Optical technique provides improved 'virtual biopsies' of internal surfaces

November 19 2006

In this OFDI image of the stented coronary artery of a pig, taken in vivo, the red reflects the inner arterial surface and the stent is represented as blue. The outer layers of the artery, exposed when the vessel was overstressed by an overinflated balloon catheter, appear as grey. Credit: Massachusetts General Hospital-Wellman Center for Photomedicine

A new optical imaging technique, developed at the Wellman Center for Photomedicine at Massachusetts General Hospital (MGH), can provide three-dimensional microscopic views of the inner surfaces of blood vessels and gastrointestinal organs.

In their report in the journal *Nature Medicine*, receiving early online release today, the MGH-Wellman researchers describe using optical frequency-domain imaging (OFDI) to visualize broad areas of the esophagus and coronary arteries of living pigs. The technique is an advance over optical coherence tomography (OCT) – another noninvasive MGH-developed technology that details much smaller areas – and could be useful for identifying precancerous lesions and dangerous

deposits of plaque in the coronary arteries.

"For diagnosing early-stage disease, the clinician has been basically looking for a needle in a haystack; so sampling only a few microscopic points of an organ, as we could with OCT, is clearly not sufficient," says Brett Bouma, PhD, of the MGH-Wellman Center, the report's senior author. "With OFDI, we can now perform microscopy throughout very large volumes of tissue without missing any locations."

While OCT can examine surfaces one point at a time, OFDI is able to look at over 1,000 points simultaneously by using a new type of laser developed at MGH-Wellman. Inside the fiberoptic catheter probe, a constantly rotating laser tip emits a light beam with an ever-changing wavelength. Measuring how each wavelength is reflected back, as the probe moves through the structure to be imaged, allows rapid acquisition of the data required to create the detailed microscopic images.

In the Nature Medicine paper, the MGH-Wellman team reports that OFDI successfully imaged the inner esophageal surfaces of living pigs, revealing the structural details and vascular networks of 4.5-centimeter-long segments with less than 6 minutes scanning time. Scans of coronary artery surfaces were similarly successful, producing three-dimensional microscopic images of the surfaces of segments 24 to 63 millimeters long. An experiment designed to evaluate OFDI's ability to detect damage to arterial surfaces confirmed that the technique could differentiate between healthy and damaged tissue.

Among potential applications for OFDI could be diagnosis of Barrett's esophagus, a precursor to esophageal cancer that can be identified with OCT, provided the affected tissue is scanned. The researchers estimate that the esophageal scan conducted in this study could be reduced from 6 minutes to less than 1 with more powerful computer processing. Another major application would be examining coronary arteries for the

vulnerable plaques believed most likely to rupture and produce heart attacks. A 2005 study from the MGH Cardiology Division found that OCT could identify vulnerable plaques in symptomatic patients, and the OCT-developed scanning criteria could be used with OFDI to further study the vulnerable plaque hypothesis and potentially to diagnose dangerous plaques and guide their treatment.

The MGH-Wellman researchers also anticipate extending the technology's capabilities into other fields. "One of the most exciting concepts would be to directly link OFDI with the delivery of therapy, such as laser treatment for early cancer," says Bouma. "Our hope is that, thorough one minimally invasive probe, clinicians will be able to diagnose and precisely treat diseased tissue while sparing adjacent healthy tissue." Bouma is an associate professor of Dermatology at Harvard Medical School.

Source: Massachusetts General Hospital

Citation: Optical technique provides improved 'virtual biopsies' of internal surfaces (2006, November 19) retrieved 26 April 2024 from https://medicalxpress.com/news/2006-11-optical-technique-virtual-biopsies-internal.html

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.