



international bowel
ULTRASOUND GROUP

Standardized reporting and tips for central reading

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Disclosures

Consultancy

Abbvie, Amgen, Biogen, Boehringer, Celltrion, Celgene, Hospira, MSD Sharp & Dome GmbH, Mundipharma, Dr. Falk Pharma GmbH, Galapagos, Gilead, Janssen, Lilly, MSD Sharp & Dome GmbH, Novartis, Takeda Pharma GmbH

Speakers honoraria

Abbvie, Amgen, Celltrion, Celgene, Dr. Falk Pharma GmbH, Ferring Arzneimittel GmbH, Galapagos, Janssen, MSD Sharp & Dome GmbH, Pfizer, Roche, Takeda Pharma GmbH, Vifor



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Advance Access publication October 10, 2021
ECCO Topical Review

OXFORD

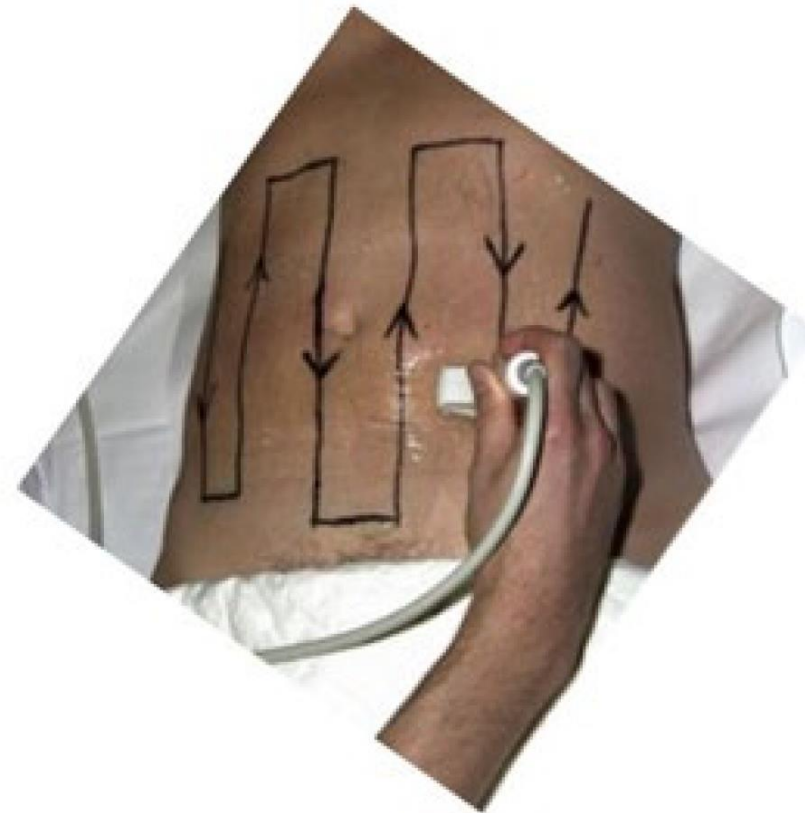
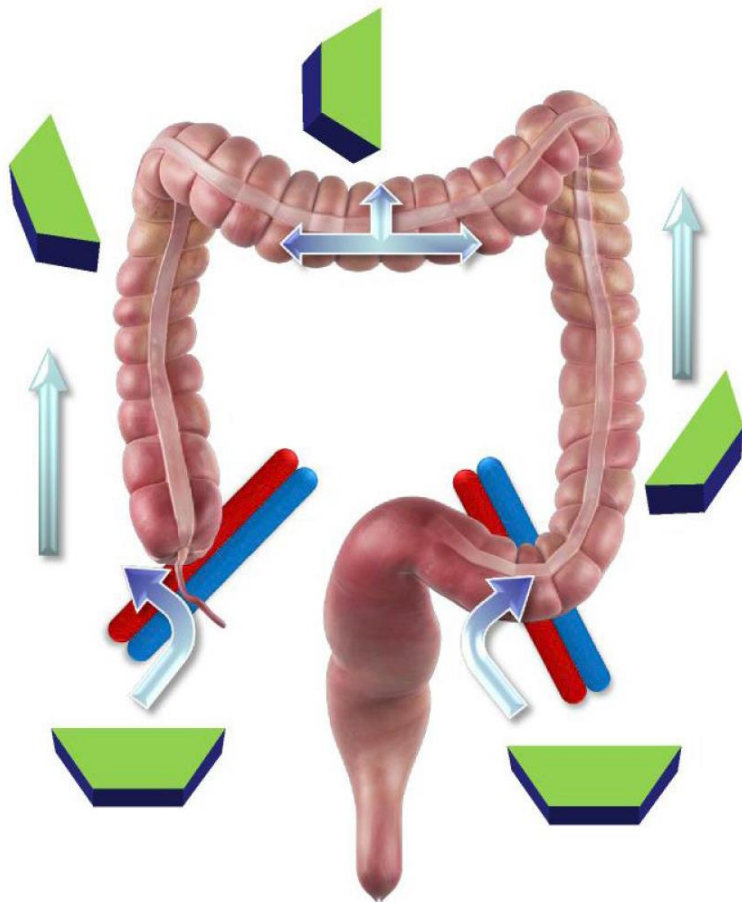
ECCO Topical Review

ECCO-ESGAR Topical Review on Optimizing Reporting for Cross-Sectional Imaging in Inflammatory Bowel Disease

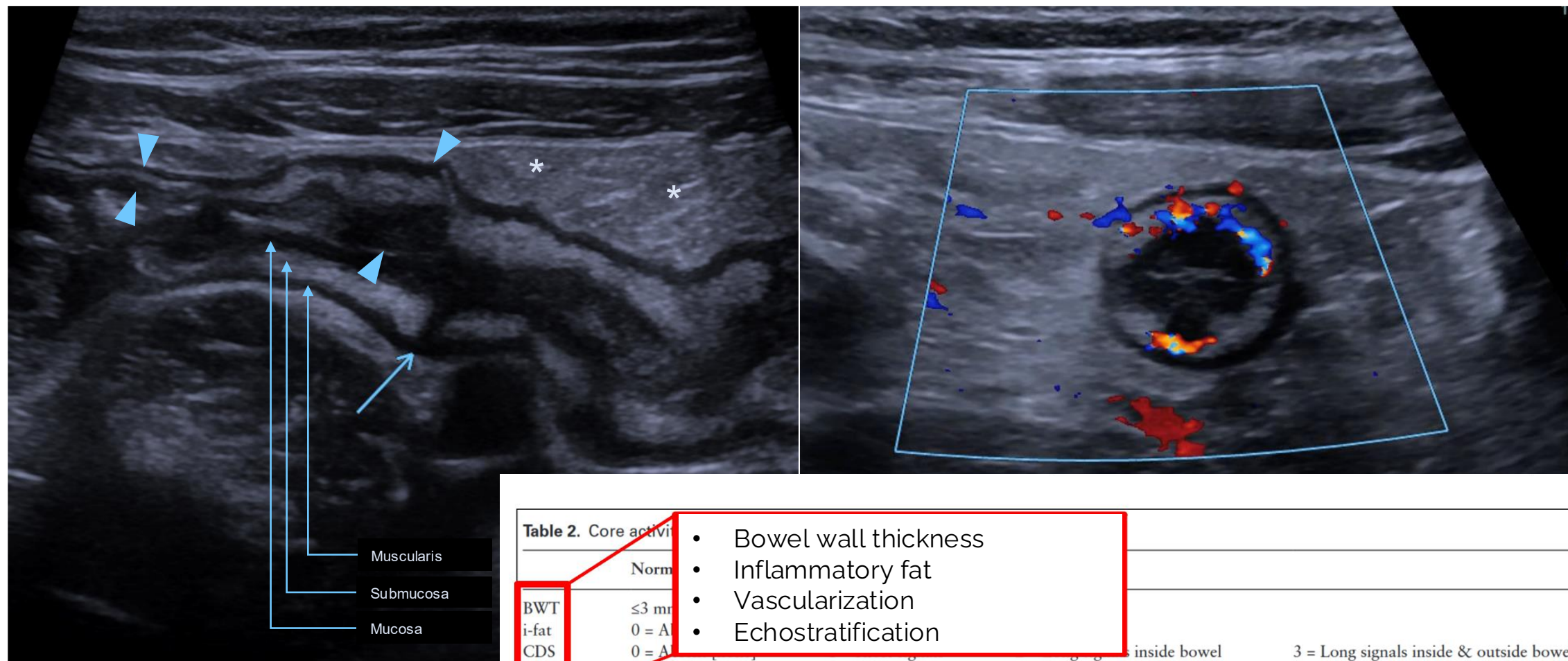


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IUS technique for a standardized complete evaluation of colon and terminal ileum (*left*) and small bowel (*right*).



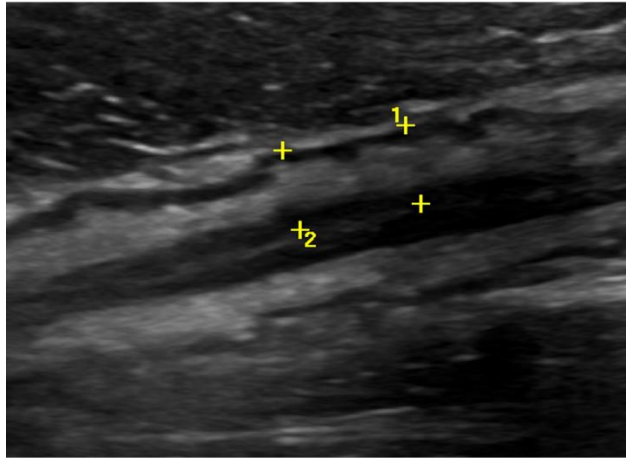
Relevant IUS parameters - Activity



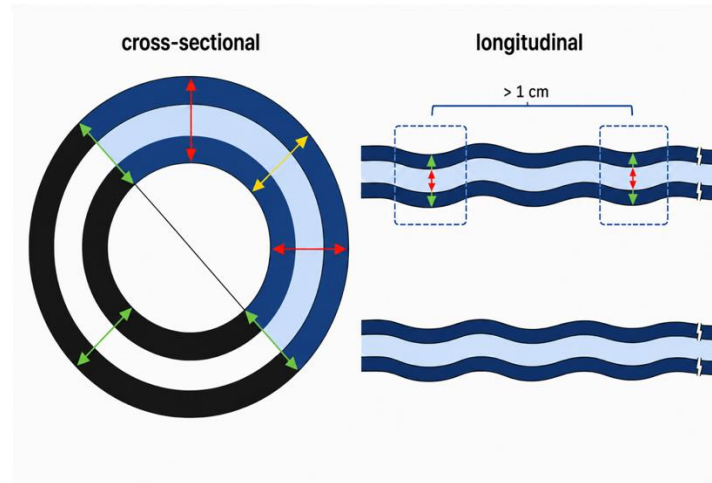
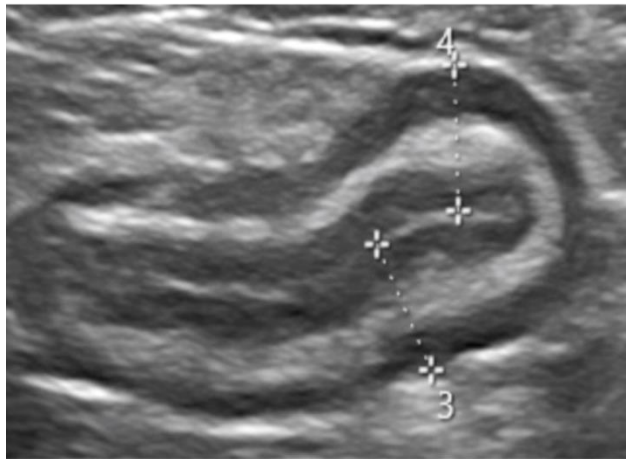
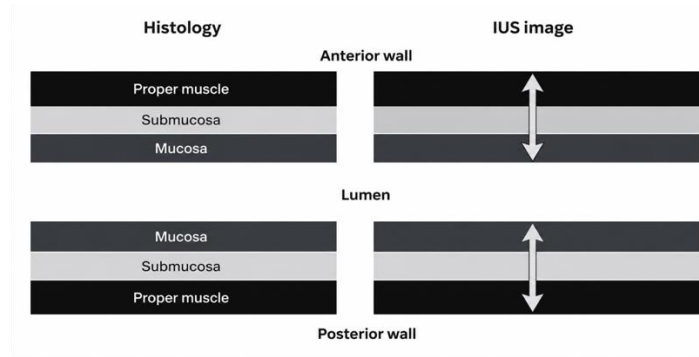
Novak K et al. *JCC* 2021

BWT, bowel wall thickness; i-fat, inflammatory fat; CDS, colour Doppler signal; BWS, bowel wall stratification; NA, not applicable.

Relevant IUS parameters - BWT



Segment with the most prominent pathology
2x transversal + 2x longitudinal/4



Interobserver variability

$\kappa = 0.72-1$

Fraquelli M et al. Dig Liver Dis 2008

ICC = 0.96

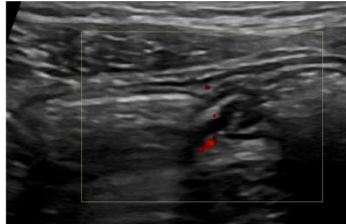
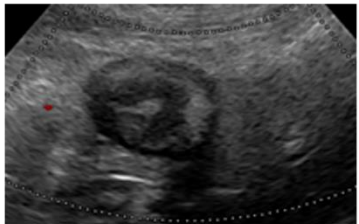
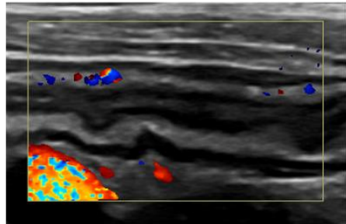
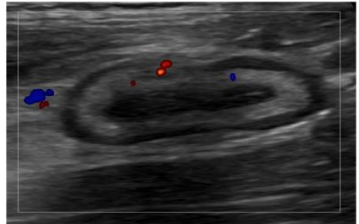
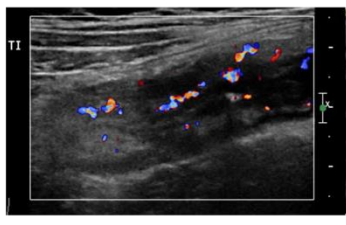
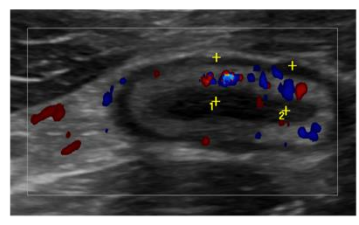
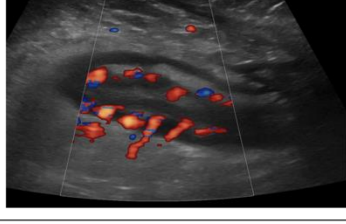
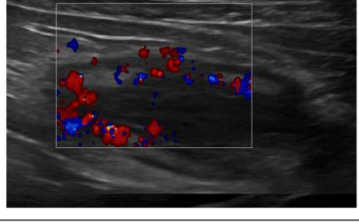
Novak K et al. JCC 2021

Vascularization - Colour Doppler Signal

set velocity range: 5-7 cm/s

- 0 – absent
- 1 – short signals
- 2 – long signals inside bowel
- 3 – long signals inside & outside bowel

ICC = 0.62

	Longitudinal scan	Transversal scan
CDS 0		
CDS 1		
CDS 2		
CDS 3		

CDS Score

- 0 – absent
- 1 – short signals
- 2 – long signals inside bowel
- 3 – long signals inside & outside bowel

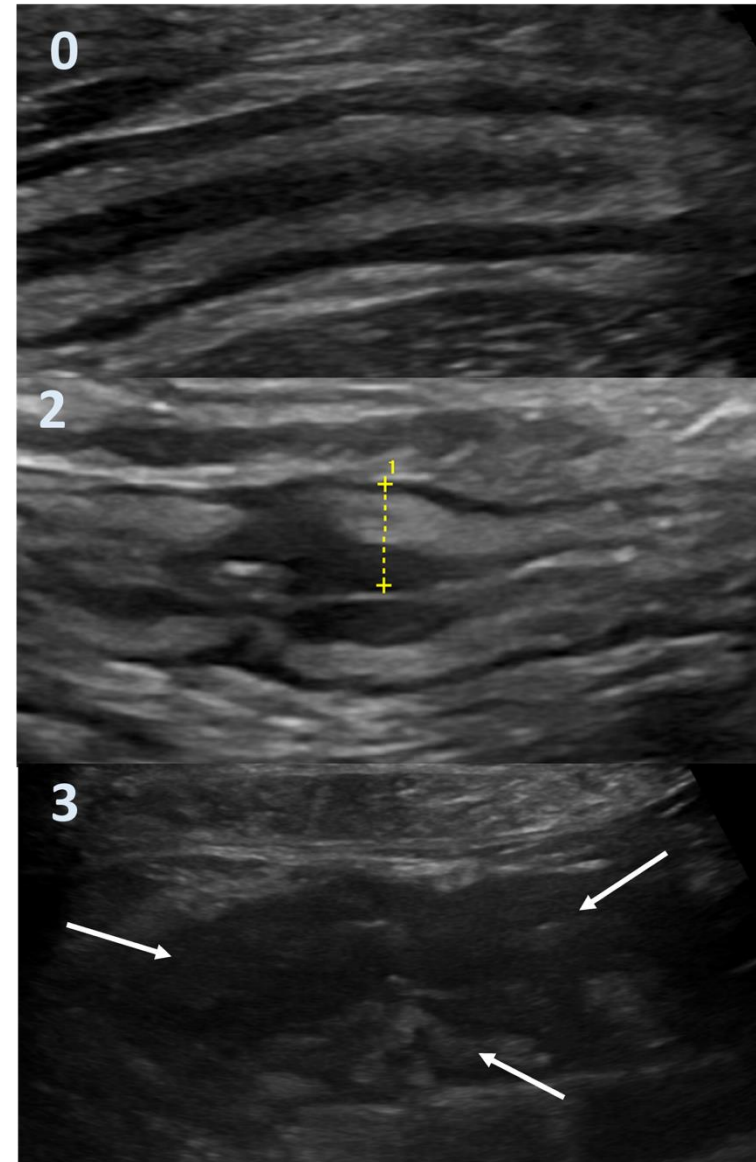
Echostratification

Categories

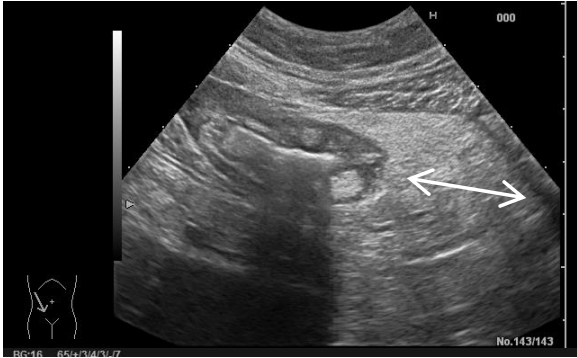
- 0: Normal/preserved echostratification
- 1: Uncertain
- 2: Focal disruption (< 3 cm)
- 3: Extensive disruption (> 3 cm)

ICC = 0.5

Novak K et al. JCC 2021



Inflammatory mesenteric fat

	Longitudinal scan	Transversal scan
Present		
Absent		

Categories

- 0: absent
- 1: uncertain
- 2: present

$$k = 0.14-0.69$$

Fraquelli M et al. Dig Liver Dis 2008

$$s = 0.43$$

Calabrese E et al. IBD 2018

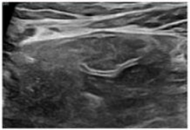
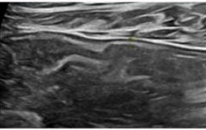
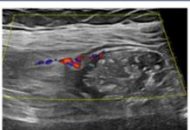
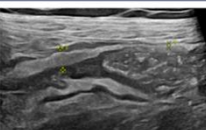
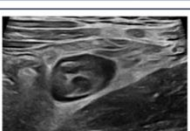
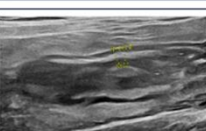
$$\text{ICC} = 0.51$$

Novak K et al. JCC 2021

The Chicago Mesenteric Fat Index: A Novel Metric for Point-of-Care Intestinal Ultrasound Evaluation of Mesenteric Fat Wrapping in Crohn's Disease



Objective: To develop and validate a reproducible ultrasound-based index for mesenteric fat wrapping in Crohn's disease, and to evaluate its clinical relevance.

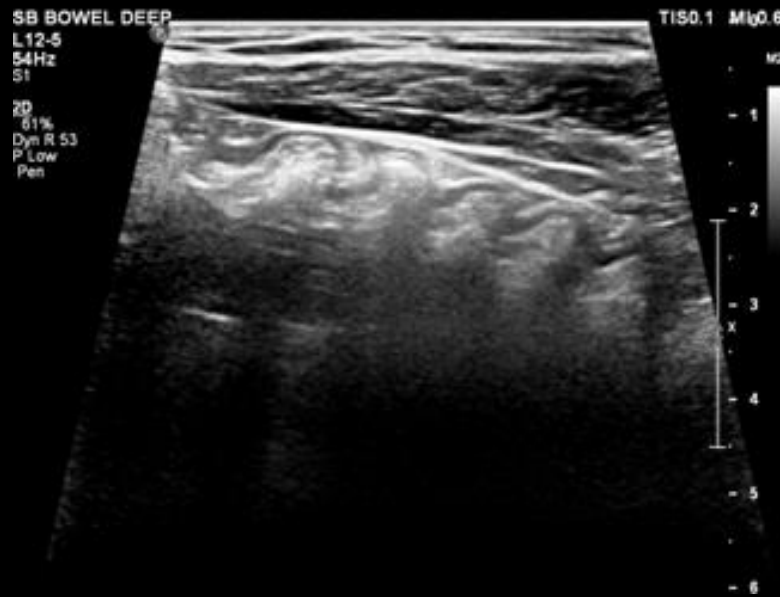
Mesenteric fat wrapping	Schematic	Cross-sectional	Longitudinal
None (0) Absence or minimal (<25%) fat wrapping			
Incomplete (1) Incomplete circumferential, with skipped areas along the TI			
Complete (2) Circumferential wrapping, continuous along the TI			

Results:

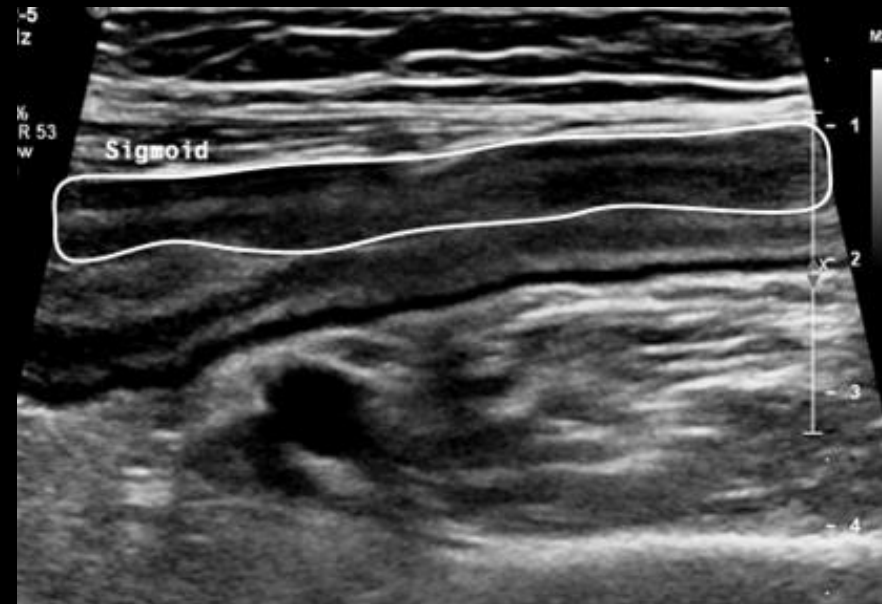
- **Reliability**
 - Inter-rater $\kappa = 0.452$ (moderate)
 - Intra-rater $\kappa = 0.653$ (substantial)
- **Associations**
 - $\uparrow$ BWT (OR 6.74, $p < 0.001$)
 - Loss of stratification (OR 22.05, $p < 0.001$)
 - $\uparrow$ hyperemia (OR 8.09, $p = 0.002$)
 - Strictures (OR 4.30, $p = 0.002$)
 - Active smoking (OR 18.86, $p = 0.035$)
 - Low albumin (OR 0.06, $p = 0.001$)

Conclusion: The CMFI offers a reliable, standardized approach to MF assessment, providing greater detail than binary grading. This may improve monitoring of disease progression and guide treatment decisions in Crohn's disease.

Haustration



Preserved haustration



Loss of haustration

Motility



Normal motility -
small bowel



Dysmotility
in small bowel CD



Absent peristalsis
in Crohn's ileitis (L1B1)

Table 3 Intestinal ultrasound scoring systems for disease activity in Crohn’s disease and ulcerative colitis					
Scoring index	Disease	Formula	Strengths	Limitations	Further research questions
Simple IUS score. Novak <i>et al</i> ¹⁰³	CD	$(0.0563 \times \text{BWT1}) + (2.0047 \times \text{BWT2}) + (3.0881 \times \text{BWT3}) + (1.0204 \times \text{Doppler1}) + (1.5460 \times \text{Doppler2})$	Validated	Ultrasonographers and endoscopists were not blinded. Needs to be validated in external cohorts.	Future studies should use MRE as a reference. Future research should focus on establishing scores that are validated against endoscopy and/ or MRE in multiple centres through central reading. Responsiveness should be assessed with clear definitions for response and
Simple IUS score. Saevik <i>et al</i> 2021 ¹⁰⁴	CD	$\text{BWT} \times 1.053 + (\text{colour Doppler} \times 1.934) + (\text{fatty wrapping} \times 1.275) + (\text{stratification} \times 1.225) + 0.242$ or simply summarising the numerical	Validated. Good inter-rater reliability.	Needs to be evaluated in external cohorts. Sensitivity to change not assessed.	

Recommendation 40

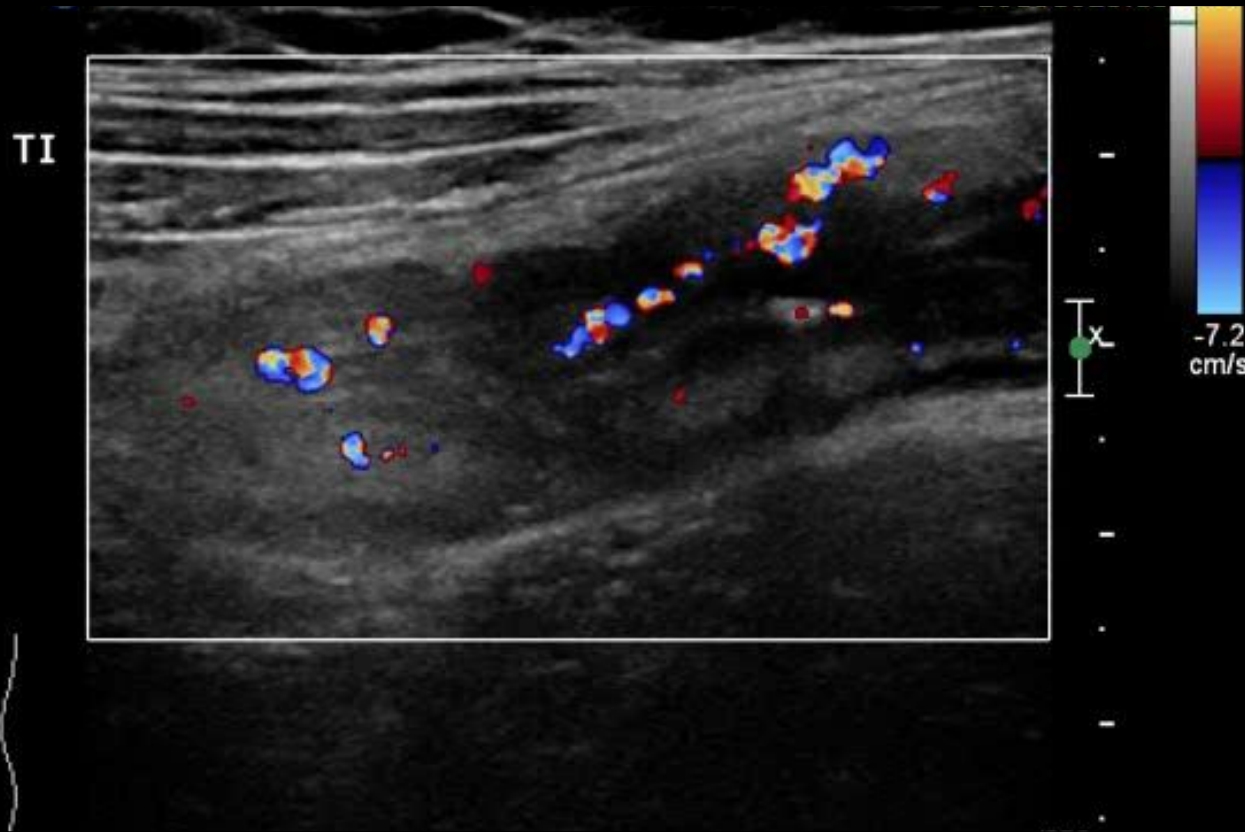
We suggest routinely using validated cross-sectional imaging indices to assess and monitor disease activity and therapeutic response in patients with IBD [EL5]. AGREEMENT 89%

Alibek <i>et al</i>			between active and non active UC	Does not discriminate different	to change and their validity to
UC IUS Index. Bots <i>et al</i> ³⁹	UC	Point-based index with four parameters graded on a 7-point scale: BWT, Doppler signal, abnormal haustration, fat wrapping.	Not validated. Strong correlation with the Mayo endoscopic subscore (p=0.830; p<0.001). Moderate-to-substantial inter-rater agreement.	The coefficient from the multivariable analysis have not been used for the score. Instead, an arbitrary grading system (a 7-point scale) was used. Needs to be validated in external cohorts.	Validity to assess treatment response needs to be assessed. Assessment of rectum needs to be included.

BWF, bowel wall flow; BWT, bowel wall thickness; CD, Crohn’s disease; IUS, intestinal ultrasound; MRE, magnetic resonance enterography; UC, ulcerative colitis; US, ultrasound.

ECCO-ESGAR-ESP-IBUS Diagnostic Guideline JCC 2025

Scoring of CD Disease Activity – IBUS SAS-Score



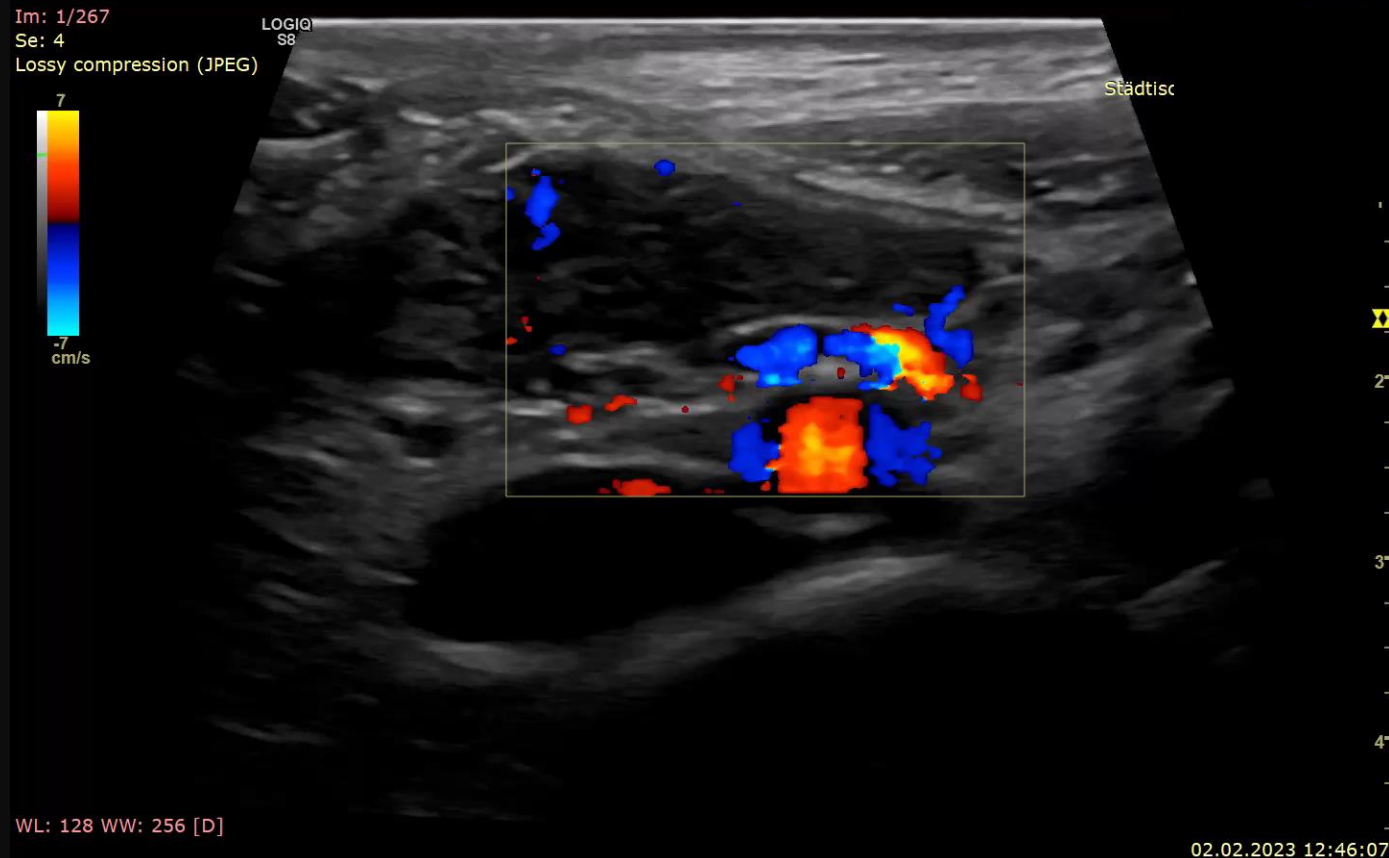
Active CD L1B1

- BWT (8 mm)
- Vascularization (CDS 2)
- Echostratification (extensive=3)
- Inflammatory fat (present=2)

IBUS SAS-Score: 88

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

Scoring of UC Disease Activity – Milan US Criteria (MUC Score)



Active UC E3

- BWT (4.2 mm)
- Vascularization (CDS 3)

MUC Score

$1.4 \times \text{BWT} + 2 \times \text{BWF}$
(Bowel Wall Flow 0 or 1)

$1.4 \times 4.2 + 2 \times 1 =$

MUC Score = 7.9

Active UC: MUC Score > 6.2

Structured IUS report – scoring template



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2. Segmental IUS activity assessment

Segment	BWT	i-fat	CDS / vascularization	BWS	Interpretation
Grading	≤3 mm	0 absent	0 absent	0 normal	normal / uncertain / active
	normal	1	1 short signals	1 uncertain	
	>3 mm	uncertain	2 long intramural	2 focal ≤3 cm	
	active	2 present	3 long intra- /extramural	3 extensive >3 cm	
Terminal / neo-terminal ileum	___ mm	___	___	___	normal / uncertain / active
Distal ileum / small bowel	___ mm	___	___	___	normal / uncertain / active
Right colon	___ mm	___	___	___	normal / uncertain / active
Transverse colon	___ mm	___	___	___	normal / uncertain / active
Left colon / sigmoid	___ mm	___	___	___	normal / uncertain / active

Affected small-bowel length: approx. ___ cm

Skip lesions: [yes / no]

Most affected segment: _____

Maximum BWT: ___ mm

Highest CDS: ___

Activity score: [none / IBUS-SAS / SUS-CD / MUC score / other: ___] — Score: ___

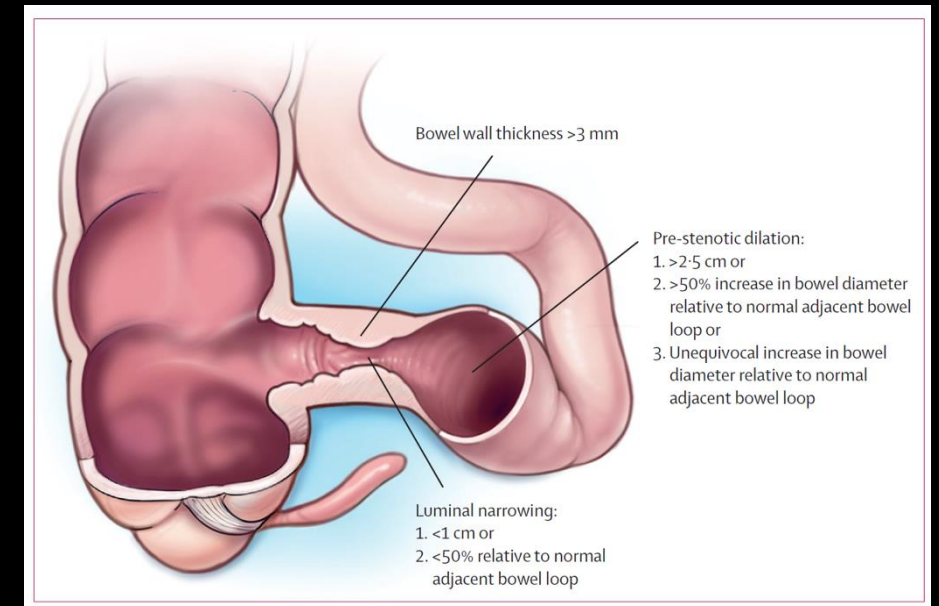
Additional findings: _____

Complications - stenosis



Stenosis - IUS criteria

- Increased bowel wall thickness
- Stiff bowel wall, loss of motility
- Narrowing of the lumen
- Prestenotic dilatation (> 2.5 cm)

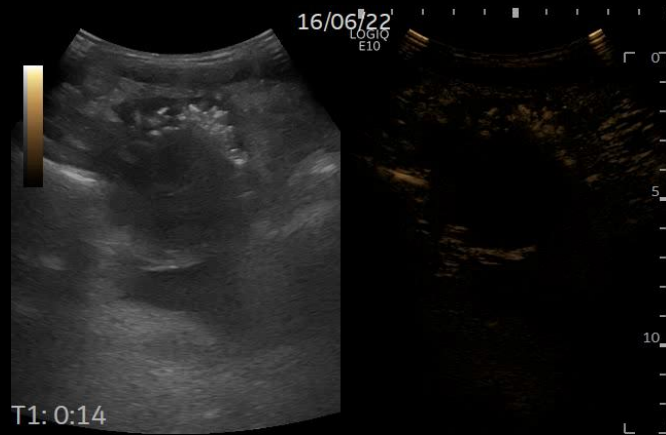


Lu C et al. *Lancet Gastro Hepatol* 2024

Kucharzik T et al *JCC* 2022

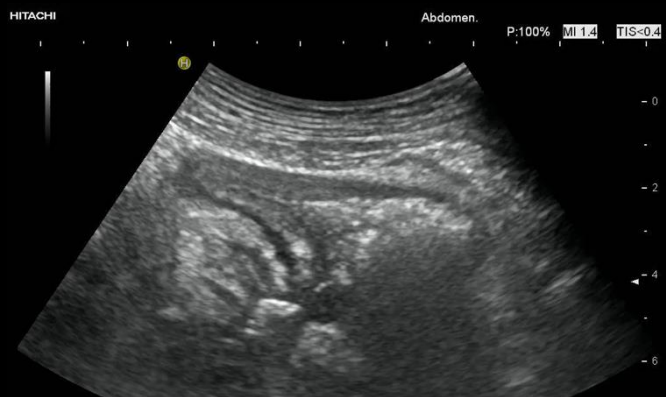
Describe your findings!

Complications – abscess/fistula



IUS criteria - abscess

- Hypo- or anechoic lesion with fluid and gaseous artefacts
- Posterior echo enhancement
- Irregular margins
- Frequently surrounded by mesenteric fat
- **CEUS:** absence of vascularization in the mass



IUS criteria - fistula

- Hypo- or anechoic extension from bowel wall filled with fluid and/or gaseous artefacts
- Irregular margins
- Frequently surrounded by mesenteric fat

Statement 3.8

A standardized IUS report should be completed, including predefined core parameters and scores when applicable. The extent of the examination should be clearly documented.

For **disease monitoring**, we suggest using the terms: **ultrasound remission, ultrasound response, unchanged disease or ultrasound progression**

New Categories

- Ultrasound remission
- Ultrasound response
- Unchanged disease
- Ultrasound progression

Definitions for transmural response and remission



Transmural response	Transmural remission
• Reduction in BWT from baseline $\geq 25\%$	• BWT normalization (≤ 3 mm)
• Reduction of at least 25% in BWT AND a decrease of at least one grade in CDS	• BWT ≤ 3 mm AND normalization of CDS
• Reduction of at least 25% in BWT AND a reduction in one grade or category in CDS or BWS or i-fat	• BWT ≤ 3 mm AND normalization of all IUS parameters

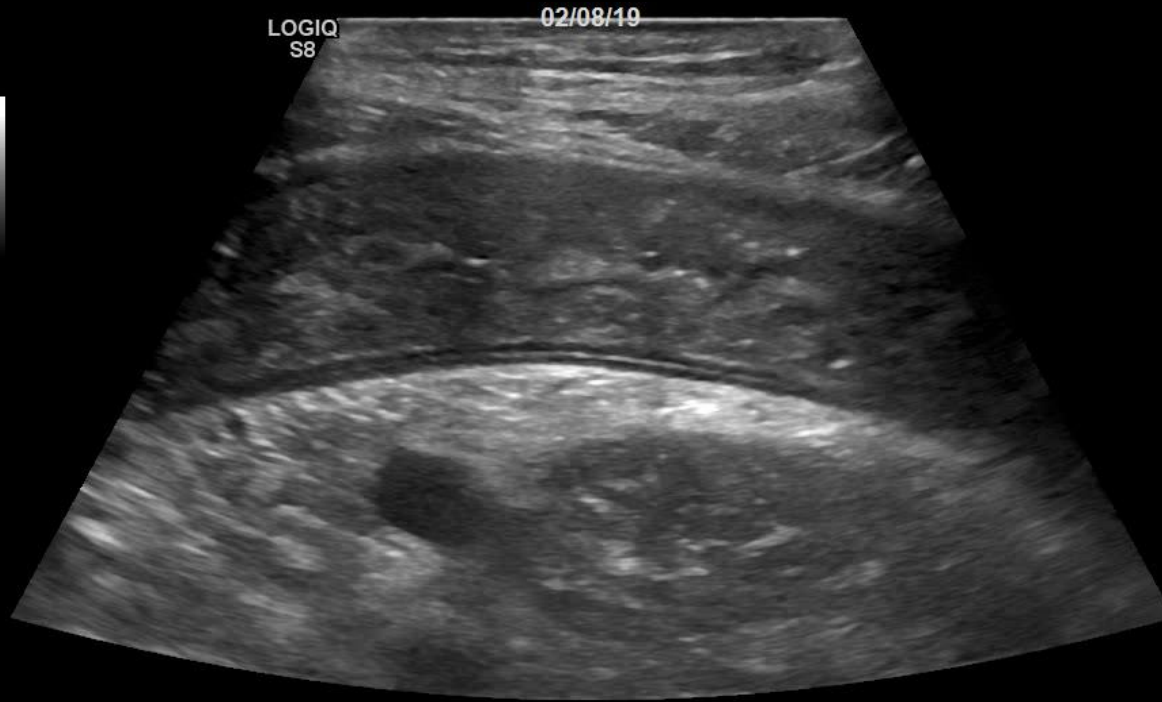
Ultrasonographic activity scores for CD:

- IBUS-SAS, International Bowel Ultrasound Segmental Activity Score ≤ 32.5 ³⁹
- BUSS, Bowel Ultrasound Score ≤ 3.52 ⁴¹

Ultrasonographic activity scores for UC:

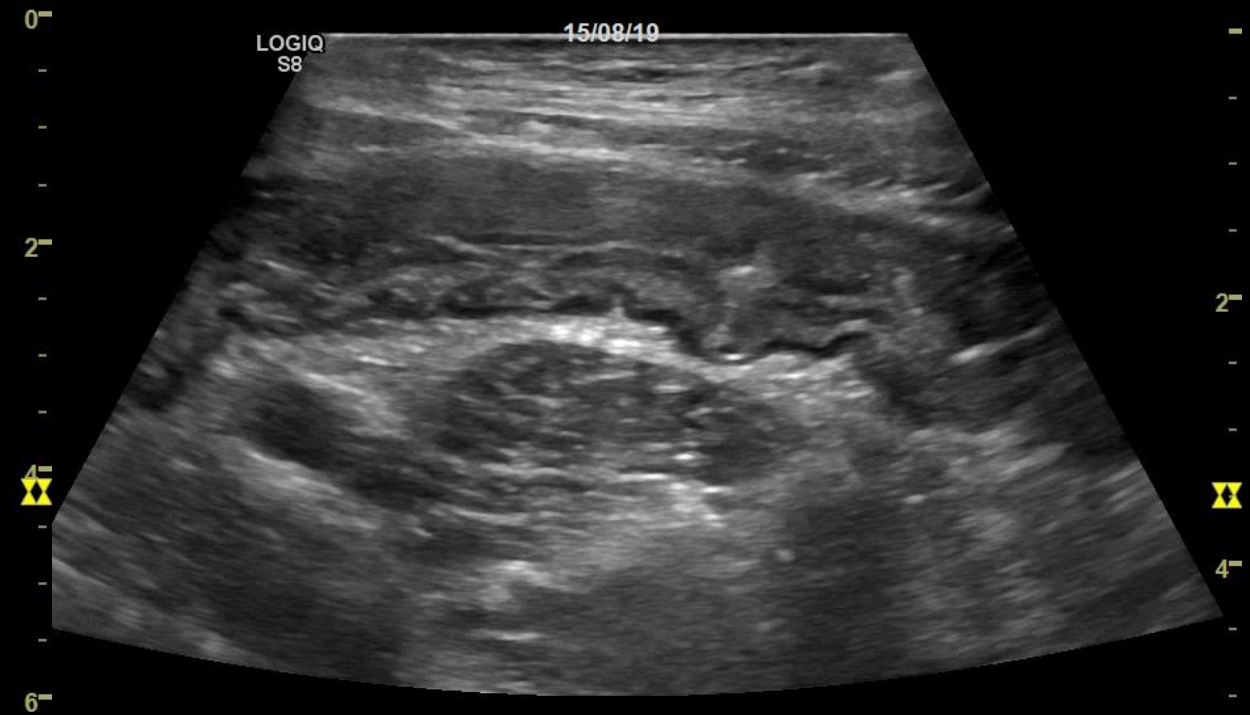
- MUC, Milan Ultrasound Criteria ≤ 6.2 (for MES = 0–1)⁵¹
- MUC, Milan Ultrasound Criteria ≤ 4.3 (for MES = 0)⁵¹

Monitoring IBD - Acute Severe UC, E2, CsA induction i.v.



BWT 8.5 mm; MUC-Score: 13.9

after 2 weeks



BWT 3.8 mm; MUC-Score: 7.32

Significant ultrasound response in sigmoid colon 2 weeks after treatment induction with decrease of MUC Score and restitution of haustration



- **Representative images/cine loops**
- **Annotation of images/loops**
- **Standardized data archiving (e.g. PACS)**
- **Well-structured IUS report**

Technical and image quality requirements for trials are higher (Central Reading)

- The **same machine, probes, and IUS settings** should be used for the same patient at each visit
- Each bowel segment (affected and unaffected) should be recorded on **three separate 5-10s cineloops (longitudinal, cross-sectional and CDI)**; if several recordings have been made, the best three cineloops should be chosen by the investigator for upload
- Additional still images can be accepted if cineloops are not of sufficient quality according to the investigator
- **Cineloops** should be covering bowel, mesentery and possible lymph nodes. Loops should **start (if possible) at the non-inflamed part** of the bowel distal/rectal of the affected bowel segment, should **cover the affected bowel segment** and should **end at the non-inflamed part** proximal/oral to the affected bowel segment
- ...



ECCO Position Statement on "Intestinal Ultrasound in IBD - Harmonisation and standardisation"

Christian Maaser (1), Gauraang Bhatnagar (2), Bram Verstockt (3), Mariangela Allocca (4), Rune Wilkens (5), Johan Burisch (6), Isabelle De Kock (7), Gabriele Dragoni (8), Krisztina B. Gecse (9), Giovanni Maconi (10), Kerri Novak (11), Sophie Restellini (12), Shintaro Sagami (13), Lauren White (14), Torsten Kucharzik (15)

JCC 2026 submitted

Statement 4.1

We recommend the use of high-end (preferred) or mid-range ultrasound systems equipped with a minimum of two probes for IUS assessment in clinical trials. (Agreement - 100%)

Statement 4.2

IUS operators in clinical trials should demonstrate defined competencies. We suggest **specific training or certification in image acquisition for clinical trials**. (Agreement - 100%)

IBUS Clinical Trial
Certificate (IBUS STAR)
program will be
available soon!

Statement 4.3

To ensure consistent image acquisition, we suggest using **instruction manuals for clinical trials**. (Agreement - 100%)

Statement 4.4

We suggest using **standardized data archiving** which is essential for quality control and central reading. In addition to Central Reading (Type A and B1), the **local storage of pseudonymized/anonymized high-quality images and cine loops in DICOM format** is mandatory as source data. (Agreement - 100%)

Statement 4.5

Central reading of pseudonymized IUS DICOM cine loops by blinded experts is mandatory (Type A) and highly recommended (Type B1) to reduce bias and ensure protocol adherence. (Agreement - 93%)

Statement 4.6

We suggest **using STARD-IUS reporting guidelines** where applicable. (Agreement - 100%)

INDICATIONS and DISEASE CHARACTERISTICS

- 22y old man, Crohn's disease L1B1 since 2017, steroid-refractory, azathioprine-failure
 - 3-4 stools, abdominal cramps right lower quadrant, temp 37.9°C
- lab results: Hb 10.2 mg/dl, CRP 67 mg/dl, fCalpro: >800 mg/kg.

INTRA-PROCEDURE FEATURES

- Point of care examination. No technical limitation. Normal body status

Fasting period: 4h

Examination quality: good

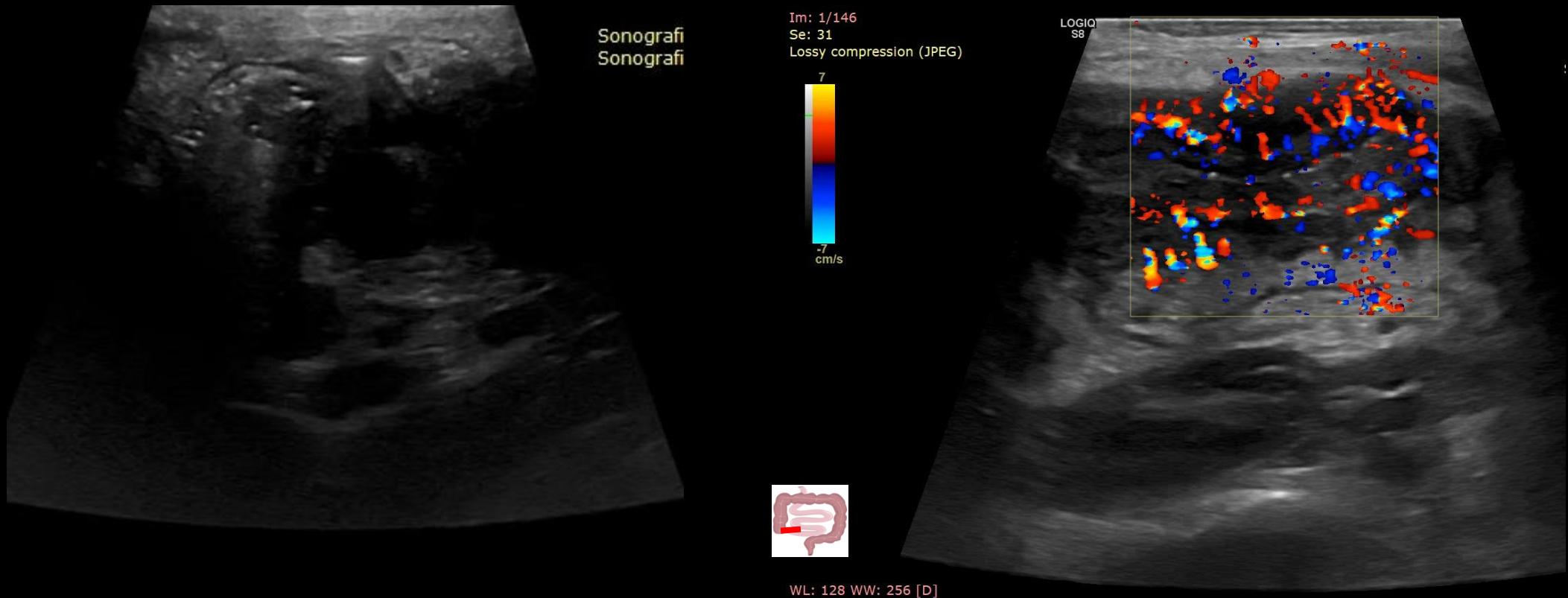
Diagnostic confidence: high confidence

Image storage location: cine loops and images stored in PACS

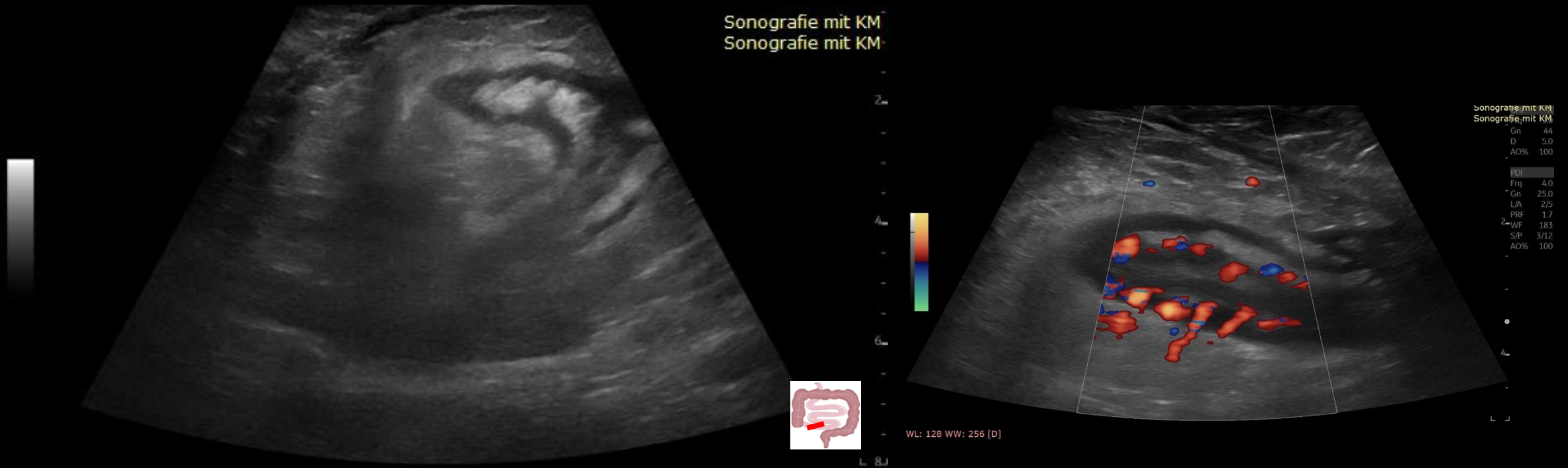
Examiner: Torsten Kucharzik

IUS machine: GE Logiq S8, GE Logiq E10; Probes: C1-6 MHz, L2-9 MHz

22y old man with Crohn's ileitis

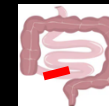
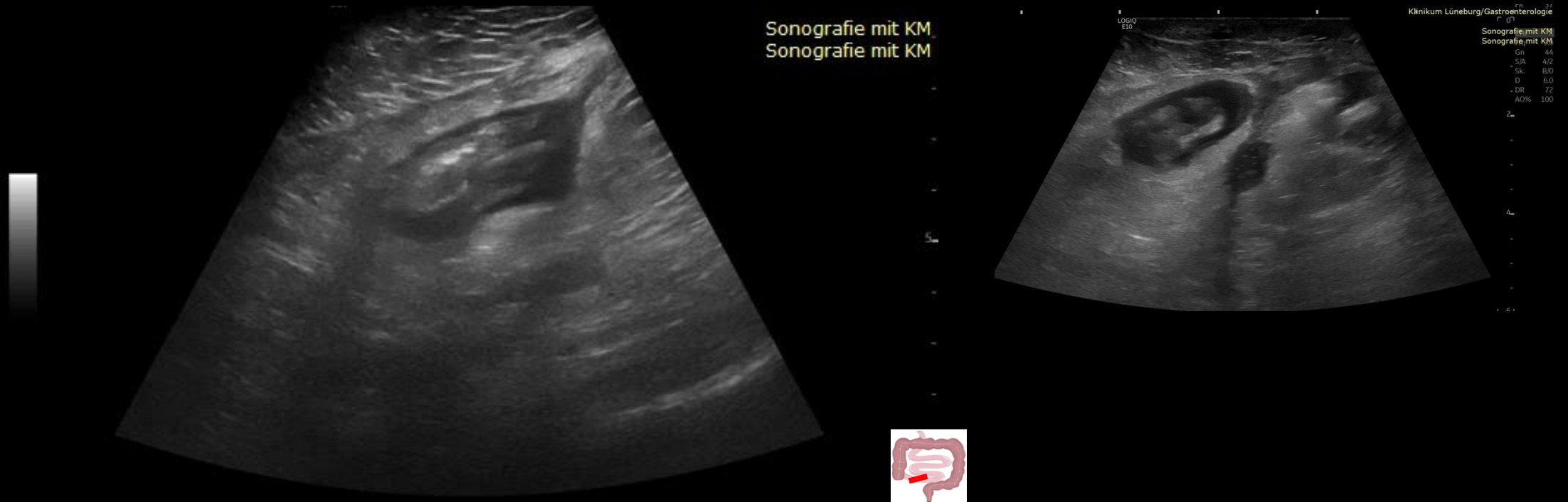


22y old man with Crohn's ileitis



WL: 128 WW: 256 [D]

22y old man with Crohn's ileitis – abscess or phlegmone?



22y old man with Crohn's ileitis – abscess or phlegmone?



WL: 128 WW: 256 [D]

Sonografie mit KM
Sonografie mit KM



IUS Report – 22y old man with Crohn’s ileitis

IUS REPORT

INDICATIONS and DISEASE CHARACTERISTICS

22y old man, Crohn’s disease L1B1 since 2017, steroid-refractory, azathioprine-failure.

3-4 stools, abdominal cramps right lower quadrant, temp 37.9°C;

lab results: Hb 10.2 mg/dl, CRP 67 mg/dl, fCalpro: >800 mg/kg.

INTRA-PROCEDURE FEATURES

Point of care examination. No technical limitation. Normal body status

Fasting period: 4h

Examination quality: good

Diagnostic confidence: high confidence

Image storage location: cine loops and images stored in PACS

Examiner: Torsten Kucharzik

IUS machine: GE Logiq E10; Probe: 2-9 MHz

RESULTS

BWT: sigmoid colon 2.5 mm, descending colon 2.5 mm, transverse colon 2.2 mm, ascending colon 2.0 mm, TI 9.2 mm

Vascularisation (IBUS CDS Score) : rectum: NA, sigmoid colon: 1, descending colon: 1, transverse colon: 1, ascending colon: 1; TI: 3, ileum: 3, jejunum: 0; duodenum: 0

Echostratification: TI: completely abrogated; ileum: partially abrogated; colon: present

Mesenteric fat: TI and ileum: present (2); sigmoid colon; descending colon; transverse colon, ascending colon: absent (0)

Extension: TI/ileum: 18 cm length

Additional findings: free fluid, mesenteric lymph nodes; **CEUS:** (2.5 ml SonoVue) phlegmone, blind ending fistula, no abscess

Complications: blind ending fistula TI, sinus tracks TI, no abscess, no stenosis

Activity Score: IBUS – SAS CD Score (0–100) = $4 \cdot \text{BWT} + 15 \cdot \text{i-fat} + 7 \cdot \text{CDS} + 4 \cdot \text{BWS}$;

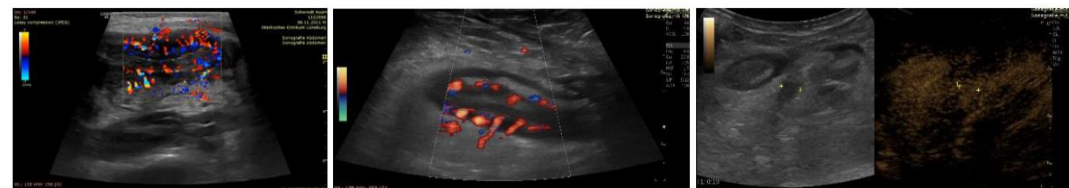
$4 \times 9.2 + 15 \times 2 + 7 \times 3 + 4 \times 3 = 99,8$

DESCRIPTION: Markedly increased BWT in the terminal ileum, with markedly increased vascularisation, abrogated echostratification, increased mesenteric fat, abrogated motility, mesenteric lymphadenopathy, phlegmonre, sinus tracks, blind ending fistula and free fluid

IUS DIAGOSIS: Highly active penetrating Crohn’s disease L1B3 with blind ending fistula and sinus tracks in the TI

RECOMMENDATIONS: Suggested IUS follow up in 4 weeks

IMAGES





**Thank
You!!!**