AbstractID: 7056 Title: Respiration induced abdominal organ motions and anatomic changes: indications for gated radiation therapy

Purpose: To quantify respiration induced organ motions and anatomic changes for organs at abdomen and to estimate benefits of gated radiation therapy in terms of dosimetry parameters and the normal tissue complication probability (NTCP).

Method and Materials: The 4DCT datasets for ten patients with respiratory diaphragm motion larger than 1 cm were selected to analyze. The 4DCT datasets consist of CT sets of ten phases within each respiratory cycle. Various abdominal tumors and structures such as liver, pancreas, spleen and kidney were contoured on individual phase CT sets. Respiration induced motion and variations in organ volumes and centroid positions of these structures were studied by comparing their contours of different breathing phases. The study was performed for all respiratory phases (non-gating) and for selected phases (gating). The magnitudes of the tumor respiratory motion under both gating and non-gating conditions were used to determine margins for the planning target volumes (PTV). Representative 3D conformal radiotherapy dosimetry plans were generated with or without gating. Dose volume histograms (DVHs) for these organs were calculated and compared. The normal liver DVHs were used to estimate the NTCP based on the Lyman model.

Results: It is found that, unlike organs in thorax, the structures in abdomen show negligible changes (<3%) in their volumes during respiration, while their centroids vary during the breathing. The DVHs from the treatment plans of liver tumor indicate that the gated delivery results in substantial sparing of normal tissues in abdomen. The gated delivery leads to significant reduction in NTCPs for the normal liver and other abdominal structures.

Conclusion: Respiration induced volume changes for abdominal structures are negligible. The gated treatment reduces radiation doses to normal tissues thus reduces NTCP.