Assessment of the uterine myometrium using T2* relaxometry with a correction of magnetic filed inhomogeneity

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Purpose Uterine myometrium has two different zones on T2-weighted images. The innermost myometrium appears as a band of low signal intensity (junctional zone), and the peripheral myometrium has higher signal intensity than that of the junctional zone. Kido et al recently reported T2* value of the junctional zone was lower than that of the peripheral myometrium using BOLD MR imaging under oxygenation. In this study, we profited quantitative T2* maps of uterine myometrium using T2* relaxometry with a main filed inhomogeneity correction.

Materials and Methods Five healthy volunteers and two patients with uterine leiomyoma of reproductive age (29-43 years) were imaged at 1.5T system (Intera Master, Philips Medial Systems) and a QD body coil. MR images were obtained two times in two of five volunteers, and a two weeks interval was imposed between the first and second examination to reach different menstrual cycle. Therefore, nine examinations were included in the evaluation of the uterine myometrium. Five sagittal slices of the uterus were obtained using a multishot EPI sequence. The parameter for the imaging were: TR/ delta TE 640/2.3, flip angle=28 degrees, 67echos, matrix 128 x 128, slice thickness 5mm with no slice gap, FOV 28 cm. Each imaging was obtained under free breathing without any oxygenation and the imaging time was 4 min. T2* value were calculated by means of T2* fitting tool (PRIDE, Philips Medical Systems) (2) with and without correction of macroscopic B0 inhomogeneities (T2* corr and T2*no-corr). The T2* corr and T2*no-corr was calculated by drawing a ROI (including around 50 pixels) over the junctional zone, peripheral myometrium, back muscle, and leiomyoma. Comparison of each T2* value in different anatomical structure was made by Wilcoxon`s signed-rank tests.

Results The mean T2*no-corr in the junctional zone, peripheral myometrium, and back muscle were 41.3, 58.4, and 30.2, respectivery. With correcting B0 inhomogeneities, those of the mean T2* corr were 41.4, 58.7, and 30.2, respectively. Each T2*corr was slightly higher than T2*no-corr, however, the difference was only statistically significant in the junctional zone (p=0.02). The T2* corr and T2*no-corr of the junctional zone was significantly lower than that of the peripheral myometrium (p=0.008). The back muscle had lower T2* corr and T2*no-corr than the junctional zone (p=0.08). Figures represented color-scaled T2* corr and T2*no-corr maps of a uterus and a leiomyoma, and red area (e.g., junctional zone and back muscle) showed relatively lower T2* corr or T2*no-corr contrast with green area (e.g., peripheral myometrium). Leiomyomas had a trend toward smaller T2*corr than the normal myometrium, however, further study was required since we had only two cases.

Conclusion T2* relaxometry provided T2* corr value of the junctional zone was lower than that of the peripheral myometrium. Our preliminary result was paralleled to the previous Kido`s report. Uterine myometrium had two different zones which may represent physiological discrimination even in the identical smooth muscle tissue. Although B0 inhomogeneities did not seriously influenced T2* relaxometry on 1.5T units, this method will be a powerful tool in further 3T examinations. The quantitative T2*corr map could be easily obtained with using PRIDE T2* fitting tool.

References 1. Kido A, et al. Proc. Intl. Soc. Mag. Reson. Med 2005; 13: 539. 2. Dahnke H, et al. Magn Reson Med 2005; 53: 1202.

Figures. T2* maps of a uterus and a leiomyoma. Left: with B0 correction, Middle: without B0 correction, Right: FSE T2-weighted images