

# Invasive Fungal Sinusitis Associated with Covid-19

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## Abstract

**Background:** The world today facing unprecedented catastrophe in the form of a global pandemic of COVID-19 infection caused by the novel corona virus SARS-CoV-2 (severe acute respiratory syndrome -corona virus-2).<sup>(3,n.d.)</sup> As most of the patients infected with COVID-19 are in the elderly age group having co-morbidities like diabetes mellitus or are immunocompromised. They are endangered to the development of various co-infections which are more common in patients with this type of clinical profile. Invasive fungal sinusitis is one of the co-infections primarily affecting paranasal sinuses, nasal cavity, orbit, brain and lungs. Common fungi causing invasive fungal sinusitis are Aspergillus, Mucor and Candida. In this article we are going to describe the major imaging findings of invasive fungal sinusitis in addition to the clinical picture which would aid in earliest diagnosis of this infections and allows radiologist to play an important role in patient management. **Subjects and Methods:** A Retrospective study with 30 patients over period of 3 months using MRI as diagnostic modality and tissue biopsy for the confirmation. Consent for participation in the study was obtained from each patient or their relatives. All COVID-19 infected patients suspected of fungal sinusitis referred for MRI paranasal sinuses, Orbit or Brain were included in the study. There were no definite exclusion criteria except in the cases where MRI was contraindicated. **Results:** Total 30 COVID-19 positive patients with suspicion of fungal infection were evaluated. Many patients had associated co-morbidities like diabetes, obesity, hypertension, steroid, chemotherapy or on long term COVID treatment. On MRI majority of patients had involvement of bilateral maxillary and ethmoid sinuses with bony erosions. 7 patients (23.3%) had shown spread to retro antral and orbital fat. 2 patients (6.6%) had shown orbital compartment syndrome with cavernous sinus thrombosis. On biopsy 21 patients (70%) confirmed with mucor, 7 (23.3%) patients confirmed with Aspergillus and 2 patients (6.6%) biopsy results were inconclusive. **Conclusion:** MRI findings were neither sensitive nor specific for invasive fungal sinusitis but it found to be useful for early diagnosis and showing its spread to the adjacent structures and brain. Contrast enhanced MRI was found to be better in characterization of the extent of spread of the disease and assessment of venous sinus thrombosis compared to Non-contrast MRI.

**Keywords:** COVID-19, Invasive fungal sinusitis, Aspergillus, Mucor, Candida imaging findings.

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## Introduction

Covid-19 infection emerged as a global pandemic with many uncertain challenges in diagnosis and treatment. ICU stay, steroid and monoclonal antibody therapy, co-morbidities like uncontrolled diabetes, invasive mechanical ventilation and obesity make patient vulnerable to development of various bacterial and fungal co-infections. In Mucormycosis patients present with complain of headache, vision loss, redness over face, ophthalmoplegia, fascial palsy.<sup>[1]</sup>

Contrast enhanced MRI the investigation of choice and will help in diagnosis as well as help clinician in management &

prognosis by showing the extent of infection and complications like extra-paranasal sinus soft tissue involvement,<sup>[2,3]</sup> cavernous sinus thrombosis or superior ophthalmic vein thrombosis, orbital cellulitis and inflammation of Dura matter of medial temporal lobe & frontal Dura matter. Mucormycosis (Zygomycosis) is serious but rare fungal infection caused by group of moulds called mucormycetes, which lives throughout the environment. It usually affects immunocompromised individuals.<sup>[4,5]</sup> Infection can be acquired through inhaling fungal spores from the environment or through the skin cut or injury.<sup>[6]</sup> Diagnosis can be confirmed by microbiological examination of biopsy specimen using KOH mount or

culture media where aseptate fungal hyphae are seen. Radiological modalities like CT scan<sup>[9]</sup> and contrast enhanced MRI are very important for the diagnosis and to know the exact extent/involvement of the disease.<sup>[7]</sup>

### Objectives

- To determine the role of MRI in early diagnosis of invasive fungal sinusitis as well as to know its spread to orbit or brain.
- To guide clinician & otorhinolaryngology in early management of this dangerous entity.

### Subjects and Methods

A Retrospective observational type of study with 30 patients done over period of 3 months using MRI as diagnostic modality and biopsy for the confirmation. Consent for participation in the study was obtained from each patient or patients relatives. All COVID-19 infected patients suspected of mucormycosis referred for MRI paranasal sinuses, Orbit or Brain were included in the study. There were no definite exclusion criteria except in the cases where MRI was contraindicated.

### Results

A total of 30 COVID-19 positive patients with suspicion of fungal infection were evaluated. Out of 30 patients, 15 patients (50%) had diabetes with obesity, 8 had long course of steroid therapy, 3 patients were immunocompromised and were on long term COVID treatment in the ICU, 4 patients did not have any pre-existing illness. (Table 1) After thorough clinical examinations patients were referred to the Radiology department for MRI of para-nasal sinus, brain or orbit. On MRI all of the 30 patients had features suggestive of fungal sinusitis and majority of the patients had involvement of bilateral maxillary and ethmoid sinuses with bony erosions. Out of the 30 patients, 7 patients (23.3%) had shown spread to retro antral and orbital fat planes. 2 patients (6.6%) had shown orbital compartment syndrome with cavernous sinus thrombosis and extensive spread to the brain with cerebritis. On tissue biopsy, 21 patients (70%) confirmed with mucor, 7 (23.3%) patients confirmed with Aspergillus and in 2 patients (6.6%) biopsy results were inconclusive.

### Discussion

Coronavirus disease (COVID-19) is caused by a severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2). Corona virus primarily affects respiratory system and can cause wide range of symptoms like fever, dry cough, weakness, shortness of breath, chest pain etc. It is more severe in older age

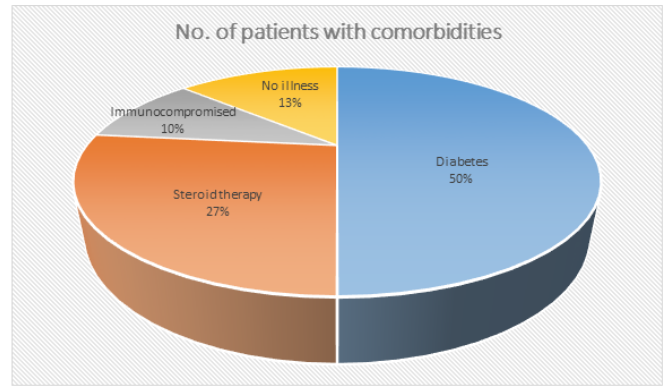


Chart 1: Illustration of number of patients with comorbidities.

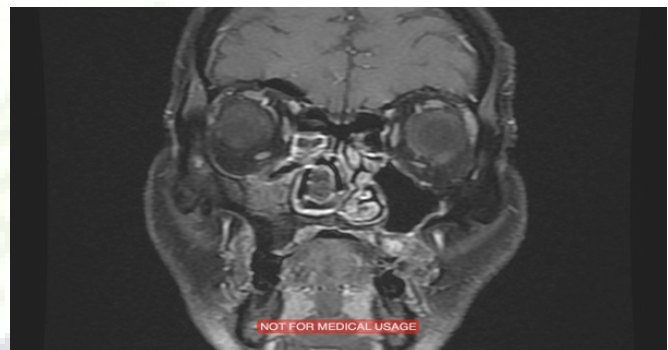
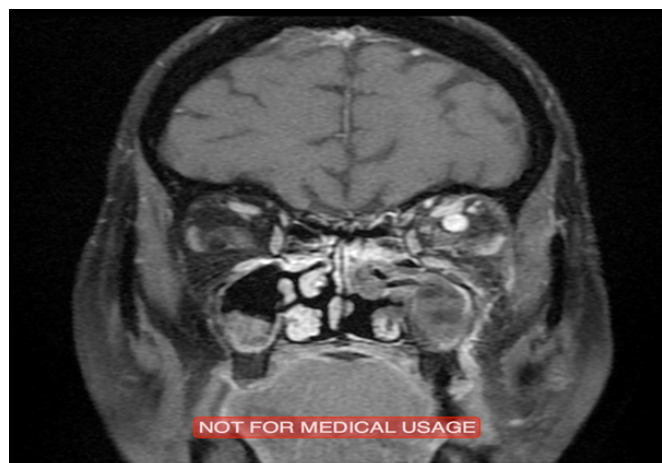


Figure 1: Coronal T1W post contrast Image shows non enhancing right inferior turbinate suggestive of black turbinate sign. Non enhancement of mucosal lining of right maxillary sinus.

group and patients with co-morbidities like diabetes mellitus, malignancy, immunocompromized states and chemotherapy or transplant recipients.<sup>[8]</sup> Along with the interplay of all these factors and use of long-term steroid therapies in COVID-19 patients for treatment makes them susceptible to secondary bacterial and fungal infections. Clinically mucormycosis is manifested by headache, fascial pain, ophthalmoplegia, loss of vision, nasal septal and palatal ulcers and rapid spread to orbit and brain may cause death of the patient. Angioinvasion and haematogenous spread is very common.<sup>[9]</sup> It may cause erosion of nasal septum and bony walls of nose and paranasal sinuses or orbit.<sup>[10]</sup> CT and MRI are very helpful for early diagnosis. Non-contrast CT scans of paranasal sinuses shows hypo attenuating mucosal thickening within the lumen of involved paranasal sinus and nasal cavity. The fungal hyphae appear hyper dense on CT. CT scan is better for the assessment of bony involvement.<sup>[9]</sup> On-contrast MRI shows mucosal thickening, soft tissue oedema, marrow



**Figure 2:** Coronal T1WPost Contrast Image shows patchy irregular non enhancing areas are seen along mucosal lining of both maxillary sinuses and left middle & inferior turbinates. Enhancing soft tissue oedema seen in left retro antral fat. Mild thickening with hyperenhancement seen involving extra-ocular muscles on left side. Focal dilatation with central subtle hypo-enhancement of left superior ophthalmic vein near posterior aspect of orbital roof, suggesting possibility of thrombosis.

oedema in adjacent bones whereas contrast enhanced MRI is better for visualisation extent of disease to orbit, brain and non-enhancing areas in mucosa which clinician needs to debride. Contrast enhanced MRI is also better characterises the inflammation or thrombosis in cavernous sinus and superior ophthalmic vein. Inflammation of medial temporal lobe Dura and frontal Dura is also well depicted by Contrast enhanced MRI. Inflammation of extra-paranasal soft tissue specially pre-maxillary, retro-maxillary, pterygopalatine fossa and infratemporal fossa appears as enhancing soft tissue on Contrast enhanced MRI and are very important from treatment point of view.

## Conclusion

MRI findings were neither sensitive nor specific for invasive fungal sinusitis but it found to be useful for early diagnosis and showing its spread to the adjacent structures and brain. Contrast enhanced MRI was found to be better in characterization of the extent of spread of the disease and assessment of venous sinus thrombosis compared to Non-contrast MRI.

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