Investigating Absolute Quantification in MR Perfusion Studies: the Role of Partial Volume Errors

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Stroke, an important cause of disability and mortality, is an acute cerebral vascular accident that generates permanent tissue damage due to a lack of blood supply. The strong relationship between cerebral flow values (CBF) and the cellular metabolic condition makes CBF a key indicator of whether or not brain tissue is likely to become compromised. Magnetic resonance (MR), perfusion protocols can provide relative (compared to normal tissue) CBF values; but absolute quantification is yet not possible. A major limitation to achieving absolute quantification is the presence of partial volume errors (PVE) that lead to low accuracy and reproducibility of perfusion estimates. Attempts to reduce partial volume errors include acquisition of an extra slice perpendicular to main arteries, analysis of the complex MR signal and signal scaling. Still, there is a need for a robust correction algorithm that applies to a majority of clinical scenarios. We have studied a voxel based means of estimating partial volumes by applying the concept of phase contrast imaging to induce signal voids through intra voxel dephasing. Results indicate that the current imaging sequence (echo planar) used in perfusion studies imposes several limitations to accurate estimate of PVE. Modifying the current acquisition parameters, selecting a different sequence and generating signal suppression within a voxel through longitudinal relaxation might reduce some of these limitations. We have also studied a post acquisition algorithm for improving image resolution and reducing inaccuracies in the estimate of the PVE. By reliably estimating and