Evaluation of Cystic Ovarian Lesions in SSFP Diffusion Imaging

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Purpose
Diffusion-weighted magnetic resonance (MR) imaging reflects the mobility of water molecules in interstitial tissue. Echo-planar imaging (EPI) is mainly applied for brain diffusion imaging. But if we use EPI for pelvis, image distortion is caused by the susceptibility artifacts due to air, and strong chemical shift artifacts from fatty tissue occur. And the signal-to-noise ratio and spatial resolution with diffusion-weighted EPI are relatively low.

The purpose of this study is to evaluate the usefulness of steady-state free precession (SSFP) diffusion imaging of cystic ovarian lesions for analyzing the fluid contents.

Materials and Methods
37 patients with 61 ovarian cystic lesions were examined. 39 ovarian cystic lesions were surgically removed and diagnosed by pathological examination. These lesions were: 1 serous cystadenoma, 6 serous cystic tumor of borderline malignancy, 1 serous cystadenocarcinoma, 13 mucinous cystadenoma, 2 mucinous cystadenocarcinoma, 16 dermoid cyst. And 22 lesions were endometrial cyst diagnosed by clinical manifestation and MR images.

MR imaging was performed with a superconductive 1.5 Tesla scanner (Vision, Siemens Medical Systems) using a phased-array coil. A phantom of pure water was placed adjacent to the body within imaging field of view. Axial and sagittal T2-weighted turbo spin-echo images (repetition time msec / effective echo time msec = 3500 / 100, echo train length 11) and axial T1-weighted spin-echo images (repetition time msec / echo time msec = 500 / 12) were obtained. And then we selected one slice in which cystic lesion was visualized in maximum size. On that slice, SSFP diffusion imaging (repetition time msec / echo time msec / flip angle = 30 / 1, 4, 8, 12 / 50°) was acquired within a breath-hold. Acquisition time of one slice was 15 seconds.

With the water phantom, we calculated the relative apparent diffusion coefficient of lesion (rADC_L) and that of subcutaneous fat tissue (rADC_F) using two images (echo time = 1 and 12). To standardized magnetic field strength for each patients, we compared rADC_L / rADC_F ratios among the various ovarian cystic lesions.

Results
rADC_L / rADC_F ratios (mean ± standard deviation) of each tumors were as follows: endometrial cyst (EM), 1.156±0.060; serous cystic tumor (SCY), 1.344±0.127; mucinous cystic tumor (MCY), 1.341±0.117; cystic part of dermoid cyst (DCY), 1.585±0.112; fat part of dermoid cyst (DF), 1.089±0.087. And the means of rADC_L / rADC_F ratios were significantly different between in EM and in SCY, in EM and in MCY, in EM and in DCY, in SCY and in DF, in MCY and in DCY, in DF in MCY and in DCY (p < .01). But the means of rADC_L / rADC_F ratios were not significantly different between in SCY and in MCY.

Conclusion
SSFP diffusion imaging may provide us the information of contents of cystic ovarian lesions. In some serous tumors, hemorrhage was identified on T1-weighted image, and confirmed at operation. We suspect this was the reason that means rADC_L / rADC_F ratios were not significantly different between in MCY and in SCY. But the means of rADC_L / rADC_F ratio of DCY was significantly higher than that of other lesions. This indicates the possibility to differentiate MCY from SCY using SSFP diffusion imaging.

Distribution of rADC_L (Lesion) / rADC_F (Fat) Ratio

![Distribution of rADC_L (Lesion) / rADC_F (Fat) Ratio](image-url)