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Metabolic diffusion and optimization of diffusion tensor imaging

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Purpose: To accurately measure the self-diffusion of molecules in isotropic liquids. In recent years, in addition to conventional MR imaging, several other in vivo MR techniques have been used for the diagnosis and evaluation of brain tumors, including ^{1}H MRS, diffusion weighted imaging (DWI), and perfusion imaging. In this study, we sought to evaluate the multidirectional diffusion tensor imaging (DTI).

Materials and Methods: Diffusion weighted MR data were acquired from healthy volunteer, using 1.5T Siemens Avanto (Siemens, Erlangen, Germany) with actively shielded magnetic field gradients (maximum amplitude, 40mT/m). The parameters for optimal schemes were derived for each measurement based on the estimated mean diffusivity and T2 measurements. Data were analyzed on an independent workstation (Pentium IV, 3.2 GHz CPU). The diffusion weighted images were corrected for gradient tables and ECC using DTI Studio software (Radiology, Johns Hopkins University, SOM).

Results: Each individual measurement of Dxx, Dyy, and Dzz can be optimized in the way as with optimal diffusion weighting the x, y, z, and other index. The more precise assessment of Tr(D) is needed, the more measurements should be made. In our study, consider the variances of each of the unique elements of the diffusion tensor.

Discussion: A variety of spatial encoding schemes have been proposed for diffusion tensor MR imaging. The advantages of multi-shot echoplanar imaging compared with single-shot are greater spatial resolution, greater signal-to-noise ratio, and less susceptibility-related distortion. And the effective scanning parameters provides comparable measurements.

Acknowledgments: This study was supported by a grant of the Seoul R&BD Program (10550), the Korea Health 21 R&D Project, Ministry of Health & Welfare, Republic of Korea (02-PJ3-PG6-EV07-0002) and a grant of the 2005 Nuclear R&D Plan Program, Ministry of Science & Technology, Korea