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**Optimal treatment parameters for left-sided whole breast cancer irradiation using TomoDirect**

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**Purpose or Objective:** To determine the optimum combination of treatment parameters between pitch, field width (FW) and number of irradiation fields for left-sided whole breast irradiation using static tomotherapy (TomoDirect™).

**Material and Methods:** 15 patients already treated with conformal radiotherapy for left-sided breast cancer without lymph nodes were selected for this study. A total of 180 TomoDirect™ plans were created by varying the field width (2.5 and 5 cm), the pitch (0.125, 0.250 and 0.5 cm/projection) and the number of irradiation fields (2 and 4). Modulation factor (MF) was set to 2 and dynamic jaws were not available. Prescribed dose was 50 Gy in 25 fractions without tumoral boost. Constraints were applied on the planning treatment volume (PTV) to ensure that 98% of the PTV receives at least 95% of the prescribed dose and 2% receives at most 107%. Treatment plans were assessed collecting Homogeneity Index (HI) for the PTV, mean doses (heart, ipsilateral and contralateral lung) and maximum dose (contralateral breast) for the organs-at-risk (OAR), integral dose that is respectively 95.72 ± 35.22 Gy.L for a FW = 2.5 cm and 105.3 ± 38.1 Gy.L for a FW = 5 cm. Keep in mind that breast size has an impact on dose homogeneity to the PTV, we separated the 15 patients into 2 cohorts of small (volume < 600 cc) and large (≥ 600 cc) PTV and compared HI.

**Results:** Modifying the pitch has no effect on either plan quality (PTV and OAR) or on irradiation time. Increasing the number of beams from 2 to 4 has no significant effect on OAR doses, but improves the HI of the PTV (0.068 ± 0.010 for 2 fields and 0.061 ± 0.011 for 4 fields) without altering significantly irradiation time (4.48 ± 1.27 min for 2 fields and 4.82 ± 1.30 min for 4 fields). Comparison of HI between small and large PTV shows that PTV volume has no significant effect on HI. Also, HI improvement does not depend on PTV volume, meaning that switching from 2 to 4 fields of irradiation is a good combination of treatment parameters for treating left-sided whole breast cancer with TomoDirect™ if dynamic jaws are available. If not the case, a field width of 2.5 cm is more suitable so that the integral dose to patients is lowered and radiation-induced secondary malignancies are minimized. This study will be completed by delivery QA to confirm that delivered doses match calculated ones.

**Conclusion:** While setting the modulation factor to 2, pitch value seems to have no impact on planning quality or on irradiation time. A field width of 5 cm with 4 field of irradiation is a good combination of treatment parameters for treating left-sided whole breast cancer with TomoDirect™ if dynamic jaws are available. If not the case, a field width of 2.5 cm is more suitable so that the integral dose to patients is lowered and radiation-induced secondary malignancies are minimized. This study will be completed by delivery QA to confirm that delivered doses match calculated ones.

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**HBR brachytherapy with hypofractionated EBRT for high risk prostate cancer**

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**Purpose or Objective:** From the biological aspects of prostate cancer, hypofractionated external beam radiation therapy (EBRT) or high-dose-rate brachytherapy (HDR-BT) has been considered as a treatment choice for prostate cancer to improve local control, especially for high risk disease because the alpha-beta ratio for prostate cancer was around 1.5-3 Gy, lower than that for other cancers. Therefore, the purpose of this study is to evaluate outcomes and toxicities of hypofractionated EBRT combined with HDR-BT for high risk prostate cancer.

**Material and Methods:** We retrospectively analyzed 111 patients with localized prostate cancer (T1-3N0M0) that was defined as high risk disease based on the D'Amico classification, which includes cases of stage T2c to T3b or those with Gleason score of 8 to 10 or prostate-specific antigen (PSA) greater than 20 ng/mL. All patients had received hypofractionated EBRT (45 Gy in 15 fractions every other weekday for 5 weeks) followed by HDR-BT (18 Gy in 2 fractions for one day) between June 1, 2007 and September 30, 2011 at our institution. Androgen deprivation therapy (ADT) consisted of 3 to 6 months’ neoadjuvant ADT before and during radiation therapy and 6 months’ adjuvant ADT after radiation therapy. Biochemical failure was defined as PSA nadir plus 2.0 ng/mL according to the Phoenix definition. We scored genitourinary (GU) and gastrointestinal (GI) toxicities based on the Common Terminology Criteria for Adverse Events Version 4, and calculated the rates of overall and biochemical-free survival using the Kaplan-Meier method, timed from the completion of the HDR-BT to death or earliest failure. Statistical analyses were performed by using SPSS software.

**Results:** During follow-up (median, 62 months; range, 4 to 99 months), 24 of 111 patients (21.6%) experienced biochemical failure (median, 41.5 months; range, 12.7 to 72.1 months). The rates of 5-year overall survival and biochemical-free survival were 99.0% and 80.3%, respectively. At the time of analysis, only 1 patient had died of other disease. Among 24 patients with biochemical failure, 1 patient developed bone metastasis, 2 patients developed pelvic lymph node recurrence, and 21 patients diagnosed with PSA failure alone. GU acute toxicity was Grade 1 or less in 99 patients and Grade 2 in 12 patients. GU late toxicity was Grade 1 or less in 108 patients and Grade 2 in 3 patients. GI toxicity including rectal bleeding was Grade 1 or less in 109 patients and Grade 2 in 2 patients.

**Conclusion:** The results of this study suggest that hypofractionated EBRT combined with HDR-BT can be feasible for high risk prostate cancer, although follow-up period is not long enough to get a definitive conclusion.

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**Feasibility of hippocampal sparing radiation therapy for glioblastoma using helical Tomotherapy**

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**Purpose or Objective:** With improvements in survival for good performance status patients with glioblastoma, some patients will survive to develop significant neurocognitive dysfunction. This retrospective planning study quantifies hippocampal radiation doses in twenty-five patients with glioblastoma receiving radical chemo-radiation therapy, and evaluates the potential for dose reduction using helical IMRT (Tomotherapy).

**Results:**
- While setting the modulation factor to 2, pitch value seems to have no impact on planning quality or on irradiation time. A field width of 5 cm with 4 field of irradiation is a good combination of treatment parameters for treating left-sided whole breast cancer with TomoDirect™ if dynamic jaws are available. If not the case, a field width of 2.5 cm is more suitable so that the integral dose to patients is lowered and radiation-induced secondary malignancies are minimized. This study will be completed by delivery QA to confirm that delivered doses match calculated ones.

**Conclusion:** The results of this study suggest that hypofractionated EBRT combined with HDR-BT can be feasible for high risk prostate cancer, although follow-up period is not long enough to get a definitive conclusion.