# Perfusion MRI of Cerebral Toxoplasmosis and Lymphoma in AIDS

Thomas Ernst, Linda Chang, Mallory Witt, Howard Aronow, Marcia Cornford, Irvin Walot
Harbor-UCLA Medical Center, Torrance, CA, and USC Medical School, Los Angeles, CA.

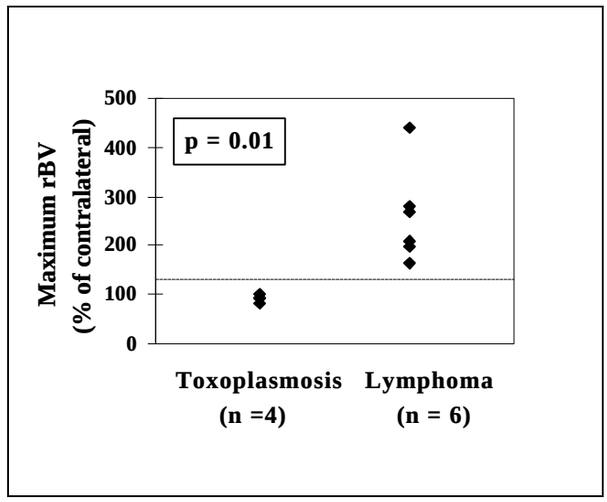
**Objective:** To evaluate whether perfusion MRI (pMRI) is able to differentiate cerebral toxoplasmosis and lymphoma lesions in patients in AIDS.

**Background:** Cerebral toxoplasmosis and lymphoma are common focal brain lesions in AIDS patients. Clinical and radiologic variables are often unable to provide a clear diagnosis. On T2-weighted MRI, both lesions appear as hyperintense lesions surrounded by edema. Both lesions may also show ring-enhancement with contrast (1). As a result, many patients with lymphoma are subjected to 2 weeks of empirical treatment with anti-toxoplasma medications, while the correct treatment for lymphoma is delayed.

**Design and Methods:** MRI and pMRI were performed in 10 AIDS patients with focal brain lesions (6 with lymphoma and 4 with toxoplasmosis). Lymphoma diagnosis was confirmed by biopsy or cerebrospinal fluid (CSF) cytology in 3 and CSF polymerase chain reaction (PCR) for Epstein Barr virus (EBV) DNA in 2 patients. None of the lymphoma patients showed improvement while on empiric anti-toxoplasma therapy. Toxoplasmosis diagnosis was based on biopsy in 2 patients, and by response to antitoxoplasma therapy in all 4 patients.

MRI was performed on a 1.5-T GE scanner equipped with echo planar imaging (EPI) hardware. Regional cerebral blood volume (rCBV) was determined using dynamic single shot gradient-echo EPI during a bolus injection of Gadolinium contrast agent (TR/TE 2500/30; 6 mm slices, 2 mm gap, 20-cm FOV, 64x64). Regional blood volume maps were reconstructed using the inverse exponential relationship between MR signal and concentration of contrast agent. The data was quantified by expressing the blood volume in the lesions relative to that in normal appearing contralateral brain tissue. Average and maximum rCBV were calculated for each lesion.

**Results:** The average rCBV was decreased (-56%) throughout the toxoplasma lesions, whereas all active lymphomas displayed areas of increased rCBV (+158%). The surrounding edema of both toxoplasma and lymphoma lesions showed marked decreases in rCBV. When the maximum rCBV in each lesion was plotted, there was no overlap between rCBV of lymphoma and rCBV of toxoplasmosis lesions (Figure; p = 0.01 with unpaired t-test).




**Conclusions:** Our findings are in parallel with single photon emission computer tomography (SPECT) and positron emission tomography (PET) measurements, which show hypometabolism in toxoplasmosis lesions, but hypermetabolic foci in lymphoma (2, 3). Low rCBV in toxoplasmosis lesions is most likely caused by a lack of vasculature within the abscess. In contrast, areas of increased rCBV in lymphomas are most likely due to hypervascularity in foci of active tumor growth. Furthermore, decreased rCBV in the surrounding edema of both lesion types is probably caused by vasoconstriction associated with increased interstitial pressure. In summary, perfusion MRI is a rapid noninvasive tool that may allow early differentiation of cerebral lymphoma from toxoplasmosis in patients with AIDS.

**Acknowledgments:** This study was supported in part by NIH (DA 00280) and the grant from the State of California Universitywide AIDS Research Program to the UCLA Care Center (CC97 LA 175).

**References**

1. Ruiz, A., et al., Neuroimaging Clinics of North America: Neuroimaging of AIDS I, 281, 1997.
2. Hoffman, J.M., Waskin, H.A., Schiffer, T., *J Nucl Med*, 34, 567, 1993.
3. Ruiz, A., et al., *AJNR*, 15, 1885-1894, 1994.