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Tangential breast irradiation: A comparison between 2D and 3D radiation therapy plans

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Purpose: To evaluate the difference between a simple radiation therapy (RT) plan utilizing a single contour and a more complex plan utilizing multiple contours, lung inhomogeneity correction and a dose-based compensator.

Materials and Methods: This is a prospective study of the RT plans of 12 patients with early breast cancer. All patients were considered for breast conserving management and treated by conventional tangential fields technique. Three RT plans were generated for each patient. The first RT plan utilized two wedges and was based on the patient contour at one C-T slice taken at the central axis. No lung inhomogeneity correction was introduced for this plan. The second RT plan was produced by using the treatment parameters obtained from the first plan to demonstrate the radiation dose distribution in the entire treatment volume after introducing a lung inhomogeneity correction factor. The third RT plan was generated by using the 3-D planning system to design a dose based compensator after lung inhomogeneity correction had been made. The same normalization point was used for the three plans and the end point of the study was the comparison between the volumes receiving $\geq$105% of the prescribed dose ($V \geq 105\%$) in the second and third RT plans.

Result: Patients separation ranged between 17–28 cm (median 20 cm) and breast volumes ranged between 270–2174 cm^3 (median 713 cm^3). The adoption of the dose-based compensator plans over the conventional wedge plans resulted in reducing the $V \geq 105\%$ between 40–94% (median 61%). The maximum volume hot spot for the compensator and wedge plan didn't differ significantly and ranged between 110–116% and 108–119% respectively.

Conclusion: Dose-based compensator plans reduced substantially the $V > 105\%$. The clinical significance of this dosimetric improvement remains to be seen.

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Intratumoral fluorouracil (5-FU) injectable gel as a potentiator of standard radiotherapy in patients with locally recurrent or advanced breast cancer

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Purpose: Use of 5-FU as a radiopotentiator has involved continuous intravenous administration with its attendant side-effects and inconveniences. A new site-specific intratumoral delivery system has been designed to provide high tumor drug concentrations for extended periods. 5-FU is formulated in a viscous aqueous gel using purified bovine collagen as a biodegradable carrier matrix. We examined the effect of dose and schedule of 5-FU gel on safety in patients receiving standard radiation therapy for locally advanced or locally recurrent breast cancer.

Methods: The ongoing Phase I/II study includes patients with breast or chest wall involvement who have indications for definitive doses of radiation therapy to a previously unirradiated field. The open-label, dose-escalation safety study uses 0.2 mL of 5-FU gel/cm^3 of tumor (5-FU dose range, 5 to 30 mg/mL). 5-FU gel is injected once or thrice weekly during a standard course of radiation (200 cGy fractions daily × 5/wk for 5 wk) before a radiation boost phase. Patients are observed for treatment-related side-effects to determine maximum tolerated dose.

Results: No dose-limiting, treatment-related side-effects, soft tissue necrosis, or systemic toxicity has been observed to date in patients treated in the first 3 treatment groups. All patients have completed the prescribed treatment except one patient in whom radiation was discontinued when she developed widespread distant metastases. All patients developed partial or confluent moist desquamation (RTOG/EORTC grade 2), which was not dose-limiting. No patient refused further injections because of discomfort during the procedure. Preliminary results indicate that patients' antitumor responses to the combination treatment have been similar to those expected for radiation alone.

Conclusions: Combined use of 5-FU gel with radiation therapy has been shown to be feasible and well tolerated in the lower levels of a dose-escalation scheme in treatment of patients with locally advanced or locally recurrent breast cancer. With further dose escalation, intratumoral 5-FU gel may prove to be a practical and effective potentiator of radiation therapy in this and other patient groups.

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Radiation induced brachial plexopathy in early breast cancer

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Purpose: In loco-regional irradiation for breast cancer, the risk of radiation induced brachial plexopathy (RIBP) should be minimal. A retrospective survey was undertaken of 223 patients (T0–3, N0, NI, M0) treated with peripheral lymphatic irradiation for operable breast cancer to determine the incidence of RIBP.

Methods: A case note review of clinical evidence of RIBP among 223 patients breast cancer from 8/90-7/91 treated by PRI (anterior shoulder field with a posterior axillary boost: mid axillary dose was 45 Gy in 20 fr over 4 weeks [4–6 MV photons]. All fields were treated daily except the post axillary boost (alternate days). Median follow up was 67.8 mths.

Results: Two disease free patients met criteria of RIBP (0.9%). CT (Case 1) and MRI of the axilla (Case 2) were negative. In each case of RIBP the maximum axillary dose was less than the mean maximum axillary dose (5224.9 cGy) for the whole cohort.

Conclusions: The incidence of radiation induced brachial plexopathy with mid axillary fraction sizes of 2.25 Gy to a total dose of 45 Gy is low (<1%).

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Acute reactions and cosmetic outcome after conservative surgery and adjuvant RT in stage I–II breast cancer

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Purpose: To evaluate the influence of different modalities of postoperative RT on acute reactions and cosmetic results, we have analyzed 1689 pts with stage I–II breast cancer treated in 11 Institutions of Northern Italy (Lombardy) during 1997.

Methods: The analysis concerns 1069 pts. The mean age was 57 yrs. 31% were premenopausal, 76.7% had a ductal invasive carcinoma, 29% had positive nodes. The RT modalities were collected according to ICRU Report 50. The whole breast was irradiated with 60Co or 4–6 Mv photons at the mean ICRU dose of 50 Gy plus a booster dose of 10 Gy. The local toxicity was recorded using the EORTC-RTOG scale, while the cosmetic results, after surgery and during the F.U., according to a 4 grade scoring system (EORTC) and a patient's judgement.

Results: 90% of the RT treatments were ICRU level 2 and 10% level 1. The mean OTT was 42.86 days. The max acute cutaneous toxicity was registered between 40 and 50 Gy: grade 0 = 14.5%, grade 1 = 66.2%, grade 2–3 = 19.2%. The rate of postop cosmetic outcome was 24% grade 1–2, 2% grade 3, 7% grade 0 (excellent outcome). The patients, opinion was good in 58%, excellent in 25.4%, sufficient in 15.5%.

Conclusions: The definitive data will allow us to define the impact of surgery and RT, according to the different treatment methods, on toxicity and cosmetic outcome.

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Intraocular metastases from breast cancer: A retrospective Study of the Breast Cancer North Italian Radiation Therapy Oncology Group

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Purpose: To summarize a retrospective, multicentric experience in the management of intraocular metastases from breast cancer conducted in five Italian Radiation Therapy Centers.

Patients and Methods: We collected a consecutive series of 51 patients (53 eyes) affected by intraocular metastases from breast cancer, treated from 1977 to 1995. The lesions were located as follows: choroid in 37 cases, peribulbar soft tissues in 7 cases, retina in 9 cases. The treatment was performed by external radiation therapy with a 4–15 MV linear accelerator (45 cases) or with CO60 (8 cases). Radiation technique varied widely, because patients were treated in multiple institutions over a long period of time. Total doses delivered ranged between 14 Gy and 60 Gy (median 40 Gy), with conventional fractionation (1.8–2.2 Gy, 5 times/week) in 40 cases and with 2.5–3 Gy per fraction in 13 cases.

Results: Subjective palliative effect was obtained in 33/42 evaluable eyes for a 76% of cumulative (partial or complete) response. The most frequent acute side effects was conjunctivitis (12 patients). As late side effects, 2 cases of cataract were observed.

Conclusions: In our experience external beam radiation therapy provides useful palliative treatment for ocular metastases from breast cancer.

271 POSTER

Nine years results of breast carcinoma conservative treatment for 295 pTI $\leq$ 10 mm N− without adjuvant medical treatment

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From January 1984 to December 1988, 1163 patients with breast conservative treatment (surgery + radiotherapy) without adjuvant medical treatment were entered into F.N.C.L.C.C. prospective multicenter study. Among these 1163 patients, 295 had an histologic tumor size ≤10 mm. With a median follow up of 9 years, 9.5% (28 cases) developed a local recurrence (LR). In univariate analysis, histologic grade: GI (13 LR/145: 9%) versus GII + III (8 LR/93: 8.6%), ductal carcinoma in situ: DCIS + (8 LR/88: 9%) versus DCIS − (20 LR/200: 10%) and progesterone receptor PR + (12 LR/145: 8.2%) versus PR − (5 LR/60: 8.3%) did not influence local control.

Two factors were statistically significant:

− Age: < 40 years (9 LR/40: 22%) versus > 40 years (19 LR/255: 7.4 ($p < 0.0001$).

− Estrogen receptor: ER − (7 LR/55: 12%) versus ER + (10 LR/152: 6.5%) ($p < 0.001$).

In multivariate analysis, age ≤ 40 years remained the only significant parameter ($p < 0.0002$).

Conclusion: With a median follow up of 9 years, this study show that local recurrence for pTI ≤ 10 mm N− without adjuvant medical treatment are not infrequent (9.5%) with only one significant risk factor: age ≤ 40 years (LR: 22%).

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Is it necessary to check blood counts routinely during definitive radiation therapy for patients with early stage breast cancer?

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Purpose: In some departments of radiation oncology blood count checks are done routinely for patients treated with breast conserving therapy followed by definitive radiation therapy. Due to rising costs of treatment we retrospectively analyzed these patients in to evaluate the need of this routine practice.

Methods: From May, 1995 until December, 1997, 51 patients with early stage breast cancer received definitive irradiation after breast conserving therapy. Cytotoxic chemotherapy was used in none of these patients. 59% were treated with tangents atone, 29% with tangents and sternal and supraclavicular fields, 6% with tangents and sternal, supraclavicular and axillary fields and 6% with tangents and a sternal field. Complete blood counts were done weekly.

Results: During radiotherapy, a significant decrease of haemoglobine, erythrocytes, thrombocytes, and leucocytes was seen ($p < 0.05$, Friedman's test). 98% presented anaemia with grade 0 (RTOG/EORTC score), 2% with grade 1. 100% showed thrombocytopenia grade 0. Leucocytopenia grade 0 was observed in 51%, grade 1 in 35%, grade 2 in 12% and grade 3 in 2%. All patients (6% (3/15)) who developed leucocytopenia in the range of 1.8 Gpt/l–2.3 Gpt/l were treated with parasternal portals ($p < 0.05$, χ^2-test). Interventions with G-CSF were prompted.

Conclusion: Due to the small number of patients examined so far, our preliminary results should be cautiously valued. However routine checks of complete blood count should be done even for patients not receiving chemotherapy. Especially patients treated with sternal portals might have a higher risk to develop abnormal values. One reason could be the affection of stem cells in bone marrow of the sternum by irradiation and/or of peripheral blood cells in the great vessels and the heart.

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Evaluation of acute local toxicity after postoperative 60 gy to the whole breast in multifocal invasive or in situ ductal breast carcinoma

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Purpose: Multifocality of infiltrating ductal carcinoma (IDC) or presence of in situ form (DCIS), treated with conservative surgery, induced the use of postoperative RT to the whole breast to a total dose of 60 Gy (2 Gy/fract) due to the lack of a precise little volume for booster dose.

Methods: From 2/4/1992 to 1/9/1997 we treated 91 female patients (pts). Depending on histopatology, we divided the pts into 4 groups: pure DCIS (20 pts), DCIS associated with microinfiltrative (mic) ductal carcinoma (9 pts), IDC associated with intraductal component >25% (EIC) (50 pts), multifocal IDC (12 pts). RT on the breast consisted of 2 tangential isocentric fields of 6 MV X photons, the treatments were studied according to the ICRU level 2. Acute and late local toxicities were evaluated according to the EORTC-RTOG scales.

Results: All the pts were evaluable for acute local toxicity: grade 0:18 pts, grade 1:44 pts, grade 2:12 pts, grade 3:20 pts. We evaluated for late toxicity 77 pts (with at least 6 months FU): grade 0:64 pts, grade 1:10 pts, grade 2:3 pts. We registered only 1 local relapse after 7 months from the end of RT and the pts was submitted to simple mastectomy. From september 1997 we modified our schedule of RT giving 50 Gy to the whole breast followed or not, in case of DCIS, by booster dose to the surgical bed, according to the recent literature data.

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Long-term (5–10 year) results of combined treatment of breast cancer patients using gamma-neutron therapy

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Purpose: The study conducted will allow to assess the efficiency of mixed gamma-neutron therapy of locally advanced breast tumors.

Methods: Combined treatment using gamma-neutron therapy was given to 85 patients with stage T1-4N1-3 breast carcinoma. In 24 patients (28.2%) primary infiltrative-edematous tumors were diagnosed. The control group consisted of 100 patients treated using conventional external beam radiation therapy. Total tumor dose was 50 Gy from gamma-component and 2 Gy from fast reactor neutrons (RBE = 5). At the second stage after a 2-week break surgery was performed to 87.8% of patients.

Results: Complete regression of primary tumors was achieved in 22% of patients compared to 7.7% in the control group. The pattern and the rate of early and late radiation complications in the groups were similar. For T3-4N1-3 tumors the overall 5-year survival was 71.8 + 12.1%, compared to 40.1 + 3.8% in the control group. The overall 10-year survival for T3-4N3 tumors was 22.7 + 6.7%. In the control group all the patients died before 10 years.

Conclusion: Thus, mixed gamma-neutron therapy significantly improves short-term and long-term treatment results for patients with locally advanced breast cancer.

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Is the timing of radiotherapy after breast conservation surgery for early stage cancer important?

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Purpose: The appropriate timing of breast irradiation [BI] following breast conservation surgery [BCS] for early stage cancer remains controversial. Our objective was to examine the temporal relationship of BI and outcome of women after BCS for early stage cancer.

Methods: The times between BCS and the initiation of BI were retrospectively reviewed in 47 patients treated during a 15-year period [1981–1995] for stage I–II breast cancer. BI commenced within [n = 20] or after [n = 27] an interval of four months. Twenty-one patients received chemotherapy before BI. The median follow-up was 47 months [range: 13–122 months].

Results: The local recurrence rate was 5 ± 10% [95% CI] (1/20) in women irradiated within four months and 15 ± 14% (4/27) in patients treated after