New tumor tracking technique may improve outcomes for lung cancer patients

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Medical physicists at Thomas Jefferson University and Jefferson's Kimmel Cancer Center are one step closer to bringing a new tumor-tracking technique into the clinic that delivers higher levels of radiation to moving tumors, while sparing healthy tissue in lung cancer patients.

Evidence has shown a survival advantage for lung cancer patients treated with higher doses of radiation. Therefore, there is an increased interest to find novel ways to better track tumors—which are in constant motion because of breathing—in order to up the dosage during radiation therapy without increasing harmful side effects

After proving its success in simulations, researchers have now shown that their real-time tracking technique can achieve such tasks. Not only can it better predict and track tumor motion and deliver higher levels of radiation to lung cancer patients and others with moving tumor targets, it can also successfully be implemented into existing clinical equipment (i.e., Elekta Precise Table).

The results of the study, led by Ivan Buzurovic, Ph.D., a medical physics resident and researcher in the Department of Radiation Oncology at Thomas Jefferson University, and Yan Yu, Ph.D., Professor, Vice Chair and Director of Medical Physics at Thomas Jefferson University, were published in the November issue of Medical Physics.

"We've shown here that our system can better predict and continuously track moving tumors during radiotherapy, preventing unnecessary

amounts of radiation from being administered to unnecessary areas," said Dr. Buzurovic. "Just as important, we've successfully modified existing technology to integrate with the system to perform the tracking and delivery, meaning no additional robotic systems is needed."

Respiratory and cardiac motions have been found to displace and deform tumors in the lung and other organs. Because of this, radiation oncologists must expand the margin during radiotherapy, and 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, robotic technique that better tracks tumor motion to deliver more precise radiation.

Here, the researchers applied a new control system (software and hardware) and robotic technology to existing treatment couches used for radiation therapy to determine the tracking technology's feasibility in a clinical setting.

They found the technology can be integrated onto treatment couches and validated the tumor tracking system capabilities to follow desired trajectories. When the active tracking system was applied, irradiated planning target volume (the area set for treatment) was 20 to 30 percent less for medium size tumors and more than 50 percent for small size tumors.

"The use of tumor tracking technology during radiotherapy treatment for lung cancer would result in significant reduction in dose to critical organs and tissue, potentially decreasing the probability or severity of side effects, and thus improving cancer treatments," Dr. Yu said.

Based on these results, it can be hypothesized that clinical

implementation of real-time tracking is feasible for achieving potentially improved patient outcome.

"With this new technique, it shrinks the margin, and 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. "And a higher, more targeted dose means a better cure in lung cancer."

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