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Original Research Article

Open surgical approach to management of rhino-orbito-cerebral mucormycosis

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ABSTRACT

Background: Since December 2019, when novel corona virus (COVID 19) was reported, it has spread widely to cause a pandemic. Rhino-orbito-cerebral Mucormycosis (ROCM), an opportunistic fungal infection caused by the order Mucorales and class Zygomycetes has led to an epidemic in our country.
Methods: This prospective cross sectional study was conducted at a 1200 bed tertiary care teaching hospital in Mysore. All patients of ROCM who presented to us for treatment were selected for the study after informed consent. Only those patients who were operated via open approach were included.
Results: Median age of the patients was 50 years (SD±10). 49 were male patients (67.1%). Diabetes mellitus was the most common underlying co-morbidity seen in 71 patients (97.3%). Facial pain (100%) and facial swelling (90.4%) were the most common presenting complaint. KOH positivity from nasal swab for Mucormycosis was positive in only 37 patients (50.7%). Traditional inaccessible areas to endoscope like the premaxilla, lateral orbit cavity, infra temporal fossa and hard palate were tackled by the open surgical approach route. Advantages of open surgical approach being the access to areas which are traditionally difficult to approach via the endoscope, aggressive debridement is possible which might be challenging endoscopically. Complications like wound dehiscence, oro-antral fistula, osteomyelitis and abscess were noted in our study.
Conclusions: Open surgical approach offers a very viable, affordable and a very effective means for aggressive surgical debridement of infection and reduce mortality associated with ROCM.

Keywords: Mucormycosis, Rhino-orbito-cerebral mucormycosis, Open surgical approach, Surgical debridement

INTRODUCTION

Since December 2019, when novel corona virus (COVID 19) was reported, it has spread widely to cause a pandemic. Glucocorticoids were commonly used in management of these patients. Opportunistic bacterial and fungal infections are a known complication of steroid therapy. Though the exact etiology for the sudden rise in the cases of Rhino-orbito-cerebral Mucormycosis could not be established, in this pandemic, an opportunistic fungal infection caused by the order Mucorales and class Zygomycetes has led to an epidemic in our country. Mucormycosis is the term used for infections caused by moulds belonging to this order. These fungi are ubiquitous in nature and are present in the soil, manure and decaying vegetation. Though we are exposed to the fungi on a routine basis, one rarely suffers from any disease due to their low virulence. It mainly affects those who are immunocompromised.

Mucormycosis can occur in immunocompetent patients with diabetes mellitus, subcutaneous tissue injury, and iron overload, and in patients who are undergoing deferoxamine therapy.[1,2]

It is uncommon, rapidly progressive, angioinvasive, commonly fatal, opportunistic infection. Mortality associated with this infection ranges from 33% to 80% across different studies.[1-7]

Most common site of infection is the nose and paranasal sinuses (PNS); however cerebral, pulmonary and cutaneous manifestations have also been reported.[1] The spread of Mucor from the nose and PNS to the orbit and brain occurs through lamina papyracea, infra-temporal fossa, infra-orbital fissure, superior orbital fissure and/or the orbital apex. It is due to this contiguous spread that it is termed as Rhino-Orbito-Cerebral Mucormycosis (ROCM).

Early treatment with Liposomal Amphotericin B (LamB) and aggressive surgical debridement are essential for successful management of Mucormycosis. Surgery alone has been reported not to be curative, but an aggressive surgical approach have been shown to improve survival.[8,9] Surgery can be either via endoscopic or open approach. The present study intends to highlight the advantages, challenges and difficulties encountered in the open surgical approach towards management of ROCM.

Aims and objective

To describe the various open approaches to manage rhino-orbito-cerebral Mucormycosis, its advantages, challenges and disadvantages.

METHODS

This prospective cross-sectional study was conducted at a 1200 bed tertiary care teaching hospital in Mysore, India. Institutional Ethical committee clearance was obtained for the study. The study was conducted over a period of 3 months extending from May 2021 to July 2021.

All patients of ROCM who presented to us for treatment were selected for the study after informed consent. These patients were screened for symptomatology via detailed clinical history taking and examination, KOH mount, biopsy, relevant biochemical and radiological investigations. Cross speciality opinions were sought from internists, ophthalmologists and neurologist's. They were taken up for surgery for debridement. Patients who were treated only by conservative medical therapy and those who were managed endoscopically for debridement were not included in the present study. Only those patients who were operated via open approach were included.

Infection site were classified as isolated sinusitis, sino-orbital or rhinocerebral. The presenting symptomatolgy, various biochemical parameters, involvement of various subsites during the surgery and post-operative challenges in these patients was recorded.

Data was analyzed using IBM Statistical package for social sciences (SPSS) for windows (version 20.0; IBM Corp., Armonk, NY, USA). Frequency was calculated for Categorical variables. Continuous variables were analyzed using the Mean / median with Standard deviation / inter-quartile range.

RESULTS

A total of 97 patients were admitted to our hospital in Mysore with a diagnosis of RCOM. All the patients received anti-fungal therapy in the form of Liposomal Amphotericin B (LamB). Open surgical approach for aggressive surgical debridement was done in 73 patients.

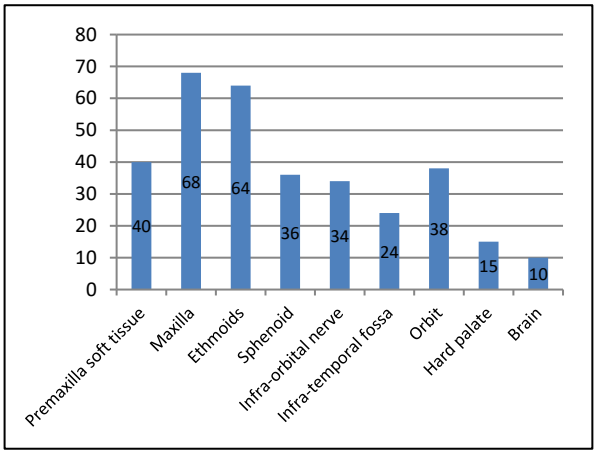

Figure 1: Different subsites involved in these patients.

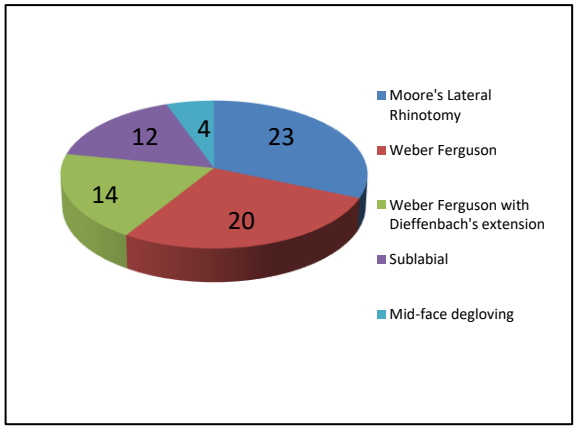

Figure 2: Different approaches used in the open surgical debridement of these patients.

Patient characteristics

Median age of the patients was 50 years (SD±10). 49 were male patients (67.1%) while 24 were female patients (22.9%). Diabetes mellitus was the most common underlying co-morbidity seen in 71 patients (97.3%) while hepatitis B infection, chronic kidney disease, chronic liver disease and HIV infection were noted in 1 patient each. Isolated sinus pathology was seen in 36 patients (49.3%) while orbital involvement was

seen in 27 patients (37%) and brain involvement was noted in 10 patients (13.7%).

Symptomatology and biochemical parameters

Facial pain (100%) and facial swelling (90.4%) were the most common presenting complaint while visual impairment was noted in 34 patients (46.6%) and Hard palate discolouration / ulceration was noted in 17 patients (23.3%).

Figure 3: Pre-operative photograph showing left orbital involvement with proptosis.

Figure 4: Pre-op photograph of a patient showing blackish discolouration of hard palate on right side.

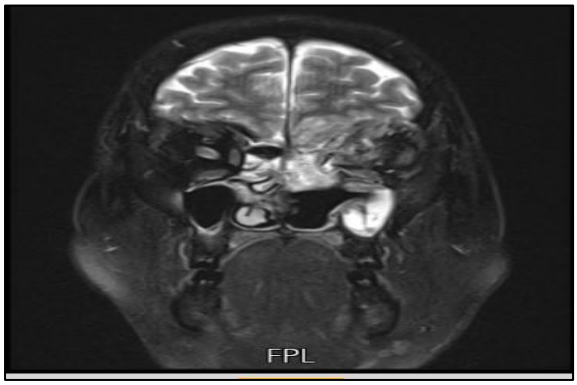

Figure 5: T2 MRI with contrast scan showing inflammatory disease involving left maxillary sinus, left pre-maxillary soft tissue, ethmoids, orbit with intra-cranial extension.

KOH positivity from nasal swab for Mucormycosis was positive in only 37 patients (50.7%). Predictor of glycemic control, HbA1c was found to be 11.1±2.5. Neutorphilia was found to be 78±10.62%.

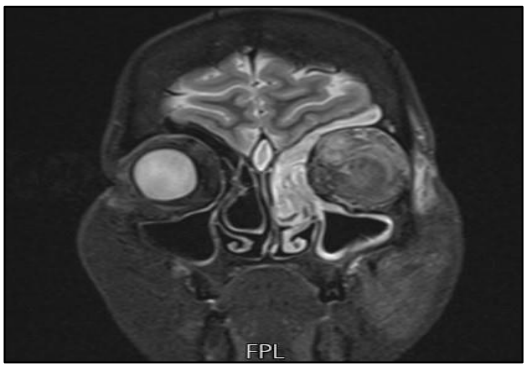

Figure 6: T2 MRI showing inflammatory changes in left maxillary, ethmoid and frontal sinus with involvement of inferior and middle turbinate and left orbit.

Surgical outcomes and complications

Average duration of surgery for open surgical debridement was 90 minutes (range 60-150 min). Figure 1 represents different subsites involved by mucormycosis. Figure 2 represents the different approaches for surgical debridement. Figure 3 and 4 represent the clinical presentation of patients with ROCM. Figure 5 and 6 represent the findings of patients with ROCM on a magnetic resonance imaging.

Wound dehiscence was the most common complication noted in 13 patients (17.8%) while Oro-antral fistula was noted in 10 patients (13.8%). Osteomyelitis was seen in 7 patients (9.6%) while residual disease was noted in 6 patients (8.2%) of whom 3 got revision surgery while the other 3 were managed consecutively, 4 patients (5.5%) succumbed to the disease in the post-operative period and 2 patients have been lost to follow-up. These patients were followed up for a period of 45-90 days.

DISCUSSION

Mucormycosis is an uncommon, rapidly progressive, angioinvasive, commonly fatal, oppurtunistic infection. Effective management of ROCM is challenging and includes extensive debridement, high dose of LamB and correction of underlying disease.[3,6,9]

Rhino-orbito-cerebral Mucormycosis is common in diabetes patients while pulmonary mucor is more common in hematological malignancy patients.[10] The risk of morbidity and mortality during acute infections increase in patients with diabetes mellitus. This is due to the suppression of innate and humoral immunity. The levels of HbA1c (glycated hemoglobin) >9% have been linked to 60% increased risk of hospitalization.[11] In our

study, we have observed patients with ROCM had elevated levels of HbA1c to the tune of 11.1±2.5.

Using clinical methodology alone to diagnose a case of mycor would be flawed as it has a low sensitivity and specificity. Direct microscopy of KOH wet mounts can be used for a rapid presumptive diagnosis of mucormycosis. It is an inexpensive, yet invaluable method to rapidly give a presumptive diagnosis. It is strongly recommended, along with histopathology, by a panel of experts of the European Confederation of Medical Mycology in cooperation with the Mycoses Study Group Education and Research Consortium (ECMM/MSG ERC).[12] The disadvantage of KOH mount is that, they are not able to identify a fungus to the genus or species level. In our study, 37 patients only (50.7%) were positive on KOH mount while all patients were positive for Mucormycosis on histopathological examination. This might be because, when the fungus is present in the maxillary antrum or ethmoid sinuses and not in the nasal cavity, a blind KOH nasal swab might be inadequate. When the disease is extensive and involving the nasal cavity and turbinates, the swab would be positive for mucor. Hence, it is not advisable to rely entirely on a nasal swab; atleast in the early or limited disease. It does however aid us in being a very quick, inexpensive and a valuable screening tool.

In a retrospective study by Kolekar, the presentation of the patients were black necrotic turbinates (50%), periorbital or facial swelling (40%), decreased vision (40%), palatal ulceration or perforation (10%), and headache (30%).[13] In our study, Facial pain (100%) and facial swelling (90.4%) were the most common presenting complaint while visual impairment was noted in 34 patients (46.6%) and Hard palate involvement was noted in 17 patients (23.3%). Sinus pathology was seen in 36 patients (49.3%) while orbital involvement was seen in 27 patients (37%) and brain involvement was noted in 10 patients (13.7%).

Endoscopic approach is preferred in patients with early limited disease or those with significant comorbidities. Studies suggest that an open surgery be reserved for an extensive disease, particularly with involvement of CNS or orbits.[12,14] Traditional inaccessible areas to endoscope like the premaxilla, lateral orbit cavity, infra temporal fossa and hard palate were tackled by the open surgical approach route.

Lateral Rhinotomy was performed in 23 patients. Its advatages were a well hidden facial scar in the naso-labial groove and very minimal morbidity; however, it did present to us with limited exposure in tackling disease beyond the ethmoidal sinuses.

Weber-Fergusson (WF) with lip split was done in 20 patients. It gave us a very good exposure especially when the hard palate was involved. however, we did face the odd complication of oro-antral fistula and poor facial scar and wound dehiscence in the post operative period.

WF with Dieffenbach's extension was done in 14 patients. this approach gave excellent approach to lateral orbital lesions and to lesions over zygoma, however poor facial scar below the lower eyelid was a major drawback

Sub-labial approach was done in 12 patients. This was an approach that completely avoided the facial scar and was well accepted by the patient but the limitation was that it could be performed in patients who had isolated maxillary sinus involvement and it also had the problem of oro-antral fistula in the post operative setting.

Mid-face degloving was done in 4 patients who had bilateral involvement. the advantage was that both side disease could be tackled simultaneously avoiding the facial scar but it did have the problem of oro-antral fistula.

Advantages of open surgical approach being the access to areas which are traditionally difficult to approach via the endoscope, aggressive debridement is possible which might be challenging endoscopically; thus leading to low chance of residue or recurrence in open approach. In our study, we had 6 patients only with residual infection. The duration of surgery for open approach was an average of 90 min (range 60-150 min).

Like advantages, disadvantages are also akin to open approach like facial scar and disfigurement which leads to low patient morale. To address bilateral disease is also an issue, so also is the problem of wound dehiscence and oro-antral fistula. Complications like Wound dehiscence, Oro-antral fistula, osteomyelitis and abscess were noted in our study.

Mortality associated with these infections ranges from 33% to 80% across different studies.[1-7] Of the 97 patient with Mucormycosis, 13 patients (13.4%) succumbed to the illness. Of these, in our study, the mortality rate was 5.5% (4 patients) out of 73 patients, albeit with the loss of 2 patients to follow-up.

The low mortality in our cohort could be attributed to multiple factors like early detection, prompt instigation of LamB, aggressive surgical debridement and proper glycemic control.

Limitations of the study are that a longer follow-up of these patients are needed to note any difficulties in rehabilitation of these patients and to recognise late complications and or recurrence of the disease in them.

CONCLUSION

ROCM is not a new disease but it has never been reported as an epidemic. The cause / reason for its outbreak needs to be looked into as much as the sudden

dissipation of this epidemic. Each approach have their own merits and demerits; but when chosen appropriately based on disease extent and patients needs, we were able to provide the best possible outcome for disease clearance along with minimal mortality. Open surgical approach offers a very viable, affordable and a very effective means for aggressive surgical debridement of infection and reduce mortality associated with Rhino-orbito-cerebral Mucormycosis.

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Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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