

AbstractID: 9027 Title: Characteristics of motion induced dose reduction for prostate cancer in proton therapy

Purpose: To quantify proton radiotherapy dose reduction in the prostate target volume due to the three-dimensional movement of the prostate based on an analysis of dose-volume histograms (DVH).

Method and Materials: Twelve prostate cancer patients were scanned in a supine position and a target contour was delineated for each using a proton treatment planning system. To simulate target movement, the contour was displaced from 3 mm to 15 mm in 3 mm intervals in the superior to inferior (SI), inferior to superior (IS), anterior to posterior (AP), posterior to anterior (PA), and left to right (LR) directions.

Results: For both intra- and interfractional movements, the average coverage index and conformity index of the target were reduced in all directions. For interfractional movements, the magnitude of dose reduction was greater in the LR direction than in the AP, PA, SI and IS directions. While the reduction of target dose was proportional to the magnitude of intrafractional movement in all directions, a proportionality between dose reduction and the magnitude of interfractional target movement was clear only in the LR direction. Like the coverage index and conformity index, the equivalent uniform dose (EUD) and homogeneity index showed similar reductions for both types of target movements.

Conclusion: Small target movements can significantly reduce target proton radiotherapy dose during treatment of prostate cancer patients. Attention should be given to interfractional target movement along the longitudinal direction since image guided radiotherapy may be ineffective if margins are not sufficient.