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Case Report

Pyogenic brain abscess, ventriculitis and diffuse meningitis with fatal outcome in an adult: Radiologic–pathologic correlation☆,#☆,#

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ABSTRACT

Rupture of brain abscesses with evolution into ventriculitis with meningitis may result in sudden and dramatic worsening of the clinical situation. We present a 57-year-old man with such an event and fatal outcome. Multiple imaging modalities including computed tomography and advanced magnetic resonance imaging were correlated with gross specimen and histologic images. The differential diagnosis of multiple lesions with ring enhancement and prominent perifocal edema includes mainly infectious and neoplastic processes, such as brain abscess, metastasis, and multicentric glioblastoma. Pyogenic ventriculitis is an uncommon manifestation of severe intracranial infection that might be clinically obscure. We discuss the characteristic magnetic resonance findings of brain abscess and its complications, including meningitis and ventriculitis with emphasis on the role of diffusion-weighted and fluid-attenuated inversion recovery imaging.

1. Introduction

A 57-year-old Caucasian male with a past medical history of splenectomy after injury in 2013 was transferred from an outside facility and presented after being brought in by his sister for progressed confusion and a 1 day history of fever, random abnormal movements of his extremities. On admission, he was found to have blood pressure 50/40 mm Hg and heart rate in the 50s. He also had 6-7 mm nonreactive pupils. Initial brain computed tomography (CT) without IV contrast was performed and showed two hypodense left frontal and right parietal mass lesions with hyperdense rim and perifocal edema (Fig. 1).

☆ No disclosure.
During February, 2016 American Institute for Radiologic Pathology (AIRP) meeting (previously known as Armed Forces Institute of Pathology, AFIP), this case was selected as the best case in neuroradiology, as it perfectly illustrated strong radiologic pathologic correlation.

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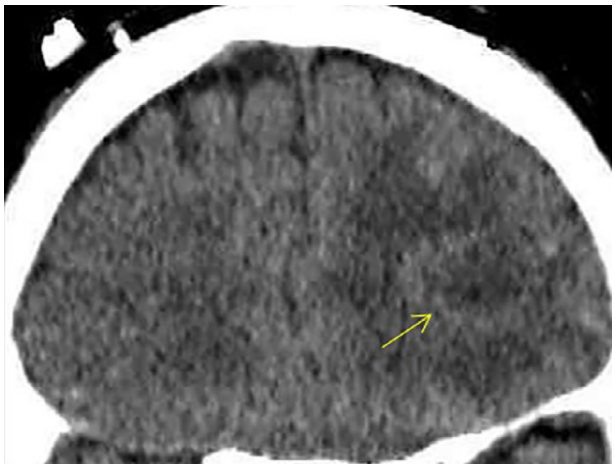

Fig. 1 – Coronal computed tomography without IV contrast shows left frontal lobe hypodense lesion.

Initially, there was concern that these lesions were metastasis versus abscess versus multicentric glioblastoma. The patient subsequently underwent magnetic resonance imaging (MRI) Siemens (Avanto 1.5T 1100g/cm Software B19) to further differentiate these masses, which showed left frontal and right parietal lobe ring-enhancing lesions with central increased diffusivity. The ring enhancement was incomplete medially toward the lateral ventricle (Figs. 2 E and F). The susceptibility weighted imaging (SWI) and T2/fluid-attenuated inversion recovery (FLAIR) showed a peripheral irregular low signal ring with typical dual rim sign on the FLAIR (Figs. 2 B, C, and D). The clinical context and image features (central diffusion restriction, dual rim sign, and the medially incomplete ring of enhancement) clearly favored abscesses over multicentric glioblastoma. Lumbar puncture showed many white blood cells but no organisms or yeast elements. Chest X-ray demonstrated left lower lobe pneumonia. Patient was empirically treated with broad spectrum antibiotics with vancomycin, ceftriaxone, and flagyl.

Neurosurgery was rapidly involved. He was given: levophed, mannitol, IV fluid resuscitation, and stress dose steroids. His vital signs improved but his pupils became small at 2 mm bilaterally, though still sluggishly and minimally reactive. He also improved to have trace decerebrate posturing on the left side and had left corneal reflex, a gag, and cough. A repeat head CT 1 day after initial study showed significant interval ventriculomegaly with bilaterally dilated temporal horns. Bacteriologic tests showed the presence of *Streptococcus viridans*. Therefore, the patient underwent an emergency bilateral frontal ventriculostomy which drained cloudy fluid and purulent material. Subsequent neuropathologic and microbiological examination confirmed the presence of intracranial abscesses with meningitis and ventriculitis (Figs. 3 and 4).

Despite management of his sepsis, ventriculitis, respiratory failure, and brainstem herniation secondary to mass effect from brain abscesses, his neurologic status was very poor and continued to worsen throughout his stay. After review and consultation with neurology and neurosurgery, it was determined that his neurologic status and brain function status was not salvageable. On 5 DAA, with no additional treatment options, family decided to withdraw support. Patient expired shortly thereafter and postmortem examination was conducted.

2. Discussion

2.1. *Pyogenic abscess*

Brain abscesses are a potentially life threatening condition requiring rapid treatment, and prompt radiological identification [1]. The diagnosis of pyogenic brain abscesses remains challenging. The differential diagnosis of multiple ring enhancing with surrounding vasogenic edema includes mainly infectious and neoplastic processes, such as brain abscess, metastasis, or multicentric glioblastoma [1,2]. Fortunately MRI is usually able to convincingly make the diagnosis, distinguishing abscesses from other ring enhancing lesions [2]. The earliest MRI experiment involving an abscess was published in Radiology in 1985. With use of a 0.35-T MRI device, Kamra et al. [3] reported that MRI could help differentiate an infectious process from a purely cystic lesion on the basis of signal intensity changes related to the protein content of the fluid and capsule characteristics [4,5]. Advanced MRI techniques and multiple MR sequences complemented the role of conventional MRI and increased the sensitivity and specificity [6]. Currently, conventional nonenhanced and contrast-enhanced MRI with diffusion weighted imaging (DWI) and MRS are the workhorse sequences for diagnosis of brain abscess. The combined use of DWI and MRS to differentiate abscess from other pathologic processes has a sensitivity of 0.72–0.96 and a specificity of 0.86–0.96 [4,7].

2.1.1. *Diffusion-weighted imaging*

In 1986, Ebisu et al. [8] were the first to report reduced apparent diffusion coefficients (ADCs) in a pyogenic abscess at DWI. The high viscosity and cellularity of pus impede water mobility and result in reduced diffusion. DWI is based on the random Brownian motion of water molecules in a voxel of tissue; thus, it may provide information about the existing disease process according to the mobility of water within the lesion [9]. However, these findings were not always pathognomonic for abscess [7]. Stadnik et al. [10] reported that the clinical value of DWI in conventional MRI lies in the ability to readily differentiate these two entities on the basis of reduced diffusion and low ADCs in abscess and usually elevated ADCs in tumor. Additionally, DWI characteristics can be used to distinguish etiologic agents of abscess. Reduced diffusion is a fairly consistent finding among pyogenic and fungal abscesses. However, parasitic infection with *Toxoplasma gondii* demonstrates increased diffusivity related to the underlying acellular core in toxoplasmosis [11]. DWI can also be used for therapeutic response particularly after antibiotic therapy or surgical drainage. Decreased signal intensity of abscess fluid on DWI, implies reduction of purulent material, whereas, persistent or recurrent reduced diffusion in a treated abscess is a characteristic finding of treatment failure [12]. Although DWI

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