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Scoring Activity and Response in CD and UC

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IBUS Advanced Ultrasound Workshop – Module 3

DDW, San Diego, US, May 5th, 2025

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Disclosure

- Speaker fees : Johnson & Johnson, Amgen and Organon
- Advisory Board : Sanofi and Celltrion

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Objectives

- Discuss common intestinal ultrasound scores in CD and UC
- Demonstrate how calculate the scores
- Discuss their limitations

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International Bowel Ultrasound Segmental Activity Score: IBUS –SAS score

- Dephi consensus of 11 world experts
- Blind reading of 20 studies
- Optimized acquisition of cineloop
- Blind read of 30 studies

Noval et al JCC 2020

Association between PGA and IUS parameters

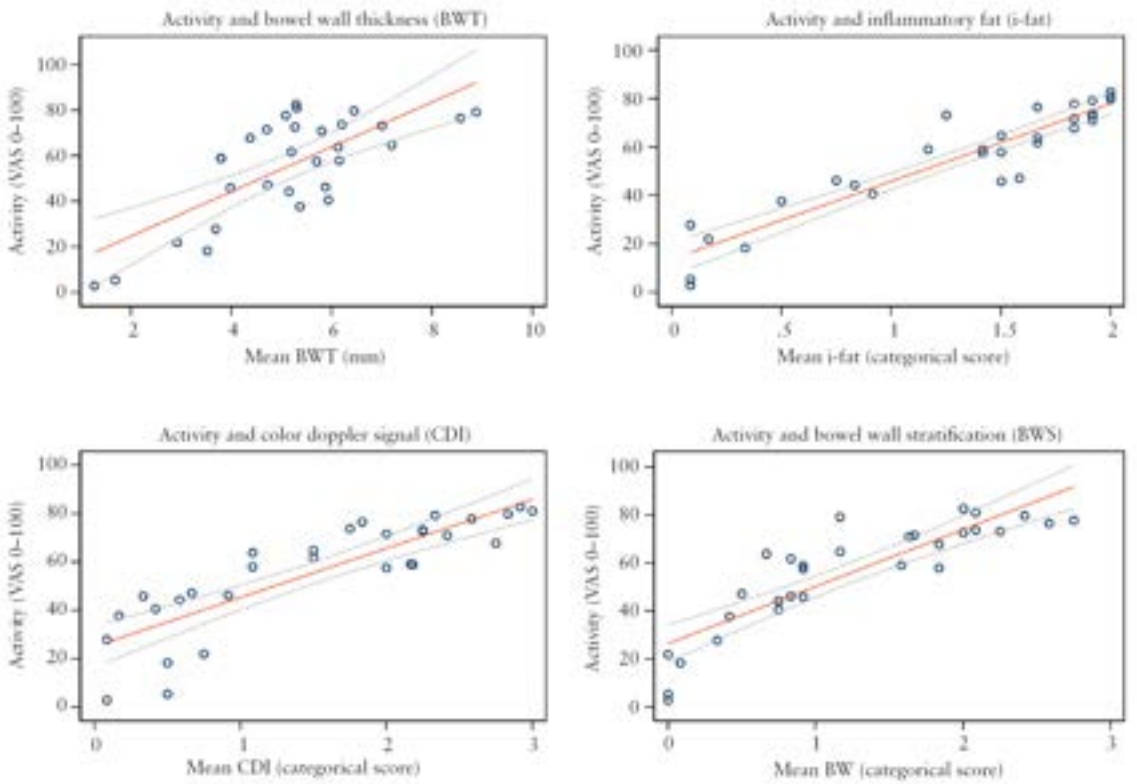

Figure 3. The association between physician global disease activity assessment and individual intestinal ultrasound parameters. Associations between A) mean activity and bowel wall thickness (top left), B) mean activity and inflammatory fat (top right), C) mean activity and colour Doppler imaging (bottom left), and D) mean activity and bowel wall stratification.

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

ACTIVITY		
Parameter	Coefficient	*p*-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

Noval et al JCC 2020

International Bowel Ultrasound Segmental Activity Score: IBUS –SAS score

Table 2. Core activity parameters, Delphi grading consensus

	Normal	Uncertain	Activity	
BWT	≤3 mm	NA	>3 mm	
i-fat	0 = Absent	1 = Uncertain	2 = Present	
CDS	0 = Absent [none]	1 = Short signals	2 = Long signals inside bowel	3 = Long signals inside & outside bowel
BWS	0 = Normal	1 = Uncertain	2 = Focal [≤ 3 cm]	3 = Extensive [>3 cm]

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

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

The optimal cut-off value for diagnosing activity with IBUS-SAS is 23.8, while the optimal cut-off value for diagnosing moderate-to-severe activity is 40.0.

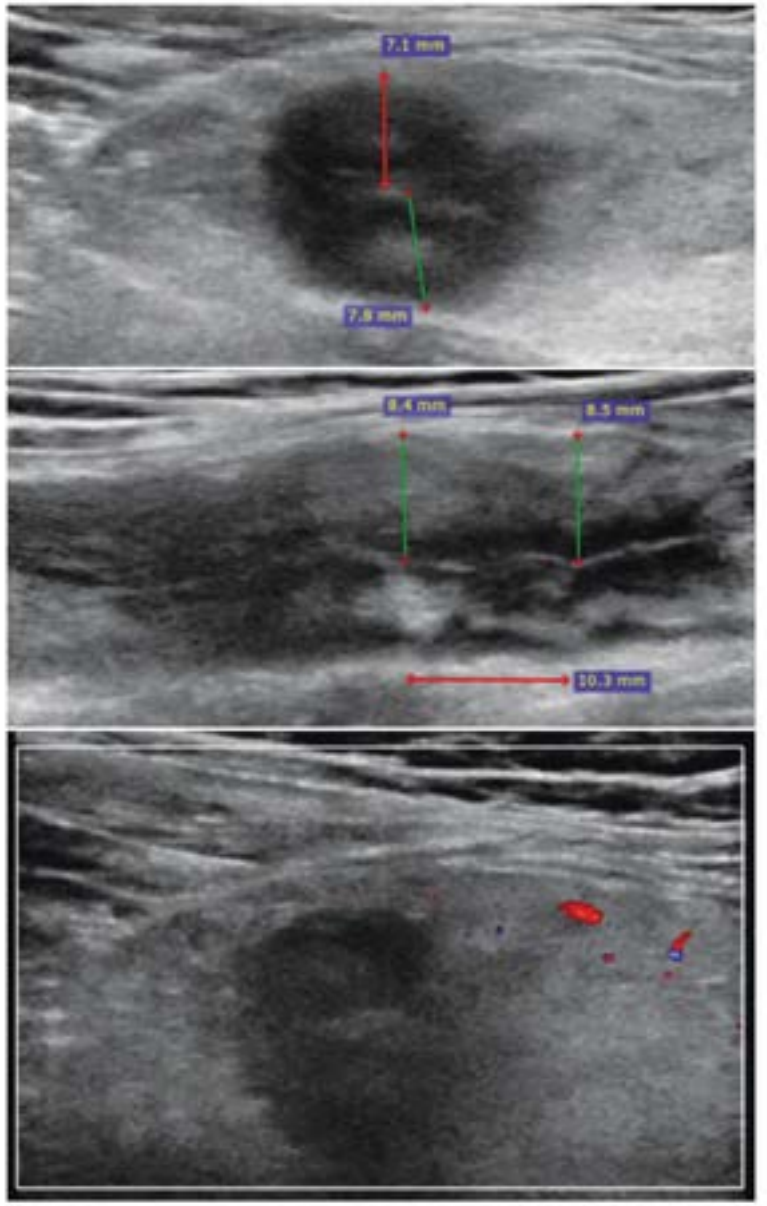

Figure 4. Application of the segmental activity and severity scores. Applying the scores: Bowel wall thickness [BWT] = [7.8 + 7.1 + 8.5 + 8.4] / 4 = 7.95 = 8.0. Blood flow/ colour Doppler signal [CDS] = 0 [no signals]. Inflammatory fat [i-fat] = 2 [certain]. Bowel wall stratification [BWS] = 2 [focal disruption <3 cm]. International Bowel Ultrasound [IBUS] Segmental Activity Score

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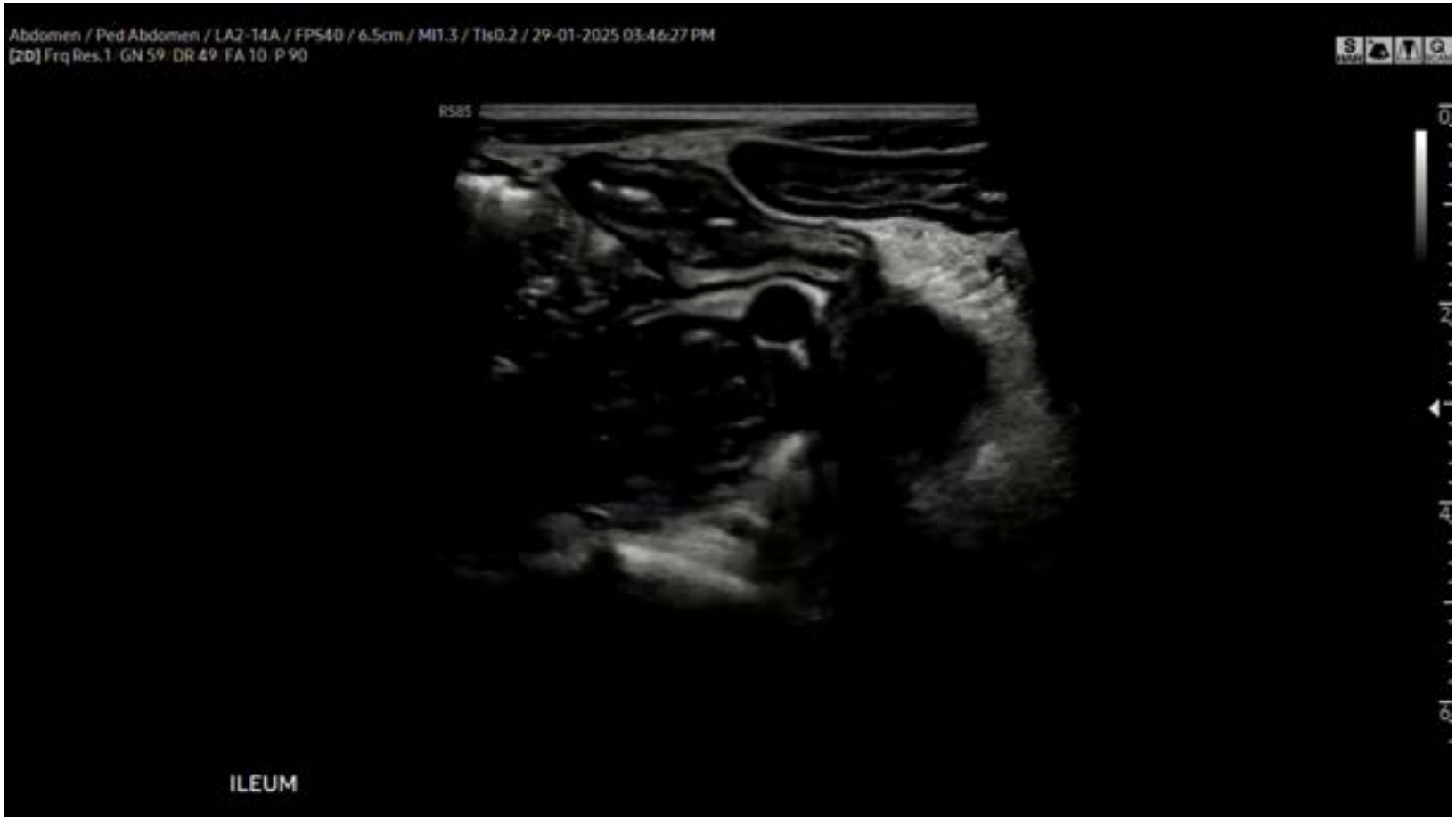
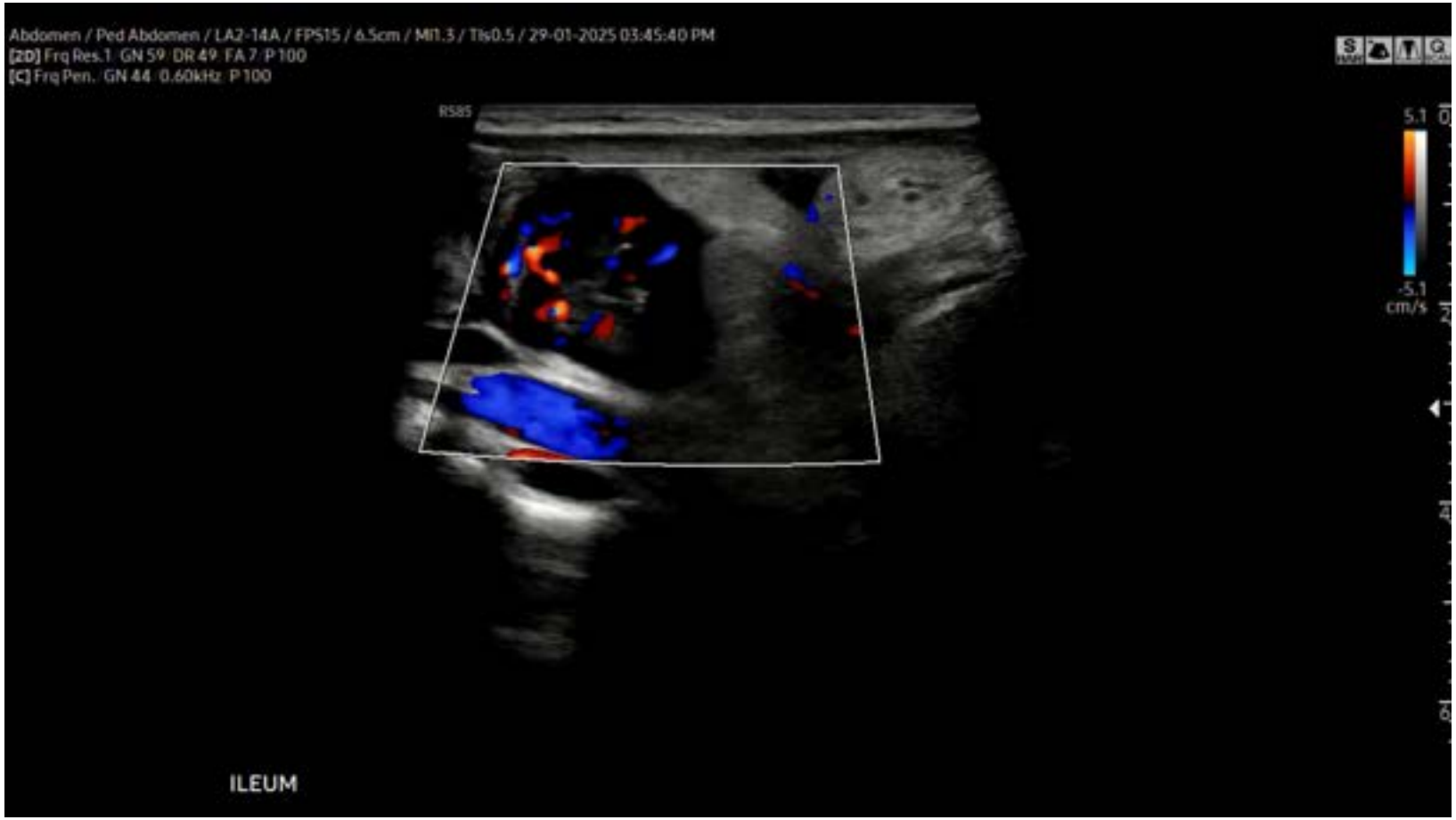
Case 1




Abdomen / Ped Abdomen / LA2-14A / FPS15 / 6.5cm / MI1.3 / TIs0.5 / 29-01-2025 03:45:40 PM
[2D] Frq Res.1 GN 59 DR 49 FA 7 P100
[C] Frq Pen. GN 44 0.60kHz P100
RS85
5.1
-5.1
cm/s
ILEUM

BWT =11 mm

IBUS – SAS score

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$$\text{IBUS} - \text{SAS}\ (0{-}100) = 4 \cdot 11 + 15 \cdot 2 + 7 \cdot 3 + 4 \cdot 3 = 107$$

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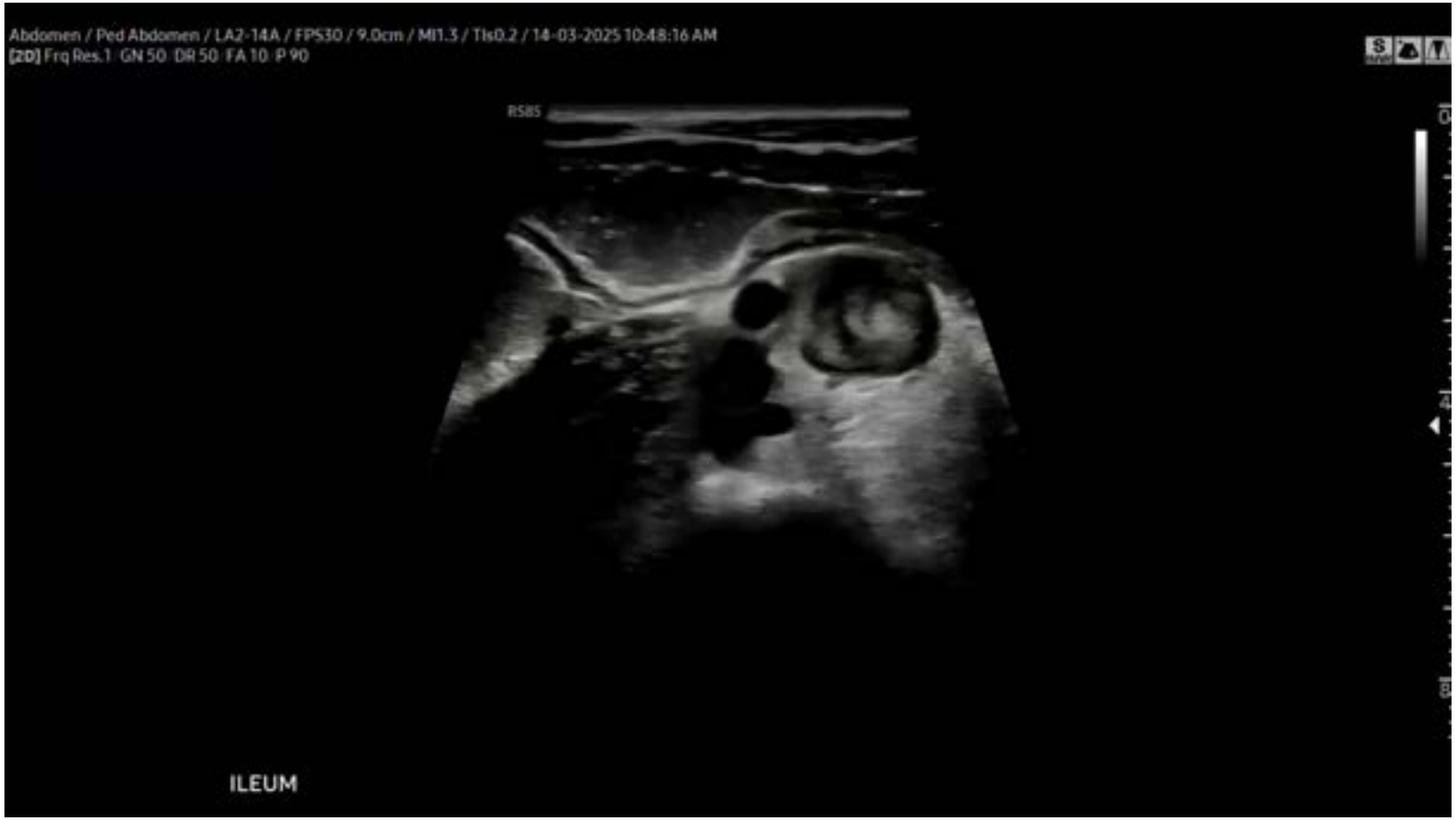
6 weeks treatment



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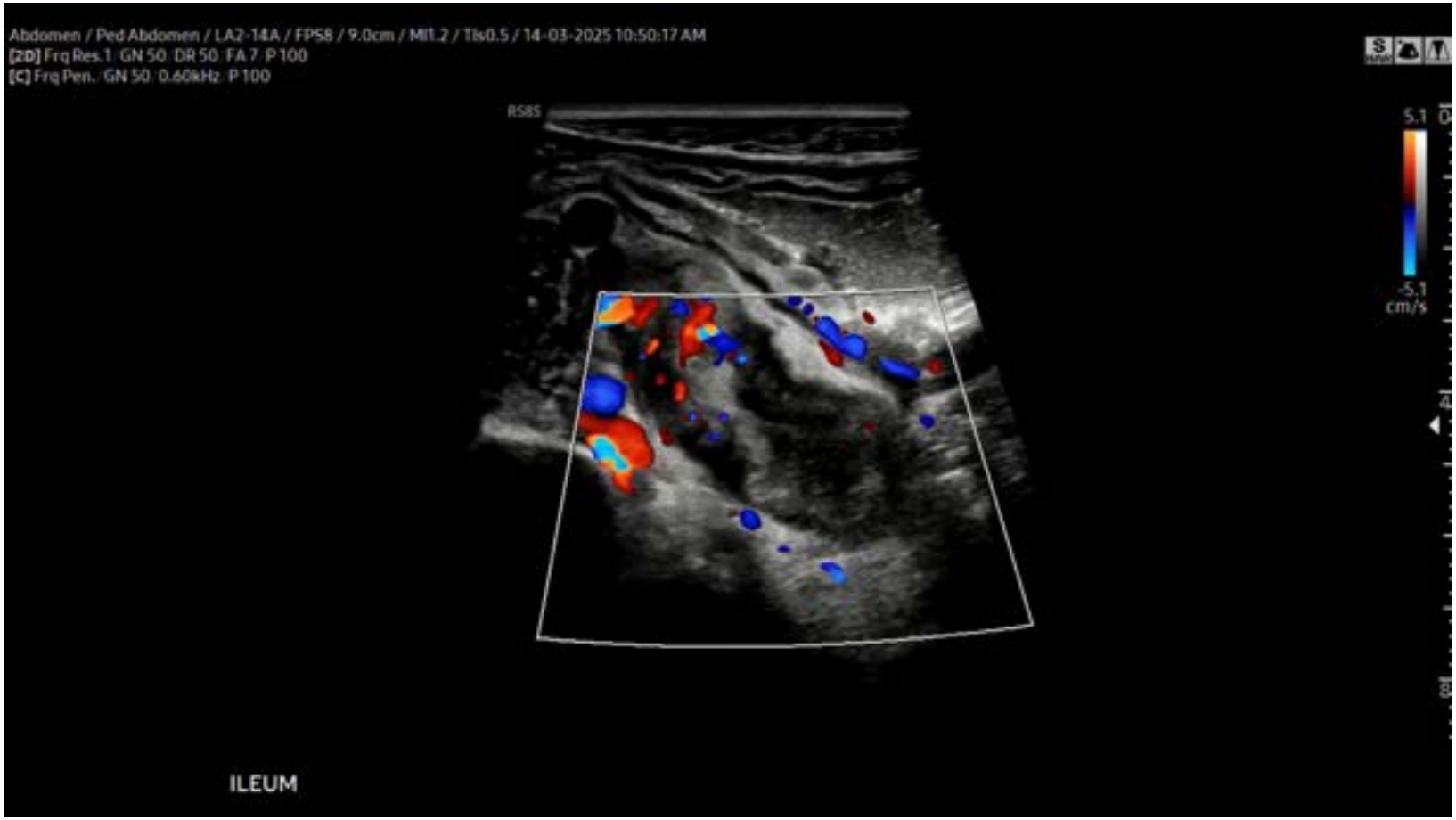
6 weesk doppler



BWT = 8mm

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IBUS – SAS score

Table 2. Core activity parameters, Delphi grading consensus

	Normal	Uncertain	Activity	
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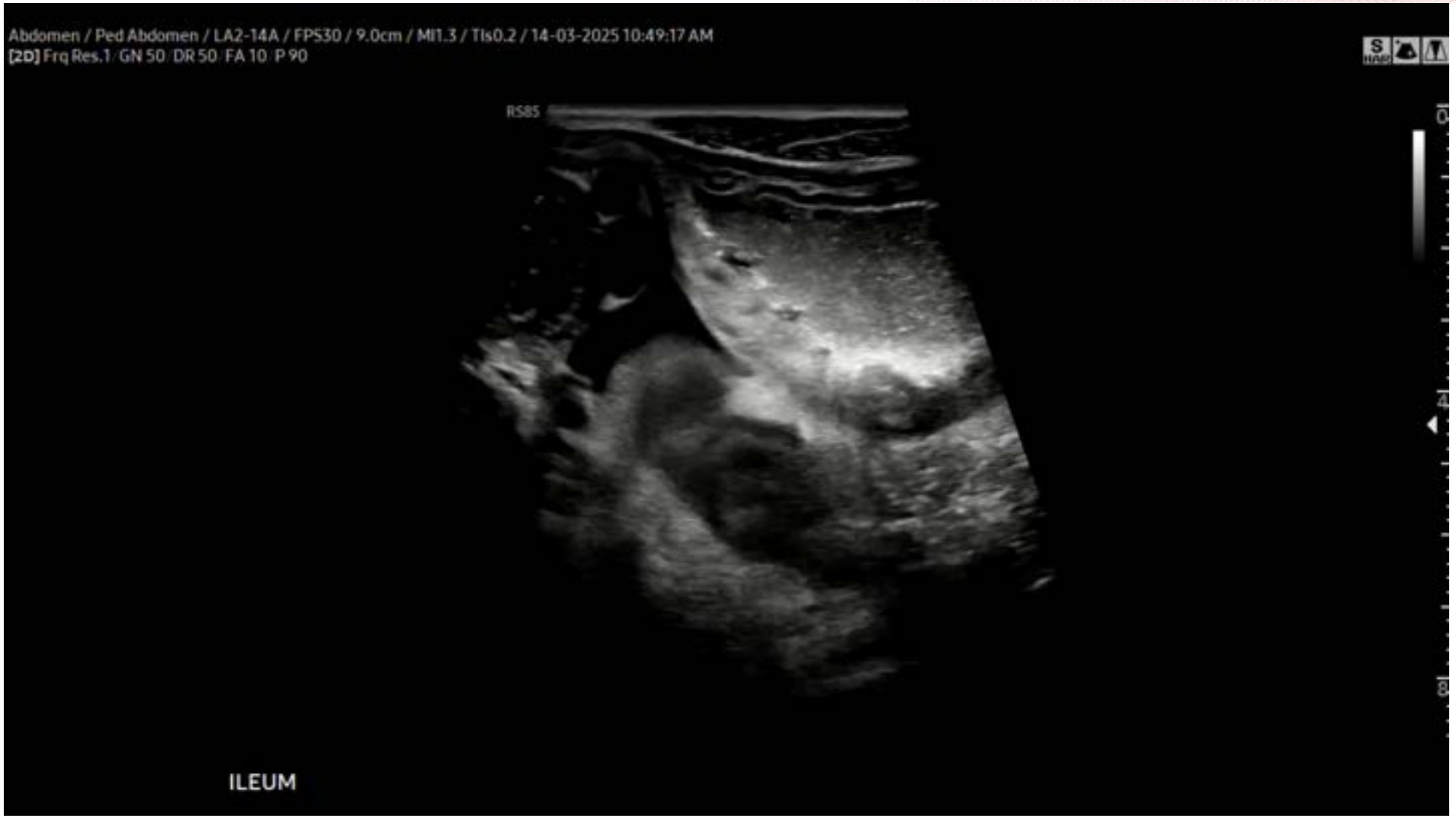
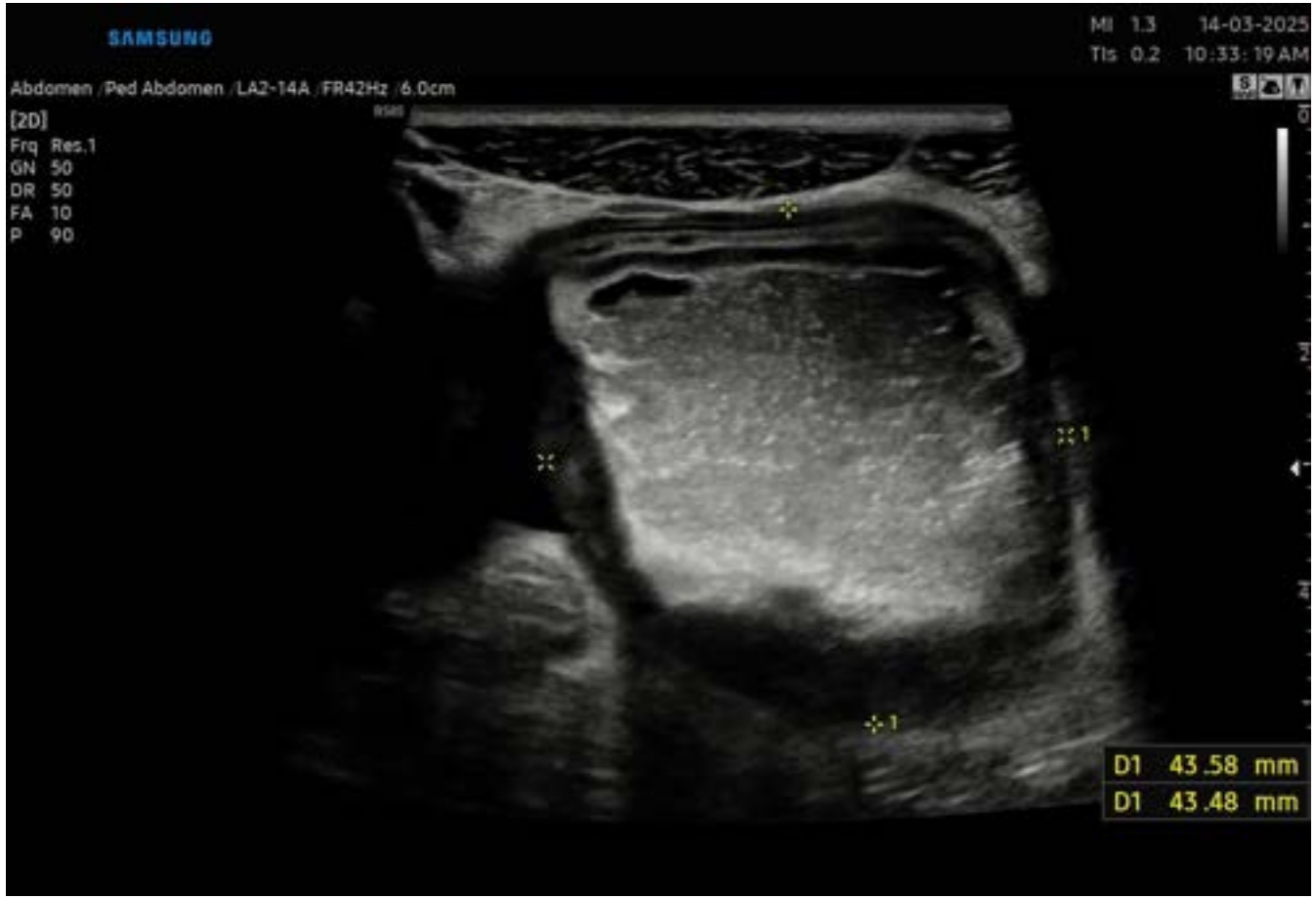
$$\text{IBUS} - \text{SAS}\ (0{-}100) = 4 \cdot 11 + 15 \cdot 2 + 7 \cdot 3 + 4 \cdot 3 = 107$$

$$\text{IBUS} - \text{SAS}\ (0{-}100) = 4 \cdot 8 + 15 \cdot 2 + 7 \cdot 3 + 4 \cdot 2 = 91$$


Abdomen / Ped Abdomen / LA2-14A / FPS30 / 9.0cm / MI1.3 / TIs0.2 / 14-03-2025 10:49:17 AM
[2D] Frq Res.1 GN 50 DR 50 FA 10 P 90
RS85
ILEUM


SAMSUNG
MI 1.3
TIs 0.2
14-03-2025
10:33:19 AM
Abdomen /Ped Abdomen /LA2-14A /FR42Hz /6.0cm
[2D]
Frq Res.1
GN 50
DR 50
FA 10
P 90
D1 43.58 mm
D1 43.48 mm

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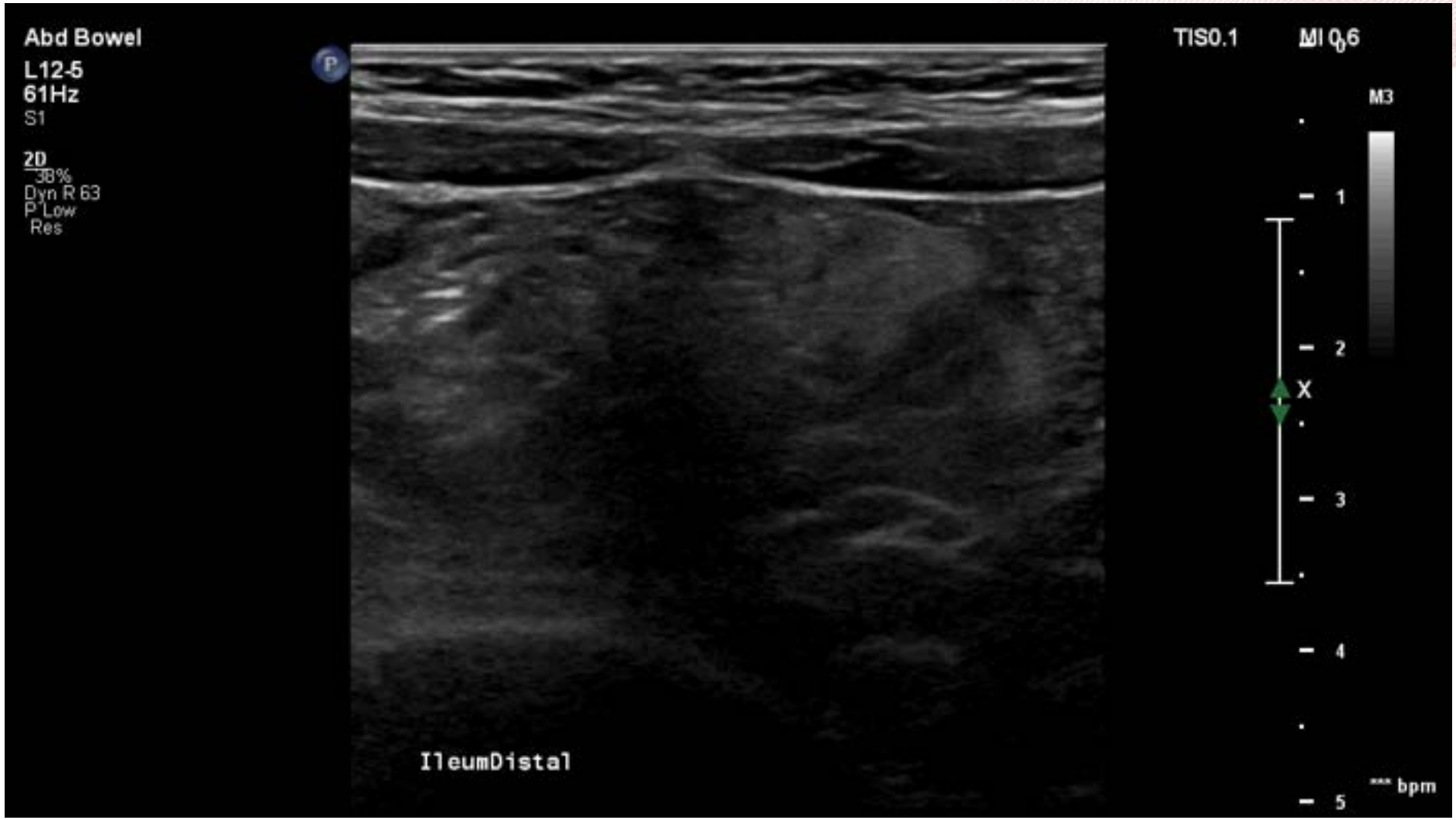
Case 2


Abd Bowel
L12-5
61Hz
S1
2D
38%
Dyn R 63
P Low
Res
TIS0.1
MI 0.6
M3
1
2
3
4
5
*** bpm
IleumDistal

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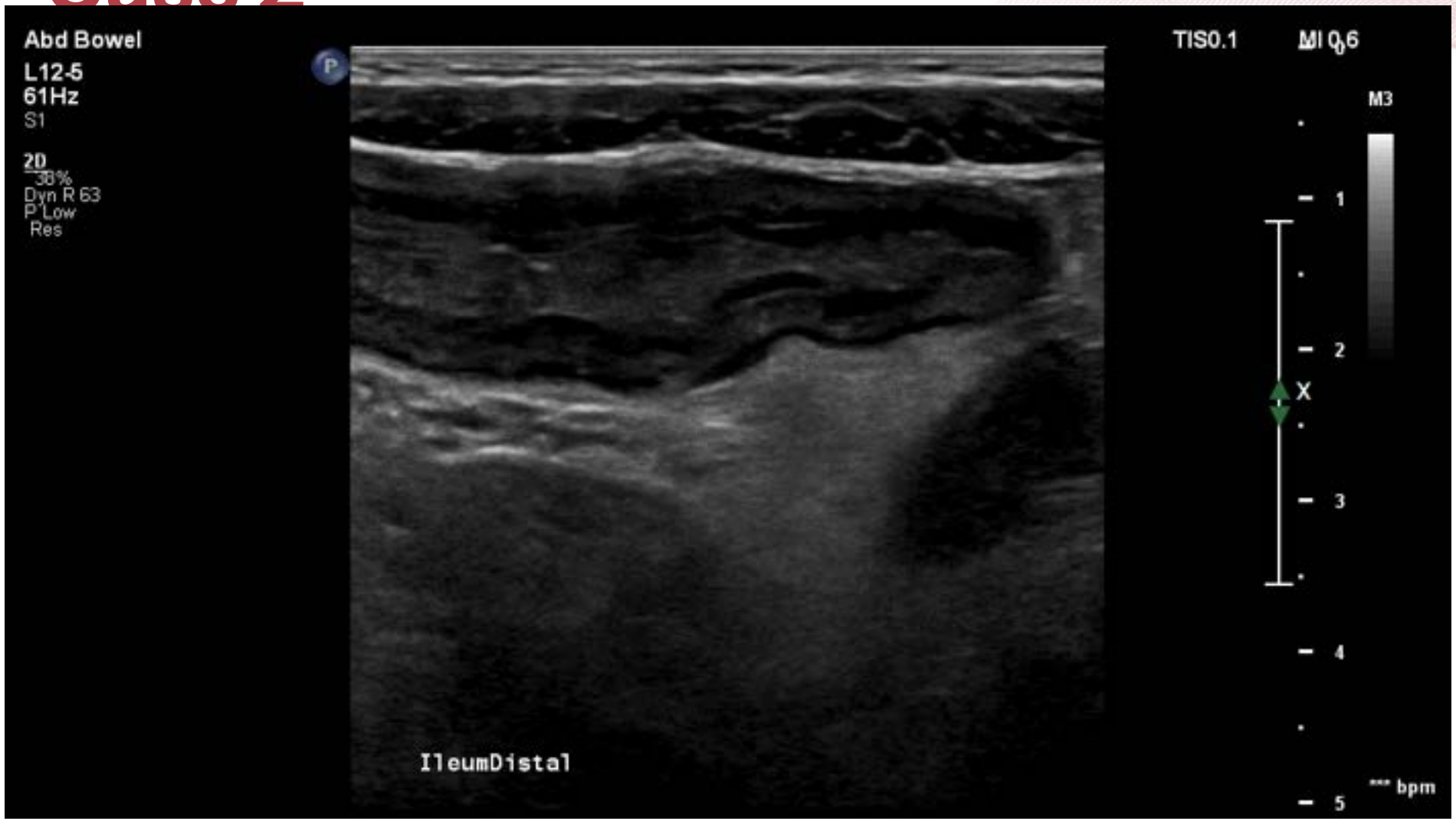
Case 2



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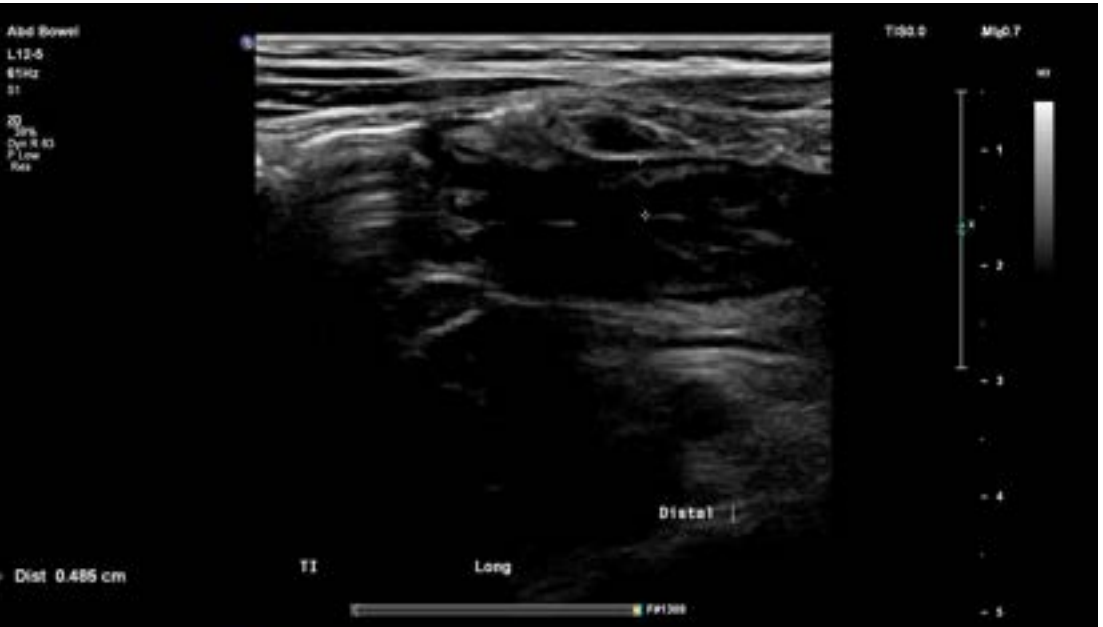

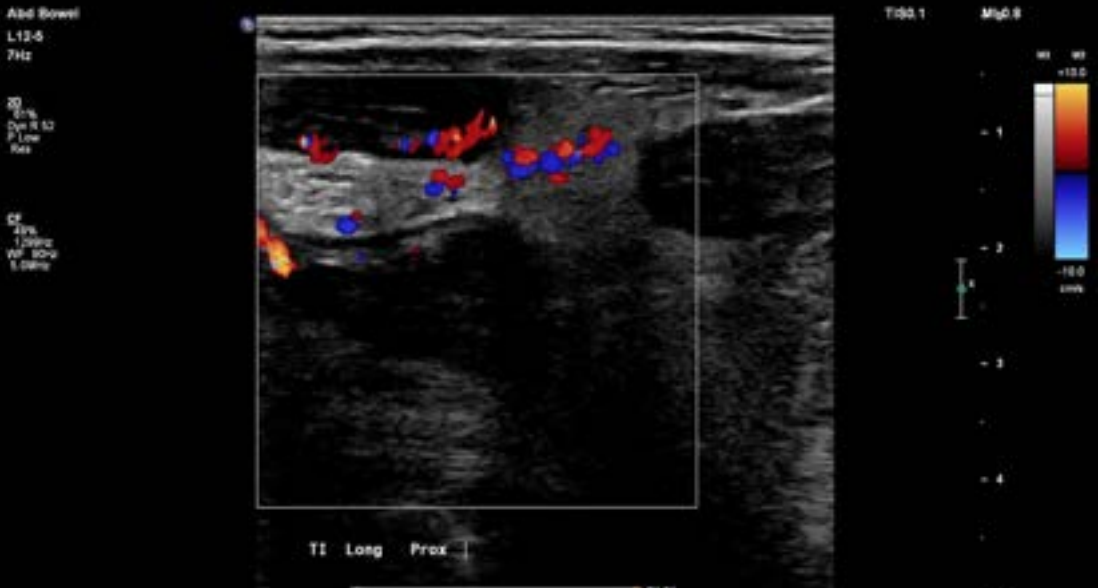

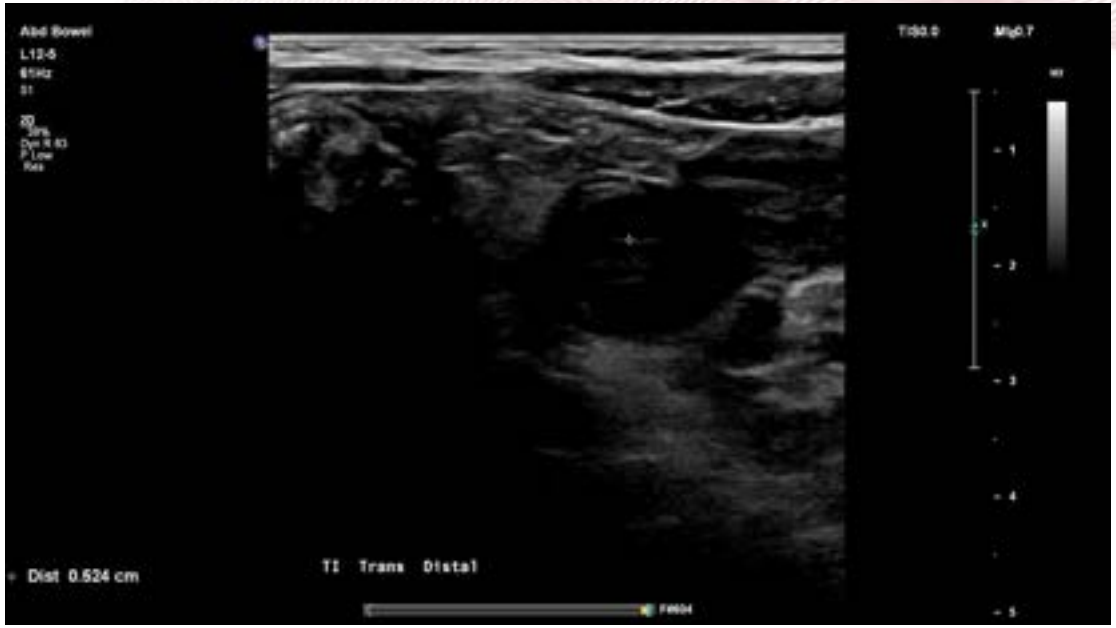

IBUS – SAS (0–100) = 4 · 5 (BWT) + 15 · 2(i-fat) + 7 ·3 (CDS) + 4 · 2(BWS) =79

Four months latter

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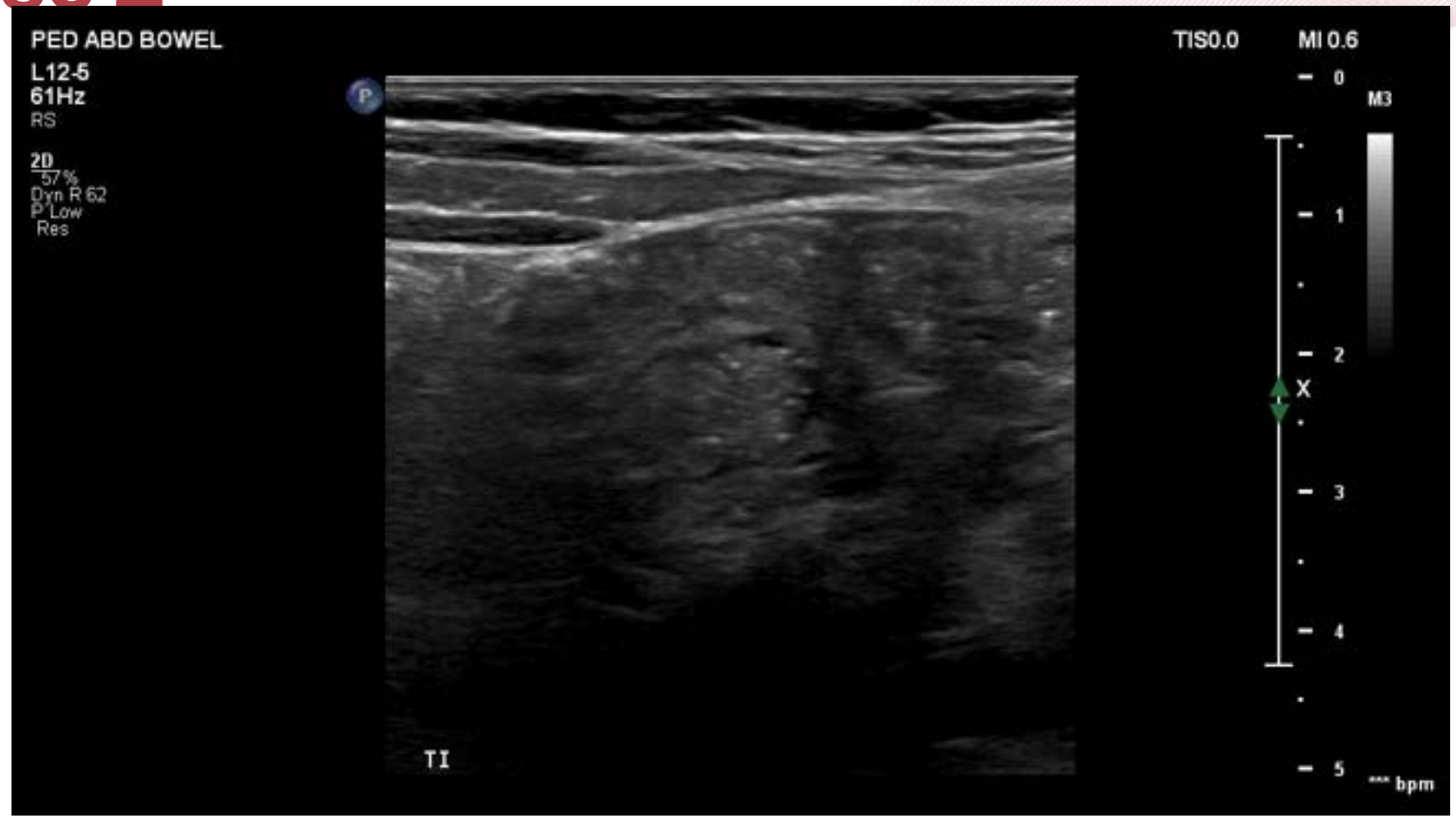
Case 2



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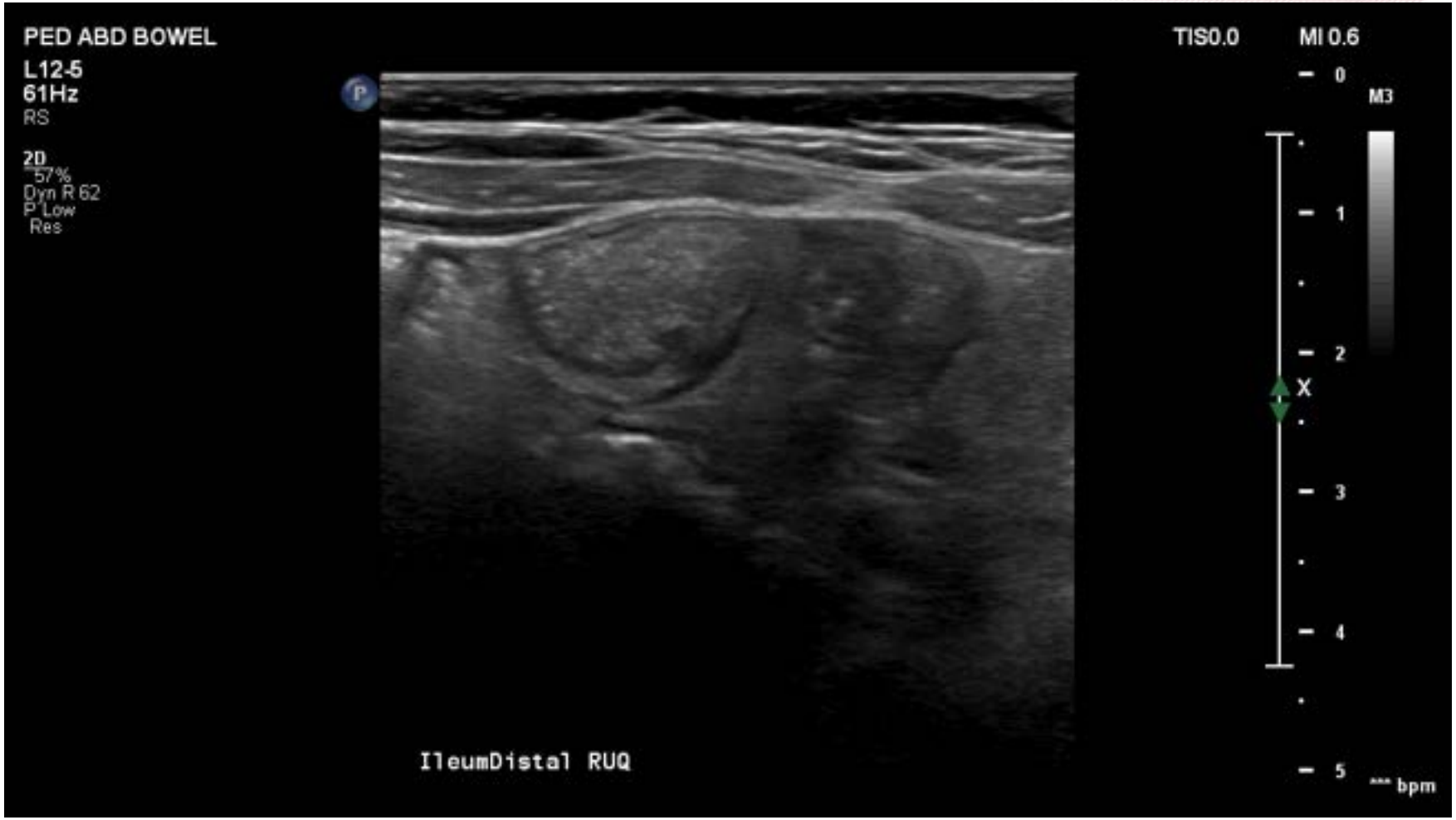
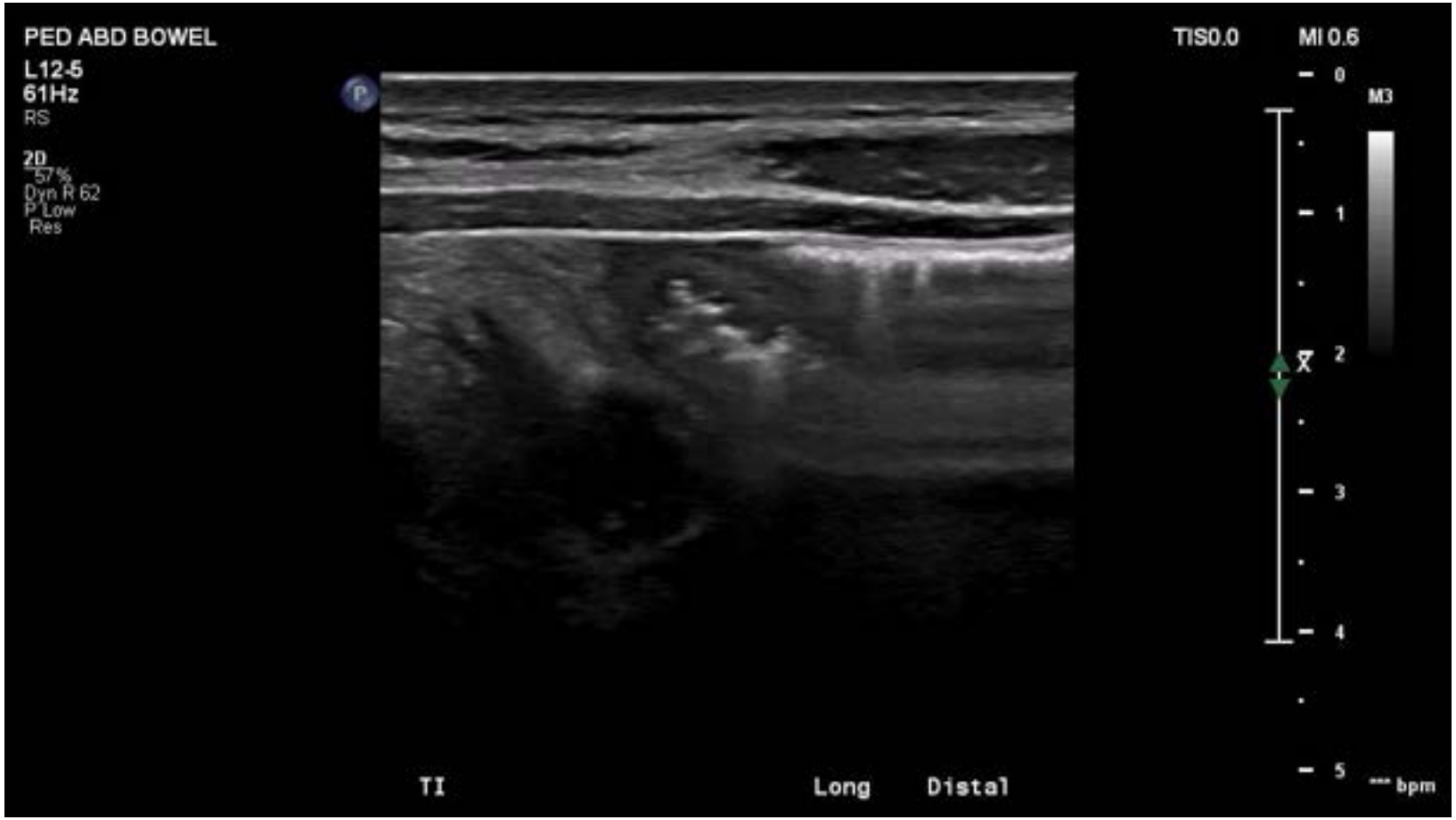
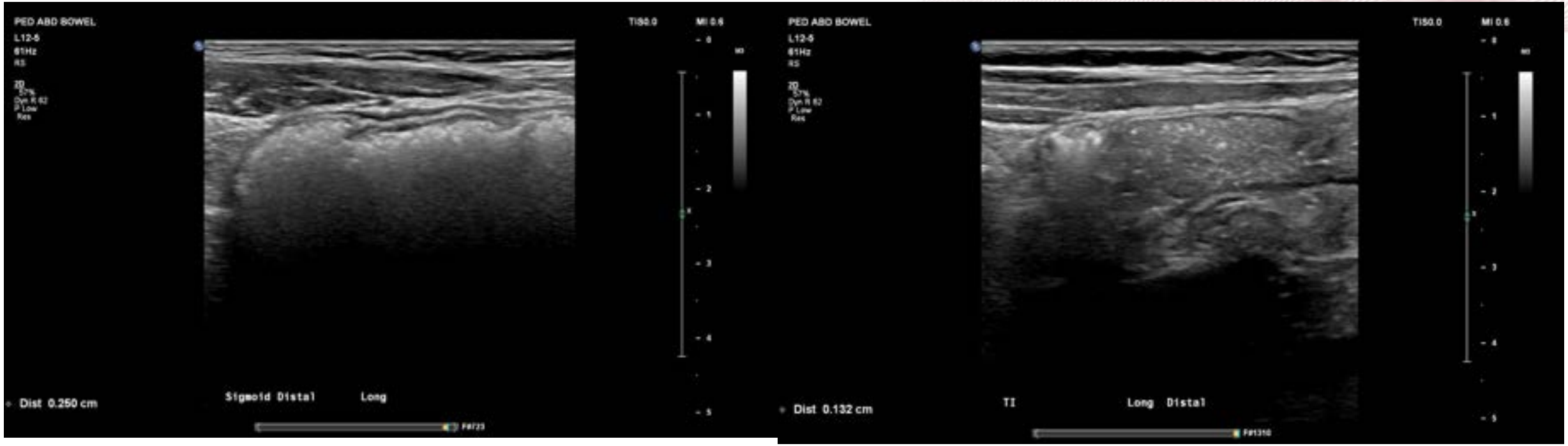
Case 2




PED ABD BOWEL
L12-5
61Hz
RS
2D
57%
Dyn R 62
P Low
Res
TIS0.0
MI 0.6
0
M3
1
2
3
4
5
bpm
TI
Long
Distal



IBUS – SAS (0–100) = 4 · 2 (BWT) + 15 · 0(i-fat) + 7 ·0 (CDS) + 4 · 0(BWS) =8

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BUSS – Bowel US score

- BUSS = 0.75 × BWT + 1.65 × CDS (0 absence and 1 presence)
- 225 pt single centre
- Sensitivity of 83% (95% confidence intervals [CI] 76 to 88) and specificity of 85% [73 to 93] for the assessment of disease activity when compared with the reference standard of the simple endoscopic score for CD [SES-CD].
- Subsequent publication – assessing for response
  - 48 patients with new therapy
  - Cut off of <3.52 for inactive disease Sensitivity of 90% and 74% specificity for identifying endoscopic remission
  - A drop of 1.2 from baseline to reassessment predicted endoscopic response Sensitivity of 74% and Specificity 83%

Allocca et al, Clin Gastroenterol Hepatol 2022
Allocca et al, Aliment Pharmacol Ther 2022

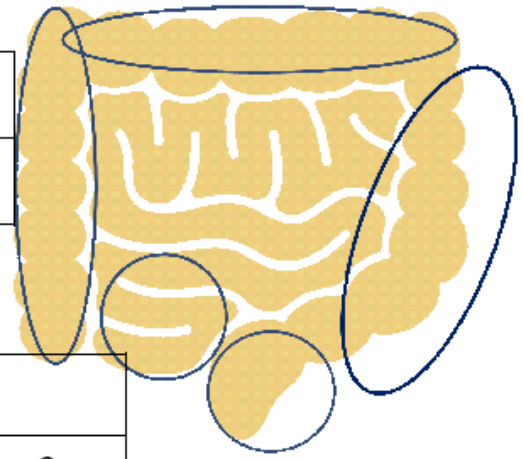
Simple Ultrasound Activity Score for Crohn's Disease (SUS-CD)

Developed in 40 adults with CD and validated in 124 patients using two variables

1) Bowel wall thickness (BWT)

Score:	0	1	2	3
BWT(mm)	<3.0	3-4.9	5-7.9	>8

- rectum 0 is < 4mm and no Doppler



2) Doppler

Score:	0	1	2
Doppler	No/single vessel	2- 5 vessels/cm2	>5 vessels/cm 2

Saevik et al. JCC May 2020

Table 5. Scoring sheet for the Simple Ultrasound Score for Crohn's Disease [SUS-CD].

Variable	Ileum	Right colon	Transverse colon	Left colon	Rectum	Total
Bowel wall thickness [0–3] Colour Doppler score [0–2]						
					Score	

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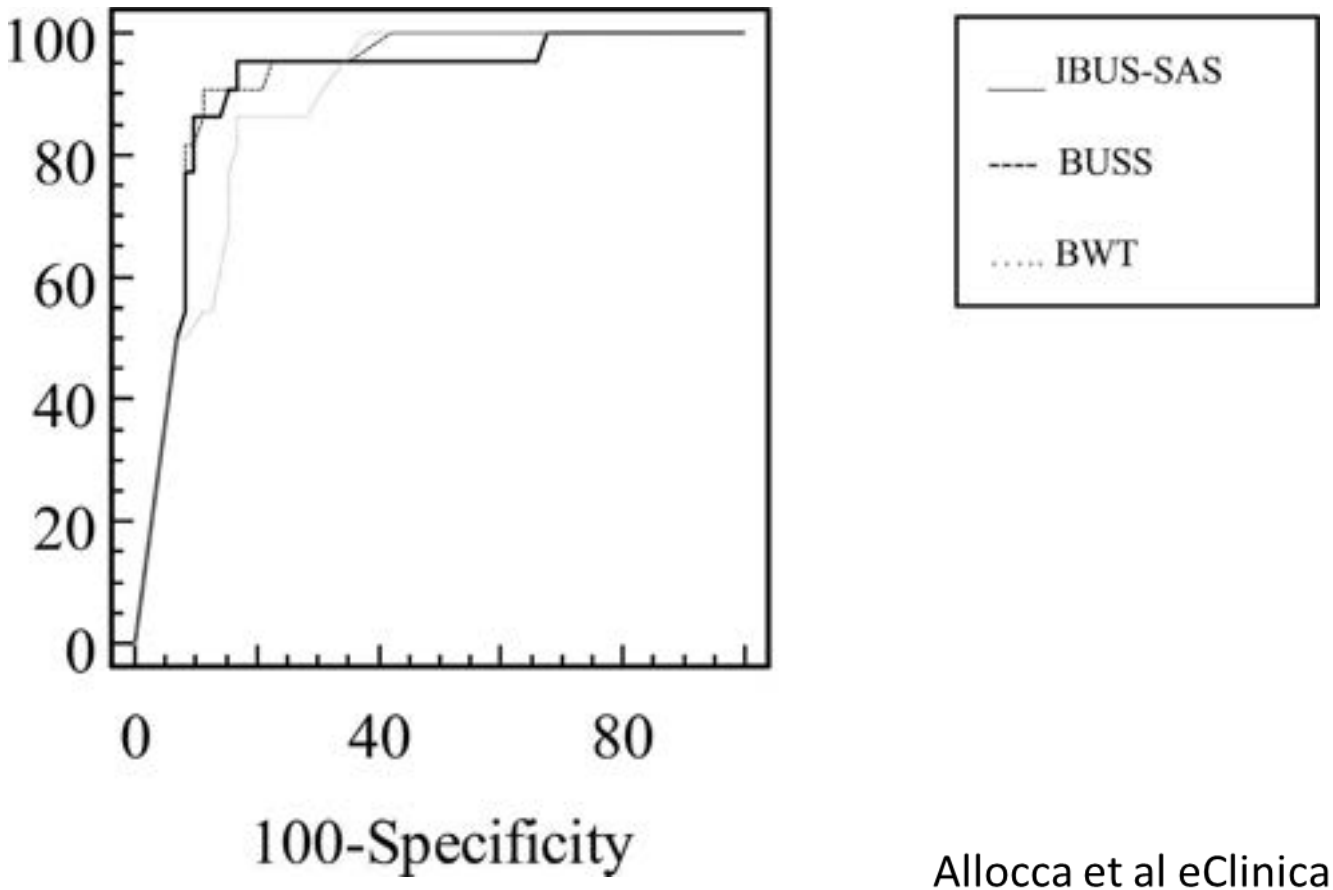
Validation for SUS-CD, BUSS and IBUS -SAS

- External validation of the IUS scores prospective cohort of 73 patients using an endoscopic reference standard.
- SUS-CD had a sensitivity of 93.3% and specificity of 71.4% for active CD,
- BUSS had sensitivity of 91.1% and and specificity of 82.1%. However, alternative cut-offs from the original descriptions were needed to achieve these performance characteristics.
- The IBUS-SAS had a sensitivity of 82.2% and specificity of 100% for detecting active CD and
  - statistically superior to the SUS-CD and the BUSS for identifying severe endoscopic CD.
  - A limitation of this validation study was that all IUS was performed by a solitary experienced practitioner at a single centre.

Dragoni *et al*. JCC 2023



Allocca et al eClinicalMedicine 2024

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Comparing IUS to MRE using SUS-CD and BUSS

- Multicentre prospective study with 19 IUS practitioners in UK
- Metric trial : 289 pts with MRE and IUS
  - compare to the sMAria
    - Sensitivity and specificity of both SUS-CD and Buss were similar 70s and 80s

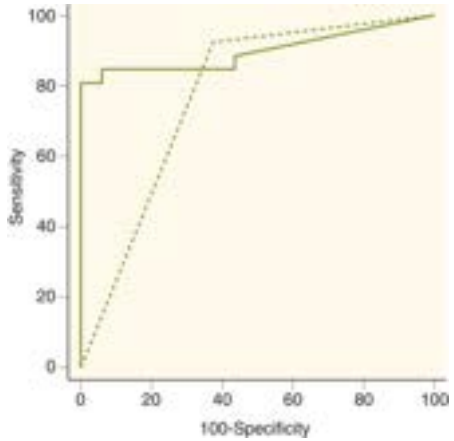
Kumar et al, Eur Radiol 2024

Disease activity score for UC – MUC (Milan UC) score

- MUC = 1.4 × CWT (mm) +2.0 × CWF(0 absence or 1 presence)

Diagnostic accuracy of Milan Ultrasound Criteria (MUC) in derivation and validation study

		MUC in derivation study			MUC in validation study		
	Cut-off	ROC	Sens	Spec	ROC	Sens	Spec
Active disease (Mayo endoscopic sub-score >2)	>6.2	0.891	0.71	1.00	0.902	0.85	0.94



Allocca et al UEG journal 2021

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MUC score and Outcome

- 98 patient with UC
- Colonoscopy and bowel US at baseline
- In Cox regression analysis, a negative disease course was predicted by
- MUC > 6.2 at baseline (HR: 3.87, 95% CI: 2.25–6.64, $p < 0.001$; Table 2 **).**
- Twenty-one (48%) patients with MUC ≤ 6.2 at baseline and 49 (91%) with MUC > 6.2 at baseline had a negative disease course over the follow-up period (log-rank test, $p < 0.001$)

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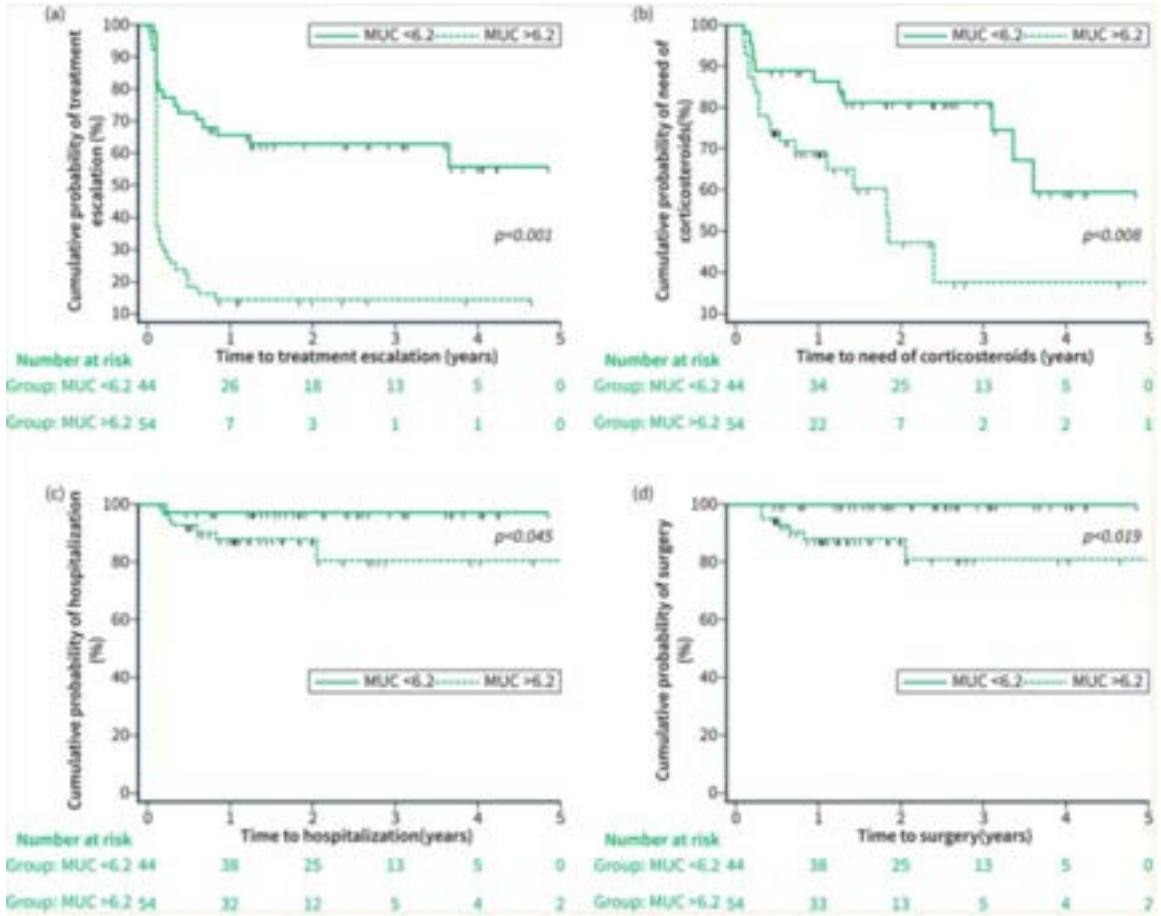
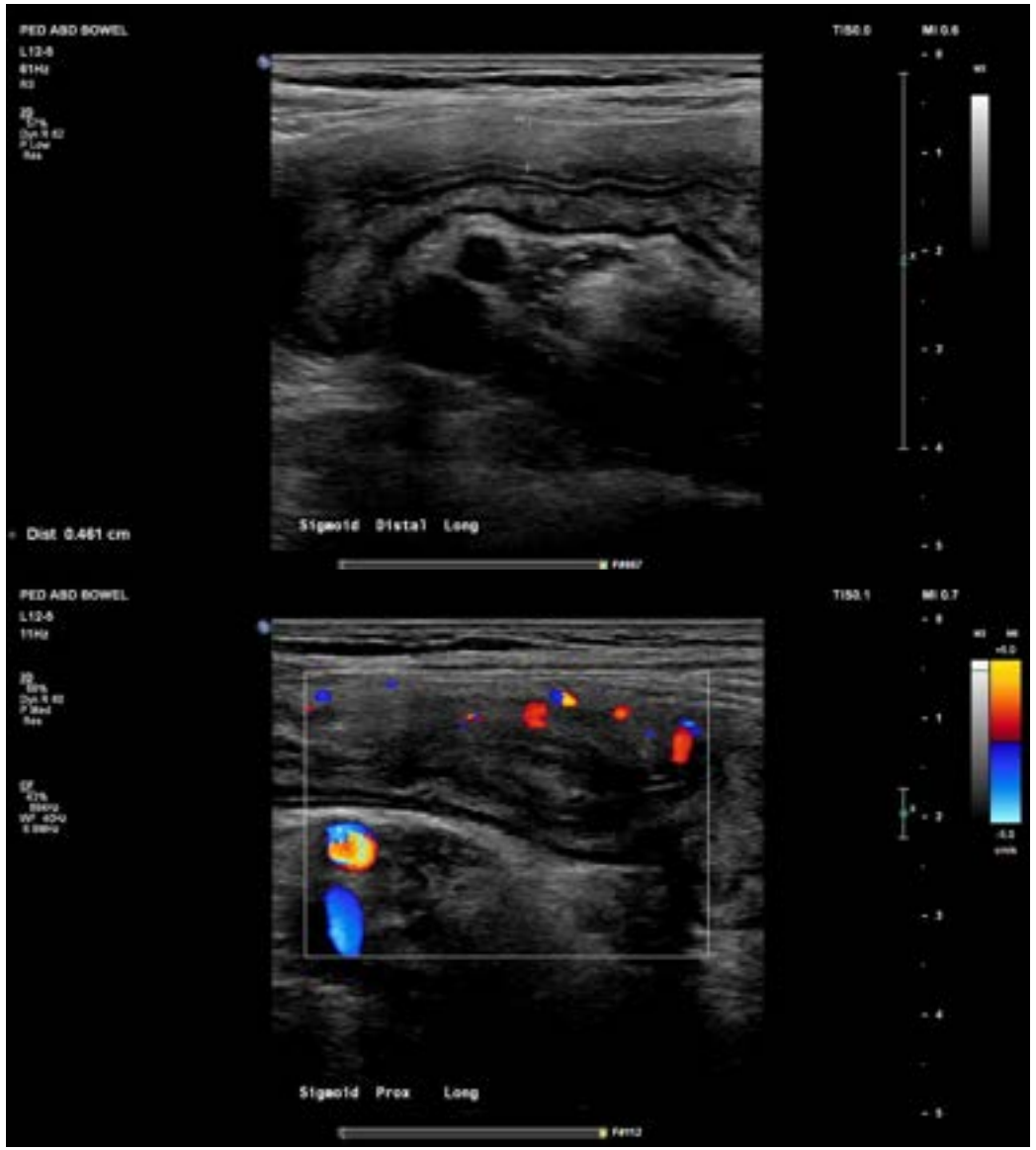
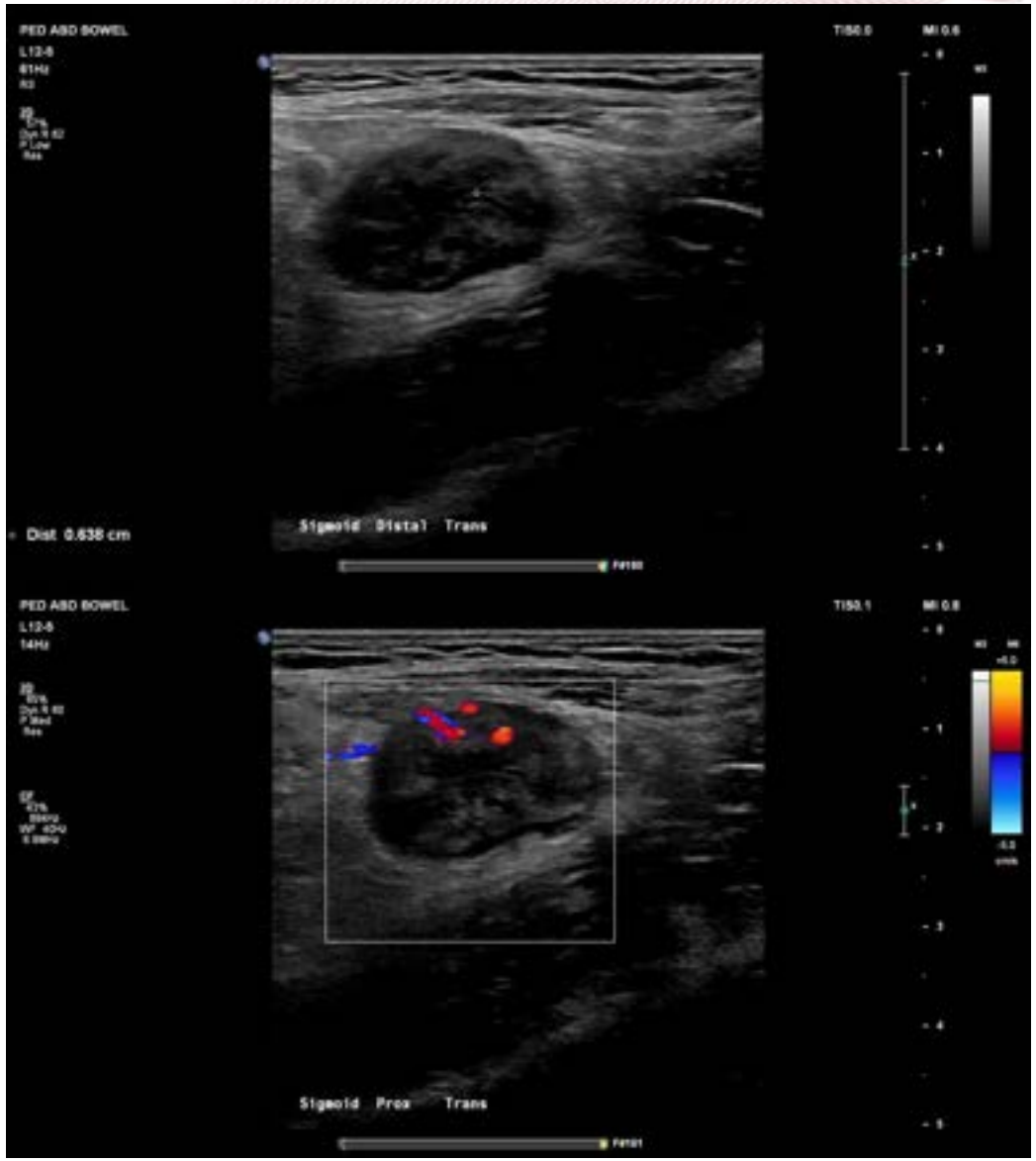
MUC Score and outcome



Allocca et al UEG J 2022

MUC = 1.4 × CWT (mm) +2.0 × CWF(0 absence or 1 presence)=9





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UC-IUS index

- UC-IUS index (0-7 points): Bowel wall thickness - >2mm = 1 , 3mm = 2, >4mm = 3. Doppler signal – Spots =1, Stretches =2. Abnormal haustrations = 1. Fat wrapping=1

The score was calculated and compared per colon segment, excluding the rectum.

Final scores's correlation with the UCEIS and endoscopic Mayo score. Mayo score [$\rho = 0.830$; $p < 0.001$]. UCEIS index [$\rho = 0.759$; $p < 0.001$].

Bots et al JCC 2021

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Summary

- These disease scores are reasonable at detecting disease activity especially moderate to severe and remain a remain a research tool
- They still require prospective validation to show responsiveness
- It remains to be determined what are the target scores for treatment response and in what context
- Clinical practice requires us to interpret IUS findings in the complete context of patients and other clinical findings