319 Poster

3-Field versus 2-field photon boost technique in breast conserving radiotherapy; more conformality, lower lung dose and a higher heart dose

A.Y. Verbeek-de Kanter[1], J.P.C. van Santvoort[2], L.D. Kwakkel-Huizenga[1], H. Struikmans[1]. [1]*Medisch Centrum Haaglanden, Radiotherapy, Den Haag, The Netherlands;* [2]*Medisch Centrum Haaglanden, Clinical Physics, Den Haag, The Netherlands*

Background: Our standard photon boost technique consists of two wedged oblique photon-beams, with an angle of some 90–110 degrees between them. However, due to this technique the breast volume receiving at least 95% of the prescribed dose (V95) is high and this might, therefore, result in worse cosmetic outcome. A reduction of the irradiated boost volume (V95) is feasible using a 3 field technique. This third field (with a low weight) is directed almost perpendicular to the other 2 fields.

Material and Methods: In 17 breast cancer patients we compared 2- and 3-field photon boost treatment plans. All patients were irradiated as part of their breast conserving therapy and received 25×2 Gy whole breast irradiation followed by a boost of 8×2 Gy. CT guided target volume delineation both for CTV breast and CTV boost were done. The heart and both lungs were also delineated. We compared the two boost techniques specifically with respect to: i) V95/PTV, ii) the mean lung dose (MLD) and iii) in the 10 left sided breast cancer patients the mean heart dose (MHD).

Results: The 3-field compared to the 2-field technique resulted in a relative reduction of volume of breast tissue outside the PTV boost receiving at least 95% of the prescribed dose (V95/PTV) from 1.96 to 1.50. The addition of a third field resulted in a reduction of the MLD from 0.96% to 0.68%. The MHD in the 3-field plan is 2.25 times higher compared with that of the 2-field plan (4.43% vs 1.9%).

Conclusions: Adding a third field to our standard 2 field photon boost technique resulted in a reduction of the mean breast dose and the mean lung dose. However, in left sided cases, a higher mean heart dose was noted. A possible next step in the optimalization of the photon boost technique could be the simultaneous integrated boost technique.

320 Poster

Adjuvant locoregional breast radiotherapy using intensity modulated radiation therapy with helical tomotherapy for breast cancer – A comparative treatment planning study and a launch of a prospective clinical study

L. Grimard[1], J. Meng[1], S. Morgan[1], L. Montgomery[1], M. Lacelle[1], M. MacPherson[1], J.M. Caudrelier[1]. [1]*Ottawa Regional Cancer Center, Radiation Oncology, Ottawa (Ontario), Canada*

Background: We have evaluated Intensity Modulated Radiation Therapy using Helical Tomotherapy (IMRT-HT), in the planning of adjuvant locoregional left breast cancer radiation therapy, to obtain dosimetric data before implementing a prospective study to clinically assess its benefits and risks.

Methods: Ten consecutively left breast cancer women stage III had a Planning Target Volume (PTV) defined as breast/chest-wall and nodal regions including the internal mammary chain (IMC). A dose of 50 Gy in 25 fractions was prescribed using our standard four-field technique: partial wide tangent beams to treat the breast and IMC and 2 anterior posterior beams to treat the axilla and supraclavicular regions. The IMRT-HT plans were developed using target and normal tissue dose constraints. Different metrics were extracted from dose-volume histograms of the standard and IMRT-HT plans and were compared.

Results: Volume of PTV irradiated by the isodose 95% was not significantly different between the standard and the IMRT-HT plans (98.8%$\pm$1.4 vs 99.0%$\pm$0.4, $p = 0.66$) but the volume receiving a dose of 107% or more was significantly greater with the standard technique (60%$\pm$21 vs. 17%$\pm$12, $p < 10^{-3}$). The mean heart dose was similar between both techniques but with IMRT-HT the heart volume receiving at least 30 Gy was reduced (1.5%$\pm$1.9 vs. 3.2%$\pm$2.2, $p = 0.05$) and the dose receiving 45 Gy was nil. The mean total lung dose was lower with the IMRT-HT (8 Gy$\pm$2 vs 10 Gy$\pm$1.5, $p < 10^{-3}$), as well the volume receiving at least 20 Gy (5.8%$\pm$1.9 vs. 14.9%$\pm$3.3, $p < 10^{-3}$). Contralateral breast volume receiving a low dose of 5 Gy was significantly greater with HT (31%$\pm$20 vs. 4.4%$\pm$9.9; $p = 0.0002$). Following these results and since January 2007, we have started a prospective phase II clinical study to evaluate IMRT-HT for locoregional breast radiation with daily acquisition of MV-CT images for positioning and with follow-up of cardiac and lung functions. Ten women have completed the full course of radiation without any particular side effects outside of a skin erythema CTC grade 2, at the maximum.

Conclusions: Compared to a standard technique, IMRT-HT provides a better PTV dose homogeneity and can spare heart and lung exposure to high dose of radiation, while keeping or decreasing the mean dose. As we any multiple beam technique, a larger normal tissue volume is receiving low dose of radiation. The clinical experience of IMRT-HT will be presented.

321 Poster

Improving dose homogeneity in large breasts by IMRT – efficacy and dosimetric accuracy of different techniques

A.Y. Abo-Madyan[1], M. Polednik[1], A. Rahn[1], M. El-Haddad[2], F. Schneider[1], B. Dobler[3], F. Wenz[1], F. Lohr[1]. [1]*Mannheim Medical Center University of Heidelberg, Department of Radiation Oncology, Mannheim, Germany;* [2]*NEMROCK Cairo University Hospitals, Department of Clinical Oncology, Cairo, Egypt;* [3]*Regensburg University Hospital University of Regensburg, Department of Radiation Oncology, Regensburg, Germany*

Background: While simple tangents with a beam energy of 6 MV are satisfactory for most clinical situations, inherent drawbacks exist for the treatment of large breast volumes. Among these are the unavoidable hot regions created within the PTV. We evaluated 4 treatment techniques regarding: dose homogeneity, target coverage, feasibility, and dosimetric reliability in patients with large breasts treated postoperatively for breast cancer.

Materials and Methods: CT datasets of 10 patients treated for breast cancer with relatively large breast volumes were selected. For each patient four treatment plans were created; Low-Energy-Conventional (C-LE) [6MV], High-Energy-Conventional (C-HE) [6MV+15MV], 3-field (MFT), and a 2-field aperture-based IMRT technique (IMRT). The conventional plans used the standard 2-tangential beams. The MFT used the same standard with a third ventral beam with 2−3 apertures. IMRT used the same 2-beam setup with 4−10 apertures each. Apertures for the IMRT and MFT were created with the aid of a 3D-dose-display which provides in the beam-eye-view a dot matrix of varying colors, representing different dose ranges in different volume depths. Dosimetric accuracy of each technique was evaluated in an anthropomorphic thoracic/breast phantom, using pencil-beam & collapsed-cone (CC) calculation algorithms, and radiochromic-films. [1]

Results: The mean of PTV volumes receiving <95% or >105% of the prescribed total dose was reduced from 16.0% to 13.9% to 10.4% to 8.9% in the C-LE, C-HE, MFT, and IMRT plans respectively. Phantom dose measurements agreed well with the calculated dose within the breast tissue, with the CC-algorithm being clearly superior in predicting the dose in the area exposed in the lung.

Conclusion: Aperture based IMRT using two tangential incident beam directions, as well as a 3-field technique with inverse optimization, provide a better alternative to the standard wedged tangential beams for patients with large breasts treated on low energy linacs while maintaining the efficiency of the treatment planning and delivery process.

Table 1. DVH Statistics. Mean $\pm$SD for the PTV

PTV	C-LE	C-HE	MFT	IMRT
D% to V95%	94.5$\pm$1.1	94.7$\pm$0.8	95.2$\pm$0.9	95.5$\pm$0.7
D% to V1%	109.4$\pm$1.4	108.2$\pm$.5	107.7$\pm$1.4	107.2$\pm$1.3
Max D%	114.3$\pm$2.9	112.7$\pm$2.7	112.3$\pm$2.6	110.6$\pm$2.1
V% receiving D <95% or >105%	16.0$\pm$4.4	13.9$\pm$3.8	10.4$\pm$4.2	8.9$\pm$3.9
V% receiving D <95% or >107%	10.8$\pm$3.8	8.3$\pm$3.5	6.5$\pm$2.7	5.5$\pm$2.4

*D=dose, V=Volume

References

[1] Polednik M, Abo Madyan Y, Schneider F, et al.; Breast Cancer Working Group (German Cancer Association). Evaluation of calculation algorithms implemented in different commercial planning systems on an anthropomorphic breast phantom using film dosimetry. *Strahlenther Onkol* 2007;183:667−72.

322 Poster

Long-term sequel of adjuvant internal mammary node irradiation after mastectomy – an Indian experience

A. Gangopadhyay[1], S. Saha[1], A. Basu[1], K. Ghosh[1]. [1]*Calcutta Medical College, Radiotherapy, Calcutta, India*

Background: There is no consensus regarding post-mastectomy adjuvant internal mammary node (IMN) irradiation in patients with medial or central quadrant breast cancer receiving anthracycline-based chemotherapy. The study aims to evaluate the benefit of inclusion of IMN during adjuvant radiotherapy as well as to analyze the cardiac effect amounting from radiation of this additional anatomical area. Study end points: locoregional recurrence, cardiac complications.