



international bowel
ULTRASOUND GROUP

Scoring Systems in IUS

From numbers to decisions: importance, comparison, and validation of ultrasound scores in IBD

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Gastroenterólogos Asociados · Pacífica Salud, Panama City, Panama

Panama City, Panama, August 18th – 19th, 2026

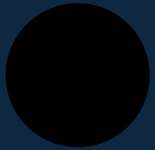
Disclosure

Intended Learning Outcomes (ILO):

By the end of this session, the learner will be able to:

- Explain the rationale behind IUS scoring systems and how they are applied in both clinical practice and research settings to assess disease activity, guide treatment decisions, and provide standardized documentation of findings.
- Evaluate the reliability and validity of different IUS scoring systems by comparing their performance, reproducibility, and correlation with reference standards such as endoscopy, cross-sectional imaging, and clinical indices.
- Utilize IUS scoring systems to:
 - Quantify disease activity in Crohn's disease and ulcerative colitis.
 - Monitor treatment response over time by documenting changes in ultrasound parameters and generating objective scores that reflect mucosal and transmural healing.

***“A score is not just a number —
it is the way we convert complexity into decisions.”***



01

Why scores matter

Importance & clinical utility of IUS
scoring



02

Comparing scores

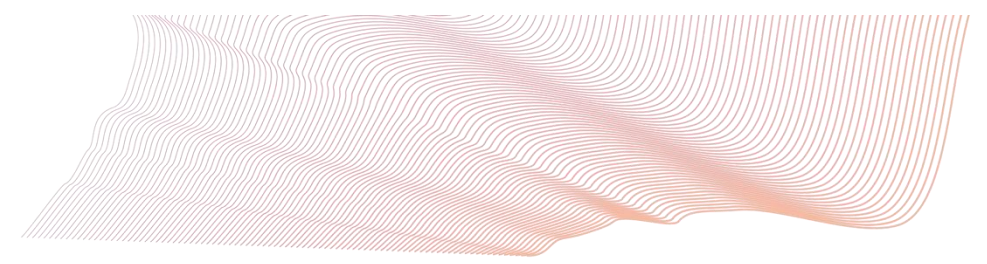
Available systems for UC and CD,
head to head



03

Validation

Performance of IUS scores against
endoscopy



Why do we need IUS scores?

Objective quantification of disease activity is essential to optimize IBD management — validated indices are generally recommended.



Objective quantification

Turn a subjective impression into a reproducible, comparable measurement of disease activity.



Standardized parameters

Identify the key ultrasound features that reliably track disease activity across operators.



Benchmark against endoscopy

Allow direct comparison with endoscopic scores, the traditional reference standard.



Build clinical trust

Increase acceptance of IUS as a reliable, non-invasive monitoring tool in IBD management.

What makes a “perfect” IUS score?

A major barrier to wider IUS use is operator dependence and the operational properties of available tools.



Validated

Measures the construct it is intended to measure



Reliable

Free from measurement error, reproducible between readers



Responsive

Detects clinically meaningful change over time



Accurate

Strong sensitivity, specificity, PPV and NPV

The landscape of IUS scores

Systematic review of all IUS scores developed for IBD (PubMed & EMBASE to Nov 2024)

23

IUS scores identified
across 23 studies

6,381 studies screened

Endoscopy = gold standard
in 83% of developments

Disease focus of developed scores

Crohn's disease

65% · 15 studies

Ulcerative colitis

26% · 6 studies

CD + UC combined

9% · 2 studies

Key parameters: bowel wall thickness, vascularity, bowel wall stratification, inflammatory fat

Innocenti T. et al. Inflamm Bowel Dis, 2025 · Boots S, J Crohns Colitis 2018 · Goodsall TM, J Crohns Colitis 2021

23 scores — but 2 stand out

The two most externally validated composite IUS scores in IBD today

Ulcerative Colitis

MUC

Milan Ultrasound Criteria

Two-parameter formula (BWT + Doppler) validated across 5+ cohorts, with prognostic value for colectomy risk.

Crohn's Disease

IBUS-SAS

Int'l Bowel Ultrasound Segmental Activity Score

Four-parameter Delphi-derived score, the most extensively validated CD index

The four parameters behind every score

Whether scoring Crohn's disease or ulcerative colitis, the same building blocks recur



Bowel wall thickness

The single strongest, most consistent predictor of disease activity



Vascularity (Doppler)

Color Doppler signal reflects active mucosal and transmural inflammation



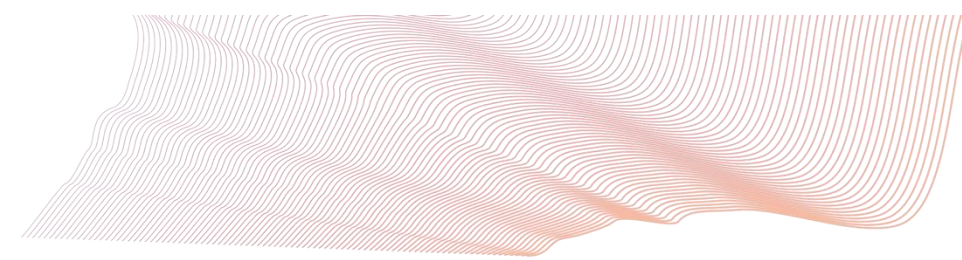
Wall stratification

Loss of the normal five-layer pattern signals transmural involvement



Inflammatory fat

Mesenteric fat wrapping / hypertrophy tracks with disease severity



MUC — how it was developed

Milan Ultrasound Criteria, also known as the Humanitas Ultrasound Criteria (HUC)

$$\text{MUC} = (\text{BWT, mm, worst segment}) \times 1.4 + 2 \times \text{Color Doppler (1 = Yes, 0 = No)}$$



BWT

Bowel wall thickness, worst affected segment

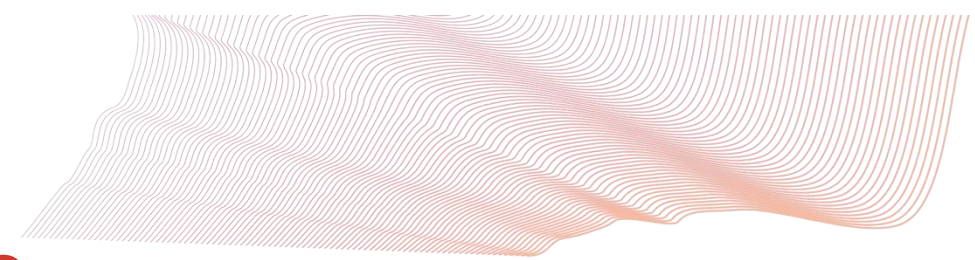


Color Doppler

Presence (1) or absence (0) of mural hyperemia

How the cutoff was chosen

Derivation cohort: 53 patients with UC (E2/E3 extent), 22 in Mayo endoscopic subscore 0–1. **On multivariable analysis, colonic wall thickness (CWT) and colonic wall flow on Doppler (CWF) were the only independent predictors of endoscopic activity — their regression coefficients (1.4 and 2.0) became the formula weights.** The best ROC cutoff for discriminating active vs. inactive UC was then selected empirically.



MUC — how well the cutoff performs

Table 3 · Diagnostic accuracy of MUC in the derivation and external validation studies

Active disease (Mayo endoscopic sub-score > 2)	Cut-off	MUC — derivation study (2018)			MUC — external validation (2021)		
		AUC (ROC)	Sens.	Spec.	AUC (ROC)	Sens.	Spec.
	>6.2	0.891	71%	100%	0.902	85%	94%

Near-identical AUC across an independent cohort (0.891 → 0.902) — the sensitivity/specificity trade-off shifted slightly, but overall accuracy reproduced closely.

IBUS-SAS — how it was built

International Bowel Ultrasound Segmental Activity Score

A modified Delphi process with 11 experts from 7 countries selected four key parameters of disease activity, each with near-perfect inter-rater reliability.



BWT

***4**



Inflammatory fat

***15**



Color Doppler (CDS)

***7**



Wall stratification (BWS)

***4**

$$\text{IBUS-SAS (0-100)} = 4 \times \text{BWT} + 15 \times \text{i-fat} + 7 \times \text{CDS} + 4 \times \text{BWS}$$

Global disease activity correlation (VAS 0–100)

0.73

BWT

0.85

CDS

0.93

i-fat

0.87

BWS

All correlations significant, $p < 0.0001$. Final IBUS-SAS ICC 0.97 (0.95–0.99).

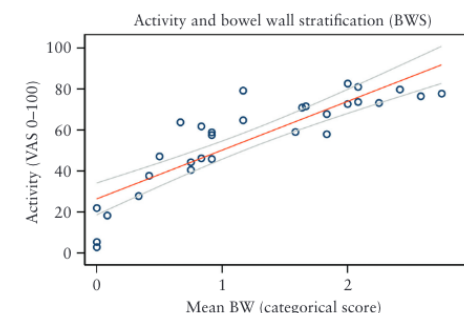
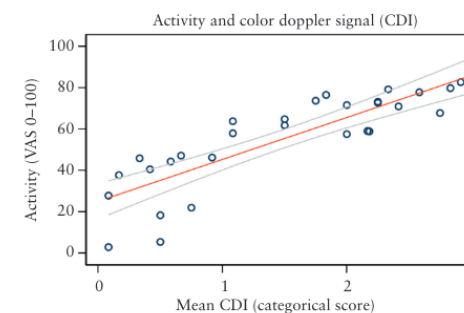
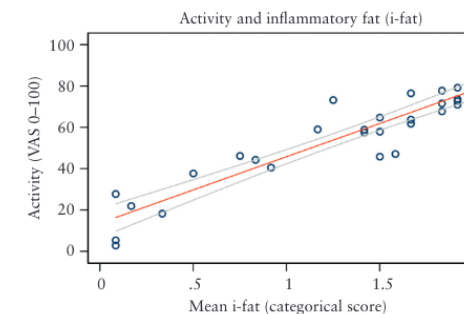
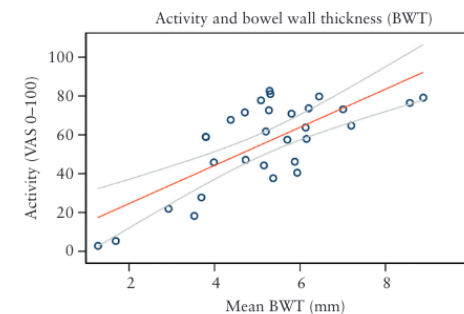
IBUS-SAS — how the cutoff was chosen

Each parameter correlated with global disease activity (VAS); weights came from multiple linear regression

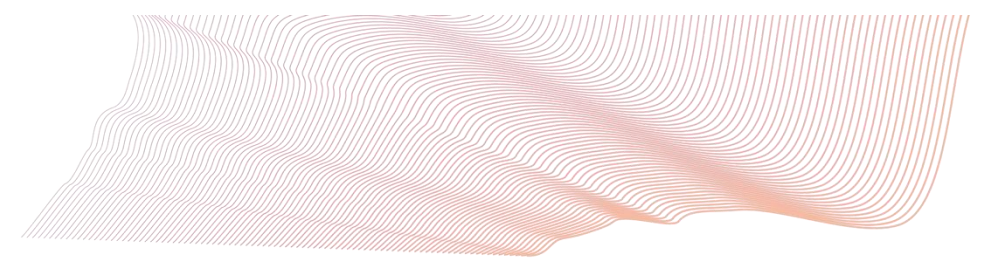
Table 4. Multiple linear regression coefficients included in the final activity score.

ACTIVITY

Parameter	Coefficient	<i>p</i> -value
BWT	4.0 [3.1–4.9]	0.001
i-fat	14.8 [9.8–19.8]	0.001
CDS	6.7 [3.3–10.0]	0.001
BWS	4.1 [0.3–7.9]	0.034

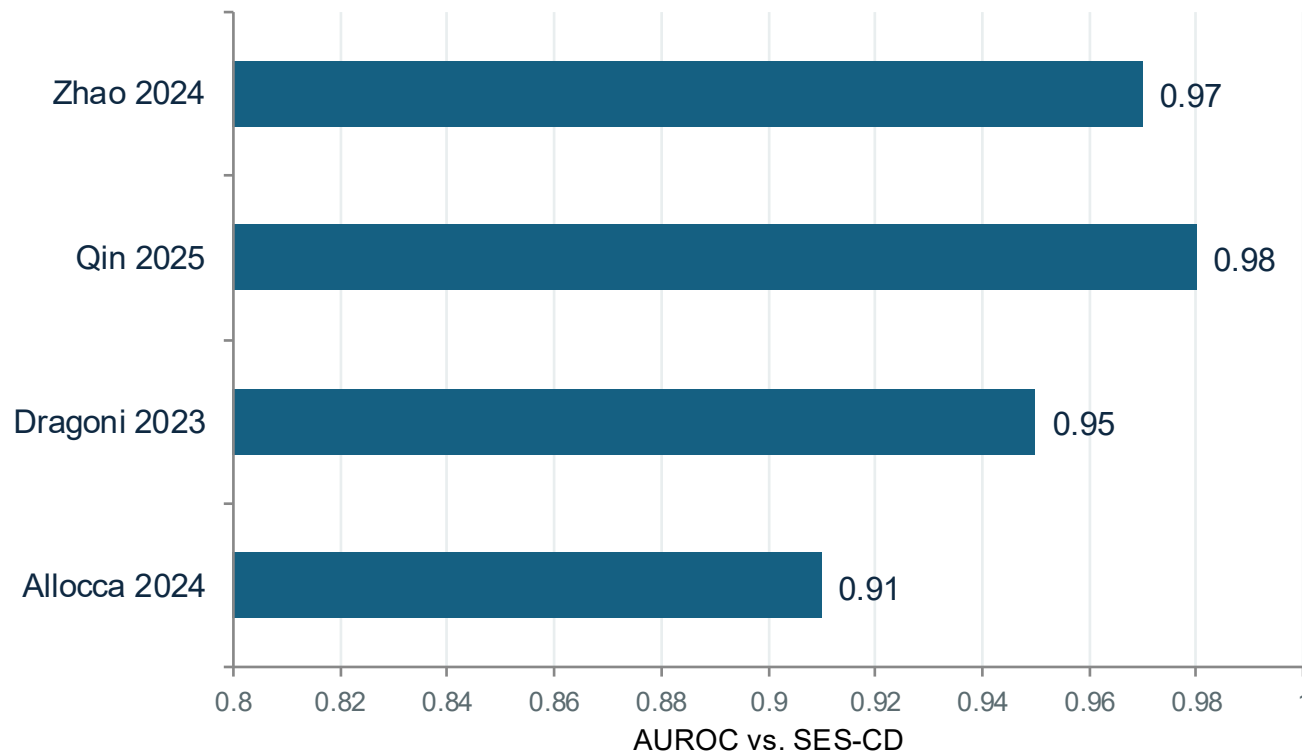


Higher coefficients (i-fat 14.8, CDS 6.7) drove more weight in the final formula; all four parameters were significant predictors ($p \leq 0.034$).



IBUS-SAS — Validation

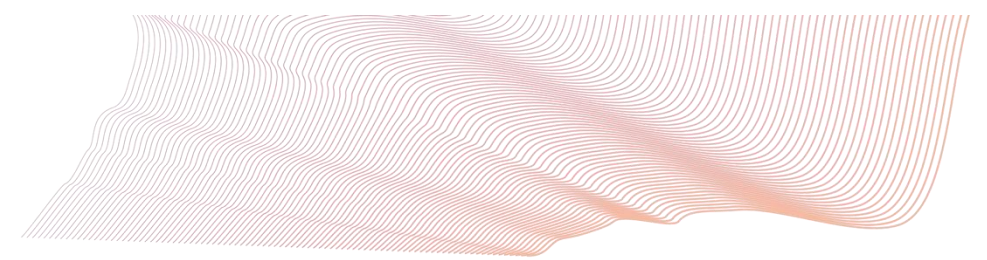
External validation studies in Crohn's disease (SES-CD as reference)



Study detail

Study	Cut-off	Se	Sp
Allocca 2024	≤22.8	95%	83%
Dragoni 2023	>25.2	82%	100%
Qin 2025	>46.5	93%	95%
Zhao 2024	>27.5	93%	91%

All 4 cohorts use SES-CD as the endoscopic reference — consistent with IBUS-SAS's primary validation in Crohn's disease.



MUC vs IBUS-SAS, side by side

	MUC	IBUS-SAS
Disease	Ulcerative colitis	Crohn's disease
Parameters	BWT + Color Doppler (2)	BWT, i-fat, CDS, BWS (4)
Development	Multivariable regression	Modified Delphi + regression
Score range	Continuous (typically 0–20)	0–100
Best AUROC	0.90	up to 0.98
Prognostic value	Yes — colectomy, hospitalization	Yes — ileocecal resection
Validation depth	5+ external cohorts	14 external cohorts

How well does IUS track endoscopy?

Consolidated performance across MUC and IBUS-SAS validation cohorts

0.85–0.98

AUROC range
across validation cohorts

71–100%

Sensitivity range
for active disease

73–100%

Specificity range
for active disease

0.65–0.86

Inter-observer
agreement (kappa/ICC)

Reading the numbers

Across independent cohorts in CD and UC, both MUC and IBUS-SAS consistently distinguish endoscopically active from inactive disease with AUROCs comparable to, or exceeding, many established endoscopic indices — supporting IUS as a credible non-invasive proxy for mucosal activity, while also capturing the transmural dimension endoscopy cannot assess.

MUC predicts disease course

Allocca M et al. *United European Gastroenterol J*, 2022 — prospective cohort, $n = 98$

Study snapshot

- 98 UC patients, regardless of activity or therapy, underwent colonoscopy and bowel US at baseline (blinded)
- Median follow-up: 1.6 years (IQR 0.9–2.7)
- MUC correlated with Mayo endoscopic subscore at baseline ($p = 0.653$, $p < 0.001$)
- Composite outcome: need for corticosteroids, treatment escalation, hospitalization, or colectomy

Negative disease course by baseline MUC

MUC ≤ 6.2 ($n = 44$)

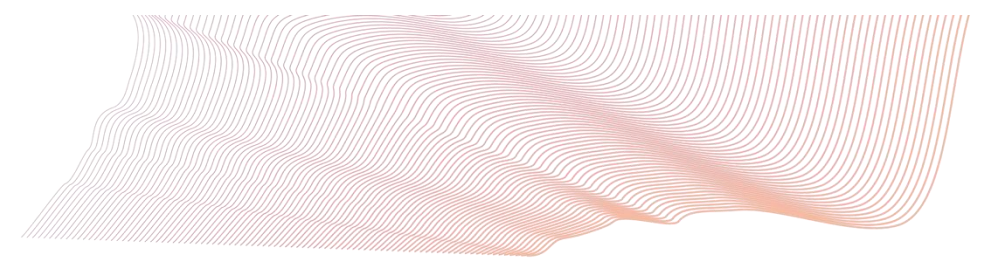
48%

MUC > 6.2 ($n = 54$)

91%

HR 3.87 (95% CI 2.25–6.64), $p < 0.001$

MUC ≤ 6.2 may be a new treatment target to reduce the risk of a worse disease course.



IBUS-SAS predicts disease course

Madsen GR et al. Clin Gastroenterol Hepatol, 2025 — Copenhagen IBD cohort, n = 201, newly diagnosed CD

Study snapshot

- 201 newly diagnosed CD patients followed prospectively from diagnosis (inception cohort)
- Terminal ileum IBUS-SAS at diagnosis predicted ileocecal resection within the first year (threshold 63; AUC 0.92, Sens 100%, Spec 73%)
- 41% reached transmural remission by 12 months
- Transmural remission linked to less treatment escalation: 26% vs. 53% without it (p = 0.003)

Treatment escalation by 12-month status

Transmural remission achieved

26%

Transmural remission not achieved

53%

IBUS-SAS $\geq$ 63 $\rightarrow$ AUC 0.92 for ileocecal resection

Baseline IBUS-SAS at diagnosis carries prognostic weight — beyond current activity, it flags patients at risk of a more aggressive disease course.

Transmural remission as a target

STRIDE-II guidelines (Turner et al., Gastroenterology 2021)



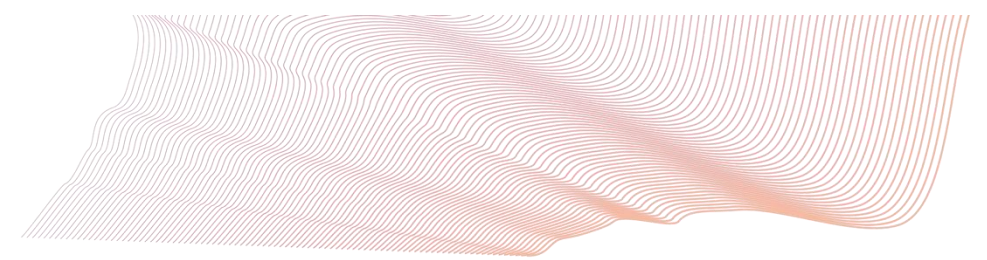
STRIDE-II recognizes transmural remission as an adjunctive treatment goal — a marker of deeper healing beyond the mucosa.



It stops short of endorsing transmural remission as a primary target, citing current limitations of available therapies in reliably achieving it.

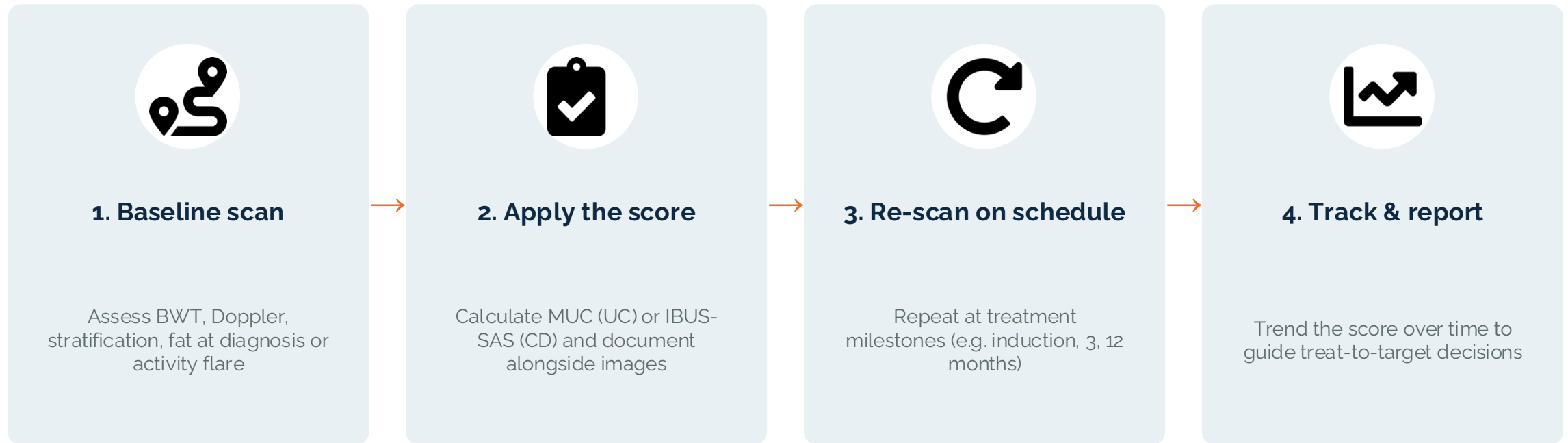


In practice: transmural remission complements — not replaces — endoscopic and clinical remission in the treat-to-target framework.



Putting IUS scores into practice

A simple workflow for standardized IBD monitoring



What defines a sonographic response?

The IBUS consensus recognizes response if any one of these 3 criteria is met:

> 25%

Relative BWT reduction
from baseline

> 2 mm

Absolute BWT reduction

**≥ 1 mm +
Doppler**

BWT reduction ≥1mm
plus 1-grade Doppler drop

⚠ A Doppler-only reduction, without a change in BWT, is NOT sufficient to be considered response.



Timing of assessment:

14 ± 2 weeks after treatment start, and again between weeks 26–52

Case 1 — Ulcerative colitis

MUC applied to a real treatment decision



Diagnosis

22-year-old, newly diagnosed
left-sided UC, started on
mesalazine



Flare

Bloody diarrhea 4–6×/day,
with urgency and tenesmus



Treatment change

Started on infliximab



Clinical response

Symptomatic improvement on
follow-up

Question: does the ultrasound confirm the clinical impression — and by how much?

Case 1 — MUC before and after treatment

Milan Ultrasound Criteria, worst affected segment

During flare

Before infliximab

8.5

Active disease (> 6.2)

BWT

3.2 mm

Color Doppler

Present

8 weeks later

After infliximab

4.8

Below cutoff

BWT

3.4 mm

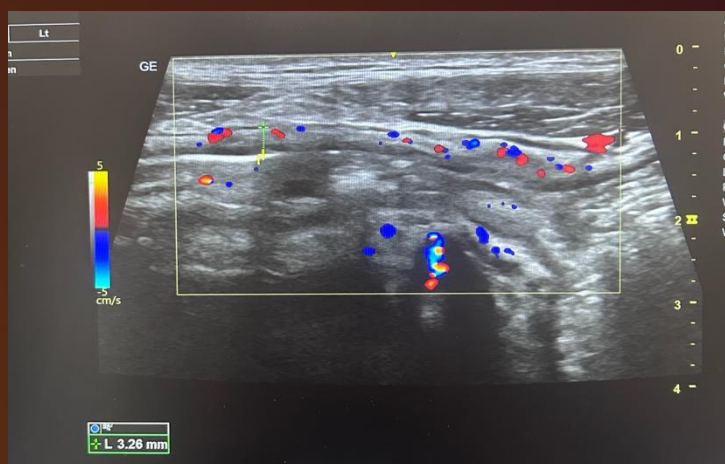
Color Doppler

Absent

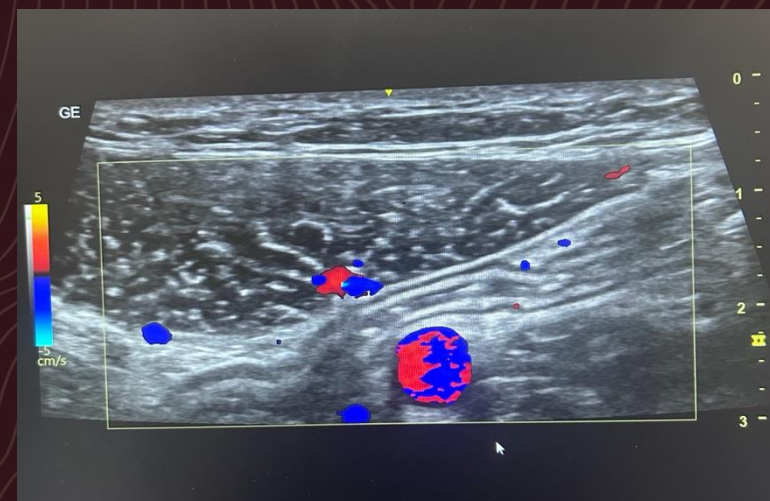
BWT barely moved — the drop below cutoff was driven by resolution of the Doppler signal, not wall thickness alone.

Case 1 — MUC before and after treatment

Milan Ultrasound Criteria, worst affected segment



3.2 mm
Present



BWT barely moved — the drop below cutoff was driven by resolution of the Doppler signal, not wall thickness alone.

Case 2 — Crohn's disease

IBUS-SAS applied to a real treatment decision



Diagnosis

47-year-old, RLQ pain, bowel habit change, weight loss. Calprotectin 311. Colonoscopy: edema and aphthous ulcers in cecum/ileum. Biopsy c/w Crohn's disease.



Treatment

Prednisone bridge (4 months) + ustekinumab: IV induction, then first SC maintenance dose at week 8.



Clinical response

Weight gain, normal bowel movements, calprotectin down to 24 — but new arthralgias and fatigue x2 months.



The dilemma

Patient attributes symptoms to ustekinumab, self-stops treatment, and turns to functional medicine.

Question: is this patient really in remission — and is it safe to stop?

Case 2 — IBUS-SAS before and after treatment

Terminal ileum segmental score

Initial referral

Before ustekinumab

72.8

Active disease

BWT	5.2 mm
i-fat	2
CDS	2
BWS	2

4 months later

Just prior to 2nd s.c. Ustekinumab dose

47.8

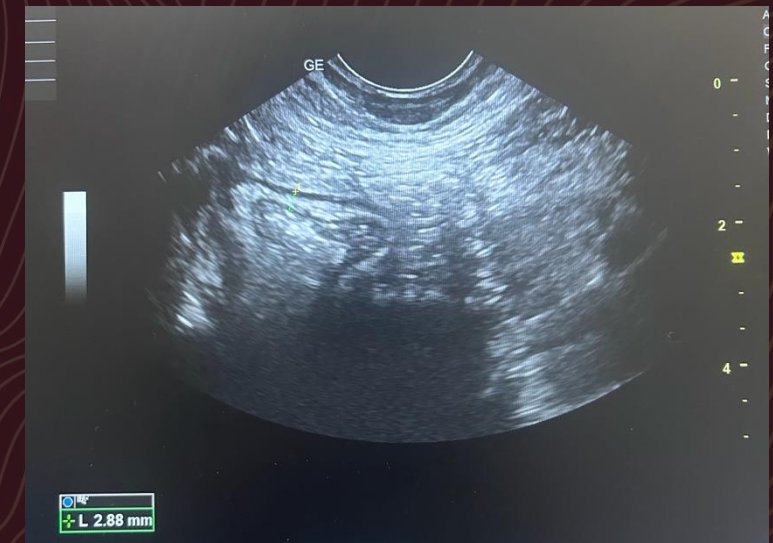
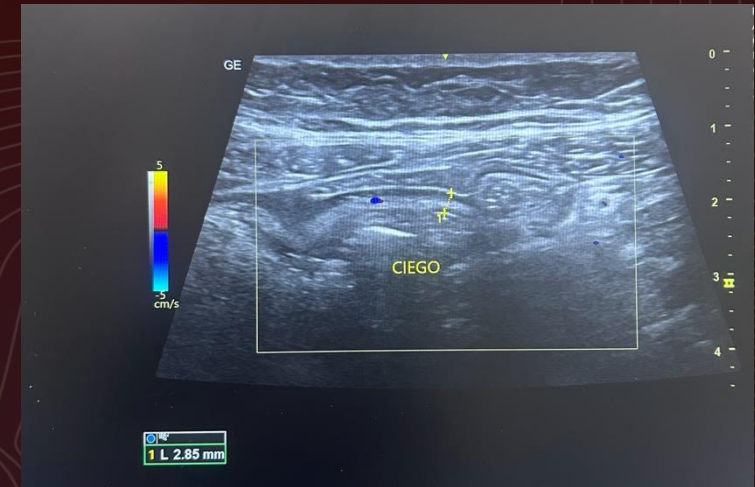
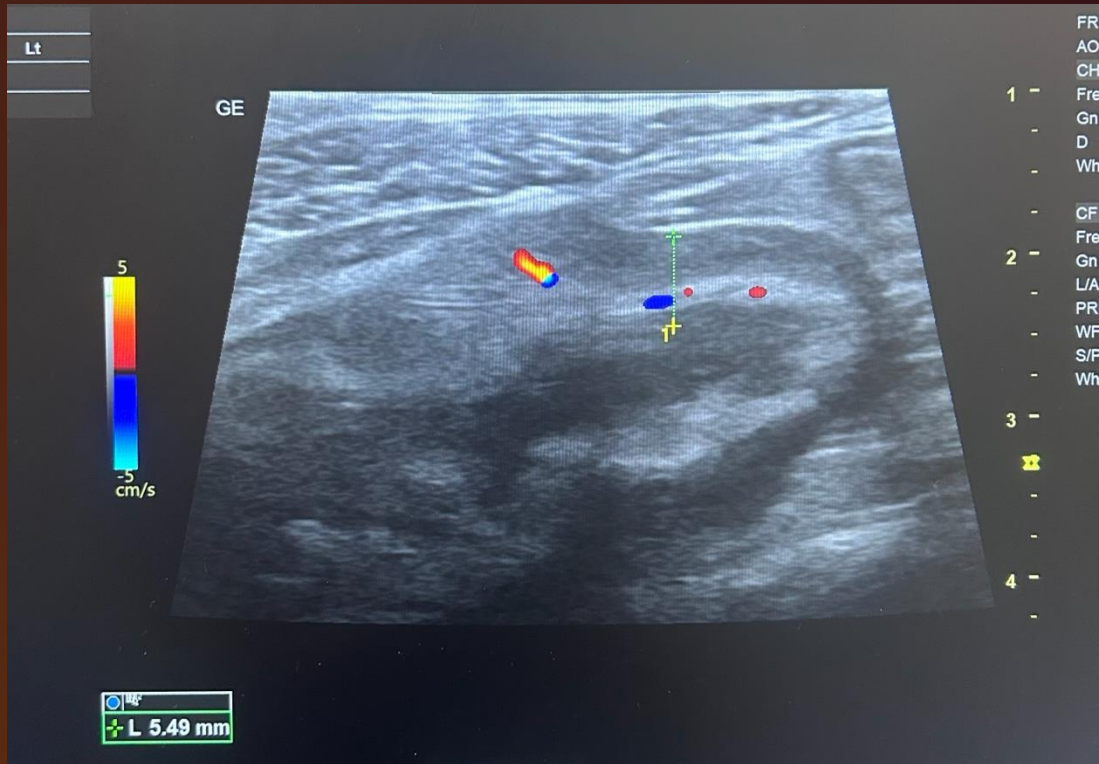
Improved — still active

BWT	2.7 mm
i-fat	2
CDS	1
BWS	0

Clinically and biochemically improved (calprotectin 311 → 24), but IBUS-SAS 47.8 shows the bowel wall is still transmurally active — supporting staying the course.

Case 2 — IBUS-SAS before and after treatment

Terminal ileum segmental score



Clinically and biochemically improved (calprotectin 311 → 24), but IBUS-SAS 47.8 shows the bowel wall is still transmurally active — supporting staying the course.

Take-home messages

- ✓ Ultrasound scores give IBD teams a shared language for standardized monitoring, in and beyond clinical trials.
- ✓ BWT and Color Doppler are the key parameters — they respond early to treatment and correlate with endoscopic outcomes in both CD and UC.
- ✓ MUC (for UC) and IBUS-SAS (for CD) are today's most validated composite scores, each with proven prognostic value.
- ✓ Treat-to-target: integrating scores turns a symptom-based approach into a proactive, precision-guided workflow.
- ✓ Assess patients in a standardized way — and report it, including images.



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Q&A

Thank you for your attention