

Keeping an Eye on the Tumor

DKFZ to be the first to treat patients by image-guided Adaptive Radiation Therapy

Directing radiation with ever increasing precision on a tumor while reliably sparing surrounding normal tissue from radiation damage – this is the prime goal of radiotherapists. A novel method facilitating simultaneous irradiation and X-ray monitoring has brought scientists of the DKFZ another step further towards this goal.

Researchers at the German Cancer Research Center (Deutsches Krebsforschungszentrum, DKFZ) have developed a prototype system for Adaptive Radiation Therapy (ART) that combines a linear accelerator (irradiation apparatus) and X-ray computed tomography. Before starting treatment, radiologists use an X-ray image to check whether the tumor is at the exact place precomputed by the radiation treatment plan. If necessary, the patient couch can be adjusted, or “adapted”, to avoid that a deviation causes healthy tissue to get into the irradiation field.

The first six patients were perfectly positioned for treatment with the aid of the new system. However, this is by far not all that physicians are hoping to achieve by ART. A common problem is that tumors shift in the body during radiation treatment as a result of involuntary movements such as breathing or bowel movements. In future, the new technology will enable radiotherapists to “keep an eye on the tumor” and to activate the treatment beam only when the tumor is in the precomputed position.

In lung cancer patients, for example, physicians use a sensor belt to record respiratory frequency and movement. At the same time, they determine by X-ray imaging the exact lifting position of the chest at which the tumor is actually at the computed position. Using these data, the treatment beam will subsequently be synchronized with the movements and triggered only at the right moments.

“Another big advantage of the method is that it may spare our patients the rigid and tight fixation with head masks and body corsets in future,” said PD Dr. Dr. Peter Huber, the radiotherapist in charge. “Such precision in patient positioning won’t be necessary any more when we are able to permanently monitor a tumor and adjust the patient during irradiation.”

The new apparatus and the accompanying software have been developed under the responsibility of DKFZ scientists Professor Dr. Uwe Oelfke and Professor Dr. Wolfgang Schlegel. To cover a possibly large body area with a single rotation of the X-ray tube around the patient and, thus, to produce a three-dimensional view of the tumor, physicists are using a technique in which the X-ray beam is emitted in a cone shape (cone beam computed tomography) and detected by a flat panel detector located opposite to the source. Due to the arrangement of the X-ray tube and the irradiation apparatus at 180 degrees from one another, the system ensures that even the slightest position deviations are registered.

The Deutsches Krebsforschungszentrum has concluded a collaboration and license agreement with Siemens in the area of ART. DKFZ has licensed out its patents for exploitation of this technology to Siemens exclusively. The company is planning to start selling the system worldwide by 2006 under the product name ARTISTE.

The task of the Deutsches Krebsforschungszentrum in Heidelberg (German Cancer Research Center, DKFZ) is to systematically investigate the mechanisms of cancer development and to identify cancer risk factors. The results of this basic research are expected to lead to new approaches in the prevention, diagnosis and treatment of cancer. The Center is financed to 90 percent by the Federal Ministry of Education and Research and to 10 percent by the State of Baden-Wuerttemberg. It is a member of the Helmholtz Association of National Research Centers (Helmholtz-Gemeinschaft Deutscher Forschungszentren e.V.).

This press release is available at www.dkfz.de/pressemitteilungen

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