Assessment of the Treatment Response of Uterine Cancer using Double-Echo Dynamic Perfusion-weighted MRI

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Purpose: Perfusion-weighted MRI (PWI), which provides blood volume information, allows us to evaluate treatment response, especially in brain tumors. In the case of uterine cancer, volumetric visual inspection is usually performed. We hypothesized that PWI could be used to assess treatment response of uterine cancer.

Materials and Methods: Six patients with uterine cancer were evaluated twice: before and after 2 courses of chemotherapy. Three patients had cervical cancer (squamous cell carcinoma: N=2, and adenocarcinoma: N=1), and 3 patients had endometrial adenocarcinoma. PWI was performed on a 1.5T MR scanner using a double-echo gradient-echo sequence to obtain a T1-bias-free estimate of the time-concentration curve. The relative tumor blood volume (rBV) was calculated in accordance with a first-pass compartment model. In addition, tumor sizes were estimated by summing the tumor areas on T2-weighted FSE axial images before and after chemotherapy.

Results: In the quantitative analysis, rBVs ranged from 0.11 to 0.31 (0.25 ± 0.08: mean ± SD) before therapy. After 2 courses of chemotherapy, rBVs decreased significantly in all cases (range 0.08 to 0.25, mean 0.18 ± 0.06, $p<0.05$) (Fig.1). As shown in Fig 2, the reduction of tumor blood volume was clearly demonstrated on rBV maps. The reduction rate of rBV and reduction rate of tumor size showed significant correlation ($r^2=0.75$, $p<0.05$).

Conclusions: The reduction in blood volume of uterine cancer after chemotherapy was clearly demonstrated by PWI. Further, the reduction rate of rBV significantly correlated to that of tumor size. Thus, our results suggest that the reduction rate of rBV can be used as a quantitative index for evaluating the effectiveness of therapy in uterine cancer.

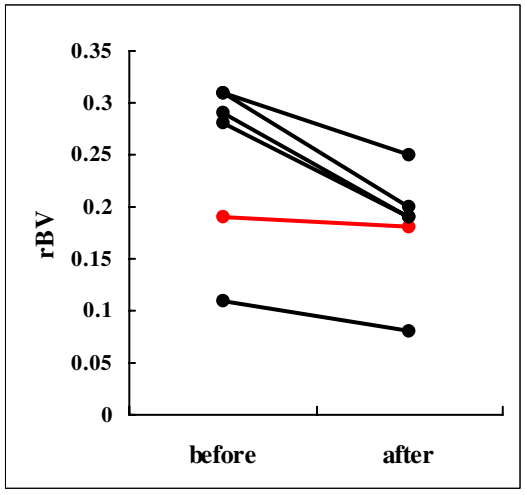

Fig.1 rBV values before and after 2 course of chemotherapy are plotted. After 2 courses of chemotherapy, rBVs significantly decreased in all cases ($p<0.05$). The case (red) showing the smallest rBV change in this figure also showed the smallest change in tumor size.

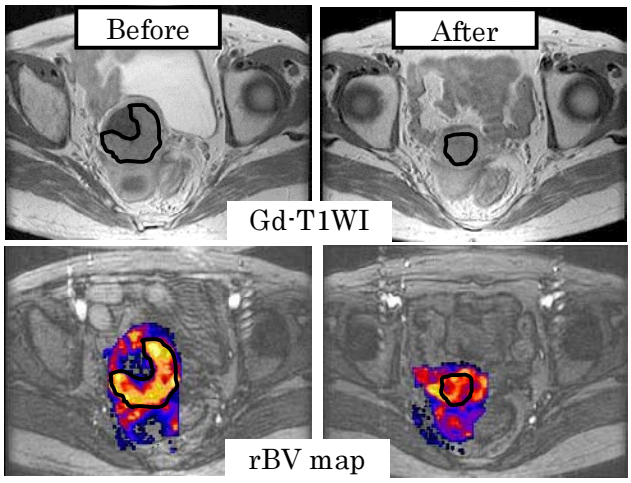

Fig. 2 Representative case of cervical cancer. The reduction of tumor blood volume is clearly demonstrated on rBV maps. Note that the textures of tumors on rBV maps are more heterogeneous than those on SE images.