



IUS after surgery: relocation and relapse

Tillmann Raith – Consultant of Gastroenterology

Skåne University Hospital, Sweden

Thursday, December 4nd 2025, Day 2

14:45-15:15

IBUS Nordic Module 1 Workshop, Copenhagen, DK



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Structure

- Surgical techniques
- Anastomosis ultrasound
- Relocation of the bowel
- Postoperative recurrence
- Ultrasound for postoperative recurrence



END-TO-END OR END-TO-SIDE ANASTOMOSIS

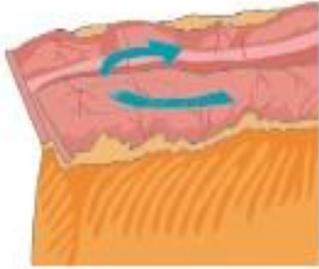


End-to-end

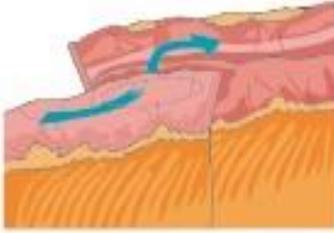


End-to-side

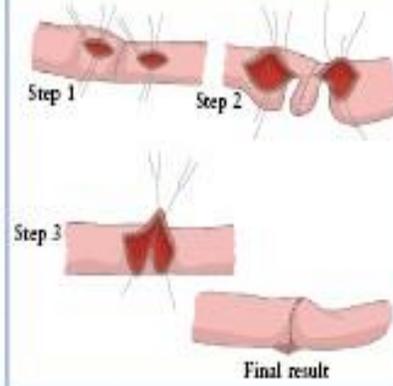
SIDE-TO-SIDE ANTIPERISTALTIC ANASTOMOSIS



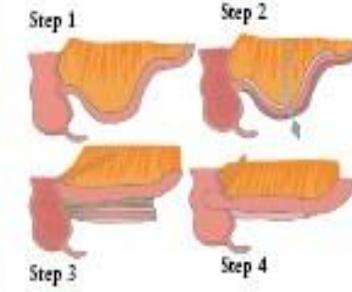
SIDE-TO-SIDE ISO-PERISTALTIC ANASTOMOSIS



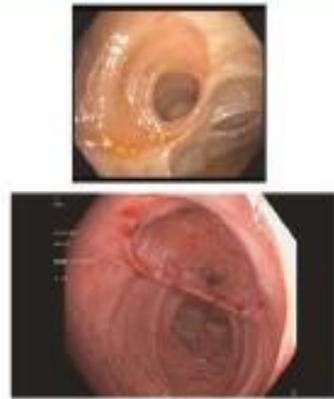
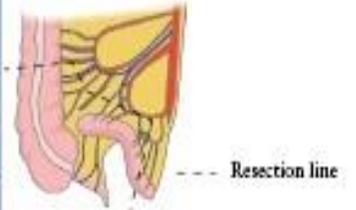
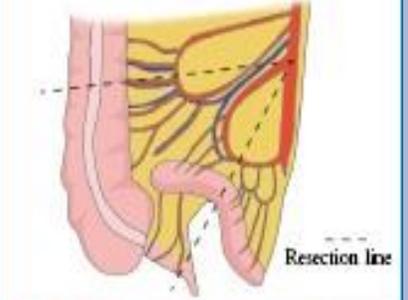
KONO-S ANASTOMOSIS



OVER THE VALVE STRICTUREPLASTY



MESENTERIC EXCISION



Ultrasound features of E-E anastomosis





Ultrasound features of E-S anastomosis



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Courtesy of Prof. G. Manconi, Milan, Italy



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Ultrasound features of S-S anastomosis



Surgical technique: Kono-S-Anastomosis

a The nearby mesentery of the ileocecal region that is to be excised is divided at the mesenteric wall of the bowel. The dotted line indicates the resection lines.

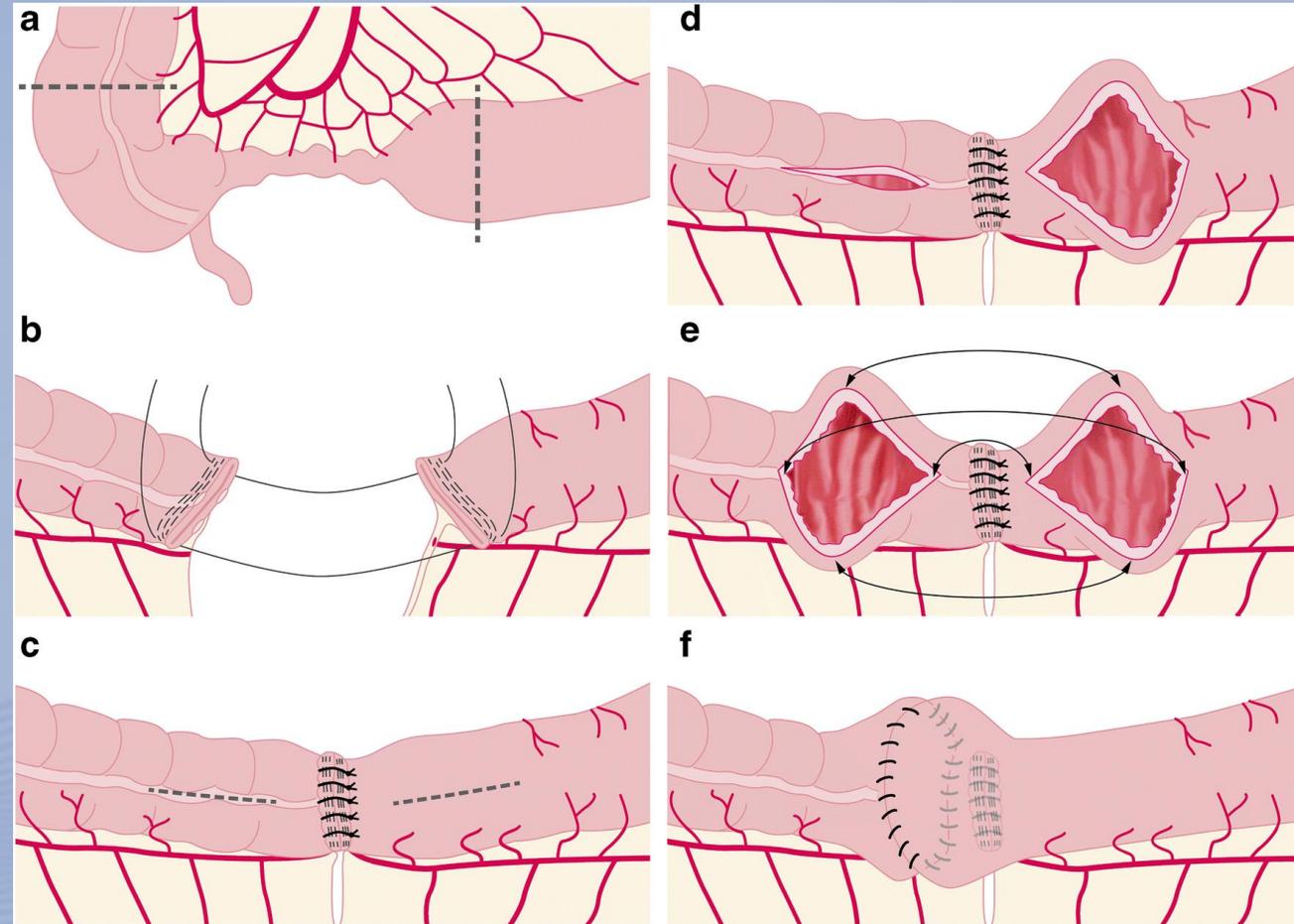
b The intestine is transected by use of a linear stapler such that the mesentery is in the middle of the staple line and at a 90° angle to it.

c Then, the staple lines are sutured together transversely to create a supporting column that is supposed to support the eventual dimension of the anastomosis.

d Longitudinal enterotomies of 7 cm length are then performed at the antimesenteric aspect, beginning 1 cm from the supporting column.

e The anastomosis is then created transversely in hand-sewn fashion. The backwall using a double-layer continuous manner, the front wall using a single-layered continuous suture. All sutures with 4/0 PDS.

f The pale lines indicate the mesenteric side below the anastomosis with the supporting column that is created with the proximal and distal bowel stumps



<https://doi.org/10.1007/s00423-020-01998-6>

/ Published online: 6 October 2020

Experiences with the Kono-S anastomosis in Crohn's disease of the terminal ileum—a cohort study

K. Horisberger1 & D. L. Birrer1 & A. Rickenbacher1 & M. Turina1

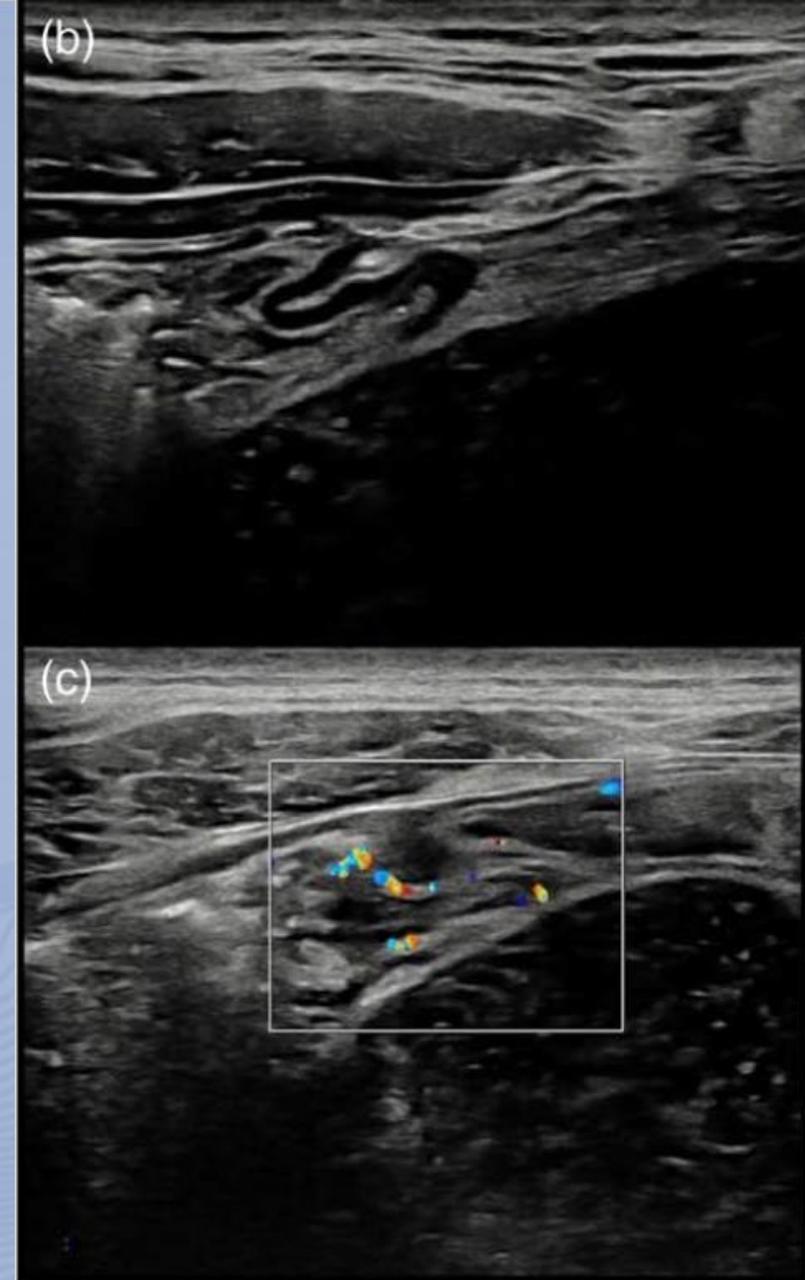
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Kono-S-Anastomosis (KSA)

- Reduction of POR
- Preserving luminal diameter
- Supporting column stabilizing
- End-to-end allowing endoscopic assessment
- IUS: Serpentine appearance
- KSA anatomy results in an increased average anastomotic BWT
- neo-TI BWT may be of greater clinical relevance



> Eur J Gastroenterol Hepatol. 2024 Sep 1;36(9):1150-1152. doi: 10.1097/MEG.0000000000002805. Epub 2024 Jul 31.

Characteristics of the Kono-S anastomosis in Crohn's disease patients using intestinal ultrasound

Elizabeth SI Low¹, Tessa Greeve¹, Ray K Boyapati¹, Gregory T Moore^{1,2}, Edward Shelton¹

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Relocation after surgery – where is the anastomosis?

- Relocated intestines after surgery can be hard to find!
- See through all existing cross-sectional imaging modalities available to prepare for your examination.
- If possible, see operation documentation to be sure where and which anastomosis to expect.
- A normal anastomosis without any BW-thickening can be challenging to distinguish.



Where is the anastomosis?





Background Postoperative Recurrence (POR)

- Decrease of surgery in the last 5 decades
- 15% surgery after first year of diagnosis
- Cumulative risk after 7 years around 30%
- Disease relapse is inevitable in most patients
- 5 year risk of second surgery 25%
- Operated patients should be screened soon after surgery to identify early recurrence and initiate/intensify treatment because of high risk for relapse within the first year

Review > Gastroenterology. 2013 Nov;145(5):996-1006. doi: 10.1053/j.gastro.2013.07.041. Epub 2013 Jul 27.

Risk of surgery for inflammatory bowel diseases has decreased over time: a systematic review and meta-analysis of population-based studies

Alexandra D Frolkis¹, Jonathan Dykeman, Maria E Negrón, Jennifer DeBruyn, Nathalie Jette, Kirsten M Fiest, Talia Frolkis, Herman W Barkema, Kevin P Rioux, Remo Panaccione, Subrata Ghosh, Samuel Wiebe, Gilaad G Kaplan

Multicenter Study > Inflamm Bowel Dis. 2014 Jan;20(1):36-46. doi: 10.1097/01.MIB.0000436277.13917.c4.

Initial disease course and treatment in an inflammatory bowel disease inception cohort in Europe: the ECCO-EpiCom cohort

Johan Burisch¹, Natalia Pedersen, Silja Cukovic-Cavka, Niksa Turk, Ioannis Kaimakliotis

Clinical Trial > Am J Gastroenterol. 2014 May;109(5):705-14. doi: 10.1038/ajg.2014.45. Epub 2014 Mar 18.

Disease course and surgery rates in inflammatory bowel disease: a population-based, 7-year follow-up study in the era of immunomodulating therapy

Marianne K Vester-Andersen¹, Michelle V Prosborg¹, Tine Jess², Mikael Andersson², Bo G Bengtsson², Thomas Blixt⁴, Pia Munkholm³, Flemming Bendtsen³, Ida Vind¹

Review > Am J Gastroenterol. 2014 Nov;109(11):1739-48. doi: 10.1038/ajg.2014.297. Epub 2014 Oct 21.

Cumulative incidence of second intestinal resection in Crohn's disease: a systematic review and meta-analysis of population-based studies

Alexandra D Frolkis¹, Debra S Lipton², Kirsten M Fiest², Maria E Negrón⁴, Jonathan Dykeman⁴, Jennifer deBruyn², Nathalie Jette², Talia Frolkis², Ali Rezaie¹, Cynthia H Seow¹, Remo Panaccione², Subrata Ghosh², Gilaad G Kaplan¹

Predictability of the Postoperative Course of Crohn's Disease

P. RUTGEERTS, K. GEBOES, G. VANTRAPPEN, J. BEYLS, R. KERREMANS, and M. HIELE
Departments of Medicine, Pathology, and Surgery, University Hospital "Gasthuisberg," University of Leuven, Belgium



ECCO-ESGAR-ESP-IBUS Guideline on Diagnostics and Monitoring of Patients with Inflammatory Bowel Disease: Part 1

Part 1: initial diagnosis, monitoring of known inflammatory bowel disease, detection of complications

Torsten Kucharzik^{1,*}, Stuart Taylor², Mariangela Allocca³, Johan Burisch^{4,5,6}, Pierre Ellul⁷, Marietta Iacucci⁸, Christian Maaser⁹, Pamela Baldin¹⁰, Gauraang Bhatnagar¹¹, Shomron Ben-Horin¹², Dominik Bettenworth¹³, Mallory Chavannes¹⁴, Ann Driessen¹⁵, Emma Flanagan¹⁶, Frederica Furfaro¹⁷, Giovanni Maconi¹⁸, Konstaninos Karmiris¹⁹, Amelia Kellar^{20,21}, Isabelle De Kock²², Konstantinos Katsanos²³, Uri Kopylov²⁴, Cathy Lu²⁵, Olga Maria Nardone²⁶, Nurulamin M Noor²⁷, Kerri Novak²⁸, Paula Borralho Nunes²⁹, Patrick van Rheenen³⁰, Jordi Rimola³¹, Francesca Rosini³², David Rubin³³, Martina Scharitzer³⁴, Jaap Stoker^{35,36}, Mathieu Uzzan³⁷, Stephan Vavricka³⁸, Bram Verstockt³⁹, Rune Wilkens⁴⁰, Nina Zidar⁴¹, Alessandra Zilli⁴², Henit Yanai^{43,44}, Roger Feakins^{45,46}; on behalf of the European Crohn's and Colitis Organisation (ECCO), the European Society of Gastrointestinal and Abdominal Radiology (ESGAR), the European Society of Pathology (ESP), and the International Bowel Ultrasonography Group (IBUS)

4.5. Postoperative follow-up

Recommendation 18 In patients with CD who have had ileocaecal resection, we recommend endoscopy 6–12 months after surgery (EL2). Cross-sectional imaging (IUS [EL3] or MRE [EL3]) in combination with FC 3–6 months after surgery (EL3) could be used to detect early recurrence. Small-bowel VCE can be considered as a noninvasive alternative (EL3). (90% agreement)

GASTROENTEROLOGY 1990;99:956-963

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**Departments of Medicine, Pathology, and Surgery, University Hospital "Gasthuisberg,"
University of Leuven, Belgium**





TABLE 1.

Modified Rutgeert score

Risk of
symptomatic
recurrence
at
5 years (%)

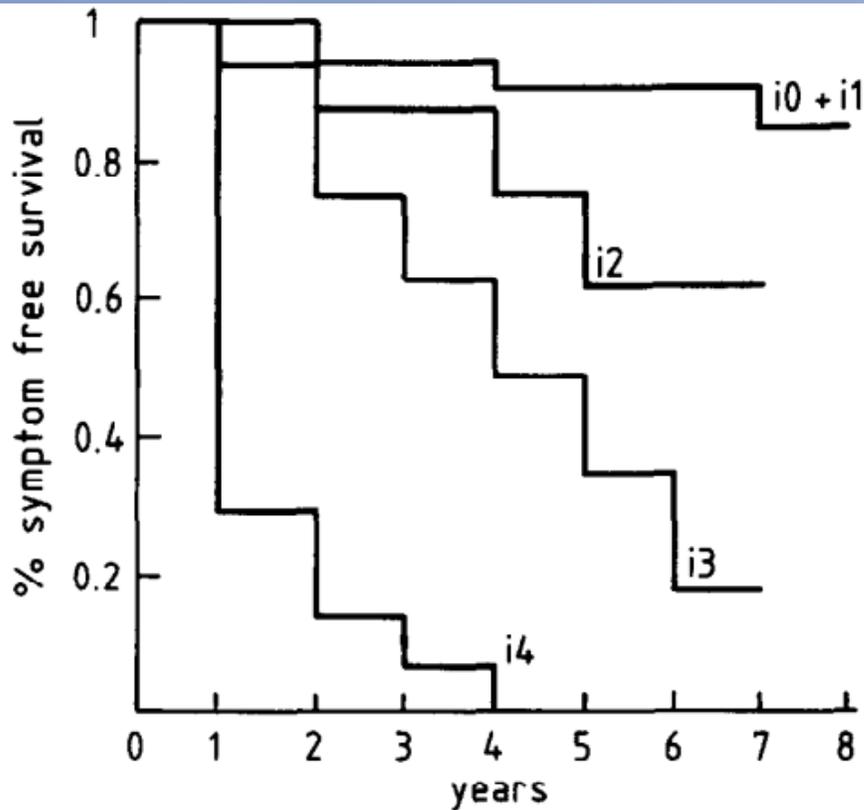
Grade	Endoscopic finding	Risk of symptomatic recurrence at 5 years (%)
i0	No lesions in the distal ileum	6
i1	Fewer than 5 aphthous lesions in the distal ileum	6
i2	More than 5 aphthous lesions with normal mucosa between the lesions or skip areas of larger lesions or lesions confined to ileocolonic anastomosis	27
i2a	Lesions confined to the ileocolonic anastomosis	
i2b	More than 5 aphthous ulcers or larger lesions with normal mucosa in between, in the neoterminal ileum (with or without anastomotic lesions)	
i3	Diffuse aphthous ileitis with diffusely inflamed mucosa	63
i4	Diffuse inflammation, with larger lesions: large ulcers and/or nodules/ cobble and/or narrowing/stenosis	100

Adapted from Rutgeerts et al.

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	year	start	1	2	3	4	5	6	7	8
at risk	i0+i1	35	35	34	24	20	16	16	8	0
	i2	15	14	13	8	5	3	2	1	0
	i3	16	15	12	9	7	4	2	1	0
	i4	23	7	3	1	0				
events	i0+i1		0	1	0	1	0	0	1	0
	i2		1	1	0	1	1	0	0	0
	i3		1	3	2	2	2	2	0	0
	i4		16	4	1	1				

Figure 2. Actuarial analysis of symptomatic recurrence in patients stratified according to the severity of endoscopic lesions at 1-year ileocolonoscopy.

IUS for postoperative recurrence

- Several studies emphasize the value of IUS in postoperative follow-up and confirm the reliability of bowel-wall thickening as an indicator of recurrence.
- SICUS has shown an excellent correlation with the endoscopic Rutgeerts score, reaching 87.5% accuracy for detecting CD recurrence
- A recent prospective study revealed that a combination of BWT ≥ 3 mm and FC ≥ 50 $\mu\text{g/g}$ correctly identified patients with endoscopic recurrence (Rutgeerts score ≥ 2), while lower values correlated closely with the absence of endoscopic recurrence

IUS for postoperative recurrence II

- Several studies have shown that the combination of bowel wall thickness and calprotectin has a high positive predictive value
- Bowel wall thickness is the most important ultrasound variable, BUT it can also signify fibrosis, anastomosis or structural change after surgery.
- Additional sonographic features aid to differentiate:
 - Loss of stratification, prominent submucosa and increased CDS stand for inflammation
 - Preserved stratification and thickened muscularis suggest fibrosis.

Clinical Gastroenterology and Hepatology 2023;21:3143-3151

Noninvasive Assessment of Postoperative Disease Recurrence in Crohn's Disease: A Multicenter, Prospective Cohort Study on Behalf of the Italian Group for Inflammatory Bowel Disease

Federica Furfaro,¹ Ferdinando D'Amico,^{1,2} Alessandra Zilli,¹ Vincenzo Craviotto,³ Annalisa Aratari,⁴ Cristina Bezzio,⁵ Antonino Spinelli,³ Daniela Gilardi,⁶ Simona Radice,¹ Simone Saibeni,⁵ Claudio Papi,⁴ Laurent Peyrin-Biroulet,^{7,8} Silvio Danese,^{1,6} Giannata Finno,^{1,6} and Mariangela Allrocca,^{1,6}

> Gut. 2019 Jun;68(6):1115-1126. doi: 10.1136/gutjnl-2018-318081. Epub 2019 Apr 3.

Assessment of Crohn's disease-associated small bowel strictures and fibrosis on cross-sectional imaging: a systematic review

Dominik Bettenworth¹, Arne Bokemeyer¹, Mark Baker², Ren Mao^{3,4}, Claire E Parker⁵, Tran Nguyen⁵, Christopher Ma^{5,6}, Julián Panés⁷, Jordi Rimola⁸, Joel G Fletcher⁹, Vipul Jairath^{5,10,11}, Brian G Feagan^{5,10,11}, Florian Rieder^{4,12};
Stenosis Therapy and Anti-Fibrotic Research (STAR) Consortium.

> Aliment Pharmacol Ther. 2003 Oct 1;18(7):749-56. doi: 10.1046/j.1365-2036.2003.01673.x.

Small bowel stenosis in Crohn's disease: clinical, biochemical and ultrasonographic evaluation of histological features

G Maconi¹, L Carsana, P Fociani, G M Sampietro, S Ardizzone, M Cristaldi, F Parente, G L Vago, A M Taschieri, G Bianchi Porro

Comparative Study > Ultrasound Med Biol. 2013 Jul;39(7):1197-206.
doi: 10.1016/j.ultrasmedbio.2013.01.020. Epub 2013 Apr 30.

Quantitative contrast-enhanced ultrasound comparison between inflammatory and fibrotic lesions in patients with Crohn's disease

Kim Nylund¹, Radovan Jirik, Martin Mezl, Sabine Leh, Trygve Hausken, Frank Pfeffer, Svein Ødegaard, Torfinn Taxt, Odd Helge Gilja



IUS for postoperative recurrence III

- Alternative suggestion for interpreting bowel wall thickness after surgery: Baseline examination shortly after surgery and comparison with follow up to detect change early – further studies needed!
- Presence of lymph nodes, generally seen as nonspecific in CD, could be seen as highly indicative for POR – even here is further research needed.
- Noninvasive testing could be repeated more frequently, potentially easing out the lower accuracy compared with endoscopy!



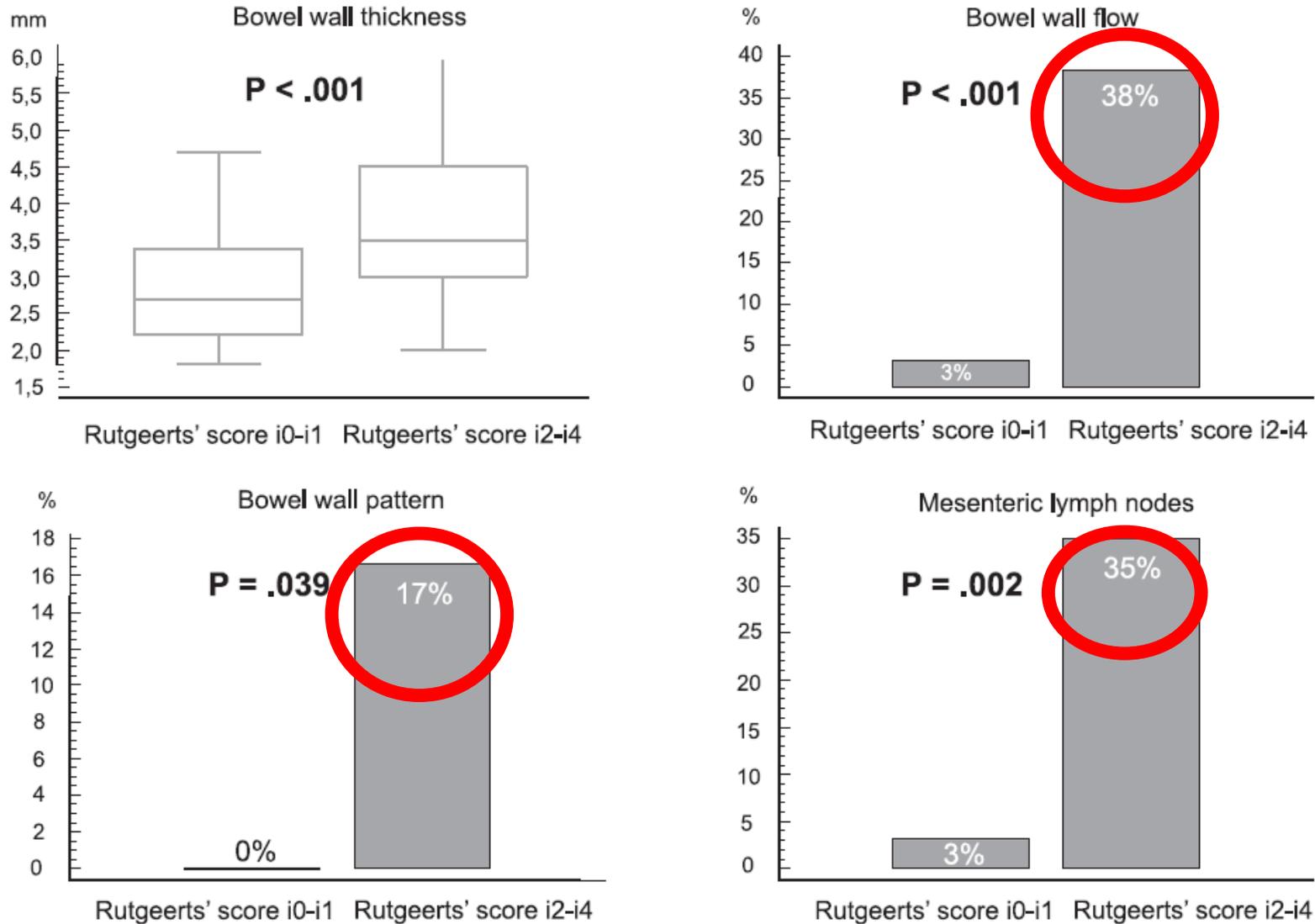


Figure 1. Bowel US parameters stratified by endoscopic recurrence disease.

Noninvasive Assessment of Postoperative Disease Recurrence in Crohn's Disease: A Multicenter, Prospective Cohort Study on Behalf of the Italian Group for Inflammatory Bowel Disease

Federica Furfaro,¹ Ferdinando D'Amico,^{1,2} Alessandra Zilli,¹ Vincenzo Craviotto,³ Annalisa Aratari,⁴ Cristina Bezzio,⁵ Antonino Spinelli,³ Daniela Gilardi,⁶ Simona Radice,¹ Simone Saibeni,⁵ Claudio Papi,⁴ Laurent Peyrin-Biroulet,^{7,8} Silvio Danese,^{1,6} Gionata Fiorino,^{1,6} and Mariangela Allocca^{1,6}



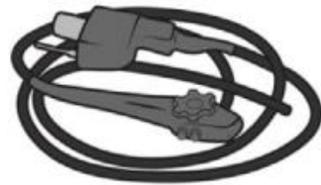
Sunil Samnani,¹ Christina M. Ray,² Priyanka Gill,² Levi Stein,³ Katherine A. Buhler,³ Rupert W. Leong,⁴ Rebecca L. Smith,⁵ Peter De Cruz,^{6,7} Gilaad G. Kaplan,^{3,8} Cynthia H. Seow,^{3,8} Cathy Lu,³ Leonardo Guizzetti,⁹ Frank Hoentjen,¹⁰ John K. Marshall,¹ Siddharth Singh,¹¹ Remo Panaccione,³ Kerri L. Novak,³ and Christopher Ma^{3,8}

IUS for postoperative recur

Diagnostic Accuracy of Non-Invasive Biomarkers and Imaging for Evaluating Postoperative Recurrence in Crohn's Disease: A Systematic Review and Meta-Analysis

CHALLENGE: repeated colonoscopy for detecting Crohn's disease (CD) recurrence after surgery is expensive and invasive

AIM: evaluate the accuracy of non-invasive inflammatory biomarkers and imaging for detecting postoperative CD

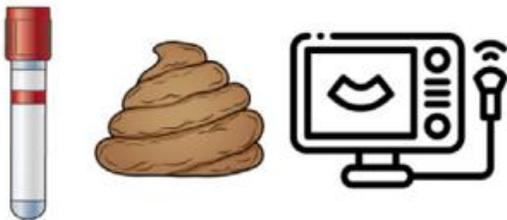


Systematic review



Meta-analysis
(34 studies)

Test	Pooled Sensitivity [95% CI]	Pooled Specificity [95% CI]
C-reactive protein	0.45 [0.33, 0.58]	0.83 [0.69, 0.92]
Fecal calprotectin	0.76 [0.7, 0.82]	0.66 [0.56, 0.75]
CTE or MRE	0.89 [0.73, 0.96]	0.65 [0.43, 0.82]
Intestinal ultrasound (IUS)	0.89 [0.75, 0.96]	0.76 [0.52, 0.90]
Optimized IUS definitions of recurrence	0.93 [0.80, 0.98]	0.85 [0.71, 0.93]



Conclusions: fecal calprotectin <50 µg/g and imaging, including IUS, have high sensitivity for excluding CD recurrence

Clinical Gastroenterology and Hepatology

Does IUS in POR of CD correlate to Rutgeerts?

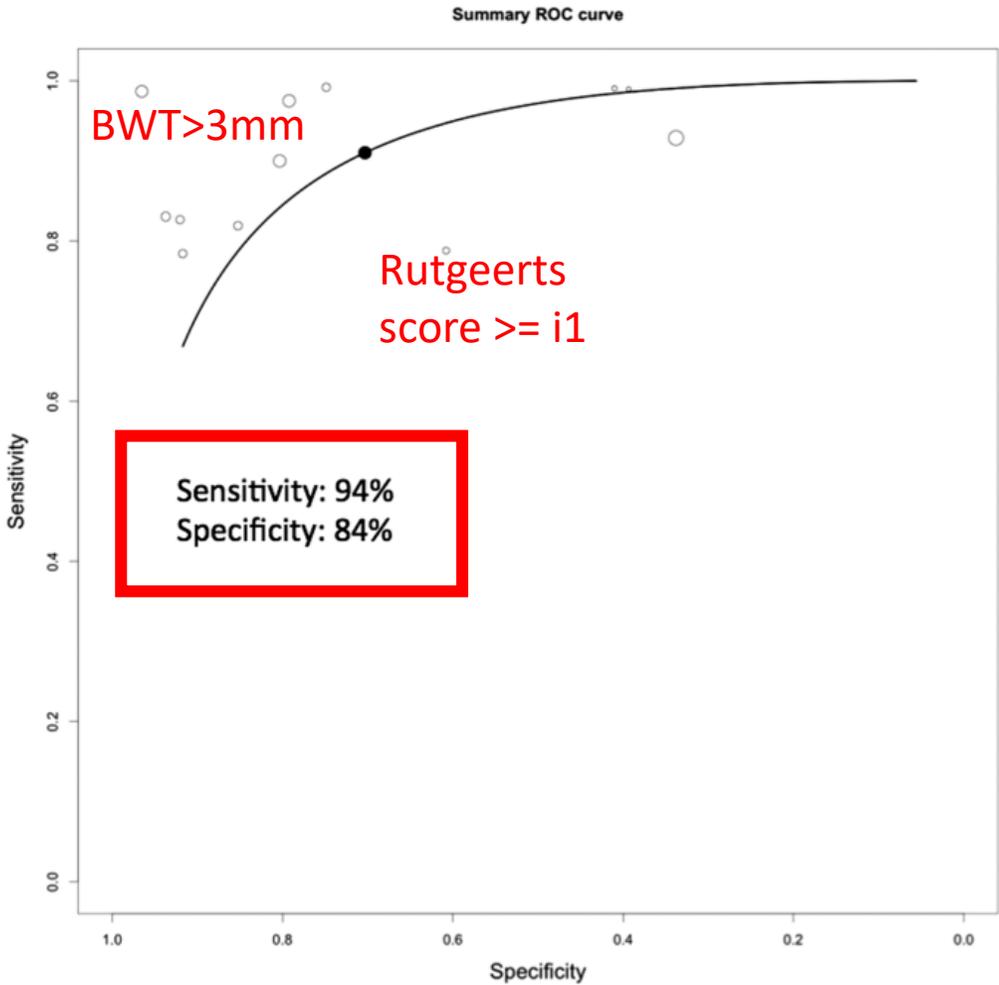


FIGURE 3. Summary receiver operating characteristic plot presenting test performance of US in detecting postsurgical recurrence.



BWT $\geq 5,5$ mm is the best cut-off to predict Rutgeert's score ≥ 3

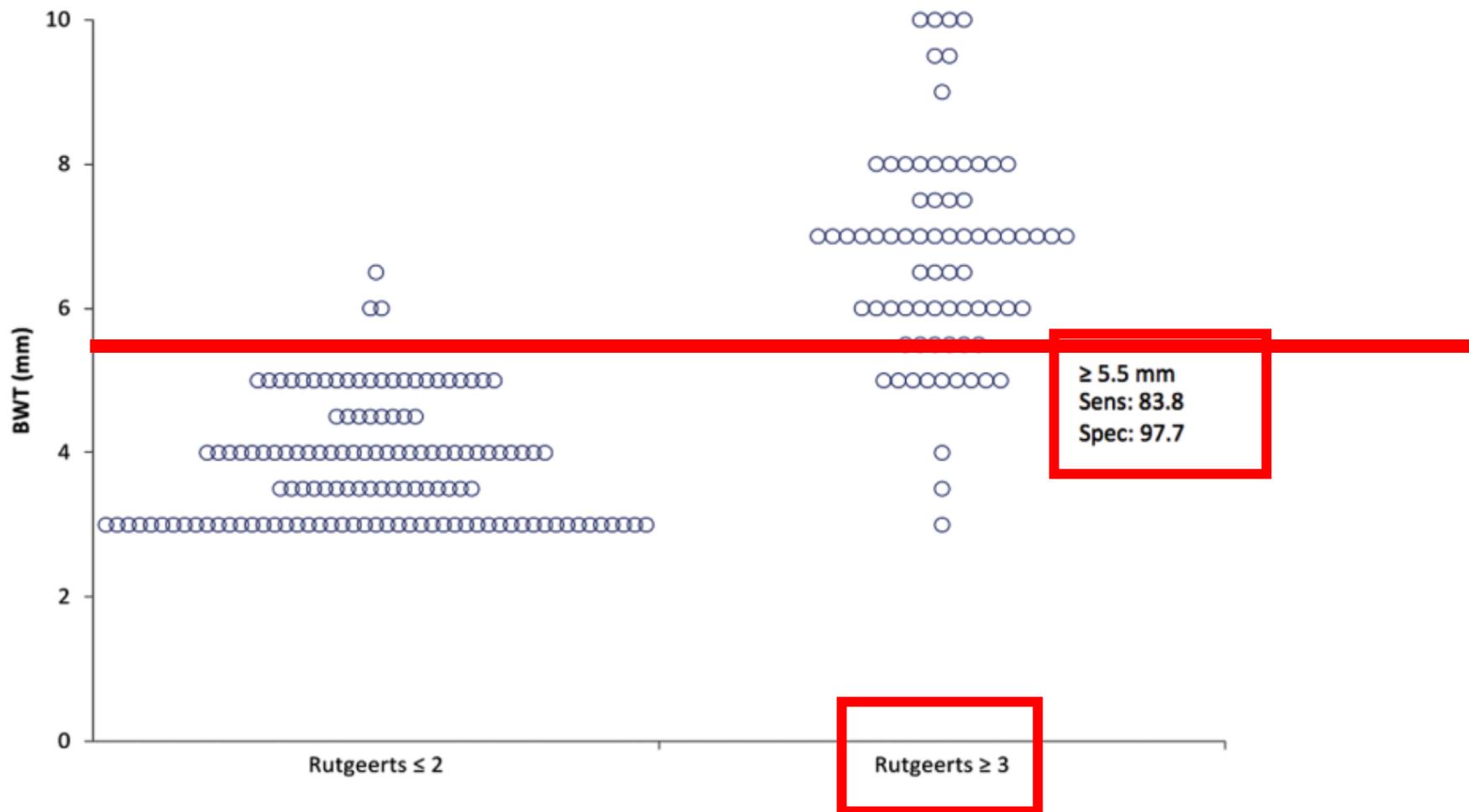


FIGURE 6. Dot diagram for the best cutoff value of bowel wall thickness (BWT) for severe postsurgical recurrence (PSR) (Rutgeerts ≥ 3).

How to do SICUS

- Patient fasting without preparation
- Ingestion of oral macrogol (PEG) at a dose ranging from 125 to 800 mL (usually 375 mL)
- Contrast is observed to flow through the neo-terminal ileum into the colon about 30min after ingestion.
- Assessment of small bowel in caudo-cranial sequence.
- Duration 30–45 min.
- Overall superior sensitivity in the detection of small bowel CD lesions with SICUS



[J Ultrasound](#). 2017 Mar; 20(1): 1–9.

Published online 2017 Jan 2. doi: [10.1007/s40477-016-0230-5](https://doi.org/10.1007/s40477-016-0230-5)

SICUS and CEUS imaging in Crohn's disease: an update

[Giammarco Mucci](#),¹ [Vincenzo Migaleddu](#),² [Francesco Cabras](#),¹ [Danilo Sirigu](#),² [Domenico Scanu](#),² [Giuseppe Virgilio](#),² and [Manuela Marzo](#)^{1,2}

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Advantages SICUS

- Proximal and jejunal lesions
- Multiple stenosis
- Stenosis without prestenotic dilatation might unveil easier
- Even good results for not that experienced sonographers
- No patient discomfort
- Repeatable



[J Ultrasound](#). 2017 Mar; 20(1): 1–9.

Published online 2017 Jan 2. doi: [10.1007/s40477-016-0230-5](https://doi.org/10.1007/s40477-016-0230-5)

SICUS and CEUS imaging in Crohn's disease: an update

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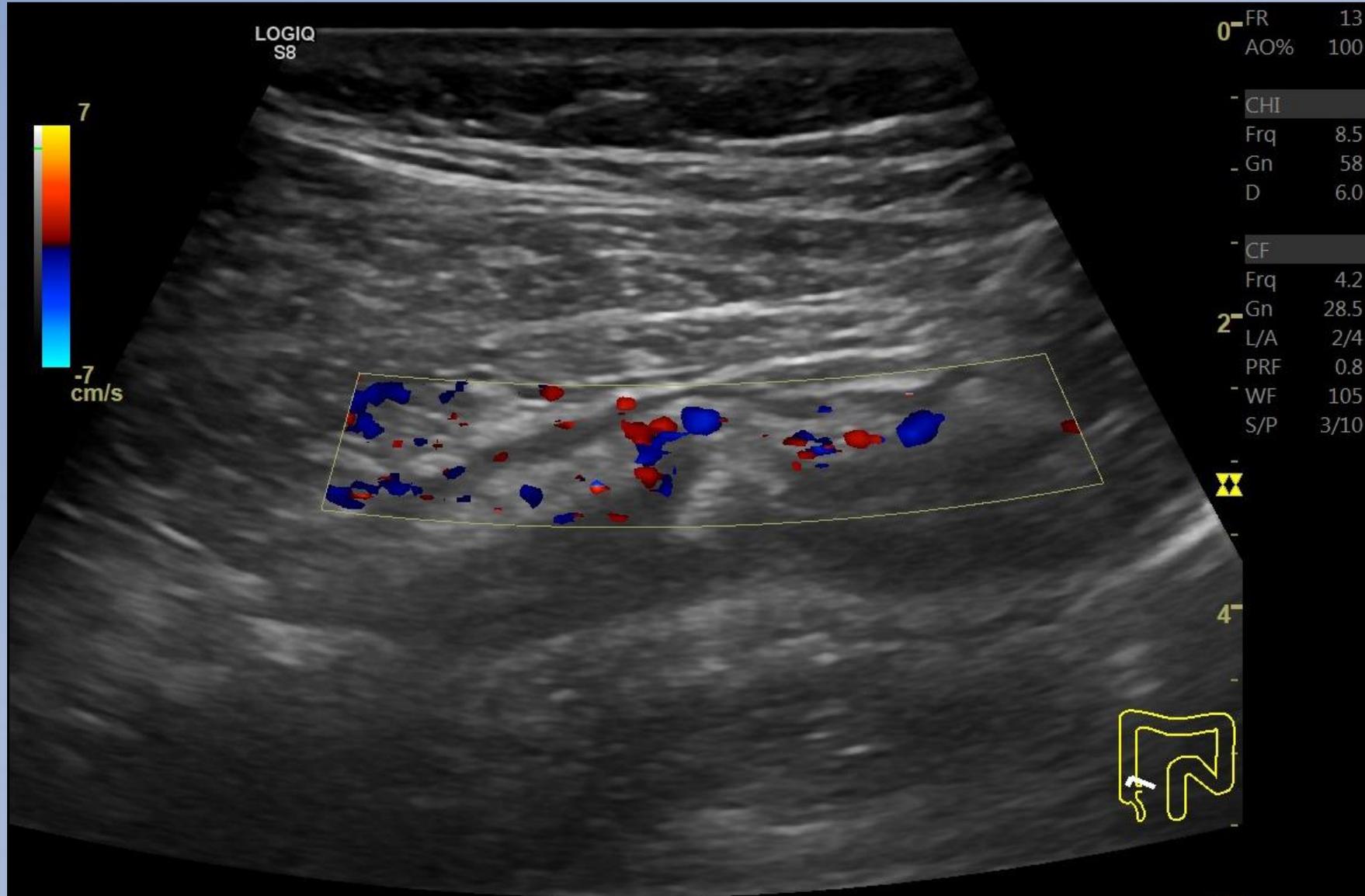


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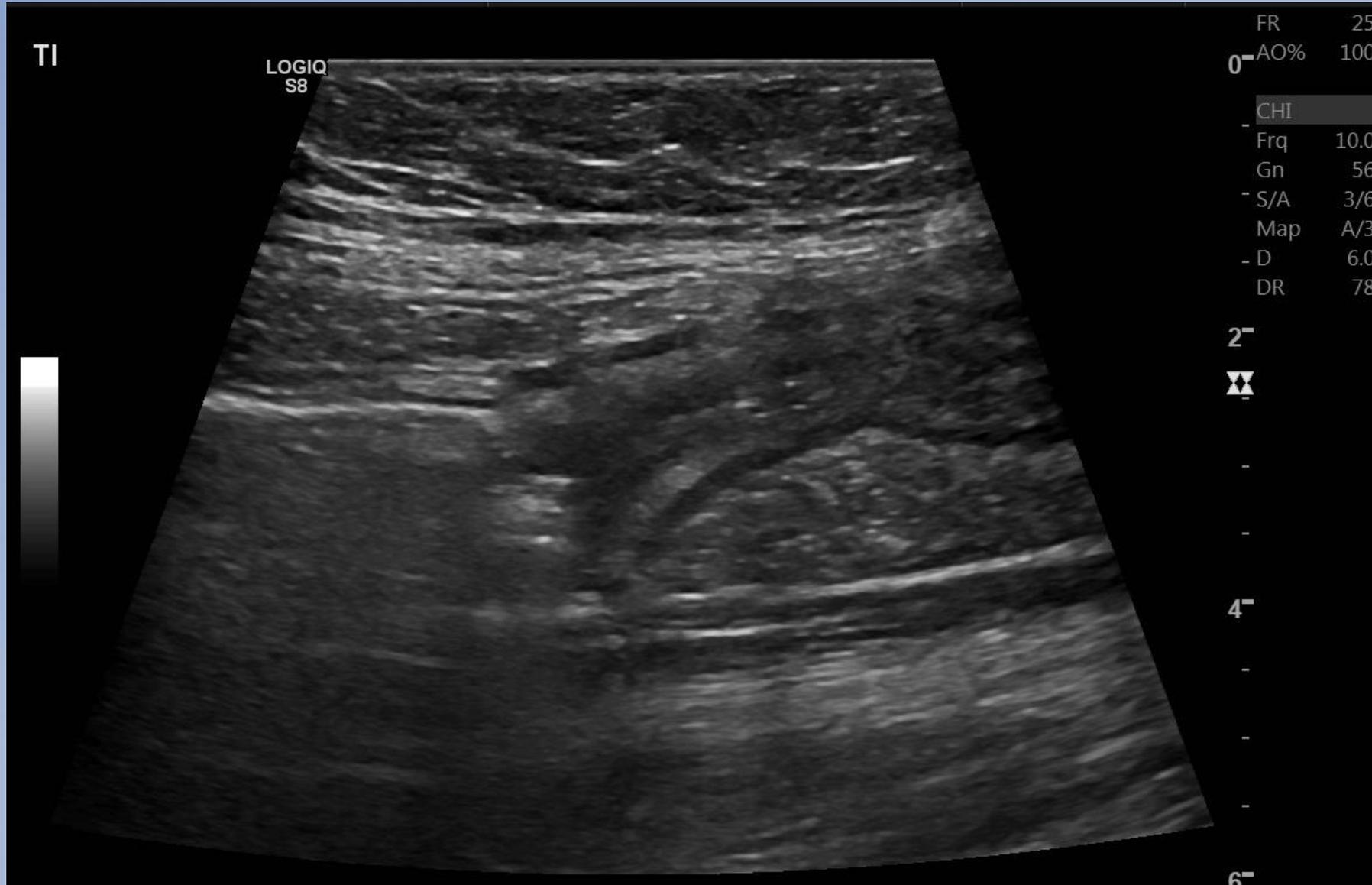
IUS features of POR in CD



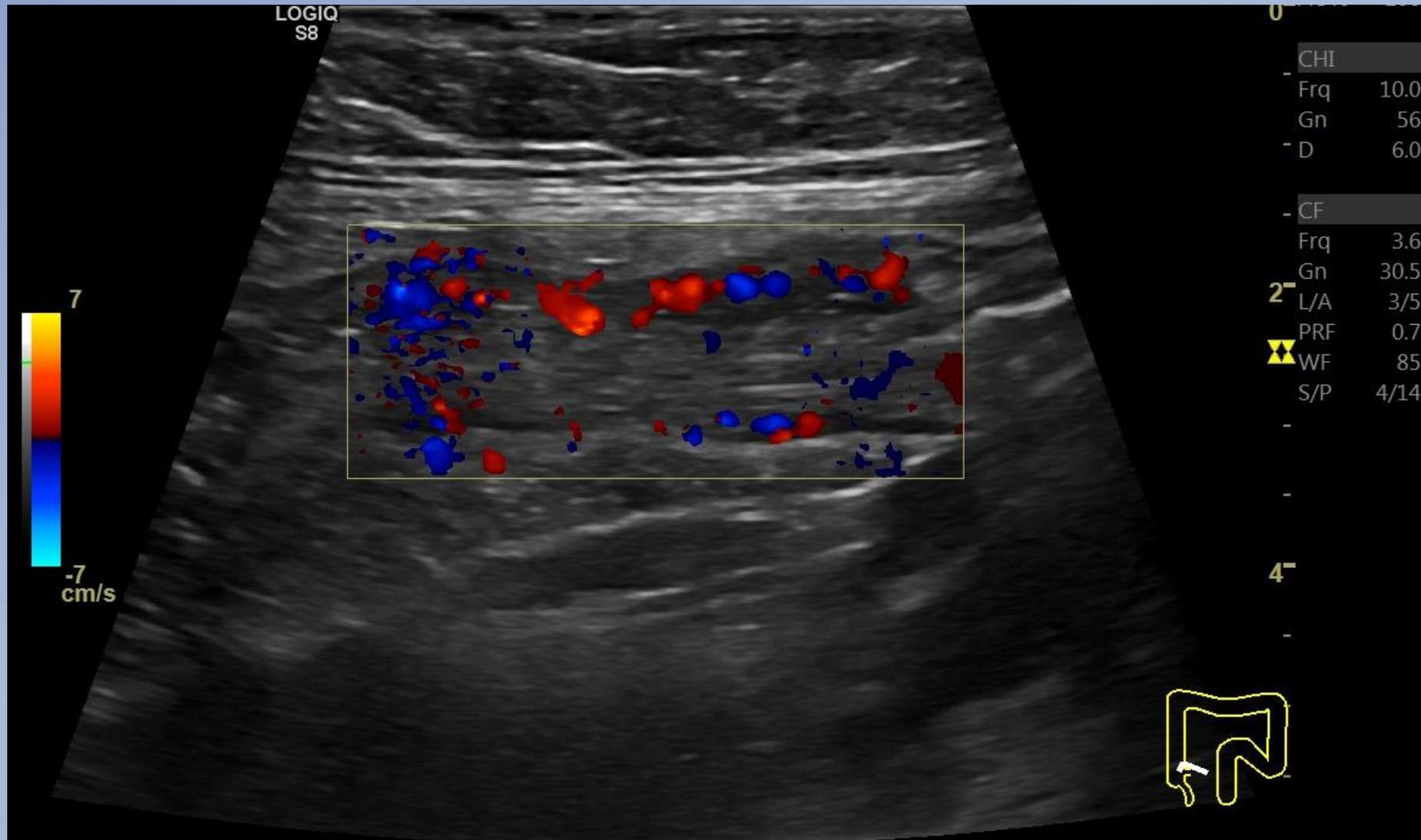
IUS features of POR in CD



IUS features of POR in CD



IUS features of POR in CD



IUS features of POR in CD, Clip w CD



IUS features of POR in CD clip



FR32 AO%100 CHI: Frq8.5 Gn52 S/A:3/4 Map:A/0 D8.0 DR66





Clinical Case POR

Background:

70yo m, 3 operations for ileocecal CD, last 2020. Side to side anastomosis

CT 2021 has difficulties to determine POR.

Endoscopy 2023 difficult and cannot reach anastomosis – cannot determine POR

Patient has daily pain in central abdomen, obstipation.

Patient does not like endoscopy and had not left many stool samples.

Calprotectin 215 march 2024.

Recent lab: Hb 124, CRP 6,6, WBC 11, no thrombocytosis.



Clinical Case POR



GE SUS Gastro 18/11/25 13:07:20 RAITH MI 0.7 TIs 0.1 9L Bowel

LOGIQ S8

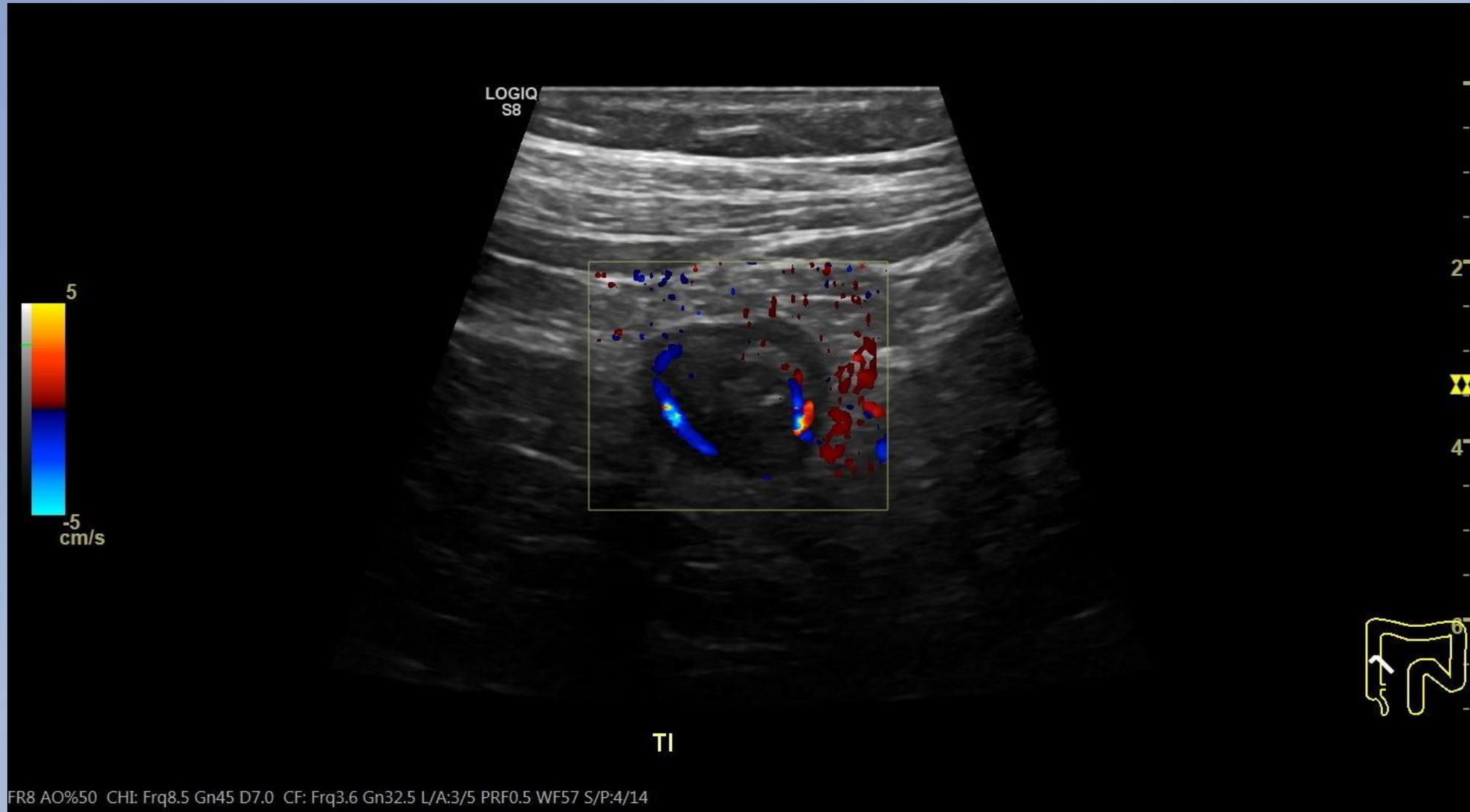
TI

+ L 3.57 cm

FR	25
AO%	50
CHI	
Frq	8.5
Gn	45
S/A	3/6
Map	A/0
D	7.0
DR	69



Clinical Case POR 2



Clinical Case POR



GE SUS Gastro 18/11/25 13:11:19 RAITH MI 0.7 TIs 0.1 9L Bowel

LOGIQ S8

TI CREEPING F

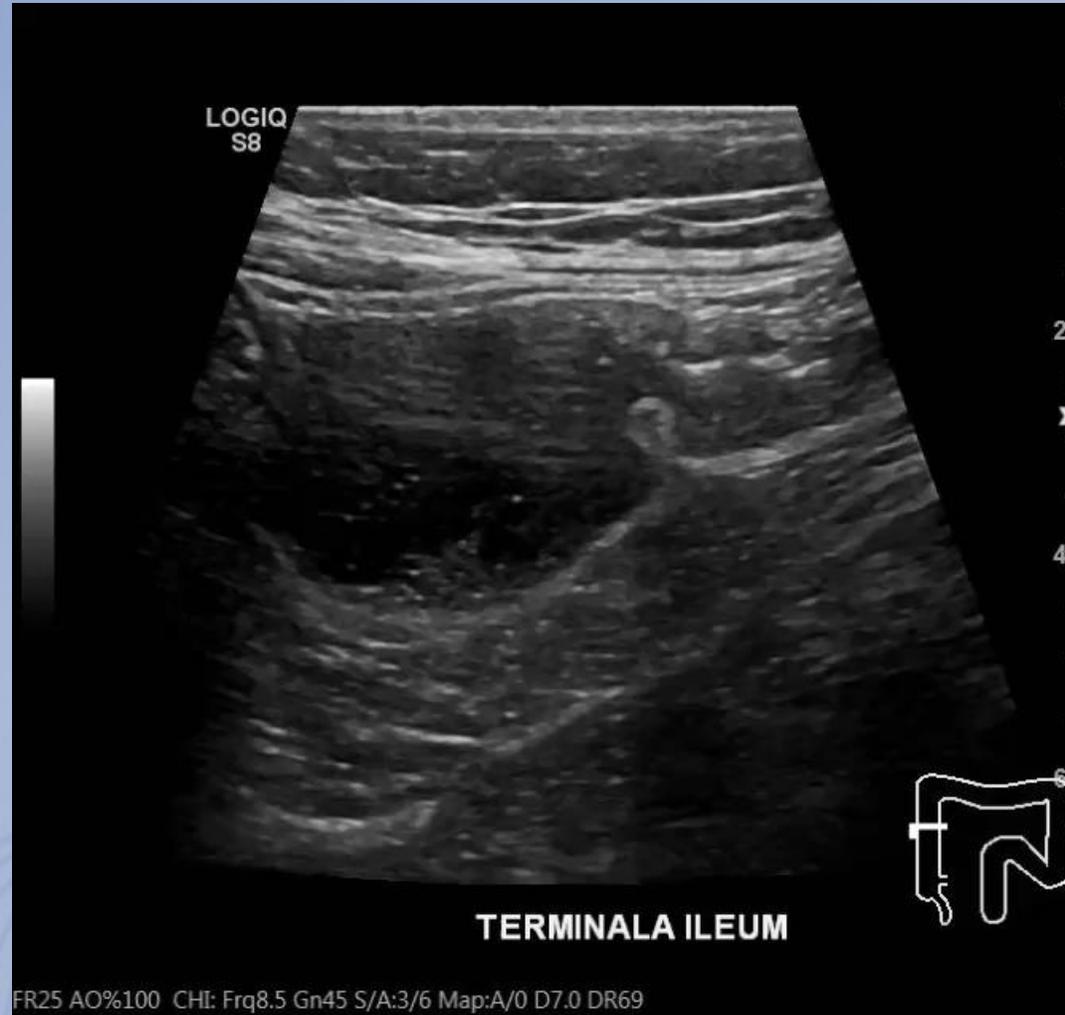
FR	25
AO%	50
CHI	
Frq	8.5
Gn	45
S/A	3/6
Map	A/0
D	7.0
DR	69

2"

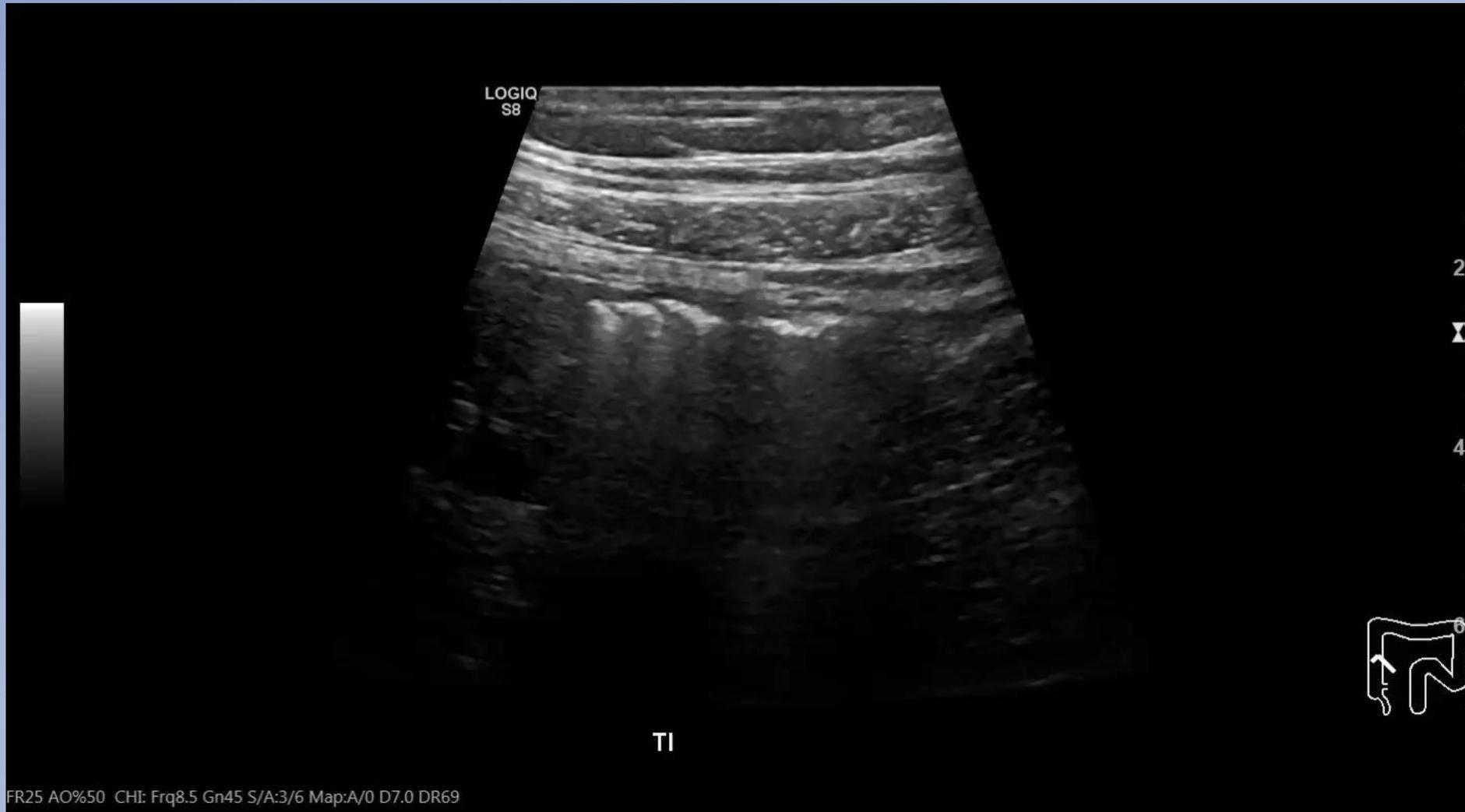
4"



Clinical Case POR video



Clinical Case POR video 2





Clinical Case POR conclusion

Findings:

At the right flank, same height as the umbilicus, there is a about 4cm long segment with bowel wall thickness of 5,6mm, loss of stratification, enhanced color doppler signal, no motility and inflammatory fat. There is a prestenotic dilatation of 3,5cm in diameter with a some back and forth peristalsis.

No lymph nodes, no ascites, normal small bowel with lawn-mower-method.

Conclusion:

Postoperative recurrence.

A BWT above 3 mm correlates to a Rutgeerts score =>1, and =>5,5mm correlates to a Rutgeerts score =>3 (diffusely aphthous inflamed mucosa)

New ultrasound three months after start of treatment escalation.

The patient shows also a liver steatosis and a 5cm parapelve renal cyst.



Interobserver Variation Rutgeerts and BWT

- The reproducibility of the RS was moderate, especially when differentiating $< i_2$ from $\geq i_2$, which may lead to incorrect therapeutic decisions in $>10\%$ of patients
- Inter-observer agreement was almost perfect for BWT (intra-class correlation coefficient [ICC]: 0.96) and substantial for CDS [$\kappa = 0.63$]. Important individual parameters such as BWT and CDS are reliable.

Interobserver Variation Study of the Rutgeerts Score to Assess Endoscopic Recurrence after Surgery for Crohn's Disease FREE

Philippe Marteau, David Laharie, Jean-Frédéric Colombel, Laurence Martin, Hugues Coevoet, Matthieu Allez, Guillaume Cadiot, Arnaud Bourreille, Franck Carbonnel, Yoram Bouhnik ... Show more

Journal of Crohn's and Colitis, Volume 10, Issue 9, September 2016, Pages 1001–1005, <https://doi.org/10.1093/ecco-jcc/jjw082>

A Reliability Study: Strong Inter-Observer Agreement of an Expert Panel for Intestinal Ultrasound in **Ulcerative Colitis**

Floris De Voogd , Rune Wilkens, Krisztina Gecse, Mariangela Allocca, Kerri Novak, Cathy Lu, Geert D'Haens, Christian Maaser

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Research Gaps

Lack of...

- Standardisation and validation of IUS parameters for accurate detection of POR.
- IUS Integration with faecal calprotectin and other biomarkers to enhance diagnostic accuracy and monitoring strategies in POR.

Review Article: Extending the Frontiers of Intestinal Ultrasound Knowledge, Performance and Expansion

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Keypoints and take home messages

- Relocated intestines after surgery can be hard to find! Check all existing cross-sectional imaging modalities to make your examination as smooth as possible
- Knowing which kind of anastomosis to scan, will make it easier.
- IUS has proven to be a sensitive, reliable and repeatable, radiation and side-effect free, non invasive screening modality of postoperative recurrence in CD after 6 (3!) month with a good interobserver agreement.
- SICUS for POR is easily performed, with higher sensitivity and very little patient discomfort. It is especially suited for non-expert sonographers, even helping to discover multiple stenoses and examining the upper thin intestine
- There seems to be a good correlation between BWT and the endoscopic Rutgeerts score.
- A low BWT and normal Calprotectin has a high negative predictive value for POR

Questions?

Thank you for your attention!





Totally empty!!!

Tillmann Raith, IUS after surgery. IBS NORDIC Module
Workshop 12/2025, CP