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Clinical–patient studies

Development of contrast enhancement after long-term observation of a dysembryoplastic neuroepithelial tumor

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Summary

Dysembryoplastic neuroepithelial tumors (DNET) are usually benign lesions that arise in cortical regions and are discovered after new onset of seizure. These lesions have many different imaging characteristics. We report a patient with a presumed low-grade medial temporal lobe lesion that was followed for many years without any change in size or imaging characteristics. This previously non-enhancing tumor evolved to become contrast enhanced on routine imaging without apparent tumor growth. The patient underwent surgery, and the pathology was confirmed as a DNET with no atypical changes. This case demonstrates the potential that DNETs may exhibit a changing MRI pattern over time. Natural history, imaging characteristics, and management are reviewed.

Introduction

Dysembryoplastic neuroepithelial tumors (DNET) are thought to arise during embryogenesis. They are usually clinically benign, stable lesions that arise in cortical regions, most frequently in the temporal lobe. Clinically, they present with partial epilepsy that is often drug resistant, usually before the age of 20 [1–3]. A wide variety of imaging techniques have been used with variable success to predict the histology pre-operatively. Contrast enhancement has been demonstrated in one third of cases [3]. We report a patient with a presumed low-grade medial temporal lobe lesion that was followed for many years without any change in size or imaging characteristics. This previously non-enhancing tumor evolved to become contrast enhanced on routine imaging. The patient underwent surgery and the pathology was confirmed as a DNET with no atypical changes. This case demonstrates the potential that DNETs may exhibit a changing MRI pattern over time and that the development of contrast enhancement does not necessarily imply malignant progression.

Case report

Clinical presentation and physical exam

The patient is a right-handed woman with a history of partial complex seizures since the age of 25. An MRI 4 years later showed a low-intensity lesion in the left mesiotemporal lobe that involved the uncus (Figure 1). Various options were discussed with the patient, but she was resistant to proceed with surgical therapy. The patient's seizures were initially treated medically with limited success and a vagal nerve stimulator was placed with little improvement. She remained medically intractable (3 medications) for several years. In the year preceding her eventual surgery, the patient's seizures grew progressively worse despite different medication trials. On MRI, which had remained stable over 15 years (the patient was now 46 years of age), the size of the mass and fluid attenuated inversion recovery (FLAIR) signal were unchanged, but new enhancement of the lesion that was concerning for progression of the disease was apparent (Figure 2). MR spectroscopy showed decreased *N*-acetyl aspartate (NAA) and increased choline consistent with tumor as opposed to cortical dysplasia (data not shown). The patient underwent an intra-arterial sodium amytal (Wada) test, which demonstrated that the left hemisphere was dominant for language functioning and the right hemisphere could support memory. At the time of surgery, the patient was having between 2 and 11 seizures in a single week. The patient's physical and neurology exams were intact.

Surgery

At the time of surgery, intra-operative electrocorticography demonstrated active spiking over the medial temporal structures. A limited lateral neocortical resection was performed superiorly (2 cm of superior temporal gyrus), extending to include 4 cm of the inferior temporal gyrus. The amygdala and anterior aspect of the hippocampus back to the posterior margin of the cerebral peduncle were resected; the anterior aspect was actively involved with the tumor. The histology of the tumor was consistent with DNET, showing predominantly small, round cells and scattered neurons (Figure 3). The neurons had prominent nucleoli and were

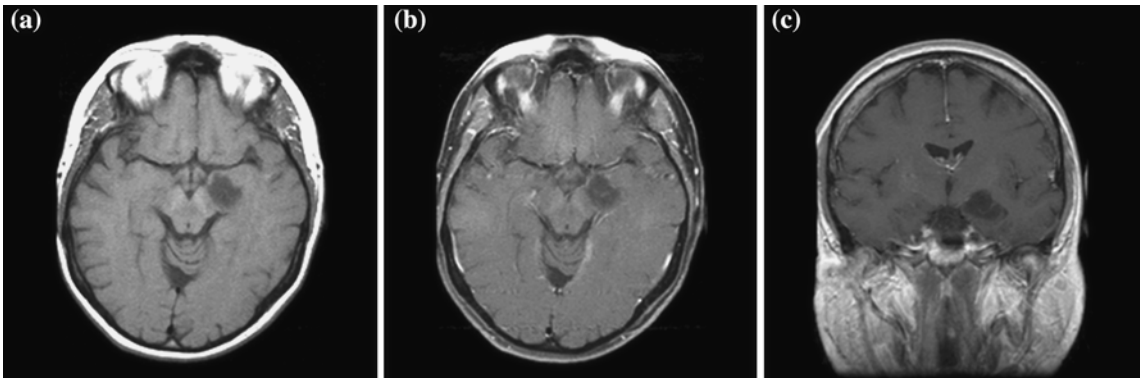

Figure 1. (a) Axial T1-weighted magnetic resonance image demonstrating a left mesial low-attenuated lesion. (b) Axial T1-weighted magnetic resonance image after gadolinium administration. (c) Coronal T1-weighted magnetic resonance image after gadolinium administration. These images demonstrate a non-enhancing 2.1×2.1×2.0 cm mass with T1 hypointensity involving the left temporal lobe uncus, which abuts but does not significantly compress the adjacent left cerebral peduncle.

immunohistochemically positively for synaptophysin. The majority of the small round cells were consistent with astrocytes and positive for glial fibrillary acidic protein (GFAP). The MIB-1 marker demonstrated only a rare positive nucleus. Post-operative imaging demonstrated complete resection of the tumor (Figure 4). The patient had an uneventful post-operative course and remains seizure free 6 months post-operatively. Anti-epileptic medications have been discontinued.

Discussion

Clinical presentation and histology

DNET occur predominately in the temporal lobe and present with focal epilepsy in young individuals. They are usually benign supratentorial tumors that contain both neuronal and glial components. Although these tumors generally have a benign course, one DNET with malignant transformation has been reported [4]. In the WHO classification, DNETs are included in the category of neuronal and mixed neuroglial tumors [1]. A diagnosis of DNET should be postulated if there is presence of partial seizures, absence of a neurological deficit, and the presence of a cortical lesion without peritumoral edema [2]. Histologically, DNETs are composed of a heterogeneous collection of oligodendrocyte-like cells with mature ganglion cells and astrocytes that can be surrounded by a myxoid or mucinous matrix [3]. Three histologic forms are recognized. The association of a specific glioneuronal element (SGNE) with glial nodules and multinodular architecture characterizes the complex form. The simple form only has the SGNE. The third form is a non-specific form that does not display a SGNE but displays the same clinical and imaging features as a complex DNET [4].

Radiological appearance

Although often variable and non-specific, neuroimaging can be useful in the diagnosis of DNET. These tumors appear as hypointense cyst-like lesions on CT with a triangular pattern of distribution and occasion overlying skull deformation [4]. Peritumoral edema and mass effect are usually not found. They tend to be hypointense on T1-weighted imaging on MRI and hyperintense on T2-weighted imaging [3,4]. As mentioned above, contrast enhancement has been shown to be present in one third of cases, however no change has been reported in

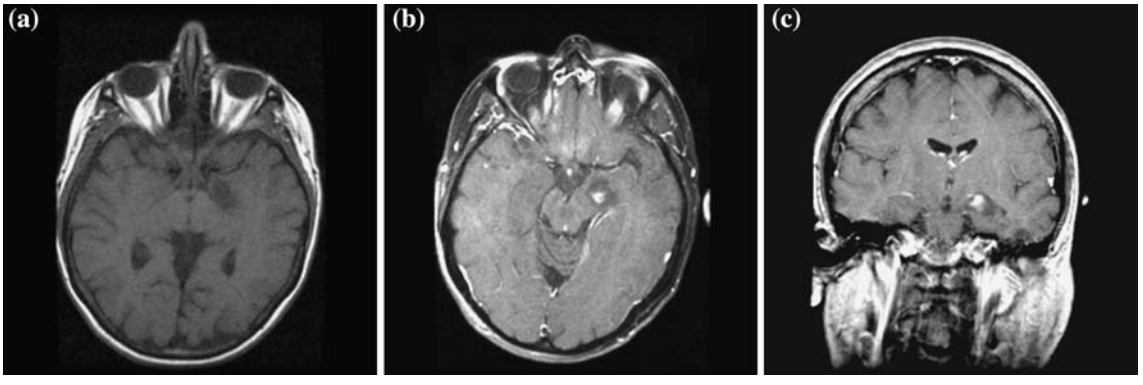

Figure 2. (a) Axial T1-weighted magnetic resonance image demonstrating a left mesial low-attenuated lesion. (b) Axial T1-weighted magnetic resonance image after gadolinium administration. (c) Coronal T1-weighted magnetic resonance image after gadolinium administration. In these images, which were obtained 15 years after those in Figure 1, the T1-weighted hypointense lesion measures 2.3×2.2×2.2 cm. A new enhancing focus at the center of the lesions measures 4×8 mm and suggested progression of the disease.

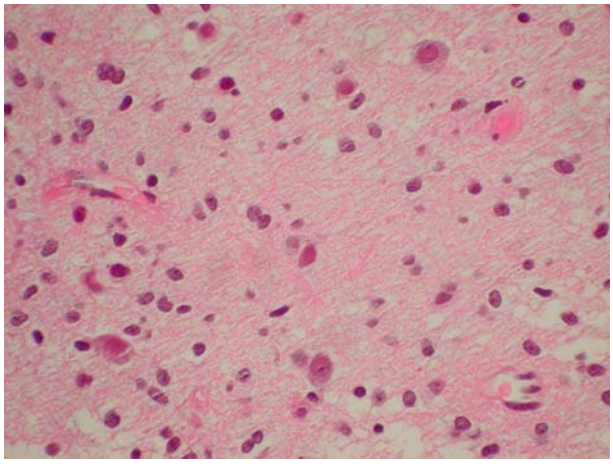

Figure 3. Hematoxylin- and eosin-stained section demonstrating small, round cells, set in a cystic background filled with pale lavender fluid. A few neurons containing prominent nucleoli float in the fluid. The synaptophysin and GFAP stains were immunohistochemically positive (not shown).

serially followed tumors without obvious tumor growth [3]. Various imaging techniques, including magnetic resonance spectroscopy (MRS), diffusion weighted MRI (DWMRI), and positron emission tomography (PET), have been used to distinguish DNETs from other common brain neoplasms with limited success [5,6]. DNETs can have close to normal spectra on MRS and high apparent diffusion coefficient (ADC) values on DWMRI [5].

Radiographic behavior in conservatively managed cases

In cases where observation has been used to manage the patient conservatively, tumor size has been monitored with CT or MR studies. Ostertun et al. [7] followed six patients with serial CT or MR studies obtained over a 13-year period, two of whom demonstrated slow progressive growth [3]. In one patient, the tumor showed calcification with progressive mass effect and pre-lesional edema. In the other patient, MR studies showed growth of the cystic tumor parts with extension into the lower insular cortex and deep into the white matter. New tumor enhancement was demonstrated in this second patient but only with increased growth of the lesion [3]. However, the patient in the present report appears to be unique in that no cases have been reported in the current literature of a previously non-enhancing lesion developing enhancement without tumor growth. As mentioned, our patient showed a low-density lesion on CT in the left mesiotemporal lobe that involved the uncus. On MRI, the patient had a stable, non-enhancing low-intensity T1-weighted cystic lesion in the left temporal lobe. With the worsening of the patient's seizures and failure of medication trials, surgical resection of the tumor was finally considered. Pre-operative imaging demonstrated that the left medial temporal mass had new enhancement with unchanged size and FLAIR signal compared with prior imaging. The mass had been followed for

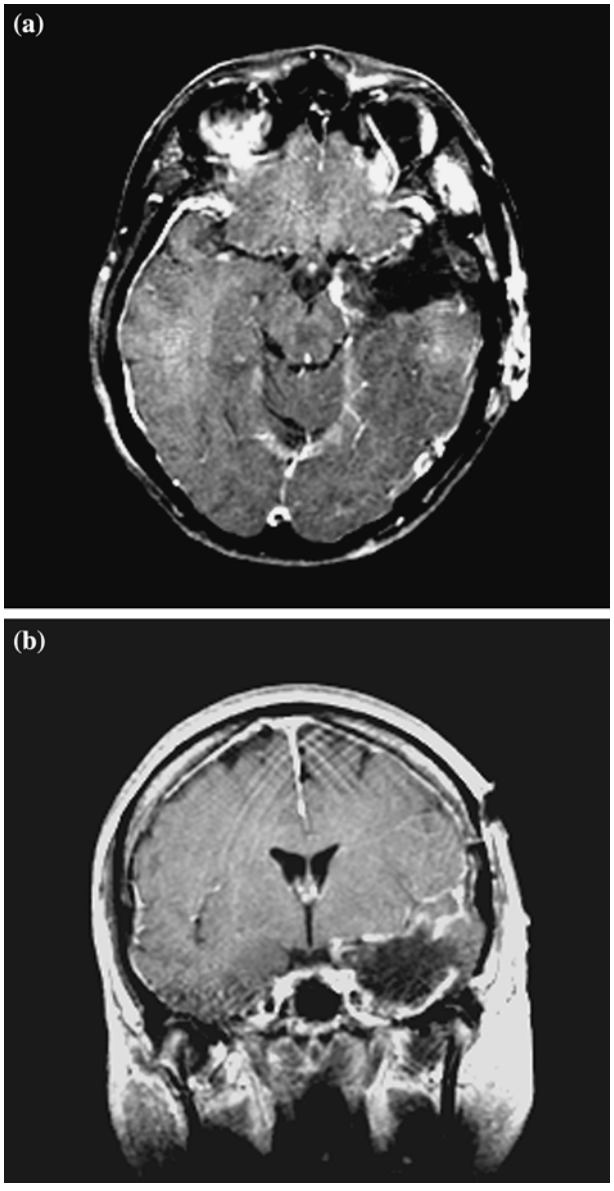

Figure 4. (a) Axial T1-weighted image after gadolinium administration. (b) Coronal T1-weighted image after gadolinium administration. These post-operative images demonstrate complete resection of the tumor.

15 years with no changes until the time of surgery. Histology of the specimen obtained from the mesiotemporal gray and white matter was consistent with a benign DNET. The interesting possibility exists that the new enhancement may relate to the increased seizure activity manifest in this patient, similar to enhancement seen with non-neoplastic foci of epilepsy. This case demonstrates the potential for changing MRI enhancement pattern in an otherwise stable benign DNET.

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References

1. Kleihues P, Cavenee WK (eds.): World Health Organization Classification of Tumours: Pathology and Genetics of Tumours of the Nervous System. IARC Press, Lyon, 2000
2. Daumas-Duport C: Dysembryoplastic neuroepithelial tumours. Brain Pathol 3: 283–295, 1993
3. Shin JH, Lee HK, Khang SK, Kim DW, Jeong AK, Ahn KJ, Choi CG, Suh DC: Neuronal tumors of the central nervous system: radiologic findings and pathologic correlation. Radiographics 22: 1177–1189, 2002
4. Fernandez C, Girard N, Paz Paredes A, Bouvier-Labit C, Lena G, Figarella-Branger D: The usefulness of MR imaging in the diagnosis of dysembryoplastic neuroepithelial tumor in children: a study of 14 cases. AJNR Am J Neuroradiol 24: 829–834, 2003
5. Bulakbasi N, Kocaoglu M, Ors F, Tayfun C, Ucoz T: Combination of single-voxel proton MR spectroscopy and apparent diffusion coefficient calculation in the evaluation of common brain tumors. AJNR Am J Neuroradiol 24: 225–233, 2003
6. Maehara T, Nariai T, Arai N, Kawai K, Shimizu H, Ishii K, Ishiwata K, Ohno K: Usefulness of [11C]methionine PET in the diagnosis of dysembryoplastic neuroepithelial tumor with temporal lobe epilepsy. Epilepsia 45: 41–45, 2004
7. Ostertun B, Wolf HK, Campos MG, Matus C, Solymosi L, Elger CE, Schramm J, Schild HH: Dysembryoplastic neuroepithelial tumors: MR and CT evaluation. AJNR Am J Neuroradiol 17: 419–430, 1996

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