New tumor-tracking technique for radiotherapy spares healthy tissue, could improve cancer treatment

February 1 2011

Medical physicists at Thomas Jefferson University and Jefferson's Kimmel Cancer Center have demonstrated a new real-time tumor tracking technique that can help minimize the amount of radiation delivered to surrounding healthy tissue in a patient—up to 50 percent less in some cases—and maximize the dose the tumor receives.

Respiratory and cardiac motions have been found to displace and deform tumors in the lung, pancreas, liver, breast, and other organs. Because of this, radiation oncologists must expand the margin during radiotherapy. Consequently, a large volume of healthy tissue is irradiated, and critical organs adjacent to the tumor are sometimes difficult to spare.

In an effort to shrink that margin, Jefferson researchers developed a new 4D, robotic technique that better predicts and continuously tracks tumors during radiotherapy, preventing unnecessary amounts of radiation from being administered to unnecessary areas. Thus, critical organs and tissues are spared; cancer treatment is potentially improved; and side effects are decreased.

Published in the online February 1 issue of *Physics in Medicine and Biology* journal, the study was co-authored by Ivan Buzurovic, Ph.D., a medical physics resident and researcher in the Department of Radiation Oncology at Jefferson Medical College at Thomas Jefferson University, and Yan Yu, Ph.D., director of Medical Physics at Thomas Jefferson

University.

In this technique, the robotic system—programmed with the proposed algorithms developed by Jefferson researchers—is automatically adjusted so that the position of the tumor remains stationary during treatment.

"The advantage of this novel approach in radiation therapy is that the system is able to predict and track tumor motion in three-dimensional space," said Dr. Buzurovic. The technique can compensate both tumor motion and residual errors during patient treatment, he added.

When active tracking was applied and tumor motion was up to 1.5 cm, irradiated planning target volume (PTV) was 20 to 30 percent less for medium size tumors and more than 50 percent for small size tumors. For tumor motion range up to 2.5 cm, irradiated PTV was two times smaller when tracking is applied.

"The proposed robotic system needs 2 seconds to start tracking with the high precision level. The tracking error was less than 0.5 mm for regular breathing patterns and less than 1 mm for highly irregular respiration," said Dr. Buzurovic. "Prediction algorithms were developed to predict tumor motion and to compensate errors due to delay in the system response."

The study findings suggest that the use of tumor tracking technology during radiotherapy treatment for lung cancer would result in significant reduction in dose to the healthy tissue, potentially decreasing the probability or severity of side effects, co-author Dr. Yu said.

With this new technique, radiation oncologists would be able to administer more radiation and faster to the tumor than conventional methods, said Adam P. Dicker, M.D, Ph.D., professor and chairman of the Department of Radiation Oncology at Thomas Jefferson University.

"If we shrink our margin by this new robotic technique, then we can bring larger doses to tumors," Dr. Dicker said. "And a higher dose means a better cure in lung cancer, for instance."

Researchers from Department of Radiation Oncology at the University of Michigan Hospital in Ann Arbor, Mich., and Brody School of Medicine at East Carolina University, Greenville, N.C., were also involved in the study.

The researchers' method, demonstrated in extensive computer simulation, can be applied to two commercially available robotic treatment couches.

Provided by Thomas Jefferson University

Citation: New tumor-tracking technique for radiotherapy spares healthy tissue, could improve cancer treatment (2011, February 1) retrieved 20 April 2024 from https://medicalxpress.com/news/2011-02-tumor-tracking-technique-radiotherapy-healthy-tissue.html