ADVERTISEMENT FEATURE

Two AI tools aid colonoscopies

NEW ALGORITHMS improve cancer identification from endoscopy video footage.

About 60% of those who die of colorectal cancer after a colonoscopy do so because lesions were missed during the screening. In response, two Japanese researchers have spent the last eight years developing artificial intelligence (AI) technology specifically to assist endoscopists.

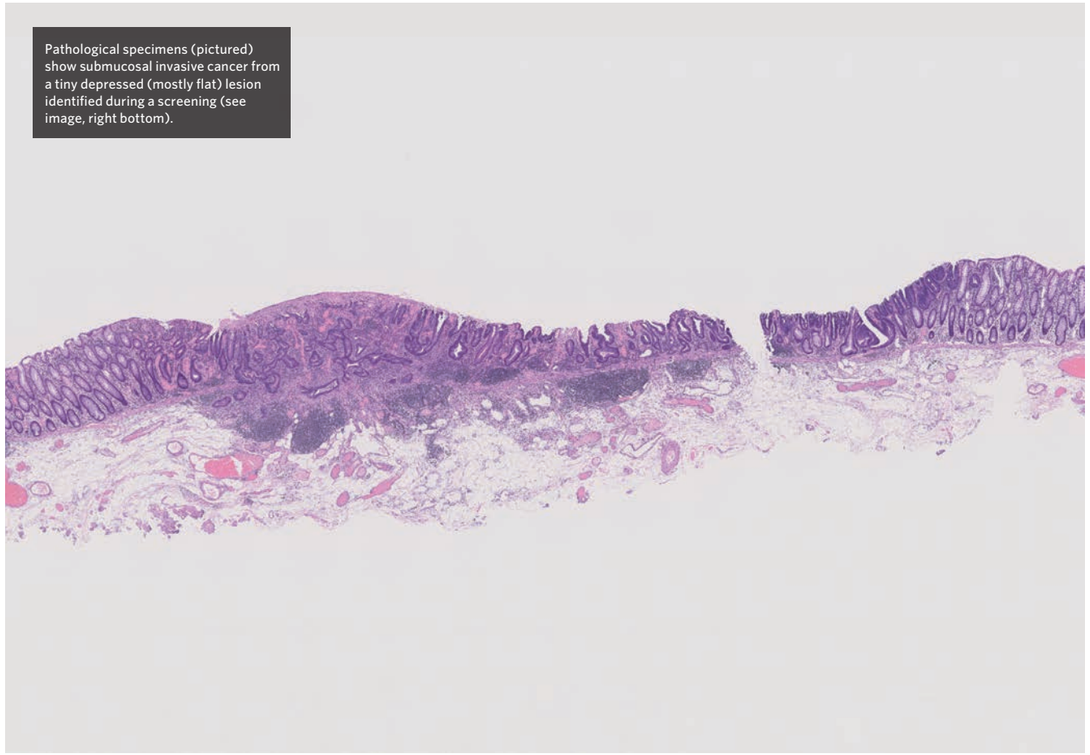
Roughly 25% of all colorectal neoplasms are overlooked by experts looking for them through tiny video cameras, explains Shin-ei Kudo, co-leader on the project and the head of the Digestive Disease Center at Showa University Northern Yokohama Hospital. However, with the right data input, deep-learning algorithms can improve on human detection abilities. Kudo's team has been developing colonoscopy AI technology since 2013 in collaboration with a team run by Kensaku Mori, director of the Information Technology Center at Nagoya University.

Among their advances, the group has designed a computer-aided detection (CADe) system called EndoBRAIN-EYE to reduce the number of overlooked colorectal neoplasms, as well as a computer-aided characterization (CADx) tool called EndoBRAIN, which provides a more accurate type assessments.

The fundamental AI technologies for both systems are the same, explains Mori. CADe applies neural networks for feature extraction of video-framed colonic polyps (abnormal masses). CADx uses the same feature extraction process to help classify lesions for more detailed pathological determination in a lab.

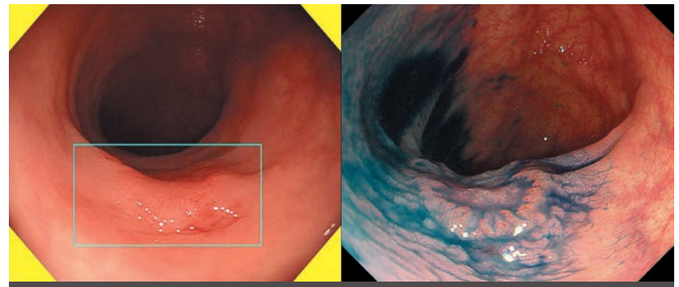
AN EARLY VERSION OF CADx WAS SHOWN TO HAVE A 94% ACCURACY IN THE IDENTIFICATION OF INVASIVE COLORECTAL CANCERS.

Both technologies bring significant improvements in detection. According to a study involving both Kudo and Mori, the CADe systems identifed colorectal lesions with 98% sensitivity and 93.7% specificity when tested on a large publicly accessible colonoscopy database containing data from five academic centres in Japan. In terms of the adenoma detection rate (ADR), an established quality indicator for colonoscopies, a recently published meta-analysis by the researchers and their collaborators on the use of CADe showed a relative 50% increase in ADR compared to standard human screenings; a 1% increase in ADR is associated with a 3% decrease in related colorectal cancer deaths.



Pathological specimens (pictured) show submucosal invasive cancer from a tiny depressed (mostly flat) lesion identified during a screening (see image, right bottom).

Shin-ei Kudo (pictured) and Kensaku Mori have worked on new colonoscopy AI for eight years.



(Left) AI helps detect a depressed tumour and (right) chromoendoscopy sets a tumour in relief.

SUBTLE BUT IMPORTANT CANCERS

Flat or depressed (fairly flat) tumours, known as nonpolypoid lesions, are easily missed during a colonoscopy. The signs are faint, a slight change in the colour of the mucosa and a deviation of subepithelial capillaries. The depressed types (see image, far right bottom) are also more likely to be invasive in nature, irrespective of their size, explains Kudo.

"I have reported on the clinical importance of depressed type and laterally spreading tumours, which are typically the colorectal lesions most overlooked during a colonoscopy," he says. "Because of their malignant potential, we emphasized the importance of precise detection of depressed and flat type tumours in our work."

In 2017, Mori and Kudo, showed an early version of CADx had a 94% accuracy in the identification of invasive colorectal cancer. CADx has also been shown to be particularly strong in invasive cancer identification *in vivo*, if used in tandem with ultra-magnified observation. Ultra-magnifying colonoscopies makes it easier to characterize tumours by making it possible to visualize the cell nuclei of tumour surfaces *in vivo*, explains Kudo.

Narrow-band imaging, in which specific blue and green wavelengths are used to enhance microvessel detail, and methylene blue staining, which helps visualize the cell nuclei of tumors, also improve diagnosis precision during ultra-magnified endoscopy, says Kudo.

Ultra-magnifying images and chromoscopy techniques also help the AI to distinguish between neoplastic and non-neoplastic polyps and between massively invasive and other neoplastic lesions, says Kudo. Thus, AI, in tandem with magnification and staining, could enable endoscopists to predict lesion pathology on site.

REDUCING COSTS

The extra speed and accuracy provided by AI will reduce the cost, time and risk of biopsies and repeated colonoscopies, adds Kudo. Precise diagnoses will also reduce the chances of superfluous treatment.

Studies by Kudo and others have suggested that real-time use of CADx for endoscopies could meet the clinical threshold for diagnose-and-leave strategies for diminutive, non-neoplastic rectosigmoid polyps.

A 2020 study by researchers affiliated with companies that have vested interests in the two systems, found CADx could potentially reduce colonoscopy-related costs by 7–20%.

Kudo adds that real-time AI systems should soon be able to alert an endoscopist instantly when a suspected colonic lesion appears on the screen, which would allow more time for observation, and removal or biopsy.

And Mori says there are other advances in the pipeline. Looking ahead, he sees semi-automated colonoscopies with endoscope manoeuvring based on AI-assisted scene recognition. He also sees a reduction in blind spots during colonoscopies through the use of real-time three-dimensional reconstructions, which would enable better monitoring of areas that are hard to visualize.

In Japan, computer-aided engineering and services company, Cybernet Systems Co., Ltd., which was involved in the development of the EndoBRAIN series, has recently obtained approval under the Pharmaceutical and Medical Device Act to distribute CADe and CADx technology. Both are compatible with endoscopes produced by Olympus Corporation. ■

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