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Clinical Letter

Delayed Radiation-Induced Stroke Mimics Recurrent Tumor in an Adolescent With Remote History of Low-Grade Brainstem Glioma

Lianne Q. Chau, BS [a], Michael L. Levy, MD, PhD [b, c], John R. Crawford, MD, MS [c, d, *]

[a] Tumor Initiation and Maintenance Program, Sanford Burnham Prebys Medical Discovery Institute, La Jolla, California
[b] Department of Neurosurgery, University of California San Diego, San Diego, California
[c] Rady Children's Hospital, San Diego, California
[d] Department of Neurosciences and Pediatrics, University of California San Diego, San Diego, California

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Patient description

This 13-year-old girl was diagnosed with a ponto-medullary brainstem glioma, and following unsuccessful treatment with chemotherapy, she underwent focal photon intensity-modulated radiation therapy that resulted in a favorable response. Ten years later, she presented with acute left hemiplegia and headaches. Magnetic resonance imaging (MRI) at presentation showed a large contrast-enhancing lesion with surrounding vasogenic edema and reduced diffusivity on diffusion-weighted imaging, most concerning for a high-grade secondary malignancy (Fig 1). However, biopsy of the lesion revealed areas of focal necrosis and gliosis, most consistent with a vascular infarction (Fig 2). In the three years after presentation, both the left-sided hemiparesis and the MRI findings have improved significantly (Fig 1E, F).

Discussion

Children with central nervous system tumors who receive cranial radiation therapy are at increased risk for vascular complications.[1-3] Late effects of cranial irradiation on cerebral vasculature include stroke, lacunar lesions, moyamoya syndrome, cavernomas, telangiectasias, aneurysms, hemorrhage, and necrosis.[1] One of the mechanisms of radiation-related injury is the overexpression of genes that regulate apoptosis, inflammation, and oxidative stress, which leads to early apoptosis of endothelial cells and subsequent edema, thrombosis, and atherosclerotic plaque formation in blood vessels.[1,2] In one study of 1876 five-year survivors of childhood central nervous system tumors, the cumulative incidence of stroke in patients who received 50+ Gy cranial radiation therapy 10 years following diagnosis was reported to be 1.3%.[3] Risk of stroke was found to be greater in patients who received higher radiation doses as well as in longer-term survivors.[3]

Radiation-induced vasculopathy and recurrent tumors can present with similar imaging features on traditional MRI and computed tomographic scans. Thus, use of additional imaging techniques may be beneficial for diagnosis. On MRI and computed tomography, both radiation changes and recurrent tumors can present with mass effect, contrast enhancement, and edema.[4,5] On perfusion-weighted MRI, recurrent tumors often show higher relative cerebral blood volume, higher relative peak height, and lower percentage of signal-intensity recovery compared with areas of radiation-induced vasculopathy.[4,5] On magnetic resonance spectroscopy, an increase in lipid and lactate levels can be detected in both conditions, but greater ratios of choline to creatine and choline to *N*-acetylaspartate are typically found in recurrent

Conflicts of interest: The authors do not have any conflicts of interest to report.

* Communications should be addressed to: Crawford; Professor of Clinical Neurosciences and Pediatrics; University of California San Diego and Rady Children's Hospital; 3020 Children's Way; San Diego, CA 92123.
E-mail address: jrcrawford@ucsd.edu (J.R. Crawford).

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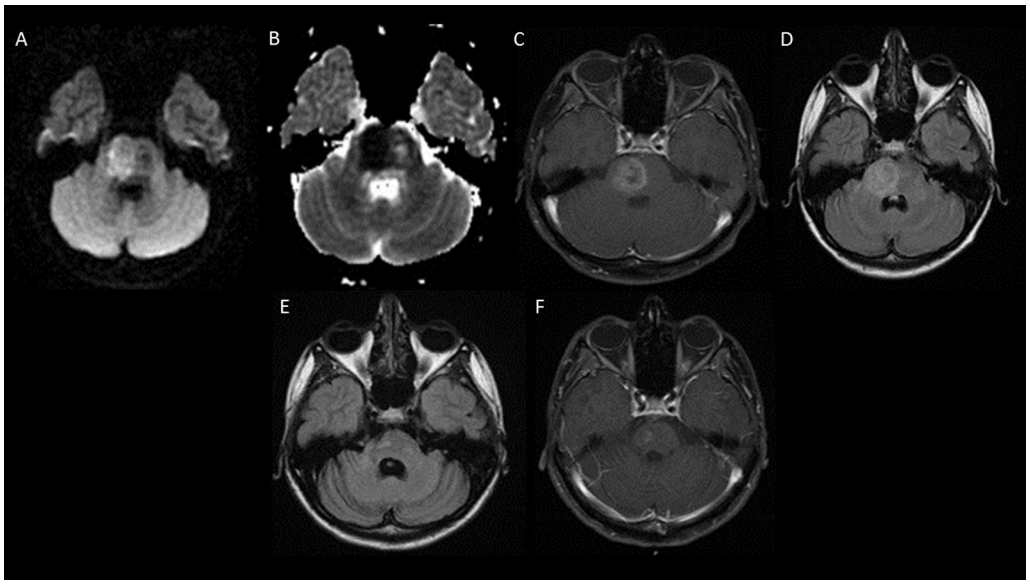

FIGURE 1. Magnetic resonance imaging (MRI) findings. MRI at diagnosis reveals a mass-like lesion in the pons with reduced diffusivity on diffusion-weighted imaging and apparent diffusion coefficient sequences (A and B) with heterogeneous enhancement postgadolinium (C) and mass-like appearance on fluid-attenuated inversion recovery (FLAIR) sequence (D). Three years postdiagnosis the MRI shows near resolution of the lesion on FLAIR and post gadolinium sequences (E and F).

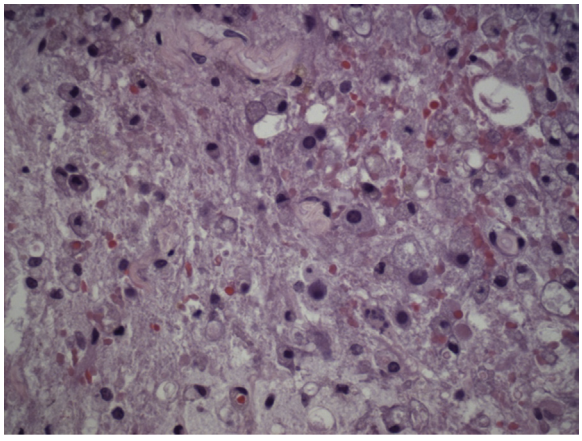

FIGURE 2. Pathologic findings. Hematoxylin and eosin tissue section obtained from robotic-guided biopsy reveals white matter with necrosis, collections of macrophages, and hyalinized and focally devitalized blood vessels consistent with vascular infarction (600× magnification). The color version of this figure is available in the online edition.

tumors.[4,5] On positron emission tomographic scans, recurrent tumors often show greater levels of metabolism than those shown by radiation changes.[4,5]

In conclusion, we highlight the need to consider delayed radiation-induced vasculopathy in the differential diagnosis of new mass-like MRI findings in patients previously treated with cranial radiation therapy and highlights the importance of biopsy confirmation.

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