Artificial intelligence in the upper GI tract: the future is fast approaching

Gastric cancer remains a major cause of morbidity and mortality worldwide.[1] Identifying early gastric cancer (EGC) during endoscopy is crucial because of the prognostic consequences associated with early diagnosis. Despite considerable technical developments in endoscopic practice, including magnified endoscopy (ME) with narrow-band imaging (NBI), the gastric cancer missed rate remains as high as 10%.[2] Furthermore, considerable interobserver differences in the characterization of lesions identified during gastroscopy have been reported.[3] To solve this problem, artificial intelligence (AI) and computer-aided diagnosis (CAD) could constitute an additional technical tool to assist and support physicians. In the past decade, AI, especially with a deep learning approach, has made tremendous progress in the identification and characterization of neoplasia in the GI tract. In the present study by Hu et al,[4] a CAD deep learning approach was implemented to evaluate ME-NBI images of EGC.

A total of 1777 fully magnified NBI images from 128 patients with EGC and 167 patients with noncancerous gastric lesions were collected from 3 centers and used for the development of the deep learning model. Patients were subdivided into 2 cohorts: an internal training and evaluation cohort and an external test cohort. A classification and a delineation task on the ME-NBI images was performed by the deep learning model, and its performance was compared with those of 3 senior and 5 junior endoscopists. In its predictive performance, the model achieved an accuracy of 0.76 in the external test cohort and showed a performance similar to that in the group of experienced endoscopists, but it was significantly better than that of junior endoscopists. Interestingly, when senior and junior endoscopists were assisted by the deep learning model, their diagnostic ability improved, irrespective of their level of endoscopy experience. In the delineation task with the use of gradient-weighted class activation mapping, the model was able to highlight malignant areas within the study images.

Most preliminary studies of CAD have made use of endoscopic still images rather than video streams, and that may be the major limitation of this study. However, the adaptation of CAD systems, which have shown potential on endoscopic still images onto video streams in a real-life setting, has been demonstrated in the past.[5] This step, although necessary, may not be a major hurdle for CAD algorithms that have undergone robust development in the experimental stage.

Hu et al[4] present an excellently executed study, and they demonstrate in concise terms which steps are necessary to develop and evaluate a deep learning model in GI endoscopy. The evaluation of gastric cancer with super-magnified images and virtual chromoendoscopy is a basic task, with which endoscopists are frequently confronted. As was nicely described in the article, the differentiation between erosive noncancerous areas and EGC can be a challenge, even for experienced endoscopists. However, the enormous potential of AI algorithms, such as the deep learning model presented by Hu et al, [4] becomes obvious when the study results are considered.

> Although the future is almost here, there is still a lot of work to be done in the upper GI tract. By contrast, AI applications and CAD systems in the lower GI tract, including the detection and characterization of colorectal lesions, have already obtained market approval.

The improvement in the average performance of both junior endoscopists and experienced endoscopists gives us a hint as to what to expect from AI and CAD in the future. The harmonious interaction between physicians and AI systems has the potential to revolutionize GI endoscopy. Although nonexperts in a general endoscopy practice will improve their basic detection abilities before referral, experts in referral centers will have the ability to perform complex differential diagnoses on borderline lesions, including those with an intermingled growth pattern, as was described in the study. The optical diagnosis of gastric lesions could thereby improve tremendously. It is easy to envisage the immense effects that such CAD systems could have on various aspects of practice, including cost reduction, and most importantly on mortality and overall prognosis.

Preliminary clinical trials have already demonstrated the feasibility of AI in predicting the invasion depth of early

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esophageal cancers in Barrett's esophagus.[6] The combination of various available technologies will also improve the overall ability of AI systems. For example, monitoring for blind spots during upper GI endoscopy could reduce the number of overseen lesions.[7] Combining this possibility with other AI systems that indicate to endoscopists which areas may need closer inspection, and then finalizing the endoscopy examination with the optical characterization and delineation of suspicious areas, will definitely improve the diagnostic skills of endoscopists using such systems.

Although the future is almost here,[8] there is still a lot of work to be done in the upper GI tract. By contrast, AI applications and CAD systems in the lower GI tract, including the detection and characterization of colorectal lesions, have already obtained market approval.[9] Obviously, the primary difference between the upper and lower GI tracts is in the number of lesions necessary for training and evaluation, being significantly more scarce in the upper GI tract than in the colon and rectum. Still, for AI and CAD systems in the upper GI tract to achieve the reliability and generalizability of systems already available for the colon and rectum, many more data are necessary. The robustness of such systems must be improved with image and video data, and then the actual additional value must be demonstrated in similar randomized, controlled, or tandem trials, which have been published for adenoma detection in the colon.[10]

The expectations of AI in the future are high. To judge from its immense potential, and from the available data from preclinical and clinical trials, this is understandable. Even the broad field of therapeutics in GI endoscopy may soon add new forms of AI applications, in addition to already existing diagnostic CAD options. Thus, it may only be a matter of time before robot-assisted and AI-assisted platforms will routinely accompany endoscopists in the quest for optimal patient outcomes.

Hu et al[4] must be commended for taking a significant step toward the improved diagnosis of EGC with AI. Such studies will ultimately draw the future closer to routine endoscopy practice and finally improve the treatment of patients with gastric cancer.

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Abbreviations: AI, artificial intelligence; CAD, computer-aided diagnosis; EGC, early gastric cancer; ME, magnified endoscopy; NBI, narrow-band imaging.

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