

Deep inside the body, tiny mechanical microscope

August 14 2012

Tiny space age probes - those that can see inside single living cells - are increasingly being used to diagnose illness in hard-to-reach areas of the body.

NewYork-Presbyterian Hospital/Weill Cornell Medical Center's Dr. Michel Kahaleh often threads a tiny [microscope](#) into the narrow bile ducts that connect the liver to the small intestine to hunt for cancer. He also uses the device to minutely explore the pancreatic duct as one of a few doctors in the country to use such technology in this way.

But because these devices are comparatively new, Dr. Kahaleh, chief of endoscopy at the Center for Advanced Digestive Care at NewYork-Presbyterian/Weill Cornell and professor of clinical medicine at Weill Cornell Medical College, suspected that the specialists who are beginning to use them may be interpreting what they see in different ways.

That's exactly what he and his research team discovered, when they sent six different specialists at five different medical institutions recorded videos taken by a probe-based confocal laser endomicroscopy (pCLE) deep inside 25 patients with abnormally narrowed bile ducts.

The study, published in *Digestive Diseases and Sciences*, demonstrates there was "poor" to "fair" agreement on the clinical significance of what the physicians were viewing in the videos - whether what they saw represented cancer, simple inflammation, or a benign condition.

"That means physicians need to come up with a standard way of interpreting what the videos reveal in order to properly use this "amazing technology," says senior author Dr. Kahaleh, who is also medical director of the Pancreas Program at Weill Cornell. "We can see detail that was just unimaginable a decade ago - this breakthrough is born for the bile duct and those tiny tubes and complicated organ structures that no one has ever been able to visualize before," he says. "And when physicians are certain of what they are seeing, we will be able to greatly improve patient treatment, avoiding unnecessary surgery whenever possible."

The Need to Know What You See

The human bile duct transports bile, secreted by the liver to aid in the process of digestion, to the small intestine. But inflammatory disease, the passing of gallstones or a tumor can cause the bile duct to constrict, resulting in a blockage that can lead to jaundice, cirrhosis, and other conditions.

The U.S. Food and Drug Administration approved pCLE diagnostic systems for use in the bile duct and pancreas two years ago. The pCLE is a mini microscopic probe that is threaded inside a larger "spy glass" probe. The pCLE can then image blood vessels, mucosal structures and epithelial tissue in real-time, broadcasting these images on a large monitor for physicians to examine.

But the vast majority of institutions may still use a rather hit-or-miss technique to determine if a bile duct is cancerous. The traditional technique is to thread a probe inside the duct to where it is abnormally narrowed and then to use a small brush or tiny forceps to gather some cells that can then be biopsied in a lab."But we still miss 20-30 percent of bile duct cancer or other tumors in this way, and that is unacceptable," Dr. Kahaleh says.

If a tumor is found in the bile duct, it can be removed, and a replacement can be fashioned out of the bowel. "It's a big operation, and you want to make sure it is necessary," says Dr. Kahaleh. "If there is any way to prevent surgery that would be a phenomenal advance for patient care."

In this study, the six gastroenterologists trained in using bile duct pCLE were asked to analyze seven variables seen in the 30-second to 1-minute video clips, and diagnose whether the bile duct was cancerous or not. (Only the study coordinator knew the results in advance due to confirmation from tissue biopsies after surgery, or other evidence of malignancy.)

Diagnostic agreement between the specialists was poor to fair, depending on the variable, as was the final diagnosis.

"It is clear physicians need a standard by which to understand what they see, which will also need to involve more training," says Dr. Kahaleh. "This is increasingly important, as these minimally invasive systems are proposed for use in diagnosing other health issues in the gastrointestinal tract, including ulcerative colitis and Barrett's esophagus."

"We can now see inside these tiny organs, but we just need to know exactly what we are looking at," he adds.

Provided by New York- Presbyterian Hospital/Columbia University
Medical Center

Citation: Deep inside the body, tiny mechanical microscope (2012, August 14) retrieved 19 November 2023 from

<https://medicalxpress.com/news/2012-08-deep-body-tiny-mechanical-microscope.html>

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