

# Use of positron emission tomography scanning to evaluate pseudoresponse

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Submitted Apr 10, 2013. Accepted for publication Apr 27, 2013.

doi: 10.3978/j.issn.2224-4336.2013.04.07

View this article at: <http://www.thetp.org/article/view/1845/2591>

Although an important part of the neuro-oncologists armamentarium, antiangiogenic chemotherapeutic agents can result in a pseudoresponse. This phenomenon occurs because the contrast enhancement that is used to measure tumor burden radiographically, depends upon the breakdown of the blood-brain barrier which may be restored after treatment with antiangiogenic agents, even without true eradication of the neoplasm. This occurrence may complicate attempts to determine an accurate prognosis for patients with malignant brain tumors as well as delay the initiation of more beneficial treatment strategies. The uncoupling of contrast enhancement from actual disease burden also makes endpoint measurement in data collection a challenge (1). In particular, bevacizumab is used frequently for the treatment of recurrent high grade glial tumors, and is often associated with pseudoresponse. At present, the changes seen on T2-weighted and fluid-attenuated inversion recovery (FLAIR) magnetic resonance imaging (MRI) are commonly used to assess the therapeutic response of a tumor in the setting of treatment with antiangiogenic agents, however, these changes can be nonspecific. In this case report, Morana *et al.* describe the use of F-DOPA positron emission tomography (PET) scanning in an attempt to demonstrate tumor progression in a patient with a ganglioglioma that had undergone malignant transformation, who was treated with bevacizumab.

The case presented here also illustrates the not infrequent issues that arise when a low grade glial tumor is incompletely resected. Attempts at gross total resection may present an unreasonable risk for neurological injury to the patient, especially when the likelihood of progression

may be low, as in a grade I lesion. The residual lesion in this case, initially a ganglioglioma, was followed radiographically after chemotherapy and eventually exhibited progressive malignant transformation. Treatment of the enlarging residual lesion with a repeat subtotal surgical resection and radiation therapy was followed by further radiographic recurrence which was in turn treated with a third subtotal resection. The patient then received temozolomide and bevacizumab. During this treatment, F-DOPA PET scanning was performed to assess for the presence of tumor progression. Unfortunately the patient did exhibit tumor extension within the surgical cavity and also within an adjacent gyrus, both of which were anticipated by F-DOPA PET scanning.

The authors are to be congratulated for their thoughtful attempt to demonstrate pseudoresponse on imaging. Instead of using the breakdown of the blood-brain barrier manifest as contrast enhancement as an indicator of tumor progression, the use of F-DOPA PET scanning can demonstrate increased metabolic activity that would be expected in areas with increased cellular mitotic activity that is indicative of tumor growth. Theoretically this investigative approach should avoid the potential for a pseudoresponse to occur and reveal areas with active tumor growth. A concern in this particular case as in many others, was the fact that FLAIR imaging would be insufficient to distinguish between tumor and postoperative changes. The finding that there were areas demonstrating increased metabolic uptake on PET that later exhibited MRI changes with a corresponding clinical decline is striking in this case. As alluded to by the authors, there is a dearth of

studies using PET scanning in pediatric brain tumors. In addition to the evaluation of tumor burden in the setting of pseudoresponse, PET shows a promise in the evaluation of tumors that cannot be approached surgically such as diffuse brain stem gliomas (2) and for stratifying the risk of progression in low grade tumors (3), which would have been pertinent in this particular case. Demonstrating the reliability of PET in a variety of clinical settings with a larger number of patients will be of importance in the future for validating its utility. Additional efforts to correlate histopathology with the findings on PET will also be necessary in order to gain widespread clinical acceptance. As the use of antiangiogenic agents in the treatment of malignant brain tumors continues to increase, the ability of clinicians to assess reliably the effects of these therapies will be of the utmost importance which provides justification for the approach taken by these authors.

### Acknowledgements

**Cite this article as:** Kim PD, Hall WA. Use of positron emission tomography scanning to evaluate pseudoresponse. *Transl Pediatr* 2013;2(2):57-58. doi: 10.3978/j.issn.2224-4336.2013.04.07

None.

### Footnote

*Conflicts of Interest:* The authors have no conflicts of interest to declare.

### References

1. Reardon DA, Galanis E, DeGroot JF, et al. Clinical trial end points for high-grade glioma: the evolving landscape. *Neuro Oncol* 2011;13:353-61.
2. Zukotynski KA, Fahey FH, Kocak M, et al. Evaluation of 18F-FDG PET and MRI associations in pediatric diffuse intrinsic brain stem glioma: a report from the Pediatric Brain Tumor Consortium. *J Nucl Med* 2011;52:188-95.
3. Kruer MC, Kaplan AM, Ettl MM Jr, et al. The value of positron emission tomography and proliferation index in predicting progression in low-grade astrocytomas of childhood. *J Neurooncol* 2009;95:239-45.