Feasibility of Diffusion-weighted MR Imaging and ADC map to predict necrosis of uterine fibroids during MR Imaging-guided Focused Ultrasound Surgery

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PURPOSE

At the time of minimum invasive treatment of MR Imaging-guided Focused Ultrasound Surgery (FUS), as only a small range of around 5 x 5 x 30mm can be treated by one sonication, many sonications are necessary to treat uterine fibroids. So, it is important to decide the end point of the treatment. Gd-DTPA enhanced T1-weighted MR images are useful to detect necrosis after treatment, however, sonication after contrast enhancement have some risk to deposit free gadolinium in the tissue. Therefore, if there are some reliable method without contrast during treatment, it is very helpful to decide end point of the treatment. The purpose of this study is to evaluate the feasibility of Diffusion-weighted MR Imaging in the prediction of necrosis of MR Imaging-guided FUS for Uterine Fibroids.

METHOD AND MATERIALS

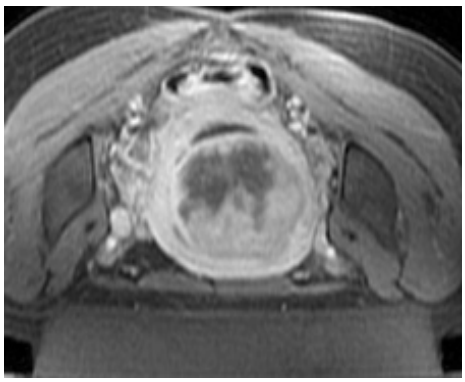
76 patients (mean age 44.0 years old, range 30-60) with symptomatic uterine fibroids, who underwent treatment with MR Imaging-guided FUS (ExAblate 2000 system, InSightec co, Israel), were included in this study. Diffusion-weighted MR images were obtained before and after FUS treatment (b=0 and 500 sec/mm2, FOV 38cm, 7mm slices, matrix 128x160, TR/TE 4000/69.5ms, BW 169kHz, NEX=7). The studies were performed on a GE Echo Speed Excite 1.5T scanner (Milwaukee, WI). After the treatment, Gd-DTPA enhanced T1-weighted imaging was performed to evaluate necrotic lesion. Apparent diffusion coefficient (ADC) map was generated from the diffusion-weighted images for analysis and was compared with Gd-DTPA enhanced T1-weighted images.

RESULTS

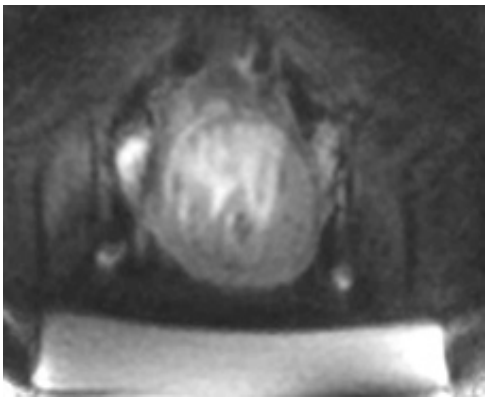
Mean ADC value of fibroids was 1.58 E-3 mm2/sec (range 1.30 E-3 to 1.95 E-3 mm2/sec) before treatment. The necrotic area after treatment, corresponding to non-enhanced area on Gd-DTPA enhanced T1-weighted images, increased to 1.70 E-3 mm2/sec (range 1.39 E-3 to 2.10 E-3 mm2/sec). On the other hand, non-treated area with enhancement of Gd-DTAP showed no increase of ADC.

CONCLUSIONS

Diffusion-weighted MR Imaging might predict necrosis of uterine fibroids during MR Imaging-guided FUS, instead of Gd-DTPA enhanced T1-weighted images.



(a) Gd-DTPA enhanced T1-weighted images



(b) Diffusion-weighted MR images