To the Editors:

Substantial usage of MR Perfusion scan in evaluating tumor response in neuro-oncology patients

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Quantified treatment response is of paramount importance in dealing with any cancer patient. So far, the conventional contrast-enhanced MRI is the standard radiological test in the follow-up of neuro-oncology patients, but with the advent of novel therapies including immunotherapy, antiangiogenic agents, or their combination, the radiological appearance of these tumors is more ambiguous on follow-up imaging, yet most important for evaluating tumor response, clinical decision-making and future planning.[1] Pseudo-progression, for instance, appears as a new enhancement on conventional MRI after the treatment with radiotherapy and concomitant chemotherapy with temozolomide (Stupp protocol). Although it is suggestive of disease progression, it is in fact due to transient tumour response to endothelial damage and subsequent tissue hypoxia before the tumour really regresses. This phenomenon is seen in almost 30 % of patients.[2] Another similar confusing radiological appearance is that a decrease in enhancement or edema on conventional post-contrast MRI does not always represent true tumor response to treatment and could be due to a phenomenon called pseudo-response. This phenomenon is seen with antiangiogenic agents like bevacizumab and cediranib. This effect is due to changes in blood-brain barrier permeability rather than antiangiogenic effects and tumor cell death. This phenomenon is reported in 25-60 % of the patients.[3]

Perfusion MR imaging (Figure1) can be performed using various techniques. The most commonly used technique is the dynamic susceptibility contrast MRI (DSC-MRI). This technique relies on T2* signal dropout after the passage of gadolinium contrast. It is readily available and can be easily performed even on a 1.5 T MRI. It provides information on cerebral blood

volume (CBV) and cerebral blood flow (CBF) in the tumour and surrounding tissue.[4]

Another commonly available technique used is the dynamic contrast-enhanced MRI (DCE- MRI), a T1-weighted spoiled-recalled echo sequence acquired during the administration of gadolinium-based contrast. This technique gives a reflection of perfusion, permeability, and extracellular volume measure. It is better and more reliable in demonstrating the microvascular permeability[4]. The last technique is a completely noninvasive non-exogenous contrast-dependent technique called the arterial spin labeling MRI (ASL-MRI). It measures blood flow by magnetically labeling arterial blood water protons and following them till they arrive in the tissue of interest.[5]

Dynamic susceptibility contrast MRI is the top modality of choice now followed by dynamic contrast-enhanced MRI. The role of ASL-MRI is limited and evolving. These techniques are being incorporated into the follow-up imaging protocols of neuro-oncology patients. In one survey conducted by the American Society of Neuroradiology (ASNR), 151 out of 195 institutions offer perfusion MRI. Another survey conducted by the European Society of Neuroradiology (ESNR) in 220 institutions in 31 European countries shows that perfusion MRI is an integral part of standard imaging protocol in 48 % of the institutions.[6]

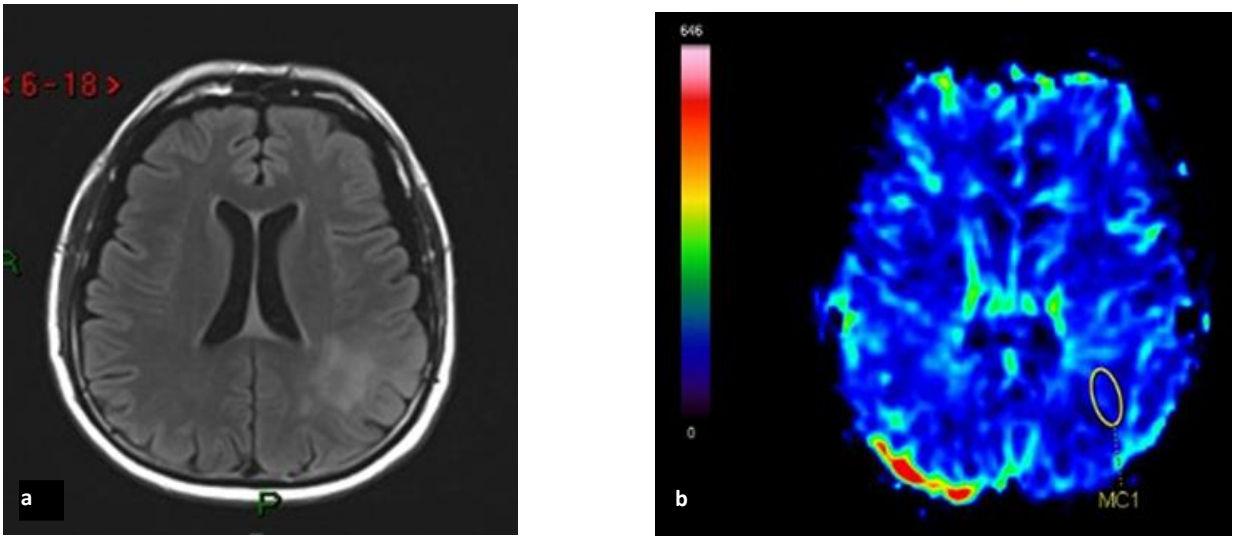

Figure 1 : Follow up MRI of a patient with known left parietal glioma; a) axial FLAIR image showing abnormal hyper intense in left parietal lobe; however the subsequent post process perfusion image(b) shows comparable perfusion dynamics with rest of the normal brain parenchyma suggesting no residual/ recurrent disease.

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