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

Omer Aras[1], Volkan Beylergil[2], Mark Hinton[3], Olga Kubassova[3], and Oguz Akin[4]
[1]Radiology, Memorial Sloan Kettering Cancer Center, New York, NY, United States, [2]Radiology, Memorial Sloan Kettering Cancer, NY, United States, [3]Image Analysis, London, United Kingdom, [4]Radiology, Memorial Sloan Kettering Cancer, New York, NY, United States

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 2005[1]. 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 response[2]. 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, SUV_{max}, SUV_{mean}, SUV_{peak}, 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 SUV_{max}, SUV_{mean}, 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; SUV_{mean}-IRE_{mean} (r=0.007), SUV_{mean}-ME_{mean} (r=0.015) and SUV_{mean}-AUC_{mean} (r=0.0001).

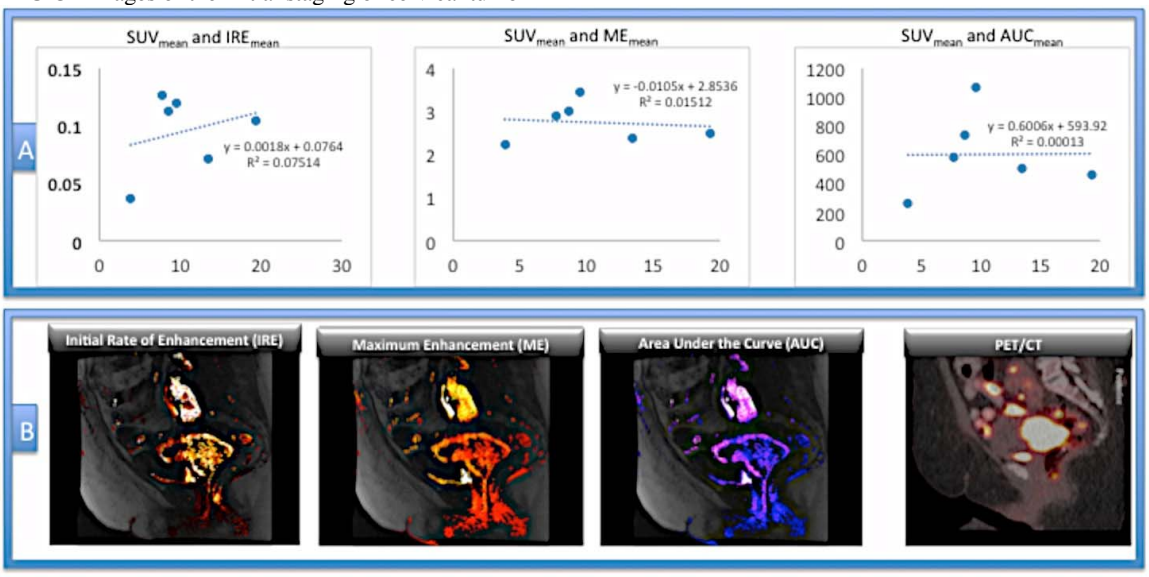
Discussion

The preliminary data from ^{18}F-FDG-PET/DCE-MRI in cervical cancer are reported. ^{18}F-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 ^{18}F-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 ^{18}F-FDG/CT images of the initial staging of cervical tumor.



References

1- WHO: Comprehensive cervical control. A guide to essential practice. WHO, Austria, 2006.
2- Barwick TD, Taylor A, Rockall A. Functional Imaging to Predict Tumor Response in Locally Advanced Cervical Cancer. Curr Oncol Rep. 2013 Oct 11