AbstractID: 9895 Title: Functional treatment planning using PET/CT Imaging

PET imaging has been incorporated into 3D-RTP recently, to provide a way to locate the most rapidly metabolizing portions of the tumor mass, and to detect unsuspected metastases. Combining PET and CT, means that functional information about tumor metabolism, is joined to the superior anatomic resolution and edge definition of CT for improved definition of the CTV. In addition the CT provides information for the delineation of radiation sensitive organs and bony landmarks essential for treatment planning process.

Prior to the introduction of PET/CT combined units, PET data for 3D-RTP had to be fused to the CT images, using a computer algorithm that mathematically matched the images. Since the images were obtained at different times, often days apart, the fusion was often imperfect, because of differences in patient set-up and even differences in position, shape, size of major organs and tumors. The combined PET/CT scanners eliminate the image registration process, since the images are acquired in the same imaging session. This facilitates accurate delineation of both anatomical and physiologic CTV's into the treatment planning computer and immediate access to those CTV's by the referring radiation oncologist.

We are now beyond hyper-metabolic tissue characterization using ^{18}FDG-PET and incorporation of this information into functional treatment planning. In an era of molecular imaging, new tumor markers are under development which will allow non-invasive imaging of tumor biology. One important example are PET radiotracers which localize within tumor hypoxia providing the opportunity to visualize and localize radioresistant tumor cell populations and thereby to selectively target these using IMRT. Other areas of interest are to investigate various selective tumor-targeting agents, such as antibodies, peptides, and gene imaging. Technological advances, such as ability of acquiring gated PET scans, will improve the accuracy of CTV . Once the target cells are identified, heterogeneity of tracer distribution in the target may lead to generation of complex plans, in which the dose prescribed to sub-regions of a tumor takes account of local variations in tumor biology. With advances in computer and biotechnology, in the near future, it may be possible to give a cocktail of tracers to the patients so as to generate multi-dimensional information, to further improve the radiobiological characterization of the target volume for consideration in the radiation therapy planning.