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Advancements and challenges in gastrointestinal imaging

Eun Jeong Gong, Chang Seok Bang

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Abstract

A recent review by Gulinac *et al*, provides an in-depth analysis of current clinical issues and challenges in gastrointestinal imaging. This editorial highlights the advancements in imaging techniques, including the integration of artificial intelligence and functional imaging modalities, and discusses the ongoing relevance of traditional nuclear medicine tests. The future of gastrointestinal imaging looks promising, with continuous improvements in resolution, enhanced ability to analyze color and texture beyond visual diagnosis, faster image processing, and the application of molecular imaging and nanoparticles expected to enhance diagnostic accuracy and clinical outcomes.

Key Words: Imaging methods; Gastrointestinal diseases; Gastrointestinal tract; Radiology; Tumors of the gastrointestinal tract

Core Tip: A recent review by Gulinac *et al*, provides an in-depth analysis of current clinical issues and challenges in gastrointestinal imaging. This editorial highlights the advancements in imaging techniques, including the integration of artificial intelligence and functional imaging modalities, and discusses the ongoing relevance of traditional nuclear medicine tests. The future of gastrointestinal imaging looks promising, with continuous improvements in resolution, enhanced ability to analyze color and texture beyond visual diagnosis, faster image processing, and the application of molecular imaging and nanoparticles expected to enhance diagnostic accuracy and clinical outcomes.

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INTRODUCTION

Imaging techniques are pivotal in modern gastroenterology, allowing for detailed examination and diagnosis of gastrointestinal diseases. A recent review by Gulinac *et al*[1], describes the current clinical issues and challenges in gastrointestinal imaging. This editorial highlights the key insights and implications of their findings.

EVOLUTION OF GASTROINTESTINAL IMAGING

Gulinac *et al*[1] provide a comprehensive overview of both non-invasive and invasive imaging modalities used in the evaluation of gastrointestinal diseases. Traditional methods such as plain X-ray, defecography, enterography, computed tomography (CT), or magnetic resonance imaging (MRI) remain foundational, particularly for assessing acute conditions like bowel perforation and obstruction. However, newer technologies like functional imaging or advanced CT/MRI techniques are revolutionizing the field.

KEY FINDINGS AND ADVANCES, CHALLENGES, AND LIMITATIONS

The review emphasizes several advancements and acknowledges the associated challenges. Videoendoscopy, including esophagogastroduodenoscopy and colonoscopy, remains a cornerstone for both diagnosis and therapeutic interventions of gastrointestinal luminal disorders. Image-enhanced endoscopy enhances visual diagnosis by allowing targeted biopsies and aiding in the decision-making process for endoscopic resection techniques. However, the effectiveness of these techniques is influenced by the experience and expertise of the endoscopists, with subjective interpretability and inter-observer variability tempering their widespread implementation[2,3]. Studies show that only experienced endoscopists with high confidence levels benefit significantly from this technology[4].

High-speed sequences and diffusion techniques in MRI, along with advanced CT imaging, provide detailed assessments of the gastrointestinal tract, aiding in the staging of cancers and evaluation of inflammatory diseases. Additionally, there is potential for advanced image processing to allow radiology to be a surrogate for biomarkers for certain gastrointestinal diseases[5]. Despite these advancements, high radiation exposure in CT, motion artifacts in MRI, and the invasive nature of endoscopy pose significant challenges. The effectiveness of imaging techniques heavily relies on the skill of the clinician, particularly in endoscopy and ultrasound. Furthermore, the high cost of advanced imaging technologies and the need for specialized training limit their widespread use.

ROLE OF ARTIFICIAL INTELLIGENCE

Artificial intelligence (AI) is increasingly being integrated into gastrointestinal imaging to improve diagnostic accuracy and efficiency. Studies on computer-aided diagnosis (CAD) models in gastrointestinal endoscopy have shown that AI can augment clinical performance, reduce the burden on endoscopists from repetitive procedures, and facilitate concentration on professional activities[6,7]. CAD models provide consistent and robust answers, irrespective of the fatigue level of users, and can help in detecting hidden or hard-to-detect lesions. Additionally, they aid in the automated determination of the optimum classification and provide real-time clinical decision support systems, particularly beneficial for novice endoscopists[2,3]. AI and machine learning techniques hold the potential to overcome the limitations of visual diagnosis by providing more detailed analysis of image texture and color. However, current CAD models are often research-based and have limited practical application due to the unique characteristics of patients in different institutions[6,7]. The advancement of AI from traditional machine learning and deep learning to models with functionality, such as Transformers with self-attention, will likely enhance the clinical applicability of CAD models in the near future. Furthermore, the development of fusion techniques and ensemble models using diverse input imaging data could lead to the creation of more robust and accurate diagnostic methods. The ultimate goal of AI-enabled predictive models or imaging modalities should be to improve clinical patient outcomes; however, there are no studies or devices that have demonstrated this with high quality evidence.

FUNCTIONAL IMAGING MODALITIES

The review also discusses the importance of functional imaging modalities such as EndoFLIP (functional lumen imaging probe), which provides detailed assessments of the geometry and function of the gastrointestinal lumen. These tech-

niques are crucial for evaluating sphincter function and motility disorders, offering a less invasive alternative to traditional methods[1]. Contrast-enhanced ultrasound is another significant advancement, enhancing the visualization of vascularity and tissue perfusion in real-time. It is particularly useful in characterizing liver lesions and assessing inflammatory bowel diseases, providing a non-invasive method to gather functional and anatomical information simultaneously[1]. High-resolution electrogastrography is an emerging technique that records electrical activity of the stomach with improved spatial resolution, allowing for a more detailed analysis of gastric motility and function. This can help in diagnosing motility disorders such as gastroparesis and functional dyspepsia, providing a non-invasive method to assess gastric electrical activity[1]. High-resolution manometry (HRM) is another advanced diagnostic tool that measures intraluminal pressure within the gastrointestinal tract with high spatial and temporal resolution. HRM is particularly useful for diagnosing esophageal motility disorders and evaluating esophageal function, offering detailed pressure topography that aids in the identification of specific motility abnormalities. HRM in anorectal disorders also provides physiological insights to the physicians for the differentiation of defecatory disorders[1]. The wireless motility capsule is an emerging technology that offers a non-invasive method to assess gastrointestinal motility throughout the entire gastrointestinal tract. This small, ingestible device measures pressure, pH, and temperature as it travels through the gastrointestinal system, providing valuable data on gastric emptying, small bowel transit, and colonic transit times. The wireless motility capsule can help diagnose conditions like gastroparesis, chronic constipation, and other motility disorders, offering an alternative to more invasive procedures like manometry.

NUCLEAR MEDICINE IN GASTROINTESTINAL IMAGING

Traditional nuclear medicine tests like the gastric emptying test or DISIDA scan continue to be valuable tools in gastrointestinal imaging. These tests provide unique insights into gastric motility and biliary function that are not easily replicated by other imaging modalities. Additionally, intestinal transit scintigraphy is used to evaluate small and large bowel transit times, helping to diagnose conditions such as chronic constipation and motility disorders. Gastrointestinal bleeding scintigraphy is another crucial tool, enabling the detection and localization of active gastrointestinal bleeding, which is especially useful in patients with obscure or intermittent bleeding when other diagnostic methods fail. Despite advances in imaging technology, there remains a lack of suitable alternatives to these nuclear medicine tests for certain diagnostic purposes.

EMERGING AND ADVANCED IMAGING TECHNIQUES

New modalities such as MR defecography and CT/MR enterography are providing more comprehensive views of gastrointestinal structures and functions. MR defecography allows detailed imaging of the pelvic floor and anorectal region during defecation, which is invaluable in diagnosing defecatory disorders. CT/MR enterography offers enhanced visualization of the small intestine, helping in the diagnosis and management of inflammatory bowel diseases like Crohn's disease. Confocal laser endomicroscopy after the injection of fluorescently labeled antibodies shows great potential for providing real-time, high-resolution histological images, allowing for precise characterization of lesions. These advanced imaging techniques represent significant strides in the field and have the potential to improve diagnostic accuracy and patient outcomes[8]. Elastography is a noninvasive test used to check the stiffness of the organs and it is mostly used to evaluate liver fibrosis. This also can be done using the endoscopic ultrasound based method[9].

THE FUTURE OF GASTROINTESTINAL IMAGING

Gulinac *et al*[1] suggest that the future of gastrointestinal imaging lies in the integration of multimodal approaches and the development of new sub-modalities. The trend towards faster image acquisition, higher resolution, and enhanced software for post-processing is expected to continue. Additionally, molecular imaging and the use of nanoparticles as contrast agents hold promise for more precise and early diagnosis of gastrointestinal diseases. The development of fusion techniques and ensemble AI models using various input imaging data could further enhance the diagnostic capabilities, leading to innovative diagnostic methods.

CONCLUSION

While there are significant challenges, the ongoing technological advancements offer a promising future. The integration of various imaging modalities, the incorporation of AI, and the continuous improvement in imaging techniques will undoubtedly enhance the field of gastroenterology, leading to better patient outcomes and more efficient clinical practices. Advances such as higher resolution, enhanced analysis of color and texture beyond visual diagnosis, faster image processing, and the application of molecular imaging and nanoparticles are expected to drive the future of gastrointestinal imaging. Despite these advancements, traditional nuclear medicine tests remain indispensable, highlighting the need for a balanced approach that leverages both new and established technologies.

FOOTNOTES

Author contributions: Gong EJ and Bang CS contributed to conceptualization; Gong EJ and Bang CS contributed to methodology; Gong EJ and Bang CS contributed to investigation; Gong EJ and Bang CS wrote the original draft; Bang CS reviewed and edited the draft; Bang CS contributed to supervision; and all authors have read and agreed to the published version of the manuscript.

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REFERENCES

1 **Gulinac M**, Kiprin G, Tsranchev I, Graklanov V, Chervenkov L, Velikova T. Clinical issues and challenges in imaging of gastrointestinal diseases: A minireview and our experience. *World J Clin Cases* 2024; **12**: 3304-3313 [PMID: 38983422 DOI: 10.12998/wjcc.v12.i18.3304]
2 **Gong EJ**, Bang CS, Lee JJ. Computer-aided diagnosis in real-time endoscopy for all stages of gastric carcinogenesis: Development and validation study. *United European Gastroenterol J* 2024; **12**: 487-495 [PMID: 38400815 DOI: 10.1002/ueg2.12551]
3 **Gong EJ**, Bang CS, Lee JJ, Jeong HM, Baik GH, Jeong JH, Dick S, Lee GH. Clinical Decision Support System for All Stages of Gastric Carcinogenesis in Real-Time Endoscopy: Model Establishment and Validation Study. *J Med Internet Res* 2023; **25**: e50448 [PMID: 37902818 DOI: 10.2196/50448]
4 **Kaltenbach T**, Anderson JC, Burke CA, Dominitz JA, Gupta S, Lieberman D, Robertson DJ, Shaukat A, Syngal S, Rex DK. Endoscopic Removal of Colorectal Lesions-Recommendations by the US Multi-Society Task Force on Colorectal Cancer. *Gastroenterology* 2020; **158**: 1095-1129 [PMID: 32122632 DOI: 10.1053/j.gastro.2019.12.018]
5 **Klenske E**, Neurath MF, Atreya R, Rath T. Molecular imaging in gastroenterology: A route for personalized endoscopy. *Dig Liver Dis* 2018; **50**: 878-885 [PMID: 30005960 DOI: 10.1016/j.dld.2018.06.009]
6 **Kim HJ**, Gong EJ, Bang CS. Application of Machine Learning Based on Structured Medical Data in Gastroenterology. *Biomimetics (Basel)* 2023; **8** [PMID: 37999153 DOI: 10.3390/biomimetics8070512]
7 **Gong EJ**, Bang CS, Lee JJ, Baik GH, Lim H, Jeong JH, Choi SW, Cho J, Kim DY, Lee KB, Shin SI, Sigmund D, Moon BI, Park SC, Lee SH, Bang KB, Son DS. Deep learning-based clinical decision support system for gastric neoplasms in real-time endoscopy: development and validation study. *Endoscopy* 2023; **55**: 701-708 [PMID: 36754065 DOI: 10.1055/a-2031-0691]
8 **Yamada M**, Hara K, Mizuno N, Haba S, Kuwahara T, Okuno N, Kuraishi Y, Yanaidani T, Ishikawa S, Yasuda T, Fukui T. The role of needle-based confocal laser endomicroscopy in the diagnosis of pancreatic neuroendocrine tumors. *Clin Endosc* 2024; **57**: 393-401 [PMID: 37743070 DOI: 10.5946/ce.2023.068]
9 **Wang TJ**, Ryou M. Defining the optimal technique for endoscopic ultrasound shear wave elastography: a combined benchtop and animal model study with comparison to transabdominal shear wave elastography. *Clin Endosc* 2023; **56**: 229-238 [PMID: 36849118 DOI: 10.5946/ce.2022.135]

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