AbstractID: 7134 Title: Investigation of Quantitative Cerebral Blood Flow Measurement from Dynamic-Susceptibility Contrast Perfusion MR Imaging on 3T system

Purpose: To investigate what factors affect the quantitative CBV, CBF and MTT measurements from dynamic-susceptibility contrast (DSC) perfusion imaging on 3T MR system. Different calculation methods were tested from healthy volunteers and critical issues were identified.

Method and Materials: Single-shot gradient echo EPI was used to acquire T_2*-weighted perfusion images from 3.0T scanner. A program was developed to interactively select the arterial input function (AIF) along with high resolution anatomic images. Perfusion data were fitted by gamma-variate function. AIFs with different peak (P), time to bolus arrival (t0), time to peak (tmax), FWHM and area (A) under the curve were selected for perfusion calculations. Four methods were used to calculate CBV, CBF and MTT: (1) No deconvolution (No-DECONV); (2) Inverse Fourier transform (IFT); (3) Singular value decomposition (SVD); (4) Block circular singular value decomposition (cSVD).

Results: Inverse Fourier transform demonstrated most consistent results. SVD's result varied much, depending on preset threshold (0.45) to eliminate ill-conditioned singular values. Although cSVD has improved AIF dispersion sensitivity, it also relied on a preset global threshold (0.04) to stop the residue function oscillation. Surprisingly, CBF from No-DECONV was very close to the result from IFT.

The selection of AIF was the most important factor that contributed to the final CBV, CBF. Since CBV is normalized by AIF, its area is more important than its peak. The t0 and tmax played less important role than A and P, especially for IFT method.

Conclusions: With large enough SNR from 3T MR system, IFT is the most reliable method to calculate CBF and MTT. AIF selection is most important step to get accurate quantitative CBF. Venous output function (VOF) should be considered if it provides larger area than those from other AIFs. All the macro-vessels should be removed so that the CBV and CBF are not overestimated.