Detecting Lung Cancer via Exhalation

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Researchers at the University of Colorado have developed a noninvasive, easy and cheap method of detecting the presence and stage of lung cancer.

A test of organic compounds in exhaled breath can distinguish patients with lung cancer from patients with chronic pulmonary disease (COPD). The test also can detect the stage of cancer. The developing device is the result of collaboration between the University of Colorado Cancer Center and researchers from Technion University in Haifa, Israel.

According to a press release issued by the **University of Colorado Denver**, patients have to blow up a balloon, which is then attached to a highly sensitive gold nanoparticle sensor. Any volatile organic compounds in the exhaled air will be trapped in the sensor and can then be analysed. A USB device for rapid analysis in a computer has recently been developed.

"This could totally revolutionize lung cancer screening and diagnosis. The perspective here is the development of a nontraumatic, easy, cheap approach to early detection and differentiation of lung cancer," says Fred R. Hirsch, MD, PhD, investigator at the CU Cancer Center and professor of medical oncology at the University of Colorado School of Medicine.

The idea of a breath test isn't totally new. In 2007 a **prototype breath test for lung cancer**, developed by Dr. Peter Mazzone of the The Cleveland Clinic in Ohio, was published in Thorax Magazine.

Recent lung cancer screening guidelines by the U.S. Preventative Task Force state that screening via low-dose computed tomography can reduce disease mortality by 20%. In this context, Hirsch points out the need for new lung cancer screening and diagnosis tools: "The metabolism of people with lung cancer is different to that of healthy people and this is reflected in the chemical signature of their breath. Thus, it should be possible to differentiate among people with lung cancer, healthy subjects and also those with other lung conditions like chronic obstructive pulmonary disease."

However, along with more sensitive screening comes a much higher incidence of false positives, primarily in the form of noncancerous lung nodules, a problem the 2007 prototype couldn't overcome. "You detect many, many nodules in those screenings and unfortunately, around 90 percent of them are benign. So you need to find out how to better distinguish malignant from benign modules. The goal of this tool is to use breath biomarkers to distinguish malignant from benign screen-detected nodules," Hirsch says.

The study by UCD enrolled 358 patients in Israel, Denver and Florida. Of them, 213 were lung cancer patients. 145 patients were free of cancer. An analysis of 80 lung cancer patients (64 advanced stage) and 31 patients with COPD showed that the device was capable to distinguish between COPD and lung cancer with an accuracy of 85%. It could also tell COPD from advanced lung cancer with accuracy of 82%, and early from advanced lung cancer (79%).

The device's potential uses go even further. "In addition to using levels of volatile organic compounds to diagnose lung cancer, we could eventually measure the change in patients' levels of VOCs across time with the intent of, for example, monitoring how well a patient responds to specific treatments," Hirsch says. Additionally, Hirsch points out that next generations of the device could potentially help doctors quickly, simply, and inexpensively define patients' lung cancer subtypes, allowing doctors to pair molecularly targeted therapies with subtypes early in the treatment process.

By Ute Eppinger