Artificial Intelligence-Assisted Optical Biopsies of Colon Polyps: Hype or Reality?

A plethora of publications in the field of artificial intelligence (AI) and colon polyps in the last 2–3 years have highlighted the potential uses of AI-assisted optical diagnosis of colonic polyps.[1] As promising as these studies might be, there are so many disparate methods and reporting styles, it is hard to separate the hype from reality in the advancement of the AI technology. Shedding some light on the "black box" applications of AI in gastroenterology is challenging. Apart from the methodological issues, considering the financial impact this technology has when imparted into standard of care is equally important.

Even though screening colonoscopies are the gold standard for polyp detection, the financial impact it has on health-care systems is enormous. With a total cost including health-care personnel, endoscopy technology, facilities, and histopathology, colonoscopy is among the most expensive diagnostic procedures. When these costs are calculated at a population level, the annual gross expenditure in the United States is >US$775 million.[2,3]

Arguably, the data above does not do colonoscopy any justice, as it does not provide the whole picture. Colonoscopy is one of the most effective preventive interventions for colon cancer. Saving a patient from colorectal cancer (CRC) or downstaging it is cost efficient. Considering the expenses of surgery, chemoradiotherapy, and palliative treatment, the savings in CRC-related costs are enough to mitigate any direct and indirect cost of screening colonoscopy.[4] Therefore, what appeared to be an expensive procedure now happens to be one of the most cost-effective preventive policies!

There is, however, a narrow margin between the costs and savings. Although costs are due in the present, the positive outcomes will be felt in 10 to 20 years because of the slow natural history of the adenoma–carcinoma sequence. Costs are certain, but the savings may be obscured by unexpected factors, such as death by competing causes and/or post-colonoscopy issues resulting from a missed lesion or incomplete resection. Therefore, it is essential to maximize the benefits of colonoscopy and one way to do that is by improving its yield (i.e., detecting more polyps that are consequential).

Optical diagnosis of diminutive polyps is clearly the most promising intervention for an immediate saving on the costs of screening colonoscopy. Due to their high prevalence, these lesions disproportionately account for most of the histopathology costs, accounting for nearly 10% for the whole colonoscopy cost in the United States.[2] Furthermore, the significance of finding these polyps is questionable, as nonadvanced adenomas or hyperplastic polyps are frequently reported.

Endoscopy classifications, based on the use of blue-light imaging, showed a high accuracy in the *in vivo* prediction of histologic diagnosis, attempting cost-saving strategies like "leave in situ" and "resect and discard." However, their application in a community environment failed due to their lower-than-expected accuracy and significant interoperator variability.[5]

Could AI-attributed savings eliminate all the barriers preventing optical diagnosis to be used in clinical practice? Firstly, the use of AI for polyp characterization requires a higher cognitive skill by the endoscopist. In the case of diagnosis, only an endoscopist competent in optical characterization will be confident enough to accept or refuse the AI diagnosis based on a complex analysis of the surface and vasculature features. Nonexpert endoscopists are likely to passively accept the AI suggestion without questioning it with a high degree of confidence, posing the risk of an increasing automation of the AI diagnostic method. If the choice is between a diagnosis by an experienced histopathologist and an AI prediction verified by a nonexpert endoscopist, health-care systems will continue being reluctant to adapt the leave-in-situ strategy, regardless of the magnitude of the financial savings. Who would be held accountable for an incorrect diagnosis: the endoscopist, the software developer, the health systems, or all of them together?

Weigt *et al*.[6] compared the accuracy of optical diagnosis among a dual AI system, expert and non-expert endoscopists. The combined AI system based on deep learning used a multicenter library of >200,000 images from 1572 polyps, while testing was performed on two independent image sets from 234 polyps that was also evaluated by six endoscopists (three experts and three nonexperts). The AI characterization system (CADx) showed a sensitivity, specificity, and accuracy of 85%, 79.4%, and 83.6% for polyp characterization, respectively. Experts showed comparable performances, while non-experts using CADx showed comparable accuracy but lower specificity. Therefore, when using CADx, nonexpert endoscopists achieve similar performances to those of expert endoscopists, but with suboptimal specificity.

A sequential algorithm between AI prediction and endoscopist's confidence may facilitate its implementation into clinical practice. The leave-in-situ strategy should only be reserved for polyps that are both predicted as hyperplastic by AI and confirmed with a high level of confidence by experienced endoscopists. In case of any discrepancy or low level of confidence, histologic analysis is warranted. Competence in optical diagnosis, acquired with a structured curriculum, is the prerequisite, not the final outcome of AI implementation!

In conclusion, there will always be questions we need to have answered by technology, but we will only get there if we start using such tools in clinical practice, although in a safe and stepwise manner.[7] Currently, we are at that turning point. In addition to CADx, AI detection tools for colon polyps are already available for clinical practice.[8] This is the first and much needed step in implementing AI tools that have more than one use—such as combined detection and characterization.[9] Only then will we start to see the true potential of AI in the practice of colonoscopy. AI will most likely not replace endoscopists. But the endoscopists who adopt the new technology may replace those who do not!

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

Hemant Goyal, Abhilash Perisetti[1], Sumant Inamdar[1], Benjamin Tharian[1], Jiannis Anastasiou[2]

The Wright Center for Graduate Medical Education, Scranton, PA, [1]Department of Medicine, Division of Gastroenterology and Hepatology, University of Arkansas for Medical Sciences, [2]Department of Medicine, Division of Gastroenterology and Hepatology, University of Arkansas for Medical Sciences and The Central Arkansas Veterans Healthcare System, Little Rock, Arkansas, USA

Address for correspondence: Dr. Jiannis Anastasiou, Department of Medicine, Division of Gastroenterology and Hepatology, University of Arkansas for Medical Sciences and The Central Arkansas Veterans Healthcare System, Little Rock, Arkansas, USA. E-mail: ianastasiou@uams.edu

Submitted: 07-Sep-2021 **Accepted:** 27-Dec-2021 **Published:** 13-Jan-2022

REFERENCES

1. Hassan C, Spadaccini M, Iannone A, Maselli R, Jovani M, Chandrasekar VT, *et al*. Performance of artificial intelligence in colonoscopy for adenoma and polyp detection: A systematic review and meta-analysis. Gastrointest Endosc 2021;93:77-85.e6.
2. Mori Y, Kudo SE, East JE, Rastogi A, Bretthauer M, Misawa M, *et al*. Cost savings in colonoscopy with artificial intelligence-aided polyp diagnosis: An add-on analysis of a clinical trial (with video). Gastrointest Endosc 2020;92:905-11.e1.
3. Jin EH, Lee D, Bae JH, Kang HY, Kwak MS, Seo JY, *et al*. Improved accuracy in optical diagnosis of colorectal polyps using convolutional neural networks with visual explanations. Gastroenterology 2020;158:2169-79.e8.
4. Zhong GC, Sun WP, Wan L, Hu JJ, Hao FB. Efficacy and cost-effectiveness of fecal immunochemical test versus colonoscopy in colorectal cancer screening: A systematic review and meta-analysis. Gastrointest Endosc 2020;91:684-97.e15.
5. Wang LM, East JE. Diminutive polyp cancers and the DISCARD strategy: Much ado about nothing or the end of the affair? Gastrointest Endosc 2015;82:385-8.
6. Weigt J, Repici A, Antonelli G, Afifi A, Kliegis L, Correale L, *et al*. Performance of a new integrated computer-assisted system (CADe/CADx) for detection and characterization of colorectal neoplasia. Endoscopy 2021;[Online ahead of print] [doi: 10.1055/a-1372-0419].
7. Shung DL, Byrne MF. How artificial intelligence will impact colonoscopy and colorectal screening. Gastrointest Endosc Clin N Am 2020;30:585-95.
8. Urban G, Tripathi P, Alkayali T, Mittal M, Jalali F, Karnes W, *et al*. Deep learning localizes and identifies polyps in real time with 96% accuracy in screening colonoscopy. Gastroenterology 2018;155:1069-78.e8.
9. Bisschops R, East JE, Hassan C, Hazewinkel Y, Kamiński MF, Neumann H, *et al*. Advanced imaging for detection and differentiation of colorectal neoplasia: European Society of Gastrointestinal Endoscopy (ESGE) Guideline – Update 2019. Endoscopy 2019;51:1155-79.

Access this article online	
Quick Response Code:	**Website:** www.sjmms.net
	DOI: 10.4103/sjmms.sjmms_524_21

How to cite this article: Goyal H, Perisetti A, Inamdar S, Tharian B, Anastasiou J. Artificial intelligence-assisted optical biopsies of colon polyps: Hype or reality? Saudi J Med Med Sci 2022;10:77-8.