CASE REPORT

Coccidioidal cerebral abscess with peripheral restricted diffusion

Abcès cérébral coccidioidal avec diffusion restreinte périphérique

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KEYWORDS
Coccidioidomycosis; Central nervous system; Fungal infections; Magnetic resonance imaging; Diffusion weighted imaging

Summary
The authors present here a case of a brain abscess with atypical imaging features, including peripheral water-motion restriction. Reduced diffusion at intracavitary projections can be helpful in identifying cases with fungal etiology.

Introduction
On conventional magnetic resonance imaging (cMRI), the appearance of a cerebral abscess is non-specific, and recent studies suggest that diffusion-weighted imaging (DWI) is more sensitive than cMRI in distinguishing abscesses from necrotic tumor and other cystic lesions [1–4]. Such differentiation is an important factor in treatment decisions.

Due to their variable nature and typical association with immunosuppression, cMRI features of fungal abscesses can range from a typical ring-enhancing pattern similar to that of pyogenic abscess to patchy or punctate lesions with or without enhancement [5]. With DWI, various patterns were reported for fungal abscesses, including peripheral water restriction [6,7]. Such a case of fungal abscess with peripheral restriction to water diffusion is presented here.

Case report
A 62-year-old man was admitted because of a tonicoclonic generalized seizure associated with fever. His prior history included major head trauma, hypertension and end-stage renal failure, for which he had been transplanted two months prior to admission and had started immunosuppressive treatment. Four weeks after the renal transplant, he received pulses of methylprednisolone because of acute rejection. Three weeks later, he presented with fever on receiving piperacillin/tazobactam for presumptive urinary infection. Mycophenolate mofetil was suspended because of leukopenia ($2.25 \times 10^9/L$). At the time of admission, the patient was unconscious.

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Computed tomography (CT) disclosed a round hypodense lesion with subtle ring enhancement and perilesional edema. cMR confirmed an ovoid subcortical parietal lesion with an irregular heterogeneous outline that was predominantly hypointense on T2-weighted imaging (WI) and isointense on T1-WI, enhancing in a thin irregular ring-like pattern with perilesional vasogenic edema. Areas of T1 shortening and T2 gradient-echo susceptibility were observed, suggesting hemorrhage. Within the ring enhancement, it was possible to distinguish two different regions, both without enhancement: T2-WI hypointense and T1-WI isointense areas that were peripheral, heterogeneous and irregular; and a T2-WI hyperintense and T1-WI hypointense central area. DWI revealed high signalling with a low apparent diffusion coefficient (ADC) in the non-enhancing peripheral areas, and low signalling with a high ADC in the central T2-WI hyperintense area (Fig. 1).

Lumbar puncture was unremarkable. CSF and blood cultures were negative. Biopsy was performed and *Coccidioides immitis* was identified after microscopy (Fig. 2) and polymerase chain reaction tests. Despite antifungal therapy with amphotericin and voriconazole, the lesion increased and the patient died two months after admission.

**Discussion**

The most typical pattern of coccidioidal brain involvement is similar to granulomatous meningitis with diffuse meningeal enhancing, which may include nodular areas, ependymitis, deep cerebral infarcts and ventricular enlargement as the most common findings [8]. Parenchymal granulomas are also described [8]. A small number of coccidioidal brain abscesses have been reported, mostly from its endemic regions in the desert areas of the southwestern United States and northern Mexico [8—10]. Neither our patient nor his kidney donor had a history of travelling to an endemic region.

Abscesses are typically described as hyperintense lesions on T2-WI with a hypointense rim, and iso-/hypointense on T1-WI with ring enhancement. These features are non-specific, and differentiation from cystic or necrotic lesions such as neoplasms can be difficult. Nodular enhancement, irregular boundaries and a lobular shape favors a diagnosis of neoplasm. Despite reports of tumors with ring enhancement and central restriction to water diffusion [11—13], many authors have reported the usefulness of DWI in distinguishing brain abscesses from necrotic neoplasms [1—4], considering central water-diffusion restriction typical of abscesses. Diffusion restriction in a peripheral pattern may also be present in neoplasms, where it is usually related to a necrotic center and high cellularity at the periphery [14]. Our patient showed a heterogeneous and highly irregular lesion with peripheral water restriction and enhancement, with nodular areas. These features are typical of a high-grade malignant glioma.

Fungal abscesses are usually included in the general description of an abscess, but they do have variable imaging patterns [5], mostly depending on the host immune status. Gaviani et al. [6] described one case of peripheral restriction out of six cases of fungal cerebral abscesses. The other five had central water restriction similar to pyogenic abscesses.
Histopathological examination found "early abscess formation" without a well-defined capsule in the peripheral restriction case. Luthra et al. [7] found the same DWI pattern in all fungal abscesses included in their study (eight cases). In our patient, peripheral, irregular, hyperintense areas were observed on DWI. Those areas matched the irregular projections into the cavity, shown on cMRI as previously described [7]. Capturing different stages of the infectious process and inflammatory response may explain the imaging differences observed for fungal abscesses [7].

The differential diagnosis of lesions with peripheral water restriction should include fungal abscesses, especially when immunosuppression is present. Special attention should be paid to the presence of irregular intracavitary projections and their match with DWI hyperintense areas.

References