Annals of Gastroenterology (2025) **38,** 1-6

Tertiary referral for double balloon enteroscopy in small bowel Crohn's disease: a retrospective assessment of diagnostic impact

Daniela Fluxa[a], Hasan Saleh[b], Christian Karime[b], Jing Wang[b], Bhaumik Brahmbhatt[a], Frank J. Lukens[a], Mark Stark[a], Michael F. Picco[a], Jami A. Kinnucan[a], Jana G. Hashash[a], Francis A. Farraye[a]

Mayo Clinic, Jacksonville, Florida, USA

Abstract

Background Diagnosing isolated small bowel Crohn's disease (CD) can be challenging, as symptoms, imaging, and capsule endoscopy (CE) can mimic other diseases. Double balloon enteroscopy (DBE) directly evaluates the small bowel. We describe the impact of tertiary referral for DBE in patients with known or suspected small bowel CD.

Methods We carried out a retrospective review of a single tertiary-center DBE database from February 2009 to May 2013. Patients referred for DBE for known or suspected small bowel CD, based on CE, imaging and/or symptoms were included. The primary outcome was the change in diagnosis and/or management after referral for DBE. A descriptive statistical analysis was performed.

Results A total of 108 patients were included, 10 with established CD and 98 with suspected/rule-out CD. DBE changed management in 8/10 patients with known CD. In patients with suspected CD, the diagnosis was confirmed in 39/98 (40%), and management was changed in 32 of those 39 (82%). An alternative diagnosis was made or CD was ruled out in 59/98 (60%) patients with suspected CD. Prior to DBE, starting CD therapy was recommended in 24/98 (25%) patients, but DBE confirmed CD in only 15 of those 24 (63%).

Conclusions Tertiary referral for DBE in suspected CD confined to the small bowel is valuable for investigating the findings from noninvasive testing, such as CE or imaging. DBE can guide CD management and establish accurate diagnoses. Physicians should consider DBE when the diagnosis of isolated small bowel CD is not confirmed by histology.

Keywords Crohn's disease, diagnosis, enteritis, double balloon enteroscopy

Ann Gastroenterol 2025; 38 (XX): 1-6

[a]Division of Gastroenterology and Hepatology, Mayo Clinic, Jacksonville, Florida, USA (Daniela Fluxa, Bhaumik Brahmbhatt, Frank J. Lukens, Mark Stark, Michael F. Picco, Jami A. Kinnucan, Jana G. Hashash, Francis A. Farraye); [b]Department of Internal Medicine, Mayo Clinic, Jacksonville, Florida, USA (Hasan Saleh, Christian Karime, Jing Wang)

Conflict of Interest: JAH: Advisory Board for BMS. JAK: Advisor/consultant for AbbVie, Fresinius Kabi, Jannsen, Pfizer, Takeda, UCB. FAF: Consultant for AbbVie, BMS, Braintree Labs, Fresenius Kabi, GSK, Iterative Health, Janssen, Pfizer, Pharmacosmos, Sandoz Immunology, and Viatris. He is an independent contractor for GI Reviewers and IBD Educational Group. He sits on a DSMB for Eli Lilly. The rest of the authors report no conflict of interest.

Correspondence to: Francis A. Farraye, M.D, M.S., Division of Gastroenterology and Hepatology, Mayo Clinic, 4500 San Pablo Rd, Jacksonville, FL 32224, USA, e-mail: Farraye.Francis@mayo.edu

Received 14 March 2025; accepted 28 July 2025;
published online 14 August 2025

DOI: https://doi.org/10.20524/aog.2025.0995

Introduction

Crohn's disease (CD) is an inflammatory condition that often has a subtle clinical presentation when confined to the small bowel, which occurs in approximately one third of cases [1]. CD confined to the small bowel can mimic other ulcerating conditions, such as use of nonsteroidal anti-inflammatory drugs, radiation, vasculitis, infection and neoplasm, among others, posing a diagnostic challenge for clinicians [2]. The diagnosis of CD is made through a combination of laboratory markers, imaging and endoscopy [3]. Ileocolonoscopy is the gold standard for diagnosis, but evaluation can be difficult when CD is confined to the small bowel without distal terminal ileum involvement.

Limited noninvasive diagnostic modalities are available for small bowel evaluation, including computed tomography enterography (CTE), magnetic resonance enterography (MRE), capsule endoscopy (CE), or intestinal ultrasound (IUS). CTE, MRE and IUS are noninvasive imaging techniques to complement ileocolonoscopy, and can help detect small bowel inflammation [4,5]. CE is another noninvasive measure

with accuracy similar to imaging, but it also lacks the ability to sample tissue when assessing the small bowel [6,7].

Invasive measures for small bowel evaluation include device assisted enteroscopy (DAE), such as double balloon enteroscopy (DBE). The traditional push enteroscopy technique is difficult for extensive small bowel assessment, but DBE allows a safe investigation using inflation and deflation of two balloons [8]. DBE provides the benefit of direct visualization, mucosal biopsies, and therapeutic interventions such as stricture dilation and polypectomy, among others [9,10]. Single balloon enteroscopy (SBE) and spiral enteroscopy (SE) are other DAE techniques that use a single balloon enteroscope and a rotational helix, respectively [10]. A major drawback of invasive enteroscopy is the lack of widespread availability of advanced endoscopists trained for small bowel enteroscopy in a tertiary medical center.

The 2022 guidelines of the European Society of Gastrointestinal Endoscopy (ESGE) recommend DAE to confirm lesions suspicious for CD, but not every institution has the capability to perform this invasive testing. The aim of our study was to describe the real-world value of tertiary referral for DBE in patients with known or suspected small bowel CD.

Patients and methods

This was a retrospective cohort study conducted at a single tertiary-care medical center. All adult patients who underwent DBE between February 2009 and May 2013 were identified using a centralized DBE database. Institutional Review Board (IRB) approval was obtained prior to data collection (IRB ID: 21-001244).

Eligible patients included adults referred for DBE to evaluate known or suspected isolated small bowel CD. All patients underwent DBE evaluation using the Fujinon enteroscope, which includes balloons on a double balloon enteroscope and overtube, with fluoroscopic guidance used for advancement into the small intestine via the mouth, stoma and/or rectum as needed. Indications for referral were clinical symptoms (abdominal pain, diarrhea, weight loss, anemia), abnormal imaging findings (CTE, MRE), abnormal CE, or combinations thereof. Patients undergoing DBE for indications other than known or suspected CD were excluded from the analysis.

Data were retrospectively collected from electronic medical records. Variables collected included patient demographics (age, sex), clinical characteristics (confirmed or suspected CD, disease activity classified as active or quiescent), referral indication (symptoms, imaging findings, CE findings), DBE procedural route (oral, rectal, stoma, or bidirectional), DBE findings (endoscopic appearance, disease severity, presence of strictures), adverse events related to DBE, pathology results, final diagnosis following DBE, changes in medical management (medication initiation, escalation, de-escalation), and follow-up DBE data when available.

The primary outcome was the impact of tertiary care referral for DBE on clinical management and diagnostic confirmation in patients with known or suspected isolated small bowel CD. We assessed how frequently DBE altered medical treatment strategies or identified alternative diagnoses compared with prior noninvasive evaluations (imaging and/or CE).

Descriptive statistics were used to characterize the study cohort. Continuous variables were presented as mean with range, and categorical variables as frequencies and percentages.

Results

A total of 108 patients referred to a tertiary center for DBE were included in final analysis; their mean age was 52 years (range 20-83), and 61 (56%) were females (Table 1). Of the 108 patients, 10 had a prior diagnosis of CD, while 98 had a suspected diagnosis of CD. For patients with a prior diagnosis of CD, the indication for DBE included disease activity assessment and/or therapeutic intervention. In the 98 patients with suspected CD, DBE was performed for diagnostic purposes in all patients. Patients with suspected CD were referred to DBE based on symptoms (abdominal pain, nausea/vomiting, diarrhea, weight loss, anemia) and abnormal imaging in 44 patients (of whom 10 had normal CE), abnormal CE in 40 patients, and imaging and CE both abnormal in 15 patients. The remaining 9 patients had unremarkable CE with no imaging obtained (n=2), unremarkable CE and imaging (n=2), unremarkable imaging and no CE (n=1), and no imaging or CE (n=4). All of these 9 patients had undergone ileocolonoscopy, and 3 had evidence of CD or ileitis.

In terms of DBE, 21 patients underwent upper DBE, 24 patients underwent lower DBE, 62 patients underwent bidirectional upper and lower DBE, and 1 patient underwent stoma DBE. DBE revealed active disease in 8 of 10 patients with known CD, with 1 patient undergoing dilation of small bowel strictures. DBE findings resulted in changes to CD medical management in all 8 patients. All patients with management changes had an addition of 1 or more medical treatments (Fig. 1). The 1 patient who underwent stricture dilation of 3

Table 1 Demographic characteristics

Demographic data	Number of patients n=108 (%)
Sex	
Female	61 (56)
Male	47 (44)
Age	
Mean: 52 years	
Range: 20-83 years	
DBE indication	
Established CD	10 (9)
Suspected CD	98 (91)
DBE evaluation	
Upper	21 (19)
Lower	24 (22)
Bidirectional	61 (56)
Stoma	1 (1)

Outlines the demographic characteristics of the population, including sex, age, indication for DBE, and the method of DBE performed

CD, Crohn's disease; DBE, double balloon enteroscopy

strictures, including a 10 mm jejunal stricture and 2 5 mm distal ileal strictures, eventually required surgery 2 months later for bowel obstruction resulting from progression of active CD.

DBE performed in patients with suspected CD resulted in a definitive diagnosis of CD in 39 of 98 (40%) patients. Based on the DBE findings, changes in medical management were recommended to 32 (82%) of these 39 confirmed CD patients. Of the 98 patients with suspected CD, 24 (25%) patients had previously been diagnosed with CD at an outside institution, and initiation of therapy for CD had been recommended. Evaluation by DBE resulted in confirmation of CD in 15 (63%) of these 24 patients. DBE outcomes in patients with suspected CD are summarized in Fig. 2. Alternative diagnoses reached are detailed in Table 2. Adverse events related to DBE included perforation in 1 (1%) patient and mouth swelling/abrasion in 3 (3%) patients. The 1 patient who had a bowel perforation was undergoing a diagnostic DBE. The perforation was suspected to be due to extensive adhesions, leading to a fixed bowel and a difficult DBE. On surgical exploration, the patient additionally had a thickened mesentery with nodularity around the proximal ileum, which was resected, and the pathology was diagnostic for CD.

Of the 49 patients with confirmed CD on DBE, repeat DBE to reassess disease activity was performed in 10 of 49 (20%) patients, with an average time between procedures of 4.5 years (range 0.7-11.6). One patient with CD was diagnosed with lymphoma 2.4 years after the initial DBE. Changes in management after repeat DBE were recommended in 6 patients, including de-escalation of therapy in 3 patients (2 of whom underwent surgery), start of thiopurine or biologic in 2 patients, and switch of biologics in 1 patient. No complications were seen in follow-up DBE.

Discussion

Our findings support the crucial role of tertiary referral for DBE in the evaluation of suspected or established isolated small bowel CD. Given the diagnostic challenges posed by isolated small bowel CD, DBE significantly impacted patient care, influencing both diagnosis and management. Medical management was changed in 80% of patients with known CD, while in 60% of patients with suspected CD either an alternative condition was diagnosed, or the CD diagnosis was not confirmed. Notably, DBE did not confirm isolated small bowel CD, diagnosed by outside facilities, in 37% of patients for whom the initiation of advanced therapies for CD had been recommended based on noninvasive testing, such as CE or imaging, without histologic confirmation. These results highlight the diagnostic dilemma of isolated small bowel CD and the limitations of noninvasive measures, underscoring the value of tertiary referral for DBE to confirm diagnosis and guide appropriate therapy.

Only a handful of other studies have been able to analyze the clinical effectiveness of small bowel enteroscopy. Table 3 outlines other studies that have explored the utility of DBE, SBE and SE in assessing patients with CD. The study populations ranged from 11-100 patients, and included those with suspected and/or known CD. The studies confirmed suspected CD in 29-69% of cases, while an alternative diagnosis was made in 12-31% of patients after small bowel enteroscopy. Changes in medical management occurred in 42-80% of patients after enteroscopy [11-20]. Interestingly, Tun and colleagues found that 7 patients were inappropriately diagnosed with CD after DBE [12]. By comparison, our study boasts the largest patient cohort, concluding the highest number of alternative diagnoses and changes in medical management, and the unique insight of the importance of histologic confirmation with DBE prior to initiation of immunosuppressive treatment for CD.

Isolated small bowel CD is a complex disease that can cause non-specific symptoms, such as abdominal pain, diarrhea, nausea and vomiting, making it difficult to differentiate from other diseases with similar symptoms or imaging findings. Common conditions misdiagnosed as inflammatory bowel disease (IBD) include granulomatous disorders

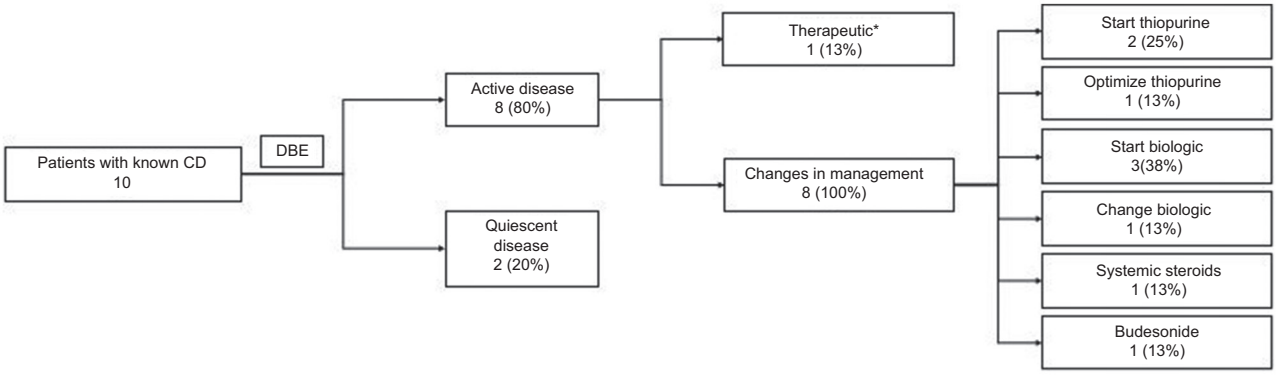

Figure 1 Outcomes in patients with known Crohn's disease. Of the 10 patients with known CD, DBE revealed quiescent disease in 2 (20%) patients and active disease in 8 (80%) patients. Among the active CD patients, all had a change in medical therapy and 1 patient underwent stricture dilation for multiple small bowel strictures

*The 1 patient who underwent stricture dilation eventually required surgery 2 months later for bowel obstruction resulting from progression of CD with extensive stricturing disease

CD, Crohn's disease; DBE, double balloon enteroscopy

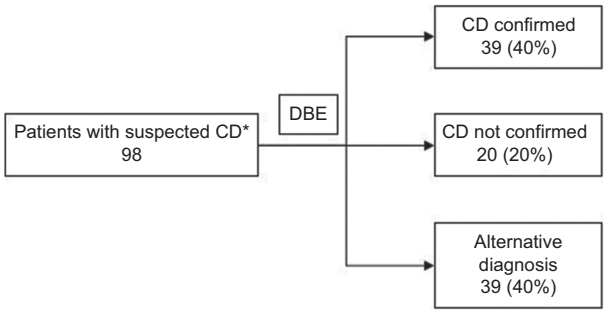

Figure 2 Outcomes in patients with suspected Crohn's disease. Of the 98 patients with suspected CD, an alternative diagnosis was reached in 39 (40%) patients, CD was not confirmed in 20 (20%) patients, whereas CD was confirmed in 39 (40%) patients
*24/98 patients had been diagnosed with CD at outside institutions, and initiation of therapy for CD had been recommended. Of these patients, CD was confirmed in only 15/24 (63%)
CD, Crohn's disease; DBE, double balloon enteroscopy

(sarcoidosis), vasculitis, Bechet's disease, intestinal ischemia, diverticulitis, medication and radiation enteritis, lymphomas, functional bowel disorders, post-surgical conditions, or infections [21-24]. Alternative diagnoses in our study interestingly included functional bowel disorders, a finding that has also been seen in previous studies.

Careful diagnosis of CD should be made, as the disease frequently requires the use of costly advanced therapies. Patients with CD have a 3-fold higher cost of healthcare than the general population, and the average annual cost of care after an initial diagnosis of IBD is more than 25,000 dollars per year, with biologic medical therapy carrying the highest cost burden [25,26]. Some patients with IBD on advanced biologic therapy experience adverse events, such as infusion reactions, skin rash, infections, musculoskeletal pain, etc. [27]. Newer oral therapies targeting small molecules, such as sphingosine-1 phosphate (S1P) receptor modulators and Janus kinase inhibitors, have a similar side-effect profile [28,29]. Proper use of these advanced therapies is essential to avoid any unnecessary financial, medical and psychological burden on the patient. Additionally, proper diagnosis can avoid progression of the underlying condition and prevent complications, thereby decreasing morbidity and mortality [30]. Despite the necessity for specialist involvement, including an advanced endoscopist and anesthesiologist, in a capable medical center, DBE remains a valuable option to investigate challenging presentations of CD confined to the small bowel, as evidenced by the prevalence of alternative diagnoses reached after DBE in our study. There was only 1 procedure-related bowel perforation seen in a total of 118 DBEs, including follow-up procedures, highlighting the low risk of complications. The patient who had a perforation in our study had risk factors including extensive bowel adhesions, compromising the ability to navigate through the small bowel, and eventually causing a perforation.

This patient sample represents one of the largest cohorts studied to date for assessing the diagnostic outcomes and management impact of DBE in isolated small bowel CD, thus providing sufficient statistical power to draw meaningful

Table 2 Alternative diagnosis reached after DBE in patients with suspected Crohn's disease

Diagnosis	Number of patients n=59 (%)
CD not confirmed	20 (34)
NSAID-related enteritis	8 (14)
Small intestinal bacterial overgrowth	7 (12)
Irritable bowel syndrome	6 (10)
Dumping syndrome	3 (5)
Radiation enteritis	3 (5)
Post surgical related stricture/adhesions	2 (3)
Lymphoma	2 (3)
Presumed infectious enteritis	1 (2)
Meckel diverticulum	1 (2)
Laxative use	1 (2)
Medication side-effect	1 (2)
Celiac disease	1 (2)
Lactose intolerance	1 (2)
Cyclic vomiting	1 (2)
Eosinophilic enteritis	1 (2)
Behcet's disease	1 (2)
Wegener vasculitis-related enteritis	1 (2)
Carcinoid	1 (2)

Highlights the alternative diagnoses seen in patients referred for suspected CD of the small bowel. After DBE failed to confirm CD on endoscopic biopsy, the alternative conditions diagnosed from clinical evaluation are listed

DBE, double balloon enteroscopy; CD, Crohn's disease; CE, capsule endoscopy; NSAID, non-steroidal anti-inflammatory drug

conclusions. Limitations of our study include its retrospective design, and an analysis limited to the review of medical records, without patient interviews or surveys. Additionally, the use of descriptive statistical analysis without a control group is a limitation. Furthermore, our study was subject to tertiary referral selection bias, as our patients were referred for complex diagnoses or care escalation, reflecting the specialized nature of DBE procedures in general. To mitigate these biases, standardized data collection from a structured database was carried out and all documentation was carefully reviewed. The study size was deemed adequate, based on previously published DBE studies investigating similar cohorts.

We conclude that tertiary referral for DBE is valuable, as isolated small bowel CD is a difficult condition to diagnose with noninvasive testing. Our study highlighted that a majority of patients had an alternative diagnosis and a change in management after DBE. In patients with established small bowel CD, DBE can effectively assess disease activity, guide medical management, and perform therapeutic interventions. Overall, DBE is a safe procedure, and physicians should consider referral to a capable medical center when the diagnosis of isolated small bowel CD is not confirmed by histology.

Table 3 Studies assessing the utility of DAE in small bowel CD

Study [ref.], year	Endoscopy Type	Patient Population	Number of Patients	CD Diagnosis	Alternative Diagnosis	Changes in Management
Mensink *et al* [16], 2009	DBE	Known CD	40	N/A	N/A	18 (45%)
Kondo *et al* [17], 2010	DBE	Known CD	75	N/A	N/A	40 (53%)
Gaidos *et al* [19], 2010	SE	Known and Suspected CD and UC	11 (10 CD, 1 UC)	Confirmed CD in 1 known case	None	N/A
Schulz *et al* [14], 2014	DBE	Suspected CD	16	11 (69%)	5 (31%)	N/A
Navaneethan *et al* [15], 2014	DBE, SBE	Known and Suspected CD	65 (22 suspected, 43 known)	6/22 (27%)	3/22 (13%)	18/43 (42%)
Rahman *et al* [13], 2015	DBE	Known and Suspected CD	81 (43 suspected, 38 known)	17/43 (40%)	6/43 (14%)	65 (80%)
Tun *et al* [12], 2016	DBE	Suspected CD	100	38 (38%)	12 (12%)	55 (55%)
Holleran *et al* [18], 2018	SBE	Known and Suspected CD	52 (13 suspected, 39 known)	4/13 (31%)	N/A	33/48 (69%)
Huang *et al* [11], 2020	DBE	Suspected CD	18	12 (67%)	4 (22%)	N/A
Pal *et al* [19], 2022	SE	Suspected CD	46	21 (46%)	12 (26%)	N/A

Outlines other studies that have assessed the utility of DAE in small bowel CD. Information regarding each study's type of DAE, patient population and outcomes after DAE are illustrated

CD, Crohn's disease; UC, ulcerative colitis; DAE, device-assisted enteroscopy; DBE, double balloon enteroscopy; SE, spiral enteroscopy; SBE, single balloon enteroscopy

Summary Box

What is already known:

- The diagnosis of isolated small bowel Crohn's disease (CD) is challenging, because of the nonspecific symptoms and the limitations of available testing
- Isolated small bowel CD can mimic other small bowel conditions (e.g., non-steroidal anti-inflammatory drug enteritis, malignancies, infections)
- Device-assisted enteroscopy, particularly double balloon enteroscopy (DBE), can directly visualize the small bowel, offering the ability to biopsy and perform therapeutic interventions, though this modality is not routinely available to patients

What the new findings are:

- This study demonstrated the real-world value of tertiary referral for DBE in the diagnosis and management of challenging cases of suspected small bowel CD, based on noninvasive testing
- DBE led to management changes in 80% of patients with established CD, and provided an alternative diagnosis or excluded CD in 60% of patients with suspected small bowel CD
- In 37% of patients to whom immunosuppressive treatment for CD had been recommended, based on noninvasive testing prior to referral, DBE did not confirm the diagnosis of isolated small bowel CD
- Accurate differentiation of CD from other small bowel conditions is essential to optimize treatments, minimize adverse events, and reduce healthcare costs

References

1. Lichtenstein GR, Loftus EV Jr, Isaacs KL, Regueiro MD, Gerson LB, Sands BE. Correction: ACG Clinical Guideline: management of Crohn's disease in adults. *Am J Gastroenterol* 2018;**113**:1101.
2. Keuchel M, Kurniawan N, Baltes P. Small bowel ulcers: when is it not inflammatory bowel disease ? *Curr Opin Gastroenterol* 2019;**35**:213-222.
3. Maaser C, Sturm A, Vavricka SR, et al; European Crohn's and Colitis Organisation [ECCO] and the European Society of Gastrointestinal and Abdominal Radiology [ESGAR]. ECCO-ESGAR Guideline for Diagnostic Assessment in IBD Part 1: Initial diagnosis, monitoring of known IBD, detection of complications. *J Crohns Colitis* 2019;**13**:144-164.
4. Bruining DH, Zimmermann EM, Loftus EV Jr, Sandborn WJ, Sauer CG, Strong SA; Society of Abdominal Radiology Crohn's Disease-Focused Panel. Consensus recommendations for evaluation, interpretation, and utilization of computed tomography and magnetic resonance enterography in patients with small bowel Crohn's disease. *Gastroenterology* 2018;**154**:1172-1194.
5. Manzotti C, Colombo F, Zurleni T, Danelli P, Maconi G. Prognostic role of intestinal ultrasound in Crohn's disease. *World J Gastroenterol* 2023;**29**:3595-3605.
6. Kopylov U, Yung DE, Engel T, et al. Diagnostic yield of capsule endoscopy versus magnetic resonance enterography and small bowel contrast ultrasound in the evaluation of small bowel Crohn's disease: systematic review and meta-analysis. *Dig Liver Dis* 2017;**49**:854-863.
7. Elosua A, Rullan M, Rubio S, et al. Does capsule endoscopy impact clinical management in established Crohn's disease? *Dig Liver Dis* 2022;**54**:118-124.
8. Yamamoto H, Sekine Y, Sato Y, et al. Total enteroscopy with a nonsurgical steerable double-balloon method. *Gastrointest Endosc* 2001;**53**:216-220.
9. Arulanandan A, Dulai PS, Singh S, Sandborn WJ, Kalmaz D. Systematic review: safety of balloon assisted enteroscopy in Crohn's disease. *World J Gastroenterol* 2016;**22**:8999-9011.
10. Tharian B, Caddy G, Tham TC. Enteroscopy in small bowel Crohn's disease: a review. *World J Gastrointest Endosc* 2013;**5**:476-486.
11. Huang Z, Liu X, Yang F, et al. Diagnostic efficacy of double-balloon

enteroscopy in patients with suspected isolated small bowel Crohn's disease. *BMC Gastroenterol* 2020;**20**:42.
12. Tun GS, Rattehalli D, Sanders DS, McAlindon ME, Drew K, Sidhu R. Clinical utility of double-balloon enteroscopy in suspected Crohn's disease: a single-centre experience. *Eur J Gastroenterol Hepatol* 2016;**28**:820-825.
13. Rahman A, Ross A, Leighton JA, et al. Double-balloon enteroscopy in Crohn's disease: findings and impact on management in a multicenter retrospective study. *Gastrointest Endosc* 2015;**82**:102-107.
14. Schulz C, Mönkemüller K, Salheiser M, Bellutti M, Schütte K, Malfertheiner P. Double-balloon enteroscopy in the diagnosis of suspected isolated Crohn's disease of the small bowel. *Dig Endosc* 2014;**26:**236-242.
15. Navaneethan U, Vargo JJ, Menon KV, Sanaka MR, Tsai CJ. Impact of balloon-assisted enteroscopy on the diagnosis and management of suspected and established small-bowel Crohn's disease. *Endosc Int Open* 2014;**2**:E201-E206.
16. Mensink PB, Groenen MJ, van Buuren HR, Kuipers EJ, van der Woude CJ. Double-balloon enteroscopy in Crohn's disease patients suspected of small bowel activity: findings and clinical impact. *J Gastroenterol* 2009;**44**:271-276.
17. Kondo J, Iijima H, Abe T, et al. Roles of double-balloon endoscopy in the diagnosis and treatment of Crohn's disease: a multicenter experience. *J Gastroenterol* 2010;**45**:713-720.
18. Holleran G, Valerii G, Tortora A, et al. The use of single balloon enteroscopy in Crohn's disease and its impact on clinical outcome. *Scand J Gastroenterol* 2018;**53**:925-929.
19. Gaidos J, Judah J, Collins D, Draganov P. Prospective evaluation of the clinical utility of spiral deep small bowel enteroscopy (SBE) in patients with known or suspected Crohn's disease (CD). *Am J Gastroenterol* 2010;**105**:S422.
20. Pal P, Vishwakarma P, Singh AP, et al. Diagnostic yield and technical performance of the novel motorized spiral enteroscopy compared with single-balloon enteroscopy in suspected Crohn's disease: a prospective study (with video). *Gastrointest Endosc* 2023;**97**:493-506.
21. Malter LaH, S. IBD mimics: most common conditions misdiagnosed as IBD. Crohn's and colitis foundation. Available from: https://www.crohnscolitisfoundation.org/science-and-professionals/education-resources/ibd-mimics-most-common-conditions-misdiagnosed-ibd [Accessed 31 July 2025].
22. Vahid B, Spodik M, Braun KN, Ghazi LJ, Esmaili A. Sarcoidosis of gastrointestinal tract: a rare disease. *Dig Dis Sci* 2007;**52**:3316-3320.
23. Uzzan M, Ko HM, Mehandru S, Cunningham-Rundles C. Gastrointestinal disorders associated with common variable immune deficiency (CVID) and chronic granulomatous disease (CGD). *Curr Gastroenterol Rep* 2016;**18**:17.
24. Humbert S, Guilpain P, Puéchal X, et al; French Vasculitis Study Group. Inflammatory bowel diseases in anti-neutrophil cytoplasmic antibody-associated vasculitides: 11 retrospective cases from the French Vasculitis Study Group. *Rheumatology (Oxford)* 2015;**54**:1970-1975.
25. Park KT, Ehrlich OG, Allen JI, et al. The cost of inflammatory bowel disease: an initiative from the Crohn's & Colitis foundation. *Inflamm Bowel Dis* 2020;**26**:1-10.
26. Alulis S, Vadstrup K, Olsen J, et al. The cost burden of Crohn's disease and ulcerative colitis depending on biologic treatment status - a Danish register-based study. *BMC Health Serv Res* 2021;**21**:836.
27. Larussa T, Basile A, Palleria C, et al. Real-life burden of adverse reactions to biological therapy in inflammatory bowel disease: a single-centre prospective case series. *Med Pharm Rep* 2021;**94**:289-297.
28. Honap S, Irving PM, Samaan MA. JAK inhibitors for the treatment of inflammatory bowel disease: results of an international survey of perceptions, attitudes, and clinical practice. *Eur J Gastroenterol Hepatol* 2023;**35**:1270-1277.
29. Choden T, Cohen NA, Rubin DT. Sphingosine-1 phosphate receptor modulators: the next wave of oral therapies in inflammatory bowel disease. *Gastroenterol Hepatol (N Y)* 2022;**18**:265-271.
30. Lee DW, Koo JS, Choe JW, et al. Diagnostic delay in inflammatory bowel disease increases the risk of intestinal surgery. *World J Gastroenterol* 2017;**23**:6474-6481.