

Table 3: History of mucormycosis patients.

Post COVID patients with mucormycosis	Total patients	100	
History of hospital admission	Hospital admission	66	
	Home isolation	34	
Duration of oxygen exposure	<5 days	11	
	5-10 days	41	
	>10 days	10	
History of oxygen exposure	Absent	38	
	Present	BiP	2
		NP	12
		HM	31
		NRM	17
History of steroid	IV	53	
	No	7	
	Oral	28	
	Not known	12	
History of zinc intake	No zinc	37	
	Zinc	63	
History of antibiotic intake	Yes	89	
	No	5	
	Not known	6	

Table 4: Newly diagnosed patients.

Total patients	DM	Newly diagnosed dm	No history of dm
100	64	24	12
	Uncontrolled	Controlled	
	46	18	

Table 5: Stage presentation.

Stage at presentation	Stage 1	Stage 2	Stage 3				Stage 4
100	2	32	60				6
			Stage 3a	Stage 3b	Stage 3c	Stage 3d	
			6	15	37	2	

Table 6: Patients with ophthalmic involvement.

Patients with ophthalmic involvement	60		
Congestion	17		
Chemosis	28		
Proptosis	10		
Ptosis	55	Mild	9
		Mod	3

		Severe	43
Ophthalmoplegia	Restricted	8	
	Total	41	
Pupil reaction	Mid dil not reacting	39	
	RAPD	4	
	NSRL	16	
Vision loss	UL	38	
	BL	5	
Peri orbital crusting	2		

DISCUSSION

A myriad of manifestations and complications have been documented with COVID 19 infection, new ones are emerging and being reported, newest being mucormycosis, not a new disease just previously a rare disease found in immunocompromised individuals, but in present scenario with COVID pandemic sudden exponential increase in cases is creating havoc in world and especially India where there are thousands of cases with increasing mortality and situation getting out of hand. Mucormycosis in last wave of COVID had few cases, but for this wave, there is no clear data to find the causes responsible for such mammoth spread [8,9].

Mucor is a saprophytic fungus; its spores spread in soil, air, food and decaying organic material. ROCM refers to the entire spectrum ranging from limited sino-nasal disease, limited rhino orbital disease (progression to orbits) to rhino-orbital-cerebral disease (CNS involvement). The area of involvement may differ due to underlying condition. The signs, symptoms and radiographic findings of mucormycosis are nonspecific; direct histologic examination of scrapings or biopsies of involved tissue or paranasal sinus secretions are diagnostic. The fungal invasion may be patchy, so multiple biopsies may be required for definitive diagnosis [10].

It may be present in the nasal mucosa of healthy people as a commensal but when patient becomes immunosuppressed, this fungus may germinate within the paranasal sinuses and it may spread directly to the orbital apex and gain intracerebral access. The optic nerve may be affected resulting in vision loss. Involvement of the superior orbital fissure and its contents, such as cranial nerves III, IV and VI and branches of V1 and V2, may cause diplopia, ophthalmoplegia and sensory loss to areas of the cornea and face [11].

Mucormycosis is difficult to diagnose early, as patients often present with non-specific symptoms. When orbital apex involvement develops, it is often too late to save the patient's vision, eye or life.

The proposed staging system follows the general progression and severity.

Stage 1: Involvement of the nasal mucosa

- Limited to the middle turbinate (Figure 1).
- Involvement of the inferior turbinate or ostium of the nasolacrimal duct.
- Involvement of the nasal septum.
- Bilateral nasal mucosal involvement.
- Symptoms of stage 1-nasal stuffiness, nasal discharge, foul smell, epistaxis.

Stage 2: Involvement of paranasal sinuses

- One sinus.
- Two ipsilateral sinuses.
- >Two ipsilateral sinuses and/or palate/oral cavity (Figure 2).
- Bilateral paranasal sinus involvement or involvement of the zygoma or mandible.

Stage 3: Involvement of the orbit

- Nasolacrimal duct, medial orbit, vision unaffected.
- Diffuse orbital involvement (>1 quadrant or >2 structures), vision unaffected.
- Central retinal artery or ophthalmic artery occlusion or superior ophthalmic vein thrombosis; involvement of the superior orbital fissure, inferior orbital fissure, orbital apex, loss of vision (Figure 3).
- Bilateral orbital involvement.

Stage 4: Involvement of the CNS

- Focal or partial cavernous sinus involvement and/or involvement of the cribriform plate.
- Diffuse cavernous sinus involvement and/or cavernous sinus thrombosis.
- Involvement beyond the cavernous sinus, *i.e.*, skull base, internal carotid artery occlusion, brain infarction.
- Multifocal or diffuse CNS disease (Figure 4).



Figure 1: Patient presenting in stage 3 with complete ptosis.

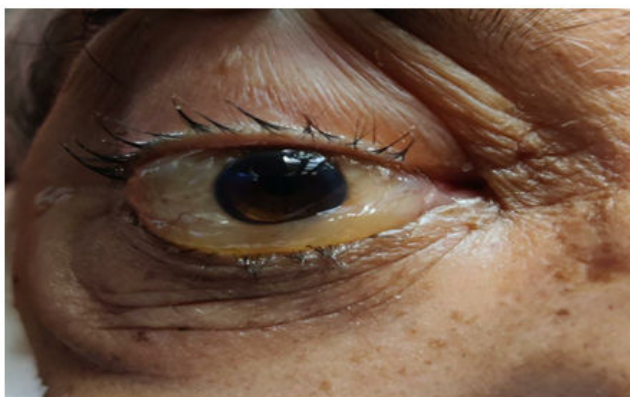


Figure 2: Patient presenting in stage 3b with intense chemosis.



Figure 3: Patient presenting with eschar formation.



Figure 4: Patient presenting with right eye ophthalmoplegia.

In our study there was male preponderance, the reason might be because of male more mobile in the environment where spores are found. The most probable age group is late middle age group from 40-60 bearing the maximum caseload while the extreme age groups are less prevalent [12].

The patients included in the study are post COVID mucormycosis cases who had RT-PCR/RAT Positive and or took treatment based on HRCT CTSS score. Majority of the patient complained of the initial symptom within 1-3 weeks after diagnosed positive mostly after getting discharged from hospital, while very few got it while admission or after being discharged >3 weeks. Though maximum patients had history of admission many were home isolated which proves that only hospital environment isn't a major factor. Though there was an increased oxygen exposure in cases but also a significant numbers state no oxygen use forcing us to look for other factors. The duration of oxygen was found to be maximum 10 days or less in patients very few requiring above it [13,14]. An important factor to be taken into consideration here is that among those 62%, 12% were admitted in hospitals with central supply oxygen while others used either oxygen cylinders or industrial oxygen which should be studied more keenly to find out any association between the same.

Coming to the biggest and common factor causing immunodeficiency in patients of mucor is Diabetes Mellitus (DM) in any form. Around 80% patients having the disease or uncontrolled steroid induced hyperglycemia during covid accounting for newly diagnosed DM during or after covid and its inefficient control with concurrent steroid use. Moreover, steroid use reduces the phagocytic activity of WBC, causes impairment of bronchoalveolar macrophages migration, ingestion and phagolysosome fusion, making a diabetic exceptionally vulnerable to mucormycosis as stated in various articles. As found in the study maximum patient had taken steroids in any form mainly iv and oral and equal with slight preponderance to the i/v group, a humongous factor to be considered for this epidemic which immunocompromises the host and its concurrent excessive and at times nonjudicial use of steroids [15].

During the treatment almost all had antibiotics with a very few exceptions. Another factor was zinc intake as proposed by some, zinc provides a suitable environment in body for fungus growth and thus can have its role.

ROCM and eye: the orbital and eye involvement is extensive, with ophthalmic findings in more than half of the patients in ROCM requiring stat and aggressive treatment because prognosis becomes poor if eye is involved causing threat of cerebral involvement, next natural course of disease and thus, fatal.

CONCLUSION

Many patients had initial ophthalmic complaints (stage 3) as they fail to recognize signs in initial nasal and paranasal stages of disease. Eye symptoms start appearing after involvement of lamina papyracea through ethmoid sinuses or through lacrimal apparatus. The patients present with a wide but repetitive ophthalmic signs and symptoms consisting of headache to permanent blindness -U/L or B/L. The cause of vision loss is either contributed to CRAO (maximally), optic nerve or corneal involvement which is usually irreversible. There is rapid involvement of brain after there are eye signs especially if there is vision loss, thus mandating appropriate management to avoid case fatality.

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