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POSTER SESSION

Radiotherapy

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Reduction of the irradiated boost volume by applying customized CTV-margins based on free resection margins in 6 directions

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Background and Aim: Several studies have suggested that CT-based localization of the boost volume is more accurate than clinically defined localization. However, these CT-based boost volumes seem to be larger than the clinically defined boost volumes, thereby possibly compromising cosmesis. The aim of this study was to determine the difference in irradiated boost volumes between treatment plans for CT-based PTVs (PTV-CT) and for clinically defined PTVs (PTV-clin), and to determine which factors were related to the irradiated volume.

Patients and Methods: PTV-CT and PTV-clin were delineated in 49 patients. The PTV-CT was outlined using strict guidelines, i.e. the CTV-CT was defined as the rim of tissue 1.5 cm around the original tumor. This meant that the tumor excision site was delineated and expanded with a margin of 1.5 cm, minus the minimal free resection margin. The resulting CTV-CT was expanded with 0.5 cm to the PTV-CT. The PTV-clin was delineated in the central plane, based on tumor size, clinical information, presence of clips and scar as visible on DRR. For 15 patients also a PTV-margin was defined, by applying customized CTV-margins taking into account all free excision margins in 6 directions as described in the pathology report.

For all 3 PTVs treatment plans were designed using 3 photon beams. The PTV-CT and PTV-margin were planned using conformal fields; the PTV-clin was planned using standardized rectangular fields.

Results: The mean volume receiving at least 95% of the prescribe dose (V95) for the PTV-CT based plan was 1.61 times larger than for the PTV-clin based plan: 237 cc vs 147 cc ($p < 0.001$). Nevertheless, the V95 of the PTV-clin was only 89% when irradiated with the plan for the PTV-CT. For the 15 patients with customized PTV margins, the V95 was similar to the V95 for the PTV-clin (175 cc vs 158 cc, N.S.). Multivariate analysis showed that size of the tumor was related to the V95 for the plan of the PTV-clin, whereas the volume of the excision cavity was significantly related to the V95 for the plan of the PTV-CT. Remarkably, the volume of the excision cavity was not related to whether the surgeon reported to have closed the excision cavity or not, but only to the time between surgery and CT.

Conclusions: The PTV-CT yielded a 1.61 times larger V95 than the PTV-clin. However, when customized margins were taken into account in 6 directions, the resulting V95 was similar to the plan for the PTV-clin.

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Comparison between brachytherapy and external beam boost in breast conserving therapy

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Background: To determine the impact of boost modality on long-term local tumor control and overall survival in breast conserving therapy for patients with stage I and II breast cancer.

Methods and Materials: All consecutive 615 patients treated from October 1989 to December 2000 with a boost as part of their breast conserving therapy were reviewed. Surgery consisted of a wide local excision and axillary node dissection in all. 50 Gy whole breast irradiation in 25 fractions was applied and if indicated the same dose was given to regional lymph node areas. The brachytherapy boost dose to the primary tumor bed was 15 Gy. In 169 cases a low dose rate boost (mean dose rate 80.5 cGy/hour) was applied, in 269 cases a pulsed-dose rate boost (9×167 cGy, office hour schedule). Intra-operative needle implantation was performed in 86.8% of the cases. 214 patients received an external beam boost consisting of 16 Gy in 2 Gy fractions with (median) 10 MeV electrons in 81% and 5 MV photons in 19%. In case of a microscopically incomplete excision an additional external beam dose of median 8 Gy in 4 fractions was applied in 15% of the brachytherapy patients and in 12% of the external beam group. Median follow-up was 8.4 years in the brachytherapy group and 7.2 years in the external beam group.

Results: There was no statistically significant difference in 7-year local recurrence free rate, being 93.7% (95% CI 91.2% to 96.3%) and 93.9% (95% CI 90.2% to 97.5%) in the brachytherapy and external beam group, respectively (log rank $P = 0.53$). The hazard ratio (HR) for local recurrence was 1.21 (95% CI 0.67−2.18), with brachytherapy as the reference group. When adjusting for potential confounders such as age (categorized into two groups: $\leqslant$45 years of age or older than 45), cT-stage and extensive intraductal component the HR increased to 1.38 (95% CI 0.75−2.53). Overall survival was not significantly different in both groups with a 7-year overall survival rate of 81.4% (95% CI 77.4% to 85.3%) and 83.1% (95% CI 77.5% to 88.7%) for the brachytherapy and external beam group, respectively (log rank $P = 0.77$).

Conclusion: In one of the largest comparative studies on boost modality there is no significant difference in local tumor control and overall survival with a median follow-up of 8.4 years for patients with stage I and II breast cancer who received breast conserving therapy.

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A feasibility study of the heart and lung 3-dimensional dosimetry in breast cancer patients who are treated with trastuzumab and radiation therapy

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Background: In this analysis, we studied the feasibility of a 3-dimensional (3-D) dosimetry study in breast cancer (BC) patients (pts) who were treated with local or (loco)regional radiation therapy (RT) and trastuzumab (T), since both can cause cardiac toxicity.

Patients and Methods: The BC pts were treated with RT and T (concomitantly (C) or sequentially (S)). The heart, including 3 coronary arteries (left anterior descending (LAD), right coronary (RCA), and circumflex (RCX) artery), left ventricle (LV), and septum, and both lungs were delineated. The dosimetry parameters were determined for all delineated structures using Pinnacle planning system (version 7.4). The toxicity was scored according to the Common Terminology Criteria for adverse events (version 3).

Results: Sixty-six BC pts (47 S and 19 C) were treated with 71 RT series (see table) to a median RT dose of 50 Gy. The median follow-up was 2 years. T was administered weekly in 85% (n = 56) of the pts, 3-weekly in 14%, and 2-weekly in 1.5%. The median baseline left ventricular ejection fraction (LVEF) was 0.64 (0.50−0.79), and the LVEF nadir during T was 0.57 (0.34−0.78). The median LAD dose was highest in left-sided local (7.9 Gy) and (loco)regional RT (19.8 Gy). The median RCA and RCX doses were moderately high in right- (4.9 Gy) and left- (4.5 Gy)-sided (loco)regional RT (see table). The median value of the mean lung dose was highest in right-sided (loco)regional RT (12.0 Gy). The toxicity in S versus C was similar, independent of the irradiated area.

Conclusions: It was feasible to perform a 3-D dosimetry study in BC pts treated with RT and T. The RT dose was highest in the LAD in patient irradiated with (loco)regional RT. The toxicity in S versus C was similar. A prospective study will be performed to determine whether concomitant treatment will increase toxicity compared to sequential treatment with RT and T.

Table: Median dose in Gy (range) in the heart and lungs

	Local RT		(Loco)regional RT	
	left-sided (n = 23)	right-sided (n = 21)	left-sided (n = 15)	right-sided (n = 12)
Heart	1.6 (0.6−9.8)	0.4 (0.1−0.7)	7.2 (2.7−12.0)	1.7 (0.4−8.2)
LAD	7.9 (0.3−32.0)	0.2 (0.1−0.5)	19.8 (8.0−24.9)	0.9 (0.2−3.1)
RCA	0.6 (0.4−10.0)	1.0 (0.2−1.3)	3.2 (0.6−9.9)	4.9 (0.9−27.3)
RCX	0.8 (0.3−5.9)	0.2 (0.04−0.3)	4.5 (0.4−9.0)	0.6 (0.2−2.1)
Septum	2.3 (0.2−18.1)	0.2 (0.1−0.6)	13.4 (3.6−19.9)	0.8 (0.2−1.5)
LV	0.2 (2.4−15.6)	0.2 (0.03−0.4)	9.4 (4.0−15.3)	0.6 (0.2−1.1)
Mean lung dose	3.0 (1.4−10.3)	3.1 (0.9−5.5)	8.4 (2.3−12.2)	12.0 (9.2−18.5)