ISSN 1948-5204 (online)

World Journal of *Gastrointestinal Oncology*

World J Gastrointest Oncol 2024 October 15; 16(10): 4037-4299

Published by Baishideng Publishing Group Inc

World Journal of Gastrointestinal Oncology

Contents

Monthly Volume 16 Number 10 October 15, 2024

World Journal of Gastrointestinal Oncology

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WJGO mainly publishes articles reporting research results and findings obtained in the field of gastrointestinal oncology and covering a wide range of topics including liver cell adenoma, gastric neoplasms, appendiceal neoplasms, biliary tract neoplasms, hepatocellular carcinoma, pancreatic carcinoma, cecal neoplasms, colonic neoplasms, colorectal neoplasms, duodenal neoplasms, esophageal neoplasms, gallbladder neoplasms, *etc*.

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NAME OF JOURNAL
World Journal of Gastrointestinal Oncology

ISSN
ISSN 1948-5204 (online)

LAUNCH DATE
February 15, 2009

FREQUENCY
Monthly

EDITORS-IN-CHIEF
Monjur Ahmed, Florin Burada

EDITORIAL BOARD MEMBERS
https://www.wjgnet.com/1948-5204/editorialboard.htm

PUBLICATION DATE
October 15, 2024

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World J Gastrointest Oncol 2024 October 15; 16(10): 4045-4051

DOI: 10.4251/wjgo.v16.i10.4045

ISSN 1948-5204 (online)

EDITORIAL

Advances in endoscopic diagnosis and management of colorectal cancer

Shi-Wei Li, Xiang Liu, Si-Yu Sun

Specialty type: Gastroenterology and hepatology

Provenance and peer review: Invited article; Externally peer reviewed.

Peer-review model: Single blind

Peer-review report's classification
Scientific Quality: Grade B
Novelty: Grade C
Creativity or Innovation: Grade C
Scientific Significance: Grade B

P-Reviewer: Horkaew P, Thailand

Received: March 14, 2024
Revised: May 11, 2024
Accepted: June 4, 2024
Published online: October 15, 2024
Processing time: 195 Days and 19.5 Hours

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Abstract

Colorectal cancer (CRC) is a leading global health concern, and early identification and precise prognosis play a vital role in enhancing patient results. Endoscopy is a minimally invasive imaging technique that is crucial for the screening, diagnosis, and treatment of CRC. This editorial discusses the importance of advances in endoscopic techniques, the integration of artificial intelligence, and the potential of novel technologies in enhancing the diagnosis and management of CRC.

Key Words: Colorectal cancer; Endoscopic diagnosis; Endoscopic management; Artificial intelligence; Endoscopic devices

Core Tip: Endoscopy is a vital tool for the early identification and accurate diagnosis of colorectal cancer (CRC). Advanced endoscopy techniques, such as endoscopic submucosal dissection and full-thickness resection, offer promising therapeutic strategies for localized CRC. Artificial intelligence has the potential to improve diagnostic accuracy and procedural outcomes in endoscopic practice. Novel innovations such as nanotechnology and molecular targeted therapy may provide personalized treatment strategies and enhance treatment outcomes in CRC.

Citation: Li SW, Liu X, Sun SY. Advances in endoscopic diagnosis and management of colorectal cancer. *World J Gastrointest Oncol* 2024; 16(10): 4045-4051
URL: https://www.wjgnet.com/1948-5204/full/v16/i10/4045.htm
DOI: https://dx.doi.org/10.4251/wjgo.v16.i10.4045

INTRODUCTION

In this editorial, we would like to comment on an article entitled "Colorectal cancer screening: A review of current knowledge and progress in research"[1]. Colorectal cancer (CRC) represents a substantial health concern worldwide, contributing significantly to the global burden of cancer-related mortality[2]. CRC prognosis is closely associated with the stage at diagnosis, with early-stage disease having a higher likelihood of successful treatment and better survival rates [3]. Early detection and accurate diagnosis of CRC are therefore crucial for improving outcomes. Endoscopy is a minimally invasive imaging technique that has become an essential tool for CRC screening, diagnosis, and management. It enables direct visualization of the colorectal mucosa and precise tissue sampling for histological examination[4,5].

ADVANCES IN ENDOSCOPIC TECHNIQUES

In recent decades, significant advances in endoscopic techniques have greatly enhanced the detection and management of CRC[6]. Narrow-band imaging (NBI) and autofluorescence endoscopy have been widely used to improve the visualization of mucosal surface patterns and microvascular architecture, particularly in the detection of early-stage CRC[7]. In addition to diagnostic imaging techniques, advanced endoscopic treatment procedures such as endoscopic submucosal dissection (ESD) (Figure 1) and full-thickness resection (FTR) have transformed the treatment of early-stage CRC[8,9]. These minimally invasive procedures facilitate *en bloc* resection of large colorectal lesions, providing curative treatment options for patients who were previously deemed ineligible for surgery due to advanced age, comorbidities, or patient preference. With careful patient selection and skilled operators, ESD and FTR have yielded promising oncological outcomes comparable to surgical resection, with reduced morbidity, shorter hospital stays, and improved quality of life [10-12].

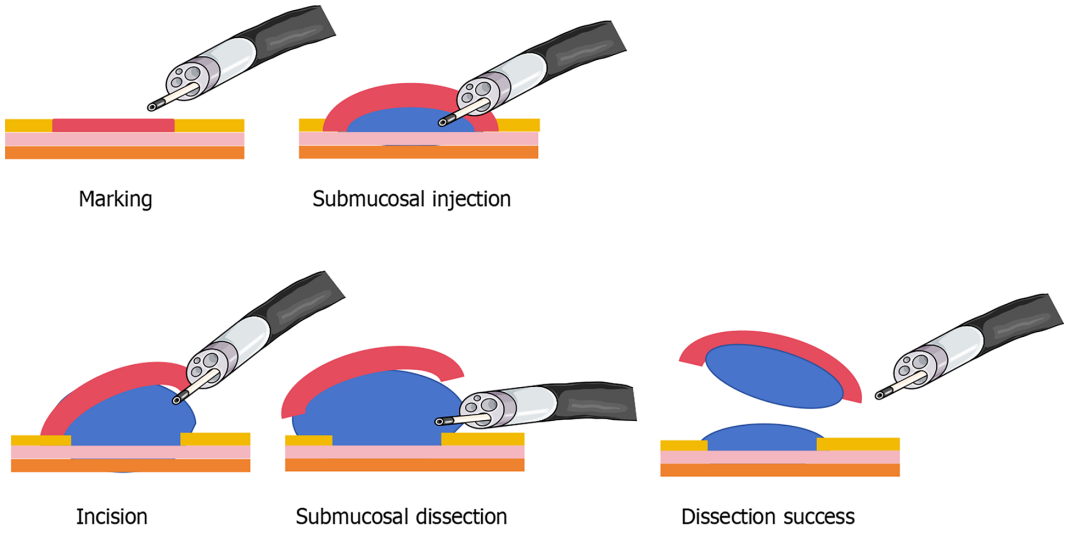

Figure 1 Endoscopic submucosal dissection procedure. The process of removing a lesion from the digestive tract is shown.

INTEGRATION OF ARTIFICIAL INTELLIGENCE

Artificial intelligence (AI) and machine learning techniques have become key focal points in the realm of endoscopic research, and have the potential to revolutionize diagnostic accuracy and procedural outcomes (Figure 2)[13]. AI algorithms can identify suspicious lesions *via* analysis of endoscopic images and videos, provide real-time feedback to endoscopists, and reduce the risk of missed diagnosis[14,15]. Machine learning algorithms, a subset of AI, have the capacity to learn from large datasets, enabling them to identify complex patterns and features that may be undetectable to the human eye[16]. These algorithms can be trained to recognize subtle changes in the colorectal mucosa that indicate the possible presence of cancerous or precancerous lesions[17]. In doing so, they help endoscopists make more informed decisions regarding treatment planning and prognostication, as well as select the most appropriate biopsy sampling

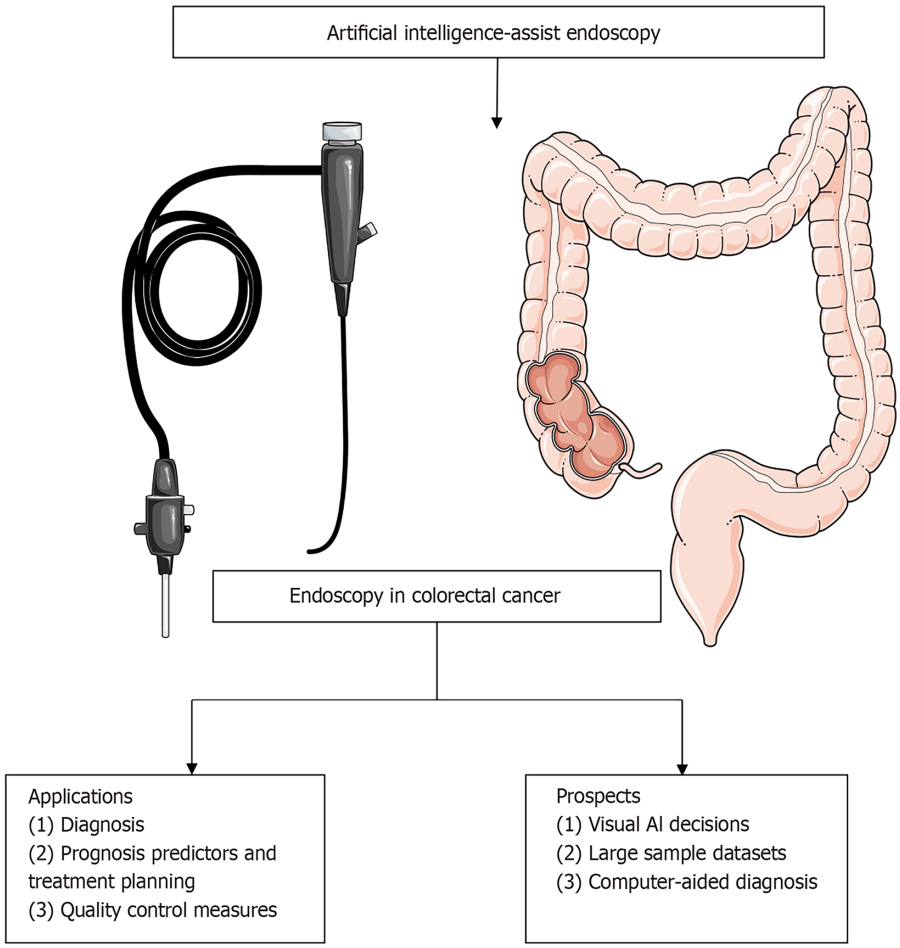

Figure 2 Artificial intelligence application in endoscopic colon cancer. AI: Artificial intelligence.

strategies[18].

The integration of AI into computer-aided diagnosis (CAD) systems is particularly transformative, as these systems can automatically identify suspicious areas on endoscopic images, reducing interobserver variability and improving the overall diagnostic yield of endoscopy[19]. AI-driven CAD systems also have the potential to enhance the characterization of lesions, estimating their likelihood of malignancy based on morphological and architectural features[20]. This capability facilitates more precise risk stratification, enabling endoscopists to tailor their interventions and therapeutic strategies to the individual needs of the patient[21]. By optimizing biopsy sampling, AI can ensure that the most informative samples are obtained, leading to more accurate histological diagnosis and timely treatment decisions[22].

AI/ML demonstrates remarkable potential in diagnosing CRC. However, it is not without limitations and drawbacks [23]. The algorithms employed are typically based on historical data, potentially resulting in inaccurate predictions for novel or unrepresented cases. Furthermore, the safety of AI/ML applications is a pressing concern among expert physicians[24]. While these systems undergo rigorous testing and validation, errors or misdiagnoses could have severe consequences in extreme cases. Radiologists are apprehensive about the potential burden of extensive data collection and training that machine learning models necessitate. Additionally, these models may lack the intuitive judgement and experiential knowledge possessed by clinical practitioners[25]. Consequently, a subset of physicians propose that AI/ML results should be considered as supplementary references to, rather than substitutes for, the judgement of clinical physicians[26]. Further research and development are imperative to address these concerns and maximize the benefits of AI/ML in the field of CRC management.

NOVEL INNOVATIONS

Novel innovations such as nanotechnology and molecular targeted therapy present exciting opportunities for personalized CRC treatment strategies (Figure 3)[27,28]. Nanotechnology has the capacity to manipulate matter at the atomic, molecular, and supramolecular levels, and is poised to revolutionize drug delivery systems in CRC[29]. Nanoparticle based drug delivery systems can enhance the therapeutic efficacy of anticancer agents by targeting the delivery of drugs directly to the site of the tumor, thereby reducing systemic toxicity and minimizing side effects[30]. Nanoparticles can be engineered to preferentially accumulate in tumor cells, thereby increasing the concentration of therapeutics at the site of action and potentially enhancing treatment efficacy[30]. Nanotechnology can also facilitate the delivery of multiple drugs

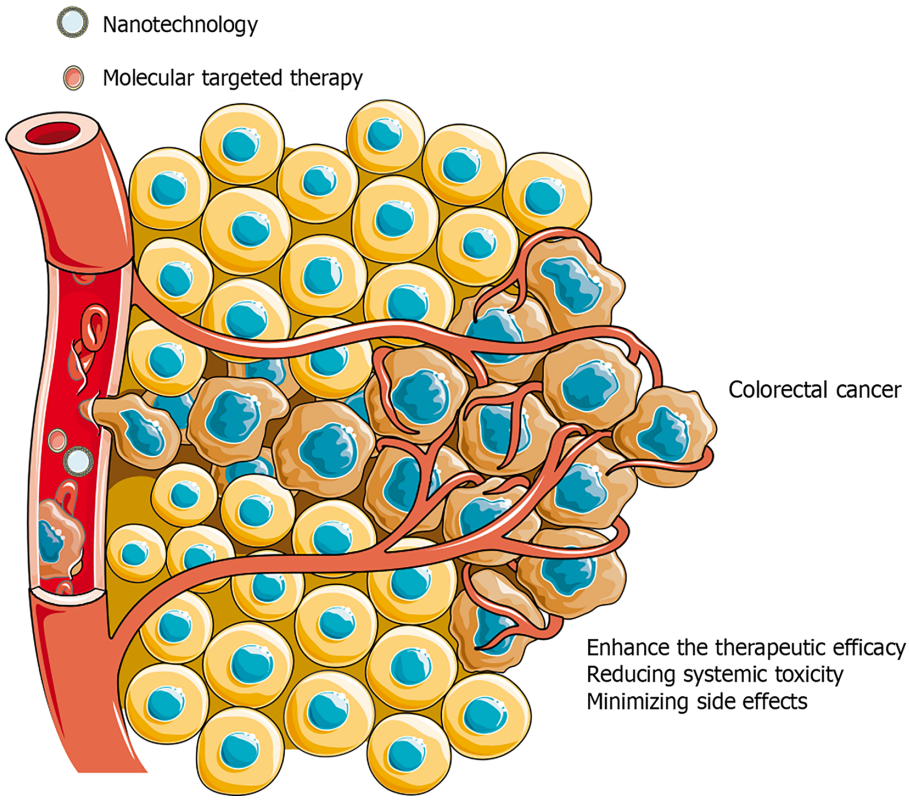

Figure 3 Advanced colorectal cancer treatment: Nanotechnology and molecular targeted therapy.

simultaneously, potentially mediating the administration of combination therapies that can address the complex biology of CRC[31].

Molecular targeted therapy represents another rapidly advancing frontier in the treatment of CRC. The approach focuses on specific genetic mutations and signaling pathways involved in CRC development and progression[28]. In so doing, molecular targeted therapies can inhibit the growth and spread of cancer cells while sparing normal cells, thereby minimizing the adverse effects associated with traditional chemotherapy[28]. Personalized medicine in CRC can be achieved by identifying the specific genetic alterations present in an individual patient's tumor and then selecting the most appropriate targeted therapy[32]. This tailored treatment strategy has the potential to enhance treatment response rates, improve outcomes, and lower the risk of disease recurrence and metastasis[26].

SENSORS AND ENDOSCOPIC DEVICES

The use of sensors in CRC diagnosis has significantly evolved over the years. Advanced imaging sensors, such as optical coherence tomography and Raman spectroscopy, allow for the detection of abnormal tissue characteristics, thereby contributing to early diagnosis of lesions[33,34]. These sensors not only enhance visualization but also provide real-time feedback during endoscopic procedures, enabling more targeted and informed decision-making. Additionally, sensors are being integrated into existing endoscopic systems, providing clinicians with valuable information to facilitate more personalized treatment plans[35].

Similarly, endoscopic devices have witnessed significant development in the diagnosis and treatment of CRC. High-definition cameras equipped with NBI technology allow for better visualization of mucosal structures, thereby enhancing lesion detection rates[36]. Furthermore, robotic systems and automated modules have been integrated into endoscopic devices, streamlining complex procedures and reducing procedural time, thereby minimizing discomfort for patients[37].

Moreover, the integration of these devices with workflow processes has significantly improved the efficiency of CRC care. Automated data collection and analysis systems have facilitated seamless communication between healthcare providers, enabling comprehensive and coordinated care. Telemedicine platforms have also emerged as a viable option for remote consultations, allowing specialists to provide expert guidance and opinions in real-time, even in areas with limited access to specialized providers.

Despite these advancements, challenges persist. Standardization and validation of these technologies are crucial to ensure reliable and accurate results. Furthermore, ensuring patient privacy and data security must be adequately addressed to avoid any breaches in patient confidentiality. Additionally, further research is needed to identify novel sensors and endoscopic devices that can further enhance the accuracy and efficiency of CRC diagnosis and treatment.

CONCLUSION

Endoscopy has become an essential tool in the diagnosis and treatment of CRC, facilitating minimally invasive diagnostic and therapeutic options. Rapid technological advances have resulted in enhanced diagnostic accuracy, improved treatment modalities, and personalized treatment strategies. Integration of AI and novel technologies in endoscopic practice exhibits great promise with respect to transforming CRC management and improving outcomes. Continued development of endoscopic techniques, knowledge sharing, and collaboration among healthcare providers, researchers, and industry partners are required to further enhance the capabilities of endoscopy in CRC management.

ACKNOWLEDGEMENTS

The authors extend the deepest appreciation to Dr. Si-Yu Sun and Dr. Xiang Liu, who have made genuine contributions to the manuscript and endorsed the conclusion.

FOOTNOTES

Author contributions: Li SW wrote the manuscript; Sun SY and Liu X reviewed and revised the manuscript; and all authors read and approved the final manuscript. Sun SY and Liu X contributed equally (provided crucial suggestions and guidance for the writing) to this work as co-corresponding authors.

Conflict-of-interest statement: All the authors report no relevant conflicts of interest for this article.

Country of origin: China

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S-Editor: Chen YL
L-Editor: Wang TQ
P-Editor: Zhao S

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