REVIEW

INFOGRAPHIC

Small bowel ultrasound: friend or foe?

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Purpose of review
Crohn's disease (CD), requires accurate diagnosis and regular monitoring to manage disease activity, prevent complications, and improve outcomes. Intestinal ultrasound (IUS) has emerged as a noninvasive, real-time imaging modality, offering a valuable alternative to traditional diagnostic techniques such as magnetic resonance enterography (MRE), endoscopy and capsule endoscopy (CE). This review examines recent advances in IUS for the diagnosis and monitoring of small bowel CD, with a focus on its applications, benefits, and limitations.

Recent findings
Recent studies have demonstrated that IUS provides high sensitivity and specificity in detecting key markers of disease activity, including bowel wall thickness (BWT), bowel wall flow (BWF), and bowel wall stratification (BWS). Advances in IUS techniques, such as elastography and contrast-enhanced ultrasound (CEUS), have expanded its diagnostic and prognostic capabilities, potentially enabling differentiation between inflammation and fibrosis. However, challenges remain, including operator dependency, variability in scoring systems, and reduced sensitivity for superficial mucosal abnormalities. Efforts to standardize parameters and improve training have shown promise in addressing these limitations.

Summary
IUS is a critical complementary tool for assessing disease activity, transmural healing, and postoperative recurrence in small bowel CD. Its noninvasiveness, cost-effectiveness, and real time assessment make it well suited for routine clinical use. Nonetheless, further multicentre studies are needed to validate scoring systems, optimize integration with other modalities, and improve consistency across clinical settings. IUS holds significant potential for advancing personalized care in small bowel CD, though ongoing research is required to refine its applications and maximize its clinical utility.

Graphical abstract
http://links.lww.com/COG/A61

Keywords
bowel ultrasound, Crohn's disease, diagnostic imaging, inflammatory bowel disease, intestinal ultrasound

INTRODUCTION

Inflammatory bowel diseases (IBD), including ulcerative colitis (UC) and Crohn's disease (CD), are chronic conditions characterized by immune-mediated inflammation of the gastrointestinal tract. These diseases are associated with severe complications and significant comorbidities [1]. Early treatment and achieving disease remission are crucial for patients' outcomes and prognosis [2]. Over the course of their disease, IBD patients need regular clinical, biochemical, endoscopic, and cross-sectional assessment. It is well known that symptoms remission does not correlate to a reduced risk of relapses and complications [3,4]. Recently, there has been a shift towards a treat-to-target strategy in IBD, aiming at achieving endoscopic and mucosal healing, and biochemical response [5,6].

Over the past 10–15 years, intestinal ultrasound (IUS) has gained increasing interest and has established itself as a valuable diagnostic tool for diagnosis and monitoring of IBD. The most recent ECCO-ESGAR guidelines [4] recommend IUS, as an alternative to magnetic resonance enterography (MRE) or capsule endoscopy (CE), as part of the diagnostic

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KEY POINTS

- Intestinal ultrasound (IUS) is a noninvasive, cost-effective imaging modality with high sensitivity and specificity for assessing small bowel inflammatory bowel disease.
- IUS evaluates key disease features, including bowel wall thickness, vascular flow, wall stratification, and mesenteric fat echogenicity, providing real-time insights into disease activity.
- Extended techniques such as elastography and contrast-enhanced SICUS potentially enhance IUS's ability to differentiate inflammation from fibrosis and evaluate deep-seated structures.
- Limitations of IUS include potential operator dependency, challenges in imaging the proximal jejunum, and reduced sensitivity for superficial mucosal abnormalities.
- Standardized training and scoring systems are essential to ensure the reliability and integration of IUS into routine clinical practice for Crohn's disease management.

work-up and follow-up in CD patients. Compared to traditional cross-sectional imaging modalities [7], IUS showed to have a similar diagnostic accuracy [8–11], with the advantage of being less time-consuming, cost-effective and allowing for real-time results and decision-making as it can be performed by trained gastroenterologists [12,13].

This review aims to provide a summary and overview of the most recent and relevant evidence on the role and applications of IUS in the diagnosis and monitoring in CD patients.

WHAT INTESTINAL ULTRASOUND MEASURES

Allows detailed assessment of bowel structure and associated changes, enabling dynamic evaluation of disease activity, severity, and complications. Key ultrasound features include:

Bowel wall thickness

Bowel wall thickness (BWT) is the most critical parameter for diagnosing IBD. A normal BWT is up to 3 mm for both the colon and ileum, with sensitivity and specificity of 88% and 93%, respectively, in identifying IBD. This threshold correlates strongly with clinical markers like the Harvey Bradshaw Index (HBI) and the Crohn's Disease Activity Index (CDAI) [14,15].

Bowel wall flow

Vascular flow detected via colour and power Doppler (Fig. 1) is a critical marker of hyperaemia and

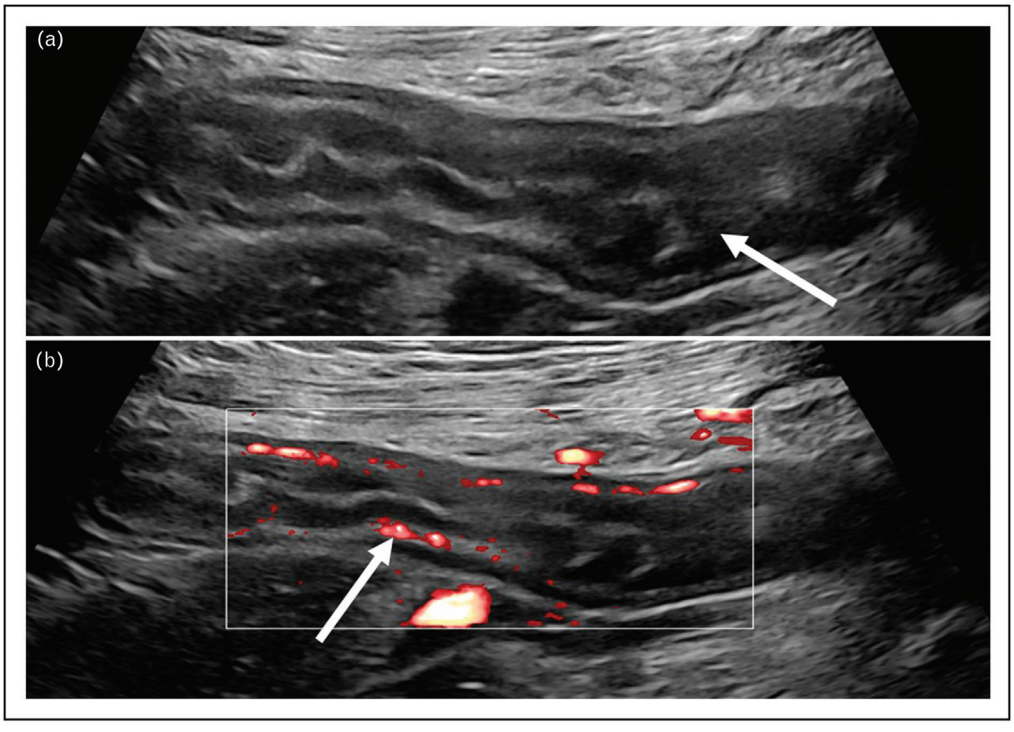

FIGURE 1. Inflamed terminal ileum segment. Image A demonstrates a thick-walled TI segment within the RIF. Note the loss of BWS (white arrow). Image B demonstrates the same thick walled TI segment within the RIF using PD to assess BWF, showing hyperaemia (white arrow). BWF, bowel wall flow; BWS, bowel wall stratification; RIF, right iliac fossa; TI, terminal ileum.

inflammation in affected bowel segments. Accurate detection requires optimizing settings to capture low-velocity flow (5–7 cm/s) while minimizing colour noise artefacts [16].

Bowel wall stratification

IUS reveals five distinct bowel wall layers, alternating between hyperechoic and hypoechoic. Disruption or loss of this stratification (Fig. 1) is a key indicator of inflammatory changes [17]. However, while the absence of stratification often signifies active inflammation, it can also occur in advanced inactive disease. Therefore, it should be interpreted alongside other findings such as BWT, bowel wall flow (BWF), and extraintestinal features [18].

Mesenteric fat echogenicity (*i*-fat)

Persistent bowel inflammation can lead to mesenteric fat hypertrophy, a hallmark of established CD [19]. On ultrasound, mesenteric fat appears more prominent and echogenic in active disease (Figure 1, Supplemental Digital Content, http://links.lww.com/COG/A64), strongly correlating with severe endoscopic manifestations of IBD [16].

Peri-intestinal lymph nodes

In the absence of malignant pathology, mesenteric lymph nodes are commonly associated with intra-abdominal inflammation, indicating intestinal inflammation [20]. Ultrasound effectively detects prominent mesenteric lymph nodes, and when combined with other ultrasonographic features, these findings strongly correlate with endoscopic activity [21].

Ulceration

IUS can visualize penetrating ulcerations of the bowel wall, appearing as mucosal depressions and echogenic foci. These features are clinically significant as early indicators of potential abscess or fistula formation, key complications of IBD. Ultrasound demonstrates high diagnostic accuracy in detecting ulcers, with studies reporting accuracy rates ranging from 81% to 96% when compared to gold-standard modalities like colonoscopy, MRE, or surgical specimens [22–24].

EXTENDED INTESTINAL ULTRASOUND TECHNIQUES

Elastography

In IBD, higher elastography speeds or stiffness values typically indicate abnormal tissue due to inflammation and/or fibrosis. Modern systems use shear wave elastography (SWE), which can be divided into point shear wave (p-SWE) and two-dimensional shear wave (2D-SWE).

Tissue stiffness measurements offer insights into chronic versus acute inflammation and fibrosis [25]. Both p-SWE and 2D-SWE provide quantitative data on tissue stiffness, with 2D-SWE also generating a strain map to visualize stiffness across the examined region.

A recent study identified 2D-SWE as an independent predictor of disease progression in CD, with values >12.75 kPa at diagnosis associated with a higher risk of stricturing or penetrating complications [26]. Ripollés *et al.* evaluated the effectiveness of colour Doppler and SWE in characterizing inflammation and fibrosis in CD. Using surgical histopathology as a reference, they found that a SWE velocity cut-off of 2.5 m/s could distinguish between mild and severe fibrosis, achieving sensitivity and specificity of 76.2% and 100%, respectively [27].

Contrast-enhanced ultrasound and small intestine contrast ultrasound

Contrast-enhanced ultrasound (CEUS) is performed after the administration of an intravenous micro bubble contrast agent [28], and allows for an improved evaluation of tissue perfusion, visualization of deep-sited structures, and better differentiation between vascular and avascular tissues, e.g. (abscess vs. phlegmon) [29]. In CD, CEUS has been shown to have a good correlation with endoscopic disease activity [30] as well as an excellent accuracy for postoperative recurrence [28,31]. Specifically, pattern enhancement has a 94% specificity and sensitivity for identifying endoscopic recurrence in postoperative CD [28]. On the other hand, data on the correlation between CEUS and clinical and biochemical activity of CD is more conflicting [28,32,33].

Small intestinal contrast US (SICUS) can improve IUS performance by ingesting oral contrast (usually polyethylene glycol solution) before examination. Similar to other small bowel (SB) cross-sectional imaging, the oral contrast allows for intestinal loops distension increasing detection of CD abnormalities of the SB [34]. A recent meta-analysis reported a pooled sensitivity of 88.3% and specificity of 86.1% of SICUS for the detection of SB abnormalities [35].

SCORING METRICS

Multiple scoring systems have been proposed within the literature relating to disease activity, with indices typically consisting of parameters including

BWT, loss of BWS, BWF and mesenteric changes relating to *i*-fat and reactive lymph nodes. The complexity of some scoring metrics means their utility in clinical practice has been limited, with some also awaiting external validation [36,37]. More popular scoring systems currently being utilised are demonstrated in Table 1,Supplemental Digital Content, http://links.lww.com/COG/A62.

INTESTINAL ULTRASOUND PER INDICATION

The ECCO-ESGAR guidelines recommend magnetic resonance imaging (MRI)/MRE or IUS as first-line modalities for assessing small bowel disease in newly diagnosed CD due to their high accuracy and avoidance of ionizing radiation. IUS and MRE are both effective for detecting inflammation in newly diagnosed small bowel CD [38]. Systematic reviews and meta-analyses consistently report high agreement between IUS and MRI [39,40], IUS has been shown to demonstrate sensitivity and specificity of 79.7% and 96.7%, respectively [41]. A meta-analysis by Lee *et al.*, including 752 patients across 11 studies, reported pooled sensitivity and specificity of 86% and 88%, underscoring IUS's diagnostic utility in IBD [39]. The multicentre METRIC study demonstrated that while MRE had slightly higher diagnostic accuracy for small bowel CD (sensitivity/specificity: MRE 97%/96%, IUS 92%/84%), both modalities performed well overall, supporting these guidelines [42,43] IUS is particularly valuable for identifying, assessing, and monitoring disease activity, enabling clinicians to evaluate disease control and adjust treatment as needed.

Point of care ultrasound

In the point-of-care (PoC) setting, IUS's utility becomes evident. Bots *et al.* found that PoC IUS identified disease activity and led to treatment modifications in 60% of cases ($n = 345$) [44▪]. Additionally, the METRIC trial reported no major differences between MRE and IUS in therapeutic decision-making, with both modalities agreeing in over 75% of cases. This supports the use of IUS in PoC environments, where it facilitates timely therapeutic adjustments and enhances personalised care for IBD patients [17,43].

Established disease

The diagnostic accuracy of IUS for detecting CD-associated lesions had been extensively documented (Table 1). Bhatnagar *et al.* demonstrated substantial agreement among practitioners in detecting small bowel CD, with rates of 84% for disease presence and 89% for activity when detected by both [45].

Proactive monitoring of IBD is increasingly emphasized following a treat-to-target approach that combines patient-reported outcomes with objective measures [6,46]. The latter often rely on endoscopy, which can be impractical [46]. IUS has emerged as a repeatable, noninvasive alternative with real-time assessment of bowel activity, aiding clinical decisions [47].

In established CD, IUS also has a role in disease monitoring and treatment management. Grunshaw *et al.* found that 59.5% of PoC IUS examinations led to immediate management changes [48▪▪]. Saleh and Abraham showed that IUS outperformed symptom-based evaluations in guiding treatment for remission or active CD, with findings independent of ESR and CRP levels (Table 2, Supplemental Digital Content, http://links.lww.com/COG/A63) [49▪].

ECCO/ESGAR guidelines [4] recommend assessing therapy response within 6 months, but there is growing evidence that IUS enables earlier evaluation. Treatment response is primarily assessed by BWT reduction – defined as >25% or ≥2 mm from baseline – supplemented by BWF, BWS, and detection of complications [50,51]. The TRUST study (234 patients) showed normalization of BWT, BWS, BWF, and mesenteric proliferation within 3 months [47]. Similar findings were reported in an Italian multicentre trial involving patients on anti-inflammatory drugs [52]. In the Stardust IUS study [53▪], a subanalysis showed that a significant reduction in BWT was observed at IUS as early as 4 weeks following treatment with Ustekinumab and was predictive of endoscopic response at 48 weeks posttreatment. These results were confirmed by a single-centre study including 31 patients with CD, showing that patients with reduction in BWT of at least 18% after 4–8 weeks following initiation of anti-TNF, were 10 times as likely to achieve endoscopic response by week 12–32, compared to those patients who did not achieve BWT reduction [54]. Moreover, in the TRUST study [47], IUS was effective in detecting and monitoring strictures and abscesses, showing a progressive resolution of these complications at 3, 6 and 12 months after treatment.

Stricturing and stenotic disease

In IBD, complications such as strictures and penetrating disease occur in approximately 50% of patients [55]. Strictures, often located in the small bowel, can cause pain and obstruction, typically presenting as stenosis with proximal dilation. Effective treatment planning requires precise characterization of strictures regarding type, location, and length [56].

Table 1. Intestinal ultrasound in the assessment of inflammatory bowel disease

Study	Objective	Sample size	Methodology	Sensitivity (%)	Specificity (%)	Comparator	Clinical relevance
Taylor *et al.* (2018) [43]	Evaluate MRE and IUS for detection and extent in CD	284 patients	Multicentre prospective	IUS: 92% (presence), 70% (extent) MRE: 97% (presence), 80% (extent)	IUS: 84% (presence), 81% (extent) MRE: 96% (presence), 95% (extent)	MRE	Robust evidence supporting the use of both MRE and IUS in complementary roles for CD management.
Lee *et al.* (2022) [39]	Comparison of diagnostic performance of IUS and MRE	11 studies, 752 patients	Systematic review Meta-analysis	IUS: Pooled 86% MRE: Pooled 88%	IUS: Pooled 88% MRE: Pooled 87%	MRE	Supports the use of IUS as an alternative to MRE for active disease monitoring.
Bots *et al.* (2022) [44▪]	Real-world cohort study evaluating PoC-IUS for disease management in IBD.	301 patients	Two cohorts: Prospective 250 patients. Retrospective 61 patients.	N/A	N/A	IUS concordance MRE- 80.0%, Endoscopy - 86.3%	Supports IUS integration into routine care for real-time monitoring and management decisions.

CD, Crohn's disease; IUS, intestinal ultrasound; MRE, magnetic resonance enterography; PoC IUS, point of care intestinal ultrasound.

IUS visualises strictures as bowel segments with luminal apposition, increased wall thickness, and narrowed lumen (<1 mm) accompanied by prestenotic dilation (>2.5 cm) [57]. As discussed, a key advantage of IUS is its dynamic capability in visualizing peristalsis. While motility sequences are now more commonly utilized with MRI, IUS offers real-time assessment [58]. While IUS generally provides good visualization of the large and small bowel it should be mentioned that it does have limitations when visualizing proximal jejunum and rectum [42].

A systematic review and meta-analysis by Pruijt *et al.* reported that IUS achieved sensitivity of 81%, specificity of 90%, and overall accuracy of 86% for detecting IBD-related strictures. Based on these findings, IUS is recommended as the preferred first-line imaging modality for evaluating suspected intra-abdominal complications of IBD [59▪▪].

Postoperative disease

Despite advancements in immune-modifying therapies, and closer monitoring, postoperative recurrence is still common [60,61]. Whilst colonoscopy remains the gold standard for identifying patients at high risk of recurrence [62], IUS offers a valuable noninvasive alternative for postoperative monitoring due to its ability to detect IBD features. Furfaro *et al.* conducted a prospective multicentre trial assessing IUS accuracy, demonstrating that each 1 mm increase in BWT above the normal baseline was associated with a 2.4-fold increase in the likelihood of recurrence. A BWT $\geq$3 mm combined with a faecal calprotectin (FC) level $\geq$50 μg/g predicted recurrence in 75% of patients, while a BWT < 3 mm and FC < 50 μg/g correctly identified nonrecurrence in 74% of cases, with only 4.5% false positives (Table 2) [63▪▪].

Malik *et al.* performed a systematic review and meta-analysis involving 1,094 patients, reporting an excellent overall sensitivity of 89% (95% CI: 85–91%), increasing to 97% with contrast enhancement, and specificity of 86% (95% CI: 81–90%). While IUS was more effective at confirming disease (PPV 94%) than excluding it (NPV 74%), the authors concluded that IUS should be a primary modality for postoperative follow-up [64▪]

Special patients' groups

IUS is especially valuable in pregnant patients and patients with severe comorbidities. In fact, IUS demonstrates a moderate-to-strong correlation with clinical activity and FC in pregnant patients with a sensitivity of 84% and a specificity of 98%, avoiding the need for invasive or radiologic procedures [65,66]. In patients with severe comorbidities, such

Table 2. Intestinal ultrasound in the assessment of postoperative disease

Study	Objective	Sample size	Methodology	Comparators	Primary outcome	Clinical relevance
Furfaro *et al.*, 2023 [63■■]	Evaluate the accuracy of IUS and FC in detecting postoperative recurrence in CD	91 patients (three centres)	Multicentre prospective cohort study	Colonoscopy (RS)	BWT $\geq$3 mm and FC $\geq$50 µg/g predicted recurrence in 75% BWT $<$ 3 mm and FC $<$ 50 µg/g correctly identified nonrecurrence in 74%	Combining IUS and FC provides an accurate alternative to colonoscopy
Pruijt *et al.*, 2024 [59■■]	Assess the diagnostic accuracy of IUS in detecting intra-abdominal complications in CD	68 studies; meta-analysis of 23 studies with 3863 patients.	Systematic review and meta-analysis	Endoscopy, SICUS, CT,MRI, histopathology	B-mode IUS sensitivity 81%, specificity 90%; SICUS sensitivity 94%, specificity 95% (strictures)	IUS is accurate for diagnosing CD related strictures
Malik *et al.*, 2024 [64■]	Determine the diagnostic accuracy of IUS in patients with IBD	20 studies 1094 patients.	Systematic review and meta-analysis	Endoscopy	Pooled sensitivity 88.6%, specificity 86%; with contrast enhancement, sensitivity increased to 97%.	IUS a reliable in assessing postoperative disease activity in IBD

BWT, bowel wall thickness; CD, Crohn's disease; CT, computed tomography; IBD, inflammatory bowel disease; IUS, intestinal ultrasound; MRI, magnetic resonance imaging; RS, Rutgeerts' score; SICUS, small intestine contrast ultrasonography.

as those with renal failure, IUS can be a valuable alternative to traditional imaging requiring contrast, and procedures requiring sedation such as endoscopy [67].

CAPSULE ENDOSCOPY VS INTESTINAL ULTRASOUND

The interest and applications of capsule endoscopy (CE) and IUS in the diagnosis and monitoring of IBD patients has grown significantly. The advantages of CE over IUS is the ability to directly visualise the intestinal mucosa of the SB [68]. However, IUS, similarly to other cross-sectional imaging techniques, can assess transmural disease activity, presence of strictures and extra-intestinal complications. Whilst there is extensive literature on the diagnostic accuracy of IUS and CE compared to other radiological cross-sectional modalities and/or endoscopy [69,70], there are only a few studies comparing these two modalities in the diagnosis and monitoring of CD patients (Table 3). A 2017 meta-analysis [71] including 5 studies, and 142 patients, showed that the diagnostic yield (DY) of the two modalities were similar (65–70%).

In the context of CD monitoring, and in particular in postoperative recurrence, a prospective longitudinal study by Biancone *et al.* showed that at 1 year from surgery, with clinical inactive disease (CDAI $<$ 150), CE and small intestinal contrast ultrasonography (SICUS) had a similar rate of disease recurrence detection compared to ileocolonoscopy [72]. These results were confirmed by Yung *et al.* in their meta-analysis evaluating the accuracy of IUS, CE and MRE for detection of endoscopic recurrence in postoperative CD patients. In particular, CE and IUS had a pooled sensitivity of 100% and 89%, and a pool specificity of 69% and 86%, respectively [73]. Overall, CE and IUS are complementary modalities in CD, assessing mucosal healing and transmural healing, respectively.

TRAINING CURVE FOR INTESTINAL ULTRASOUND

The role of IUS in IBD is increasingly recognized, prompting efforts by international societies to standardize its practice, definitions, and training [74–76]. Despite this, IUS remains operator-dependent and challenging to learn, especially for gastroenterologists, who have only recently adopted this traditionally radiological technique [14]. The European Federation of Societies for Ultrasound in Medicine and Biology recommends achieving at least Level 1 competence before independent practice, enabling detection of major abnormalities in the

Table 3. Studies comparing capsule endoscopy and intestinal ultrasound

Author, year	Country	Paediatric/ adult	Patients included	Indication	Type of study	N of patients	CE type	DY SBCE	IUS	DY IUS
Biancone *et al.*, 2007 [85]	Italy	Adults	SB CD	Postop recurrence	Prospective, single centre	22	SB CE	94%	SICUS	100%
Petruziello *et al.*, 2010 [86]	Italy	Adults	SB CD	Diagnosis, staging	Prospective, single centre	32	SB CE	94%	SICUS	94%
Aloi *et al.*, 2015 [87]	Italy	Paediatric	Established and suspected CD	Diagnosis	Prospective, single centre	25	SB CE	64%	SICUS	64%
Oliva *et al.*, 2016 [88]	Italy	Paediatric	SB and colon CD	Diagnosis, staging	Prospective, single centre	38	CCE	50%	SICUS	55%
Yung *et al.*, 2017 [73]	/		SB CD	Postop recurrence	Meta-analysis	76/186	SBCE	Sn 100% Sp 69%	IUS	Sn 84% Sp 92%
Elli *et al.*, 2022 [83]	Italy	Adults	Established and suspected CD	Diagnosis	Retrospective, single centre	46	SBCE	51%	IUS	46%

CCE, colon capsule endoscopy; CD, Crohn's disease; CE, capsule endoscopy; DY, diagnostic yield; IUS, intestinal ultrasound; postop, postoperative; SB, small bowel; SICUS, small intestinal contrast ultrasonography.

large and small bowels, including obstruction [76,77].

Over the last few years, several IUS training curricula and pathways have been developed. However, evidence on the length of training needed to achieve competency on this technique is limited. Experts suggest that a mastery learning approach rather than time and volume- based approaches would be more adequate in the context of IUS training [78]. On the other hand, recent studies evaluated the training curve of trainees in IUS showing that to learn the set of skills to obtain a level 1 of competence it takes between 80 and 100 IUS under expert supervision; in case of previous experience in abdominal ultrasound, the learning curve was faster [79–81].

EXPERT OPINION

Endoscopy is still considered the reference standard for the diagnosis, assessment, and monitoring of CD patients. However, due to the complexity of CD and the intrinsic limitations of endoscopy, cross-sectional imaging techniques are established as valid alternatives. As highlighted in this review, over the past years, IUS has emerged as an accurate and reliable tool with both diagnostic and prognostic roles in IBD, offering comparable accuracy to MRE.

At the same time, the applications of IUS in gastroenterology have been expanding rapidly. Beyond its established role in IBD, IUS has been utilized for the diagnosis and assessment of appendicitis, colonic diverticulitis and ileus; but also, of functional GI disorders [82], such as gastric emptying assessment or to exclude conditions mimicking irritable bowel disease [76,83].

The growing interest in IUS stems from its noninvasiveness, cost-effectiveness, safety, and repeatability, alongside strong diagnostic performance. However, IUS has limitations. Its operator dependency can affect diagnostic accuracy and reproducibility, with only BWT showing strong interobserver correlation, while other parameters demonstrate modest agreement. Imaging deep-seated structures is challenging, particularly in obese patients, where signal attenuation can impair image quality. Although recent studies suggest good performance in such cases, further validation is needed. IUS also has limited sensitivity for detecting mild or superficial mucosal lesions, restricting its role in assessing mucosal response compared to CE. Furthermore, without oral contrast, IUS is less effective than MRE in evaluating the entire length of the SB.

The integration of IUS into clinical practice and trials is hindered by a lack of validated scoring systems. Recent efforts include consensus statements

and standardized parameters for IUS evaluation [42,77,84]. Future research should focus on multicentre validation of IUS scores against endoscopy, MRE, and biomarkers, with clear definitions of treatment response and remission. Standardized training is also essential.

CONCLUSION

In conclusion, current evidence supports IUS as crucial complementary tool in CD care for assessing disease activity, including transmural healing, disease progression and extraintestinal manifestations. However, further studies are needed prior to its broad integration into the follow-up of IBD patients and its potential use as a substitute for endoscopy.

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Conflicts of interest

There are no conflicts of interest.

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Papers of particular interest, published within the annual period of review, have been highlighted as:

- ■ of special interest
- ■■ of outstanding interest

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