Early experience of tumor detection and therapy response assessment in cervical cancer using advanced DWI in PET/MRI

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Objectives
Staging and surveillance of cervical cancer include MRI and PET/CT. Advanced stages are routinely treated with radio(chemo)therapy. Treatment-induced inflammation/edema can mimic/obscure residual or recurrent tumor, especially early after treatment. Restriction spectrum imaging (RSI) is an advanced diffusion-weighted MRI (DW-MRI) technique with potential to differentiate tumor from inflammation/edema by dividing the diffusion signal into separate compartments (slow to fast). The aim of this study was initial evaluation of RSI in cervical cancer detection pre- and post-radio(chemo)therapy.

Material and Method
Eight patients with cervical cancer stage ≥ IB2 were enrolled to undergo pre- and early post-therapy PET/MRI, post-therapy MRI at 3 months and PET/MRI at 6 months. A cervical cancer-specific four-compartment RSI model was used for generating the RSI maps, where C_1 and C_2 emphasize restricted and hindered diffusion whereas C_3 and C_4 reflect faster diffusion components. A combined C_1C_2 map was calculated. All examinations included RSI and were conducted with a PET/MR system. Preliminary visual assessment of RSI was compared to clinical evaluation of metabolic and morphologic tumor response from PET and conventional MRI, respectively. Inconclusive findings from 6-month conventional PET/MRI evaluation were supplemented by clinical examination and biopsy.

Results
Before treatment, tumors showed high signal and contrast in at least one of the C_1, C_2 and C_1C_2 maps. The tumor signal and contrast varied between patients. Four of eight patients had completed all examinations. None had residual tumor (complete morphologic and metabolic response) at 6 months, in line with RSI. One of these patients showed suspicious residual tumor on conventional PET/MRI and focal RSI signal at 6 months, where a biopsy concluded post-treatment reaction.

Conclusions
This preliminary study shows the potential of RSI for pre-therapy tumor detection with promise also for post-therapy assessment. Study completion, with further inclusion of patients, will elucidate this potential and any limitations.