RF-Spoiled Gradient Echo を用いた緩和時間と磁化率の高速 3D マッピング［大会長賞記録］

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マルチエコーの高速 RF-spoiled GE を用いて T_1，T_2*，PD，B_1 の各マップを取得するマルチパラメータマッピングにおいて，磁化率マップと水/脂肪画像も同時に取得する方法を提案し，ヒト頭部へ適用した．全脳を 1.1 mm の 3D 等方ボクセルにて 12 分で撮影可能であった．

Fast 3D Multi-Parameter Mapping of Relaxation Times and Susceptibility Using RF-Spoiled Gradient Echo［Presidential Award Proceedings］

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Introduction : Multi-parameter mapping of relaxation times and proton density can be applied to clinical image diagnosis and is expected for disease quantification. Quantitative susceptibility mapping (QSM) is also expected for early diagnosis of brain diseases such as neurodegenerative diseases. In this work, a simultaneous quantification method of these multiple tissue parameters is presented. 3D T_1, T_2*, proton density (PD), B_1, and susceptibility (χ) maps and fat/water images can be acquired from a whole brain scan at clinical resolution.

Method : 1.1 mm-isotropic 3D images were acquired at 3T using RF-spoiled gradient echo sequences with six scan parameter sets where TR, FA, and RF phases are varied in the range of 10–40 ms, 10–40 degrees, and 2–22 degrees, respectively. The optimal parameter sets were selected using the law of error propagation with target relaxation times of GM, WM,CSF, and fat at 3T. The intensity function used in the optimization was formulated by computer simulations. Five multi-echo images were acquired in one of the parameter sets for QSM and fat/water imaging. TEs of the images were 4.6, 10.4, 16.2, 22.0, and 27.8 ms. The acquisition time per parameter set is a few minutes using a parallel scan,and thus the ten volume images were acquired in 12 min. T_1, T_2*, PD, and B_1 maps were calculated pixel by pixel by fitting intensities to the intensity function using a least-square method. Other parameters were as follows: Fov 167×205×167 mm, matrix size 148×186×148, 32-ch head coil.

Results and Discussion : T_1, T_2*, PD, B_1, and χ maps and fat/water images were successfully obtained. Image registration between the volume images will be expected to reduce the likelihood of motion, as the scan time for each volume is only a few minutes.