AbstractID: 13948 Title: Sparing of lung function using perfusion SPECT guided IMRT treatment planning for lung cancer patients

Purpose:

To develop a method for improving functional lung sparing utilizing perfusion SPECT information and Monte Carlo (MC) dose calculation in IMRT optimization of lung cancer radiotherapy.

Methods and Materials:

99mTc-macroaggregated albumin (MAA) SPECT scans were acquired before radiotherapy (RT) for five non-small cell lung cancer patients treated with RT (60Gy / 30 fx). Perfusion SPECT images were reconstructed with attenuation, scatter correction and rigidly registered with planning CT afterwards. Beamlets generated from MC simulation were incorporated into direct aperture optimization (DAO) of static gantry step and shoot IMRT treatment planning.

For each patient, three RT plans were generated.

1. Clinical plan: 3D-CRT plan generated in vendor's software which is clinically delivered.

2. DVH driven plan: IMRT plan generated using DAO and MC dose calculation without SPECT guidance. Conventional DVH constraints for targets and OARs were used in the treatment planning,

3. SPECT driven plan: IMRT plan generated using DAO and MC dose calculation with SPECT guidance. SPECT weighted mean dose (SWMD) and Equivalent uniform dose (EUD) constraints were incorporated into the objective function. SWMD constraints were applied to ipsilateral and contralateral lungs respectively as the metric of lung function sparing. EUD was adopted to optimize planning target volume (PTV) dose coverage.

Results:

1. Compared to clinical plan, same target dose coverage was achieved in both DVH driven and SPECT driven plans. 95% iso-dose line covered more than 97% of PTV in both plans.

2. Compared to DVH driven plans, in SPECT driven plans, V5 and V20 were reduced by ~8% and ~3% respectively, SWMD were reduced by ~1Gy. Thus superior sparing of both lung function and volume was achieved.

Conclusion:

Comparing to conventional DVH driven IMRT plans, superior lung sparing of both anatomical and functional volumes can be achieved in SPECT driven IMRT planning based on EUD and SWMD.