Preliminary Results of Metabolic-flow relationship in primary cervical cancer: correlation of combined PET/Dynamic contrast-enhanced MRI

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Target audience: Radiologist, Oncologist, Gynecologist, and Medical Physicists.

Purpose
Worldwide, cervical cancer is the second most common cancer in women (after breast cancer), with more than half a million new cases diagnosed in 20051. Novel imaging techniques using magnetic resonance (MR) and positron emission tomography (PET) can facilitate time resolved spatial evaluation of biological characteristics (perfusion, permeability, cellularity, proliferation, oxygenation, and apoptosis) thereby serving as early surrogate biomarkers for prognosis and therapeutic response2. The purpose of this study was to correlate 18F-FDG-PET and dynamic contrast-enhanced (DCE) MRI metrics in the assessment of primary cervical cancer.

Methods
Six female patients (mean age 60.1 years, range 32–82 years) with initial diagnosis of cervical carcinoma were included to undergo 18F-FDG PET/DCE-MRI imaging protocol. Dynamic MRI data were used to calculate a range of parameters of tumor vascularity by using Dynamika Software (London, UK), and tumor 18F-FDG uptake (standardized uptake value, SUVmax, SUVmean, SUVpeak, total lesion glycolysis (TLG) was used as a metabolic indicator. Statistical analyses were performed to determine the relationships between metabolic (18F-FDG PET) and flow (DCE MRI) values.

Results
The mean tumor SUVmax, SUVmean, and TLG were 16.79 (range 2.4–26.1), 10.39 (range 3.86–19.3), and 481 (range 14.73–1394.9). The mean values for tumor initial rate of enhancement (IRE), maximum enhancement (ME), and AUC mean were 0.095 (range 0.036–0.127), 2.744 (range 2.24–3.016), and 600.16 (range 257–1067), respectively. There were no significant correlations between tumor SUV and tumor perfusion; SUVmean-IREmean (r=0.007), SUVmean-MEmean (r=0.015) and SUVmean-AUCmean (r=0.0001).

Discussion
The preliminary data from 18F-FDG-PET/DCE-MRI in cervical cancer are reported. 18F-FDG PET and DCE-MRI tumor measures of tumor metabolism and vascularity were not correlated in cervical cancer indicating a complex interaction between tumor enhancement characteristics and tumor metabolism.

Conclusion
The lack of correlation between tumor vascular, perfusion, and metabolic parameters suggests that both diagnostic techniques may provide complementary information. Further work is necessary to assess the value of combined PET and MRI for evaluating tumor pharmacodynamics in response to novel therapy and prognosis.

Figure 1 A. Scatterplots from 18F-FDG PET measures vs. DCE-MRI measures of the cervical tumor, with linear regression fit. B. Parametric maps derived from the same DCE-MRI dataset reflecting the Gadolinium behavior with maximum enhancement (ME), initial rate of enhancement (IRE), and area of under curve as well sagittal fused 18F-FDG/CT images of the initial staging of cervical tumor.

References