

patients (7%). There seemed to be no correlation between central lung depth and irradiation of the cardiac apex in our series.

Long-term follow-up of older series suggests no risk of premature cardiovascular incidents if less than 4% of the cardiac volume is irradiated. 93% of left-sided breast cancer patients can be treated without significant cardiac irradiation, however a minority of patients may need more sophisticated treatment planning to completely eliminate unnecessary cardiac toxicity.

O-106. INTRAOPERATIVE RADIOTHERAPY AFTER BREAST CONSERVING THERAPY – AN ALTERNATIVE TO CONVENTIONAL POSTOPERATIVE BOOST?

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Introduction: Local recurrence (LR) rate after breast conserving therapy (BCT) varies between 5% and 8%. One of the reasons for LR could be a "geographic miss" during boost irradiation of the tumor bed. Therefore high quality boost techniques are demanded.

Methods: From 10–98 until 12–00 160 patients with stage I and stage II breast cancer were operated in a dedicated IORT facility. After tumorectomy the tissue surrounding the excision cavity was temporarily approximated by sutures to bring the tissue in the radiation planning target volume. A single fractional dose of 9 Gy was applied to the 90% reference isodose with energies ranging from 4–15 MeV, using round tubes 5 to 6 cm in diameter. After wound healing patients received additional 51 to 56 Gy EBRT to the whole breast.

Results: There were no early complications associated with the use of IORT. In five patients a secondary mastectomy had to be performed because of tumormulticentricity in the final pathological report. Two patients developed rib necrosis. In five patients wound healing problems occurred. To date there has been no local recurrence, cosmesis of the breast has been excellent.

Conclusion: Interim results suggest that IORT after breast conserving therapy could be a reliable alternative to conventional postoperative fractionated boost by accurate dose delivery and avoiding of geographic miss, by enabling of smaller treatment volumes and complete skin sparing and by reducing the postoperative radiation time for 7 to 10 days.

O-107. TARGETED INTRA-OPERATIVE RADIOTHERAPY (TARGIT) FOR BREAST CANCER – A RANDOMISED TRIAL

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The need for 6-wks of post-operative radiotherapy after breast conserving therapy is both inconvenient and costly. It may cause

many women from geographically remote areas to choose mastectomy. A rationale for avoiding whole breast radiotherapy by delivering intra-operative radiotherapy is emerging.

Whole-organ analysis of mastectomy specimens¹ revealed that 80% of occult cancer foci are situated remote from the index quadrant. In contrast, over 90% of local recurrences after breast conserving therapy occur near the original tumour – even when radiotherapy is not given and irrespective of margin status. Therefore, these occult cancer foci may be clinically irrelevant and targeted radiotherapy to the peri-tumoural area alone might provide local control.

'Intrabeam' (PeC) is a portable electron-beam driven device that can deliver therapeutic radiation (soft x-rays) in 20–30 minutes within a standard operating theatre environment. The pliable breast tissue – the target – is wrapped around a spherical applicator – the source – providing truly conformal radiotherapy. The prescribed dose is 5–20 Gy at 1 cm and 0.2 cm respectively, from the tumour bed. The biologically effective dose is 7–53 Gy for $\alpha/\beta = 1$ and 20–120 Gy for $\alpha/\beta = 1.5$.

In our pilot study of 25 patients (age 30–80 years, T = 0.42–4.0 cm), we replaced the routine post-operative tumour bed boost with targeted intra-operative radiotherapy. There have been no major complications and no patient has developed local recurrence, although the median follow-up time is short at 21 months.

Having established the safety and feasibility in the pilot study, we started a randomised trial in March 2000. This compares TARGIT with conventional post-operative radiotherapy for infiltrating duct carcinomas with local recurrence and cosmesis as the main outcome measures. If proven effective, TARGIT could eliminate the need for post-operative radiotherapy potentially saving time, money and breasts.

References

- [1] Vaidya JS et al. Multicentricity of breast cancer: whole organ analysis and clinical implications. *Br J Cancer* 1996 Sep; 74 (5): 820–4

O-108. PERCUTANEOUS MINIMALLY INVASIVE STEREOTACTIC PRIMARY RADIOTHERAPY: A NOVEL APPROACH FOR BREAST CANCER IN ELDERLY WOMEN

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As the population ages, many elderly women are affected by breast cancer. Local treatment is advisable, in addition to tamoxifen, but many of these women may not be fit enough to stand an operation.

We describe a novel approach of dealing with this growing problem with minimal intervention using three converging technologies:

- (a) the Fisher Mammostest table for digital real-time tumour localisation

(b) the Mammotome Vacuum biopsy system for large excision biopsy and

(c) the Accubeam (PeC) for localised portable radiotherapy.

A Fisher Mammotest prone table uses two digital mammographic images 30° apart to stereotactically compute location of non-palpable lesion in the breast. The patient lies prone while the breast is suspended between the image sensor and a small windowed compressing pad, under the table. The Mammotome vacuum biopsy apparatus is directed to the correct location through a tiny incision on the breast made under local anaesthetic. With the Mammotome, it is usually possible to take about 1–2 cm³ of tissue. This is adequate for tissue diagnosis, is frequently therapeutic for benign lesions and may even achieve nearly complete excision for small screen detected malignant lesions. Accubeam (PeC) is an ingenious device electron-beam driven soft x-ray source which provides a point source of low energy X-rays at the tip of a 3.2 mm diameter tube. With a 50 kV machine, the typical dose is about 130 Gy and 20 Gy at the surface of the tumour in about 12 minutes. In cases of elderly infirm women, it is possible to deliver therapeutic radiation in one sitting, under local anaesthetic with precise localisation in the centre of the tumour. With this approach, the area of maximum tissue anoxia – the most likely site of failure receives the highest dose and the normal tissues receive the least.

As a proof of principle, we have treated 3 patients. In every patient, there was near complete-loss of tumour vascularity on MRI within 6 days of treatment. The lump became impalpable by 3 months and has remained so at a median follow up of 18 months. The combination of these three evolving technologies can yield the diagnosis, localisation, part excision and radiotherapy in a single session.

O-109. CAN ULTRASOUND IMPROVE THE ACCURACY OF DELIVERY OF ELECTRON BOOST TREATMENT FOLLOWING BREAST CONSERVING SURGERY?

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The purpose of this study was to compare the accuracy of boost planning using conventional technique with planning using ultrasound to delineate tumour bed.

Twenty patients who underwent wide local excision and were prescribed radiotherapy to the involved breast plus boost where selected randomly. Time interval between surgery and the boost planning varied between 9 months to 6 weeks.

Standard boost planning (relying on examination, information from surgical notes, previous mammograms and ultrasound) was undertaken, this was followed by an ultrasound scan to identify the tumour bed and accordingly optimum boost planning area was calculated (cavity size plus 1 cm margin plus $\frac{1}{2}$ cm error margin). Comparison of the relative size and overlap of the standard and optimum boost fields were undertaken and estimate of potential under and over treated areas were made.

Results showed that 45% (9 out of 20) had 100% overlap,

20% (4 out of 20) had 90–99% overlap, 30% (6 out of 20) had 80–89% overlap and 5% (1 out of 20) had only 10% overlap.

Under treated area values (accepted at 0% of optimum boost area size) showed that 45% (9 out of 20) had 0% under treated area and 55% had calculated under treated area, these were divided as: 25% (5 out of 20) had 1–10% under treated area, 20% (4 out of 20) had 11–20% under treated area, 5% (1 out of 20) had 21–30% under treated area and 5% (1 out of 20) had 90% under treated area.

Over treated area values (accepted at 300% of optimum boost area size) showed that 80% had values within 300% and 20% had values over the 300%.

In conclusion this study demonstrated that with conventional breast planning, a significant number of patients (around 50%) are under treated and that ultrasound can be useful for accurate planning and reducing the chance of not including the tumour bed in the planning volume.

O-110. SERIAL MONITORING OF SERUM HER-2/neu IN WOMEN WITH METASTATIC BREAST CANCER

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The extracellular domain (ECD) of HER-2/neu is shed into the serum of normal women and is elevated in women with metastatic breast cancer (MBC). Our studies have been conducted with a standardized ELISA, which was specifically validated for measuring ECD in human serum.

In this study the serum ELISA has been used to analyze serial samples from over 100 women with MBC, as well as samples from over 200 normal women, and women with benign breast diseases or non-malignant, non-breast diseases. The upper limit of normals was established at 15 ng/ml. Longitudinal measurements of serum HER-2/neu ECD were found to correlate with changes in disease status in greater than 80% of cases. We found that increases of 20% or greater from previous determinations were indicative of progressive disease, while decreases of 20% or greater were reflective of a response to therapy or lack of progression.

Data from our study demonstrate that some women with MBC who had elevated ECD serum levels did not respond as well to hormone therapy as women with normal serum HER-2/neu levels.

Clinical response to Herceptin could also be monitored by measuring the serum HER-2/neu levels.

In summary quantification of the serum HER-2/neu ECD may have several clinical applications, such as monitoring women with metastatic breast cancer or predicting response to hormone therapy. Serum HER-2/neu measurements provide a real-time opportunity to assess a woman's Her-2/neu status rather than depending on a semi-quantitative retrospective tissue.