Medical Xpress

New form of endoscopic scanning improves detection of precancerous condition

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Cancer of the lower esophagus develops almost exclusively in patients with Barrett's esophagus, an otherwise benign complication of esophageal reflux that affects approximately 3 million Americans. Although the prognosis of patients diagnosed with esophageal cancer is poor, the chances of successful treatment increase significantly if the disease is detected at an early dysplastic stage.

Now, a new endoscopic scanning technique developed by scientists in the Biomedical Imaging and Spectroscopy Laboratory (BISL) at Beth Israel Deaconess Medical Center (BIDMC) has proven successful in the early detection of dysplasia in Barrett's esophagus. The results of the study, which appear in the April 11 on-line issue of the journal *Nature Medicine*, could help clinicians to diagnose esophageal cancer at an earlier stage, when the condition is still treatable.

"We have established that this multispectral scanning technique, which we have named endoscopic polarized scanning spectroscopy [EPSS] offers great promise for the early detection of dysplasia in patients with Barrett's esophagus," explains inventor and senior author Lev Perelman, PhD, Director of the BISL at BIDMC and Associate Professor of Obstetrics, Gynecology and Reproductive Biology at Harvard Medical School. "When used to guide the endoscopist, EPSS appears to not only help to avoid unnecessary biopsies, but also to help the endoscopist to locate suspicious dysplastic areas that might otherwise be missed."

The esophagus is the muscular tube that connects the throat to the

stomach, allowing food to enter the stomach for digestion. Although cancer of the esophagus remains relatively rare, it is currently the fastest increasing cancer in the U.S., possibly due to an increased incidence of obesity. Furthermore, the symptoms of esophageal cancer - including difficulty swallowing, chest pain, or choking - generally do not appear until advanced stages of the disease.

"Barrett's esophagus often develops in individuals who suffer from heartburn and gastrointestinal reflux disease [GERD] which occurs when stomach acid flows backward into the esophagus," explains Ram Chuttani, MD, Director of Interventional Gastroenterology and Endoscopy at BIDMC and a coauthor of the study. "Over time, repeated exposure to stomach contents can result in further progression of the precancerous nature of Barrett's. Known as dysplasia, these precancerous changes occur on a cellular scale, and can currently only be diagnosed by staining numerous cell samples taken from multiple biopsies of different parts of the esophagus," he adds, noting that in spite of multiple biopsies, dysplasia and even cancer may be missed due to inherent sampling errors that can occur when tiny samples are obtained from large surface areas.

The new EPSS instrument, developed by Perelman, enables the endoscopist to more thoroughly search for these dysplastic changes on a subcellular scale. EPSS works by using light-scattering spectroscopy, an optical method that relates color of reflected light to the size, shape and refractive index of the illuminated particle.

"The idea behind light scattering spectroscopy is rooted in the same principles as the formation of a rainbow," explains Perelman. "In a rainbow, white light from the sun is refracted and reflected by tiny water droplets in the atmosphere, which form a colorful spectrum which you see with your eyes. Light scattering spectroscopy employs a bright arc lamp in place of the sun, targets epithelial cells and cell nuclei instead of water droplets, and is viewed through a spectrometer rather than just the

human eye. In the case of EPSS, instead of viewing a beautiful arc, the information obtained from these spectra tells us whether or not the esophageal cells we are viewing are dysplastic.

A clinically useful technique in the detection of dysplasia in Barrett's esophagus must rapidly survey a comparatively large area while simultaneously detecting changes on a cellular scale, explains Perelman, and by combining polarized light scattering spectroscopy with an endoscopically compatible scanning approach, he and his scientific team were able to achieve both goals.

In its first pilot clinical test, conducted at the BIDMC Interventional Endoscopy Center, the EPSS instrument successfully guided the endoscopist in performing biopsies of the esophagus, detecting and mapping sites of numerous invisible dysplasia - which would have been missed by the currently used biopsy standards.

"The detection of the signal related to precancerous epithelial cellular changes is made possible through the use of polarized light," explains Perelman. "Since light reflected from sub-epithelial tissue will become 'depolarized,' while light that is backscattered from epithelial cells will preserve its polarization, the technique of polarization subtraction - or polarized light scattering spectroscopy - retains and conveys only the diagnostically important information."

Provided by Beth Israel Deaconess Medical Center