AbstractID: 4778 Title: Cardiac Dose Heterogeneity and Relationship to Tumor Location in Patients Receiving Radiation for Lung Cancer

Purpose: To assess dose heterogeneity to subregions of the heart (e.g. four chambers), and its relationship to tumor location in patients irradiated for lung cancer.

Methods and Materials: 236 patients receiving 3D-planned radiotherapy for lung cancer from 1991-2005 were retrospectively analyzed. Pre-treatment CT planning images were segmented to define the whole heart, four cardiac chambers, and aortic root. For each patient, the mean dose to the heart and each cardiac subregion was calculated, reflecting tissue density inhomogeneities. Population average of those doses, their differences, and 95% confidence intervals were computed. Patients were divided into subgroups based on tumor location (left vs right, superior vs inferior, and central vs peripheral). Differences between subgroups were assessed using Student t-tests.

Results: Mean doses to the whole heart and each subregion are shown in Figure 1. Compared to the mean heart dose (the parameter typically considered in treatment planning), atrial doses are higher (11Gy for left and 3Gy for right), ventricular doses are lower (9Gy for left and 5Gy for right), and aortic root dose is 23Gy higher. Table 1 shows the impact of tumor location on cardiac subregional dose heterogeneity. Dividing patients into superior versus inferior lung tumors changes the dose to most subregions. Similarly, dividing patients into central versus peripheral tumors leads to dose changes in several subregions, but only for peripheral tumors. Dividing patients into left versus right lung tumors only changes the dose to one subregion.

Conclusions: Doses to cardiac subregions are significantly different than mean dose to the whole heart. Treatment planning using DVH of whole heart does not adequately portray doses to cardiac subregions, which have distinct functions in cardiac physiology. DVHs inherently discard all spatial information and may be suboptimal to describe exposures to heterogeneous organs such as the heart.

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