

Chromosome Aberrations in Lymphocytes of Prostate Cancer Patients Treated with IMRT and Carbon Ions

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Carbon ions are successfully used in tumour treatment for more than 10 years in Chiba and Hyogo (Japan) and at GSI Darmstadt (Germany). Carbon ions are beneficial for the treatment of deep seated tumours, as they deliver the highest dose at the end of their range, and in addition this dose shows an enhanced radiobiological effectiveness.

In a clinical study at GSI and at the Clinical Radiology Heidelberg carbon ion therapy is combined with conventional IMRT to treat prostate cancer patients (intermediate risk). In parallel, a study investigating chromosome aberrations in blood lymphocytes of prostate cancer patients is performed.

Chromosome aberrations in blood lymphocytes are widely used in biological dosimetry as they represent a sensitive marker for ionizing radiation. Since they are unavoidably exposed to radiation during tumour treatment, this study makes it possible to investigate the cytogenetic effects of carbon ion irradiation in vivo and to compare with conventional tumour treatment. The results may be helpful regarding biological dosimetry, as only very little is known about the effects of partial body irradiation with heavy ions.

In this clinical trial, prostate cancer patients are irradiated with a Carbon ion boost (6x3GyE) followed by IMRT (30x2Gy) or solely with IMRT (38x2Gy). Blood samples are drawn from each patient before, during, at the end of and one year after therapy. Lymphocytes are isolated and cultured according to standard techniques, chromosome spreads are prepared and slides are stained using Fluorescence-Plus-Giemsa staining (FPG) and multiplex fluorescence in situ hybridization (mFISH), respectively. In addition, in vitro irradiation experiments with lymphocytes are performed.

The number of aberrations found in lymphocytes of prostate cancer patients increases during therapy course, and decreases slightly during the first year after treatment. There is up to now no significant difference visible between patients treated with combined therapy of carbon ions plus IMRT (n=9) and patients treated solely with IMRT (n=2). In addition, prostate cancer patients treated with a larger irradiation field IMRT were included in the study (n=3). The lymphocytes of these patients showed a significantly higher amount of aberrations during therapy course as well as one year after treatment.

At the present status of this study, we can conclude that an important influence of irradiation field size on the induced damage in surrounding tissue exists, but that under the given treatment conditions differences in the radiation quality are

not observable at chromosomal level.