



MUCORMYCOSIS: AN OVERVIEW FROM PROSTHODONTIC PERSPECTIVE

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ABSTRACT

Mucormycosis is a fungal infection which has drawn everyone's attention after an enormous outbreak in covid-19 patients who have been hospitalized. Even those covid-19 positive patients who were at home, but were treated with steroid therapy without any oxygen support had developed this serious infection. Steroid therapy compromised their immune system thereby facilitating exponential growth of this commonly found fungus in the environment, which was previously harmless. Incidences of this disease has become so frequent that it has been declared an epidemic in various states of India by the local government. It has already created a widespread havoc in our Healthcare system along with fatally compromising the health of some patients and handicapping others due to the surgery required to remove infected eye or necrosed alveolar bone. This requires rehabilitation of lost part to regain function and esthetics.

KEYWORDS : mucormycosis, COVID-19, co-infection, ocular prosthesis, obturator

INTRODUCTION

Fungal infections are very common type of infections in human beings. They were the least of our concern as they were easy to treat. Hence, they did not pose any deadly threat in majority of cases.^[1] This changed when a global pandemic of covid-19 hit the world along with co-infection caused due to commonly found environmental contaminants causing mucormycosis.^[2]

This infection occurs as immunocompromised individuals. Therefore, infection caused by Black fungus have now become a deadly infection with the mortality rate of 53% with incidence rate of 26.7%.^[3] Various other fungal infections were also detected in patients treated for covid-19, such as white fungus infection caused by Aspergillosis with incidence of 19.6%-33.3% and mortality rate of 64.7% which is higher than mucormycosis.^[4] All these fungal infections have been detected in patients recovering from covid-19 as they are treated with dexamethasone to prevent cytokine storm.^[5]

DISCUSSION

Mucormycosis is an aggressive and angioinvasive fungal infection.^[7] It is caused by a group of molds called mucomycetes. Mucormycosis is typically an airborne infection in which sinusitis, rhino-orbito-cerebral and pulmonary infection are more common. It rarely disseminates to other parts such as skin or brain.^[9] Mucormycosis has been classified into 6 types as described in table 1. There are various risk factors compromising host immune system in COVID-19 patients that make them more susceptible to such infections. For example, patients suffering from uncontrolled diabetes mellitus, HIV/AIDS, hematological malignancies, steroid therapy, organ transplantation, prolonged neutropenia, voriconazole therapy, deferoxamine therapy, iron overloading therapy, etc.^{[7][8][9][10][11]}

Table 1: Types Of Mucormycosis According To Cdc

TYPES	SITES AFFECTED	SIGNS & SYMPTOMS	DIAGNOSIS
1 Rhinocerebral Rhino-orbito-cerebral mucormycosis	Sinus, orbits and brain	Nasal discharge and stuffiness, epistaxis, foul smell, unilateral facial oedema, diplopia, proptosis, restricted eye movement with pain and redness, fever, headache, blackish discoloration over bridge of nose/palate, toothache, loosening of teeth, etc. ^[3]	Histopathological analysis, CT scan, MRI, HRCT scan

2 Pulmonary mucormycosis ^[12]	Lungs	Refractory fever, Non-productive cough, progressive dyspnea, pleuritic chest pain	Sputum culture, Microscopic examination of biopsied tissue
3 Gastrointestinal mucormycosis ^[13]	Stomach, colon, ileum	Nonspecific abdominal pain, abdominal distention with nausea and vomiting, fever, Hematochezia, bleeding per anus, masslike lesion, perforation of gut.	Endoscopic biopsy of lesion (mostly diagnosed postmortem as it is an acute, rapid and fatal infection)
4 Cutaneous mucormycosis ^[14]	Skin, arms, legs, scalp, face, thorax, abdomen, perineum, breast, neck, gluteal area	Erythema, indurated plaque followed by necrosis, black eschar at injured site, muscle pain with deeper involvement.	Aspiration from drained abscess, tissue for biopsy from both center and edge of the lesion
5 Disseminated mucormycosis ^[15]	Lungs, brain, pancreas and spleen	Confusion, dyspnea, productive cough, jaundice, fever	Biopsy of the lesion.
6 Mucormycosis of bones and joints ^[16]	Bones and joints	Cellulitis, local pain and tenderness. Fever is rare.	MRI

Pathophysiology:

Compromised immune system of the patient results in defective phagocytosis. This results in germination of fungal spores forming fungal hyphae. Increased number of fungal hyphae in blood vessels (angioinvasion) results in ischemia. This is followed by thrombosis resulting in infarction and finally tissue necrosis.^[17] This prevents delivery of leukocyte and antifungal agents at the site of infection. Therefore, pathogen keeps on multiplying and disseminate throughout the body to reach vital organs.^[18]

Diagnosis:

Clinical examination is done by asking patient's medical history and performing physical examination to look for signs and symptoms enlisted in table 1. If mucormycosis is suspected, examinations enlisted in the table should be done immediately. CT scan is done to assess abnormalities present in the soft tissue of the sinuses, orbits and brain. Edematous tissue can be observed. Infarction, inflammation or opacification and necrotic part of the tissues can be detected. Bony erosions are clearly visible. MRI can be helpful in delineating vascular invasion and perineural spread in early stage. It detects intracranial spread very clearly.

For microbiological analysis, fungal hyphae are highlighted using potassium Hydroxide mount, calcofluor white (optical brightener), methamine silver, etc. Histopathological analysis of the biopsied specimen can be performed using stains such as Gomory methamine silver or periodic-acid Schiff.^{[7][8][17]}

Definitive diagnosis: Following signs are present in mucormycosis:

- presence of hyphae in the necrotic tissue
- neutrophilic infiltrate
- infarction along with angioinvasion
- formation of granuloma

Management:

Management of Rhino-orbito-cerebral mucormycosis infection requires an interdisciplinary approach.

A. Pharmacological management

Early diagnosis is key to success of a pharmacological therapy. Amphotericin B is most widely used drug to treat systemic fungal infection. It is considered gold standard for antifungal therapy but it has been known to produce nephrotoxicity.^{[20] [21]} Some studies have shown that Amphotericin B impairs liver function thereby affecting its metabolic capacity.^[22]

For mucormycosis amphotericin B is the drug of choice. Second line of drugs include posaconazole, isavuconazole, etc. Combination therapy can also be advocated in some cases.^[23]

B. Surgical management

Aggressive surgical debridement of the necrotic tissue as well as the infected tissue should be performed in order to prevent further spread of the infection along with hyperbaric oxygen therapy to promote wound healing.^{[7][8][23][24]}

C. Post-surgical rehabilitation

Surgical resection of severe rhino-orbito-cerebral mucormycosis depends on the extent of infection. This may result in resection of necrosed portion of maxilla along with teeth and removal of eye causing deformity. This has a psychological impact on the patients making them self-conscious. Therefore, prosthetic rehabilitation of the defect in maxillofacial region not only restores function but also boost the self-confidence of the patient by restoring the esthetics. Prosthetic rehabilitation can be done after 8 weeks of surgery.^[25]

Maxillary defects:

- Obturator: Maxillary resection without orbital involvement can be rehabilitated with an obturator to fill the oro-antral communication.^{[25] [26]} This will aid in speech, mastication and deglutition. It can be fabricated using metal or resin.

Ocular defect:

Surgical reconstruction is not recommended in case of mucormycosis post COVID-19 infection due to prolonged hospitalization contributing to a major risk factor for recurrence. Maxillofacial prosthesis is fabricated depending upon the extent of defect as larger defects can be covered. Exenteration of orbital content along with extensive maxillary

resection results in a complex maxillofacial defect. Since infraorbital bone has been resected, there is no vertical support for the prosthesis. This causes the prosthesis to move during mastication. This poses a challenge in retention of the prosthesis. Adhesive retained prosthesis is not recommended due to risk of re-infection. Mechanical retention has to be achieved. Non-rigid retentive attachments can be incorporated between obturator bulb and extraoral prosthesis to enhance stability and retention in such cases.^{[25][26][27]}

CONCLUSION

In cases requiring surgical resection, surgical treatment compromises the function and aesthetics of the patient. Since, no age predilection has been observed so far, young individuals are also presenting with this infection. Prosthetic rehabilitation of patient undergone extensive surgical resection is a must in order for them to regain self-confidence. Meticulous hygiene maintenance is of paramount importance to prevent recurrence of infection and is the key to successful rehabilitation of the defect.

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