

AbstractID: 7590 Title: Dosimetric Comparison of 4D and 3 Multi-phase CT Imaging for Stereotactic Body Radiation Therapy (SBRT) Planning in Lung Cancer

To explicitly include organ/target motion in treatment planning and delivery, we have used 4D CT and a multi-phase CT images, respectively, to assist planning target volume (PTV) definition in treatment planning for lung cancer patients. The purpose of the study is to compare the geometric and dosimetric differences for SBRT.

Consented patients underwent CT simulation consisting 1 set of 4D images, in addition to 3 sets of CT scanning taken under free-breathing and maximum inspiration and expiration breath-holding conditions. A PTV_4D was created from the target delineated on the reconstructed 4D images by applying 3 mm margin, while the PTV_3CT was generated based on a composited gross tumor volume delineated from 3 sets of multi-phase images after image registration. The target volumes were compared between the two approaches. To study the dosimetric impact, we have further compared these targets coverage for the plans designed for either the PTV_4D or PTV_3CT. The dosimetric parameters studied include D_{95} and D_{99} (dose received by 95% and 99% of the volume), and V_p (the volume encompassed within the prescribed dose surface).

For all patients studied, it was found that the PTV_3CT was larger than the PTV_4D, due to larger composited GTVs from multi-phase images. The geometric center of the mass between the two types of PTV is small (less than 3 mm). As a consequence, the coverage for the PTV_4D was almost unchanged (with the maximum differences of 1.2% for D_{95} and 4.3% for V_p). However, the coverage for the PTV_3CTs under the plan designed for the PTV_4Ds was affected noticeably. The maximum differences are 6.2% for D_{95} , and 7.1% for V_p .

The multi-phase CT scanning appears to over-estimate tumor motion, resulting in larger PTVs. Adequate coverage of lung tumors based on patient-specific tumor motion can be obtained without the aid of 4D CT.