Endoscopic Advances in IBD: Where Are We Now?

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INTRODUCTION

Inflammatory bowel disease (IBD), comprising Crohn's disease (CD) and ulcerative colitis (UC), is a chronic relapsing disorder of the gastrointestinal tract characterized by mucosal inflammation. Endoscopy plays a pivotal role in the diagnosis, monitoring, and management of IBD. Recent years have seen a paradigm shift from symptom-based treatment goals toward objective targets such as endoscopic and histological remission. Furthermore, technological advances, including artificial intelligence (AI), high-definition imaging, and enhanced resection techniques, are transforming clinical practice. This abstract reviews current advances in endoscopy for IBD, focusing on mucosal healing, advanced visualization, AI-assisted evaluation, surveillance strategies, and therapeutic endoscopy.

MUCOSAL AND HISTOLOGICAL HEALING

The concept of mucosal healing (MH) has become a central therapeutic target in IBD management. Achieving MH is associated with reduced hospitalization, lower surgery rates, and improved long-term outcomes. However, complete histological remission, defined as the absence of microscopic inflammation, has emerged as an even stronger predictor of favorable prognosis. Despite the widespread adoption of MH in randomized controlled trials, definitions remain inconsistent. Standardization of MH assessment across trials is urgently required to ensure comparability and reproducibility.

ADVANCED ENDOSCOPIC IMAGING

High-definition endoscopy and advanced imaging modalities significantly enhance lesion detection. Dye-based chromoendoscopy remains the gold standard for dysplasia detection, but virtual chromoendoscopy (e.g., narrow-band imaging, i-scan, Fuji intelligent chromoendoscopy) is increasingly validated. Confocal laser endomicroscopy (CLE) and endocytoscopy allow for real-time histologic assessment, reducing reliance on random biopsies. These techniques provide superior visualization of mucosal architecture and vascular patterns, enabling early detection of neoplastic transformation.

ARTIFICIAL INTELLIGENCE IN ENDOSCOPY

AI-assisted endoscopy is a rapidly evolving field. Deep learning algorithms have demonstrated high accuracy in assessing disease activity, detecting dysplasia, and differentiating IBD phenotypes. Importantly, AI reduces inter-observer variability, which is a major limitation in traditional endoscopic scoring. Early trials suggest that AI models can pre-

dict endoscopic remission with non-invasive markers, potentially decreasing the need for frequent invasive procedures. Despite promising results, integration into routine practice requires robust validation in multicenter settings.

ENDOSCOPIC SURVEILLANCE AND DYSPLASIA MANAGEMENT

Patients with long-standing IBD are at increased risk for colorectal cancer. Surveillance protocols emphasize targeted biopsies with chromoendoscopy rather than random sampling. Endoscopic mucosal resection (EMR) and endoscopic submucosal dissection (ESD) have expanded therapeutic options, allowing curative resection of visible lesions in IBD patients. Determining optimal surveillance intervals and balancing cancer prevention with procedure burden remain key challenges.

THERAPEUTIC ENDOSCOPY FOR COMPLICATIONS

Interventional endoscopy is increasingly applied in IBD complications. Endoscopic balloon dilation (EBD) is effective for Crohn's-related strictures, delaying or preventing surgery in selected patients. Endoscopic approaches for fistulas, such as over-the-scope clips and stent placement, are under evaluation. These minimally invasive techniques offer an alternative to surgery, although long-term efficacy and safety data are still limited.

MOLECULAR ENDOSCOPY AND FUTURE PERSPECTIVES

Emerging molecular endoscopy techniques allow visualization of mucosal biomarkers, immune activation, and microbiota-related changes in vivo. These novel approaches may guide personalized therapy by predicting therapeutic response at the mucosal level. Integration of molecular imaging, AI, and histologic assessment may define the future of precision endoscopy in IBD.

CONCLUSION

Endoscopy in IBD has evolved from a purely diagnostic tool into a central component of disease monitoring, cancer prevention, and therapeutic intervention. The shift toward mucosal and histological healing, combined with innovations in imaging, AI, and therapeutic techniques, is reshaping clinical practice. Future integration of molecular endoscopy and digital technologies will further personalize IBD care. The key message is that endoscopy remains indispensable in IBD, with ongoing innovations offering safer, more accurate, and more patient-centered approaches.

Table 1. Overview of Current Advances in Endoscopy for IBD

Domain	Key Advances	Clinical Relevance
Mucosal & Histological Healing	Standardization of definitions; integration in RCTs	Target for improved outcomes
Imaging Techniques	HD scopes, chromoendoscopy, CLE, endocytoscopy	Enhanced dysplasia detection
Artificial Intelligence	Automated scoring, dysplasia detection, prediction	Reduced variability, efficiency
Surveillance	Targeted biopsies, EMR, ESD	Cancer prevention
Therapeutic Endoscopy	EBD for strictures, fistula closure techniques	Minimally invasive management

Abbreviations: CLE = confocal laser endomicroscopy; EMR = endoscopic mucosal resection; ESD = endoscopic submucosal dissection; EBD = endoscopic balloon dilation; RCT = randomized controlled trial.

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