Role of Dentist in Diagnosis and Management of Mucormycosis in Association with COVID-19

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ABSTRACT
In surge of the novel corona virus, there is increase in the frequency of fungal infections. Mucormycosis is one of the deep fungal infections which are increasing rapidly in this global pandemic period. Thus the early diagnosis and management is of utmost importance to decline the rate of this fatal infection. The clinical signs and symptoms and the culture reports are strictly considered in the management of oral fungal infection. This review article focuses on the importance of early diagnosis, prevention and management of mucormycosis and the role of the dentist in doing so.

Keywords: Mucormycosis, diagnosis, management, dentist.

INTRODUCTION
Most of the fungal infections occur due to opportunistic conditions depending upon the resistance offered by the host. Impairment of the host resistance may lead to the initiation and later on progression of the pathogenic condition in the oral cavity through local colonization. As the incidence of the viral infections is increasing globally, the frequency of the oral mycosis also increasing rapidly. [1,2] Depending upon the severity, oral mycological conditions are divided into superficial and deep fungal infections of the oral tissues. Slight oral discomfort, paraguesia, burning sensation are mostly seen in superficial fungal infections while the deep fungal infections are presented with ulcerations and also perforations in the bony areas. [3,4] One of the deep fungal infection which is rapidly increasing in this time of covid-19 pandemic is Mucormycosis.

Mucormycosis is also known as ‘black fungus’. Saprophytic fungi like Rhizopus, Rhizomucor, Mucor, Saksenea, Cunninghamella are causative organisms for mucormycosis. Most common type of mucormycosis being rhino maxillary disease. [8] The black fungus has emerged as a new challenge for doctors. Mucormycosis has increased immensely after the surge in the viral infection, Covid-19. Post Covid mucormycosis cases are being reported massively. [18]

This review focuses on the diagnostic and therapeutic approaches to mucormycosis of the oral cavity. Dictates the role of the dentist in the prevention and management of this huge outbreak of fungal infection. All the data presented in this review was collected from available literature in PubMed and Google Scholar database.

PATHOGENESIS
Immunocompromised, poorly controlled diabetes, bone marrow transplant and hematological malignancies individuals
are primarily affected. Mucormycosis is commonly found on bread mold, decaying vegetation and soil. Even the healthy person may show this fungal infection when cultures of swab are obtained from oral cavity, nasal cavity, throat and stools. After entering the host tissues, the fungi germinate to form hyphae and these hyphae bring about the start of the clinical symptoms. Impaired phagocytic function leads to ischemia, infarction and tissue necrosis as there is an increase in the levels of hyphae. Elevated levels of iron also promote the growth of mucormycosis. Patients with elevated iron levels are at a higher risk of getting mucormycosis.

Risk Factors
AIDS, organ transplant, uncontrolled diabetes mellitus, cancers, prolonged use of corticosteroids, cirrhosis, immunosuppressive therapy are the major risk factors for mucormycosis but some cases with no predisposing risk factors have also been reported. Patients with Covid-19 are usually treated with corticosteroids which are an immunosuppressant and it also increases the levels of blood sugar in both diabetic and non diabetic patients which may contribute to increase the risk for mucormycosis.

CLINICAL FEATURES
Mucormycosis are of five types mainly Mucormycosis of the sinuses and brain, Mucormycosis of the lung, Mucormycosis of the digestive tract, Mucormycosis of the skin and Disseminated Mucormycosis. A classic clinical sign of mucormycosis is the rapid onset of tissue necrosis with or without fever. Various signs and symptoms include: Mobile teeth, halitosis, dental pain, palatal ulceration, intra oral draining sinuses, nasal stuffiness, nasal discharge with epistaxis, black purulent discharge, erythema of nasal mucosa, one sided facial swelling, facial erythema, black discoloration of skin, periorbital erythema and edema, orbital pain, ptosis, diplopia, fever, all of this are the red flags in mucormycosis.

Transmission
Transmission occurs through inhalation, inoculation, or ingestion of spores from the environment. Although, most cases are sporadic, healthcare-associated outbreaks have been linked to adhesive bandages, wooden tongue depressors, hospital linens, negative pressure rooms, water leaks, poor air filtration, non-sterile medical devices, and building construction.

DIAGNOSIS
Radiographic Diagnosis of mucormycosis
The earlier the mucormycosis is diagnosed, the better the infection can be treated. As this lethal disease requires prompt and aggressive treatment, early imaging is must in assessing the extent of the involvement. Gadolinium enhanced MRI is considered as the gold standard for radiographic diagnosis while CT-PNS with contrast are the adjuvant imaging.

Features on CT-PNS
Mucosal thickening, inflammation of nasal turbinate, bony erosion, fluid filled sinus, sequestered bone.

Features on MRI
Perisinusal spread on T2 weighted images, black turbinate sign which is the first sign, high intensity signal in fat suppressed T2 image in pterygoid bone, osseous erosion as T2 weighted hypointense signal and mucosal thickening.

Lab Investigations for diagnosis of Mucormycosis
Deep nasal swab for KOH smear and fungal culture, CRP level, negative galatomannan and beta glucan test, biopsy (50% tissue in saline for fungal culture, 50% tissue in 10% formalin for histopathology)
Protocol for Prevention of Mucormycosis in a Covid-19 patient
1. Diagnosis of glycemic control on admission using glycated hemoglobin (Hba1c)
2. Judicious use of Steroid and Tocilizumab
3. Blood Sugar level monitoring and maintenance (110-180 mg/dl)
4. Hygiene maintenance of O2 delivery system and use of distilled water in Humidifiers
5. ENT/OMFS evaluation of patient on day 3, day 7 and before hospital discharge (Nasal endoscopy, Biopsy, Deep nasal swab for fungal culture can be done in suspected cases)
6. Nasal Saline Spray twice daily
7. Application of Amphotericin B gel intranasally for high risk patients

Protocol for Prevention of Mucormycosis in post-Covid patient:
1. Maintenance of Oral hygiene and Use of 2% povidone Iodine Gargles.
2. Steam inhalation to improve ciliary function and sinus health.
3. Use of 0.5% Betadine Nasal Irrigation
4. Patient education regarding early signs and symptoms of mucormycosis leading to early reporting.
5. Strict Glycemic control
6. Defer non-emergency invasive oral or dental procedure for 3 months after Covid 19 infection.
7. Use of Tablet Vitamin E 1000IU Tablet [13] Vitamin A 6000IU [14], B-complex tablets and high protein low sugar diet.

ROLE OF DENTIST IN PREVENTION AND MANAGEMENT OF MUCORMYCOSIS
1. Note down patient’s chief complaint and ask for symptoms related to nasal cavity, paranasal sinuses, nasal discharge, ophthalmic pain or vision disturbance.
3. Evaluate patient’s discharge file for deranged blood markers like ferritin and CRP and raised blood sugar levels
4. Evaluate patient’s oral cavity for red flags.
5. Draining sinus should be suspected as mucormycosis in Covid-19 recovered patient.
6. Avoid rushing into extraction of mobile teeth in Covid-19 recovered patient without complete evaluation.
7. If intraoral draining sinus is present then send pus for KOH mount and fungal culture.
9. Take immediate OMFS/ENT opinion for suspected cases.
10. No prophylactic anti-fungal therapy is required as per ICMR guidelines. [15]
11. Mucormycosis patients require a team approach of ENT, OMFS and Ophthalmologist with in-patient hospital care.

Surgical Management
It includes Aggressive clearance of pathologic tissue to make healthy tissue bed for perfusion of anti-fungal therapy. Role of maxillofacial surgeon in clearance of pathologic tissue while the role of prosthodontists for reconstruction and rehabilitation post mucormycosis surgery. Resection of involved jaw bone by Maxillectomy, Mandibulectomy, Caldwell-Luc operation for maxillary sinus debridement, resection of zygomatic bone. Use of free vascular grafts/regional soft tissue flaps for reconstruction and use of zygomatic implants for dental rehabilitation in indicated cases.
12. Do not delay specialist’s opinion and treat patients with facial or jaw related pain with antibiotics and analgesic therapy as this is a fast spreading disease and time is of utmost importance.

**CONCLUSION**

To cease the rise of mucormycosis, early diagnosis and management becomes the crucial step in this time of COVID-19 pandemic. Dentist plays a huge role in the management of the outbreak of this fungal infection and acts as an important lethal weapon in making the early diagnosis possible. This fatal fungal infection can be managed with minimum morbidity and mortality with help of early diagnosis and the preventive measures.

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