Researchers develop non-invasive early diagnostic test for gastric cancer

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(Medical Xpress) -- Early detection of cancer may eventually become as easy as taking a home pregnancy test, according to new University of Georgia research.

Two studies recently published in the journal PloS ONE identified for the first time that certain proteins excreted in urine can indicate the presence of gastric cancer.

The researchers initially studied stomach cancer because it is the number two cancer killer in the world. They hope that with further study, the detection of abnormally abundant proteins in urine will lead to diagnosis of many types of cancer and other diseases, said Ying Xu, lead author of the study and Regents-Georgia Research Allianceeminent scholar of bioinformatics and computational biologyin the UGA Franklin College of Arts and Sciences.

“In theory, the methodology that we developed should be applicable to other cancers,” said Xu, who also is a professor of biochemistry and molecular biology and director of the UGA Institute of Bioinformatics.

Xu and his colleagues, Celine Hong, Juan Cui and David Puett of the Institute of Bioinformatics, identified a protein called endothelial lipase that differed significantly in its abundance in urine samples of stomach cancer patients versus healthy people. Xu said the computational capability presented in the study for predicting which of the abnormally abundant proteins in diseased tissues can be excreted into urine is a key

breakthrough in cancer detection. Using samples from already known excretory and non-excretory proteins, the study found that the classification system was more than 80 percent accurate.

Of the 21 urine samples of healthy people, only two did not have the protein. In the 21 urine samples of stomach cancer patients, only one sample was considered to have a relatively high level of the protein; levels in the rest were low or absent. “We are suggesting from this relatively small urine sample set that healthy people should have this protein in their urine,” Xu said.

The researchers are currently working on a larger urine sample set of 200 gastric cancer patients and 200 healthy people. “If the EL protein still has the 10 to 15 percent miscalculation rate as with the 21 versus 21 samples, I think we have found a good diagnostic marker for stomach cancer and potentially other cancers,” said Xu.

Now that the researchers have identified a protein marker, Xu says they should be able to develop a method where urine can change the color of a piece of paper to indicate the presence or absence of the protein, similar to the way a home pregnancy test works. The researchers hope to find multiple protein markers for each cancer to increase the accuracy of the test.

Although the test is not yet 100 percent accurate, it can lead at-risk patients to seek a more comprehensive exam, said Xu. Current procedures such as endoscopy are invasive, uncomfortable and may be avoided by many people. “A person could go get a urine test, and if the marker protein is present, then they are generally stomach-cancer free,” said Xu. “If the protein is not present, we might suggest that they get their stomach checked.”

The researchers began by studying a set of 1,500 proteins known to be

excreted in urine and identified a list of features that distinguish them from proteins that are not excreted into urine. Identifying these distinguishing features allowed them to develop a classification system that could predict which proteins in cancerous tissues are excreted into urine.

Xu and his colleagues then used microarrays—chips that are about the size of a stamp that contain nearly twenty thousand human genes—to identify which proteins varied in abundance in the cancerous versus non-cancerous tissues. Messenger RNA (mRNA) molecules extracted from the sample tissues are converted to complementary DNAs (cDNAs) and hybridize with their complement genes on the microarray and light up as spots when the corresponding mRNAs are abundant. The researchers then identified proteins corresponding to those genes that appeared at significantly different levels in the cancer and non-cancer samples. From there, the researchers were able to determine which of the abnormally abundant proteins were secreted into the blood and then excreted in urine using the classification method they developed.

The UGA researchers work in conjunction with a team of researchers led by Fan Li of Jilin University in China, where Xu spends two months a year working with medical doctors and researchers on sample collection and carrying out microarray experiments. This long-term collaboration has led to the establishment of the Jilin University/University of Georgia Joint Research Center for Systems Biology. The researchers are currently collecting tissues from patients with different types of cancer to identify more protein markers that can be detected in urine.

Provided by University of Georgia