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Clinical and Radiological Correlation of Involvement of Various Paranasal Sinuses in Post Covid-19 Mucormycosis

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ABSTRACT
Mucormycosis is a rapidly progressing invasive opportunistic fungal disease due to species Rhizomucor and Mucor which usually starts from the nasal cavity and paranasal sinuses. Magnetic resonance imaging (MRI) has been considered a sensitive modality to detect mucormycosis; however, overall MRI appearance of the disease entity and its correlation with clinical and histopathological findings and disease outcome is poorly understood, hence we have undertaken this study at our tertiary care institute. In this retrospective study 198 patients with clinically evident sinonasal mucormycosis confirmed on radiological investigations and histopathology report were included. There was a significant male preponderance with 131 (66.16%) male patients. Majority, 164 (82.82%) cases were managed by endoscopic debridement. Seventy two 28% patients were successfully treated and discharged while 21.71% succumbed to the disease. On comparing clinic-histopathological and radiological findings, we found that radiological findings are consistent in 73.74% cases. Radiology has good consistency with histopathology and helps in early detection.

INTRODUCTION

India had witnessed second wave of COVID-19 pandemic since April 2021. Covid -19 is an infection caused by severe acute respiratory syndrome coronavirus-2 (SARS-2). This was characterized by the initial picture of dry cough, high grade fever and other symptoms including shortness of breath, anosmia, ageusia, diarrhea, generalized malaise, acute cardiac injury etc.

Oto-rhino-laryngology has been relevant to corona virus pandemic from the start, beginning with nasopharyngeal swab sampling for diagnosing purpose to declaration of anosmia as a symptom marker. As we were recovering from the second wave, recently we have come across the most dangerous, worrisome, fatal disease associated with covid 19 infection i.e. mucormycosis. Mucormycosis is a rapidly progressing invasive opportunistic fungal disease due to species Rhizomucor and Mucor which usually starts from the nasal cavity and paranasal sinuses[1]. These secondary opportunistic infections are particularly widespread among hospitalized, critically ill COVID-19 patients, with fungal infections being 10 times more likely[2]. This could be attributed to risk factors such as preexisting uncontrolled diabetes or diabetes worsened by COVID-19, malignancies, solid organ transplant recipient, indiscriminate use of steroids in the management of COVID-19, oxygen therapy and high serum ferritin levels[3-6]. Clinical symptoms depends on the site of involvement but at the start it presents as nasal blockage, crusting, occasional episodes of epistaxis, facial pain, facial swelling, proptosis, ptosis, chemosis and opthalmoplegia which later on progressing to neurological signs and symptoms due to intra cranial extension[7,8].

Magnetic resonance imaging (MRI) has been considered a sensitive modality to detect mucormycosis, however, overall MRI appearance of the disease entity and its correlation with clinical and histopathological findings and disease outcome is poorly understood, hence we have undertaken this study at our tertiary care institute.

Objective:

- To correlate clinical and radiological findings, thereby assessing involvement of various paranasal sinuses in post covid-19 mucormycosis patients

MATERIALS AND METHODS

This was a facility based retrospective study, protocol of which was approved by the Institutional Ethical committee of the medical college and it is compliant with all ethical standards. Written informed consent was taken from all study subjects. Present study included 198 Patients >18 years of age with clinically evident sinonasal mucormycosis confirmed on radiological investigations and histopathology report who were willing to be part of the study. Study was carried out over a period of 2 years. Cases with with covid -19 negative status and with palatal involvement were excluded.

All cases were analyzed as regard to the history, clinical presentation, routine investigations were carried out. A detailed history was asked in every case such as history of covid+ve status, DM, DKA and any other comorbidity, prolonged steroid use, blood transfusion related history etc. Nasopharyngeal swab was taken for KOH mount/fungal culture. Clinical examination along with DNE, general and systemic examination was performed followed by oto-rhinolaryngological examination. This was followed by computed tomographic examination and magnetic resonance imaging of nose and paranasal sinuses and diagnostic nasal endoscopic examination. Details of every case was recorded in separate case proforma. All patients were treated by endoscopic surgical debridement. All patients were followed up after discharge at 1 month, 3 months and 6 months for assessing disease outcome, complications and recurrences if any. Data was collected in pre-structured proforma which was pilot tested and after ensuring it's validity. The data collected was then analyzed by using SPSS IBM version 20. The Qualitative data was presented as frequency and percentage.

RESULTS

In the present retrospective study, we have analyzed clinically and microscopically proven 198 cases of mucormycosis. Most (n = 181, Percentage = 91.41%) of the cases in our study were of pansinusitis and rest (n = 17, Percentage = 8.59%) were of maxillary sinusitis. The involved paranasal sinuses shown moderate to severe mucosal thickening.

Out of total 198 cases majority, 89 (44.94%) between 56-74 years age group followed by 70 (35.35%) from 37-55 years, 20 (10.10%) from old i.e. >74 years age group and least, 19 (9.59%) from young age group i.e. 18-36 years. There was a significant male preponderance with 131 (66.16%) male patients. Most common comorbidity in our study was diabetes mellitus present among 117 (59.09%) cases followed by hypertension in 42 (21.21%), asthma and hyperthyroidism in 4 (2.02%) followed by comorbidities such as IHD, acute kidney injury and others. Among 20 (10.10%) cases there was no history of any comorbidities (Table 1).

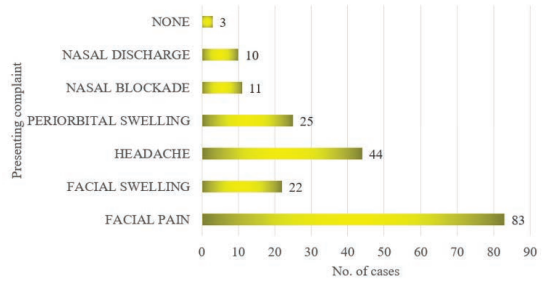

Fig. 1: Distribution of patients according to presenting complaints (n = 198)

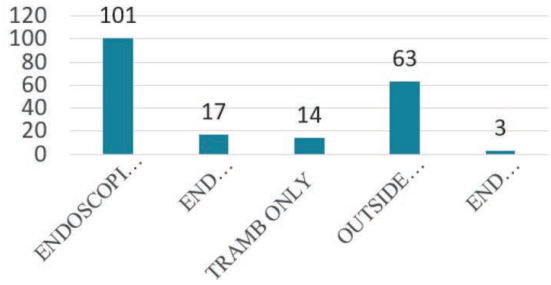

Fig. 2: Distribution of patients according to type of operative management (n = 198)

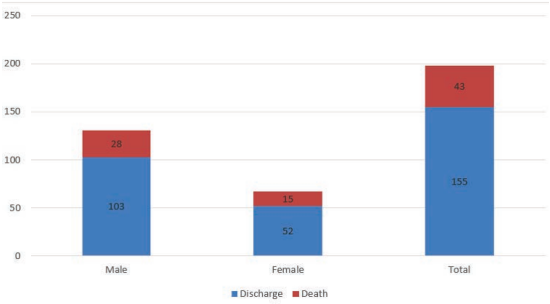

Fig. 3: Distribution of patients according to outcome (n = 198)

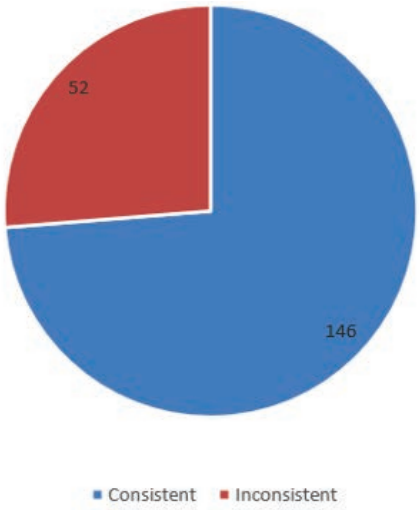

Fig. 4: Consistency of clinical findings with radiological findings

Fig. 5: MRI- coronal section-showing destructed inferior turbinate, middle turbinate, along with mucosal thickening in maxillary sinus

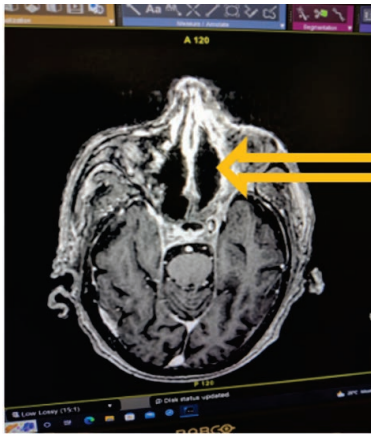

Fig. 6 : MRI T2 weighted, axial section s/o- destruction of right lateral nasal wall, loss of retro antral fat pad

Fig. 7: T1 weighted MRI-s/o hypointense lesion in right cerebral hemisphere with enhancing rim-s/o cerebral abscess

Fig. 8: T2 weighted MRI-showing cavernous sinus thrombosis, right side

Table 1: Distribution of patients according to baseline characteristics

	Cases	
Baseline characteristic	No.	Percentage
Age (years)		
18-36	19	9.59
37-55	70	35.35
56-74	89	44.94
>74	20	10.10
Gender		
Male	131	66.16
Female	67	33.83
Comorbidities		
DM	117	59.09
HTN	42	21.21
Asthma	04	2.02
Hypothyroidism	04	2.02
IHD	03	1.52
AKI	03	1.52
Others	05	2.52
None	20	10.10

Most common presenting complaint in this study was facial pain among 83 (41.91%) patients followed by headache in 44 (22.22%), periorbital swelling in 22 (12.62%), nasal blockade (5.55%) and nasal discharge (5.05%) while 3 (1.51%) cases were asymptomatic. (Fig. 1). In our study, majority, 164 (82.82%) cases were managed by endoscopic debridement followed by endoscopic debridement plus transcutaneous retrobulbar amphotericin B in 17 (8.59%) patients, transcutaneous retrobulbar amphotericin B only among 14 (7.07%) and endoscopic debridement with orbital exenteration in 3 (1.52%) cases (Fig. 2).

In the present study, 155 (78.28%) patients were discharged of which 103 (52.02%) were males and 52 (26.26%) were females. While 43 (21.71%) patients were died of which 28 (14.14%) were males and 15 (7.57%) were females (Fig. 3). On comparing clinic-histopathological findings with radiological findings, we have found that MRI findings are consistent with, among most i.e. 146 (73.74%) cases and inconsistent among 52 (26.26%) cases (Fig. 4). Out of these 198 patients, 27 (13.63%) had orbital involvement, 44 (22.22%) had CNS involvement and rest 127 (64.14%) had nasal and paranasal sinus involvement only.

DISCUSSIONS

During second wave of COVID 2019 pandemic India has witnessed enormous rise in the cases of devastating mucormycosis. Unless treated early it leads to devastating complications, hence early diagnosis is utmost important. Sandeep Singh *et al.*[9] studied the aggressive necrosis caused by rhino-orbital mucormycosis[10]. CT and MRI are useful early investigations for assessing the disease spread and invasion into nearby anatomical structures as histopathology could result in delay in diagnosis. In this study we investigated to what extent radiological findings are consistent with the clinic-histopathological findings.

Most i.e. 91.41% of the cases in our study were of pansinusitis and rest 8.59% were of maxillary sinusitis. Consistently Roger Anthony Manuel *et al.*[11] in their study noted pansinusitis among 93.9% patients. The involved paranasal sinuses shown moderate to severe mucosal thickening. After the administration of contrast the mucosal thickening was not seen to enhance. There was bony erosion and rarefaction of the paranasal sinus walls on CT imaging. On MR imaging the mucosal thickening was seen to be iso-intense or hypointense on T1-weighted imaging and hyperintense on T2-weighted imaging. (Fig. 1 and 2) T1 weighted MRI shown hypointense lesion in cerebral hemispheres in cases of cerebral abscess. (Fig. 3) Consistent radiological findings to our study were observed by Rania Mostafa Hassan *et al.*[12]

Out of 198 cases, most, (44.94%) were from advancing (56-74 years) age group with a significant male preponderance (66.16%). Similar to our study, Dorkar Shashikant Narayan *et al.*[13] reported male majority and cases with the advancing age, Abd El Megid *et al.*[14] found that diabetes present in 90.3%, was the commonest comorbidity. So, apart from diabetes mellitus advancing age and male gender could be other risk factors in cases of post covid mucormycosis. Suresh Naruka *et al.*[15] noted similar risk factors in their study. Sulem Ansari *et al.*[16] also revealed that diabetes (93.42%) was the commonest morbidity among rhinomaxillary mucormycosis cases. In the present study, facial pain (41.91%), headache (22.22%), periorbital swelling (12.62%), nasal blockade (5.55%) and nasal discharge (5.05%) were common presenting complaints. Abd Megid *et al.*[14] noted headache as the main complaint. Of these, 82.82% cases were managed by endoscopic debridement, 8.59% patients by endoscopic debridement plus transcutaneous retrobulbar amphotericin B, 7.07% with transcutaneous retrobulbar amphotericin B only and 1.52% by endoscopic debridement with orbital exenteration. In line with this, Suresh Naruka *et al.*[15] in their study reported that all 27 patients with disease limited to sinuses underwent extended endoscopic sinus surgery and debridement and patients with

orbital extension had to undergo orbital exenteration. Most of the patients were discharged after completion of amphotericin-B therapy. Fortunately, 78.28% patients were successfully treated and discharged while 21.71% were died. This is because, on comparing clinic-histopathological and radiological findings, we found that radiological findings are consistent in 73.74% cases and we could improve final outcome in most of the cases and those who have developed rhino-cerebral or rhino-orbital complications presented late and died. In agreement with our study Rania Mostafa Hassan *et al.*[12] also noted that MRI features of ROCM in post-COVID-19 patients helps in early detection, early proper management and prevention of complications. Dorkar Shashikant Narayan *et al.*[12] and Sheetal Agarwal *et al.* also highlighted the importance of MRI to define the disease extent in rhino-orbito-cerebral mucormycosis. 127 (64.14%) cases had nasal and paranasal sinus involvement only but 27 (13.63%) had orbital involvement and 44 (22.22%) had CNS involvement additionaly. (Fig. 1-4) Similar to our study Arora *et al.*[17] also in their study on mucormycosis of paranasal sinuses reported that involvement of CNS, orbit and other structures to varying degrees and confirmed the need of early diagnosis and aggressive treatment with surgery and Roger Anthony Manuel *et al.*[11] reported that 35.4% patients had only sinonasal mucormycosis, 38.5% patients had rhinoorbital mucormycosis, 4.6% patients had rhino-cerebral mucormycosis and 16.9% patients had rhino-orbitocerebral mucormycosis.

CONCLUSION

From the findings of present study, we can conclude that radiology has good consistency with histopathology and helps in early detection, early proper management, prevention of complications and alters the final outcome as well as prognosis of paranasal mucormycosis cases.

Declaration: There was no source of funding in our study and there was no any conflict of interest.

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