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Conformal boost technique with 7 fields for the treatment of prostate cancer

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Background: We used rotational conformal radiotherapy with two axes technique (2ARCRT) for the treatment of prostate cancer to make the concave dose distribution sparing the rectum before. We report the static 7-field conformal radiotherapy techinique (7FSCRT) newly developed and currently used at our institution comparing with 2ARCRT. Material and methods: After the 44 Gy of radiation with 4-field box technique, the boost dose of 26 Gy with less field margin is delivered to the total dose of 70 Gy for the curative intent radiotherapy of localized prostate cancer. We currently use 7FSCRT for this boost therapy which is combination of wedge filter and field arrangements with various degree of rectum block. The equivalent uniform doses (EUDs) for the target and normal tissues were calculated in actually treated 30 cases to evaluate the dose distributions.
Results: It is necessary to delineate two hypothetical target volumes in addition to the real one for the planning of 2ARCRT. We need to change the contour of the hypothetical target for modification of the dose distribution and it was time-consuming to make a sufficient treatment plan. It is easier to develop a 7FSCRT plan using template function and only minor change in several fields is required to optimize dose planning. The mean EUDs for the target, the rectum, and the bladder were 70.1, 54.7, 58.8 Gy in 8 cases treated with 2ARCRT and 70.9, 51.9, 60.9 Gy in 10 treated with 7FSCRT, respectively. While the rectum dose was smaller, the bladder dose was larger in 7FSCRT cases due to development of hot spots in the bladder volume. We refined the arrangement of wedge filter and beam angle of some fields, then EUDs for the three volumes were 70.2, 50.9, 55.6 Gy, respectively, in recently treated 12 patients with 7FSCRT.
Conclusions: This newly developed and refined 7FSCRT is useful technique for the institution in which IMRT is not available.

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Effectiveness and side effects of conformal radiation therapy after radical prostatectomy for prostate cancer

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Background: To evaluate biochemical recurrence free survival (bNED) and side effects of postoperative conformal radiation therapy (CRT) for prostate cancer.
Material and methods: 188 patients received postoperative CRT between 3/94–12/00. Median follow-up was 37 months (12–104 months). Treatment indication: adjuvant/additive: 122 patients (aCRT; med. dose: 59.4 Gy; 50–66.6 Gy); rising PSA after radical prostatectomy (RP): 41 patients (bCRT; 64 Gy; 59.4–66.6 Gy) and clinically overt local recurrence: 25 patients (lCRT; 66 Gy; 60–70 Gy). A biochemical recurrence (bREC) after CRT was defined as a post-nadir PSA rise above 0.2 ng/ml. Scoring of side effects: CTC (acute) and modified RTOG (chronic).
Results: The bNED at 3 years after CRT was 62%. The following variables were associated with bNED in multivariate analysis (3-year-bNED): treatment indication (aCRT: 70% vs. bCRT: 53% vs. lCRT: 36%); Gleason Score (2–6: 84% vs. 7–10: 53%); PSA prior to surgery (⩽10: 70% vs. >10–50: 64% vs. >50 ng/ml: 0); PSA Nadir after surgery (⩽1: 64% vs. >1 ng/ml: 41%); PSA immediately prior to CRT (⩽1: 70% vs. >1 ng/ml: 41%). Patients with bREC had a higher incidence of metastasis (at 3 years: 18% vs. 0%, p<0.0001), a lower disease specific survival (93% vs. 100%, p = 0.0006) and a lower overall survival (88% vs. 99%, p = 0.0001). No. grade IV or V acute or late side effects were observed. Chronic urologic side effects: II: 19.5%; III: 3.5%; intestinal: II: 21.1%; III: 0.5%.
Conclusions: With regard to bNED salvage CRT after RP is less effective than adjuvant/additive CRT despite of higher doses applied to the prostatic bed. A post nadir increase of the PSA above 0.2 ng/ml was highly predictive for metastasis, disease specific- and overall survival. CRT after RP is well tolerated with an incidence of chronic grade III toxicity below 5%.

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Planning target volume margins for prostate radiotherapy using daily electronic portal imaging and implanted fiducial markers

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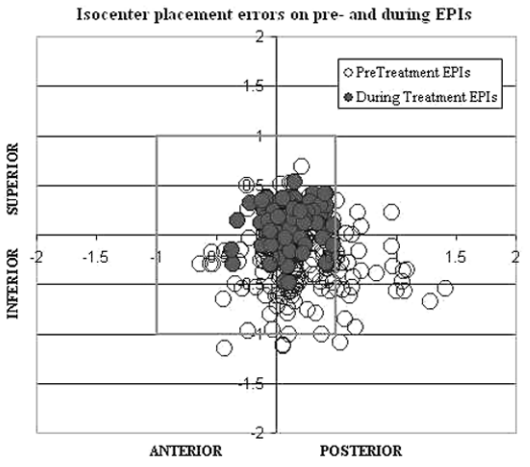
Background: In prostate cancer RT, the risk of geographic miss can be lessened by the placement of fiducial markers in the prostate, with daily pre-treatment electronic portal imaging (EPI) and adjustment of patient position if necessary. It is unknown how large the planning target volume (PTV) margins must then be to account for the isocenter correction tolerance and intra-fraction motion.
Materials and methods: Twelve patients participating in a study of hypofractionated RT for localized prostate cancer (55 Gy/16 fractions in 4 wks) underwent implantation of 3 gold markers into the prostate, followed by RT planning using 3DCRT or IMRT. PTV margins were 10 mm in all directions except posteriorly (5 mm). Daily orthogonal pre-treatment EPIs of the target were taken from the anterior and lateral directions, and the isocenter position was determined by comparing the position of the gold markers on the EPIs with reference planning images (DRRs), using the anatomy matching feature of Varian Vision® software. Patient position was adjusted if there was a discrepancy larger than a correction tolerance level of 2.9 mm in the right-left (R-L) and superior-inferior (S-I) directions, or 1.9 mm in the anterior-posterior (A-P) direction. EPIs were then repeated during treatment. The difference between pre- and during-treatment isocenter positions, after subtracting any correction, was used to estimate intra-fraction motion of the target. The treated isocenter position, as estimated by the "during-EPI", was also compared with the DRR.
Results: The maximum intra-fraction motion (standard deviation) in cm in the R-L, A-P and S-I directions was 0.55 (0.15), 0.40 (0.14) and 0.59 (0.15) respectively. After any necessary isocenter corrections, the maximum isocenter placement errors relative to the DRR (standard deviation) in cm in the R-L, A-P and S-I directions were 0.49 (0.17), 0.48 (0.16) and 0.53 (0.19). The isocenter position relative to the DRR on pre- and during EPIs for all patient treatments is shown in the figure, with the box representing the PTV margins used in the protocol.



Conclusions: With the use of daily EPIs and the correction protocol described above, the target was in all cases covered by the PTV margins that were used, with maximum sparing of the rectum. While the anterior, L-R and S-I PTV margins of 1.0 cm appear over-generous, they may be justifiable to account for contouring uncertainty and/or microscopic disease extension.