

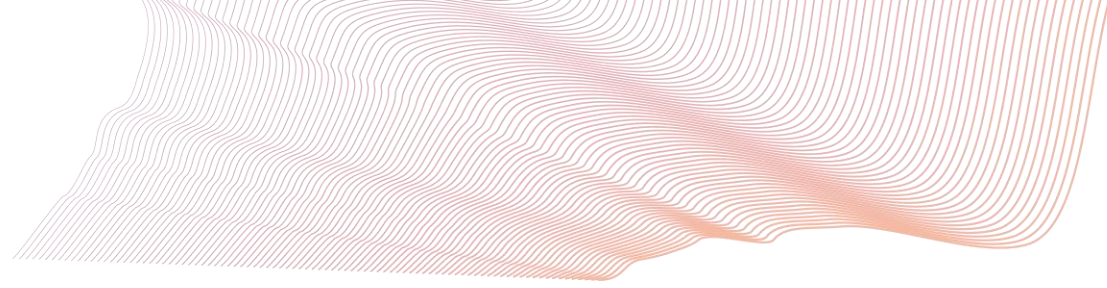


international bowel
ULTRASOUND GROUP



Intestinal Ultrasound in CD

Kenneth Ernest-Suárez
Inflammatory Bowel Disease Unit,
Zeidler Ledcor Centre
University of Alberta
Edmonton, Canada



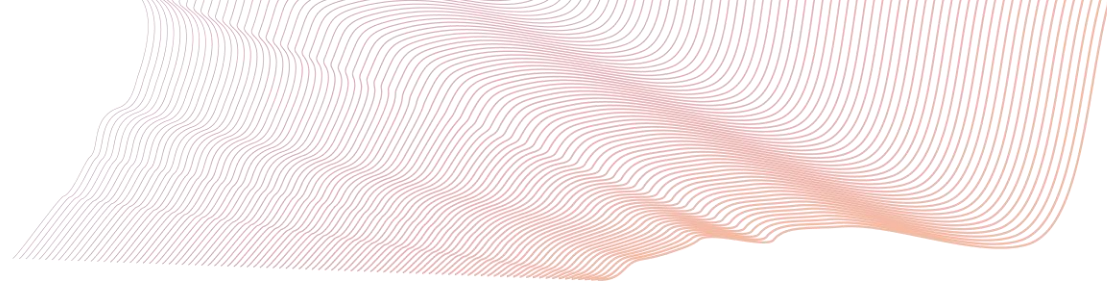
Speaker guidelines

This standard presentation has been prepared by the IBUS Educational Committee to provide baseline content and guidance for speakers on this topic. Speakers are encouraged to adapt the presentation by adding or removing material as appropriate, while keeping the core structure and key messages aligned with the standardized content. All adaptations should ensure that the **Intended Learning Outcomes (ILOs, on slide 4)** are fully met.

If any content from this presentation is used, please **retain slide 3** to acknowledge the contributors.

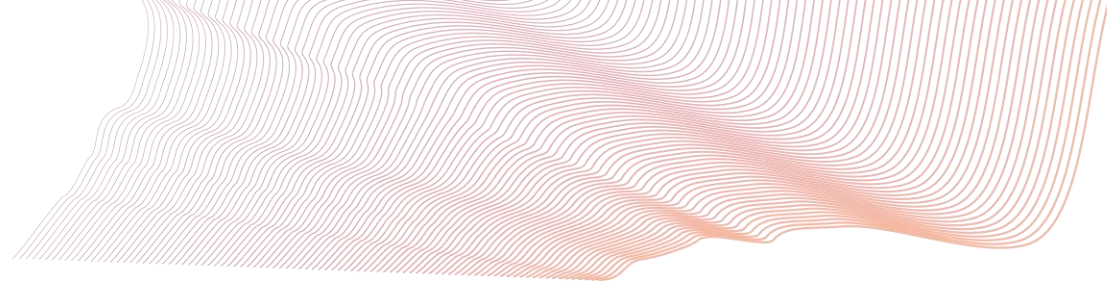
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Thank you to all contributors who helped create this presentation:

Dr. Torsten Kucharzik
Dr. Frauke Petersen
Dr. Kayal Vizhi
Dr. Federica Furfaro



Intended Learning Outcomes (ILOs):

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

1. Apply bowel wall thickness (BWT) measurements according to standard and research criteria.
2. Identify and describe mural and extramural IUS signs suggestive of inflammation in Crohn's disease.
3. Integrate and weigh the importance of multiple individual IUS signs to form a comprehensive assessment of Crohn's disease activity and potential complications.
4. Evaluate the overall diagnostic and monitoring performance of IUS for Crohn's disease assessment against established reference standards (e.g., endoscopy, cross-sectional imaging, histology).
5. Understand the relative time course over which different IUS parameters typically respond to effective treatment in Crohn's disease.
6. Define different IUS response and remission definitions used in Crohn's disease assessment and explain how they can be used to predict and monitor disease activity over time.

IUS parameters and modalities to determine disease activity and severity in CD

Conventional IUS (B-Mode)

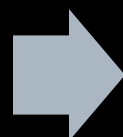
- Bowel wall thickness (pathological: > 3 mm, ileum, colon)
- Bowel wall stratification
- Vasularisation
- Surrounding structures
 - Mesenteric fat
 - Fistula
 - Abscess
 - Interenteric fluid
 - Lymph nodes
- Motility
- Stiffness

Advanced modalities

- Oral contrast IUS (SICUS)
- Intravenous contrast enhanced IUS (CEUS)
- Elastography

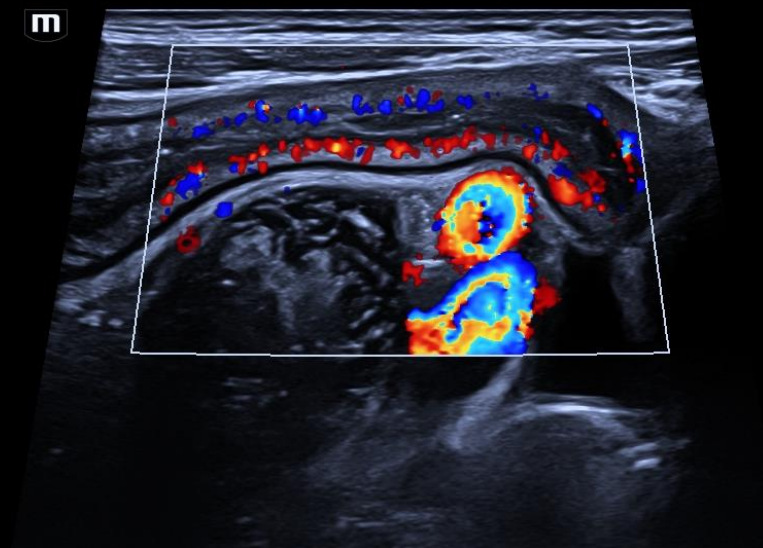
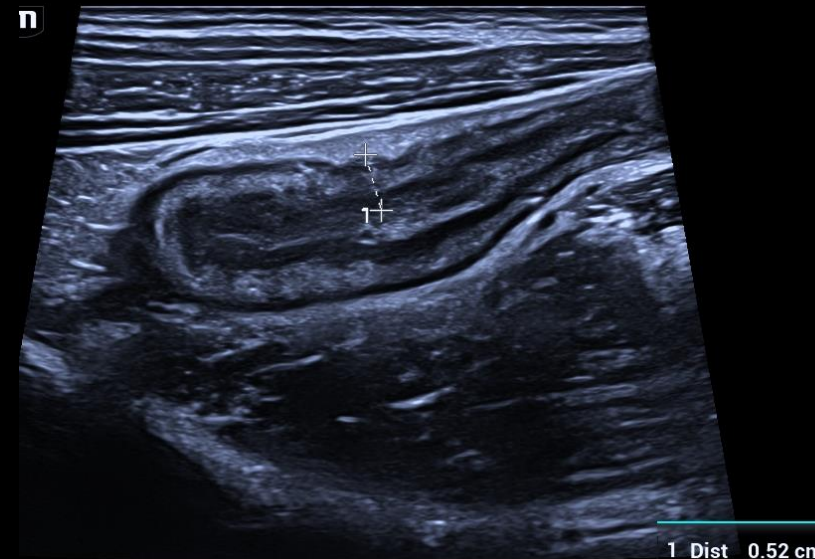


Bowel
Wall
Thickness



Increased
doppler
activity

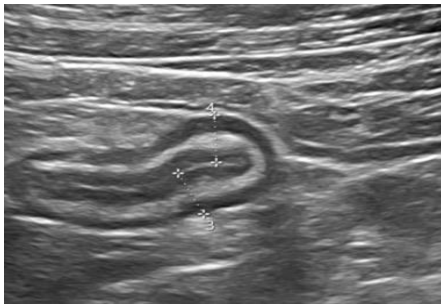
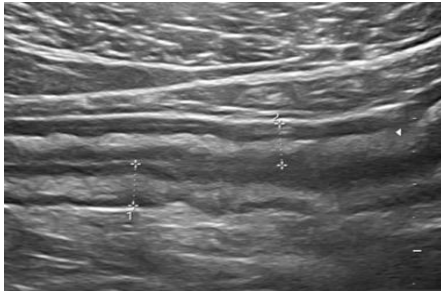
Salient
features of
Inflammation



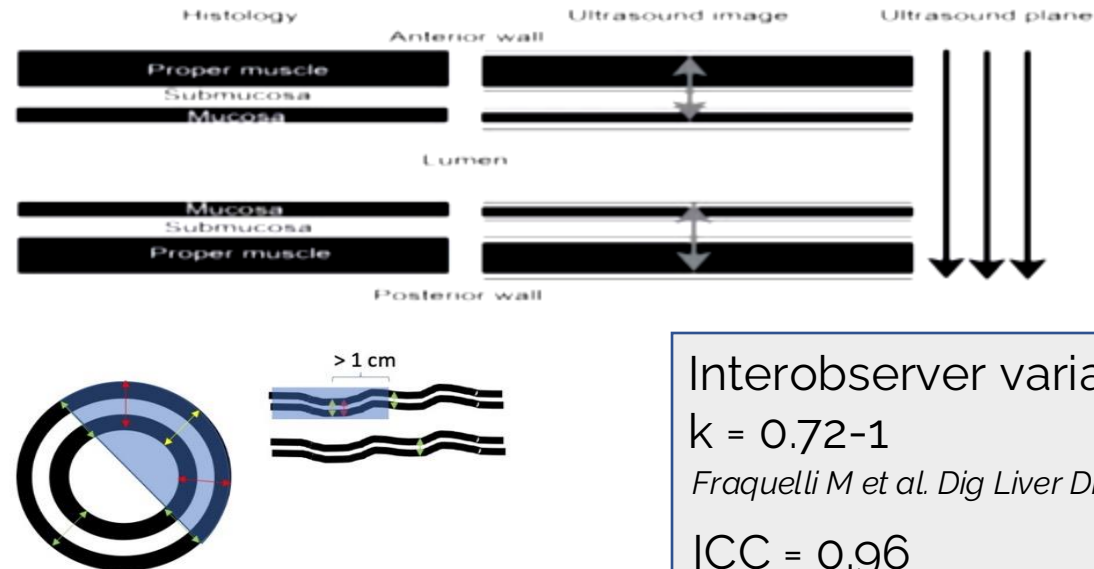
IUS Phenotyping of IBD Patients

Simple parameters - Standardization of measurement

Bowel wall thickness



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



Interobserver variability

$k = 0.72-1$

Fraquelli M et al. Dig Liver Dis 2008

$ICC = 0.96$

Novak K et al. JCC 2021



Standardized measurement of IUS parameters

Vascularization - Doppler signal

IBUS CDS score

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

set velocity range: 5-7 cm/s

ICC = 0.62

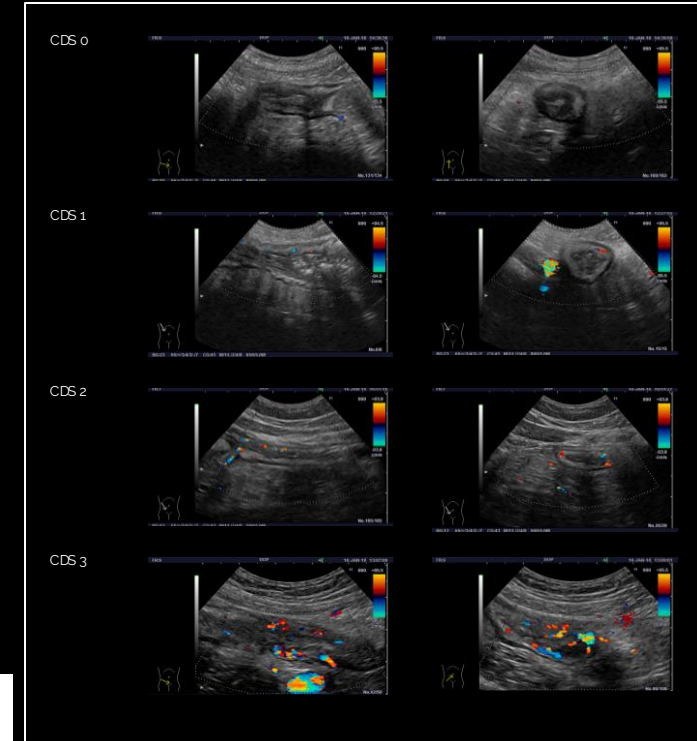


Table 2. Core activity parameters, Delphi grading consensus

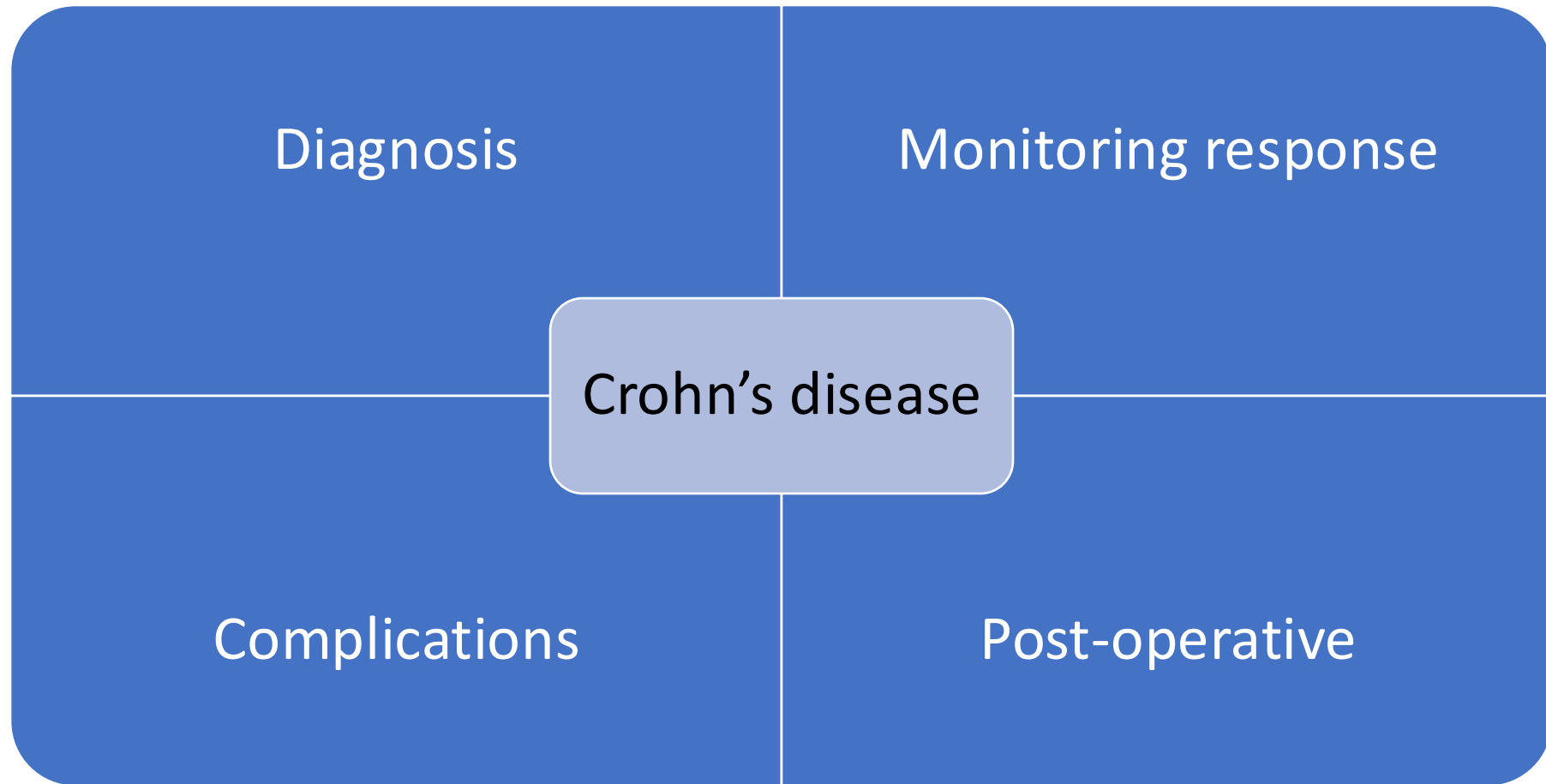
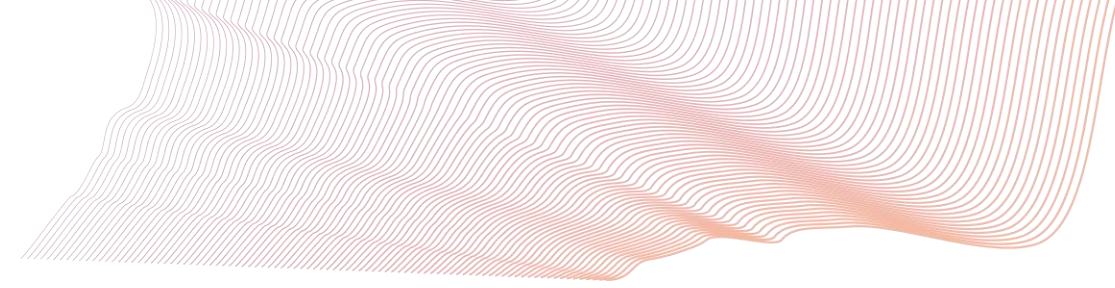
	Normal	Uncertain	Activity	
BWT	≤3 mm	NA	>3 mm	
i-fat	0 = Absent	1 = Uncertain	2 = Present	
CDS	0 = Absent [none]	1 = Short signals	2 = Long signals inside bowel	3 = Long signals inside & outside bowel
BWS	0 = Normal	1 = Uncertain	2 = Focal [≤ 3 cm]	3 = Extensive [>3 cm]

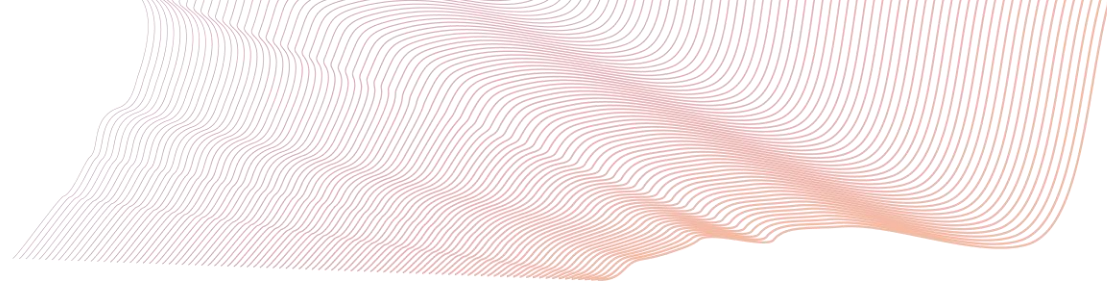
BWT, bowel wall thickness; i-fat, inflammatory fat; CDS, colour Doppler signal; BWS, bowel wall stratification; NA, not applicable.



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Role of IUS in Crohns disease





Case Capsule

- 14 year old girl
- Pain abdomen ~18 months
- Hb: 11gm%. CRP: 3mg/dl. Fecal calprotectin: 180
- Upper and lower GI endoscopy: Normal
- Multiple USG abdomen: Normal
- Weight loss 2-3kg. No gain in height last 2 years
- Recurrent abdominal pain of childhood



Colour doppler
signal: Grade 2



5.2 mm

BG:7

DR:65
HdTHI-P



3.7 mm

BG:7

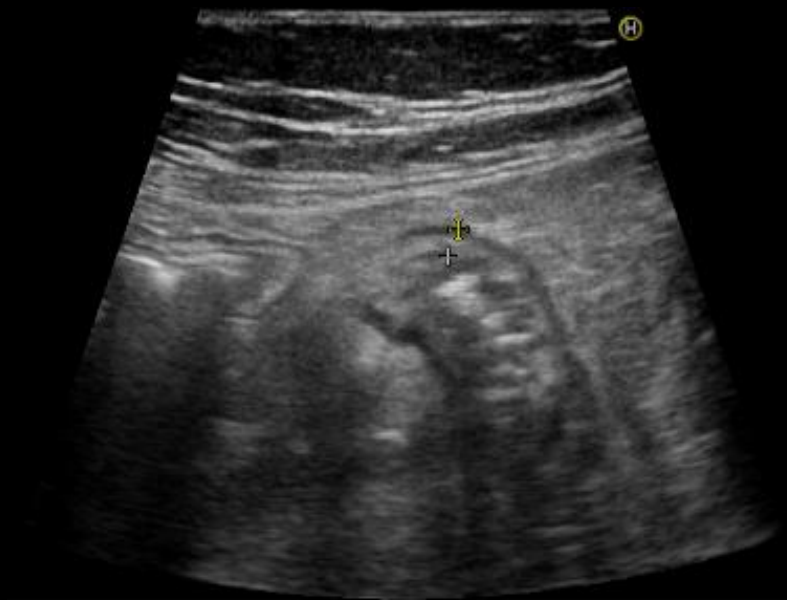
DR:65
HdTHI-P



4.0 mm

BG:7

DR:65



2.8 mm

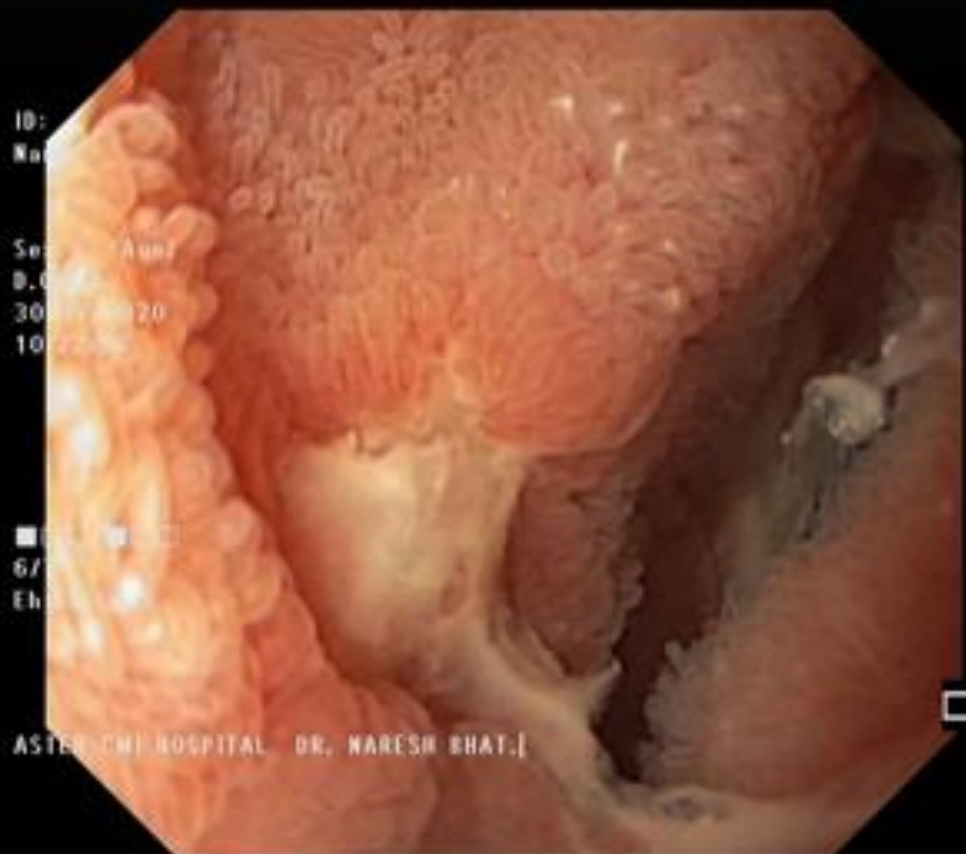
BG:7

DR:65
HdTHI-P





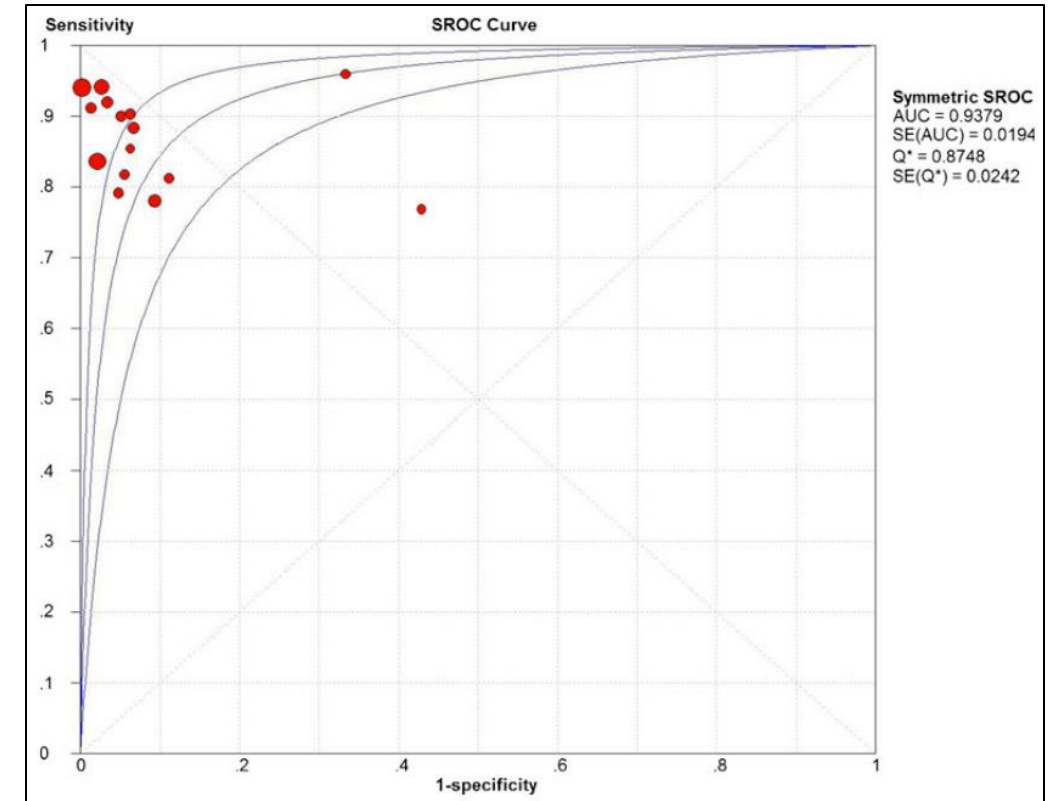
Antegrade enteroscopy



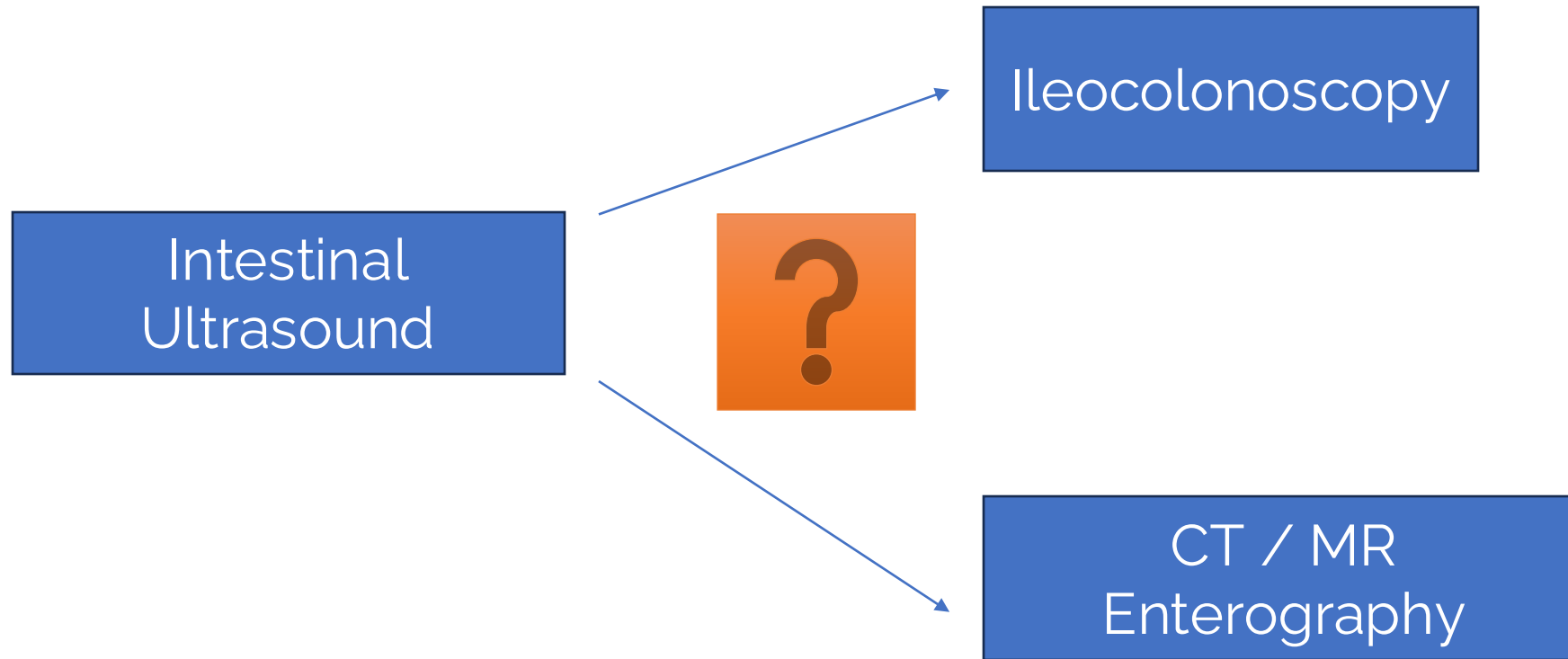
IUS is a sensitive initial screening tool

- Meta-analysis of 15 prospective studies
 - N=1558 patients
 - Pooled sensitivity = 88%
 - Pooled specificity = 73%
 - AUC = 0.94

Picks up inflamed bowel



Correlation?





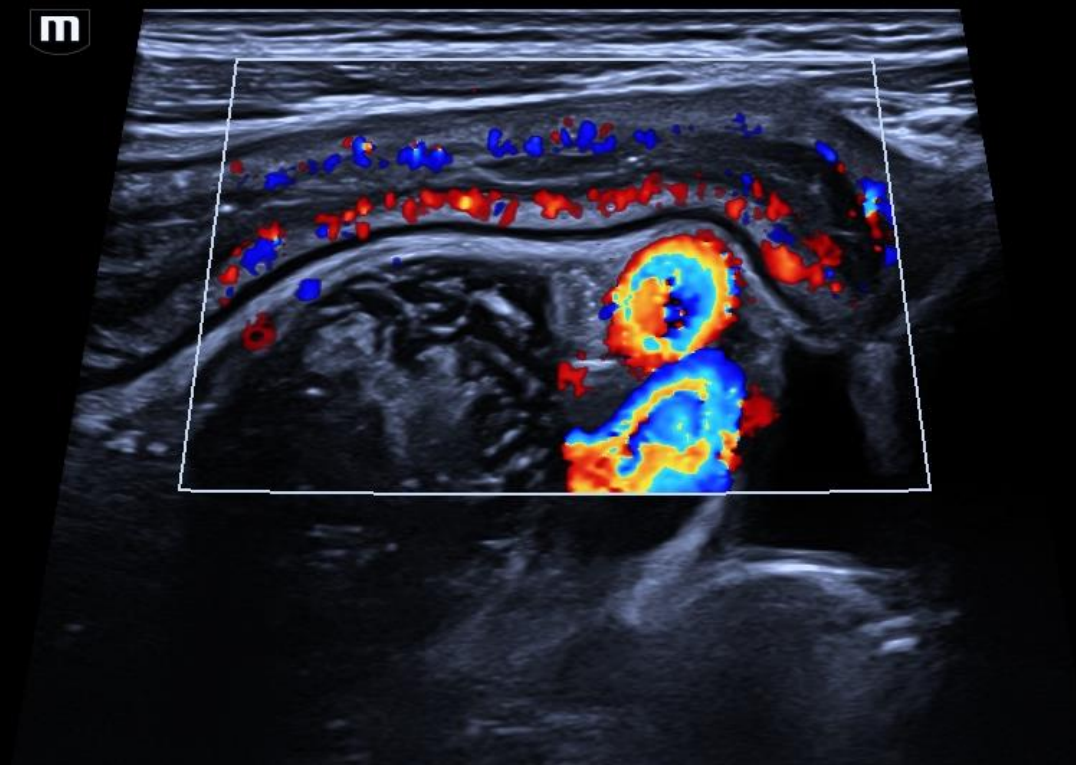
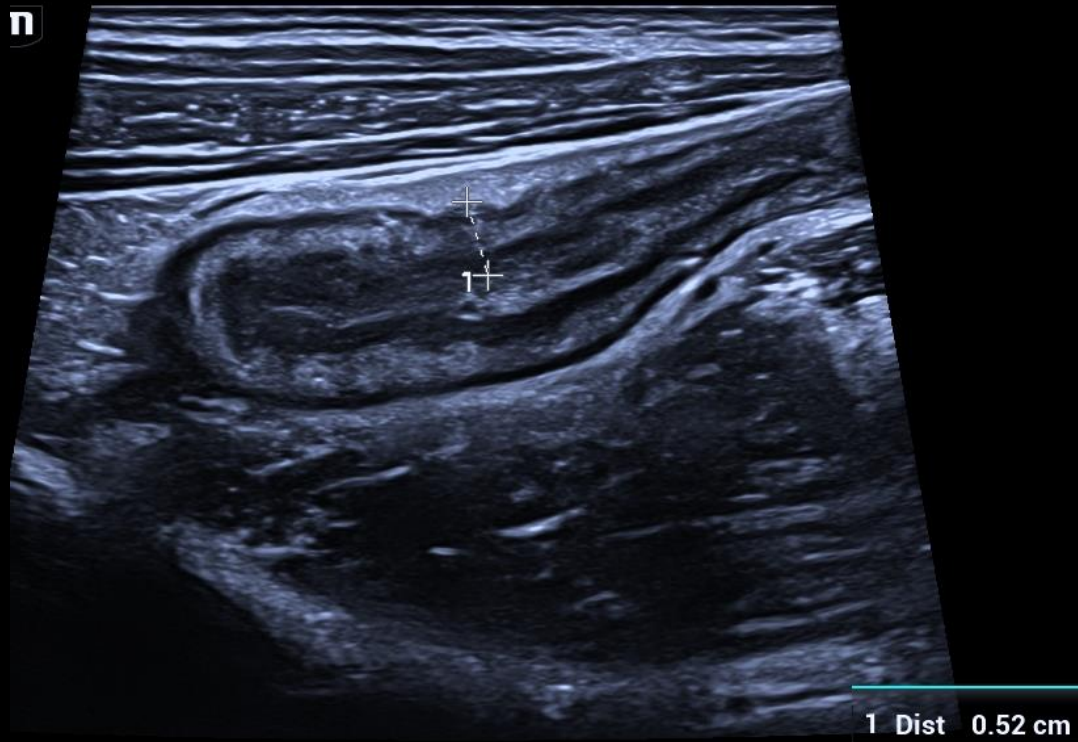
Dec 2024

24-year-old gentleman,

Intermittent pain abdomen with altered bowels ~ 6 months

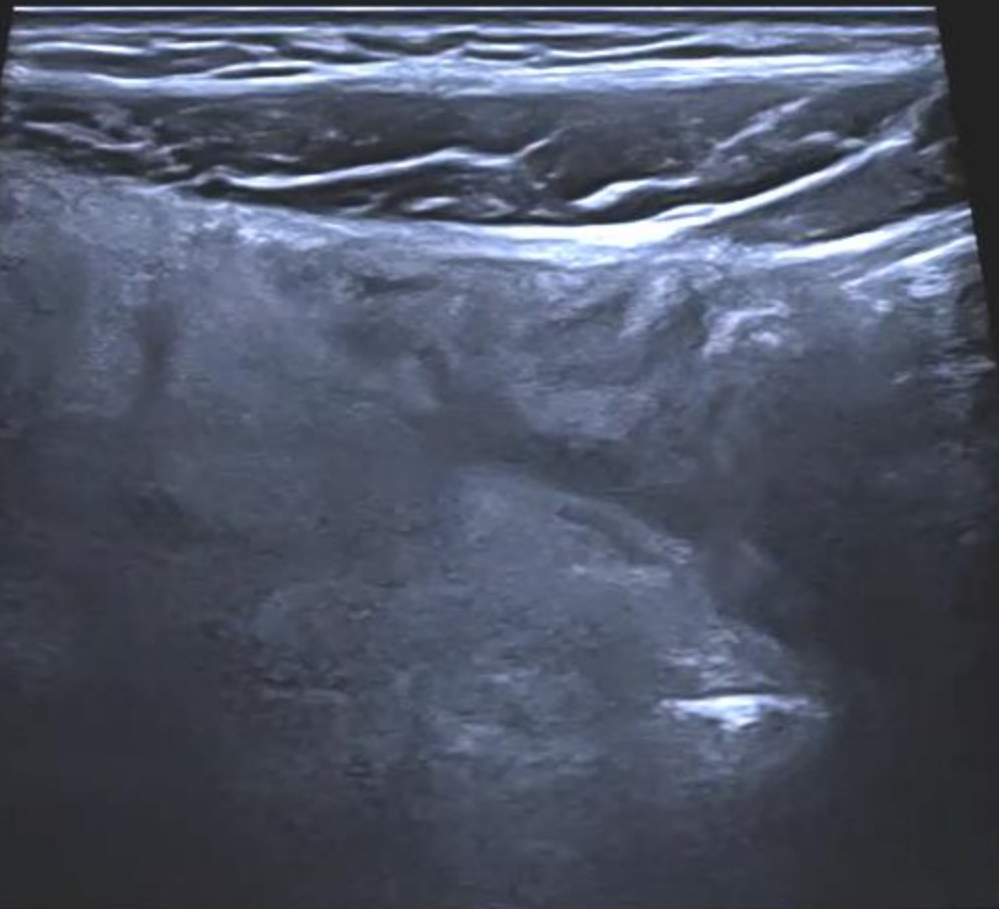
Weight loss 6kg

Hb: 10gm%; CRP: 32mg/dl





m



1/12/2024

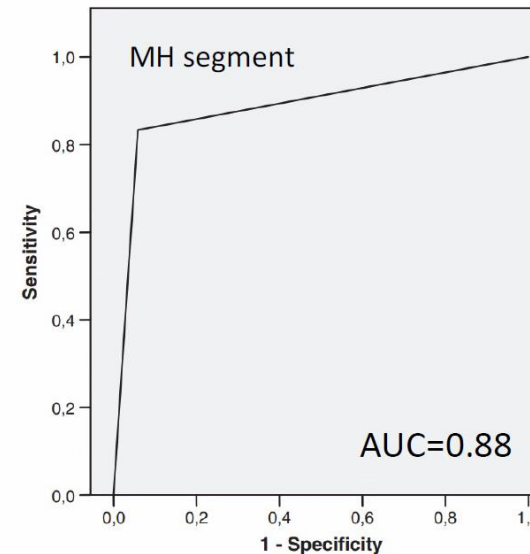
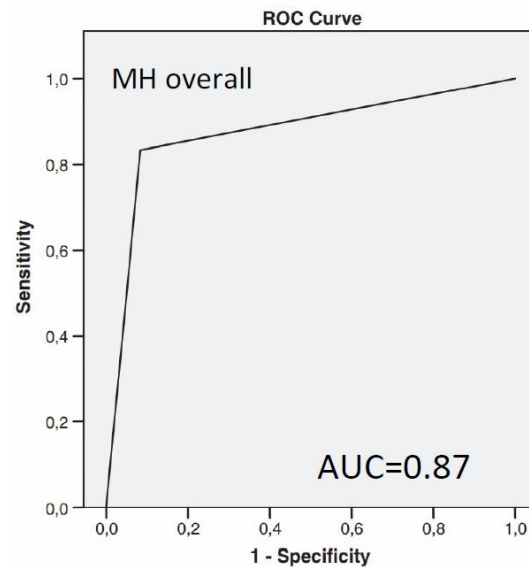
1

using temporary patient ID

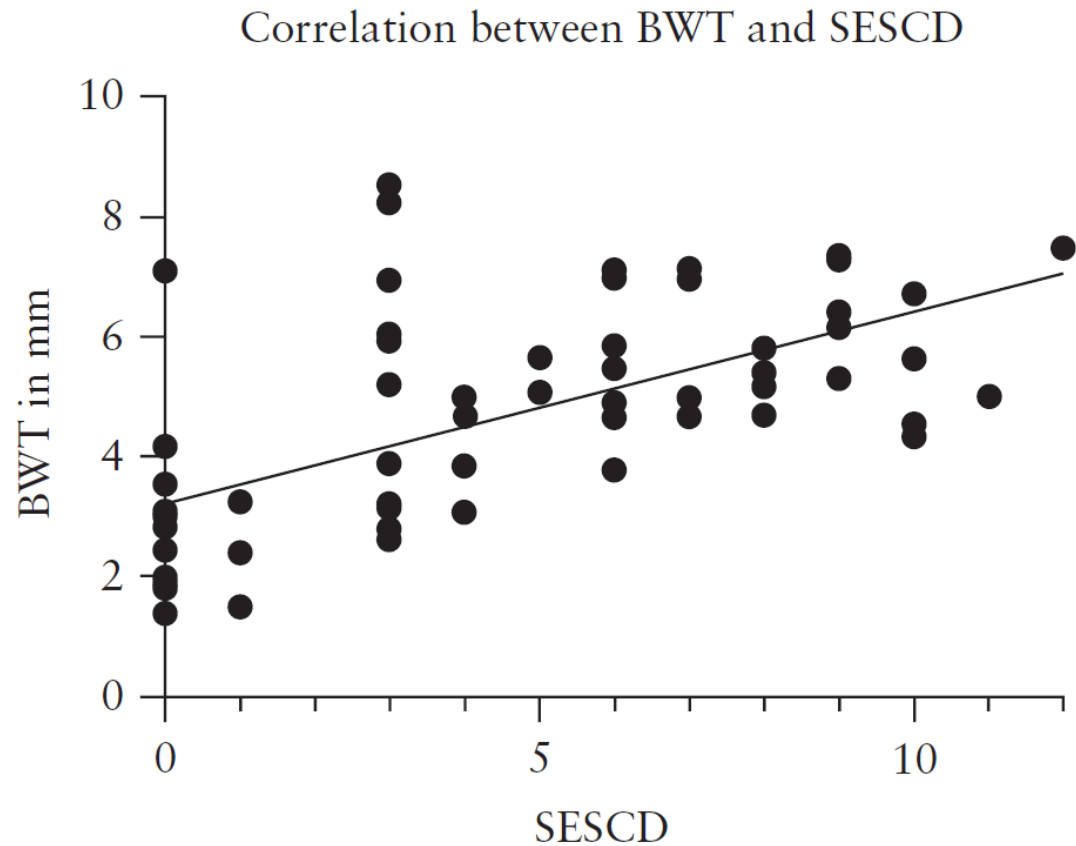


Accuracy of IUS compared to endoscopy

- IUS has a pooled sensitivity of 86% (95% CI 83-88%) and a pooled specificity of 94% in CD (95% CI 93-95%) to identify disease activity when compared to endoscopy
- BWT<3mm of all ultrasound variables showed the best correlation with endoscopic remission ($k=0.86$, $p<0.001$)



Correlation of IUS parameters with Endoscopic activity



$r=0.61$, $p=0.0001$

Endoscopic vs. transmural remission

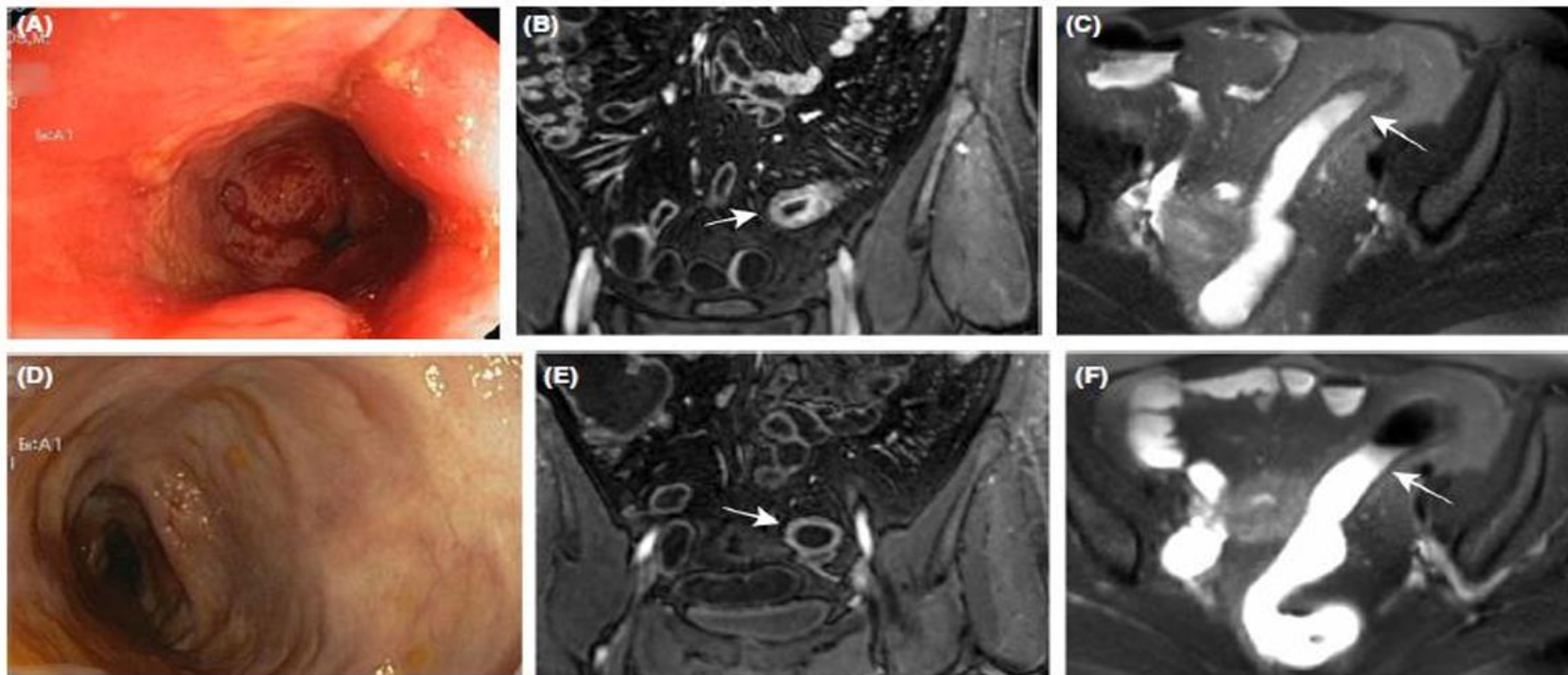


FIGURE 3 Ileocolonoscopy of a 31-year-old female with CD showed severe inflammation and ulcers of the sigmoid colon (A). MRE of the same patient showed a moderate thickening and hyperenhancement of the sigmoid wall in T1-gadolinium enhanced sequences (arrow in B) together with mural oedema on T2-weighted sequence with fat saturation at the same segment (arrow in C). After 52 wk of HSCT, the same patient reached endoscopic remission (D). MRE confirms disease transmural improvement by showing reduction of wall thickening on T1-gadolinium enhanced sequence (arrow in E) and absence of oedema on T2-weighted sequence (arrow in F) but persistence of some bowel wall thickening (arrow in E)

Only **68%** (49/72) of the segments with **ER** also reached **TR** (BWT<3 mm)

→ In almost 1/3 of patients ongoing transmural inflammation

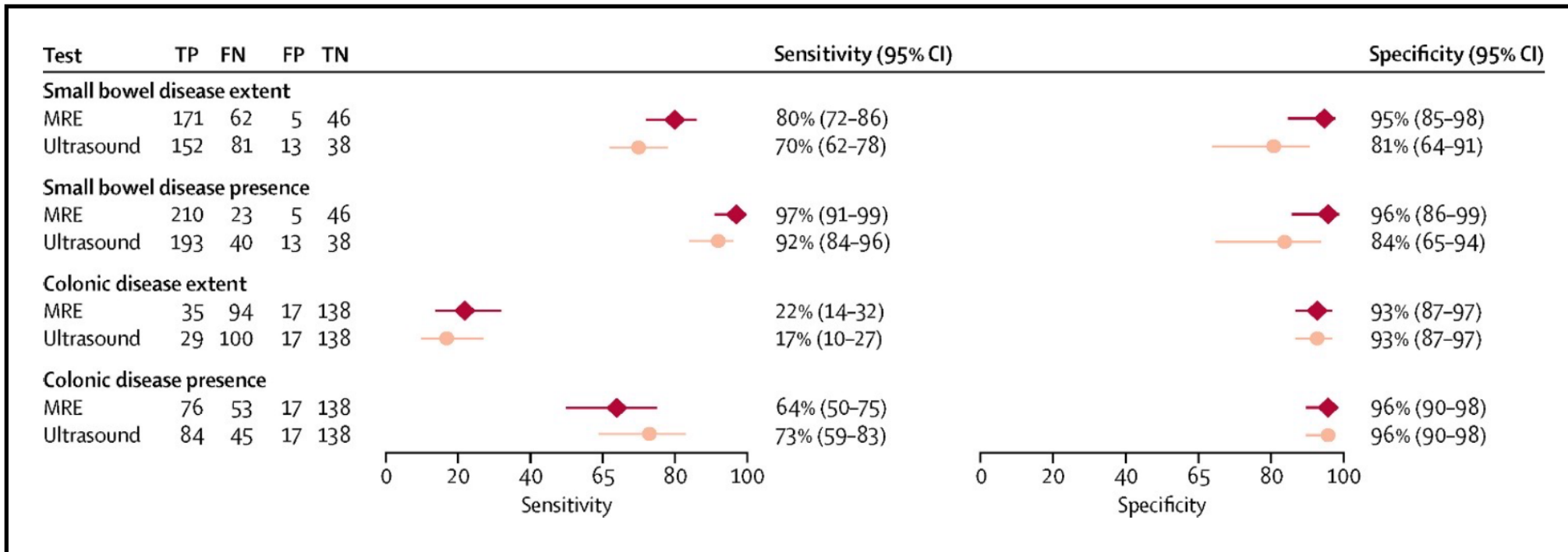


CT Enterography

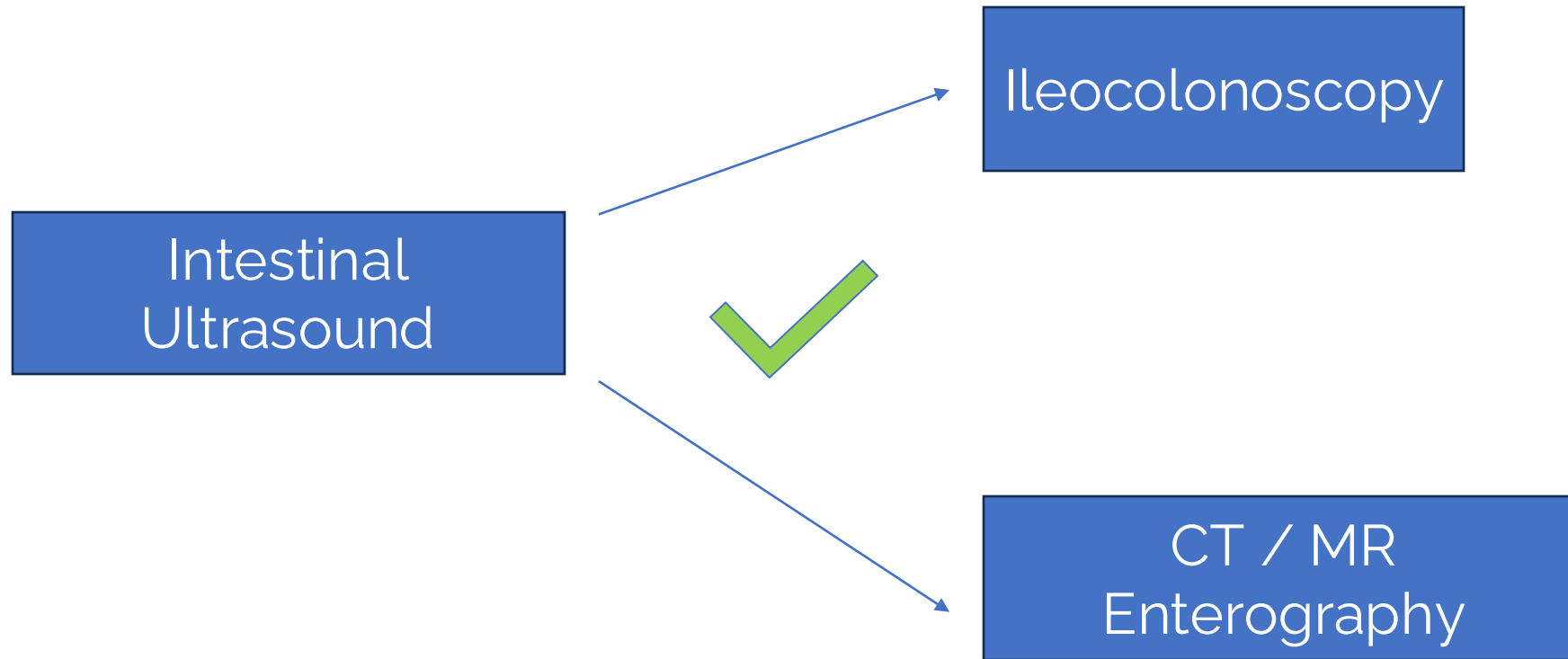


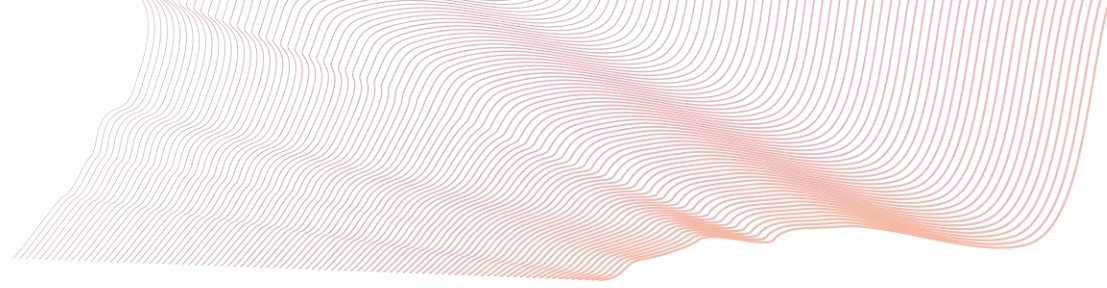
Accuracy of IUS compared to MRE: METRIC study

- Patients had newly diagnosed CD, or established disease with suspected relapse
- **284** patients completed the trial

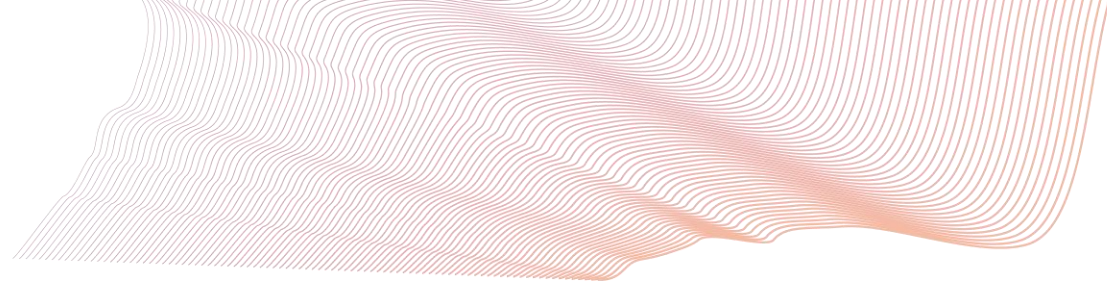


Good correlation!





Monitoring response to therapy

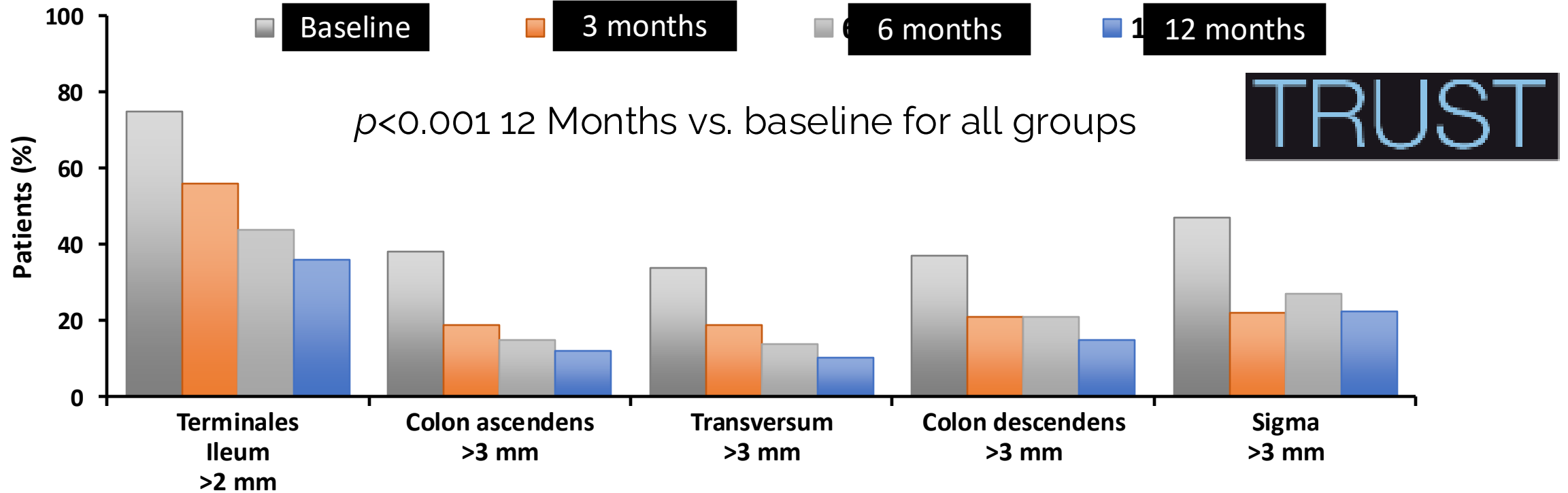


How do I follow up ?

- Can I use it to monitor ?
- Can it predict response to treatment?

TRUST-CD Study: Normalisation of BWT in Crohn's disease during treatment

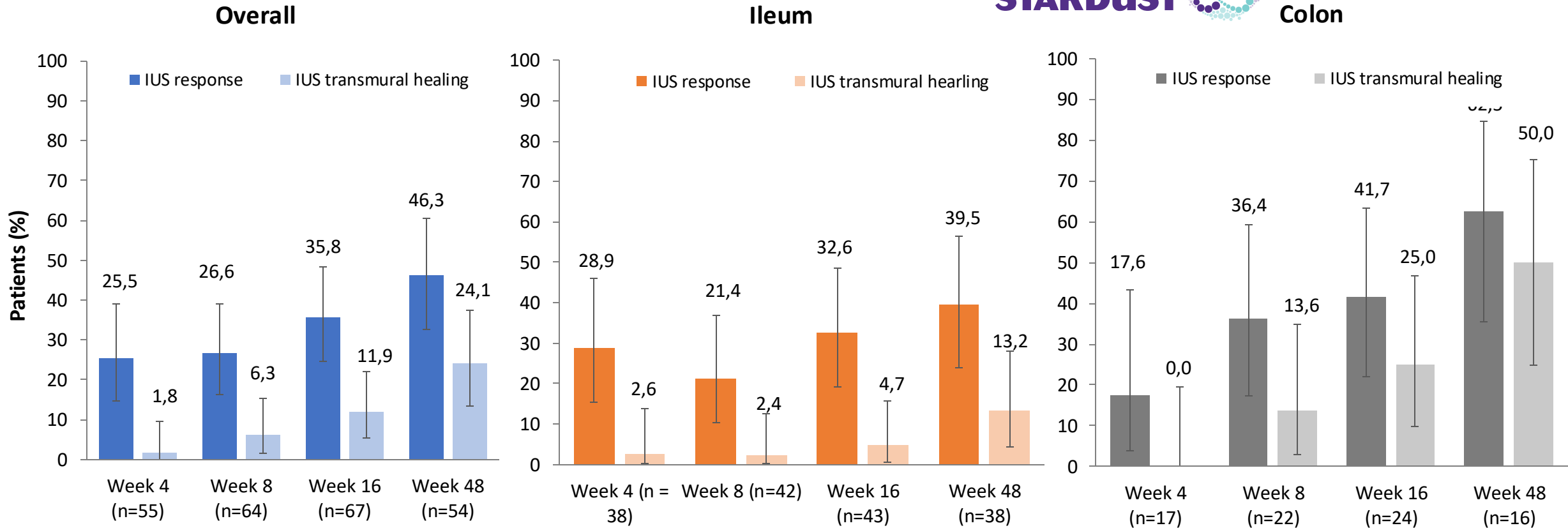
Percentage of patients with normalization of BWT improves over time



n=243 patients

Kucharzik T et al. Clin Gastro Hepatol 2017

Transmural IUS Response and Remission after treatment with Ustekinumab

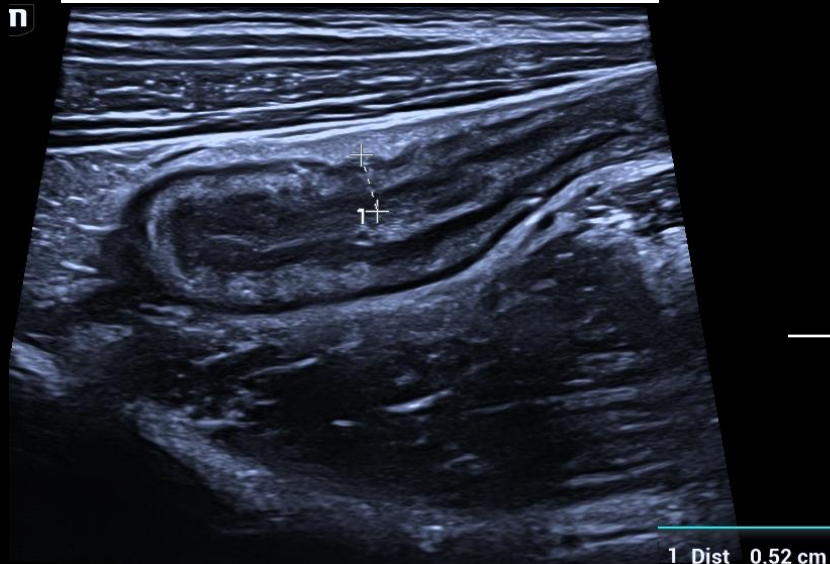


Effect more prominent in the colon compared to the ileum



Dec 2024

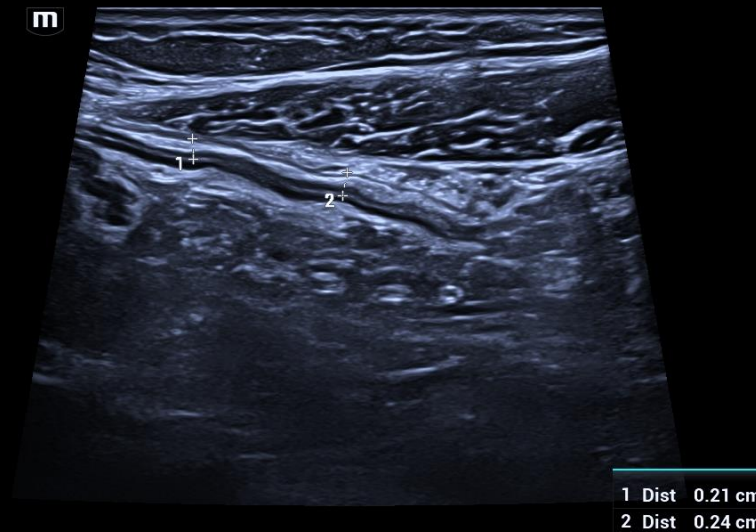
n



1 Dist 0.52 cm

March 2025

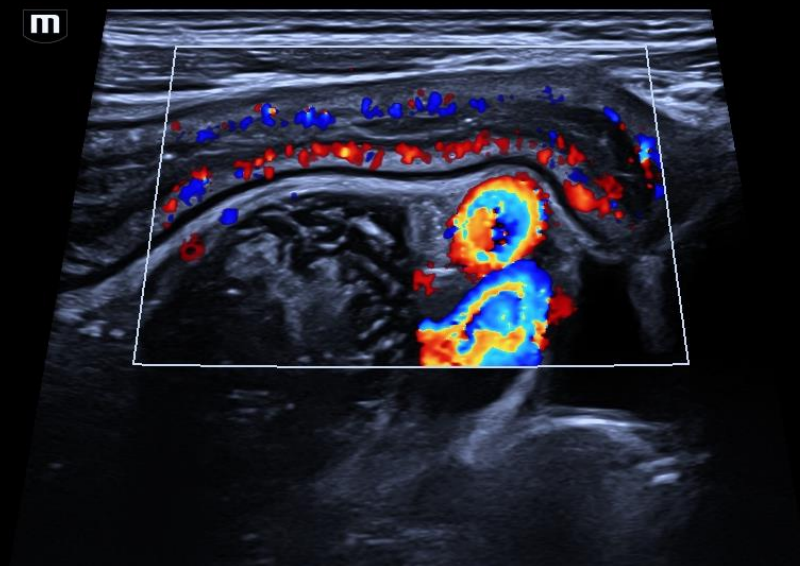
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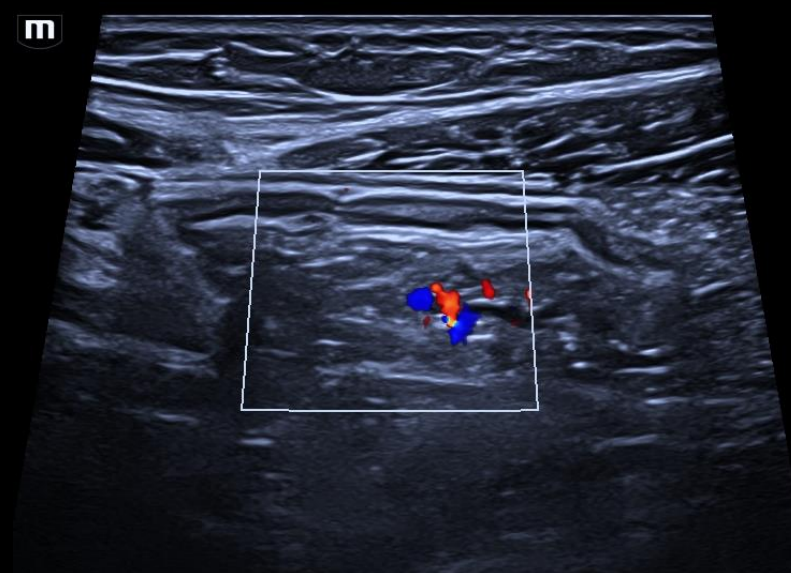
1 Dist 0.21 cm
2 Dist 0.24 cm

IFX
+
Aza

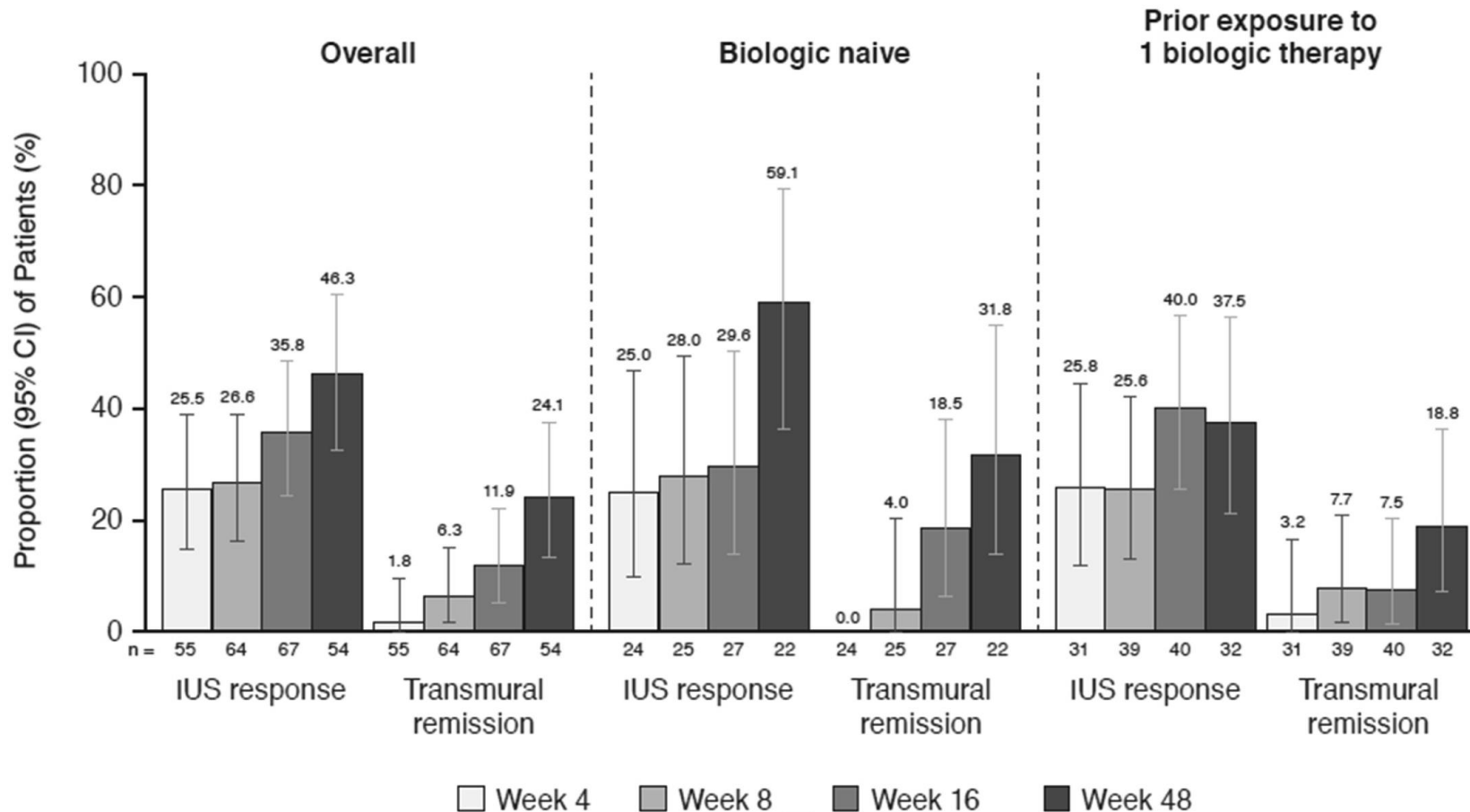
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m



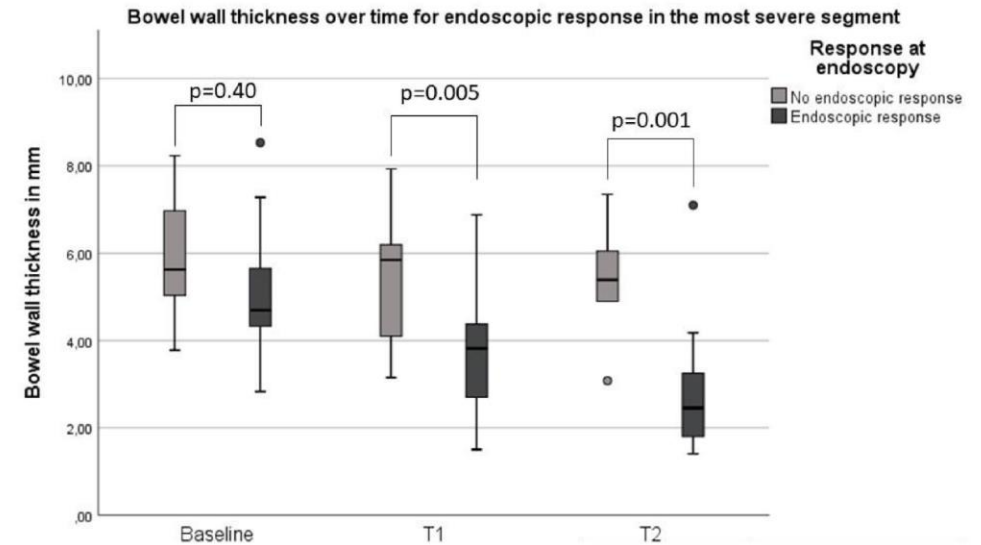
IUS response and transmural remission is more pronounced in biologic naive patients



IUS can predict endoscopic outcomes in CD

Single-center prospective cohort: 40 consecutive patients with endoscopically active CD starting anti-TNF went through IUS and CEUS at baseline, at 4-8 weeks and 12-34 weeks and endoscopy at 12-34 weeks

- At early and late FU 18% (AUROC: 0.77; OR: 10.80, $p=0.012$) and 29% (AUROC: 0.833; OR: 37.50, $p=0.006$) BWT decrease predicted endoscopic response
- 3.2 mm was most accurate to determine endoscopic remission (AUROC: 0.94; OR: 39.42, $p<0.0001$) at late FU

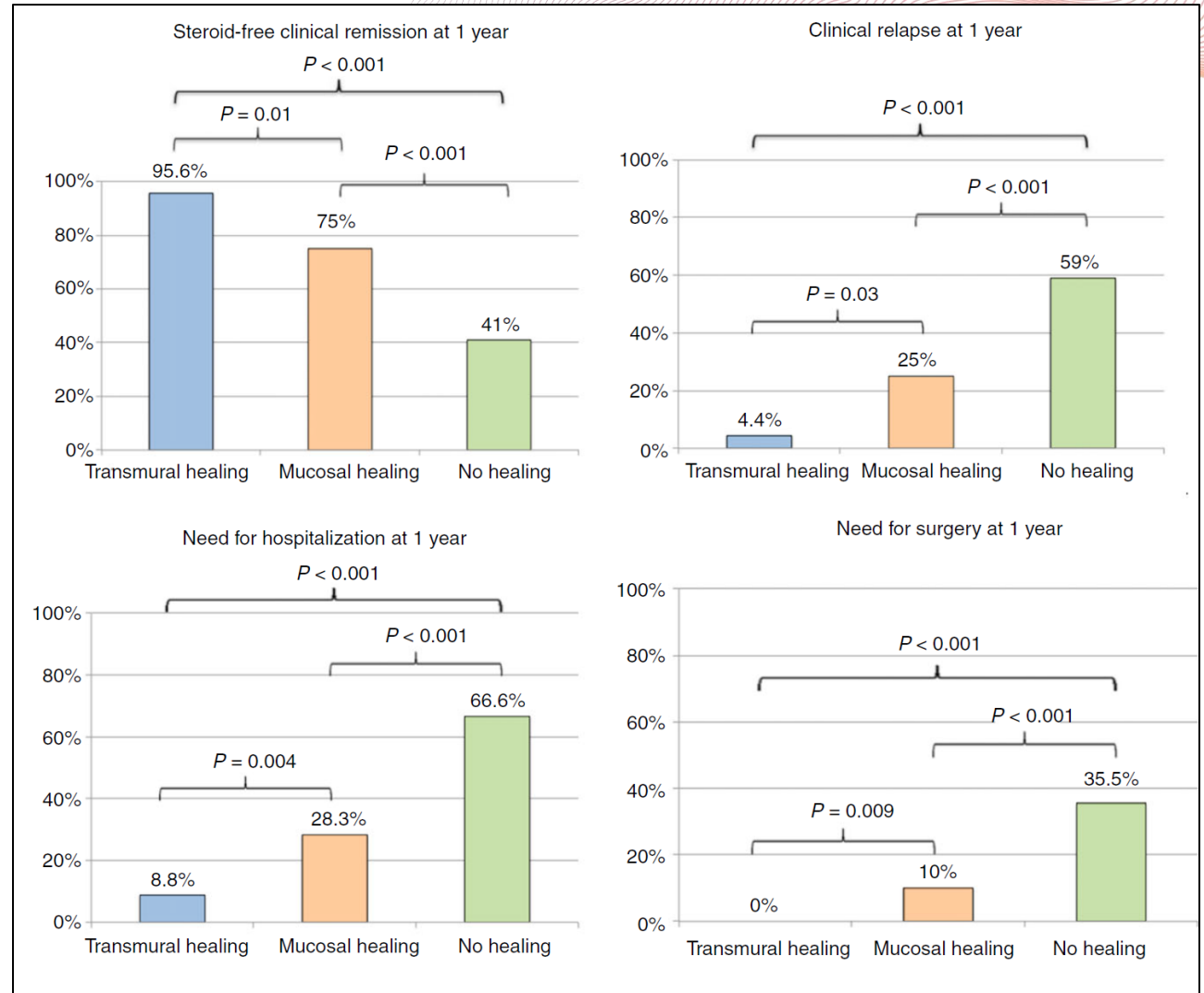


Time-point	Endoscopic response	Endoscopic non-response	p-value
Median BWT [IQR] at T0	4.7 mm [4.2-6.8]	5.4 mm [4.7-7.0]	0.40
Median BWT [IQR] at T1	3.9 mm [2.5-4.8]	5.4 mm [3.4-6.4]	0.005
Median BWT [IQR] at T2	2.5 mm [1.8-3.3]	5.3 mm [4.0-6.4]	0.001

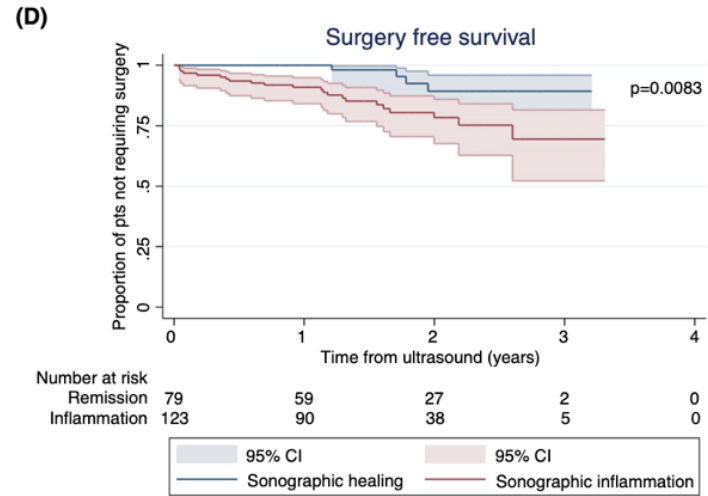
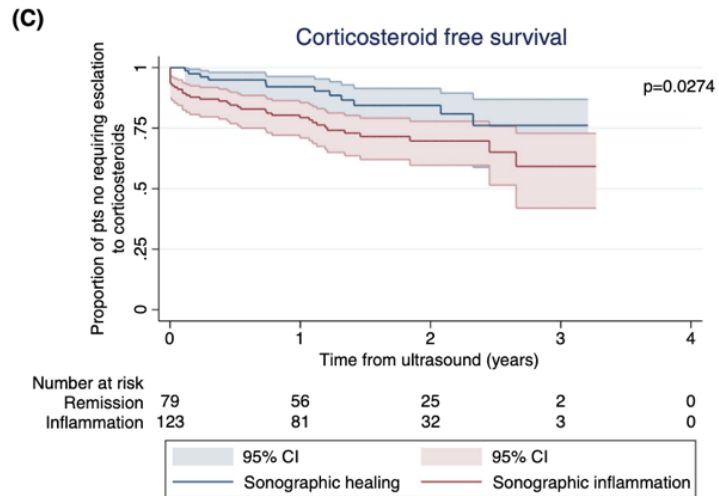
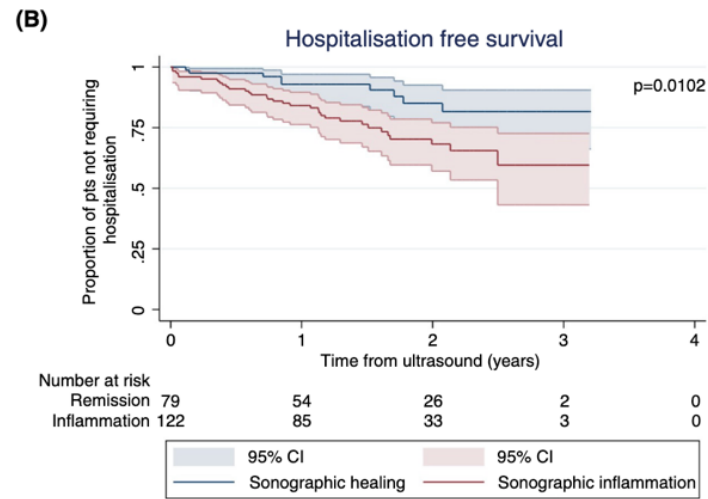
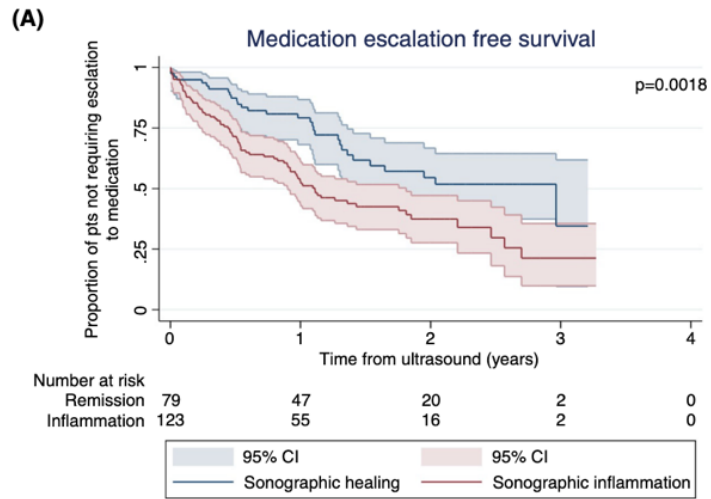
One-year clinical outcomes with biologics in Crohn's disease: transmural healing compared with mucosal or no healing

Prospective cohort study

- 218 CD patients
- 1-year outcome depending on transmural, mucosal or no healing
- Transmural healing: BWT $\leq 3\text{mm}$
- Mucosal healing SES-CD ≤ 2

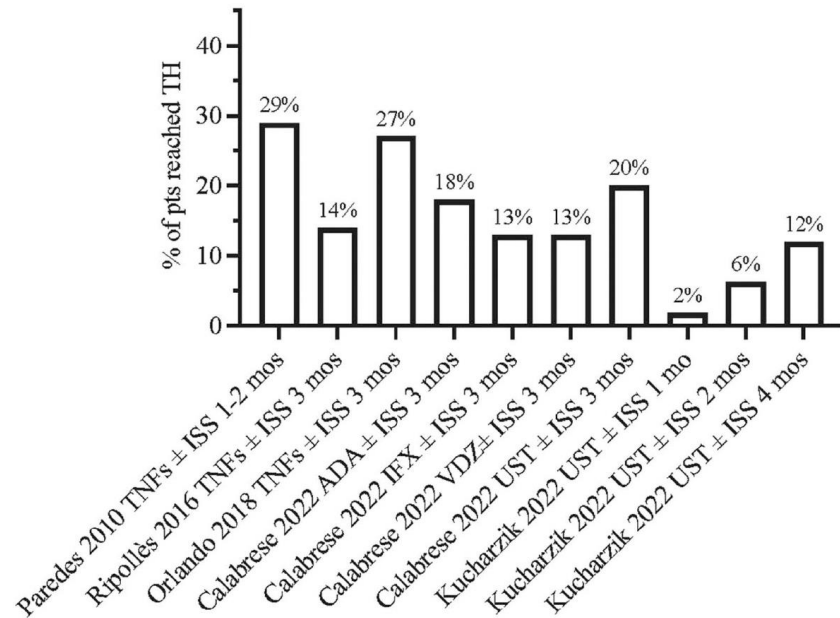


Early IUS improvement in CD is predictive of long-term outcome



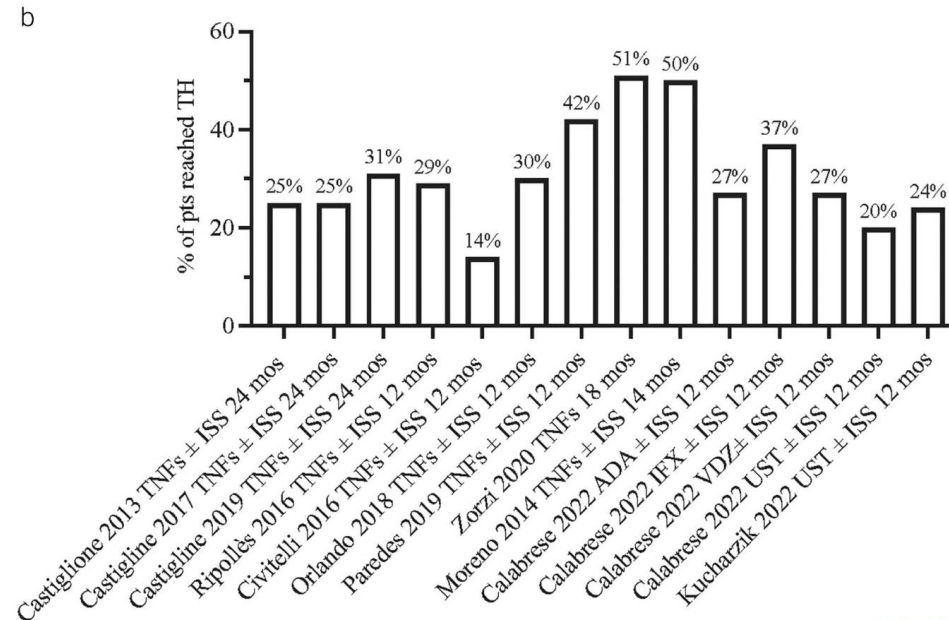
Transmural healing is influenced by treatment duration and by the therapeutic agent

Early IUS assessment at 1-4 months



NNT: 6.1

Delayed IUS assessment bw 12-24 months



NNT: 3.7

CD – Consensus on the Definition of Transmural Response and Remission and on Monitoring Criteria

Journal of Crohn's and Colitis, 2021, 1–27
<https://doi.org/10.1093/ecco-jcc/jjab173>
Advance Access publication October 6, 2021
Original Article

OXFORD

Original Article

Defining Transabdominal Intestinal Ultrasound Treatment Response and Remission in Inflammatory Bowel Disease: Systematic Review and Expert Consensus Statement

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Christian Maaser,^p Giovanni Maconi,^q Kim Nylund,^{r,s} Carolina Palmela,^t
Stephanie R. Wilson,^u Kerri Novak,^{o,*} Rune Wilkens,^{v,w,*}; on behalf of the
International Bowel Ultrasound [IBUS] Group

JCC
JOURNAL OF CROHN'S AND COLITIS

Transmural Remission
Consensus: BWT $\leq$ 3 mm + CDS 0

Ilvemark J et al JCC 2022

Response should initially be assessed in the small and large bowel after treatment initiation (regardless of treatment) at 14 $\pm$ 2 weeks. However, in a subset of patients' response after steroids or biologics may occur already after 4 weeks. Early IUS assessment may in certain situation be beneficial between week 4-8.

Ideal assessment of intestinal ultrasound response within 1st year of treatment initiation/escalation/change is at baseline, week 14 $\pm$ 2, AND between week 26 - 52 + IUS depending on elevated calpro OR symptoms OR clinical suspicion of flare



Detection of Complications



SYSTEMATIC REVIEW
& META-ANALYSIS

Diagnostic accuracy of
intestinal ultrasound and its
advanced modalities in the
detection of intra-abdominal
complications in Crohn's
disease



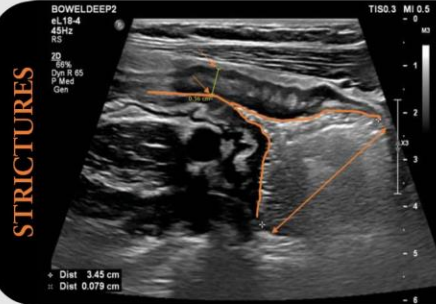
1498 studies screened



68 studies included in this review
23 studies in the meta-analysis



3863 patients



B-mode

SICUS

Sensitivity
Specificity
Accuracy

81%
90%
86%

94%
95%
94%



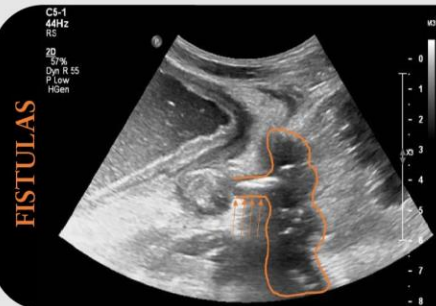
B-mode

SICUS

Sensitivity
Specificity
Accuracy

87%
95%
91%

91%
97%
94%



B-mode

SICUS

Sensitivity
Specificity
Accuracy

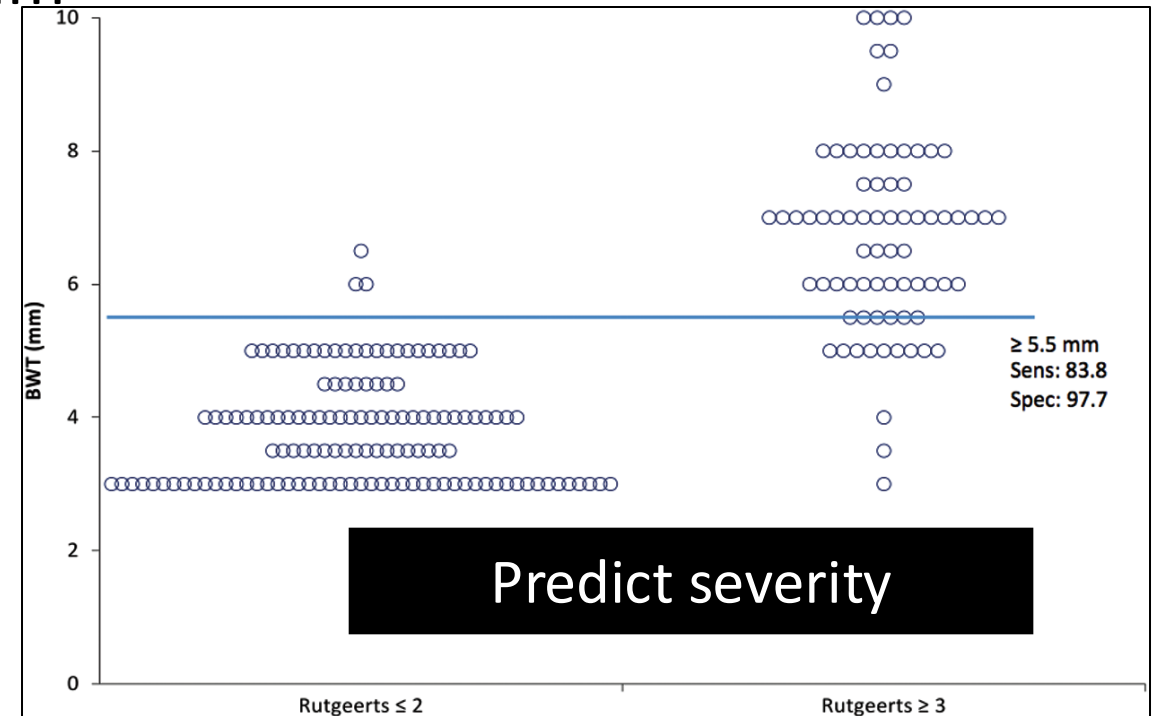
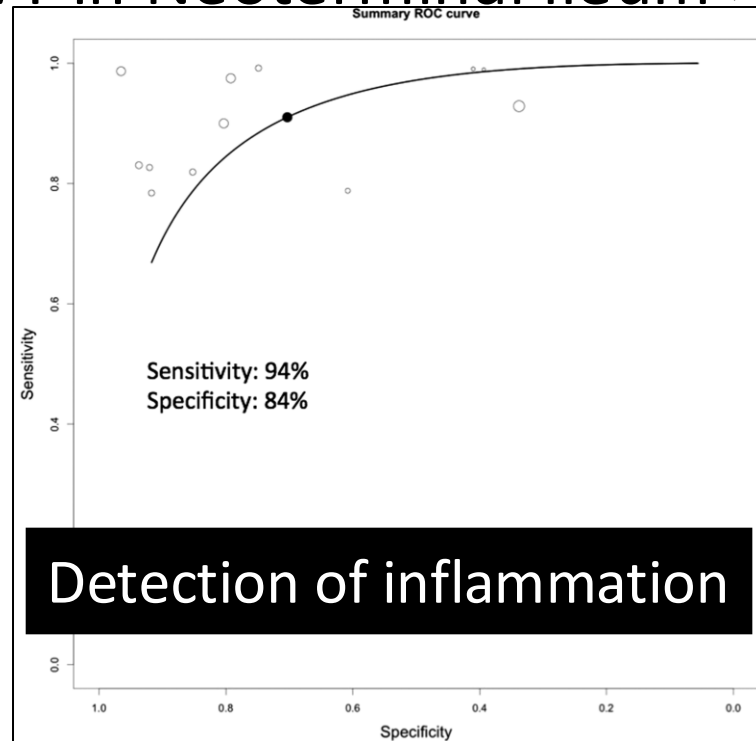
67%
97%
82%

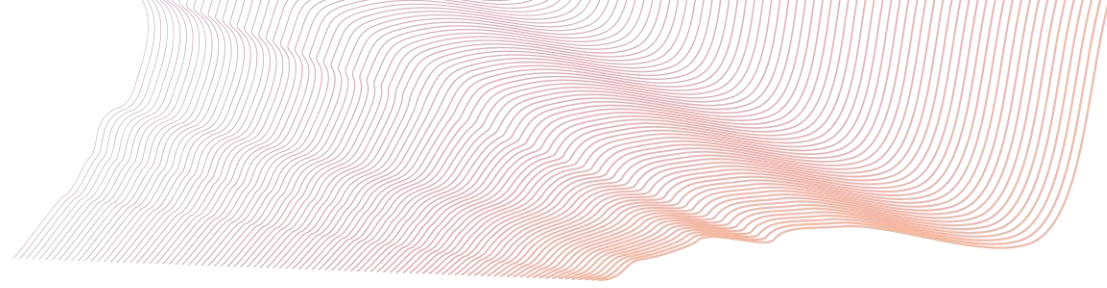
90%
94%
92%

Diagnostic Accuracy of Ultrasonography in the Detection of Postsurgical Recurrence in Crohn's Disease: A Systematic Review with Meta-analysis

Antonio Rispo, MD, PhD,* Nicola Imperatore, MD,* Anna Testa, MD, PhD,*
Olga Maria Nardone, MD,* Gaetano Luglio, MD,† Nicola Caporaso, MD,* and Fabiana Castiglione, MD*

- IUS comparison with Ileocolonoscopy: 10 studies (n:536)
- BWT in Neoterminal ileum > 3mm





IUS Scoring in CD

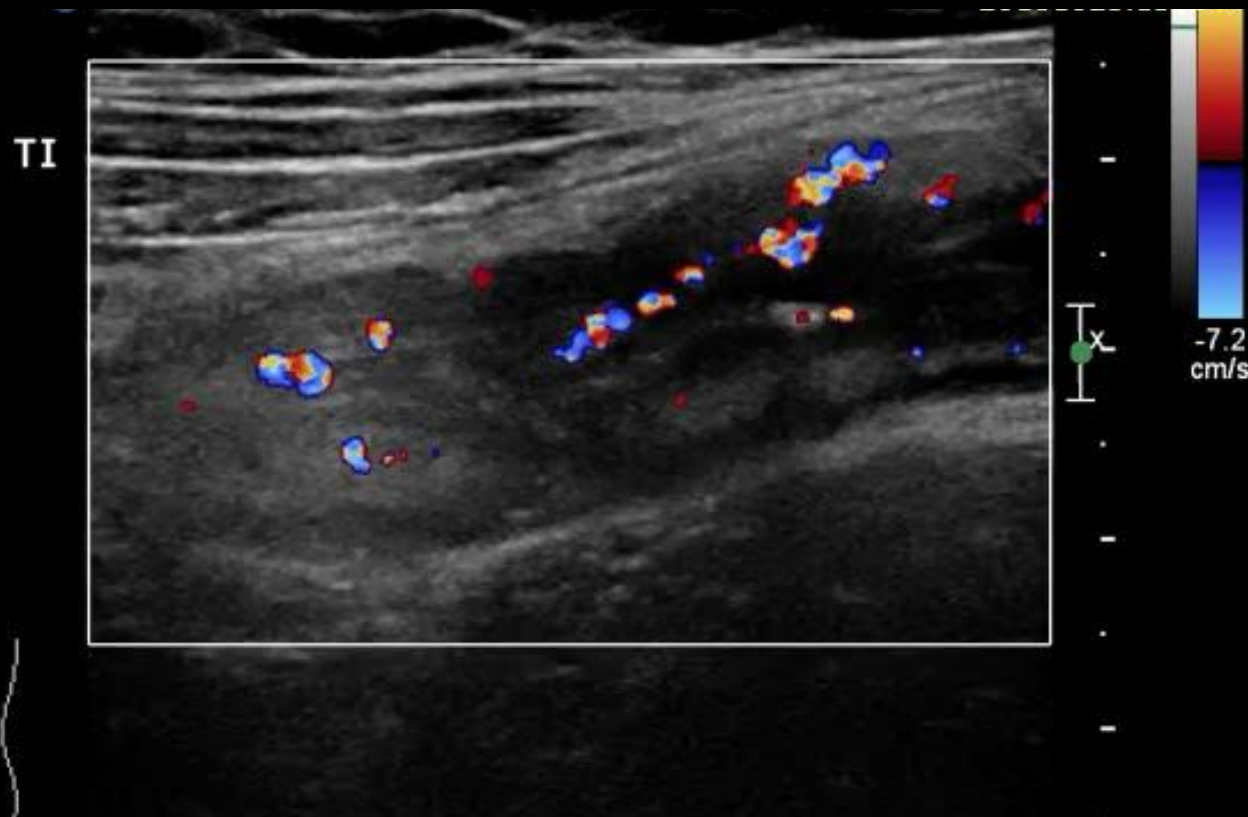
IBUS SAS-Score

1. Expert consensus Delphi method to derive measures of IUS activity
2. Determine inter-rater reliability for individual measures
3. Refinement of case acquisition and interpretation with 30 blinded cases and evaluate reliability

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



IBUS SAS-Score

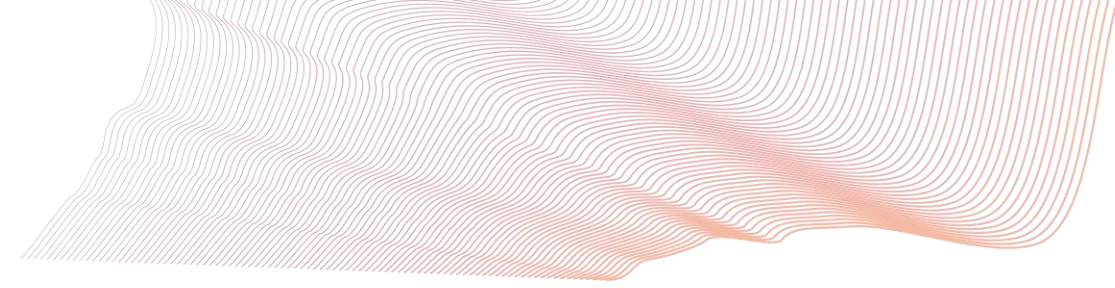


Active CD L1B1

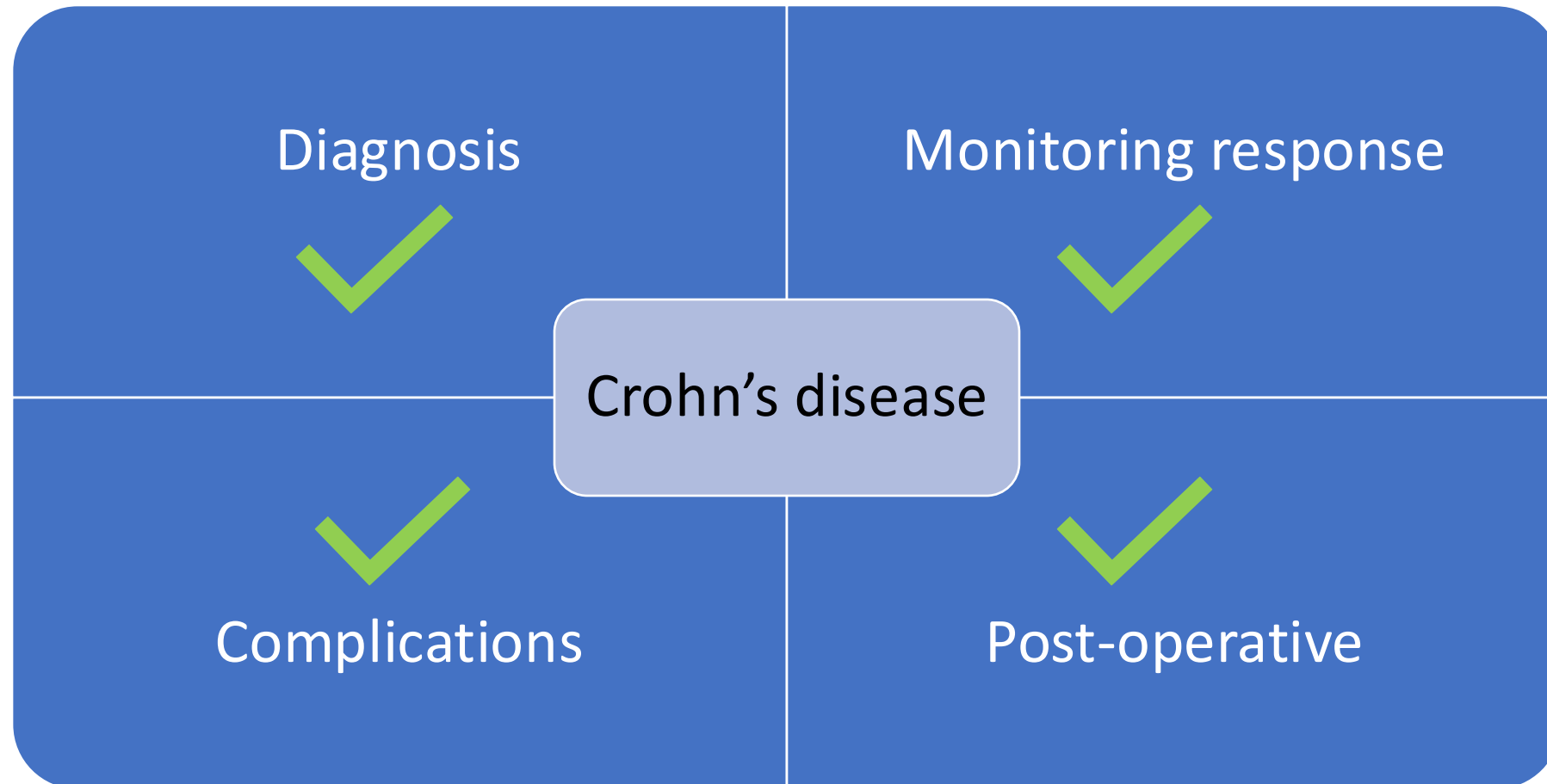
- BWT (8 mm)
- Vascularization (CDS 2)
- Echostratification (extensive=3)
- Mesenteric fat (present=2)

IBUS SAS-Score: 88

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



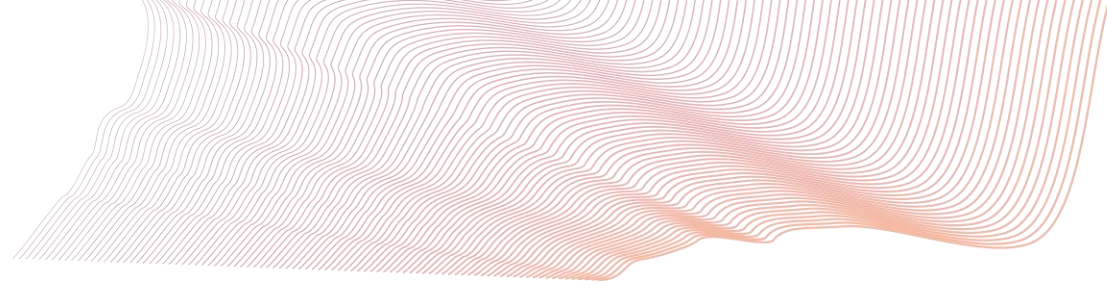
IUS in Crohn's disease.... Ticks all the boxes.





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Thank you!



12:45-14:00

Hands-on Session 4: Intestinal Ultrasound in Crohn's Disease