New cancer imaging technology shows promise

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(Medical Xpress)—A new imaging technology that combines ultrasound and laser technologies has been shown to be highly effective in identifying prostate cancer. The system, which was developed by University of Rochester Medical Center (URMC) researchers, could also ultimately be deployed to detect and track breast, kidney, liver, skin and thyroid cancers.

The new medical imaging technology – called multispectral photoacoustic imaging – was created by Vikram Dogra, M.D., a professor in URMC's Department of Imaging Sciences, in collaboration with Naval Rao, Ph.D. from the Rochester Institute of Technology's Center for Imaging Technology.

Physicians currently have a suite of tools at their disposal to test for prostate cancer. Monitoring PSA levels, digital rectal examinations, and transrectal ultrasound are all used as frontline screening tools. The current gold standard for a definitive diagnosis of an aggressive vs. slow growing prostate cancer is a prostate biopsy. But even this method – which is invasive, uncomfortable, and carries a risk of side effects – has its limitations; cancers are only successfully detected 70 percent of the time.

Seeing the need for a noninvasive and effective imaging technology to detect cancerous tissue, Dogra and his colleagues began to explore the use of a hybrid technology that combines ultrasound and laser irradiation .

The system uses nanosecond long bursts of light from a laser to bombard the target tissue. This heats the tissue and creates thermal waves that can be detected by ultrasound. These signals are then used to recreate an image of the target tissue and – because different wave lengths elicit different responses – observe variations in light absorption. To accomplish this, the researchers used an acoustic lens to focus the image, a method that is more cost effective than the alternative electronic focusing system.

The system enables researchers to track the level of lipids (fat), water, and forms of hemoglobin found in the blood, all of which respond to different wave lengths from the laser. Fluctuations in these compounds can indicate a tumor's status. Hemoglobin, the protein in red blood cells responsible for transporting oxygen, is of particular interest. Increases in the level of deoxyhemoglobin – the form hemoglobin without the bound oxygen – significantly raises the odds that the tissue is malignant.

"By observing increases and decreases in these things, particularly deoxyhemoglobin levels, we can tell if the tissue is malignant or benign," said Dogra.

Earlier this year, the researchers presented the findings of the first study using multispectral photoacoustic imaging to evaluate prostate cancer specimens at a meeting of the meeting of the American Roentgen Ray Society. The system was able to identify 25 or 26 healthy prostates, and 12 of 16 cancerous prostates, a 96 percent and 81 percent success rate.

Dogra and his team are now in the process of developing a prototype version of their scanner and hope to begin clinical evaluation of the device within two years. They believe that the system will ultimately be significantly less expensive – both in terms of equipment cost and cost per test – than biopsies and that the underlying technology could ultimately be applied to several other forms of cancer.

Provided by University of Rochester Medical Center