acquisition technique can give a wide cranio-caudal coverage beyond the detector width for the same respiratory phase; however, motion artifacts are not mitigated completely due to the low temporal resolution. Therefore, uncertainties of the actual position, volume, and shape of a moving object result in planning errors in radiotherapy treatment planning CT. Respiratory motions during irradiation may cause the radiation beam to miss a portion of the target volume.
Conclusions: The RS-FDK has capabilities for high temporal resolution and good SNR. Therefore, we expect it will demonstrate good ability to significantly increase accuracy in the dose distribution. It will be useful for more precise treatment planning for respiratory-moving tumors. We have already found that it is possible to achieve more precise radiotherapy including 4D radiation therapy with the RS-FDK.

1370 POSTER

Microbeam Radiation Therapy (MRT) applied to rats' brain tumor: finding the best compromise between normal tissue sparing and tumor curing

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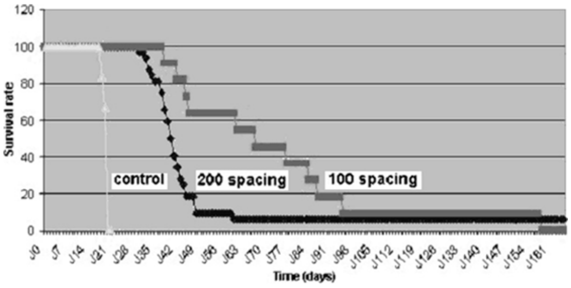
Microbeam Radiation Therapy (MRT) (Laissue et al; 1998; Int J Cancer) consists of irradiating animals with very high doses (>100 Gy) delivered by arrays of microbeams (MB), which are few micrometers wide and few hundreds of micrometers spaced. This preclinical therapy is presently applied in synchrotron radiation sources where high intense, quasi parallel X-ray microbeams can be produced. MRT is based on the dose/volume effect, and literature reports cases of brain tumors cured in rats by MRT while sparing the surrounding normal tissues. Irradiation parameters are various and include the skin dose, the dose rate, the X-ray beam spectrum, the width and the spacing between the MB.
10^4 9L gliosarcoma cells contained in 1 μl were stereotactically implanted in the right caudate nucleus of Fisher rats at day 0. Between day 11 and 13, an MRI examination was performed to confirm the presence of tumors. At day 14, tumors were laterally irradiated either from right hemisphere to left hemisphere or from left hemisphere to right hemisphere by using 50 MB covering a $10.5 \times 12\,mm^2$ field. After irradiation, rats were weighted 3 times per week, and clinical signs were annotated. At the death/euthanasia of rats, brains were taken for histology. Experiments were performed using a skin entrance dose of 625 Gy, MB of 25 μm in width, and spacing of 200 or 100 μm.
Rats irradiated with 200 μm spacing showed normal weight curves after implantation with a decrease before death, which occurred at 41.6 days (left to right) and 37.9 days (right to left) in average after the implantation. All rats were found with a brain tumor, except 2 rats (1 for each irradiation direction) that were cured (and survived more than 600 days). Very few of those rats present clinical signs after irradiation (4/32). On the contrary, rats irradiated with 100 μm spacing showed unusual weight curves, always below 300 g, in parallel with neurological disorders (8/11). Average lifespan was 64.2 days after tumor implantation with a long term survivor (154 days). Four of those rats presented no brain tumors at the histological examination.



Survival curve of series at 200 spacing, 100 spacing and control

Results suggest that this technique can ablate only few tumors at 200 μm spacing while preserving the normal tissue. The 100 μm spacing appeared too aggressive for the normal tissues, even if tumors can be ablated more efficiently. Future experiments will aim at performing a fine tuning of irradiation parameters to find the adequate balance between 100 and 200 μm spacing.

1371 POSTER

Comparison of locoregional recurrences following postmastectomy radiotherapy using electrons or photons: poor supraclavicular node control of electron beam irradiation in patients with four or more positive axillary nodes

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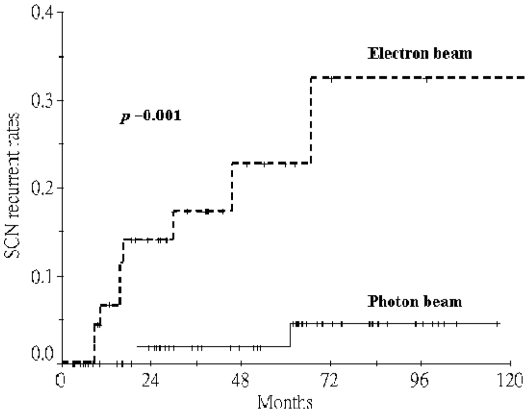
Background: We retrospectively compared locoregional (LR) recurrence between electrons and photons for postmastectomy radiotherapy.
Materials and methods: From January 1988 to December 1999, 124 and 122 women with breast cancer of AJCC 2002 stage II and III received electrons and photons irradiation following modified radical mastectomy, respectively. Doses of 46–52.2 Gy/23–29 fractions were delivered to the chest wall (CW) and peripheral lymphatic drainage with 12–15 MeV single-portal electrons or 6 MV photons. Eighty-four patients received an additional 6–20 Gy boost to the surgical scar using 9 MeV electrons.
Results: The 8-year rates of LR recurrence were 19% and 10% ($p = 0.071$) in patients receiving electrons and photons, respectively. The corresponding rates of CW recurrence were 12% and 7% ($p = 0.227$). However, recurrent rate of ipsilateral supraclavicular node (SCN) was significantly higher in patients following electrons (11%) than photons (3%) irradiation ($p = 0.025$). In multivariate analysis of CW recurrence, N2–3 stage (positive axillary nodes $\geqslant 4$) ($p = 0.013$) and diabetes ($p = 0.004$) were independent factors. Multivariate analysis of ipsilateral SCN recurrence revealed interaction between N2–3 stage and electrons ($p<0.001$). The interaction was also noted for LR recurrence ($p<0.001$). Further subgroup analyses revealed the beneficial effect of photons existed only in N2–3 stage for SCN ($p = 0.008$) and LR ($p = 0.006$) recurrence but not N0–1 stages.



Conclusion: Photons may be superior to electrons for treatment of N2–3 breast cancer. The impact of electrons on LR control may result from poor SCN control. A single-portal electron is not suggested for these patients.

1372 POSTER

Interindividual variations in positioning accuracy and patient motion during pelvic radiotherapy

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Purpose: Safety margins are in general based on population-averaged measurements. The aim of this study is to investigate interindividual differences in positioning accuracy and motion characteristics as a basis for individualized treatment planning.
Materials and methods: For 10 patients with gynecological carcinomas positioning accuracy was evaluated using repeated electronic portal images. Inter- and intrafractional patient movement was registered by online documentation of body marker movement using the ExacTrac system (Brainlab, Munich, Germany). From these data, values for individual random and systematic positioning errors in all directions including rotational angles were calculated. Further, patient-dependent movement during radiotherapy was analyzed including respiratory amplitudes, mean breathing positions and respiratory frequencies. Patient-specific clinical parameters were correlated with positioning and motion data.
Results: Individual systematic positioning errors ranged from −7.4 to 10.4 mm for the three coordinates ($p < 0.0001$), individual random positioning errors from 1.6 to 4.8 mm ($p > 0.05$). Mean rotation errors were between −0.7 and 2.3 degrees. Over the radiation series individual mean respiratory amplitudes ranged from 0.7 to 5.2 mm, mean frequencies