Medical Xpress

Research fellow conducts research to minimize negative effects of cancer treatments

October 13 2015

Texas A&M University predoctoral research fellow Gleb Kuzmin and scientists at the National Institutes of Health (NIH) are conducting research to understand negative effects proton therapy cancer treatments can have on normal human tissue. They are seeking to find not only the best way to accurately estimate unintended radiation dose to normal tissue in the short term, but also to provide efficient and targeted treatment while minimizing unintended negative effects.

Kuzmin has been given the opportunity to work at NIH through the institute's Graduate Partnership Program individual track distinction (for students of universities that do not have a direct partnership with NIH). Kuzmin works with Dr. Choonsik Lee, a principal investigator for the Division of Cancer Epidemiology and Genetics under the NIH's National Cancer Institute. The pair is currently assessing the effects the radiation dose can have on normal tissues from proton therapy treatment on cancer patients, a treatment that uses an external beam of protons to target a specific tumor area.

While clinicians and researchers understand the effectiveness of proton therapy on a targeted cancer area, lasting secondary effects to the surrounding tissue are not well documented. Lee and Kuzmin seek to develop a dose calculation system for normal tissues outside the treatment area, allowing healthcare professionals to apply precise radiation treatment doses to the targeted areas without inadvertently affecting the surrounding tissue or other body systems in a negative way. Any dosage beyond the precise necessary amount or outside the intended location needed for treatment has the potential to have negative effects.

The human body works in much the same way as a naturally contained ecosystem. In the same way that any impact to an ecosystem can have unintended changes to the way it functions, an unintended amount of radiation to a specific body area can have effects on the surrounding tissues and body systems, creating unforeseen consequences such as secondary cancers and other serious health outcomes. The current system that is used to calculate radiation dosages is a series of fast-based algorithms that only focus on the possible effects on the tumor and its immediate surrounding areas, rather than the body as a whole. "Part of what I am doing will be geared for usage by epidemiologists," Kuzmin said. "They will be able to use the system I develop to calculate and quantify the doses patients receive and do studies to see if there were any later affects or correlations between doses on outside organs. Once those studies have been done, we may begin to see more clinical applications."

"What we are doing right now is not something that has an immediate effect on patients," Kuzmin said. "We are rather interested in any secondary effects the treatment may have and whether there will be any effects later in life."

Kuzmin and Lee are working to develop this dose calculation system for tissues outside the intended treatment area through three-dimensional computer models of the human anatomy. These models will allow the researchers to focus on the portions of the body not covered by CT scans by using both computational phantom techniques in conjunction with controlled experiments using a physical human-sized phantom. The physical phantom is made of material that is equivalent to human tissue, allowing any radiation applied to the dummy to affect it in the same way it would a human body. The human phantom will also be equipped with radiation detectors inside it's body to measure the dosage of the treatments it receives, allowing Kuzmin to take radiation measurements from the specific tissues or organs outside the direct tissue that is being treated.

"Both the computational and physical phantoms will experience the same procedures as a patient would— get a CT, go through the treatment planning procedure and become irradiated with a proton beam," Kuzmin said. "We will first run our simulations and calculate how much dose the phantom's organs receive. Then we will validate our simulations and calculations by comparing our results to the output from the detectors inside the phantom."

Kuzmin's background is in radiation physics, and he is a student in the Texas A&M nuclear engineering department health physics Ph.D. program under his adviser Dr. Gamal Akabani. Once he finishes his research, he is considering pursuing a medical physics residency to become a board certified medical physicist. However, he also enjoys research and may seek a postdoctoral position.

"I was always drawn to the field of physics, but I still wanted to do something medically related that is beneficial for society," Kuzmin said. "I've been at NCI for a couple of months doing modeling work, and I will also do experimental work, I'm getting both sides of the research. It's a very collaborative research environment."

Provided by Texas A&M University

Citation: Research fellow conducts research to minimize negative effects of cancer treatments (2015, October 13) retrieved 9 May 2024 from https://medicalxpress.com/news/2015-10-fellow-minimize-negative-effects-cancer.html