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1: [Curr Mol Med](#). 2008 Dec;8(8):711-26. [Related Articles](#), [Links](#)

Molecular imaging of brain tumors personal experience and review of the literature.

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Non-invasive energy metabolism measurements in brain tumors in vivo are now performed widely as molecular imaging by positron emission tomography. This capability has developed from a large number of basic and clinical science investigations that have cross fertilized one another. Apart from precise anatomical localization and quantification, the most intriguing advantage of such imaging is the opportunity to investigate the time course (dynamics) of disease-specific molecular events in the intact organism. Most importantly, molecular imaging represents a key-technology in translational research, helping to develop experimental protocols that may later be applied to human patients. Common clinical indications for molecular imaging of primary brain tumors therefore contain (i) primary brain tumor diagnosis, (ii) identification of the metabolically most active brain tumor reactions (differentiation of viable tumor tissue from necrosis), and (iii) prediction of treatment response by measurement of tumor perfusion, or ischemia. The key-question remains whether the magnitude of biochemical alterations demonstrated by molecular imaging reveals prognostic value with respect to survival. Molecular imaging may identify early disease and differentiate benign from malignant lesions. Moreover, an early identification of treatment effectiveness could influence patient management by providing objective criteria for evaluation of therapeutic strategies for primary brain tumors. Specially, its novel potential to visualize metabolism and signal transduction to gene expression is used in reporter gene assays to trace the location and temporal level of expression of therapeutic and endogenous genes. The authors present here illustrative data of PET imaging: the thymidine kinase gene expression in experimentally transplanted F98 gliomas in cat brain indicates, that [(18F)FHBG visualizes cells expressing TK-GFP gene in transduced gliomas as well as quantities and localizes transduced HSV-1-TK expression if the blood brain barrier is disrupted. The higher uptake of [(18F)FLT in the wild-type compared to the transduced type may demonstrate the different doubling time of both tumor tissues suggesting different cytosolic thymidine kinase activity. Molecular imaging probes are developed to image the function of targets without disturbing them or as drug in order to modify the target's function. This is transfer of gene therapy's experimental knowledge into clinical applications. Molecular imaging closes the gap between in vitro to in vivo integrative biology of disease.

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