

Multi-modality imaging of tumor phenotype and response to therapy

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Imaging and radiation oncology have historically been closely linked. However, the vast majority of techniques used in the clinic involve anatomical imaging. Biological imaging offers the potential for innovation in the areas of cancer diagnosis and staging, radiotherapy target definition, and treatment response assessment. Some relevant imaging techniques are FDG PET (for imaging cellular metabolism), FLT PET (proliferation), CuATSM PET (hypoxia), and contrast-enhanced CT (vasculature and perfusion). Here, a technique for quantitative spatial correlation of tumor phenotype is presented for FDG PET, FLT PET, and CuATSM PET images. Additionally, multimodality imaging of treatment response with FLT PET, CuATSM, and dynamic contrast-enhanced CT is presented, in a trial of patients receiving an antiangiogenic agent (Avastin) combined with cisplatin and radiotherapy. Results are also presented for translational applications in animal models, including quantitative assessment of proliferative response to cetuximab with FLT PET and quantification of vascular volume with a blood-pool contrast agent (Fenestra). These techniques have clear applications to radiobiological research and optimized treatment strategies, and may eventually be used for personalized therapy for patients.