

AbstractID:9061 Title : Dosimetric differences for dose painting, based on SUV or K_{FLT} -PET imaging

Purpose:

One of the most important properties for biologically-based radiotherapy (dose painting) is accurate definition of the treatment target. Here we investigate consequences of non-uniform dose escalation based on proliferative response, when the treatment target is defined on FLT-PET's standardized uptake values (SUV) as opposed to the parametric image parameters K_{FLT} obtained through compartmental modeling.

Methods and materials:

Patients were imaged with FLT-PET before the start and after one to two weeks of radiation therapy. The SUV images and K_{FLT} parametric images were calculated from dynamically acquired PET data. Mid-therapy images were co-registered with pre-treatment images, and ratios of mid-treatment to pre-treatment SUV or K_{FLT} images were calculated. These ratios were connected to spatially-dependent radiosensitivity according to the linear-quadratic survival model. The two continuous voxel-based dose painting treatment plans were compared to each other and to the uniform dose escalation treatment plan.

Results:

Calculated SUV and K_{FLT} images show similar, although distinctively different visual patterns. Ratios of SUV or K_{FLT} images show increased spatial heterogeneity compared to the original images. Correlation of the ratio images is comparable to the correlation of individual SUV or K_{FLT} images. Dosimetric evaluation of the plans revealed that approximately 25% of the target volume received more than 10% different dose for the SUV ratio prescription compared to the K_{FLT} ratio prescription. On the other hand, the SUV ratio dose painting plan was clearly superior to the uniform dose escalation plan where over 75% of the target volume received more than 10% different dose.

Conclusion:

Dose painting using the prescriptions based on SUV or K_{FLT} lead to significantly different treatment plans; however, their differences are smaller than the difference to the uniform dose escalation. These differences warrant careful clinical investigation to establish superiority of either prescription.