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Letter to the Editor
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Artificial Intelligence in the Diagnosis of Colonic Lesions: Advancing Beyond Conventional Colonoscopy

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Dear Editor,

Colorectal carcinoma (CRC) ranks as the third most prevalent malignancy globally, and its incidence is projected to increase up to 3.2 million cases by 2040 (1). The recent emergence of cases in younger adults highlights the necessity for effective diagnostic and preventive modalities that rely heavily on detecting premalignant precursors such as adenomatous and serrated polyps (2).

Clinicians employ white-light colonoscopy (WLC) as a primary screening tool, often augmented by advanced imaging modalities such as Narrow-band imaging and chromoendoscopy to visualize microvascular structure and detect lesions (3). Nevertheless, Histopathology of tissue specimens remains the gold standard for definitive diagnosis, which can be supplemented by genetic and molecular analyses.

However, these tools have certain limitations. Colonoscopy is operator-dependent, with inter-operator heterogeneity and adenoma miss rates of 6% to 27%, particularly for small, right-sided, or flat lesions (4). Procedural aspects such as endoscopist fatigue and inadequate bowel preparation further compromise diagnostic accuracy (5). Lastly, the strain of processing biopsies creates time delays and increases healthcare costs. These constraints lead to interval lesions and highlight the need for technological diagnostics to alleviate this health burden.

In recent years, artificial intelligence has become a powerful tool for the diagnosis, management, and prevention of disease. Using deep learning algorithms, it analyzes real-time endoscopic images, reduces human error, and increases detection rates for colorectal lesions, including adenomas, serrated lesions, and cancer. Advancements in AI have led to the development of AI-assisted Colonoscopy, which aims to enhance lesion recognition through computer-aided detection (CADe) and optical diagnosis through computer-aided diagnosis (CADx) (6). CADe aims to localize abnormal regions, thereby reducing the probability of missing a lesion during colonoscopy and increasing the adenoma detection rate (ADR) by 7.4% (7) compared to standard colonoscopy.

Meanwhile, a systematic review and network meta-analysis by Tan et al., reported that ENDOANGEL-assisted colonoscopy, a CADe model, achieved the highest detection rate for colorectal polyps and adenomas, with a success rate of 97.8%. CADx combines various advanced imaging techniques, such as

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magnifying narrow-band imaging (M-NBI), magnifying chromoendoscopy, elastic scattering spectroscopy (ESS), endocytoscopy (EC), confocal laser endomicroscopy (CLE), and autofluorescence endoscopy (AFE), to provide real-time optical diagnosis of colorectal lesions and to predict histopathology based on visual appearance. It allows low-risk polyps to be either discarded after resection or left in situ, thereby enhancing diagnostic efficiency and reducing unnecessary polypectomy and healthcare costs.

The key advantages of AI-based systems over traditional methods include real-time lesion detection, automatic tracking of withdrawal speed and time during the procedure, and improved detection of small, flat, and sessile serrated lesions that might be overlooked during visual inspection, thus improving ADR, reducing miss rates, reducing human error, and improving patient outcomes. Moreover, computer-aided diagnosis enables characterization of polyps, thereby reducing unnecessary biopsies and histopathological workload (8).

Despite promising evidence, a substantial translation gap remains. Training datasets usually lack real-world diversity, which limits generalizability across many platforms and demographics.1 Furthermore, the "black-box" nature of algorithms obscures their interpretability, and potential "automation bias" might make future endoscopists less proficient. To overcome these challenges, the research has to shift its focus to multicenter, pragmatic validation of platform-independent models. Effective clinical integration of AI requires clear regulatory guidelines and robust training programs. These measures ensure that AI is used primarily as a decision-making support tool, enhancing the expertise of healthcare professionals rather than replacing them. Clinicians, data scientists, and policymakers work together for a successful and ethical integration. By combining their expertise, they can develop strong ethical guidelines and oversight measures. Such collaboration is essential to ensuring the safe and equitable deployment of these technologies and to enhancing human decision-making rather than replacing it.

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Declaration of generative AI and AI-assisted technologies in the manuscript preparation process:

During the preparation of this manuscript, the authors used ChatGPT (OpenAI; GPT-4, at the time of use) to assist with language refinement, grammar, and clarity of expression. The authors take full responsibility for the integrity, originality, and accuracy of all content.

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