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Is LCI the best for virtual chromoendoscopy?

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Since the introduction of narrow-band imaging (NBI) in 2005, based on optic filters that select wavelengths of light that correspond to the peak light absorption of hemoglobin, and the further systems that digitally process endoscopic images to provide a series of wavelengths of light, such as Fuji Intelligent Chromo Endoscopy (FICE) and i-Scan, there has been a great improvement in colorectal lesions characterization, delineation and classification, specially when combined to high-optical magnification. However, when it comes to colorectal polyps or adenoma detection, virtual chromoendoscopy techniques have not demonstrated significant improvement over white-light endoscopy (WLE) in colonoscopy screening targeting an average-risk population. A meta-analysis of 42 studies concluded that only conventional dye-based chromoendoscopy was associated with an increase in adenoma detection rate (ADR) in comparison to NBI, FICE, i-Scan, autofluorescence imaging and cap-assisted colonoscopy [1]. Another single-center randomized controlled trial (RCT) enrolling 1650 patients also showed no difference in ADR and adenoma miss rate between virtual chromoendoscopy with NBI or FICE and WLE [2].

More recently, a second generation of equipment-based image-enhanced endoscopy (IEE) technologies has been launched, which includes NBI in the latest Olympus scopes (2G-NBI); i-Scan Optical Enhancement from Pentax; Blue Laser Imaging (BLI) and Linked Color Imaging (LCI) from Fujifilm [3]. The new generation of IEE technologies has improved the brightness of the light source, offering a better quality of image and overcoming the darkness associated with far-field examination in earlier versions [3]. Conceivably, the new generation of IEE could perform much better in detection of superficial neoplastic lesions and could be a powerful tool for colorectal cancer screening. LCI particularly has been accepted with enthusiasm due to the lighter colors and brighter image that resembles WLE, and the more reddish appearance of mucosal abnormalities in comparison with NBI and BLI. A multicenter prospective RCT in China demonstrated that LCI increased ADR and sessile serrated polyp detection compared to WLE [4]. Another RCT, designed in Japan, reported an improvement in polyp detection rate in the right colon by six non-expert endoscopists with use of LCI (92.3 ± 2.3 % with LCI vs. 72.7 ± 11.5 % with WLE; $P<0.01$) [5]. Moreover, a recently published European RCT revealed a reduction in the adenoma miss rate with use of LCI in comparison to WLE (11.8 % vs 30.6 %; $P<0.001$) [6].

In this issue of Endoscopy International Open, Sakamoto et al. [7] from National Cancer Center Hospital (NCCH) in Japan report an interesting study aiming to evaluate the additional benefit of LCI in detection of colorectal polyps compared to WLE in the insertion phase of colonoscopy. The authors enrolled 138 patients equally distributed into two groups: colonoscope insertion with WLE or with LCI. All patients underwent colonoscope withdrawal from cecum to rectum under LCI imaging. A single, experienced endoscopist carried out all procedures. Interestingly no difference was noted in detection of right colon polyps, because the majority of lesions were detected during scope withdrawal. In addition, the efficacy of LCI for detection of advanced adenomas (>10 mm, villous component or presence of high-grade dysplasia) was not superior to WLE. However, in the left colon, particularly in the sigmoid, more polyps were detected during insertion with LCI imaging than with WLE, 16 % out of 48 lesions for LCI against 0 % in the WLE group ($P=0.045$). Of note, most of the lesions detected were small tubular adenomas smaller than 5 mm. The authors concluded that colonoscopy with LCI improves colorectal polyp detection during the insertion phase of the examination.

Many investigators have studied whether use of virtual chromoendoscopy is superior to WLE in detection of colorectal

polyps and flat lesions. The majority of studies published to date have attempted to answer this question during the withdrawal phase of colonoscopy, usually comparing two groups, the first under WLE (control group) and the second with different types of virtual chromoendoscopy technologies (intervention group), either in more sophisticated methodology such as in a back-to-back or tandem fashion, with patients undergoing two consecutive examinations, whereas in other studies, each individual undergoes a single exam (control or intervention), the design adopted by Sakamoto et al [7]. What is unique about this study is that LCI impact was compared to WLE during the insertion phase of colonoscopy. In this stage of the examination, the majority of colonoscopists usually attempt to reach the cecum as fast as possible and do not particularly carefully inspect the colonic mucosa. Occasionally when small polyps are identified during insertion, immediate resection may be carried out, avoiding the risk of being unable to find the lesion again during colonoscopy return. The group from NCCH proposes an innovative approach, carrying out a meticulous examination during scope insertion using LCI, to avoid missing polyps in the left colon. In their experience, approximately 10 % of polyps could only be detected during the insertion phase. It is an interesting proposal, although their study has methodological limitations, as acknowledged by the authors, particularly lacking a formal randomization design and enrolling a small sample size, which could provide more robust evidence in favor of such an approach.

There is still a lot of space for improvement in colorectal cancer screening, and virtual chromoendoscopy techniques may be the key to better performance in several quality standards, such as ADR, adenoma miss rate and right colon examination. Although IEE plays a definite role in lesion characterization and classification, its value in routine inspection of the colon in screening programs is still being debated, especially when taking into account studies that enrolled the first generation of virtual chromoendoscopy. There is a growing body of evidence showing that newer techniques such as LCI improve such parameters in small, prospective controlled trials; however, further large-scale studies are warranted to add up to these findings.

In addition, the quality of colonoscopy screening involves several factors, ranging from patient selection and pre-procedure counseling, to bowel preparation, sufficient time dedicated to complete inspection, technology of the endoscopy system, and more importantly, endoscopist expertise and training. Although the largest trials addressing virtual chromoendoscopy's impact on colorectal screening failed to demonstrate an improvement in pathology detection, the first studies about LCI have presented promising results. However, one must always take into account the importance of the knowledge and experience of the endoscopist when analyzing either a scientific study or when considering the addition of new technology to daily practice.

In our personal view, it will be difficult to prove that any type of virtual chromoendoscopy technology per se will be able to overcome a highly trained endoscopist with a WLE high-resolution scope in hands, performing a dedicated colonoscopy aimed at finding and properly removing any colorectal polyp or flat lesion in his/her way. Therefore, we endorse the recent statement of Matthew Rutter concerning this same issue: "pick your endoscopist before you pick your technology." [8] Perhaps, in the near future, the frontiers recently opened with artificial intelligence will revolutionize gastrointestinal endoscopy practice and demonstrate that both of us were wrong.

In conclusion, we would like to congratulate the authors from NCCH on developing a study that prompts some new questions based on its conclusions: Should we change our routine and proceed careful examination during scope insertion? What is the impact of higher detection of diminutive left-sided polyps? Is there a definitive role for new-generation virtual chromoendoscopy in colorectal cancer screening? And is LCI the best technique for virtual chromoendoscopy?

Competing interests

None

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