prospects (Table 3).

4. Discussion

Mucorales fungi are the source of mucormycosis, sometimes referred to as zygomycosis or phycomycosis, which is a severe, invasive, and sometimes fatal opportunistic illness. According to 2019-2020 estimates, the prevalence of mucormycosis varies between 0.005 and 1.7 cases per million individuals worldwide; however, in India, the rate is approximately 80 times greater (0.14 cases per 1000) than in wealthy nations. Since most treatments target eukaryotic pathogens, which closely resemble human cells, there are few treatment options available for deep fungal infections like mucormycosis. Dentists must be involved in early discovery of this disease due to its severe nature and high death rate. Achieving this goal requires assessing dentists' attitudes, knowledge, and awareness.

An online questionnaire survey was employed in this study to evaluate the attitudes, knowledge, and awareness of Uttarakhand's dental practitioners. Although nearly half of the participants thought mucormycosis was a communicable disease, 65.1% of them demonstrated great understanding of the condition. This suggests a void in their knowledge of mucormycosis. Fungal spores or direct touch with an open oral wound can both transmit the infection. Fungal spores that cause angioinvasion, which results in thrombosis and subsequent tissue necrosis, are a crucial aspect of this condition. Nonetheless, 72% of participants correctly recognized that spore inhalation, burns, and skin contact were the ways in which the fungi propagated.[9]

Pulmonary mucormycosis is commonly observed in patients with graft-versus-host disease and severe neutropenia; rhino-orbital mucormycosis is commonly observed in individuals with diabetes. According to a thorough investigation by Singh et al., 76.3% of COVID-19 patients with confirmed mucormycosis also had diabetes mellitus. 7. 85.8% of participants in our study accurately identified the factors that predispose them to mucormycosis.[10]

The clinical characteristics of mucormycosis were reviewed by Piyush Dongre et al. The symptoms that were mentioned included tooth mobility, halitosis, toothache, palatal ulceration, nasal stuffiness, intraoral draining sinuses, epistaxis with nasal discharge, blackish discharge, nasal mucosal erythema, unilateral facial erythema, skin blackening, and periorbital edema. Seventy-two percent of participants in our survey correctly identified these symptoms.[11]

According to our study, 85.9% of participants know that mucormycosis is a serious disorder, underscoring the necessity of dentists in public education about the disease. In addition to cytopathology, histology, and microbiology, contrast-enhanced CT scans are utilized in the diagnosis and management of mucormycosis to verify the diagnosis and assess the disease's extent. The gold standard for radiographic diagnosis is MRI; additional imaging is provided by contrast-enhanced CT of the paranasal sinuses (CT-PNS). Early therapy beginning, surgical excision of contaminated tissue, antifungal medication, and

Table 3: Assessment of attitude level

Awareness of Attitude level	Frequency	Percentage	P value (Chi-square test)
Q9. Have you come across any person recently affected by mucormycosis?			
Yes	80	36.7	
No	138	63.3	0.0001*
Total	218	100.0	
Q10. If yes, do you treat patients affected by mucormycosis in your practice?			
Yes	71	32.6	
No	147	67.4	0.0001*
Total	218	100.0	
Q11. Do you think dentists should treat mucormycosis in first line?			
Yes	158	72.5	
No	60	27.5	0.0001*
Total	218	100.0	
Q12. How will you diagnose mucormycosis?			
CT scan of lungs, sinuses etc	69	31.7	
Fine needle aspiration.	32	14.7	0.0001*
Tissue biopsy.	117	53.7	
Total	218	100.0	
Q13. How will you treat mucormycosis patient?			
Antifungal therapy for atleast 4 to 6 Weeks.	13	6.0	
Installation of the peripherally inserted central catheter (PICC line)	6	2.8	0.0001*
Surgically debriding of necrotic (dead) tissues.	7	3.2	
All of the above	192	88.1	
Total	218	100.0	
Q14. Will you treat the patients who have recovered from mucormycosis?			
Yes	201	92.2	
No	17	7.8	0.0001*
Total	218	100.0	
15. If yes, what are your suggestions for the long-term prospects of these patients?			
Prosthetic reconstruction.	9	4.1	
Replacement of the missing facial structures with prosthetics.	6	2.8	
Surgical intervention for the loss of upper jaw and eyes.	8	3.7	0.0001*
Prosthetic reconstruction.	9	4.1	
All of the above.	195	89.4	
Total	218	100.0	

underlying disease management are all necessary for an effective course of treatment. The recommended first-line treatment is amphotericin B (AmB), with posaconazole and isavuconazole as backups.[12]

Only a tiny percentage of Uttarakhand dentists who participated in our study reported treating patients with mucormycosis, and 67.4% of them expressed hesitation about treating such cases. Oladele et al. assessed resident physicians' knowledge and awareness of invasive fungal diseases in Nigeria, spanning seven tertiary institutions across five geopolitical zones. Their results demonstrated a commendable degree of awareness and understanding, highlighting the necessity of further training for resident physicians.[13]

We assessed the dentists in Uttarakhand's knowledge, understanding, and attitudes toward mucormycosis based on our assessment. Our research found that although Uttarakhand's dentists exhibited good knowledge, awareness, and a suitable attitude, more teaching and training is still required to enhance their capacity to offer comprehensive care.

5. Conclusion

Mucormycosis is a rapidly progressing and severe illness. Research reveals that a multidisciplinary approach can lower mortality and enhance patient quality of life. This approach should include a thorough history-taking, clinical examination, early detection and diagnosis, preventive

antifungal treatment, surgical intervention, prosthetic rehabilitation, and correction of surgical defects.[14] Studies have shown that posaconazole (injectable), a triazole antifungal medication, is effective in reducing the infection burden and providing timely therapeutic options. Simple measures, such as saline nasal irrigations, also play a vital role in managing the condition. Dentists and other healthcare professionals must continuously update their knowledge of mucormycosis to contribute effectively to public health and patient care.[15]

6. Source of Funding

None.

7. Conflict of Interest

None.

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