

# CT and MR Imaging in the Diagnosis of Mucormycosis in COVID-19 Era - An Overview

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## ABSTRACT

Mucormycosis is a rare but serious fungal infection caused by mucormycetes. Mucormycosis mainly affects people who take medicines that lower the ability of the body to fight germs and have health problems. The involvement and the extension of the disease can be investigated with the medical imaging modalities like CT scan and Magnetic Resonance Imaging. The knowledge and the interpretation of medical imaging is very useful in the treatment planning. CT scan and Magnetic Resonance Imaging is very useful in finding the intra-orbital involvement which is common in mucormycosis.

**Key words:** Mucormycosis, CT scan, MR Imaging, Covid-19

## INTRODUCTION

Mucormycosis is a rare but serious fungal infection caused by mucormycetes, a group of molds. Mucormycosis mainly affects people who are taking immunosuppressive drugs have health problems. Mucormycosis is also known as phycomycosis. It was initially described in 1885 by Paltauf, is an uncommon and aggressive fungal infection that usually affects patients with alteration of their immunological system.<sup>1</sup> It is consider to be a lethal fungal disease, with rhinocerebral presentation being its most common form.<sup>2</sup> Although it has a low incidence rate, varying from 0.005 to 1.7 per million population, many cases have been reported recently, amounting to a notable increase in its incidence in the ongoing covid-19 pandemic.<sup>3</sup>

Mucormycosis infection of the sinuses that typically affects immunocompromised patients with an impaired neutrophilic response. Persons can include those with uncontrolled diabetes mellitus, iatrogenic immunosuppression, acquired immunodeficiency syndrome and haematological malignancies, and those who have underwent organ transplantation.<sup>4</sup>

Mucormycosis is delineated by the presence of hyphal invasion of sinus tissue and a time period of less than four weeks.<sup>5,6</sup> Clinically, rhinocerebral mucormycosis can be present with atypical signs and symptoms similar to chronic sinusitis, such as nasal blockage, proptosis, facial pain and oedema, chemosis, ptosis, and ophthalmoplegia, with headache and fever and various neurological symptoms if intracranial extension is present.<sup>7,8</sup> A black eschar is often seen over the hard palate region or in the nasal cavity.<sup>9,10</sup> Histological features include mycotic infiltration of blood vessels, tissue infarction, vasculitis with thrombosis, haemorrhage and acute neutrophilic infiltrate.<sup>11</sup>

Without early diagnosis and treatment, there may be rapid progression of the disease, with reported mortality rates from intracranial and intra-orbital complications of 50–80 per cent.<sup>12</sup> Even with prompt diagnosis, aggressive medical and surgical intervention treatment of underlying diseases, the management is often not very effective, leading to an extension of the infection and ultimately death.<sup>13</sup>

A complex interplay of factors that include any previous respiratory pathology, diabetes mellitus, immunosuppressive therapy, nosocomial infection sources and systemic immune alterations of Covid-19 infection itself may lead to secondary infections. These are increasingly being recognised in view of their impact on morbidity and mortality.<sup>14</sup> Extensive use of steroids in managing Covid-19 can also suppress immunity, allowing opportunistic

fungal infections to colonise. Hence, it is important to be careful that Covid-19 patients can develop further fungal infections during the treatment and latter stages of this disease, also especially severely ill individuals.<sup>15</sup>

Mostly patients had a primary disease infection involving the ethmoid sinus air cells. The maxillary sinus was affected in most of the cases. Sphenoid and frontal involvement was less common.

### Medical Imaging in Mucormycosis

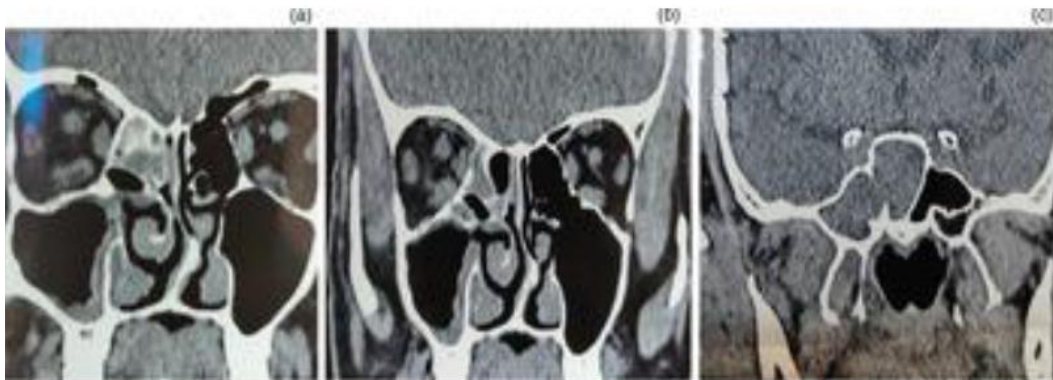


Fig. 1: (a–c) Coronal, non-contrast computed tomography scans of the paranasal sinuses, showing involvement of the sinuses with intracranial involvement.

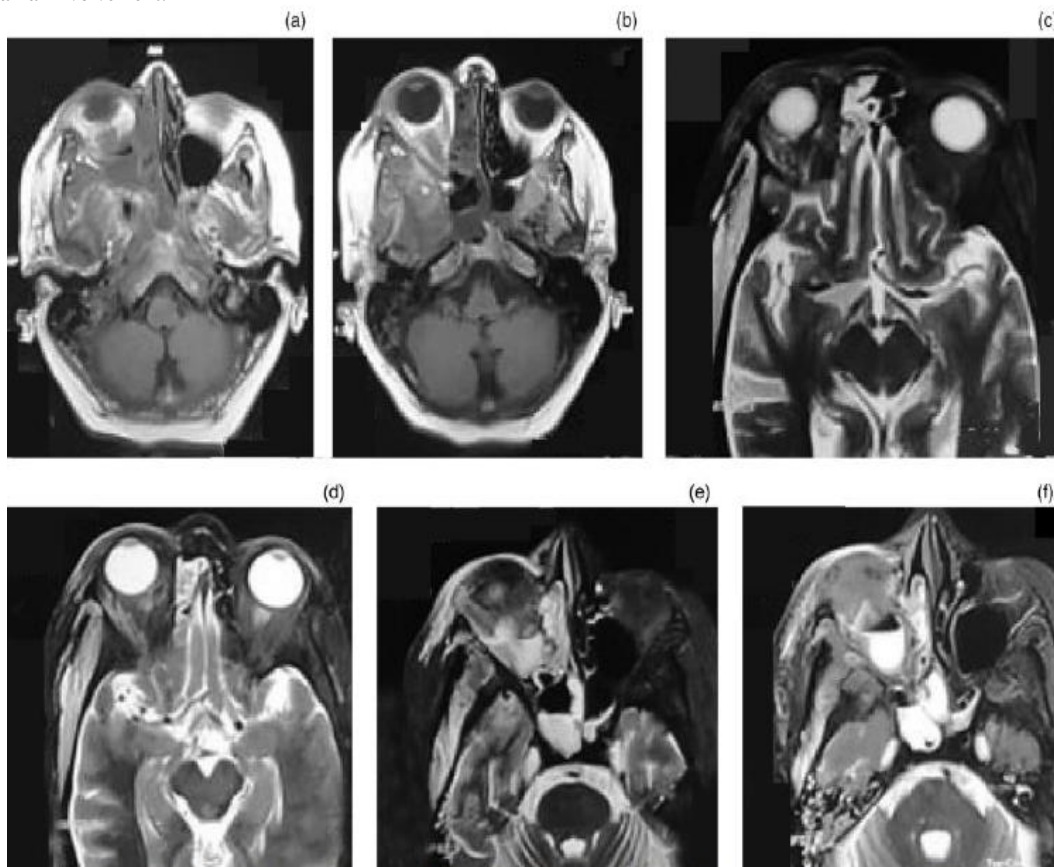


Fig. 2: (a–f) Axial, magnetic resonance imaging scans showing intra-orbital extension of mucormycosis.

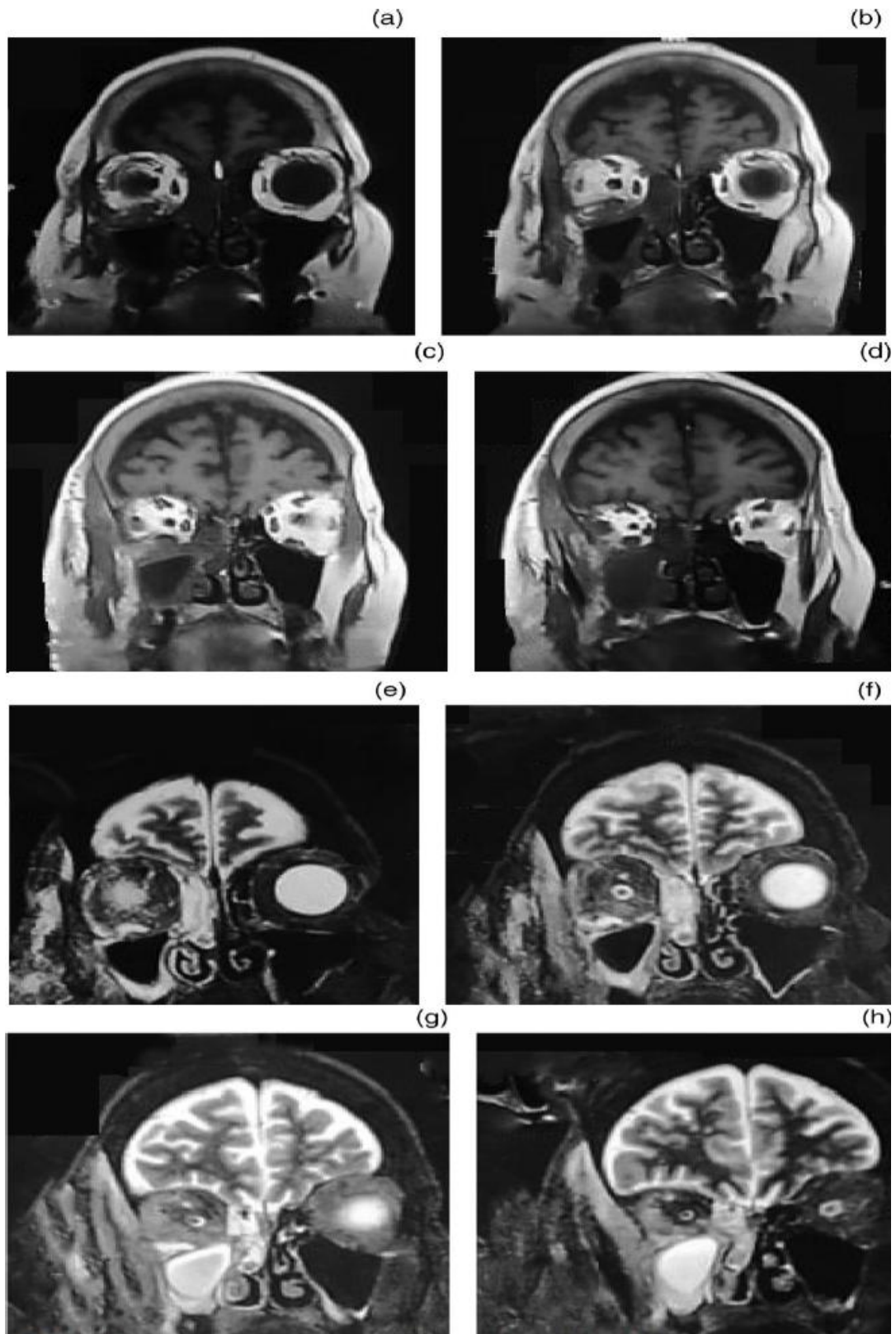


Fig. 3: (a-h) Coronal, magnetic resonance imaging scans showing intra-orbital extension of mucormycosis.

Because of nonspecific clinical signs, a high index of suspicion should be made in the existence of risk factors. Biopsy of antral necrotic tissue should be performed

immediately after suspicion for histopathological study to confirm the diagnosis. And the correct parallel comparison between clinical and

histological features helps in diagnosis. Some clinicians prefer CT scan before biopsy because biopsy may take time.<sup>16</sup> So, to appraise the extent of disease and to get a quick picture of disease CT scan is done immediately before histopathology results.

Nearly 50 percentage of the patients, had involvement of the eye. Intracranial involvement was seen very rarely. The classical black eschar on the hard palate was observed in nearly half of the patients.

Imaging reveals the erosion of bones, obliteration of sinuses, and MRI is favored to visualize the soft tissue changes but is more expensive.<sup>17</sup>

## DISCUSSION

The Covid-19 infection caused by the novel SARS-CoV-2 has been associated with a wide range of disease patterns, ranging from a mild cough to life-threatening pneumonia.<sup>18</sup> A myriad of manifestations and complications are documented, and new ones are emerging and being reported on with each passing day as we learn more about this novel Covid-19 pandemic.

During the SARS-CoV infection spread in 2003, the incidence of mycosis was 14.8–27 per cent, and it had been the most explanation for death for severe acute respiratory syndrome patients, accounting for 25–73.7 per cent in all causes of death.<sup>19-21</sup> Studies have shown that SARS-CoV and SARS-CoV-2 belong to the same species, and have similar prevalence rates and biological and clinical characteristics.<sup>22</sup> supported our experience in 2003, it's important that physicians pay critical attention to the high probability of increased incidence of fungal infections in Covid-19 affected or recovered patients, almost like the finding observed in mucormycosis cases here. White et al. studied 135 adults with Covid-19 infection, and reported an incidence of 26.7 per cent for invasive fungal infections.<sup>23</sup> Song et al. studied the association between Covid-19 and invasive fungal sinusitis in April 2020, and concluded that an outsized number of

patients suffering from or recovered from Covid-19 are at increased risk of developing invasive fungal diseases, and gave a management algorithm for such cases.<sup>15</sup> In a recent review, 8 per cent of coronavirus-positive or recovered patients had secondary bacterial or fungal infections during hospital admission, with widespread use of broad-spectrum antibiotics and steroids.. Mucor is a saprophytic fungus; its spores exist widely in nature, and are spread in soil, air, food and decaying organic material.<sup>13</sup> due to the low virulence potential, it's going to be present within the nasal mucosa of healthy people as a commensal. If the patient becomes immunosuppressed, this fungus may germinate within the paranasal sinuses, and spread intracranially or to other nearby structures like the orbit. Non-contrast computerized tomography of the paranasal sinuses is typically the primary investigation of choice, with gadolinium-enhanced resonance imaging being resorted to if intra-orbital or intracranial extension is suspected. Focal bony erosions and extrasinus spread are strongly implicational the diagnosis.<sup>13</sup>

## CONCLUSION

Mucormycosis is a fungal infection with high mortality and rising incidence associated with Covid19 disease affected or recovered patients. The most common sinuses involved are the ethmoids followed by the maxillary sinus. The involvement and the extension of the disease can be investigated with the medical imaging modalities like CT scan and Magnetic Resonance Imaging. The knowledge and the interpretation of medical imaging is very useful in the treatment planning. Uncontrolled diabetes mellitus increases further risk.

CT scan and Magnetic Resonance Imaging is very useful in finding the intra-orbital involvement which is common in mucormycosis. The intracranial involvement is rare and also it can be diagnosed by the help of CT scan and MRI. Extensive steroid and broad-spectrum antibiotic use

for Covid-19 management may cause or exacerbate fungal disease

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## REFERENCES

1. Paltauf, A. Mycosis mucorina. Virchows Arch Pathol Anat Physiol Klin Med 1885;102:543-64
2. Arnáiz-García, ME, Alonso-Peña, D, González-Vela Mdel, C, García-Palomo, JD, Sanz-Giménez-Rico, JR, Arnáiz-García, AM. Cutaneous mucormycosis: report of five cases and review of the literature. J Plast Reconstr Aesthet Surg 2009;62:e434-41
3. Werthman-Ehrenreich, A. Mucormycosis with orbital compartment syndrome in a patient with COVID-19. Am J Emerg Med 2021;42:264.e5-264.e8
4. DeShazo, RD. Fungal sinusitis. Am J Med Sci 1998;316:39-44
5. Ferguson, BJ. Definitions of fungal rhinosinusitis. Otolaryngol Clin North Am 2000;33:227-35
6. Chakrabarti, A, Denning, DW, Ferguson, BJ, Ponikau, J, Buzina, W, Kita, H et al. Fungal rhinosinusitis: a categorization and definitional schema addressing current controversies. Laryngoscope 2009; 119:1809-18
7. Scheckenbach, K, Cornely, O, Hoffmann, TK, Engers, R, Bier, H, Chaker, A et al. Emerging therapeutic options in fulminant invasive rhinocerebral mucormycosis. Auris Nasus Larynx 2010;37:
8. Vairaktaris, E, Moschos, MM, Vassiliou, S, Baltatzis, S, Kalimeras, E, Avgoustidis, D et al. Orbital cellulitis, orbital subperiosteal and intraorbital abscess. Report of three cases and review of the literature. J Craniomaxillofac Surg 2009;37:132-6
9. Mohindra, S, Mohindra, S, Gupta, R, Bakshi, J, Gupta, SK. Rhinocerebral mucormycosis: the disease spectrum in 27 patients. Mycoses 2007;50:290-6
10. Munir, N, Jones, NS. Rhinocerebral mucormycosis with orbital and intracranial extension: a case report and review of optimum management. J Laryngol Otol 2007;121:192-5
11. DeShazo, RD, Chapin, K, Swain, RE. Fungal sinusitis. N Engl J Med 1997;337: 254-9
12. Gillespie, MB, O'Malley, BW. An algorithmic approach to the diagnosis and management of invasive fungal rhinosinusitis in the immunocompromised patient. Otolaryngol Clin North Am 2000; 33:323-34
13. Ballester, DG, González-García, R, García, CM, Ruiz-Laza, L, Gil, FM. Mucormycosis of the head and neck: report of five cases with different presentations. J Craniomaxillofac Surg 2012;40:584-91
14. Chen, N, Zhou, M, Dong, X, Qu, J, Gong, F, Han, Y et al. Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: a descriptive study. Lancet 2020;395:507-13
15. Gangneux, JP, Bougnoux, ME, Dannaoui, E, Cornet, M, Ralph, ZJ. Invasive fungal diseases during COVID-19: we should be prepared. J Mycol Med 2020;30:100971
16. Mnif N, Hmaied E, Oueslati S, Rajhi H, Hamza R, Marrakchi M, Kaffel N, Kooli H, Ben Salah M, Ferjaoui M. [Imaging of rhinocerebral mucormycosis]. J Radiol. 2005 Sep;86 (9 Pt 1):1017-20.
17. Ramadorai A, Ravi P, Narayanan V. Rhinocerebral Mucormycosis: A Prospective Analysis of an Effective Treatment Protocol. Ann Maxillofac Surg. 2019 Jan-Jun;9(1):192-196
18. Mehta, S, Pandey, A. Rhino-orbital mucormycosis associated with COVID-19. Cureus 2020;12:e10726
19. Zhang, Y, Li, WX, Huang, KW, Cao, ZX, Hao, JY. Hospital acquired pneumonia occurring after acute stage of the serious SARS and its treating strategies. Chin J Nosocomiol 2003;11:1081-7
20. Yin, CH, Wang, C, Tang, Z, Zhang, SW, Wang, BS. Clinical analysis of 146 patients with critical severe acute respiratory syndrome in Beijing areas. Clin J Emerg Med 2004;1:12-14
21. Li, CS, Pan, SF. Analysis and causation discussion of 185 severe acute respiratory syndrome dead cases [in Chinese]. Zhongguo Wei Zhong Bing Ji Jiu Yi Xue 2003;15:582-4

22. Peeri, NC, Shrestha, N, Rahman, MS, Zaki, R, Tan, Z, Bibi, S et al. The SARS, MERS and novel coronavirus (COVID-19) epidemics, the newest and biggest global health threats: what lessons have we learned? *Int J Epidemiol* 2020;49:717–26
23. White, L, Dhillon, R, Cordey, A, Hughes, H, Faggian, F, Soni, S et al. A national strategy to diagnose coronavirus disease 2019-associated invasive fungal disease in the intensive care unit. *Clin Infect Dis* 2020;ciaa1298

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