CASE REPORT

Atypical fungal granuloma of the sphenoid wing

Granulome fongique atypique de l’aile du sphénoïde

S. Banuprakasha, M. Jolappara, C. Kesavadas, J. Saini, R.M. Rao, V.V. Radhakrishnan

Department of Imaging Sciences and Interventional Radiology, Sree Chitra Tirunal Institute for Medical Sciences and Technology (SCTIMST), Medical College PO, Trivandrum 695011, India

Department of Neurosurgery, Sree Chitra Tirunal Institute for Medical Sciences and Technology, Trivandrum 695011, India

Department of Pathology, Sree Chitra Tirunal Institute for Medical Sciences and Technology, Trivandrum 695011, India

Available online 12 August 2009

KEYWORDS
Fungal granuloma; MRI; Meningioma; Diffusion-, perfusion- and susceptibility-weighted imaging

Summary A 29-year-old immunocompetent patient presented with a 3-month history of headache and vomiting. Computed tomography (CT) and conventional magnetic resonance imaging (MRI) revealed a mass lesion in the right sphenoid wing. The conventional imaging findings were typical of meningioma. However, diffusion-weighted imaging (DWI), susceptibility-weighted imaging (SWI) and perfusion-weighted imaging (PWI) all revealed details that were unusual for a meningioma. DWI showed diffusion blackout, perfusion was not raised in PWI, and susceptibility effects were noted in SWI. Based on these findings, the possibility of granuloma was kept as the differential diagnosis. Histopathological examination of the lesion was suggestive of fungal granuloma. This case report highlights the importance of advanced neuroimaging techniques in differentiating meningioma and granuloma.

Introduction

Computed tomography (CT) and conventional magnetic resonance imaging (MRI) are routinely used for visualizing intracranial mass lesions. However, as a specific diagnosis is not possible in some cases, a differential diagnosis is included in the radiological report. Advanced MRI techniques, such as diffusion-weighted imaging (DWI), susceptibility-weighted imaging (SWI), perfusion-weighted imaging (PWI) and magnetic resonance spectroscopy (MRS), provide considerably more information on the tissue characteristics of lesions and, thus, are widely used to diagnose intracranial mass lesions [1]. The tissue characteristics can be better understood with these techniques, thereby narrowing the differential diagnoses or allowing a more specific diagnosis to be given.

We report here on a case of fungal granuloma in the right sphenoid wing that showed the imaging characteristics of meningioma on CT scanning and conventional MRI. The location of the mass lesion also favored a meningioma. However, using advanced imaging techniques, we obtained imaging findings that were unusual for a meningioma, leading us to report a granulomatous lesion as the first diagnostic
Figure 1  Axial plain CT (a) and postcontrast axial CT (b) show a hyperdense homogeneously enhancing extra-axial mass lesion in the right basifrontal region. Coronal T2W (c) and axial FLAIR (d) images show a slightly hypointense lesion. The surrounding edema is conspicuous. The axial T1W image (e) shows an extra-axial isointense basifrontal–sphenoid region mass lesion. Axial and coronal postcontrast T1W images (f, g) show homogeneous enhancement.

posibility while keeping meningioma as the less likely diagnosis.

Case report

This 29-year-old male patient, with no known comorbidities, presented with a history of headache and vomiting over the past 3 months. There was no history of fever, loss of consciousness, seizures, limb weakness or gait disturbances. The physical examination was normal. Laboratory investigations revealed a normal hemogram test, and viral markers were negative.

Frontal chest X-ray and abdominal sonography were also normal. Plain and contrast-enhanced CT of the head showed a large, well-defined, lobulated, extra-axial, hyperdense, homogeneously and moderately enhancing mass lesion in the right basifrontal–sphenoid region (Fig. 1a,b). The underlying bone was normal. On conventional MRI (T2-weighted [T2W], T1-weighted [T1W], FLAIR and postcontrast T1W sequences), the lesion appeared to be well defined, lobulated and extra-axial. It was mildly hyperintense compared with gray matter on T1W images, and hypointense on T2W and FLAIR images (Fig. 1c–e). The postcontrast study showed homogeneous enhancement of the lesion, with minimal adjacent dural enhancement (Fig. 1f,g). The surrounding brain parenchyma showed white matter edema. Thus, on the basis of these CT and conventional MRI findings, a diagnosis of meningioma was entertained.

The patient also underwent advanced MRI, including DWI, SWI and PWI in one sitting, using a 1.5-T clinical scanner (Avanto SQ-Engine; Siemens, Erlangen, Germany) and a 12-channel head coil. Cerebral PWI was performed with a first-pass contrast-enhanced T2*W single-shot gradient-echo planar sequence, using a rapid bolus (5 mL/s) of 0.2 mmol/kg of MRI contrast material delivered through a 20-gauge intravenous line. DWI showed diffusion blackout (Fig. 2a,b). There was neither restriction nor facilitation of diffusion (ADC value $0.901 \times 10^{-3}$ s/mm$^2$). SWI showed a diffuse, mild, hypointense blooming within the lesion (Fig. 2c). Dynamic contrast-enhanced T2*W PWI showed a low regional cerebral blood volume (rCBV; Fig. 2d) ($136 \pm 99$, and normal-appearing white matter on the opposite side, with an rCBV value of $98.3 \pm 93.3$). The rCBV ratio of the lesion—obtained by dividing the former rCBV value with the latter value for normal white matter—was 1.38, which is a comparatively low rCBV ratio for meningioma. Based on these findings and correlations with the conventional imaging findings, the possibility of a granulomatous lesion was proposed as the most likely differential diagnosis.
Atypical fungal granuloma of the sphenoid wing

A right frontotemporal craniotomy with gross total excision of the lesion was carried out. Histopathological examination was suggestive of a granulomatous lesion. Caseous necrosis was not seen (Fig. 3a). PAS staining showed segmented hyphae (Fig. 3b), and mycological culture and microscopy revealed the presence of Aspergillus flavus. The postoperative period was uneventful, and the patient was started on voriconazole 400 mg twice daily.

Discussion

Differentiation of brain tumors from other diseases is of major importance in neuroimaging because their management strategies are generally entirely different. It is well known that several conditions, including cerebrovascular, demyelinating, inflammatory and infective lesions, can mimic tumors [1]. However, clinical, radiological and laboratory findings can help in reaching a specific diagnosis in most cases. However, in some conditions, an atypical clinical course and/or radiological findings, as was the case with our patient, can also simulate brain tumor. The newer imaging techniques, such as DWI, SWI, PWI and MRS, can provide information on the microstructure and physiology of mass lesions and, thus, help to achieve a better understanding of the pathology of a lesion [2].

On analyzing the imaging findings in our patient, the lesion was hyperdense on CT and showed contrast enhancement, and the underlying bone was normal. On MRI, the lesion was hypointense on T2W sequences and mildly hyperintense on T1W sequences, with homogeneous contrast enhancement. The differential diagnosis of such a lesion includes meningioma, granuloma (fungal granuloma, tuberculosis, sarcoidosis, plasma-cell granuloma and foreign-body granuloma) and metastasis. These are difficult to differentiate based on CT and conventional MRI findings alone. Other, more unusual, differential diagnoses include lymphoma, extraskelatal plasmacytoma, Rosai–Dorfman disease and Chester–Erdheim disease [2–7].

However, advanced MRI techniques can help to differentiate these lesions. Metastasis may show restricted or facilitated diffusion, depending on cellularity, microhemorrhages, increased perfusion (rCBV), and high choline and lipid peaks [8]. They are also usually seen in older patients. Malignant and atypical meningiomas also show restricted diffusion [9] and, although microhemorrhages are less commonly seen, they may be present in malignant variants [10]. PWI of meningioma shows increased perfusion (rCBV ratio of 8.02 ± 3.89) while, on MRS, there is an increase in choline and alanine peaks [11,12]. Granulomas appear hypointense on T2W imaging and show facilitated diffusion [13], and SWI may show diffuse mild blooming due to free radical or mineral deposition [14]. Granulomas also show contrast enhancement but, on perfusion imaging, the rCBV is usually low [15]. MRS may show increases in glutamine/glutamate, lactate and amino acids [16]. In our patient, diffusion-, perfusion- and susceptibility-weighted imaging findings all favored a granulomatous lesion.

Extra-axial granulomas are usually indistinguishable from meningiomas on CT and conventional MRI. Fungal infections of the brain, such as blastomycosis and aspergillosis, usually arise as opportunistic infections in immunosuppressed individuals. However, our patient was immunocompetent, yet diagnosed with an aspergillosis, which comprises loosely arranged inflammatory cells and, therefore, shows no restriction of diffusion [13]. The presence of free radicals and mineral deposition causes diffuse blooming on SWI [10]. These lesions have low vascularity, but the vessels are leaky with no blood–brain barrier. This means that they show a low rCBV on PWI and good contrast enhancement on postcontrast T1W imaging [15].

This case report highlights the benefits of using newer neuroimaging techniques to differentiate brain tumors from tumor-like infective lesions. A definitive presurgical diagnosis of an infective lesion can influence the management strategy for such patients. Also, knowing that a lesion is a granuloma can help the surgeon with his surgical planning, while emphasizing the need to take extracare while removing the tumor to avoid or minimize spillage into the subarachnoid spaces to prevent postoperative granulomatous meningitis.

References


Figure 3  The histopathology (a) shows inflammatory and Langerhans cells (arrow) that are suggestive of a granulomatous lesion. Caseous necrosis was not seen. PAS staining (b) reveals segmented hyphae of Aspergillus flavus (arrow).
[6] Goel AH, Deegaonkar M, Nagpal RD. Extra-axial clival blastomyco-
granuloma simulating meningioma on MR imaging. J Comput 
Assist Tomogr 1990;14:467–9.
DM, et al. Differentiation between glioblastomas and solitary 
brain metastases using diffusion tensor imaging. Neuroimage 
[9] Filippi CG, Edgar MA, Ulug AM, Prowda JC, Heier LA, Zimmer-
man RD. Appearance of meningiomas on diffusion-weighted 
images: Correlating diffusion constants with histopathologic 
[10] Santhosh K, Kesavadas C, Radhakrishnan VV, Thomas B, 
Kapilamoorthy TR, Gupta AK. Rhabdoid and papillary menin-
gioma with leptomeningeal dissemination. J Neuroradiol 
M. Evaluation of different cerebral mass lesions by perfusion-
ular meningiomas: MR imaging and MR spectroscopic findings in 
cerebral infection. AJNR Am J Neuroradiol 2005;26: 
1115–21.
al. Invasive fungal granuloma of the brain caused by Aspergillus 
fumigatus: a case report and review of the literature. Surgical 
C, et al. Differentiation of infective from neoplastic brain 
lesions by dynamic contrast-enhanced MRI. Neuroradiology 
[16] Oner AY, Celik H, Akpek S, Tokgöz N. Central nervous sys-
tem aspergillosis: Magnetic resonance imaging, diffusion 
weighted imaging and magnetic resonance features. Acta 
Radiol 2006;47:408–12.