local therapy in one session avoiding 3−6 weeks of post-operative therapy. This may be preferable to many women including those seeking breast-conserving surgery in the developing world and for women living in remote areas of the Western world.

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Late toxicity and long term results after partial breast irradiation with high-dose-rate brachytherapy: results from a phase II prospective study

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Background: radiation therapy aims at achieving disease control with a low risk of side effects. Here late toxicity and long term results are analyzed in patients who received partial breast irradiation (PBI) with high-dose-rate (HDR) brachytherapy after conservative surgery.

Materials and Methods: 4 Gy were administered twice daily in 8 fractions over 4 consecutive days to 96 patients (median age 65 years; range 49−84). Tumors included 79 infiltrating and 13 ductal in situ carcinoma. Median tumor size was 7 mm (range 2−18). Estrogen receptors were positive in 82 cases, progesterone in 61 and HER2 in 3; Ki-67 was overexpressed (>25%) in 14 and p53 (>20%) in 7. Implantation was intra-operative in 18 cases and post-operative in 78 (median time after surgery 8 weeks; range 4−12) with implant geometry being defined with pre-implant computed tomography (CT). In the last 82 patients treatment planning was CT-based. At a median of 24 (range 1−43) days after PBI 8 patients received adjuvant chemotherapy. In 1 case PBI was performed between the first and the second CMF cycles. Adjuvant hormone therapy was given to 77 patients.

Results: median V100 was 105 cm^3 (range 22.3–271), median V150 was 27 cm^3 (range 8.04–57.10), median V200 was 11.65 cm^3 (range 4.21–27.20), median DHI was 0.751 (range 0.612–0.810). At a median follow-up of 45 months (range 14−72) late side effects were breast pain in 1 case, teleangectasis in 13 (12 G1 and 1 G2), 2 sieromas, 8 liponecrosis (1 G1 e 7 G2), 9 subcutaneous fibrosis (8 G1 and 1 G2) and 1 G3 cutaneous fibrosis. Patients and the radiation oncologist judged cosmetic results as good or excellent in all cases except 1, judged as fair. Late toxicity occured in 4/8 patient who received chemotherapy: 1 (starting CMF 43 days after PBI) developed G2 teleangiectasia and G1 subcutaneous toxicity, 1 (starting CMF 6 days after PBI) developed G1 teleangiectasia, 1 (starting EC plus paclitaxel 24 days after PBI) presented G1 subcutaneous toxicity, 1 (starting FEC 31 days after PBI) presented G1 teleangiectasia, G2 subcutaneous toxicity, G3 cutaneous toxicity and liponecrosis. The 1st, 3rd and 4th patients were implanted during surgery. Two local relapses occurred. One (48 months after PBI) was in a different quadrant to the original tumor. The second (19 months post-PBI), in a patient with a previous superior internal quadrant, was very close to the mediosternal line. One patient with negative sentinel node developed axillary metastases 7 months after PBI. All relapsed patients are alive, the first 2 in NED, the 3rd with disease.

Conclusions: Our results demonstrate that PBI, administered with HDR brachytherapy, is associated with very low relapse and late toxicity rates. Late toxicity was higher in patients implanted during surgery, in whom the dose to the skin was >70% of the prescribed dose, which may account for the teleangectasis development. PBI-chemotherapy timing does not seem to affect toxicity.

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Can total lung volume increase predict the benefit in respiratory gated patients with left-sided breast cancer?

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Background: To investigate the proportion of left-sided breast cancer patients that may have an advantage of respiratory gated radiotherapy. To investigate whether the increase in lung volume can predict which patients have the highest benefit.

Materials and Methods: Twenty-one left sided-breast cancer patients, treated with radiotherapy on the breast alone were sequentially enrolled in this study. 18 patients underwent a non-gated CT-scan on the virtual simulator (Siemens Sensation Open™), followed by a CT scan using prospective gating (PG). To perform the PG CT-scan, the RPM system (Varian™) was used to record the patients breathing pattern and patients were audio-coached to breath deeply. A gated window was chosen in deep inspiration and by an automatic interface between the RPM system and the CT scanner, CT acquisition was triggered in this window. For 3 patients, only a non-gated (NG) CT scan was performed because coached breathing was too difficult or they were belly-breathers, these patients were excluded from the study. The clinical target volume (breast) and normal tissues (heart and lung) were delineated on both the NG and PG CT-scans. For each patient, a treatment plan was designed on both CT-scans, using an isocentric photon technique. Dose volume histograms were used to evaluate the normal tissue doses.

Results: For all patients (N = 18), a significant reduction in mean heart dose [3.1 Gy (NG) to 2 Gy (PG), $p < 0.0005$] and heart V30 [3.9% (NG) to 3.2% (PG), $p < 0.0006$] was achieved with respiratory gating. The total lung volume increased by 66% [2800 cm^3 (NG) to 4652 cm^3 (PG)]. Mean lung dose was comparable in both CT scans [3.1 Gy (NG) and 3 Gy (PG)] and V20 was the same (3%). Mean reduction in heart dose in all patients was 35%. 9 patients (50%) had an advantage in mean heart dose of >35% and were considered for treatment with respiratory gating. Patients that were selected for gated treatment based on an advantage for the heart, had a significant higher increase in total lung volume (87%) [2388 cm^3 (NG) to 4464 cm^3 (PG)] compared to patients not treated with gating (53%) [3130 cm^3 (NG) to 4802 cm^3 (PG)].

Conclusions: In this study, respiratory gating leads to a significant heart (>35%) sparing effect in 50% of left-sided breast cancer patients, irradiated on the breast alone. The patients with the highest increases in total long volume correlate with the patients which benefit most from the gated treatment.

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Is exclusive radiotherapy an option for early breast cancers with complete clinical response after neoadjuvant chemotherapy?

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Background: Neoadjuvant chemotherapy (NCT) emerged in the 1990s as a treatment option that challenged primary surgery for non-metastatic operable breast adenocarcinomas, especially when they were deemed too large to be treated by breast-conserving surgery. The study was designed to determine whether exclusive radiotherapy (ERT) could be an option after complete clinical response (cCR) to NCT for early breast cancers (EBC).

Material and Methods: Between 1985 and 1999, 1477 patients received NCT for EBC considered to be too large for primary conservative surgery. Of 165 patients with cCR, 65 were treated by breast surgery (with radiotherapy) and 100 by ERT.

Results: Median follow-up was 12 years. The two groups were comparable in terms of baseline characteristics, except for larger initial tumor sizes in the ERT group. There were no significant differences in overall, disease-free and metastasis-free survivals. Five-year and 10-year overall survivals were 91% and 77% in the no surgery group and 82% and 79% in the surgery group, respectively ($p = 0.9$). However, a non-significant trend towards higher locoregional recurrence rates (LRR) was observed in the no surgery group (31% vs. 17% at 10 years; $p = 0.06$). In patients with complete responses on mammography and/or ultrasound, LRR were not significantly different ($p = 0.45$, 10-year LRR: 21% in surgery vs. 26% in ERT). No significant differences were observed in terms of the rate of cutaneous, cardiac or pulmonary toxicities.

Conclusion: Surgery is a key component of locoregional treatment for breast cancers that achieved cCR to NCT.

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Single dose intra-operative radiotherapy for breast cancer patients where external beam radiation was not feasible − results after 3 years of follow-up

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Background: Intra-operative radiotherapy (IORT) with Intrabeam® (Carl Zeiss, Germany) has been used since 2000 in the international randomised TARGIT Trial to determine if there is equivalence between IORT and conventional external beam radiotherapy (EBRT) in women with early breast cancer. The primary endpoint is local recurrence. Some patients were unsuitable for inclusion in our trial for a number of reasons and were given IORT as a single treatment off-trial.

Materials and Methods: Patients with invasive breast cancer underwent wide local excision followed by IORT (n = 74). Low energy x-rays are