

Study paves way for early detection of liver cancer

May 14 2015

Led by Georgia State University, researchers have developed the first robust and noninvasive detection of early stage liver cancer and liver metastases, in addition to other liver diseases, such as cirrhosis and liver fibrosis.

Their findings were published Wednesday (May 13) in *Proceedings of the National Academy of Sciences*.

More than 700,000 people are diagnosed with [liver cancer](#) each year. It is the leading cause of cancer deaths worldwide, accounting for more than 600,000 deaths annually, according to the American Cancer Society. The rate of liver cancer in the U.S. has sharply increased because of several factors, including chronic alcohol abuse, obesity and insulin resistance.

"Liver cancers associated with high mortality rates and poor treatment responses are often diagnosed in the late stages because there is not a reliable way to detect primary liver cancer and metastasis at a size smaller than one centimeter," said Jenny Yang, lead author on the paper, Distinguished University Professor and associate director of the Center for Diagnostics and Therapeutics at Georgia State.

The liver is a common site for a variety of cancers, including melanoma, breast, pancreatic and colon cancers. Magnetic resonance imaging (MRI) is the leading imaging technique to detect disease without using radiation. MRI contrast or imaging agents aid MRI techniques to obtain

tissue-specific images.

As reported by Yang, the applications of MRI contrast agents are not effective for early detection of [cancerous tumors](#) because they are hampered by uncontrolled blood circulation time, low relaxation rate or sensitivity, and low specificity. Most contrast agents, she said, are rapidly excreted from the liver, not allowing sufficient time to obtain quality imaging.

To more effectively detect cancerous tumors at an early stage, researchers from Georgia State, in collaboration with researchers from Emory University, Georgia Tech, the University of Georgia and the University of Virginia, have developed a new class of protein-based [contrast agents](#) (PRCAs) and an imaging methodology that provides robust results for the early detection of liver cancer and other liver diseases.

ProCA32, the researchers' newly developed contrast agent, allows for imaging liver tumors that measure less than 0.25 millimeters. The agent is more than 40 times more sensitive than today's commonly used and clinically approved agents used to detect tumors in the liver.

ProCA32 widens the MRI detection window and is found to be essential for obtaining high-resolution quality images of the liver. This application has important medical implications for imaging various [liver diseases](#), the origin of cancer metastasis, monitoring cancer treatment and guiding therapeutic interventions, such as drug delivery.

"Our new agents can obtain both positive and negative contrast images within one application, providing double the accuracy and confidence of locating cancerous tumors," Yang said. "These agents are also expected to be much safer with reduced metal toxicity."

The researchers have shown proof-of-concept that ProCA32 can be used to detect cancerous liver tumors at an [early stage](#) with high sensitivity. They have also demonstrated that these new agents better aid the imaging of multiple organs, including the kidney and blood vessels, in addition to the [liver](#) and tumors.

"ProCA32 may have far-reaching implications in the diagnosis of other malignancies, which in turn would facilitate development of targeted treatment along with effective monitoring of reduction of tumor burden," Yang said. "Our agent and methodology can also be applied to study the brain and monitor treatment outcomes in a number of disorders, including stroke and recovery after stroke, Alzheimer's disease, brain tumors and gliomas,"

More information: Protein MRI contrast agent with unprecedented metal selectivity and sensitivity for liver cancer imaging, *PNAS*, www.pnas.org/cgi/doi/10.1073/pnas.1423021112

Provided by Georgia State University

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