Editorial

The Transformative Role of Artificial Intelligence in Gastroenterology

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Artificial Intelligence (AI) is emerging as a transformative force in healthcare, and the field of gastroenterology is no exception. It is worthwhile for every gastroenterologist to understand the basics of what it does, how to use it, and what to watch for. Gastroenterology is a complex and demanding field that requires a high level of skills and expertise from physicians. Gastroenterologists also encounter many challenges in their daily work, such as increasing workload, administrative burden, regulatory compliance, and rising costs. One way to address these challenges and improve gastroenterologists' operational efficiency and well-being is to use the power of artificial intelligence.

The development of AI, which began in the 1950s with programs simulating human cognition, has accelerated dramatically. The 1980s introduced machine learning (ML), followed by deep learning in the 2010s, which uses complex artificial neural networks to imitate the human brain. A landmark moment occurred in 2022 with the launch of ChatGPT, bringing generative AI and large language models (LLMs) to the forefront.

In medicine, AI's impact is most profound in two areas: image recognition and big data analysis. AI can reach the desired output within seconds and with more consistent performance. Doctors may have inconsistent performance due to insufficient training or exhaustion from busy clinical demands. A visual assessment by a physician is qualitative, subjective, and prone to error, and subject to intra-observer and inter-observer variability. AI may have better performance than physicians in some cases and it has great promise to reduce clinician workload and the cost of medical care.

Image recognition AI softwares have the capacity to compensate for human error and improve the efficiency and quality of upper endoscopies and colonoscopies. Image recognition can fall into a category of computer aided detection (CADe) or computer aided diagnosis (CADx). CADe can help with identification and localization of an abnormality and CADx can help distinguish between diagnoses.

In the esophagus and stomach, identifying premalignant conditions and subtle changes of malignancy can be assisted by CADe and CADx. Identifying possible areas of Barrett's esophagus is of utmost importance for endoscopists as early detection is associated with decreased mortality from esophageal adenocarcinoma. A meta-analysis from 2021 showed that AI systems have a high accuracy, of up to 90%, in detection of all upper GI neoplasias including gastric cancers.[1]

One of the most well studied areas in AI endoscopy is the use of CADe in adenoma detection during colonoscopies. Adenoma detection rate (ADR) is one of the most validated indicators of colonoscopy quality, and increased ADR is associated with decreased interval colorectal cancers. In addition to CADe and CADx, colonoscopy may incorporate AI for monitoring withdrawal time, another important indicator of colonoscopy quality.

Another area of potential benefit in endoscopic management of GI pathologies is in assessment of GI bleeds (GIB). ML models may be used to predict rebleeding risk, success of potential interventions, and mortality in GIB with a greater accuracy than existing clinical risk stratification tools.[2]

Wireless video capsule endoscopy (VCE) allows for less invasive intraluminal image capture than traditional endoscopy. However, image analysis in VCE is time consuming and operator dependent, which can result in missed lesions or pathologies. Use of AI is being studied to improve the detection of lesions, bleeding, and other pathologies.

The role of AI in advanced endoscopy, specifically endoscopic ultrasound (EUS) and endoscopic retrograde cholangiopancreatography (ERCP) is linked to a need to diagnose malignant and premalignant pancreaticobiliary lesions. Pancreatic cancer has been difficult to diagnose at an early stage, and for this reason, mortality has increased by 53% over the past 25 years. Sometimes pancreatic cancer arises from a pancreatic cyst. Pancreatic cysts are often initially identified by CT or MRI. Once a high-risk pancreatic cyst is identified, usually defined by above 2 cm, growth of 5 mm in 1 year, dilated pancreatic duct, mural nodules, etc., the patient is usually referred to gastroenterology for an endoscopic ultrasound for further characterization and potential sampling through fine needle aspiration or biopsy. Detection of high-risk pancreatic cysts is critical in preventing the progression to pancreatic cancer.AI assisted EUS in premalignant pancreatic cysts has been evaluated as a potential answer to the limitations of CT, MRI, and traditional EUS in differentiating between benign lesions, high risk intraductal papillary mucinous neoplasms (IPMNs) and malignancy.3

AI is increasingly used to predict disease development, outcomes, and treatment responses. For gastric cancer, deep learning models have demonstrated higher accuracy than the traditional TNM staging system in predicting the likelihood of metastasis. In inflammatory bowel disease (IBD), AI analyzes large datasets to identify genetic risk factors. ML models can predict IBD flares by analyzing data on hospitalizations, steroid use, and biologic initiations, sometimes outperforming traditional biomarkers like fecal calprotectin. This highlights the potential cost advantage of using existing EMR data. In hepatology, ML models like random forest and artificial neural networks are being applied to predict outcomes for liver transplantation, showing performance comparable to or better than traditional statistical models like MELD in predicting post-transplant survival.[3]

AI can also augment gastroenterologists' roles in education and communication. Virtual assistants can provide patients with pre- and post-procedure information and guidance. Furthermore, AI can help create interactive educational content—such as case studies, simulations, and quizzes—for trainees and practicing gastroenterologists, fostering lifelong learning and skill enhancement.[4]

AI has the potential to transform the practice of gastroenterology, but it also faces some challenges and limitations. The first concern is Data quality and availability. AI relies on large and diverse datasets to learn and perform its tasks, but the data in gastroenterology may be incomplete, inconsistent or inaccurate, which can affect the reliability and validity of the AI outputs.The second is Ethical and legal issues.AI raises some ethical and legal issues in gastroenterology, such as privacy, consent, accountability and liability. For example, how to protect the privacy and security of patients' data and ensure their informed consent for the use of AI in their care?[4]

AI is not meant to replace human gastroenterologists but to augment and assist them in their work. However, there may be some challenges and barriers to effective and efficient human-AI collaboration in gastroenterology, such as trust, acceptance and adoption. For example, how to build and maintain the trust and confidence of gastroenterologists and patients in the AI systems and their outputs? How to ensure the acceptance and adoption of AI solutions by gastroenterologists and patients and overcome resistance and skepticism? How to optimize the workflow and interaction between humans and AI and ensure their complementarity and synergy? These are some of the issues that need to be addressed and resolved by the human-AI collaboration models and strategies in gastroenterology.[4]

Finally, as AI becomes integrated into care, the value of human interaction—empathy, critical thinking, and the physician-patient relationship—remains irreplaceable. AI should be a tool that enables physicians to provide better care, not a substitute for their judgment.

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