Dosimetric consequences of the application of off-line setup error correction protocols and a hull-volume definition strategy for intensity modulated radiotherapy of prostate cancer.

Abstract:

PURPOSE: To evaluate the consequences of a planning volume definition based on multiple CTs and the application of off-line setup error correction for the treatment of prostate cancer with intensity-modulated radiotherapy (IMRT). Further, to compare various setup correction protocols (SCP) by their influence on the average dose distributions.

MATERIALS AND METHODS: A planning target volume (PTV) consisting of the bounding volume of prostate contours of five CTs (CTV_hull) plus an additional margin of 5mm and a virtual Rectum_hull volume (the solid bounding volume of the five corresponding rectum contours) are used for treatment planning. Simulations of treatment courses with the non-parametric bootstrap method allow to estimate the distribution of the expected equivalent uniform dose (EUD). The impact of off-line setup error correction protocols is evaluated based on estimated EUD distributions.

RESULTS: Off-line SCP allow to achieve the intended prostate and rectum EUD and a reliable coverage of the CTV despite the reduced margins. The EUD of the virtual hull volumes is a good estimate for the EUD of prostate and rectal wall.

CONCLUSION: Treatment planning based on Rectum_hull and CTV_hull plus setup margin as PTV in combination with SCP results in a
robust and safe IMRT planning concept.