AbstractID: 11609 Title: Quantitative Measurement of Hypoxia in Human Brain Tumors Using qBOLD MRI

Purpose:

The main objective of this study is to evaluate the feasibility of using a recently developed MR technique, quantitative blood oxygenation level-dependent (qBOLD), to quantify the oxygen extraction fraction (OEF) of tumors metastatic to the brain.

Materials & Methods:

The qBOLD technique provides a regional OEF measurement based upon an MR signal model of brain that incorporates prior knowledge about brain tissue composition. A 3D version of gradient echo sampling of spin echo sequence with RF spoiling is used to obtain the MRI signal. (He, Zhu, and Yablonskiy, *MRM* 60:4, 882-888, 2008).

To evaluate the feasibility of qBOLD quantify OEF in central nervous system tumors, six patients (47.9 y to 67.2 y, mean 55.4 y, 4 female and 2 male) with metastatic brain tumors were prospectively enrolled in a longitudinal imaging study. The primary malignancies were lung cancer (in five patients) and renal cell carcinoma (in one patient). The qBOLD procedure was performed as part of an integrated neuroimaging protocol, including conventional pre- and post-contrast images and dynamic susceptibility contrast perfusion. The patients were scanned at 1.5T (Siemens TIM Espree) while wearing a stereotactic frame prior to radiation therapy. Post processing was performed offline using Matlab.

Results:

Supratentorial metastatic tumors (6 patients) and surrounding vasogneic edema demonstrated marked visual conspicuity and quantifiably altered OEF using the qBOLD MRI: e.g, OEF values for the area of vasogenic edema were 54.8+/-12.3 % compared to 36.6+/-6.6 % in contralateral normal white matter.

Conclusions:

Using a recently developed MR pulse sequence, qBOLD, we were able to quantify the OEF in humans with metastatic brain tumors. qBOLD offered excellent visual conspicuity for lesion detection for supratentorial, non-hemorrhagic lesions. Interestingly, vasogenic edema surrounding both primary and metastatic tumors was also associated with elevated OEF, a finding which warrants further investigation.