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Radiological aspects in mucormycosis: Recent update

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***Abstract*---**The purpose of this study was to describe common radiographic patterns that may be useful in predicting the diagnosis of rhinocerebral mucormycosis. Methods: We retrospectively evaluated the imaging and clinical data of four males and one female, 3 to 72 years old, with rhinocerebral mucormycosis. Results: All the patients presented with sinusitis and ophthalmological symptoms. Most of the patients (80%) had isointense lesions relative to brain in T1-weighted images. The signal intensity in T2-weighted images was more variable, with only one (20%) patient showing hyperintensity. A pattern of anatomic involvement affecting the nasal cavity, maxillary sinus, orbit, and ethmoid cells was consistently observed in all five patients (100%). Our series demonstrated a mortality rate of 60%. Conclusion: Progressive and rapid involvement of the cavernous sinus, vascular structures and intracranial contents is the usual evolution of rhinocerebral mucormycosis. In the context of immunosupression, a pattern of nasal cavity, maxillary sinus, ethmoid cells, and orbit inflammatory lesions should prompt the diagnosis of mucormycosis. Multiplanar magnetic resonance imaging shows anatomic involvement, helping in surgery planning. However, the prognosis is grave despite radical surgery and antifungals.

***Keywords*---**rhinocerebral mucormycosis, imaging findings, MRI, neuroradiology.

Introduction

Rhinocerebral mucormycosis is an acute, fulminant, and often lethal opportunistic infection typically affecting diabetic or immunocompromised patients.[1] It is caused by one of the members of the mucoraceal family, including Absidia, Mucor, and Rhizopus.[2] Clinically, presenting symptoms are nonspecific including headache, low-grade fever, facial swelling, and orbital or paranasal sinus syndrome. After infection of the nasal cavity and paranasal sinuses, the

fungi cause a necrotizing vasculitis that extends rapidly into deep face, orbits, cranial cavity, and brain through skull base partitions and foramina.[2] When limited involvement of the paranasal sinuses is present, survival rates are between 50% and 80%.[3] However, when brain invasion has occurred, mortality is greater than 80%. Because of its lethal nature, it must be recognized early and treated aggressively. We retrospectively reviewed the neuroimaging findings in a series of five patients with rhinocerebral mucormycosis to establish common radiographic patterns that may be useful in predicting the diagnosis of this infection**.**

Methods

We evaluated the imaging and clinical data of four males and one female, 3 to 72 years old, with mucormycosis of the craniofacial areas. Patients were selected for study if the diagnosis of mucormycosis was established by means of biopsy, culture, or autopsy, and computed tomography (CT) scans or magnetic resonance (MR) images were available for review. All the patients were immunosuppressed. Two had diabetes mellitus, and four had hematologic conditions and concomitant immunocompromised states. All patients had MR imaging with a 1.5-T system. Both T1- and T2-weighted images were obtained as well as T1-weighted images after intravenous injection of gadopentetate dimeglumine (0.1 mmol/kg). Four patients had CT scans available for review.

Images were evaluated for density, signal intensity, and contrast enhancement characteristics. The CT density was evaluated in non-enhanced images and compared with muscle/brain. The MR signal intensity was compared with gray matter on the T1- and T2-weighted images . Gadolinium enhancement was graded on a scale from none to marked. All studies were reviewed by two neuroradiologists (DAH, ABD), and the anatomic structures involved by the infection were defined by consensus. Clinical information about the presentation, management, and evolution of disease was obtained from medical history in all cases.

Results

Clinical Presentation

All the patients presented with sinusitis and ophthalmological symptoms. Three patients (60%) had clinical symptoms of cavernous sinus involvement including diplopia/ophthalmoplegia and facial pain/numbness.

Computed Tomography Findings

Of the four patients who had CT scans available for review, 3 (75%) had isodense to muscle/brain lesions. Only one patient (25%) had hyperdense lesions relative to muscle/brain in the noninvasive portion suggesting secondary obstructive changes (inspissated secretions).

Magnetic Resonance Imaging Signal Intensity

Most of the patients (80%) had isointense lesions relative to brain in T1-weighted images. The signal intensity in T2-weighted images was more variable, with only one (20%) patient showing hyperintensity. The rest of the lesions were either hypointense or isointense in long retention time images.

Enhancement Pattern

One patient (20%) didn't have enhancement of his inflammatory process after the administration of gadolinium. Two patients (40%) had variable enhancement, with mixed non-enhancing and marked enhancing portions of their inflammatory lesions. One patient (20%) had mild enhancement and the remaining patient (20%) had no enhancement at all. Dural enhancement was observed in two patients (60%) and mixed leptomeningeal and pachymeningeal enhancement was present in another patient (20%).

Clinical Evolution

Orbital exenteration, ethmoidectomy, medial maxillectomy, and debridement of the nasal vault were performed in all patients. More extensive debridement of necrotic tissue was performed as required in each particular case according to surgical findings . All patients received amphotericin-B locally and parenterally. Two patients (40%) recovered, while three patients (60%) expired.

Discussion

Mucormycosis, also known as zygomycosis and phycomycosis, was first described by Paulltauf in 1885.[4] Phycomycetes are ubiquitous fungi occurring in soil, air, skin, body orifices, manure, spoiled food, and dust.[5,6] Inoculation occurs by inhalation, when spores reach the nasal cavity and/or nasopharynx. The fungus may then spread to the paranasal sinuses and subsequently to the orbit, meninges, and brain by direct extension.[7] Orbital involvement results from spread through the nasolacrimal duct and medial orbital wall. Such invasion is facilitated by the thinness of the lamina papyracea, congenital dehiscence often present along the medial wall, and the perforations of the medial wall by arteries and veins.[8,9] Mucormycosis invades the walls of the blood vessels resulting in vascular occlusion, thrombosis, and infarction, as well as dissemination to the central nervous system from the primary focus.[5,10,11] Spread to the brain may occur via the orbital apex, orbital vessels, or via the cribriform plate.[12] Generally, the presenting symptoms are low-grade fever, cephalgia, sinusitis, facial swelling, orbital apex syndrome with blurred vision, and cranial palsies from cavernous sinus involvement in an immunocompromised patient.[13,14,15] Early visual loss would favor the diagnosis of rhino-orbital-cerebral mucormycosis over bacterial cavernous sinus thrombosis in which blindness is a much later finding.

We found that MRI signal intensity of mucormycosis lesions tends to be isointense or hypointense in all sequences. After the administration of gadolinium the lesions had variable enhancement patterns ranging from homogeneous to heterogenous or non-enhancing at all. We think that contrast-enhanced T1-

weighted images are helpful in delineating the intracranial spread when meningeal enhancement is present as well as in identifying invasion of the cavernous portion of the internal carotid artery by the disease. This had been previously described by Mohindra and associates who showed that MRI can detect cavernous sinus invasion and vascular complications such as ischemia.

Conclusions

Progressive and rapid involvement of the cavernous sinus, vascular structures, and intracranial contents is the usual evolution of rhinocerebral mucormycosis. Multimodality imaging is helpful in prompting an early diagnosis when a pattern of nasal cavity, maxillary sinus, ethmoid cells, and orbit inflammatory process is present, especially when iso- or hypointense lesions are observed. Multiplanar MRI shows anatomic involvement, which helps in surgery planning. However, the prognosis is grave despite radical surgery and antifungals.

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Conflict of Interest – Nil

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