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EDITORIAL

Artificial intelligence for endoscopy

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Abstract

In recent times, there has been progressive development in artificial intelligence (AI) following the introduction of deep learning in the medical field including gastroenterology and endoscopy. Most of the reported studies were based on retrospective data. Several prospective studies of real-time diagnosis of moving images using the AI system are expected to match the real clinical situation and to aid the endoscopists in the detection and diagnosis of neoplasms without missing any lesion. AI can read a large number of endoscopic images in a few minutes and make a diagnosis; therefore, it is expected to cover the lack of support for the screening esophagogastroduodenoscopy in the health check-up and a large number of capsule images, thereby freeing the endoscopists from this burden. AI can help make the diagnosis during the endoscopic procedure and thereby prevent an unnecessary biopsy for patients taking antithrombotic drugs. AI can also be useful for education and training in endoscopy. Trainees can learn to perform endoscopy and the detection and diagnosis of lesions by the support of AI. In the near future, real-time endoscopic diagnosis using AI is expected to lessen the burden of endoscopists, to enhance the quality level of endoscopists, to overcome the miss of lesions and to make optimal diagnosis.

Key words: Artificial Intelligence; Endoscopy; Gastric cancer; Colonic neoplasm

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Core tip: Artificial intelligence (AI) has an increasing role in medical imaging in recent times. It has numerous benefits in the field of endoscopy. It aids in the accurate identification and diagnosis of lesions. AI also helps in reading and accurately interpreting large volumes of endoscopic images. It can play a role in the training of endoscopists as well.

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ARTIFICIAL INTELLIGENCE FOR ENDOSCOPY

In recent times, there has been progressive development in artificial intelligence (AI) following the introduction of deep learning in various fields. As expected, AI has been introduced into the medical field, and many papers have reported on its use in different specialties in the medical field, including gastroenterology and endoscopy[1].

In the field of endoscopy, conventional endoscopy, magnifying endoscopy and endocytoscopy using white light images and optical digital images for gastrointestinal neoplasia, gastritis related to *Helicobacter pylori* infection, and ulcerative colitis have been reported. Most of the reported studies were based on retrospective data. In addition, the results from these retrospective studies have been based on good-quality still images and not on either low-quality images or moving images[2,3]. Real-time imaging involves moving images from different levels in the endoscopic fields and not still images. Therefore, the results from retrospective studies might not match the real images. Several prospective studies of real-time diagnosis using the AI system have also been reported[4]. The data from these studies are expected to match the real clinical situation and to be more beneficial. For more robust clinical verification, well-designed multicenter prospective studies with adequate inclusion/ exclusion criteria that represent the target population are needed[1]. Moreover, the efficiency and accuracy of AI increases as the amount of data increases: For example, the use of moving images. Based on the prospective studies, real-time detection and diagnosis of lesions during endoscopic procedure are expected to become feasible. At present there is high sensitivity for the detection of gastric cancers; however, the specificity is not so good[5], because most gastric cancers involve gastric inflammation as well, which makes the gastric mucosa red or white, irregular, and granular. Gastric inflammation causes erosion, ulcer, or polyp, and is relatively similar in appearance to the mucosa in gastric cancer. On the other hand, the diagnosis of colonic neoplasms using narrow band imaging (NBI), magnifying endoscopy with NBI, or endocytoscopy shows high sensitivity as well as specificity. Recently, EndoBRAIN software (Olympus Medical Systems, Japan) which is an AI system used in endocytoscopy for colonic neoplasms has become available in Japan. This allows the differential diagnosis of a colonic lesion and the confirmation of a colonic neoplasm to be made in a very short time. The endocytoscopy involves a special scope which magnifies the target lesion 520 times and enables observation at the cell level as with a microscope, whereas, EndoBRAIN software has not detected colonic polyps automatically yet.

Until now, it usually took huge time and effort for endoscopists to learn about the many gastrointestinal diseases and train in the endoscopic detection and diagnosis of gastric cancer or colonic neoplasm. Even when the endoscopists are experts, they might sometimes miss the detection and diagnosis of the neoplasms due to similar color of the lesions to the surrounding area, small size of the lesion, difficult location such as behind the folds or on the bending site, and lesions endoscopically observed in a moment among a lot of visual images. AI is expected to aid the endoscopists in the detection and diagnosis of neoplasms without missing any lesion.

AI also helps in the quick interpretation of endoscopic images taken in screening esophagogastroduodenoscopy (EGD) without waste of time. In Japan, screening EGD is conducted as part of the health check-up, and a double check of the screening EGD images is necessary. However, the number of endoscopists is not enough, especially in the local suburbs. Extensive time is required to interpret numerous endoscopic images, and the interpretation of endoscopic images is a burden for Japanese endoscopists. AI can read a large number of endoscopic images in a few minutes and make a diagnosis; therefore, it is expected to cover the lack of support for the screening EGD in the health check-up, thereby freeing the endoscopists from this burden. Moreover, there are numerous software that can easily detect lesions in capsule endoscopy. The interpretation of a large number of capsule images by the endoscopists takes a lot of time, and AI can free the endoscopists from the burden of capsule endoscopy image interpretation.

Lately, there has been a gradual increase in the number of patients taking antithrombotic drugs, and there is a hesitancy in performing a biopsy in these

patients. Although the guidelines for patients taking antithrombotic drugs is available not only in Western countries[6], but also in Eastern countries[7,8], and endoscopic biopsies are allowed in these patients, bleeding following a biopsy is sometimes observed. In addition, colonic polyps were sometimes resected and discard during colonoscopic procedure, therefore, it is important to decide the indication of resection and discard for colonic polyps. AI can help make the diagnosis in vivo during the endoscopic procedure and thereby prevent an unnecessary biopsy and resection, and careless discard.

AI can also be useful for education and training in endoscopy. Generally, instructors teach trainees on the various aspects of endoscopy. Even in the absence of an instructor in some hospitals, trainees can learn to perform endoscopy and the detection and diagnosis of lesions by the support of AI. However, if they always rely on AI for the diagnosis, the diagnostic acumen of the trainees does not improve. The trainees need to learn detection and diagnosis of lesions without the use of AI as well.

On the other hand, as deep learning algorithm is black-box, the machine-generated decision is sometimes hard to understand for endoscopists and it does not match the diagnosis by endoscopists. Therefore, the level of detection and diagnosis sometimes has to be checked periodically.

In the near future, real-time endoscopic diagnosis during endoscopic procedures with real moving images using AI is expected to become widespread in all endoscopic fields, to lessen the burden of endoscopists and to enhance the quality level of endoscopists. AI is desired to overcome the miss of lesions by endoscopy and to make endoscopic diagnosis comparable with optimal diagnostic accuracy by histopathological findings, and to reduce medical costs by avoiding pathological examination and unnecessary resection.

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