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MR Perfusion Study for Cerebral Toxoplasmosis and CNS Lymphoma in an Immunocompromised Host

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Patients in advanced stage of acquired immunodeficiency syndrome (AIDS) are severely immunocompromised and hence prone to a variety of opportunistic infections and malignancies. Cerebral toxoplasmosis and primary central nervous system lymphoma (PCNSL) are two of the most common focal brain pathologies, often presenting as a diagnostic dilemma from clinical and radiological perspectives. Distinction between the two is crucial, since it has therapeutic and prognostic implications.

Infection with *Toxoplasma gondii* results in single or multifocal brain lesions which are amenable to antibiotic treatment. Serological tests and polymerase chain reaction analysis for Toxoplasmosis are not always conclusive [1,2]. On routine magnetic resonance imaging (MRI), it may show single or multiple ring enhancing lesions with surrounding edema. The lesions have predilection for cortical and basal ganglia regions. PCNSL in AIDS is an aggressive disease which is nearly always a B-cell type. It has been hypothesized that it may occur secondary to Epstein Barr virus infected B-cells [3]. Standard MRI shows multicentric T1 hypointense and T2 iso-hyperintense lesions with surrounding edema; located usually around the periventricular areas with sub ependymal involvement. Being a rapidly growing tumor, central area is deprived of blood supply, leading to central necrosis and post contrast ring enhancement [4]. When the clinical and radiological data are inconclusive, definitive diagnosis rests on invasive biopsy and histopathological examination.

MRI features like single isolated lesion, solid enhancement within the lesion and sub ependymal location favor lymphoma, whereas multiple lesions located in cortical and basal ganglia regions with well circumscribed margins suggest toxoplasmosis. However, diagnostic challenge arises in an atypical case where either features are present. Lymphoma lesions in AIDS patients are shown to have ring enhancement and parenchymal involvement, mimicking toxoplasmosis. Novel techniques like MR Spectroscopy (MRS), SPECT and PET imaging might be helpful in these situations. Both type of lesions show lactate and lipid peaks in MRS, but lymphoma is associated with elevated choline levels [5]. Thallium 201 SPECT uptake is increased in lymphoma and reduced in toxoplasmosis [5]. PET scan shows increased uptake in lymphoma lesions, unlike toxoplasmosis [6].

Findings on MRI perfusion (MRP) study correlates well with the results on nuclear scans. Regional cerebral blood flow (rCBV) values are decreased in toxoplasmosis and elevated in lymphoma. This observation in more accurate and consistent with values within the lesion rather than surrounding it. Ernst., *et al*. [7] studied the role of MRP in differentiating toxoplasmosis and lymphoma in 13 patients with AIDS, where he observed that toxoplasma lesions had consistent reduction in rCBV (average and maximum values) within the lesions when compared to lymphoma. Hyperperfusion in lymphoma is likely to be secondary to hypervascularity associated with rapidly progressive neoplastic process. Hypoperfusion in toxoplasmosis might be explained by lack of vasculature and vasoconstriction caused by surrounding edema [7].

Perfusion MR provides certain advantages [7] over conventional MRI and MR spectroscopy (MRS). It studies a wider area of brain simultaneously, as against a focal region of study with MRS. Also, MRP uses the same contrast material (gadolinium chelate) as used with

routine contrast imaging. It provides higher spatial resolution and adds only a few more minutes to the total acquisition time. However, the drawback with MRP is that it should be interpreted with caution in lesions localized near the cortex since perfusion studies are sensitive to blood flow in large vessels. An area of hyperperfusion near the cortex may be neoplastic or may be related to high blood flow in an adjacent large vessel.

To conclude, on perfusion imaging, rCBV within the lesion is increased in active lymphoma lesions and reduced in toxoplasmosis. More importantly, MRP observations, when considered in light of clinical and serological details, provide a more conclusive information. Addition of perfusion MR to the conventional MRI protocols in AIDS patients with focal brain lesions may assist in accurate and early diagnosis, thereby helping in prognostication and avoiding invasive procedures.

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