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Ebrt Of Prostate Cancer: Does Rectal Spacer Application Show Influence On Inter- And Intrafraction Prostate Mobility?

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Abstract : Purpose/Objective(s):In EBRT of prostate cancer, safety margins can be reduced by the means of interfractional correction following IGRT, hence reducing doses to organs at risk. An innovative method for further rectal dose reduction was successfully introduced by spacer materials injected between prostate and rectum. Aim of the study was the investigation of the spacer's influence on inter- and intrafractional movements of the prostate.

Materials/Methods: In a prospective matched-pair comparison, eight patients were investigated up to now. In all of them, four gold marker fiducials were implanted perineally into the prostate under endorectal sonographic guidance. Four of the patients additionally received a rectal spacer consisting of 10 ml polyethyleneglycol (PEG) hydrogel. Fiducials were used to determine translations and rotations of the prostate. During 7 field IMRT, we captured MV portal images on the fly and registered them by means of a panel flex correction procedure. 2D marker positions were automatically detected by means of a marker kernel convolution algorithm. 3D marker positions were reconstructed from two oblique projections. Daily analysis of first pair of MV images (gantry angles 220° and 265°) was done to determine interfractional movements. Intrafractional movements were derived from shifted marker positions in the last pair of MV portal images (gantry angles 95° and 140°). The time gap in between the two reconstructions was 4.4 min on average.

Results: 884 images gained during 221 fractions (supine, flat couch, knee support, comfortably full bladder, empty rectum, no intraprostatic marker migrations >2 mm of more than one marker) were analysed: 95 fractions in the spacer group and 126 fractions in the control group, respectively. Interfractional 3D vector translations and L-R rotations were found to be 9.4 +/- 4.5 mm / 5.5° +/- 6.4° with spacer, 7.5 +/- 3.5 mm / 2.2° +/- 2.9° without spacer, respectively.(mean of means). Intrafractional movements were 1.9 +/- 2.1 mm / 2.3° +/- 2.7° in the spacer cohort, 1.9 +/- 1.1 mm / 2.0° +/- 2.8° in the control cohort. Differences were statistically not significant.Our findings compare to previously published 9.3 +/- 4.4 mm / 5.3° +/- 4.9° inter- and 3.0 +/- 3.7 mm / 2.5° +/- 2.3° intrafractional movements of 39 patients / 833(1013) fractions without spacer. Distensions of the anterior rectal wall could successfully be provided in all spacer patients. Spacers so far did not show a stabilizing effect on motion degree and direction between and during treatment fractions. Both cohorts will be completed to a sample size of 20 each.

Conclusions: Whereas spacer application leads to a significant dose reduction in the anterior rectal wall, inter- and intrafractional mobility of the prostate was not affected, which has to be taken into account in safety margin design.