



ORIGINAL RESEARCH PAPER

Radiology

STUDY OF ROLE OF IMAGING IN RHINO-CEREBRAL MUCORMYCOSIS

KEY WORDS: MRI, ROCM

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ABSTRACT

Introduction: Rhino orbital cerebral mucormycosis (ROCM), caused by a saprophytic fungus is a life-threatening infection. During second wave of COVID-19, it has emerged as a secondary complication among clinically severe COVID-19 and uncontrolled diabetic patients with involvement of PNS, rhino-orbitalo cerebral, cutaneous, gastric and lungs. Early diagnosis and timely intervention are very important for successful treatment. In present study we aimed to evaluate diagnostic accuracy & imaging findings of MRI in Mucormycosis **Materials and Methods:** 30 Patients with symptoms of suspected of paranasal sinus Mucor mycosis with history of COVID 19 of age >30 years were enrolled. All patients had undergone MRI (plain and contrast) using GE1.5 T machine. MRI head with orbit and paranasal sinus imaging including T1 weighted image, T2 weighted image, FLAIR and fat suppressed post contrast T1 weighted images were taken. Diffusion weighted images acquired too. **Observations and Results:** In majority of cases (27 out of 30) headache was dominant symptom. Covid -19 severity was moderate in 22 (73 %) & severe in 7 (4 %) cases. No one had mild history. 16 (54 %) cases had diabetes. Majority cases i.e. 24 (80 %) were of unilateral involvement. Maxillary & ethmoid (28/30 & 27/30 respectively) was involved in majority cases. Dominant site of extension was orbit, found in 22 cases out of 30. Soft tissue infiltration and fat stranding present in 19, Orbital cellulitis in 18 & Optic neuritis in 11 out of total 30 cases. PNS involvement was divided in 3 stages. Stage 1 was found in 4 (13 %), stage 2 in 20 (67 %) & stage 3 in 6 (20 %) cases **Conclusion:** MRI determines the extent of involvement very well. Radiologists should be aware of the imaging findings and of the extensions, which can lead to their early diagnosis which further promotes timely management

INTRODUCTION

Rhino-orbital-cerebral mucormycosis (ROCM), caused by a saprophytic fungus with non-septate hyphae of class Phycomycetes, order Mucorales and genus Rhizopus is a life-threatening infection¹. Through inhalation spores reach nasal cavity or nasopharynx and may spread to the Paranasal Sinuses (PNS), orbit, meninges or brain by direct extension². During second wave of COVID-19, it has emerged as a secondary complication among clinically severe COVID-19 and uncontrolled diabetic patients with involvement of PNS, rhino-orbitalo cerebral, cutaneous, gastric and lungs. Rhino orbital cerebral mucormycosis (ROCM) is an acute and aggressive fungal infection occurring especially in immunocompromised patients or those with associated condition like diabetes. Ketoacidosis in diabetes patients enhances the susceptibility to disease. Rhino-orbital-cerebral mucormycosis (ROCM) originates in the sinonasal mucosa and extends rapidly to neighboring structures, including orbit and sometimes brain. It is characterized by angioinvasive property causing vascular occlusion which may result in extensive tissue necrosis³. In early-stage disease presents with fever, headache, facial pain, nasal discharge, nasal obstruction and crusting which may progress rapidly within a period of a few hours to days leading to abnormalities of cranial nerve suggesting CNS involvement⁴. Early diagnosis and timely intervention are very important for successful treatment. In present study we aimed to evaluate diagnostic accuracy & imaging findings of MRI in Mucormycosis

Aim

To study role of imaging in Rhino orbital cerebral mucormycosis (ROCM)

Objectives

1. To assess diagnostic accuracy & imaging findings of MRI in Mucormycosis

2. In patients where biopsy is planned, imaging can be used to help guide the site for biopsy

Material and Methods

Present study is a cross sectional prospective study conducted from duration December 2022 to February 2023. Institutional ethics committee permission was taken prior to commencement of study. 30 cases of Rhino orbital cerebral mucormycosis (ROCM) fulfilling inclusion and exclusion criteria were enrolled. Study was explained to all participants and written informed consent was obtained from all.

Inclusion Criteria

30 Patients with symptoms of suspected of paranasal sinus Mucor mycosis with history of COVID 19 of age >30 years were enrolled

Exclusion Criteria

1. Disoriented and sick patients
2. Patient not willing to participate

Procedure

Detailed clinical history with nasal obstruction, nasal discharge, visual disturbances, headache, vomiting, fever or any other symptom suggestive of focal neurological deficit was asked & noted in case record form. Diabetic history and immune status were mentioned. Detailed clinical examination including nose and paranasal sinuses, ophthalmic and neurological examination were carried out. All patients had undergone MRI (plain and contrast). All the MRI scans were done using GE 1.5 T machine. MRI head with orbit and paranasal sinus imaging including T1 weighted image, T2 weighted image, FLAIR and fat suppressed post contrast T1 weighted images were taken. Diffusion weighted images acquired too. T1 weighted, T2 weighted, and DWI images with post contrast fat suppressed T1 weighted images were evaluated for signal changes and also enhancement patterns. Paranasal sinuses (PNS), nasal cavities, orbits and brain were

visualized & assessed for any extension of the disease. Soft tissue extension into the nasal cavity, along the nasal septum, nasolacrimal duct, lacrimal sac, orbits, pterygopalatine fissure, infratemporal fossa, face, cavernous sinus and brain were examined. In cases of orbital cellulitis, fat stranding in intraconal fat space along with thickening of either extraocular muscles or superior ophthalmic vein was visualized. PNS involvement were categorized into 3 stages according to Rupa V et al (2015)⁵ study as follows

- A. Stage 1: Nose and paranasal sinuses alone
- B. Stage 2: Paranasal sinuses with immediate adjacent areas which are surgically resectable with minimal morbidity e.g., Orbit (extraconal), palate and oral cavity.
- C. Stage 3: Intracranial extension (extradural/intracerebral) or partially resectable with extension to pterygopalatine fossa, cavernous sinus, cheek and periorbital region.

Statistical Analysis

Statistical analysis was performed using SPSS software, version 20. Data are expressed as frequency with percentages N (%). χ^2 -test was used to evaluate qualitative data and to study association between two variables. Statistical significance was assumed if P value less than 0.05.

OBSERVATION AND RESULT

Table 1: Age & Gender Distribution

Sr No.	Age (Years)	Male N (%)	Female N (%)	Total N (%)
1	30-40	4 (13 %)	1 (3 %)	5 (16 %)
2	41-50	10 (33 %)	2 (7 %)	12 (40 %)
3	51-60	8 (28 %)	2 (7 %)	10 (35 %)
4	61-70	1 (3 %)	1 (3 %)	2 (6 %)
5	>70	1 (3 %)	0 (0 %)	1 (3 %)
Total N (%)		24 (80 %)	6 (20 %)	30 (100 %)

As Table 1 showing, male cases were maximum i.e., 24 (80 %) whereas females were 6 (20 %). Majority cases i.e., 12 (40 %) were from age group 41 to 50

Table 2: Clinical History

Sr No.	Clinical history	Number of cases N (%)
1	Symptoms	
	a. Proptosis	2/30
	b. Headache	27/30
	c. Fever	18/30
	d. Facial swelling	12/30
2	Severity of COVID-19	
	a. Mild	1 (3 %)
	b. Moderate	22 (73 %)
	c. Severe	7 (4 %)
3	Associated comorbidity	
	a. Diabetes	16 (54 %)
	b. Hypertension	6 (20 %)
	c. Renal disease	4 (13 %)
	d. None	4 (13 %)

In majority of cases (27 out of 30) headache was dominant symptom. Covid -19 severity was moderate in 22 (73 %) & severe in 7 (4 %) cases. No one had mild history. 16 (54 %) cases had diabetes.

Table 3: MRI Findings

Sr No.	MRI findings	Number of cases N (%)
1	Side involved	
	a. Unilateral	24 (80 %)
	b. Bilateral	6 (20 %)
2	Sinus involved	
	a. Maxillary	28/30
	b. Ethmoid	27/30
	c. Sphenoid	21/30
	d. Frontal	18/30
	e. Maxillary + Ethmoid	12/30

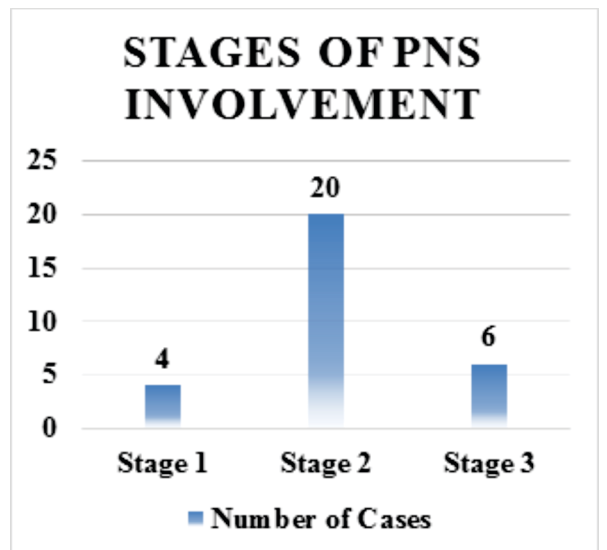
	f. Sphenoid + Ethmoid	6/30
	g. Maxillary + Sphenoid + Ethmoid	11/30
	h. Pansinusitis	10/30
	3	Site of extension
	a. Orbit	22/30
	b. Face	4/30
	c. Orbital apex	3/30
	d. Pterygopalatine fossa	3/30
	e. Bone	2/30
	f. Cavernous sinus	1/30
	g. Brain infarct	1/30
	h. Internal carotid artery	1/30
	4	Type of involvement
	a. Soft tissue infiltration and fat stranding	19/30
	b. Orbital cellulitis	18/30
	c. Optic neuritis	11/30
	d. Skull base lytic destruction	1/30
	e. Cavernous sinus involvement	2/30
	f. Brain (Cerebritis, Abscess, Infarcts)	10/30
	g. Black turbinate sign	9/30

As shown in Table 3, majority cases i.e. 24 (80 %) were of unilateral involvement. Maxillary & ethmoid (28/30 & 27/30 respectively) was involved in majority cases. Dominant site of extension was orbit, found in 22 cases out of 30. Soft tissue infiltration and fat stranding present in 19, Orbital cellulitis in 18 & Optic neuritis in 11 out of total 30 cases.

Table 4: Stages of PNS Involvement

Sr No.	Stages of PNS involvement	Number of cases N (%)
1	Stage 1	4 (13 %)
2	Stage 2	20 (67 %)
3	Stage 3	6 (20 %)
Total N (%)		30 (100 %)

In table 4 PNS involvement was divided in 3 stages. Stage 1 was found in 4 (13 %), stage 2 in 20 (67 %) & stage 3 in 6 (20 %) cases (Graph 1)



Graph 1: Stages of PNS Involvement

DISCUSSION

Rhino-orbital-cerebral mucormycosis (ROCM) is a rapidly

progressive fatal opportunistic infection which predominantly affects immunocompromised people. Aspergillosis, zygomycosis, Candida, coccidioides, histoplasma and cladosporium are the fungi responsible. Early diagnosis and treatment are key elements in survival in Rhino-orbital-cerebral mucormycosis (ROCM). Present study was undertaken in 30 cases of Rhino-orbital-cerebral mucormycosis (ROCM) To assess diagnostic accuracy & imaging findings of MRI in Mucormycosis. Results of MRI findings compiled & analysed. In present study male cases were maximum i.e., 24 (80 %) whereas females were 6 (20 %). Majority cases i.e., 12 (40 %) were from age group 41 to 50. In similar study by Vidyashree Shridhar Kotian et al (2022)⁶ males were affected more than females, with 16 out of 20 study subjects being males. Mean age of all the patients was 47±13 years. Anil Baddula et al (2022)⁷ in their study found infection was more common in males (73.3 %) than females (26.6 %). D, Prasad U et al (2023)⁸ in their study enrolled 38 males and 14 females in age range of 2 to 75 years. Patients over the age of 40 (78.8%) were suffering most. In present study in majority of cases (27 out of 30) headache was dominant symptom. Covid-19 severity was moderate in 22 (73 %) & severe in 7 (4 %) cases. No one had mild history. 16 (54 %) cases had diabetes. Majority cases i.e. 24 (80 %) were of unilateral involvement. Maxillary & ethmoid (28/30 & 27/30 respectively) was involved in majority cases. Dominant site of extension was orbit, found in 22 cases out of 30. Soft tissue infiltration and fat stranding present in 19, Orbital cellulitis in 18 & Optic neuritis in 11 out of total 30 cases. PNS involvement was divided in 3 stages. Stage 1 was found in 4 (13 %), stage 2 in 20 (67 %) & stage 3 in 6 (20 %) cases. In similar study by Vidyashree Shridhar Kotian et al (2022)⁶ they found severity of the COVID-19 in 15 out of 20 was moderate and five out of 20 was severe. 15 out of 20 patients had diabetes mellitus. In majority patients, multiple sinuses were involved with combination of ethmoid, maxillary and sphenoid sinuses being common. Ethmoid sinuses involvement was seen in all 20 patients and its involvement was either isolated or in combination with other sinuses. Anil Baddula et al (2022)⁷ in their study found unilateral (70 %) involvement of sinus was more common than Bilateral (30 %). Ethmoid sinus (96 %) was most commonly involved paranasal sinus followed by maxillary sinus (90 %). D, Prasad U et al (2023)⁸ in their study found out of 52 patients, 47 (90.4 %) were diabetic. Ethmoid sinus was the most common sinus involved 46 (88 %), followed by the maxillary sinus 27 (52 %). Orbit was the most common site in which extraconal fat stranding or soft tissue opacification was most commonly seen (39, 75%)

CONCLUSION

Present study concludes that magnetic resonance imaging (MRI) is highly useful imaging modality in the diagnosis of Rhino-orbital-cerebral mucormycosis (ROCM). MRI determines the extent of involvement very well. Radiologists should be aware of the imaging findings and of the extensions, which can lead to their early diagnosis which further promotes timely management.

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