



international bowel
ULTRASOUND GROUP

IUS in the post-operative scenario: when and what should I see?

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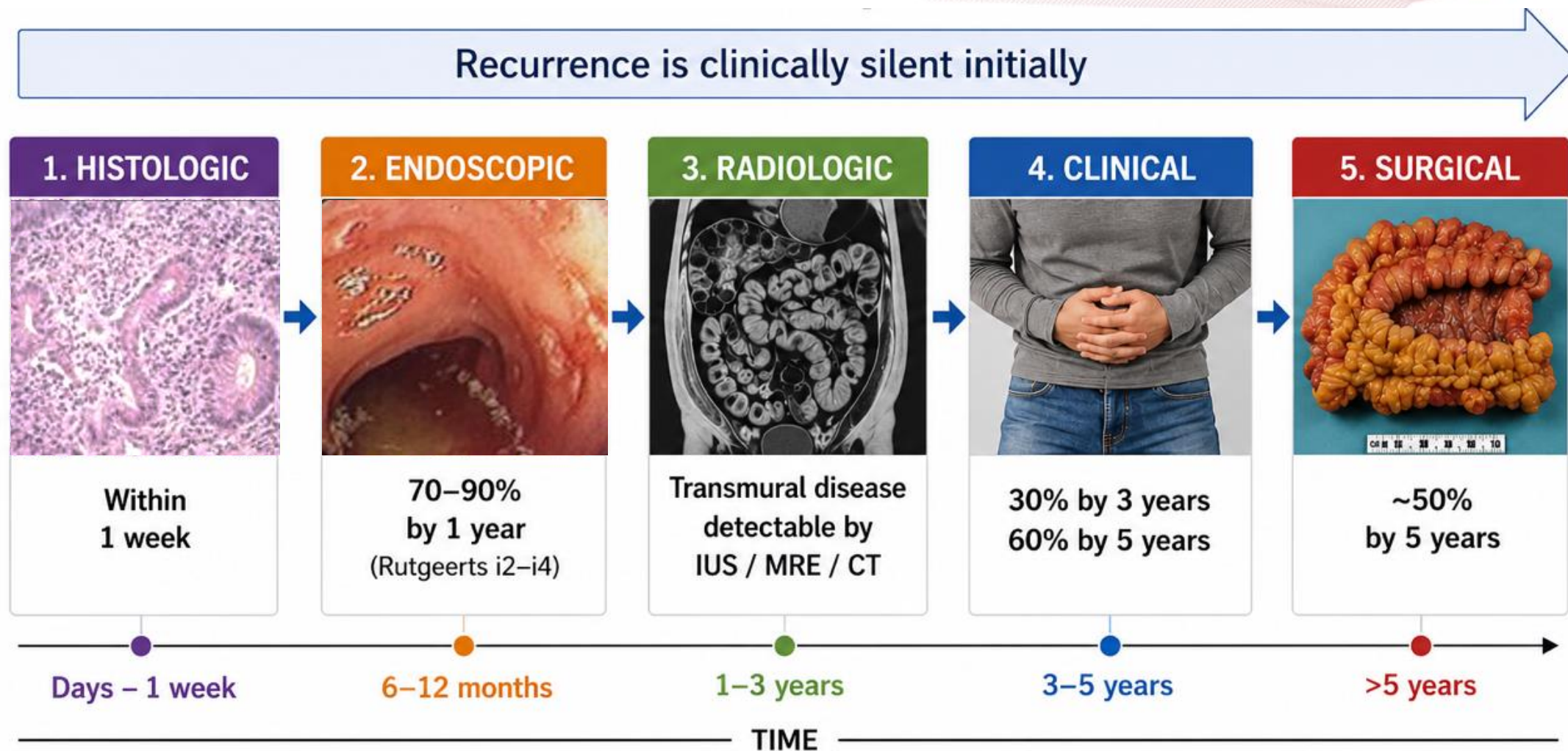
Disclosure

I have received:

- Speaker fees from **Janssen, AbbVie, Pfizer, Galapagos, Tillotts, Alfa Sigma**
- Advisory board/consultancy fees from **Janssen, AbbVie, Pfizer, Galapagos, Takeda, Clario**

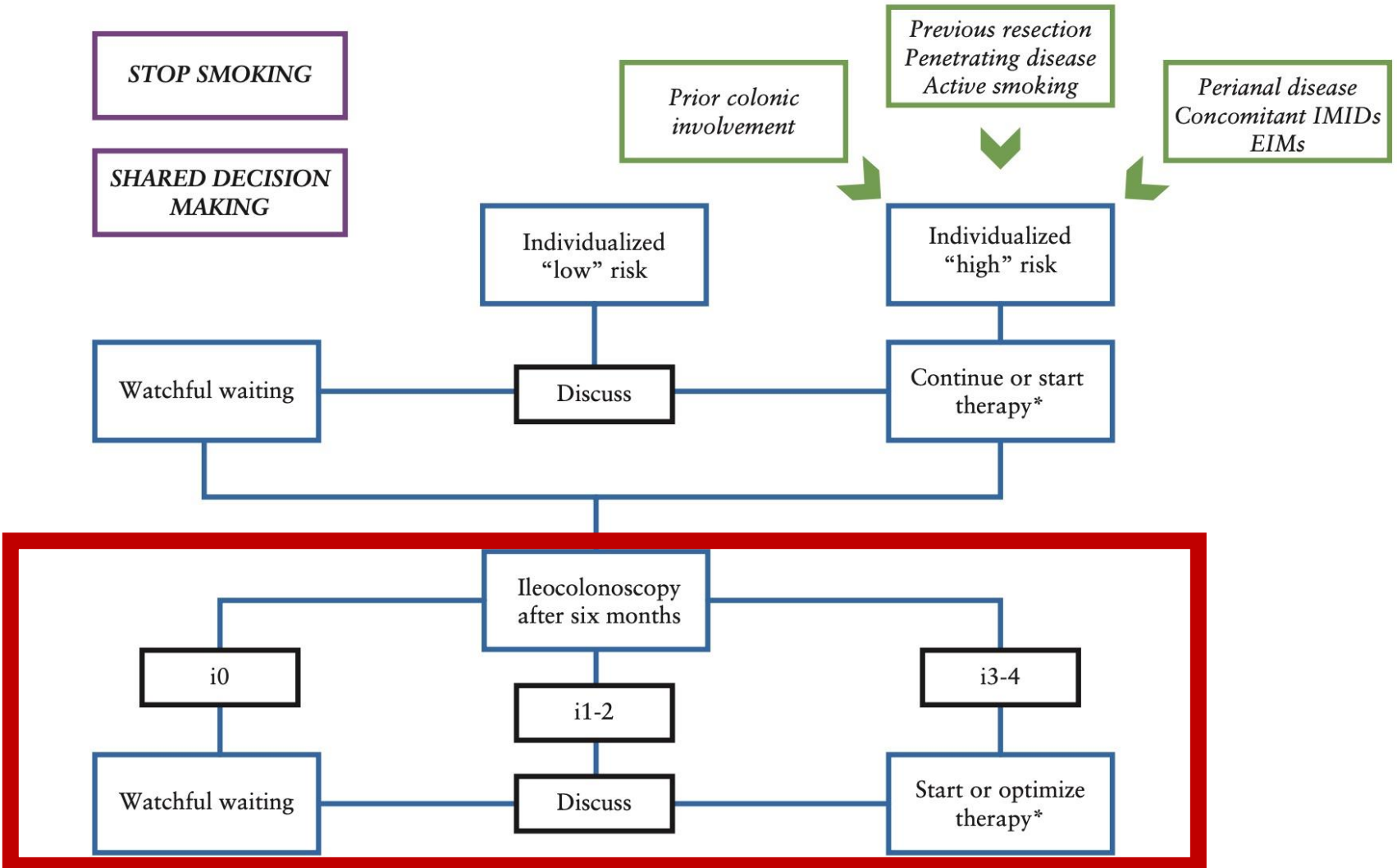


The natural course of postoperative Crohns is recurrence



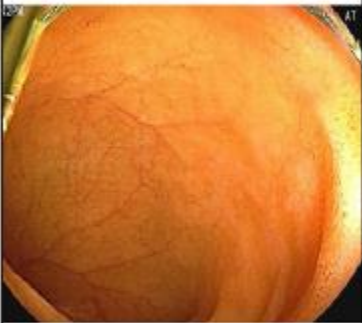
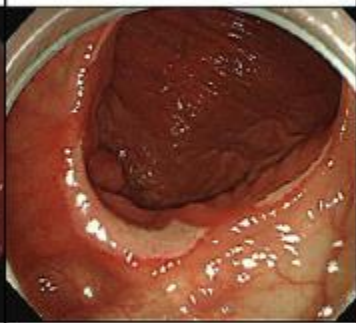
Results of the Eighth Scientific Workshop of ECCO: Prevention and Treatment of Postoperative Recurrence in Patients With Crohn’s Disease Undergoing an Ileocolonic Resection With Ileocolonic Anastomosis

Marc Ferrante^{1,2}, Lieven Pouillon³, Míriam Mañosa^{4,5}, Edoardo Savarino^{6,7}, Matthieu Allez⁸, Christina Kapizioni⁹, Naila Arebi¹⁰, Michele Carvello¹¹, Pär Myrelid¹², Annemarie C. De Vries¹³, the 8th Scientific Workshop of the European Crohns and Colitis Organisation, Pauline Rivière¹⁴, Yves Panis¹⁵, Eugeni Domènech^{4,5}



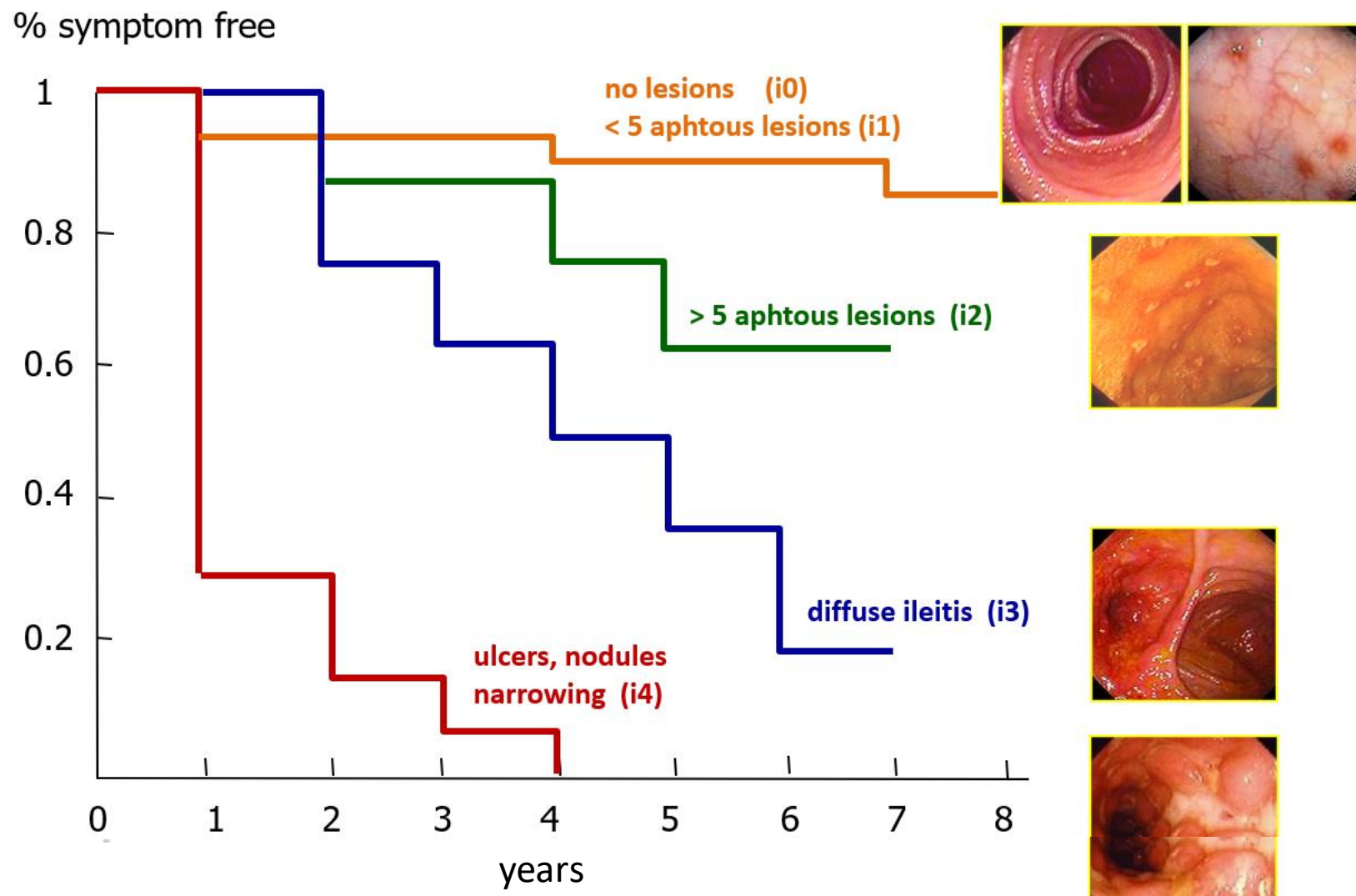


Modified Rutgeert's score

i0	i1	i2		i3	i4
		i2a	i2b		
					
No lesion in distal ileum	≤5 Aphthous lesions	Lesions confined to ileocolonic anastomosis	>5 Aphthous lesions with normal mucosa between the lesions	Diffuse aphthous ileitis with diffusely inflammed mucosa	Diffuse inflammation with already large ulcers and/or narrowing

Ileal and anastomotic lesions graded separately

Symptomatic recurrence according to the severity of endoscopic recurrence at 1-year colonoscopy



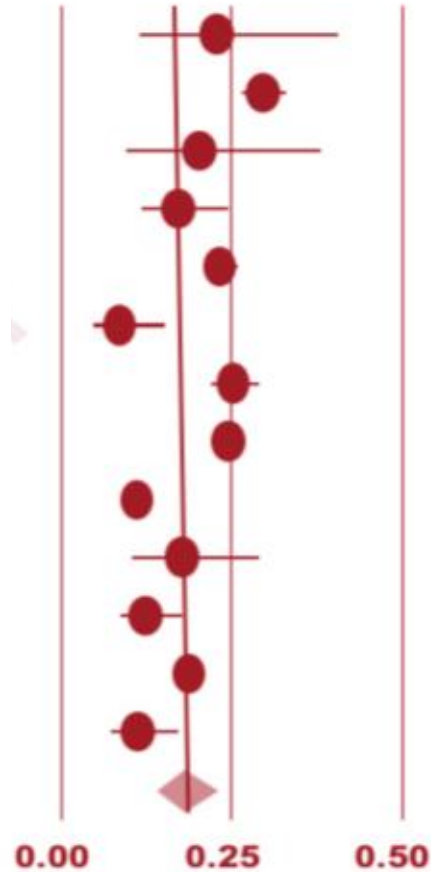


Risk of re-resection after a prior surgery

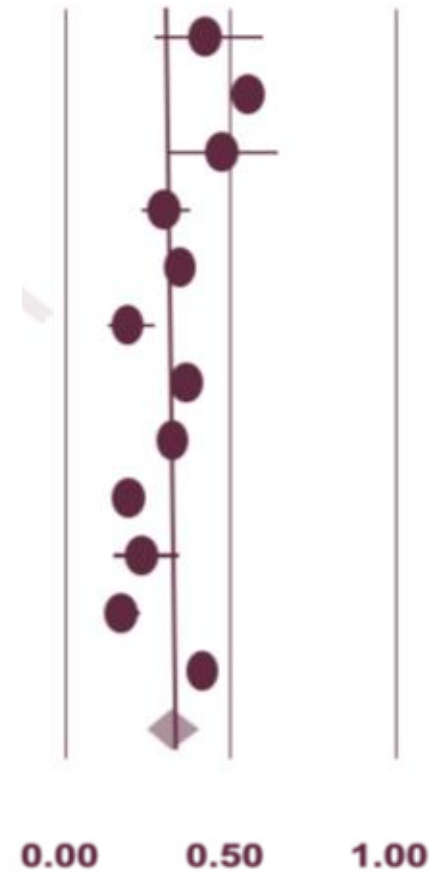
5 years

10 years

O'Keefe 1970-1979
Shinagawa 1982-2002
Burr 1990-1995
Boualit 1988-2004
Nguyen 1988-2008
Burr 1996-2001
Benchimol 1994-2007
Nguyen 1996-2007
Beelen 1991-2015
Vester-Andersen 2003-2004
Burr 2002-2007
Shinagawa 2002-2016
Burr 2008-2013



17.7% (13.5-22.9)



31.3% (24.1-39.6)



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Role of IUS.....



Moderate IOA for IUS, but also for Rutgeerts...

IUS – INTESTINAL ULTRASOUND

Calabrese et al. 2018

Interobserver agreement for individual ultrasound parameters in postoperative Crohn's disease.

Parameter	Kappa (κ)	Interpretation
Bowel wall thickness (BWT)	0.48	Moderate
Bowel wall stratification	0.41	Moderate
Vascularity	0.52	Moderate
Lymph nodes	0.61	Good

Interpretation (Landis & Koch)

< 0.20

Poor

0.21 – 0.40

Fair

0.41 – 0.60

Moderate

0.61 – 0.80

Good

0.81 – 1.00

Excellent

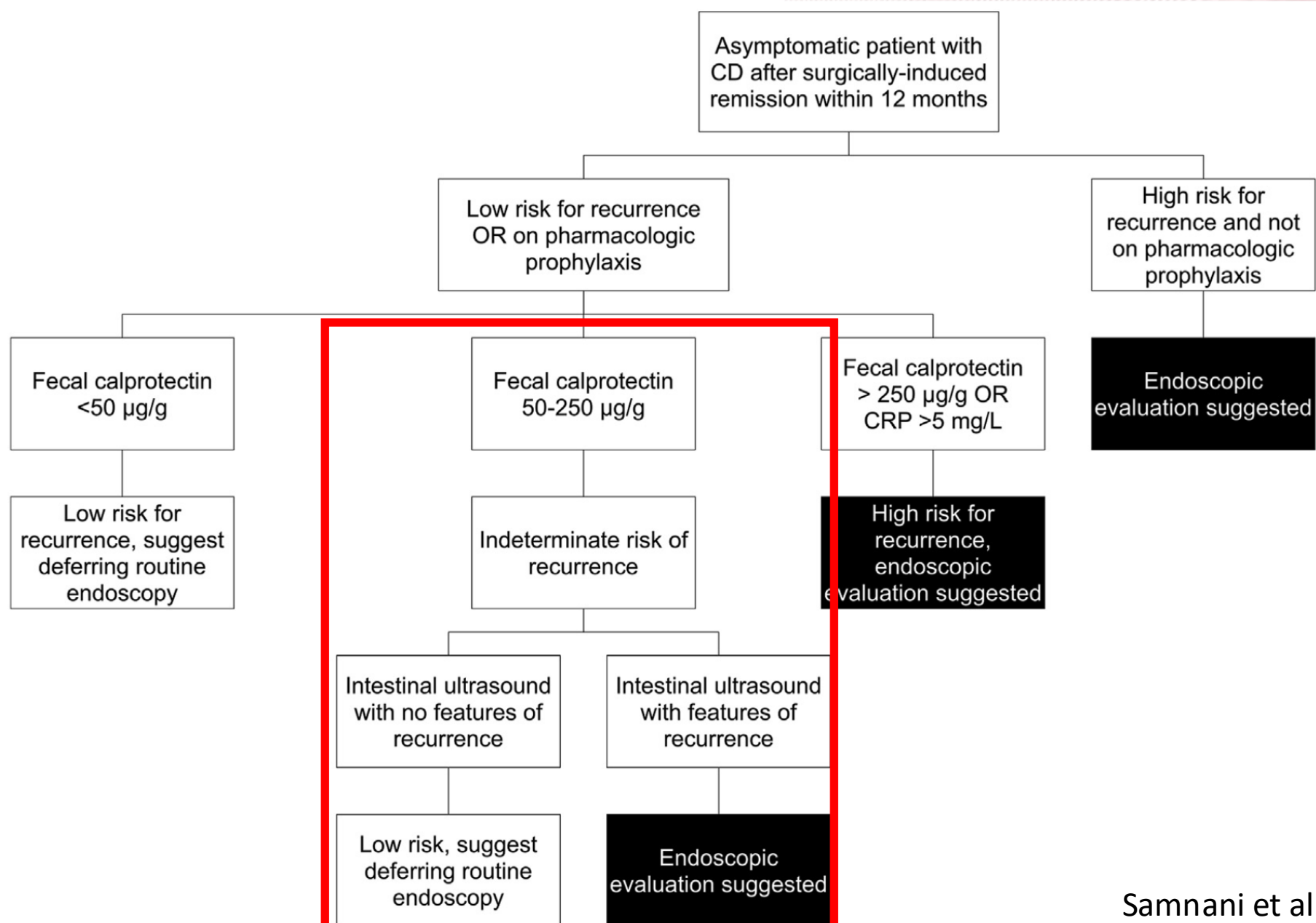
Novak et al. 2021

Expert consensus on interobserver reliability for the first and second assessment of IUS parameters.

Parameter	1st round κ	2nd round κ	p-value
Bowel wall thickness (BWT)	0.96	0.96	n.a.
Bowel wall stratification (BWS)	0.50	0.39	0.120
Doppler signal	0.62	0.60	0.776
Confidence	0.92	0.96	0.005
Activity	0.92	0.96	0.005
Severity	0.97	0.93	0.980

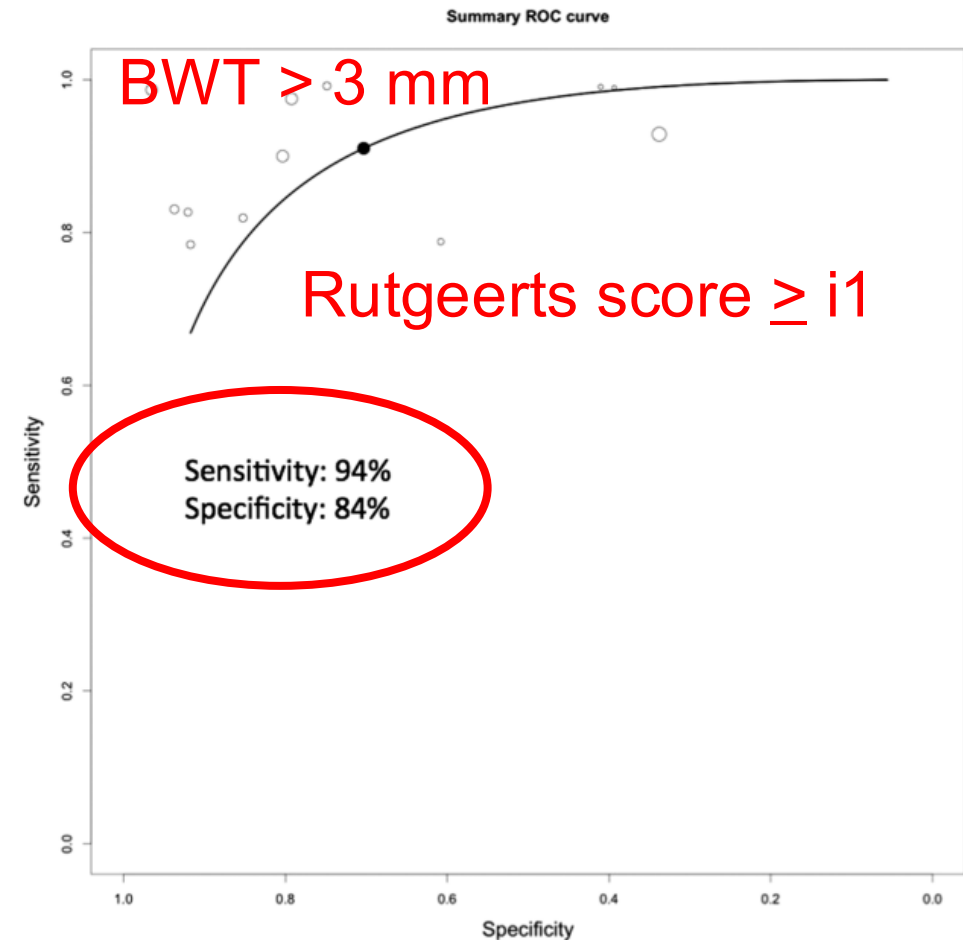
Kappa = weighted Fleiss' kappa, except * intraclass correlation coefficient (ICC) based on a two-way mixed-effects model.

RUTGEERTS – ENDOSCOPY		
Bak et al. Interobserver agreement of postoperative endoscopic recurrence scores and anatomical locations.		
Scores	Weighted κ	95% CI
Modified Rutgeerts Score	0.67	0.59–0.74
REMIND Score	0.46	0.35–0.58
Anastomosis	0.46	0.35–0.58
Neoterminal ileum	0.73	0.65–0.80
Updated Rutgeerts Score	0.69	0.62–0.77
Specific anatomical locations	Weighted κ	95% CI
Ileal blind limb – Body	0.61	0.49–0.73
Ileal blind limb – Inlet	0.63	0.54–0.72
Neoterminal ileum	0.61	0.49–0.74
Colonic blind limb – loop	0.83	0.62–1.04
Ileal blind limb – loop	0.68	0.47–0.89
CI = Confidence interval		

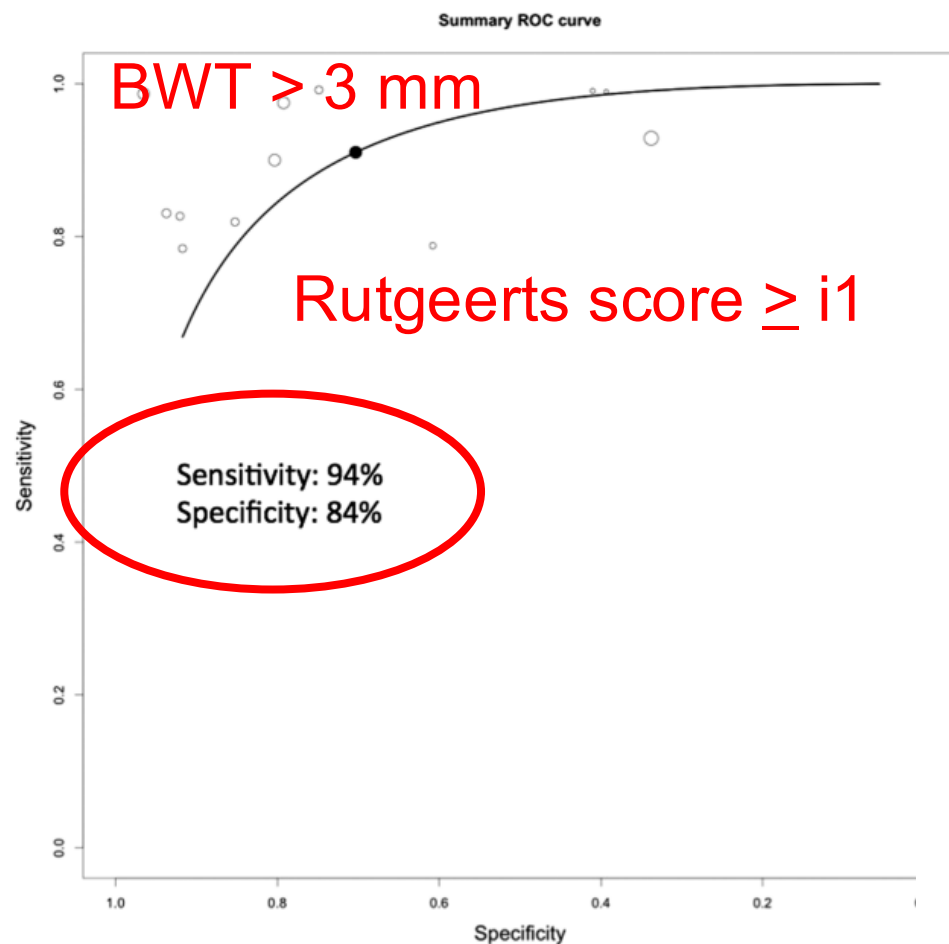




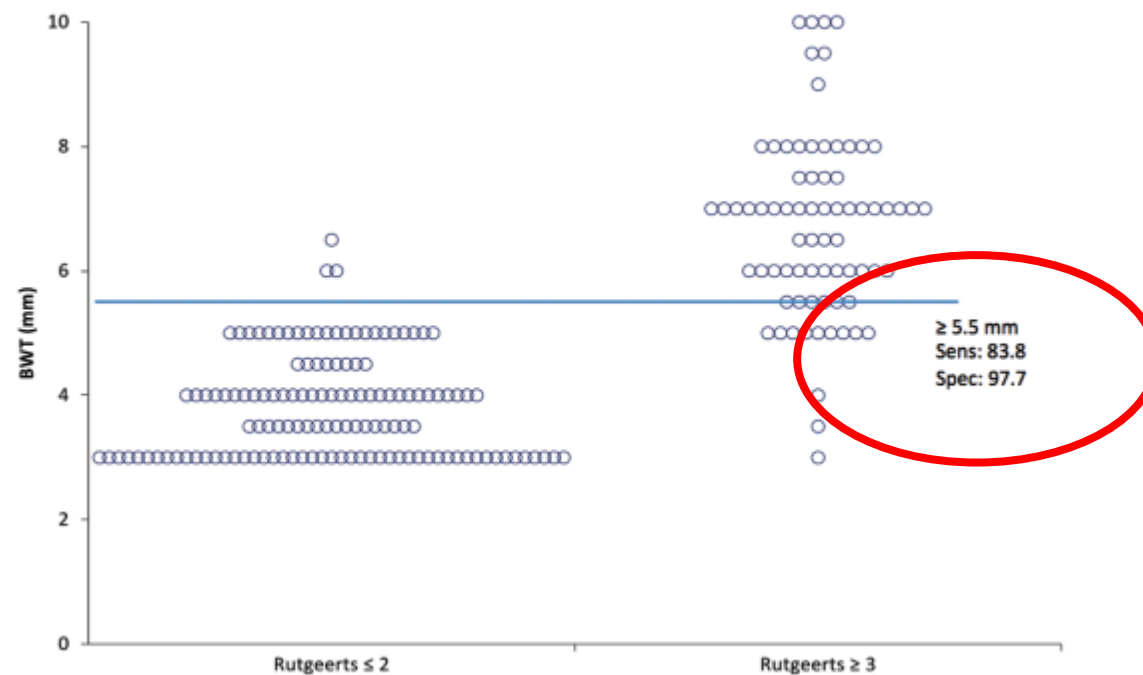
IUS has a diagnostic accuracy of
90% in detecting POR: results
from a Systematic review with
Meta-analysis



IUS has a diagnostic accuracy of 90% in detecting POR: results from a Systematic review with Meta-analysis



BWT $\geq$ 5.5 mm is the best cut-off to predict Rutgeerts score i3-i4



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}

Combination of IUS + FC vs ileocolonoscopy
91 patients; Post op recurrence in 66%

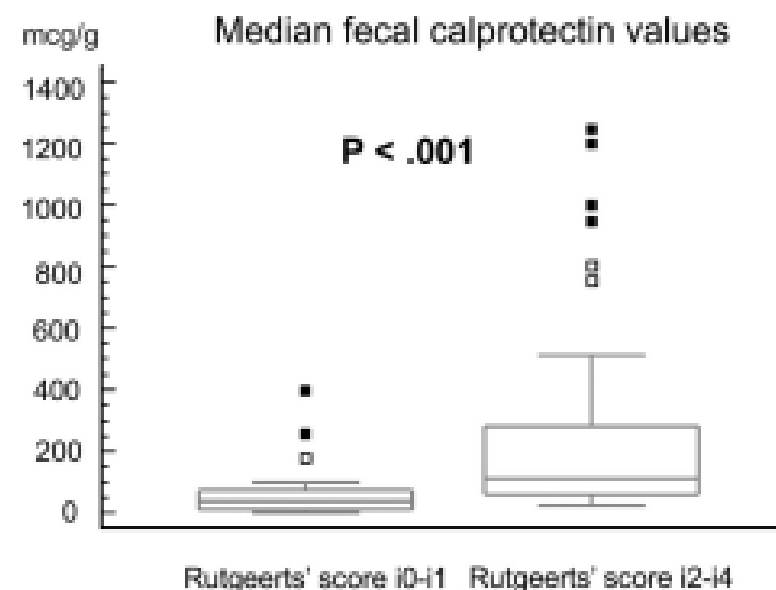
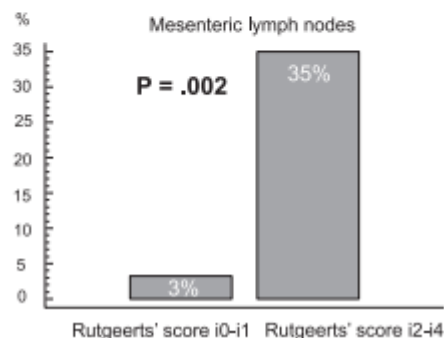
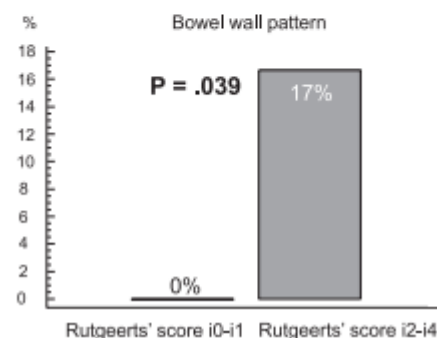
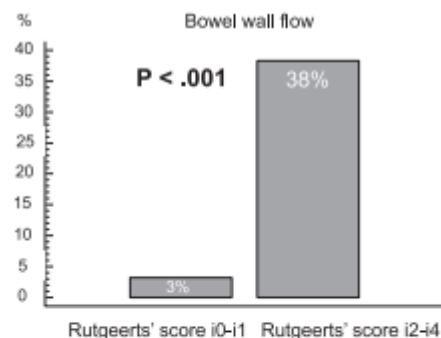
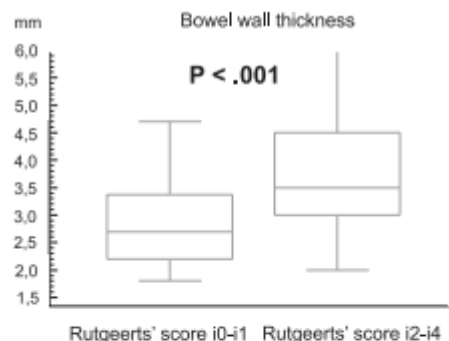
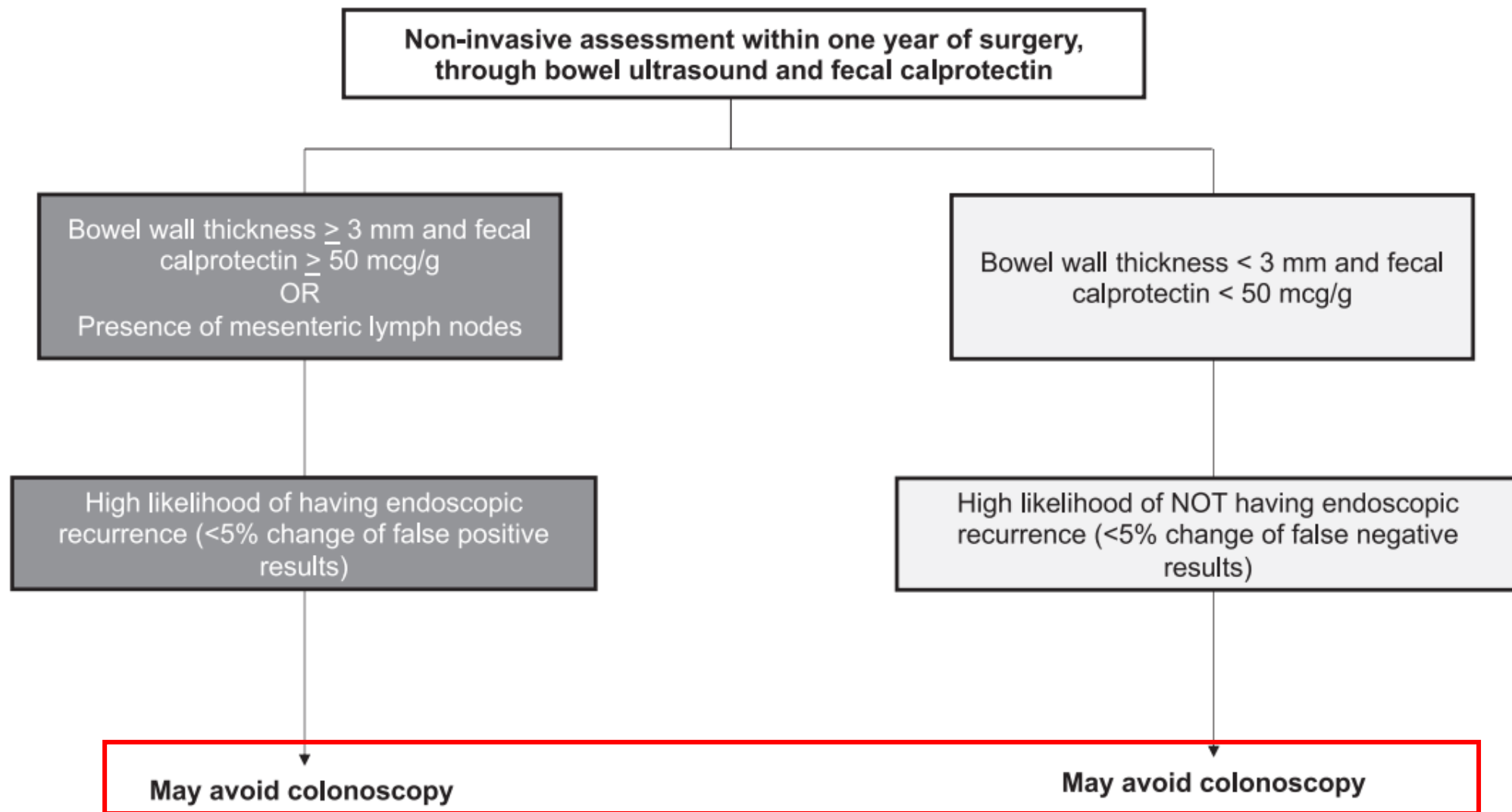




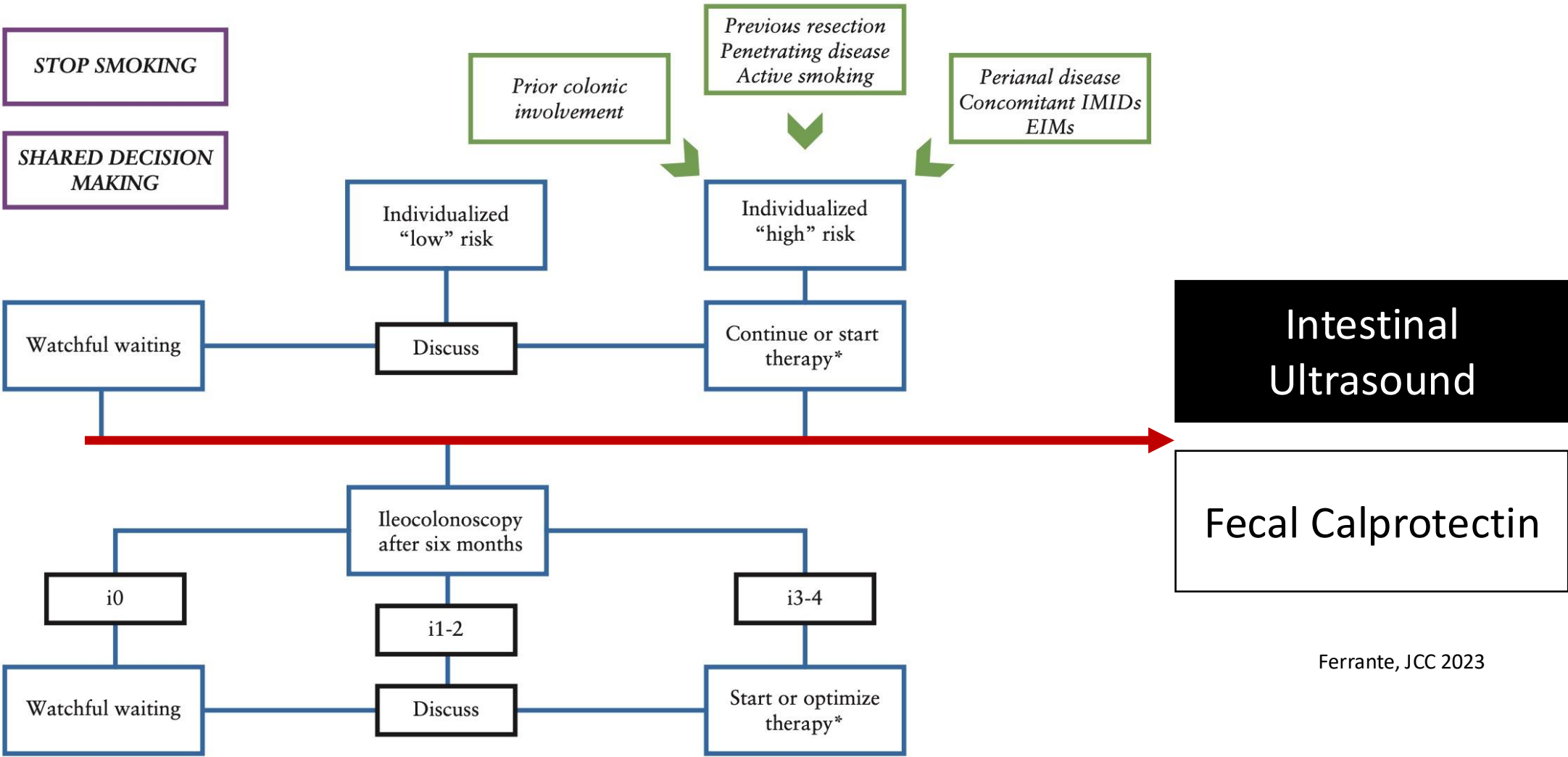
Table 2. Relationship Between Noninvasive Parameters and Endoscopic Recurrence

Parameters	Univariable analysis		Multivariable analysis	
	OR (95% CI)	<i>P</i>	OR (95% CI)	<i>P</i>
BWT (per 1-mm increase)	2.66 (1.49–4.72)	< .001	2.43 (1.21–4.89)	.012
BWF	18.64 (2.37–146.20)	.005	–	–
BWP (hypoechoic/lost)	6.00 (0.73–49.23)	.095	–	–
Mesenteric lymph nodes	16.15 (2.05–126.97)	.008	15.63 (1.48–164.54)	.022
Mesenteric hypertrophy	7.50 (0.92–60.66)	.058	–	–
HBI > 4	3.42 (0.90–12.99)	.069	–	–
CRP ≥ 5 mg/L	3.50 (1.07–11.37)	.037	–	–
FC (per 1 mcg/g increase)	1.00 (1.00–1.01)	.007	–	–
FC ≥ 50 mcg/g	8.60 (2.99–24.70)	< .001	8.58 (2.45–29.99)	< .001



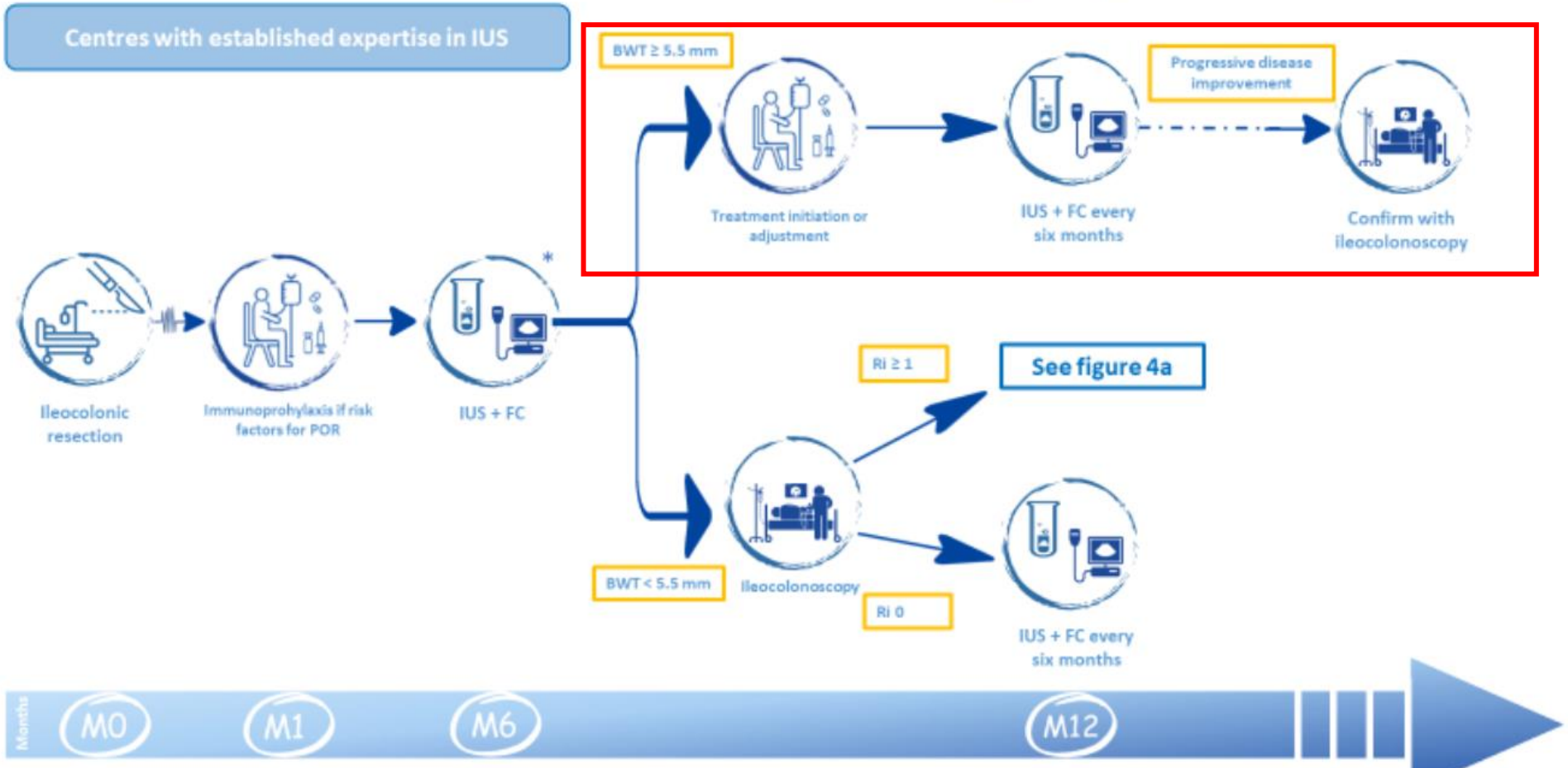
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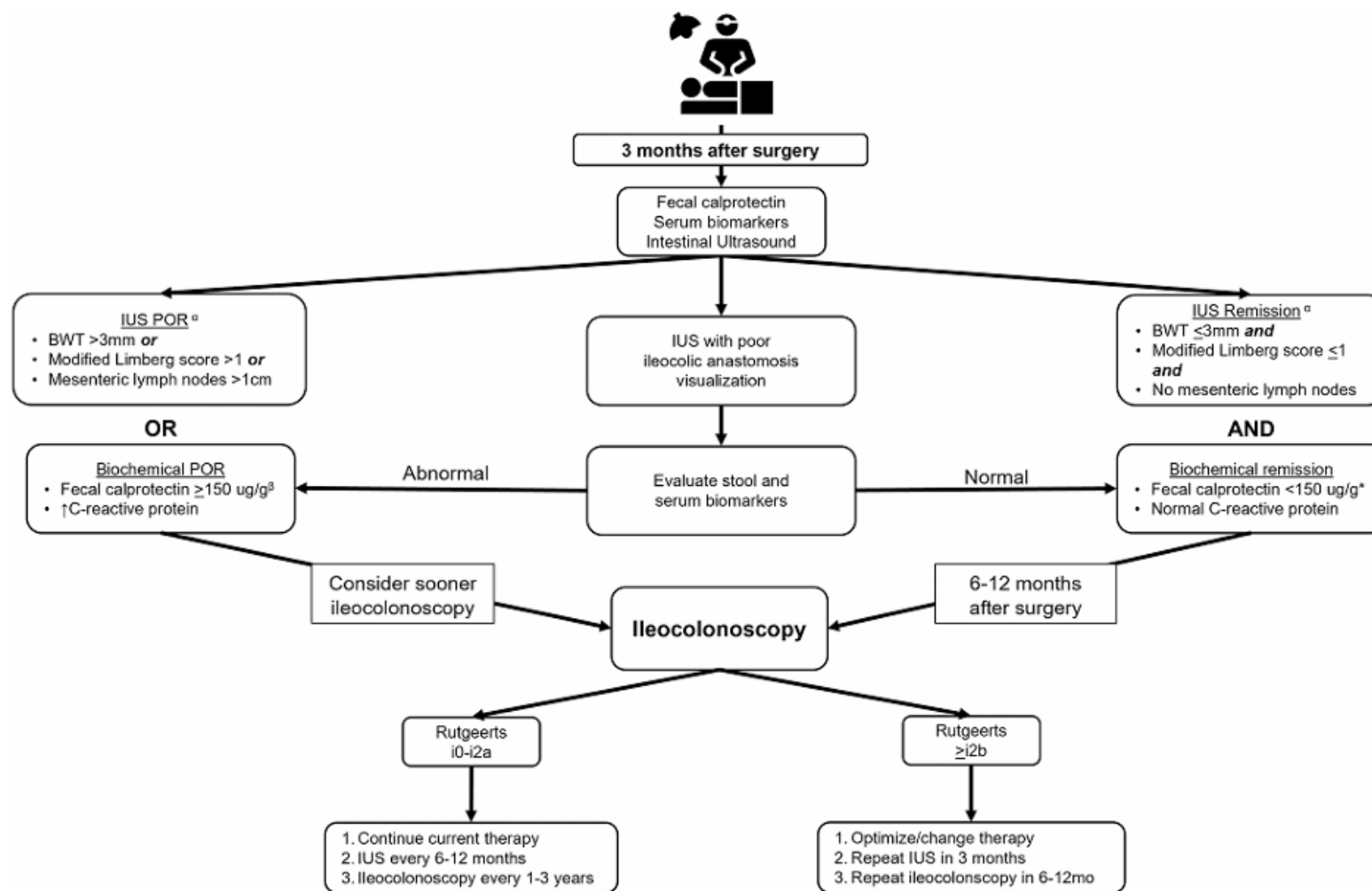
Results of the Eighth Scientific Workshop of ECCO: Diagnosing Postoperative Recurrence of Crohn's Disease After an Ileocolonic Resection With Ileocolonic Anastomosis

Gabriele Dragoni,^{a,b} Mariangela Allocca,^c Pär Myrelid,^d Nurulamin M. Noor,^e Nassim Hammoudi,^f the Eighth Scientific Workshop of the European Crohn's and Colitis Organisation, Pauline Rivière,^g Yves Panis,^h Marc Ferrante^{i,j}





State-of the art practice is to evaluate early and use non invasive tools



IUS, intestinal ultrasound; BWT, bowel wall thickness; CDS, color doppler signal

^aBowel wall measurements taken at the ileocolic anastomosis and neo-terminal ileum, which is measured ≥1cm proximal to ileocolic anastomosis)

³Thams, et al. Therap Adv Gastroenterol. 2018

Figure 5. Algorithm for monitoring postoperative Crohn's disease incorporating intestinal ultrasound (IUS). BWT, bowel wall thickness; POR, postoperative recurrence

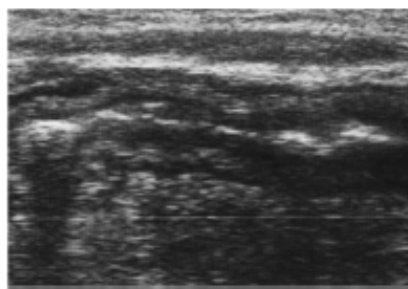


GIUS and SICUS for post-operative recurrence

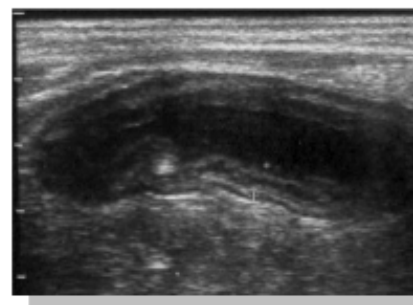
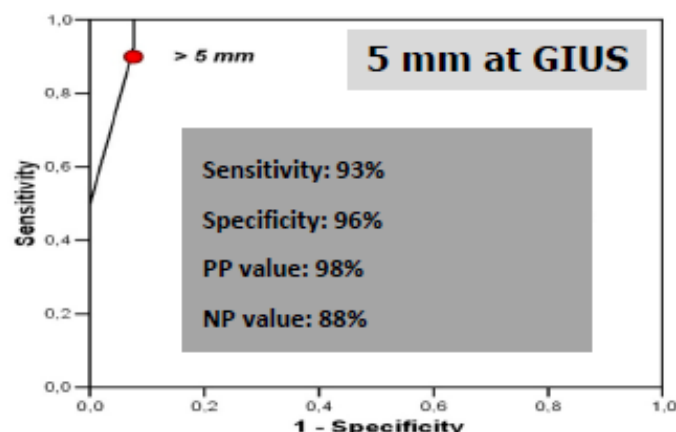
Diagnosis

	SENSITIVITY	SPECIFICITY
US	77% (95% I.C. 54-92)	94% (95% I.C. 73-99)
SICUS	82% (95% I.C. 54-94)	94% (95% I.C. 73-99)

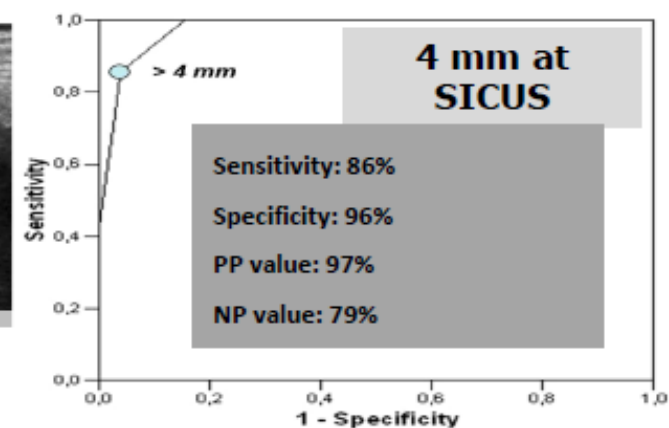
Grading (Rutgeert's score: 0-2 vs 3-4)



GIUS



SICUS





US Techniques and Diagnostic Accuracy

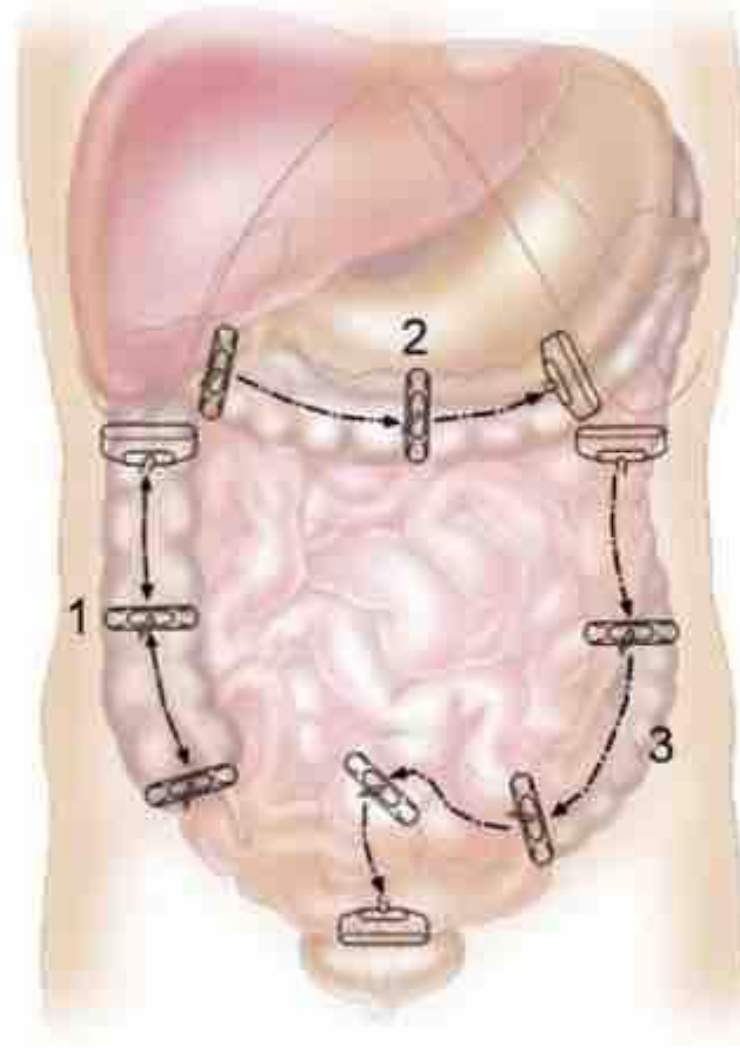


Color Doppler and CEUS

	Parietal thickness of the neoterminal ileum > 3 mm and/or Doppler positive	Contrast-enhanced of the neoterminal ileum > 34.5%
Positive true	44	48
False positive	2	2
Negative true	9	9
False negative	5	1
Sensitivity (95% CI)	89.8% (78.2–95.6)	98.0% (89.3–99.6)
Specificity (95% CI)	81.8% (52.3–94.9)	81.8% (52.3–94.5)
PPV (95% CI)	95.7% (85.5–98.8)	96.0% (86.5–98.9)
NPV (95% CI)	64.3% (38.8–83.7)	90.0% (59.6–98.2)



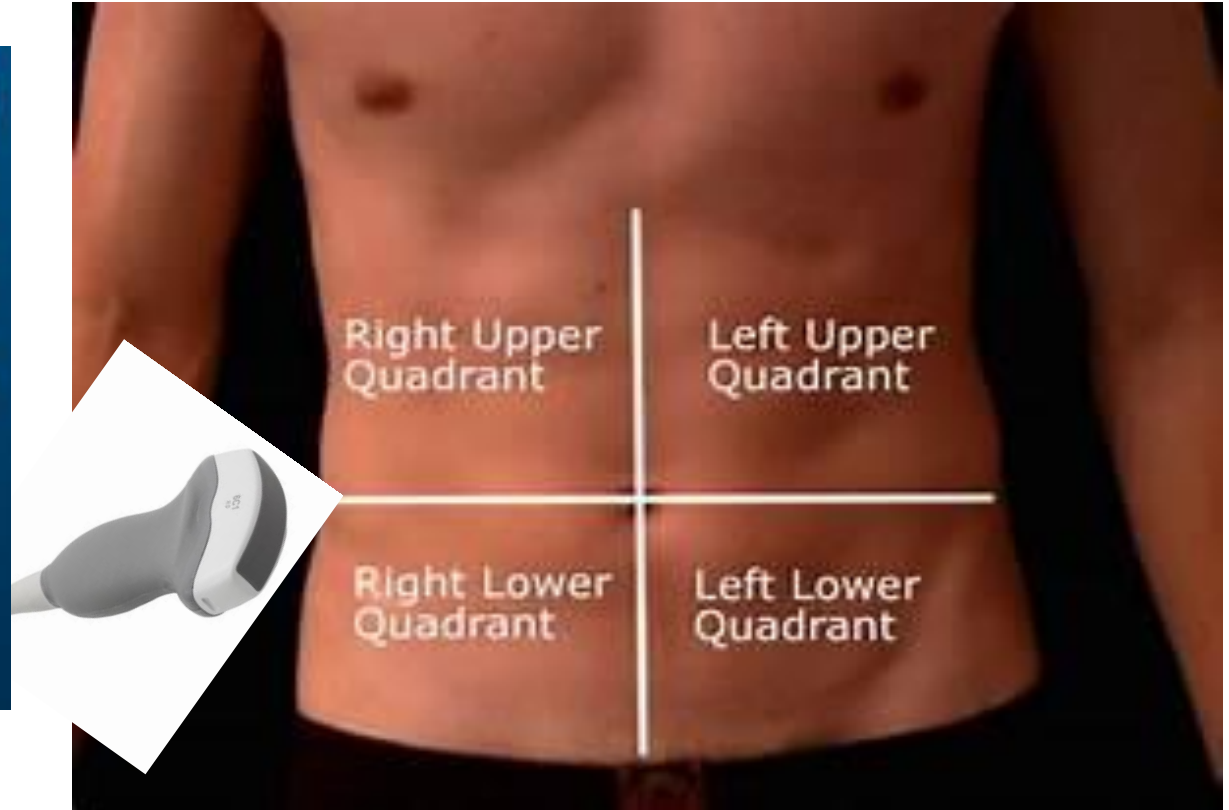
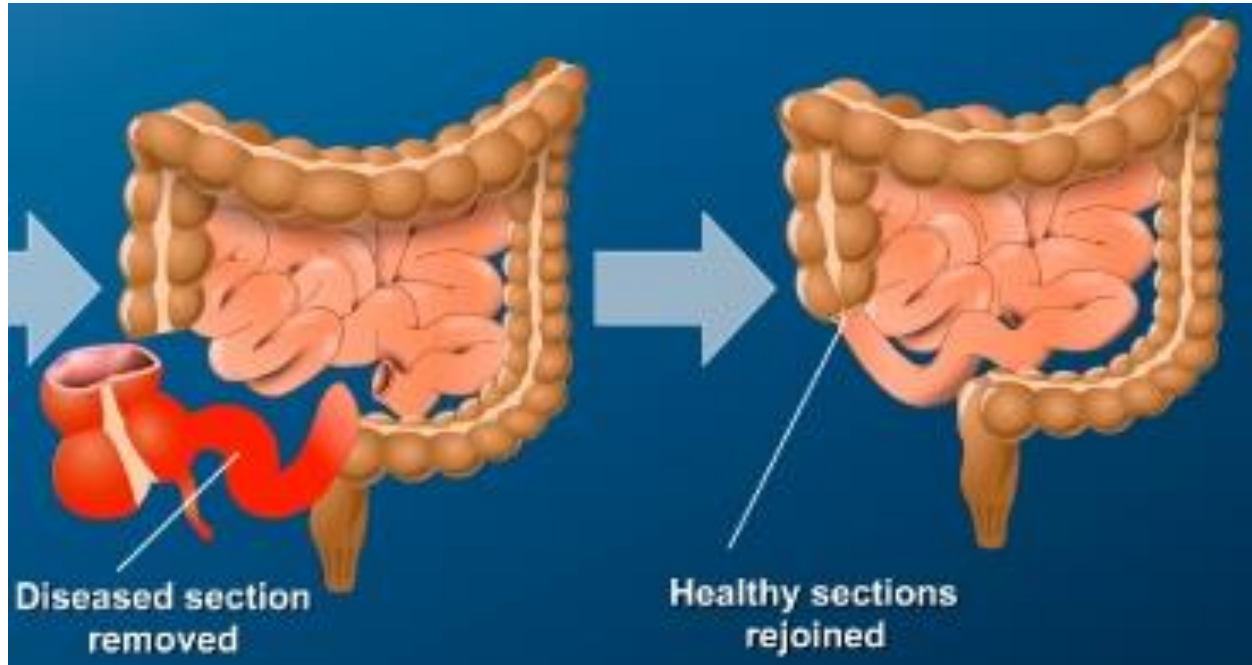
Scanning





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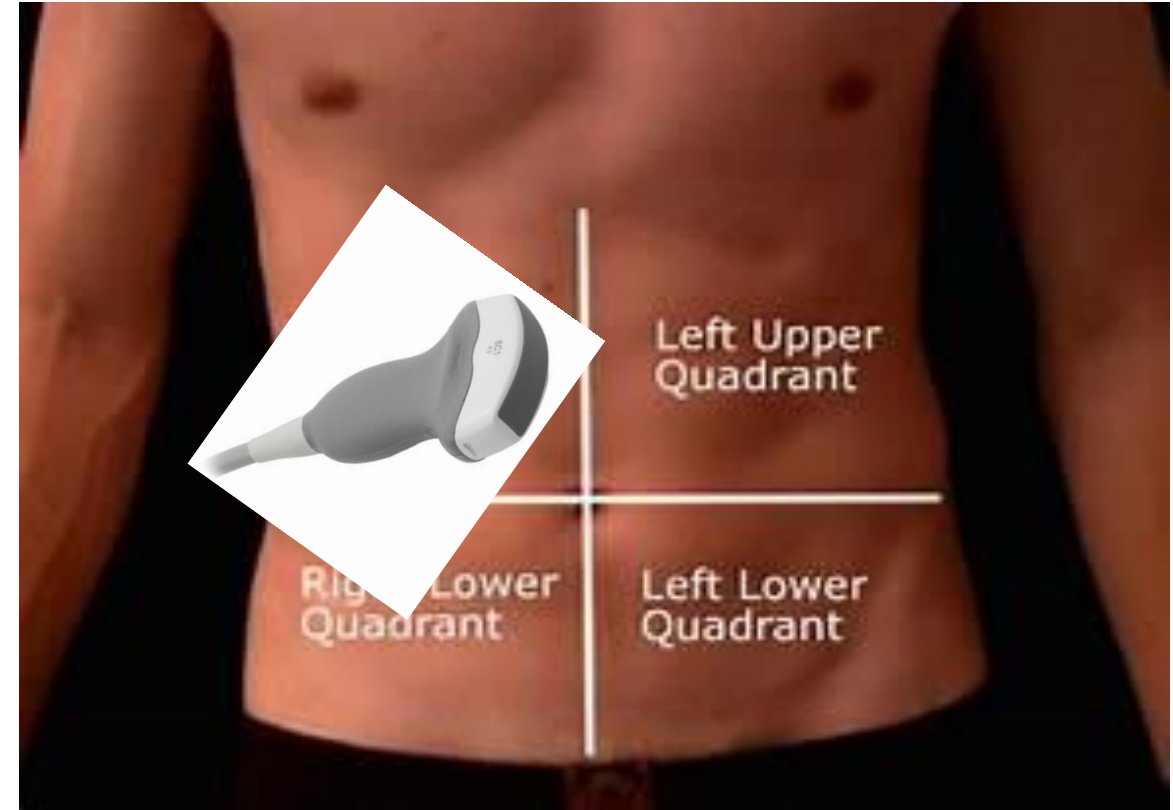
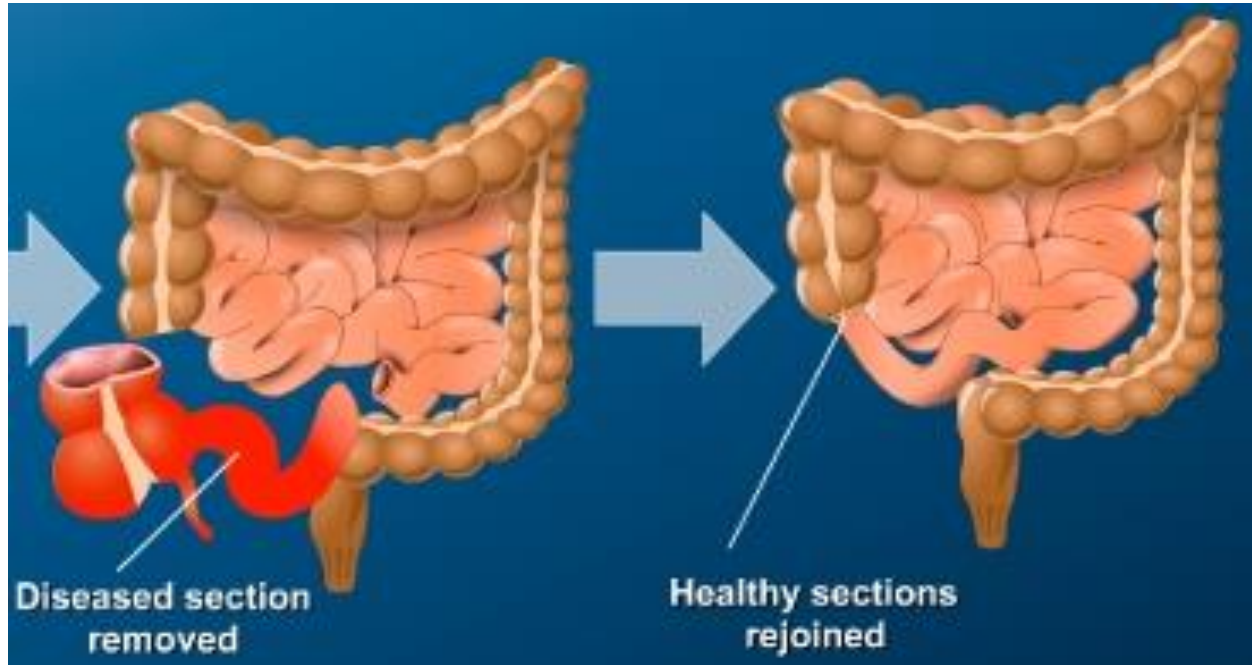
• Anatomy Post-Surgery





- **Anatomy – Post Surgery**

Ileo-cecal resection

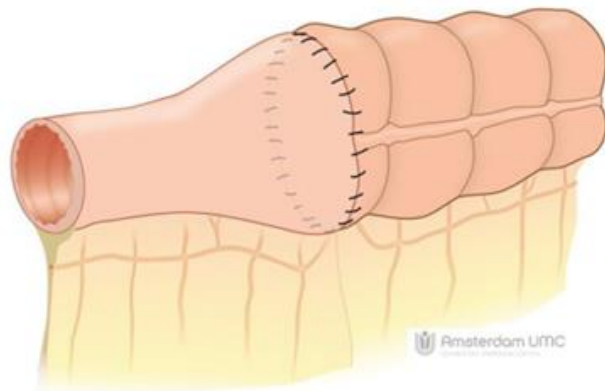




Postoperative Crohn's disease

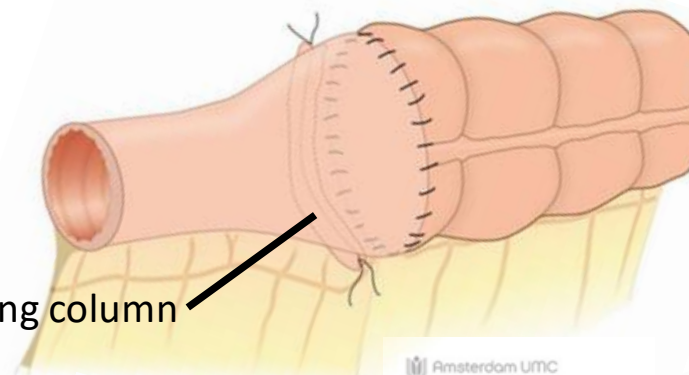
Ileocolic anastomosis

**End to end
(hand sewn)**

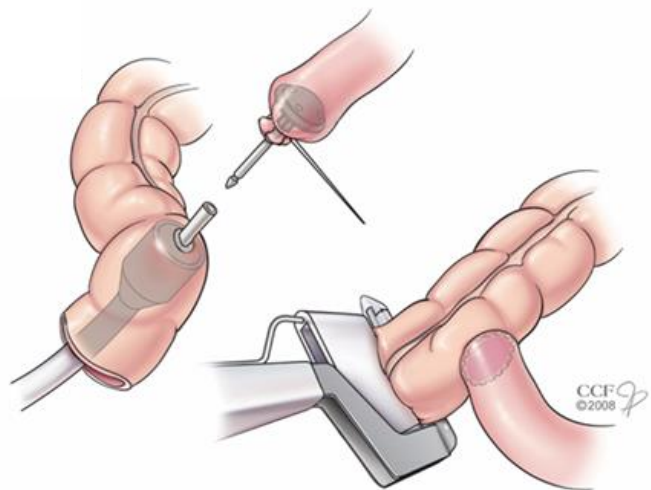


Kono-S

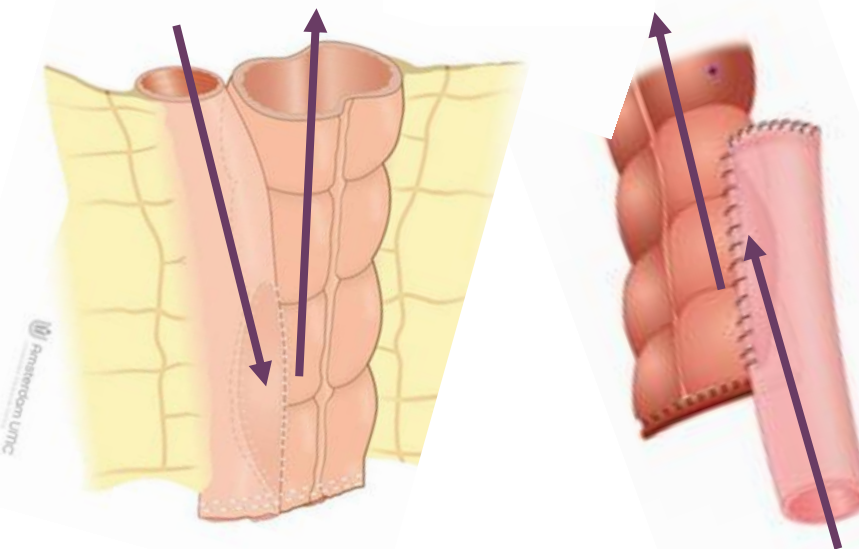
Supporting column



**End to side
(stapled)**



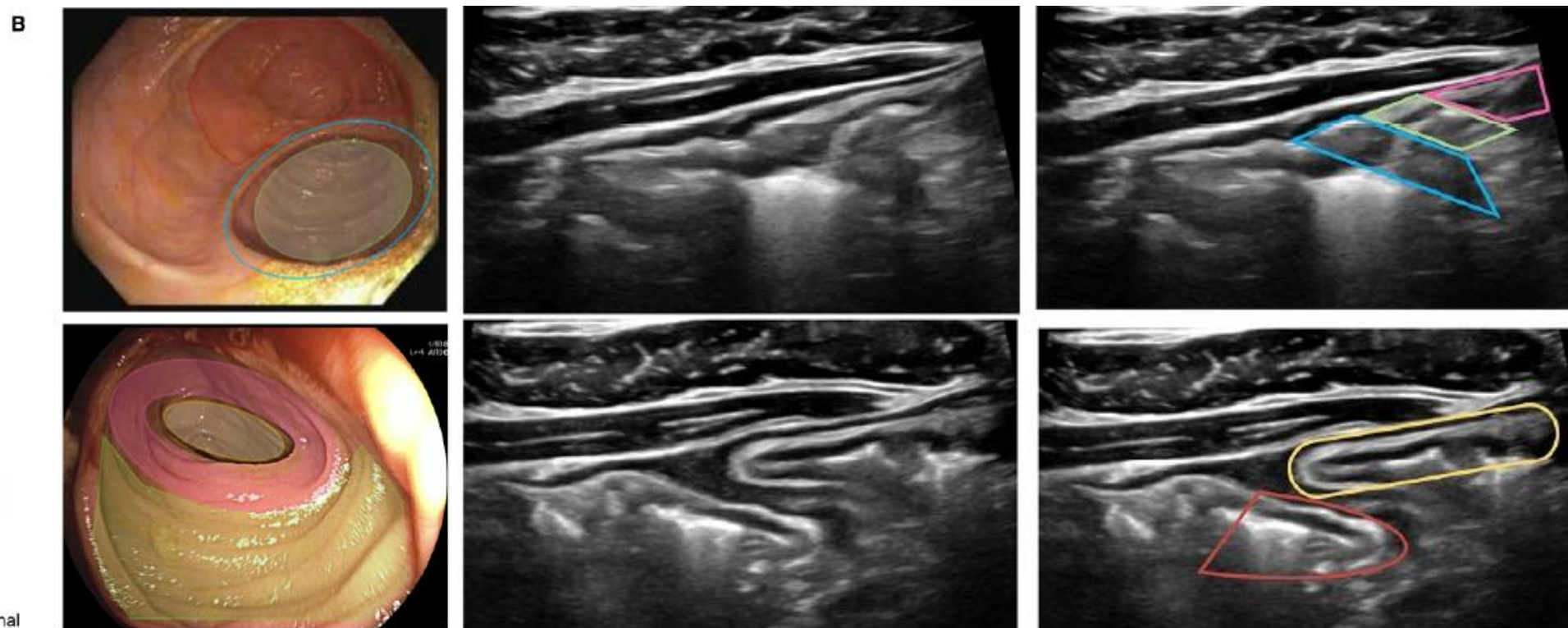
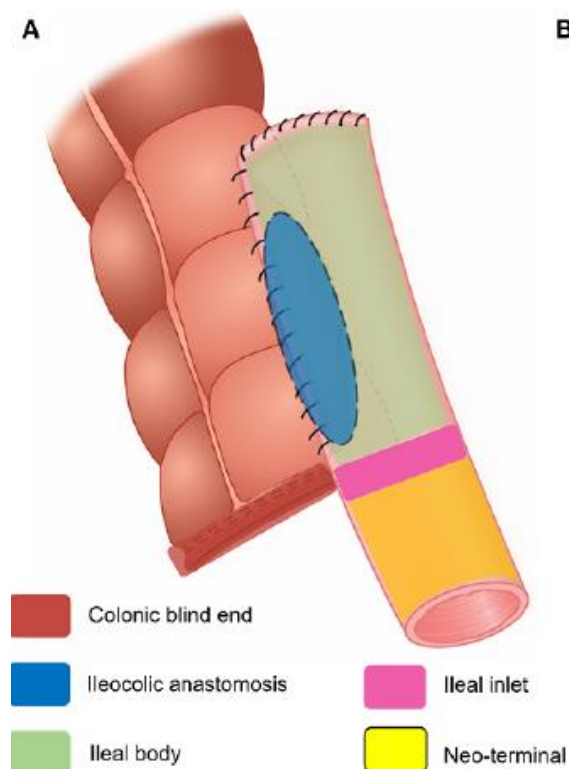
**Side to side
(non axial vs. axial)**





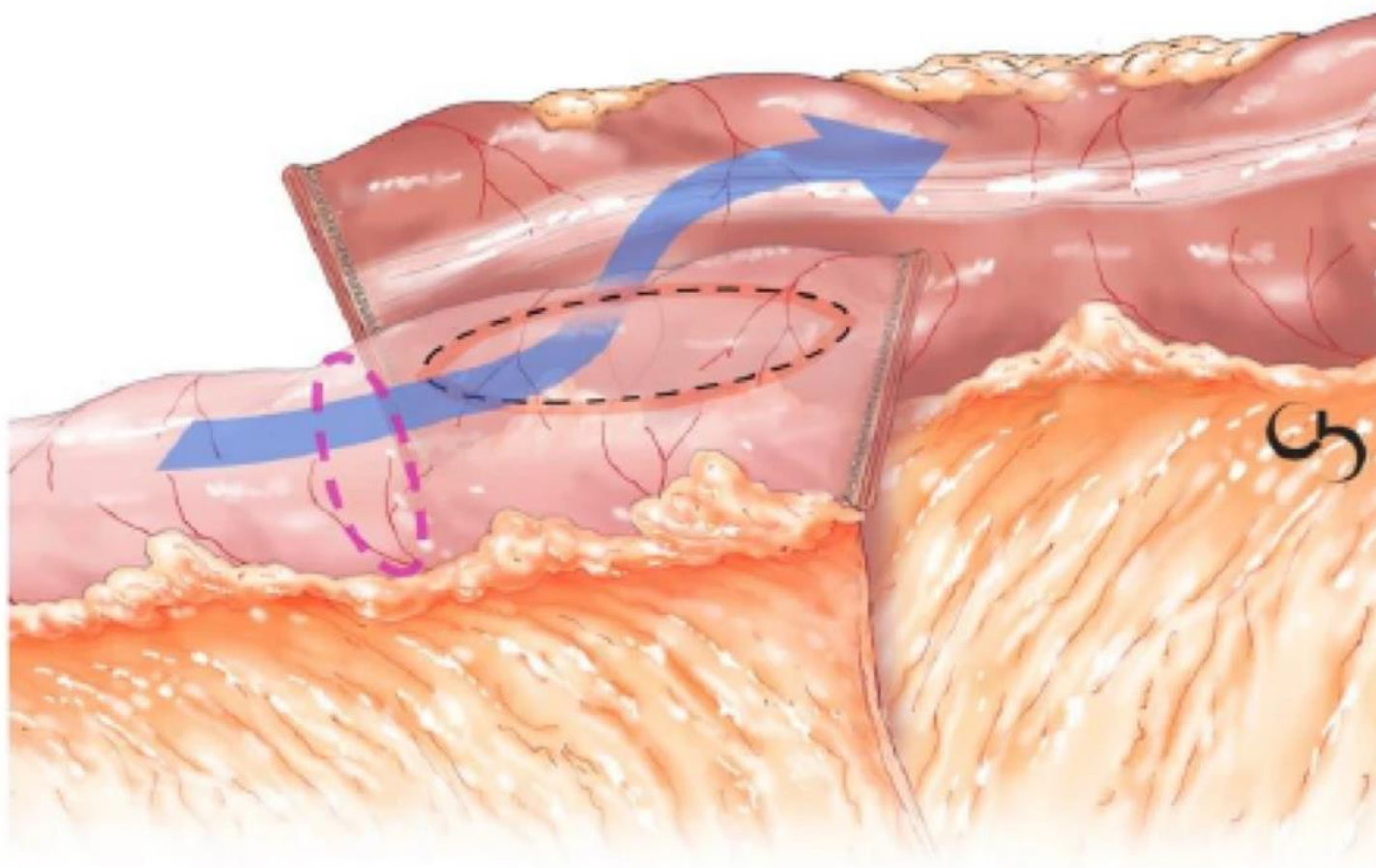
Ileocolic Anastomosis

Topography

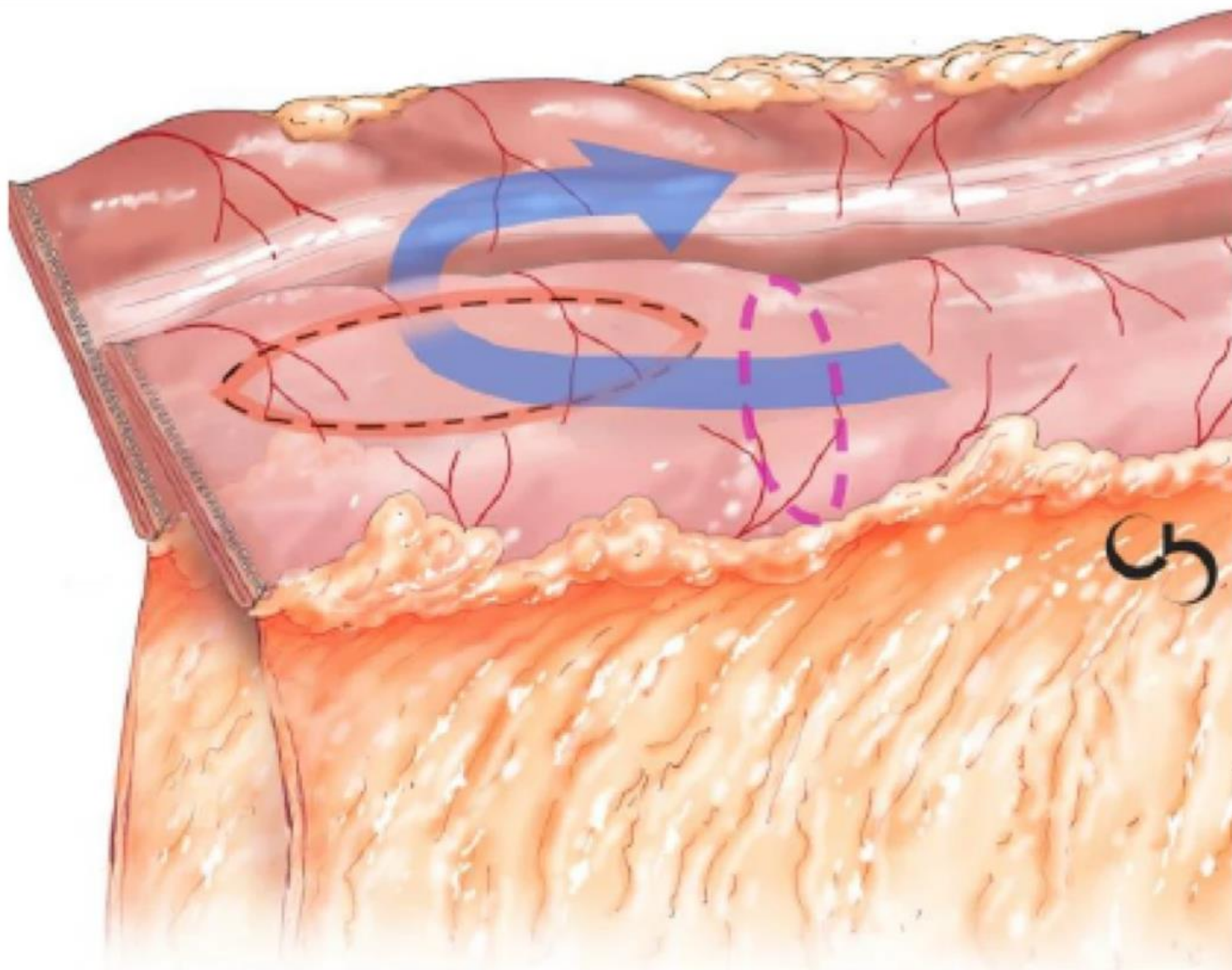


Measurements: 1. Anastomosis 2. neoterminal Ileum, $\geq 1\text{cm}$ from anastomosis

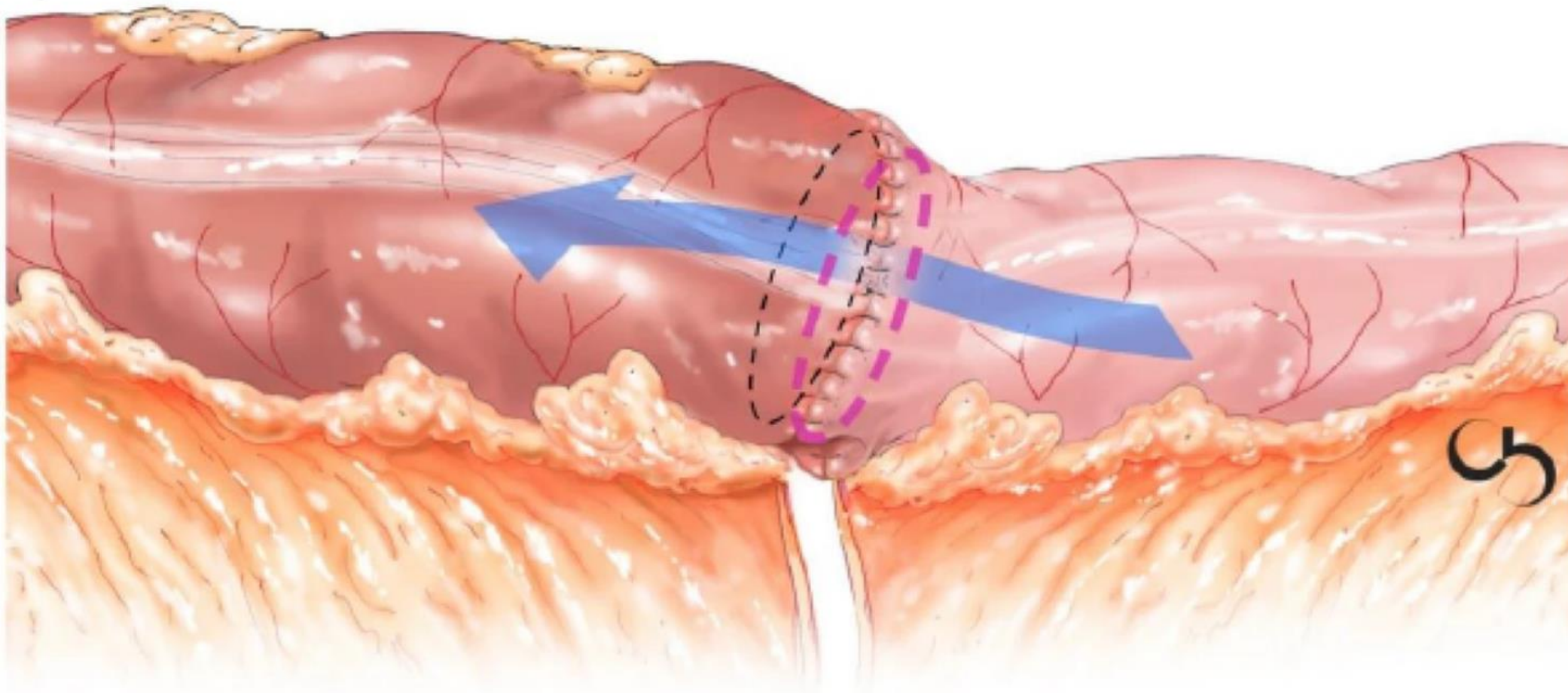
Parameters: BWT $> 3\text{mm}$, lymph nodes $> 1\text{cm}$, CDI positive, FC > 150



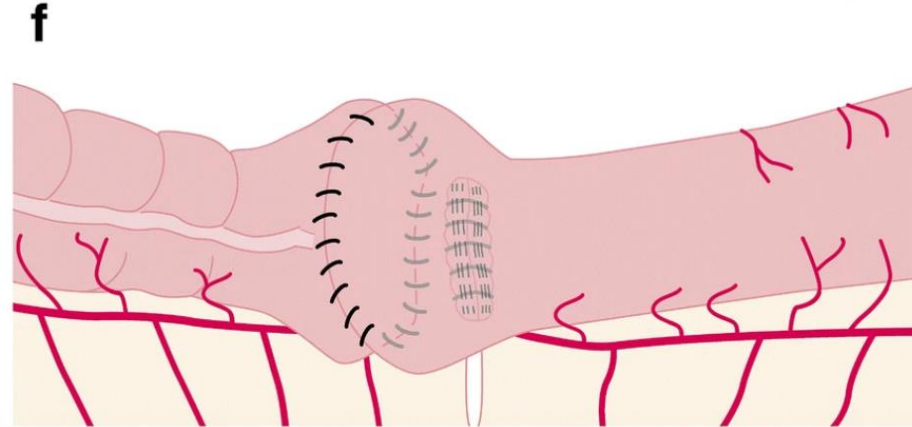
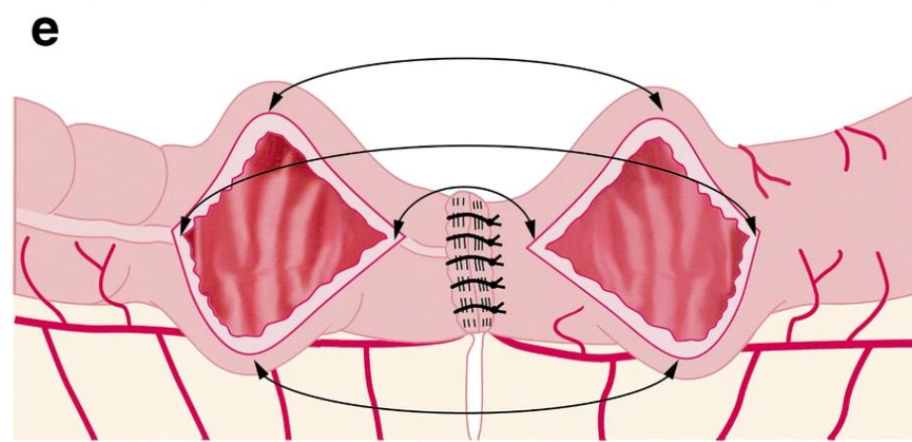
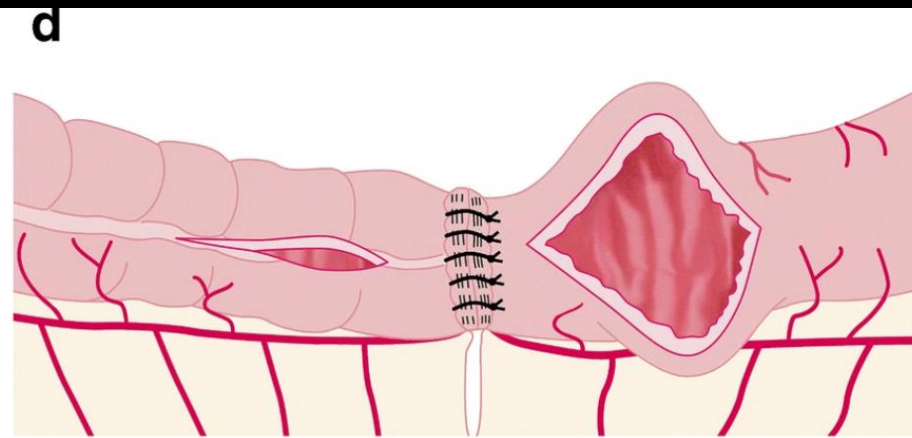
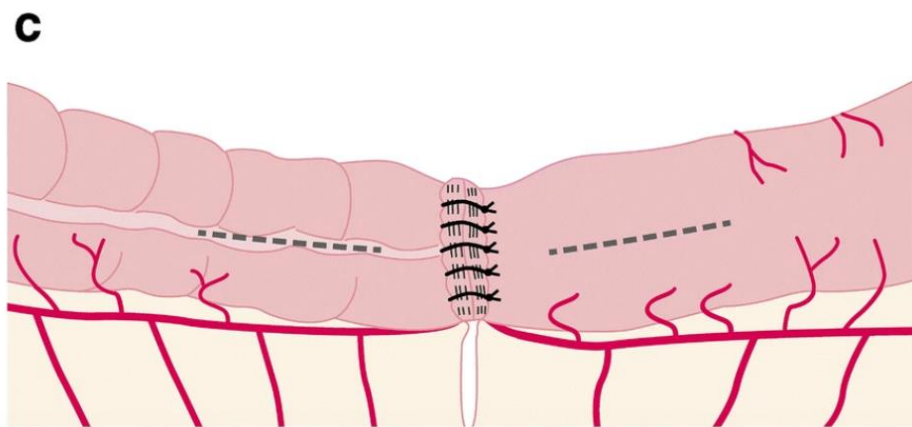
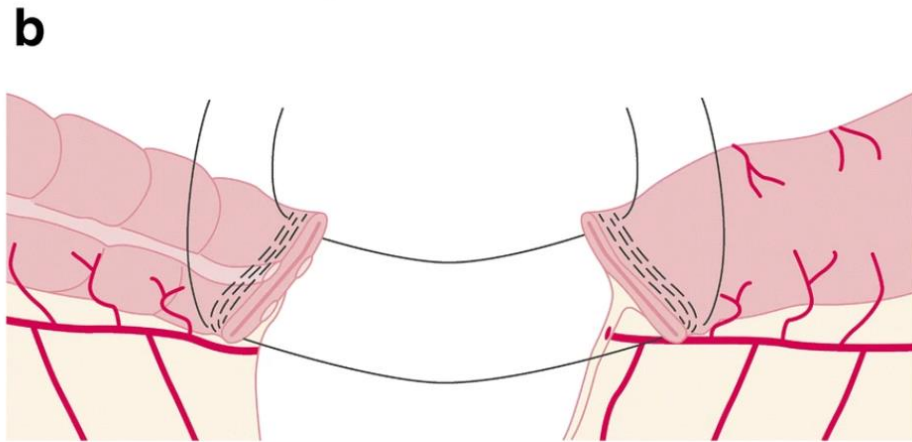
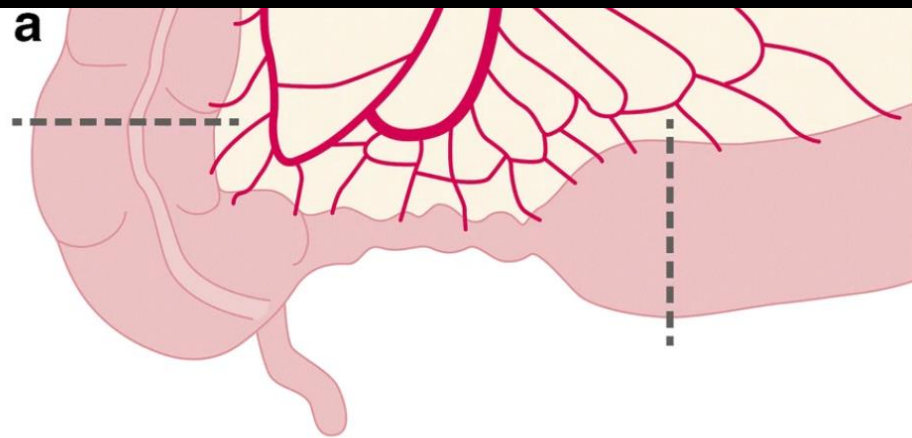
A. Side-to-side Isoperistaltic ileocolic anastomosis



B. Side-to-side antiperistaltic ileocolic anastomosis



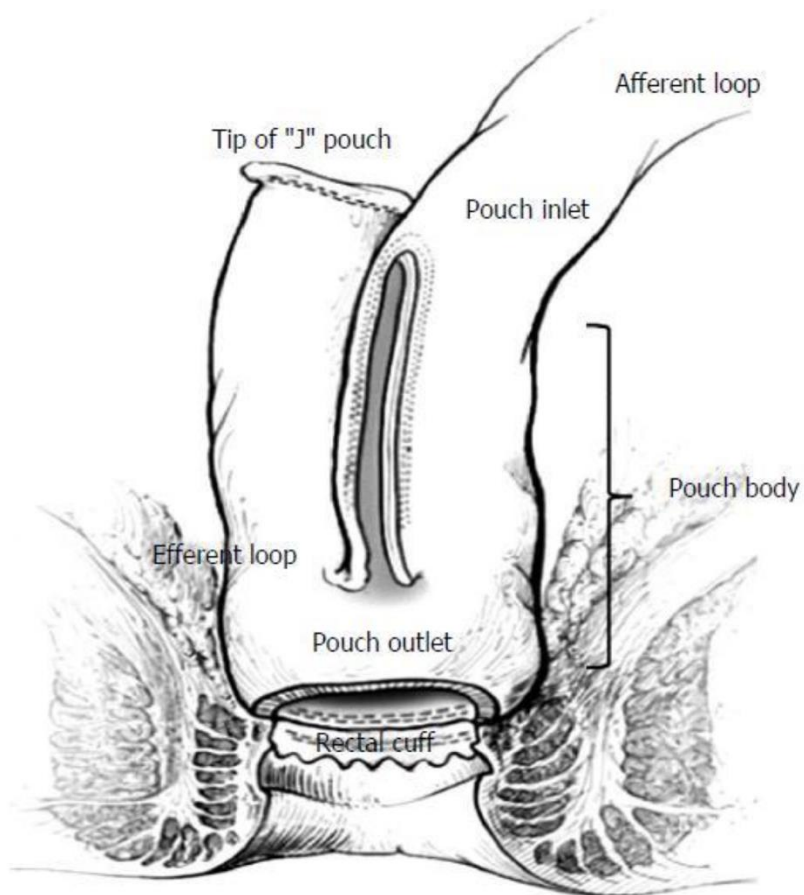
C. End-to-end ileocolic anastomosis



Kono-S



Colectomys



Postoperative Colitis

Type of operation:

1. Proctocolectomy with ileoanal pouch (IPAA)
2. Subtotal colectomy with terminal ileostomy
3. Proctocolectomy with terminal ileostomy

Ultrasound:

1. transabdominal
2. perineal
3. transvaginal/rectal

Key Sonographic Findings:

Normal Pouch

BWT <3–4 mm

Preserved wall layers

Minimal vascularity

Pouch diameter <3 cm

Normal prepouch ileum

Inflammation / Pouchitis

BWT >3 mm

Increased Doppler signal

Peri-pouch inflammation

Increased CEUS enhancement

Usually pouch-confined

Crohn's Disease of the Pouch

Marked BWT, hyperemia

Inflammatory fat

Lymphadenopathy

Fistulas, sinus tracts, strictures

Prepouch ileal involvement



Clinical case 1

- 32 yo Male
- Ileal Crohn's disease diagnosis after surgery because of obstructive symptoms

No treatment



SAMSUNG

U OF C

20-10-2023

10:52:43 AM

Bowel1 / LA2-14A / 6.0cm / 38Hz ^S_{HAR}

TIs 0.3 / TIb 0.3 / MI 1.2

[2D]

Pen1

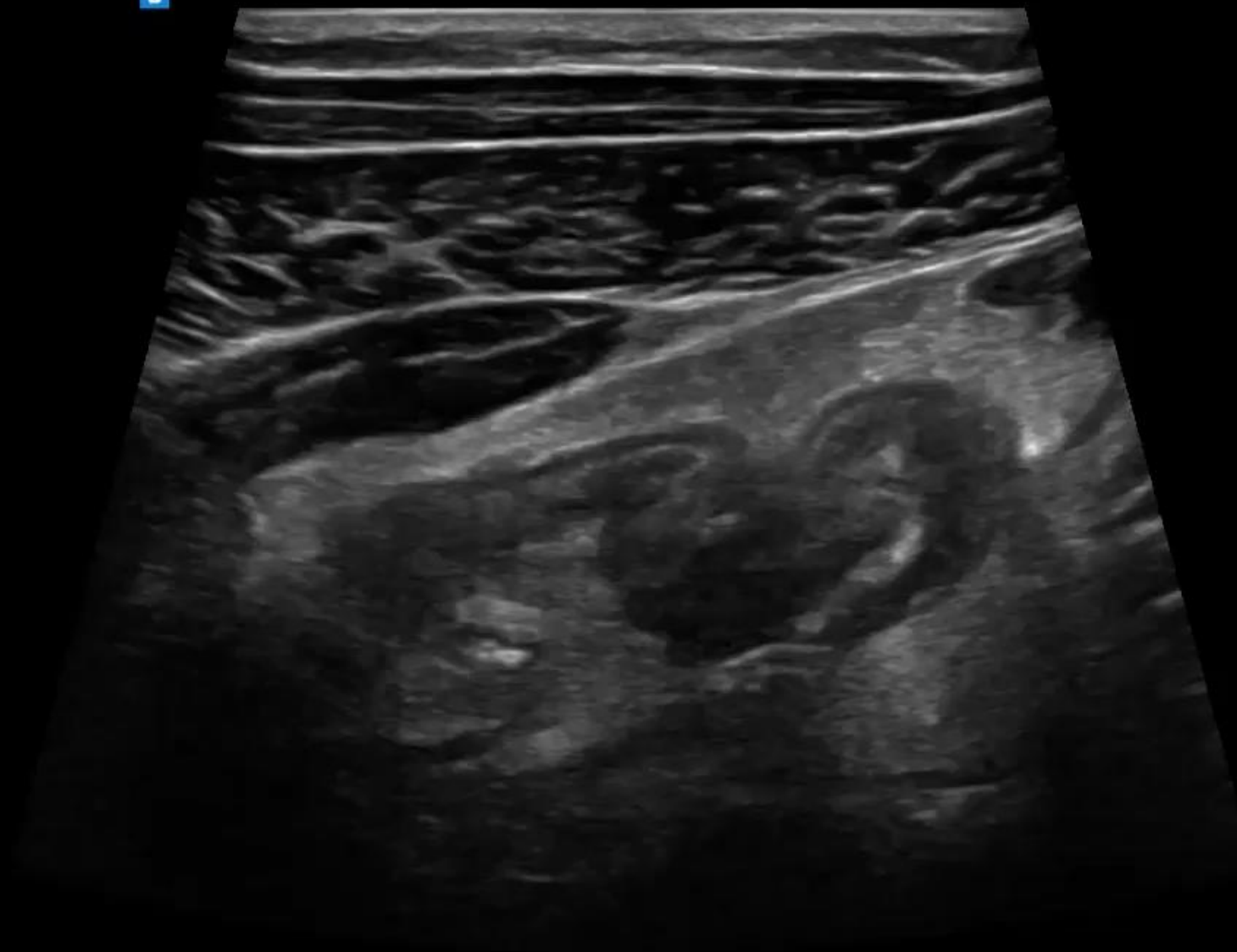
Gn 60

DR 104

FA 5

P 90%

S



0
-
1
-
2
-
3
-
4
-
5
-
6



SAMSUNG

inteli
ULTRA

Bowel1 / LA2-14A / 6.0cm / 38Hz



U OF C

20-10-2023
10:55:55 AM

Tls 0.3 / Tlb 0.3 / MI 1.2

[2D]

Pen1

Gn 66

DR 104

FA 5

P 90%

S



TI

0

-

1

-

2

-

3

-

4

-

5

-

6



SAMSUNG

i

Bowel1 / LA2-14A / 6.0cm / 16Hz S HAR

U OF C

20-10-2023

10:56:52 AM

Tls 0.8 / Tlb 0.8 / MI 1.1

[2D]

Pen1

Gn 66

DR 104

FA 5

P 90%

[C]

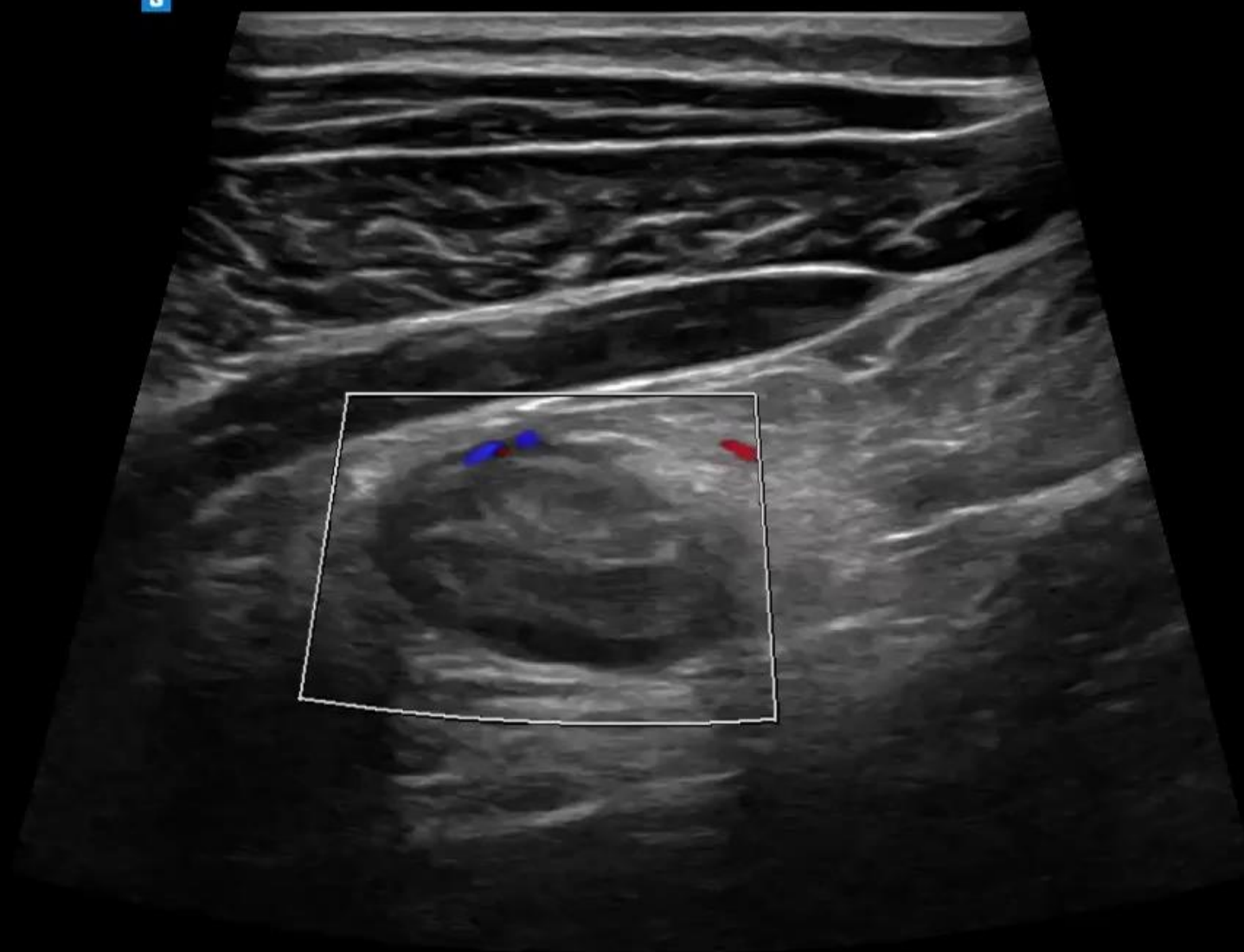
Res1

Gn 73

PRF 0.86kHz

P 90%

S



6.0
-6.0
cm/s

0

-

1

-

2

-

3

-

4

-

5

-

6

TI



inte
ULTI

SAMSUNG

U OF C

20-10-2023

10:51:04 AM

Bowel1 / LA2-14A / 6.0cm / 38Hz ^S_{HAR}  

TIs 0.3 / TIb 0.3 / MI 1.2

[2D]

Pen1

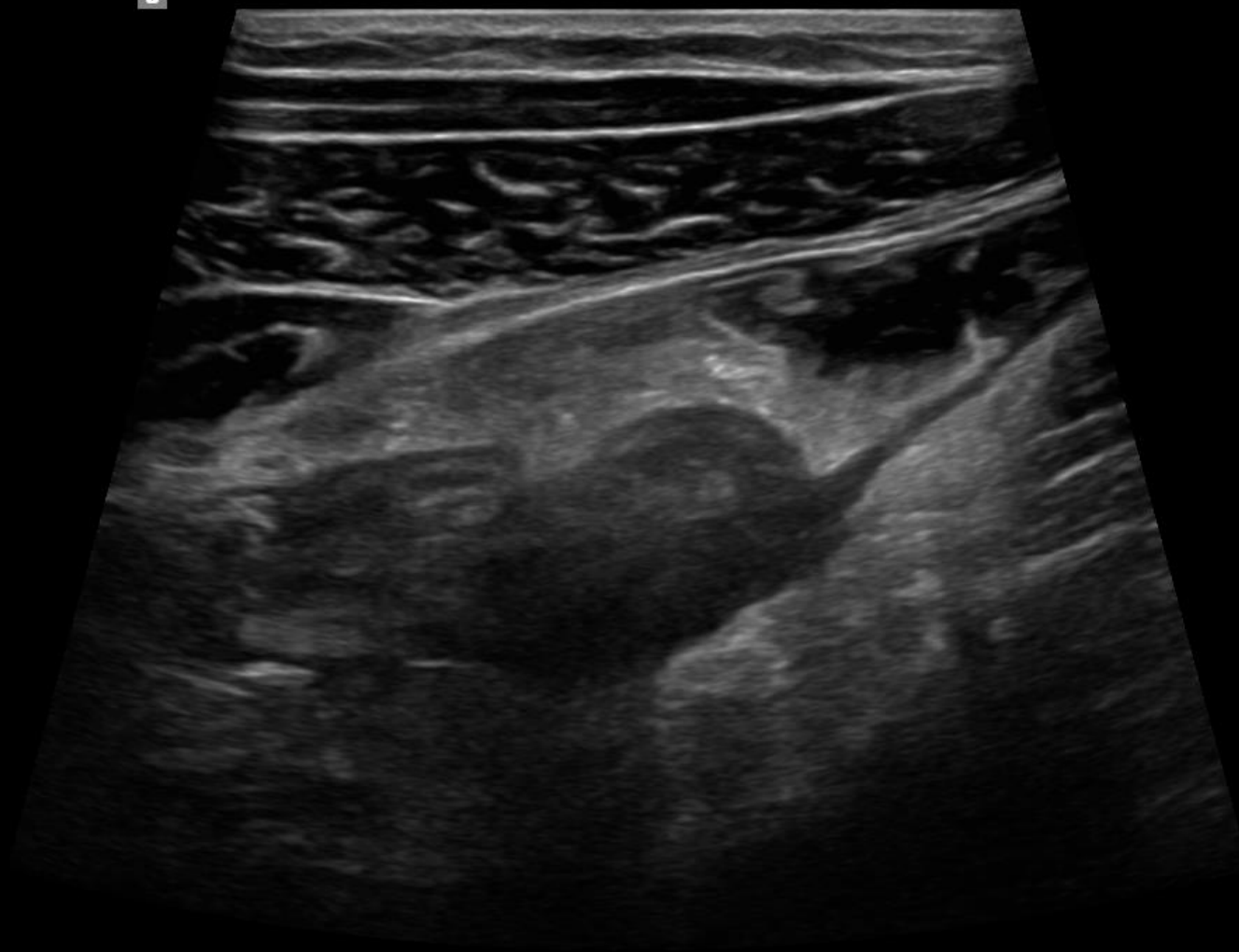
Gn 60

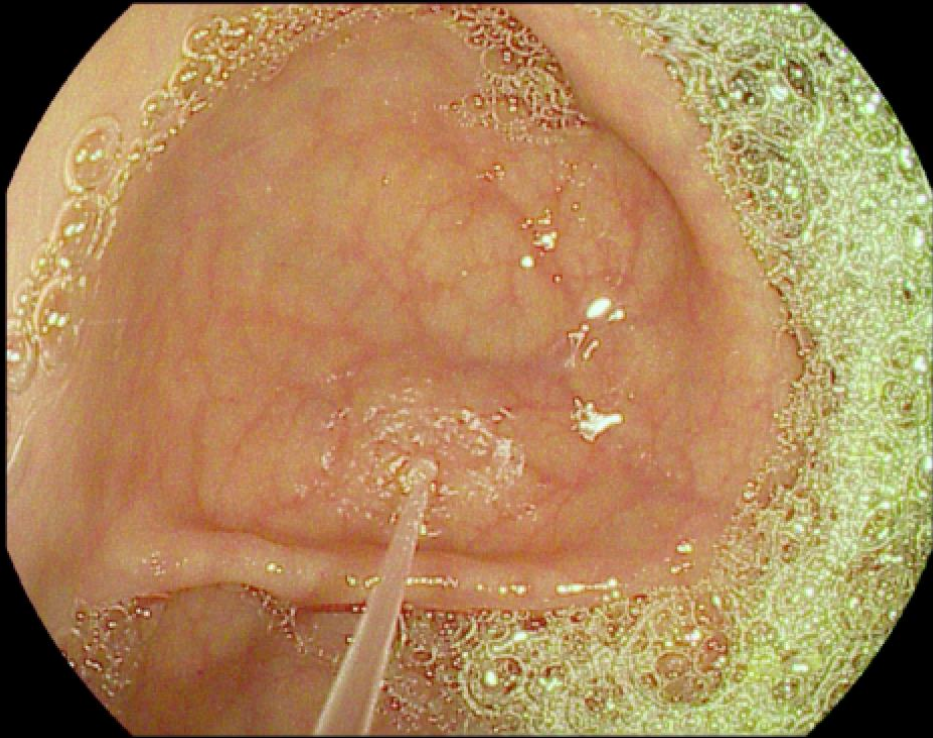
DR 104

FA 5

P 90%

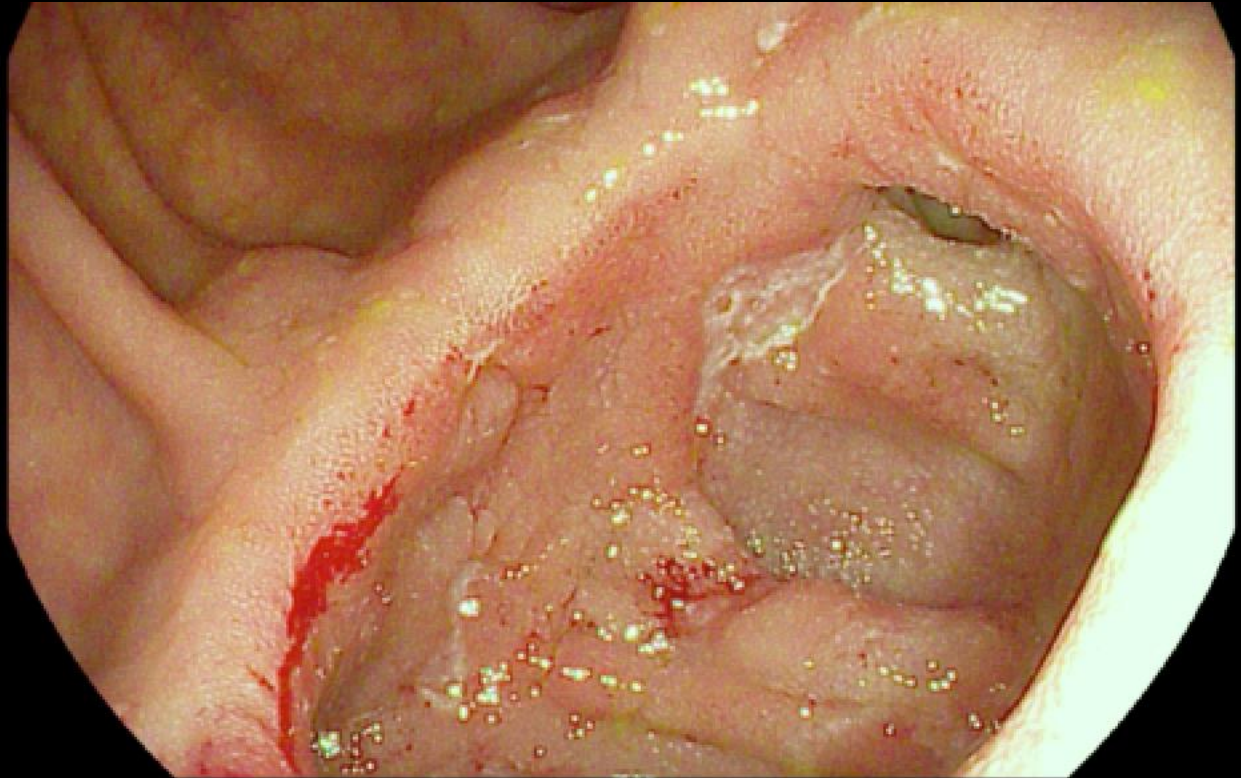
S

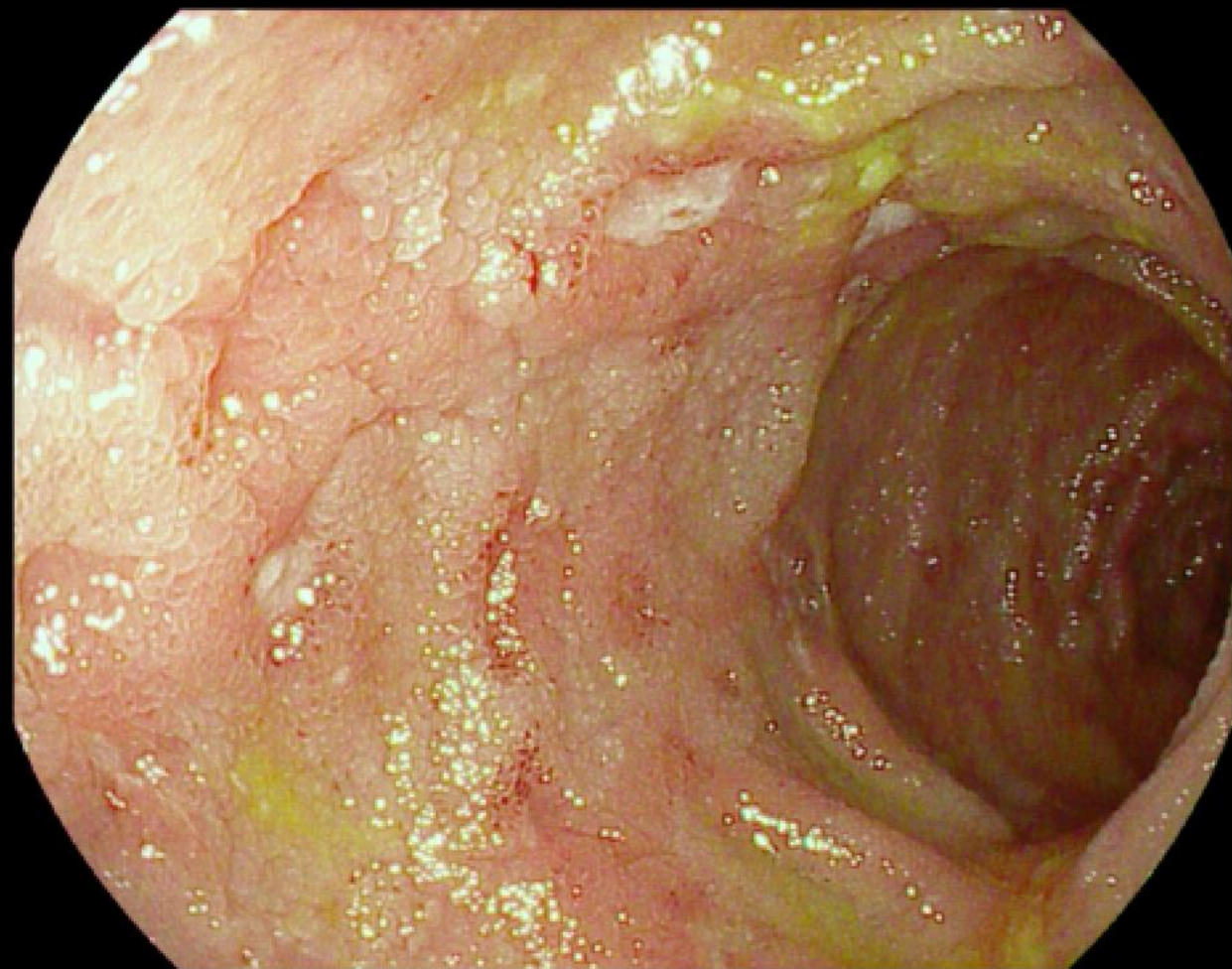




Colonic side

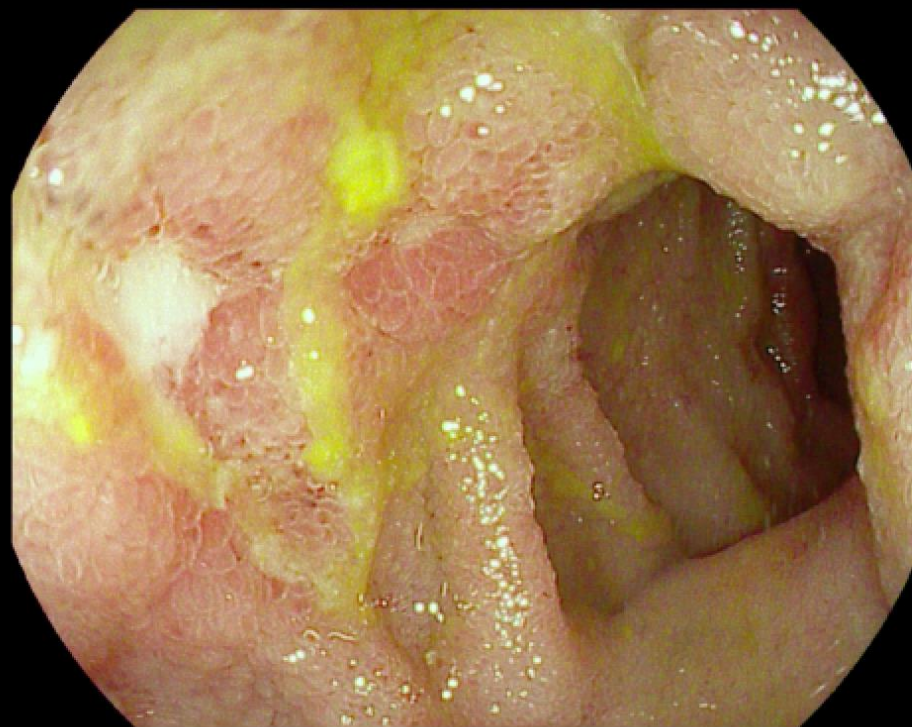
Anastomotic Ring, NTI outlet





I-sc

NTI



I-scar



Clinical case 2

- 58 yo woman, non-smoker with stricturing Ileal CD
- ileo-cecal resection in 2019
- Severe inflammatory arthropathy, post op IFX combo AZA.
- Recent cessation of combo, intolerance
- MRI negative
- Presented to hospital with obstructive symptoms



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NTI Anast

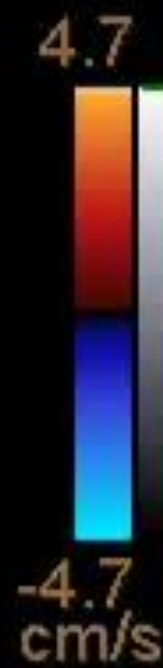


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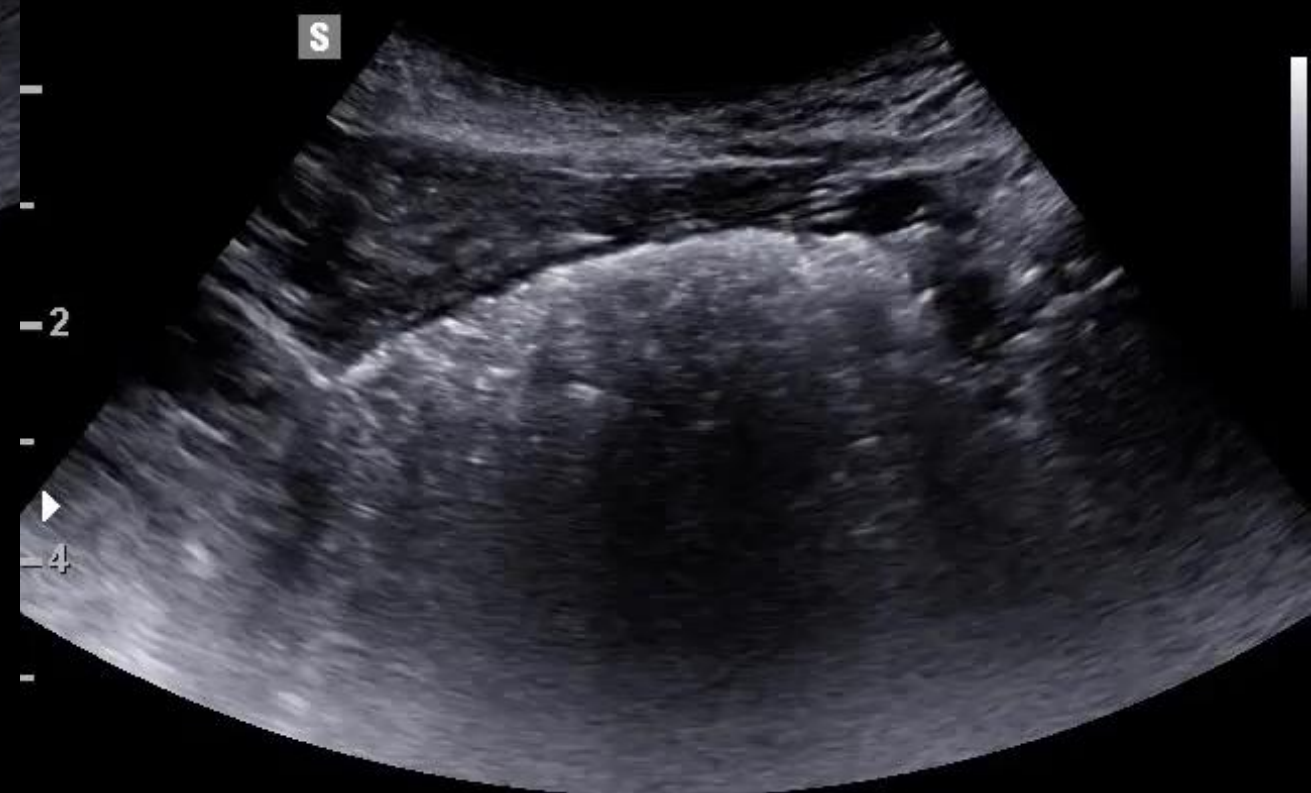
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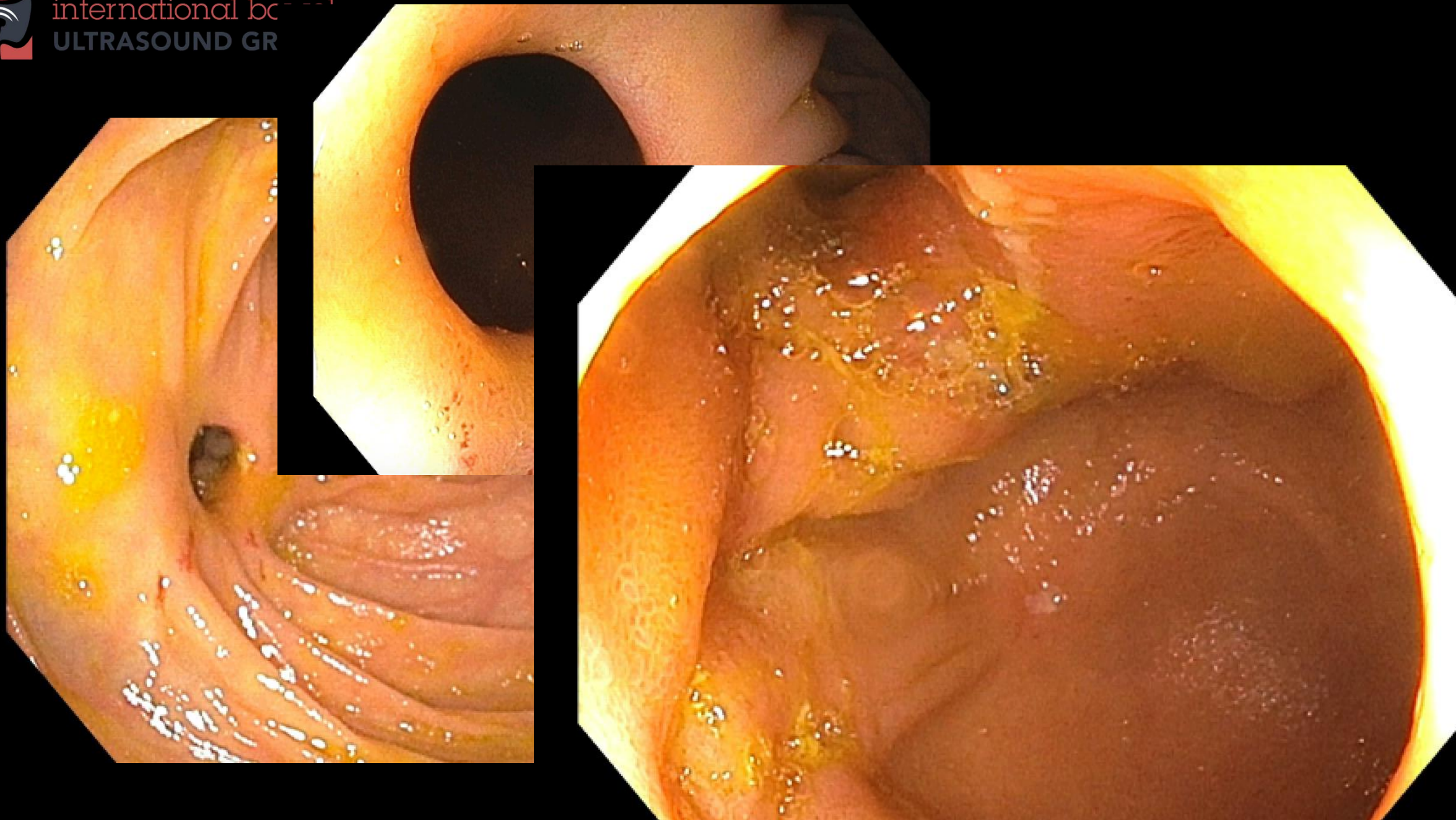
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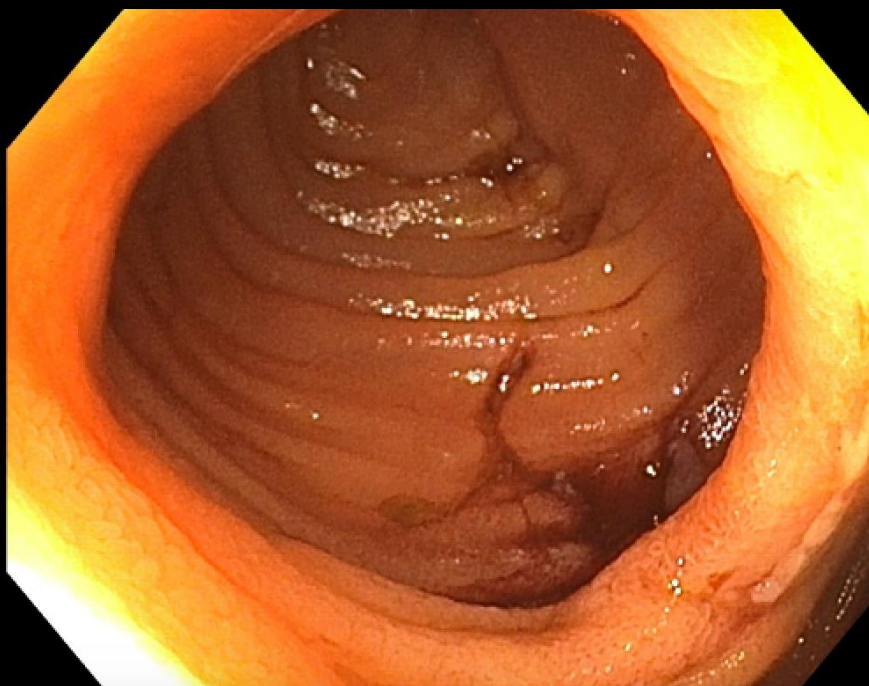
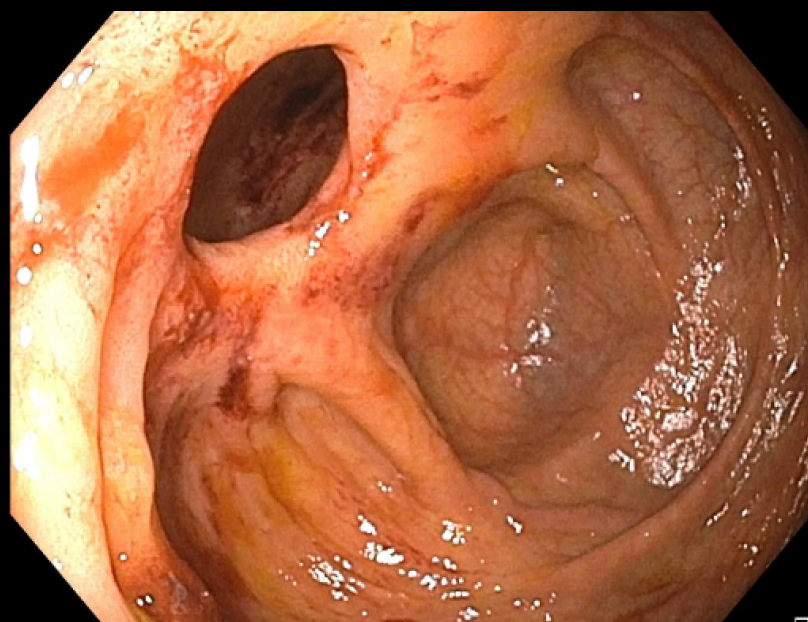
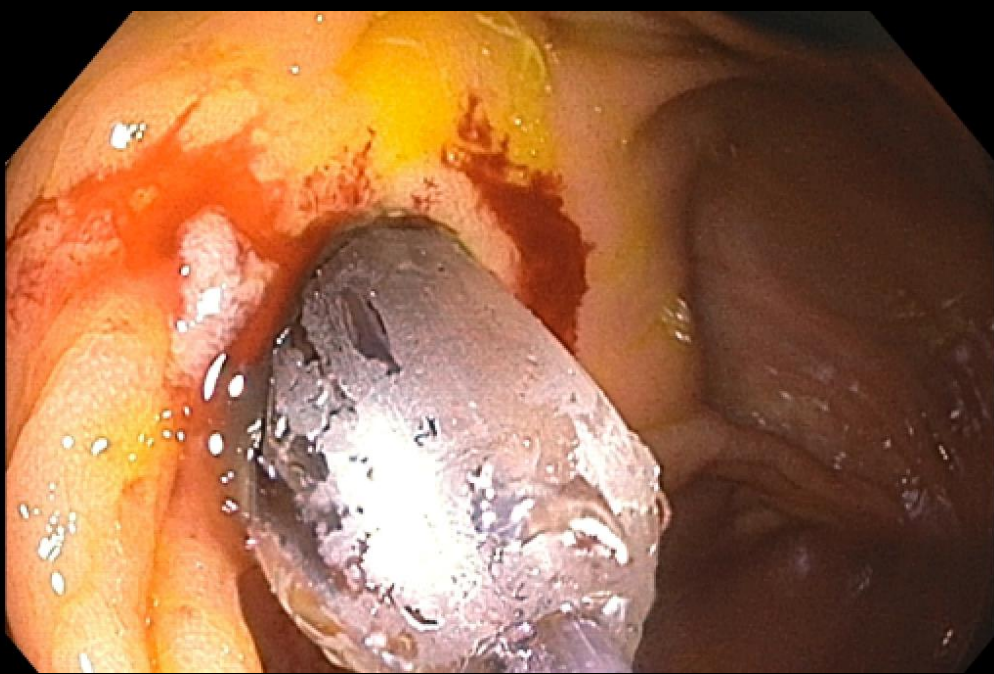
-6



NTI Anast







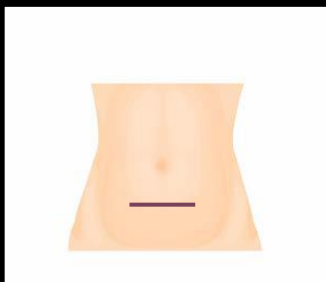


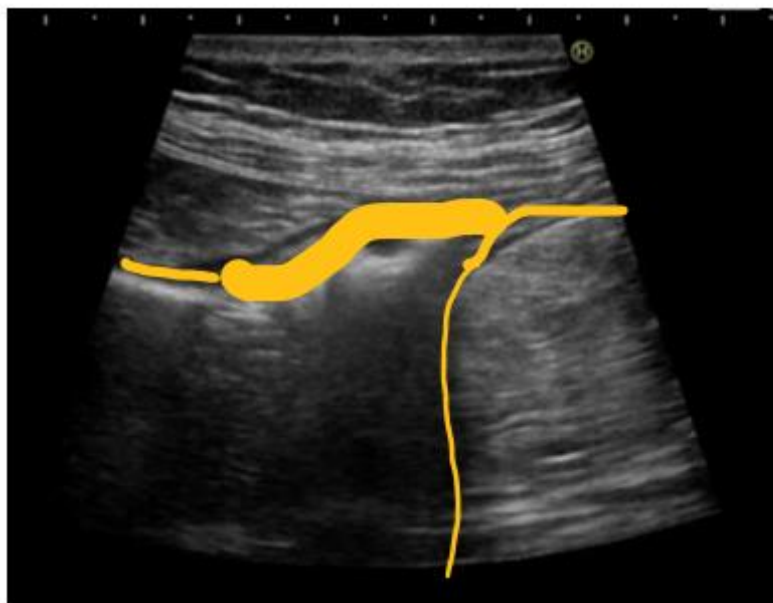
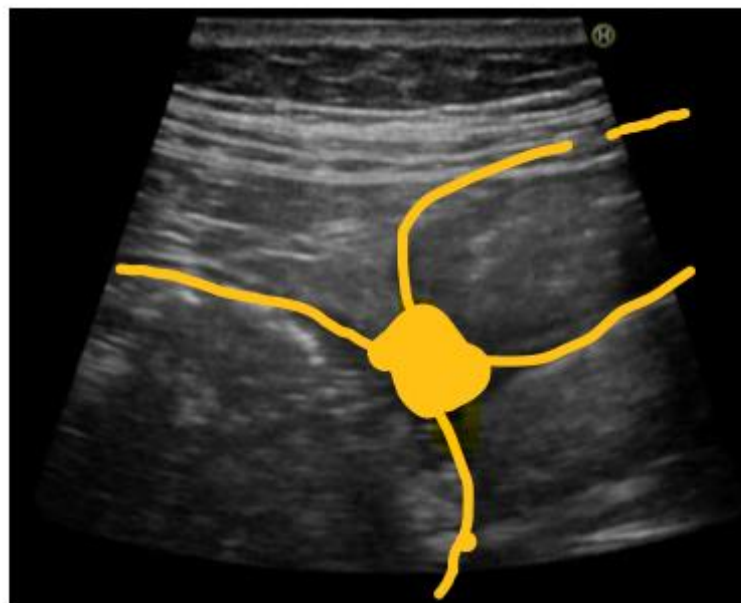
Clinical case 3

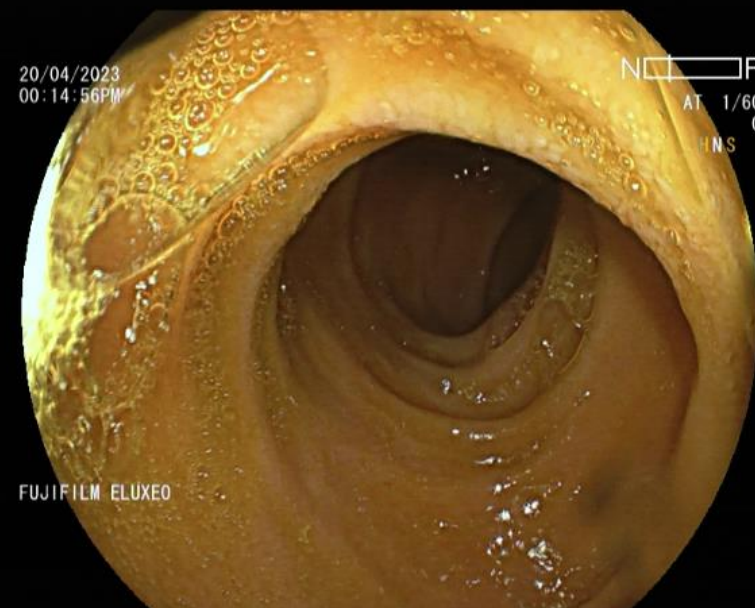
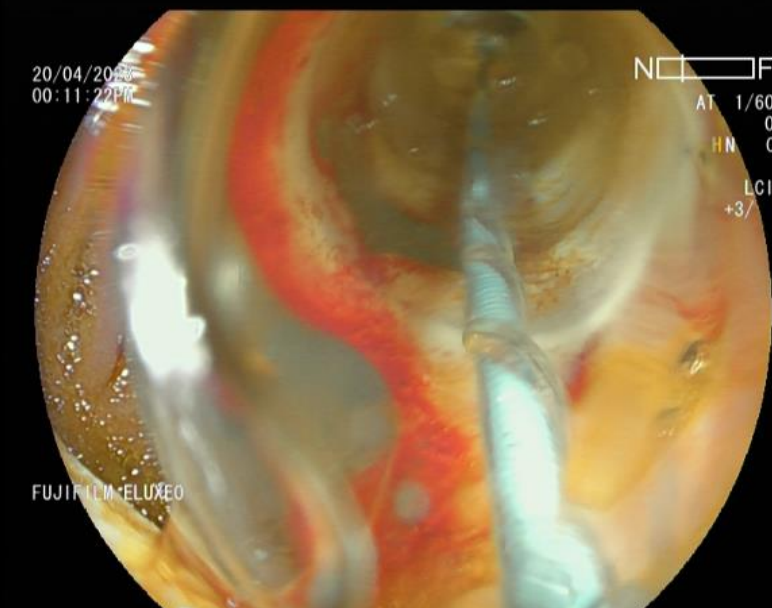
- 28 years-old gentleman
- Crohn's disease; A2L3B2p
- ileo-cecal resection 2 years ago
- On Infliximab since surgery
- Clinical and endoscopic remission documented about a year ago
- Last 6 weeks: 2 episodes of partial bowel obstruction – resolved with conservative management



international
ULTRASOUND









Clinical case 4

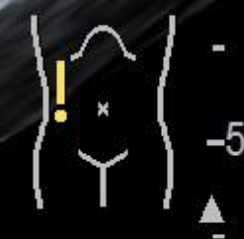
- 42 years-old female
- ileo-colonic Crohn's disease since 2004 (Montreal Classification A2L3B2)
- ileo-cecal resection in 2011
- previous therapies: steroids, AZA, 6MP, started ADA in 2019, every week since 8/2023

MI 0.85 TIS < 0.4 AP: 100% 43 FPS 1

F

December 2023

C42
HdT-5.0P R:6.00 BG:73 BD:89



ANSE Micro.



inte
ULTI

F

AP:100%

43 FPS

1



▼
-
-1
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-2
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-3
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-4
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-5
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C42
HdT-5.0P

Dist: 4.4mm
R:6.00 BG:73 BD:89



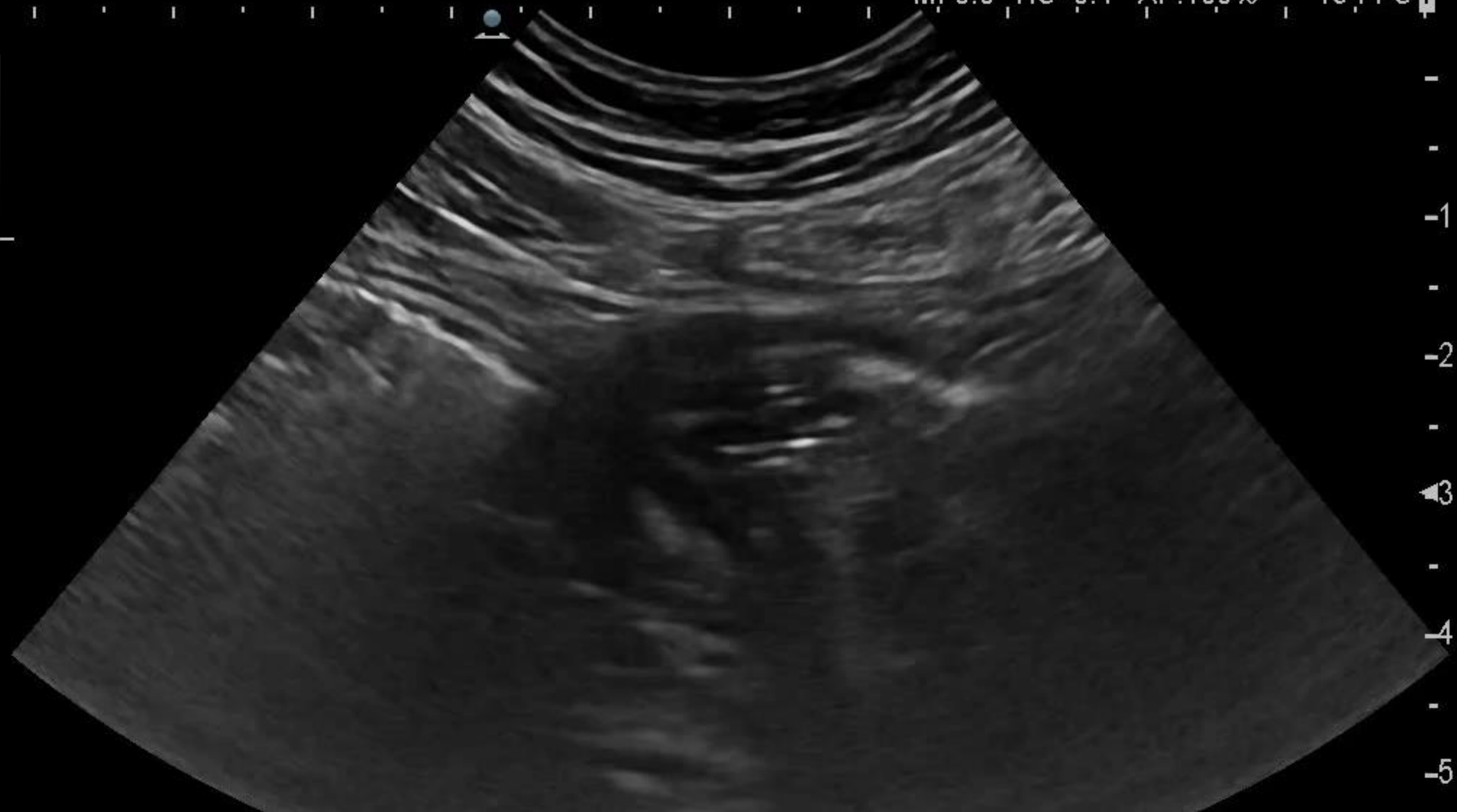
ANSE Micro.
985/986



M 33yr old

- 2007 diagnosis of Crohn's disease (Montreal Classification A2L1B2-3p)
- Smoker
- 2010 ileo-cecal resection with end-to-end anastomosis for stricturing and penetrating Crohn's disease, two ileosigmoid fistulae
- Azathioprine 2 mg/kg/die after surgery
- October 2020,: first visit in our IBD Center
- No symptoms, HBI 1
- Hb 14.3 mg/dL, CRP 25.3 mg/L, calprotectin 1848

MI 0.8 TIS < 0.4 AP: 100% 19 FPS 1



This endoscopic image shows a large, polypoid lesion in the colon. The lesion is a reddish, fleshy mass protruding from the mucosal surface. It has a lobulated, irregular shape with a central area that appears slightly more depressed or ulcerated. The surrounding colonic mucosa is visible, showing normal haustra and vascular patterns. The image is framed by a circular endoscopic view.





Clinical case 6

- M 69yr old
- Ileal Crohn's disease since 2008
- Montreal classification A2L1B2
- EIM: ankylosing spondylitis, nodosum erythema, uveitis
- 09/2021: ileo-cecal resection with side-to-side anastomosis



MI 0.6 TIS<0.4 AP:100% 19 FPS 1



HdT-7.8Rx R:5.00 BG:50 BD:77

MI 0.6 TIS<0.4 AP:100% 19 FPS 1



HdT-7.8Rx R:5.00 BG:50 BD:77



04-06-2020
11:18:01



04-06-2020
11:17:58



M 44yr old

- leocolic Crohn's disease since 2000, with perianal disease
- Montreal classification A2L3B3p
- Comorbidities: psoriasis, enteropathic oligoarthritis
- Smoker
- Multiple fistulectomies with seton placement (2010, 2014, 2021)
- Previously treated with anti-TNF and ustekinumab
- 05/2021: ileo-cecal resection with end-to-end anastomosis

MI 0.8 TIS < 0.4 AP: 100% 19 FPS 1





MI 0.8 TIS < 0.4 AP: 100% 19 FPS 1



-
-
-1
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-2
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-3
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End-to-end

Rutgeerts' score is 2





Clinical case 8

F 45yr old

- 48 years-old lady,
- Crohn's disease – 4 years
- Small bowel resection and anastomosis – 4 years ago
- On Adalimumab for 8 months
- Presentation: Abdominal pain ~ 2 weeks / Fever ~ 3 days



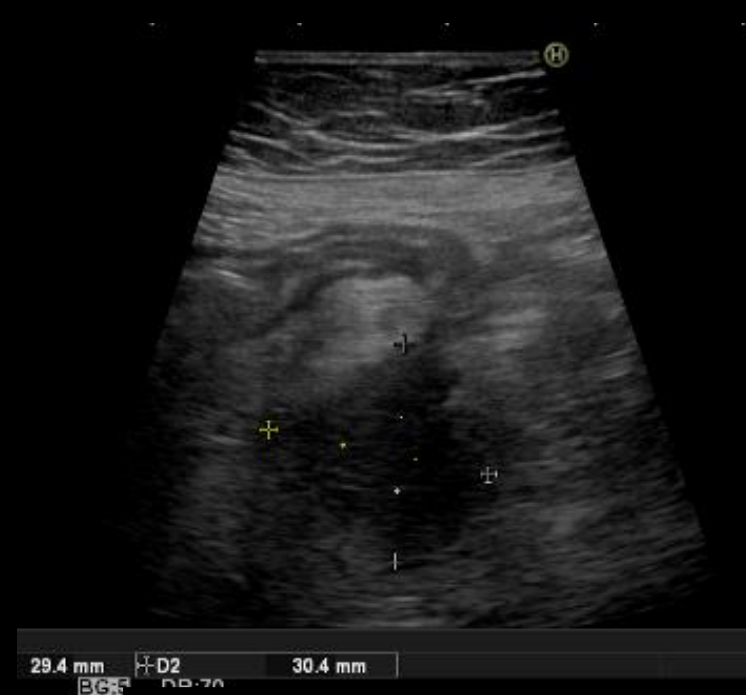


BG:5 DR:70
HdTHI-P

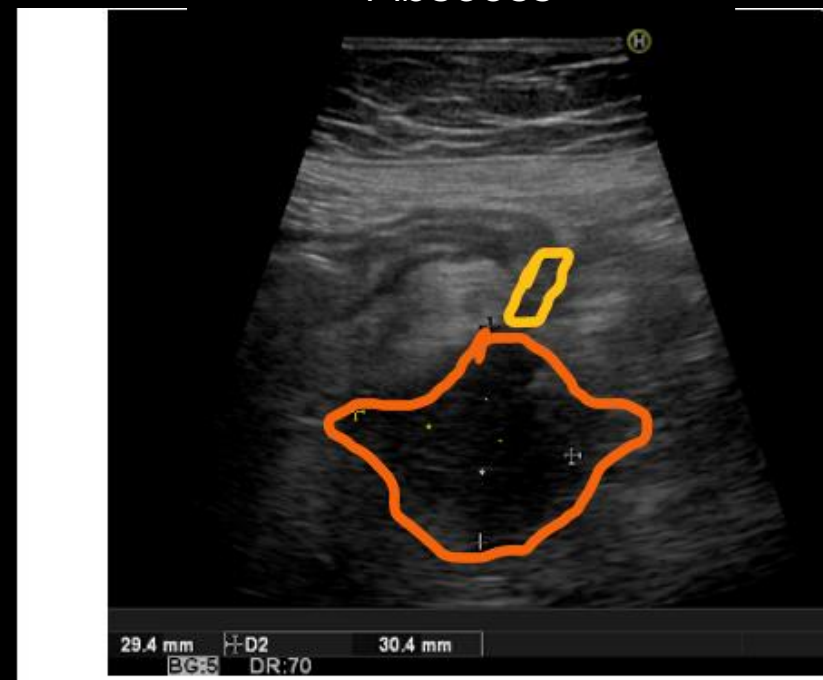
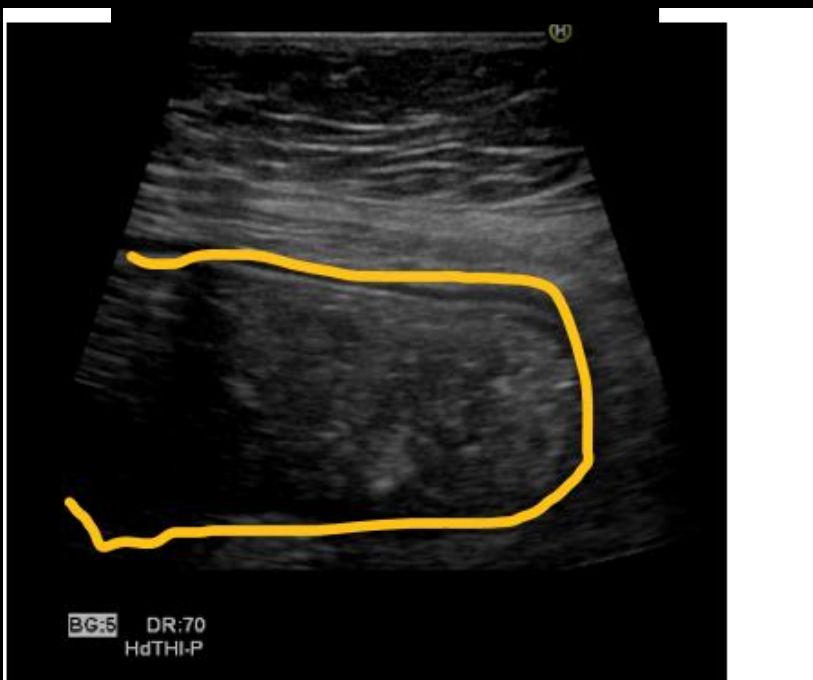
Pre-stenotic dilatation



Stricture



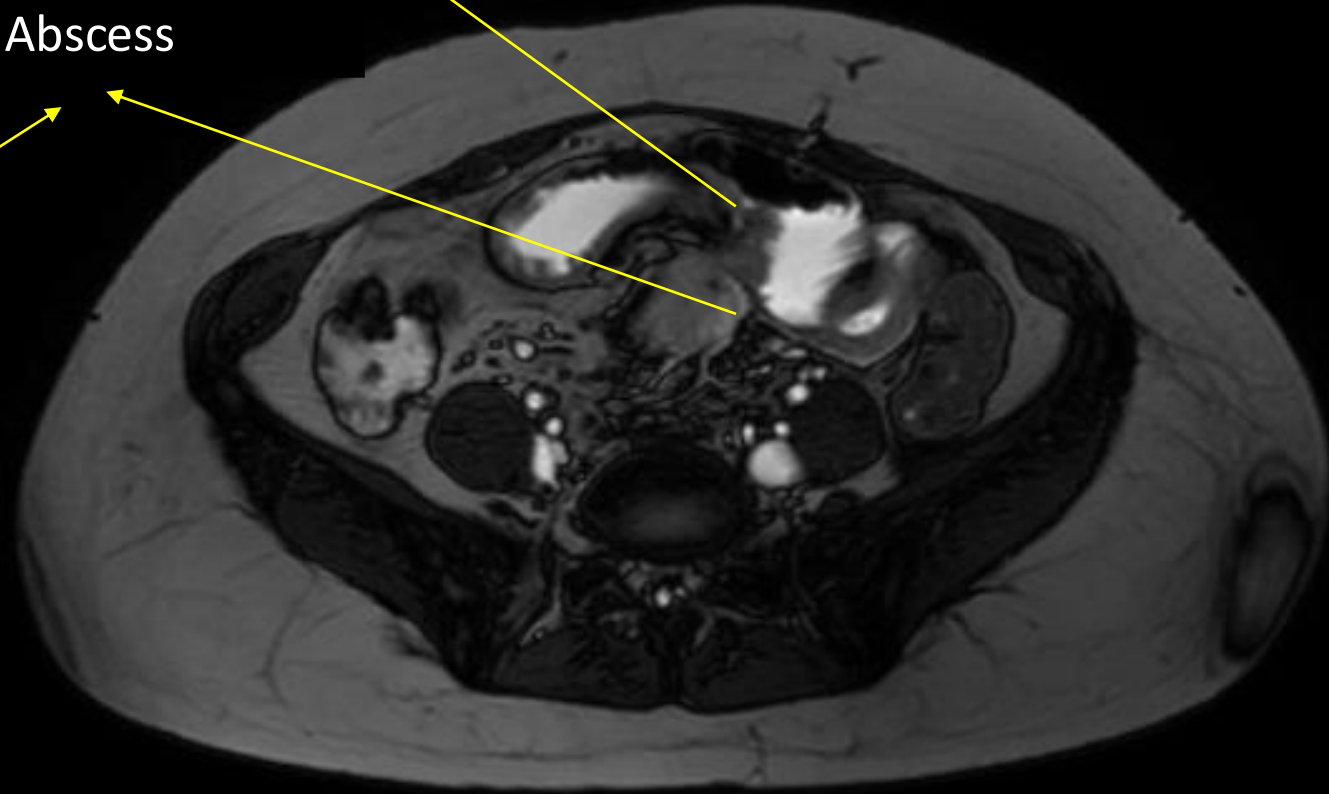
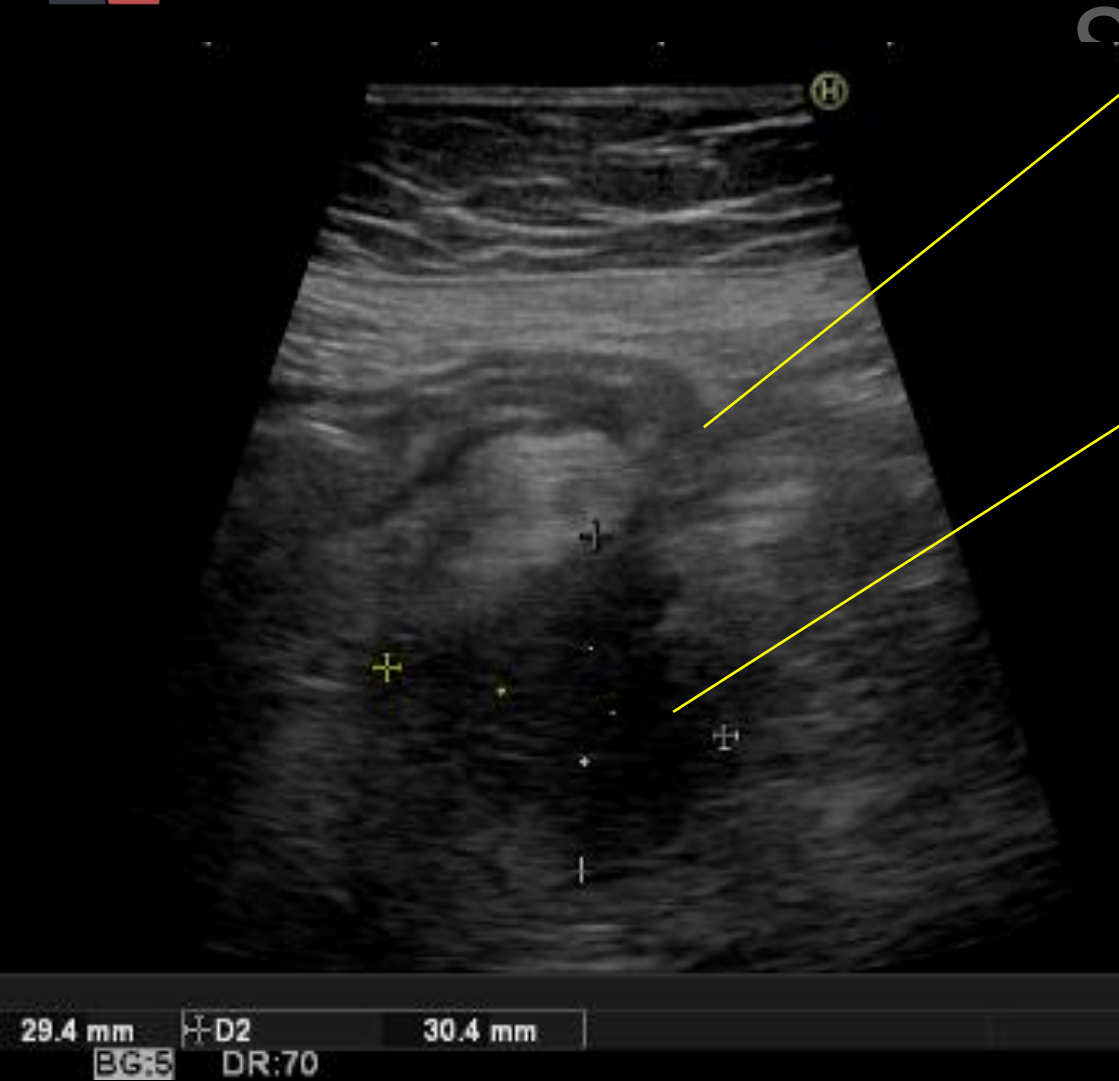
Abscess





Anastomotic site

Abscess



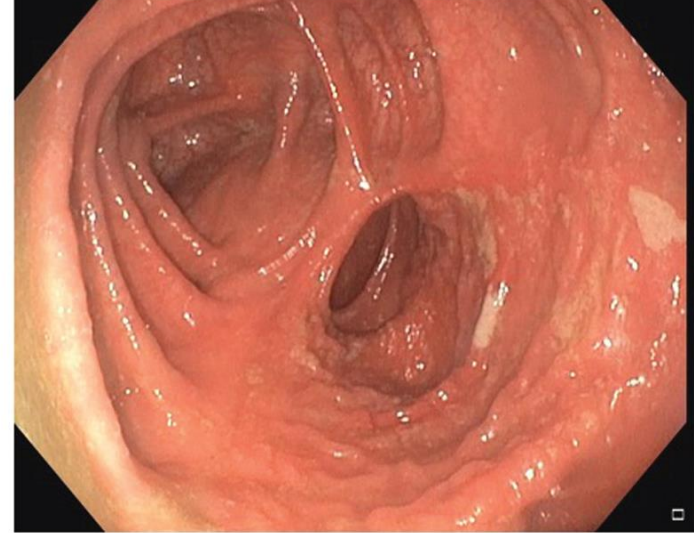


Clinical case 9

- 45 yo female
- ileal CD
- ileo-cecal resection
- high risk factors: smoker, penetrating disease, perianal disease

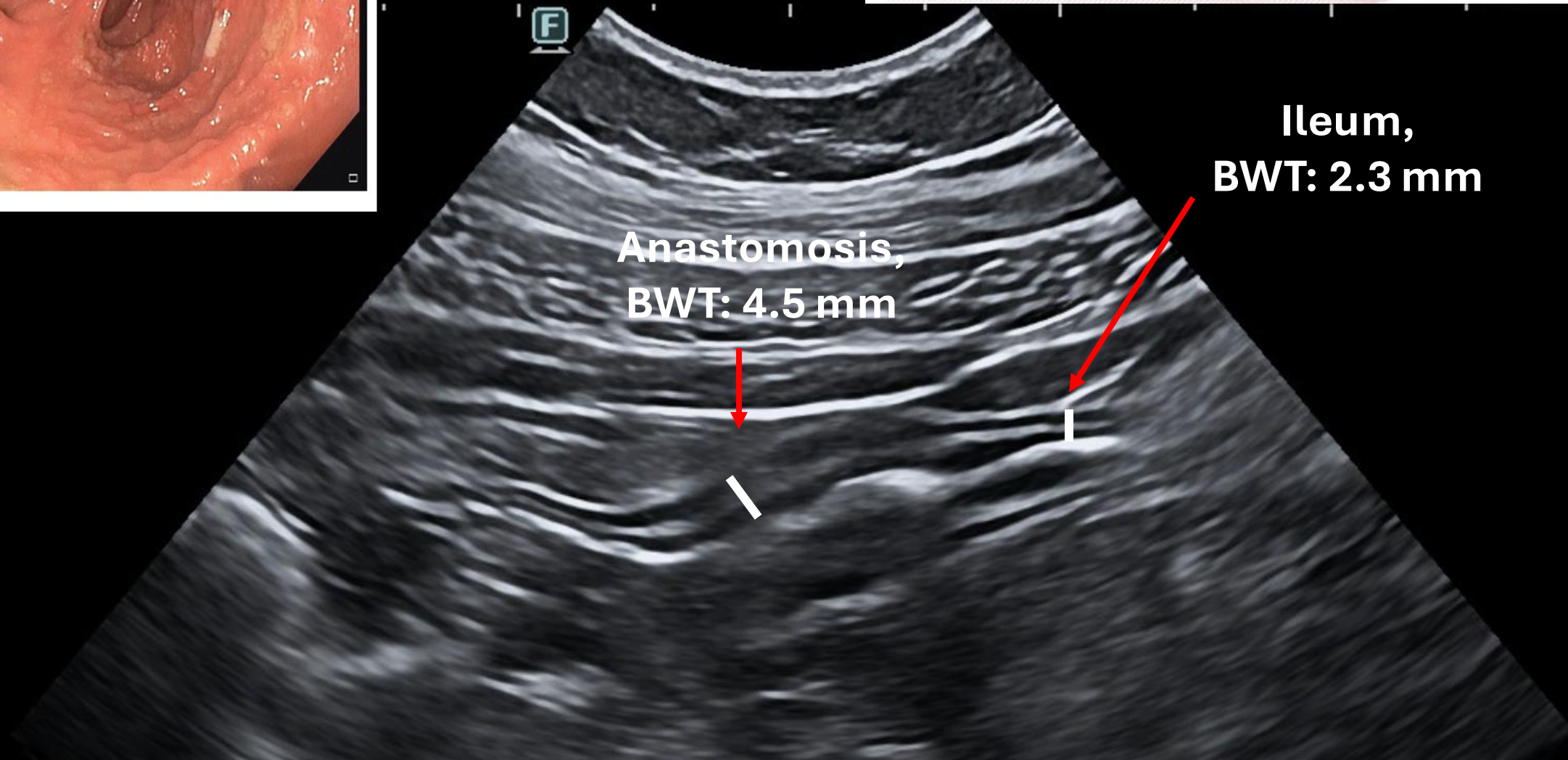


Kono-S anastomosis UniSR



**Ileum,
BWT: 2.3 mm**

**Anastomosis,
BWT: 4.5 mm**





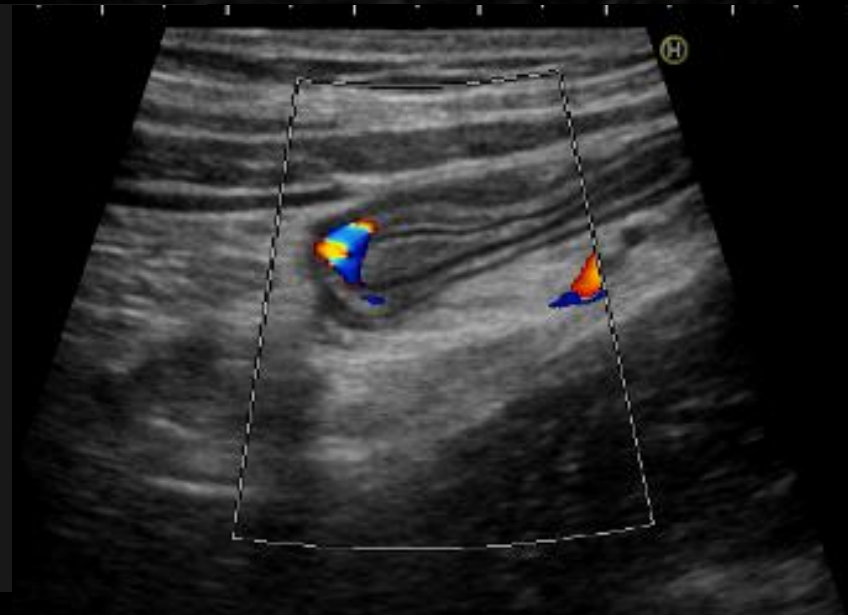
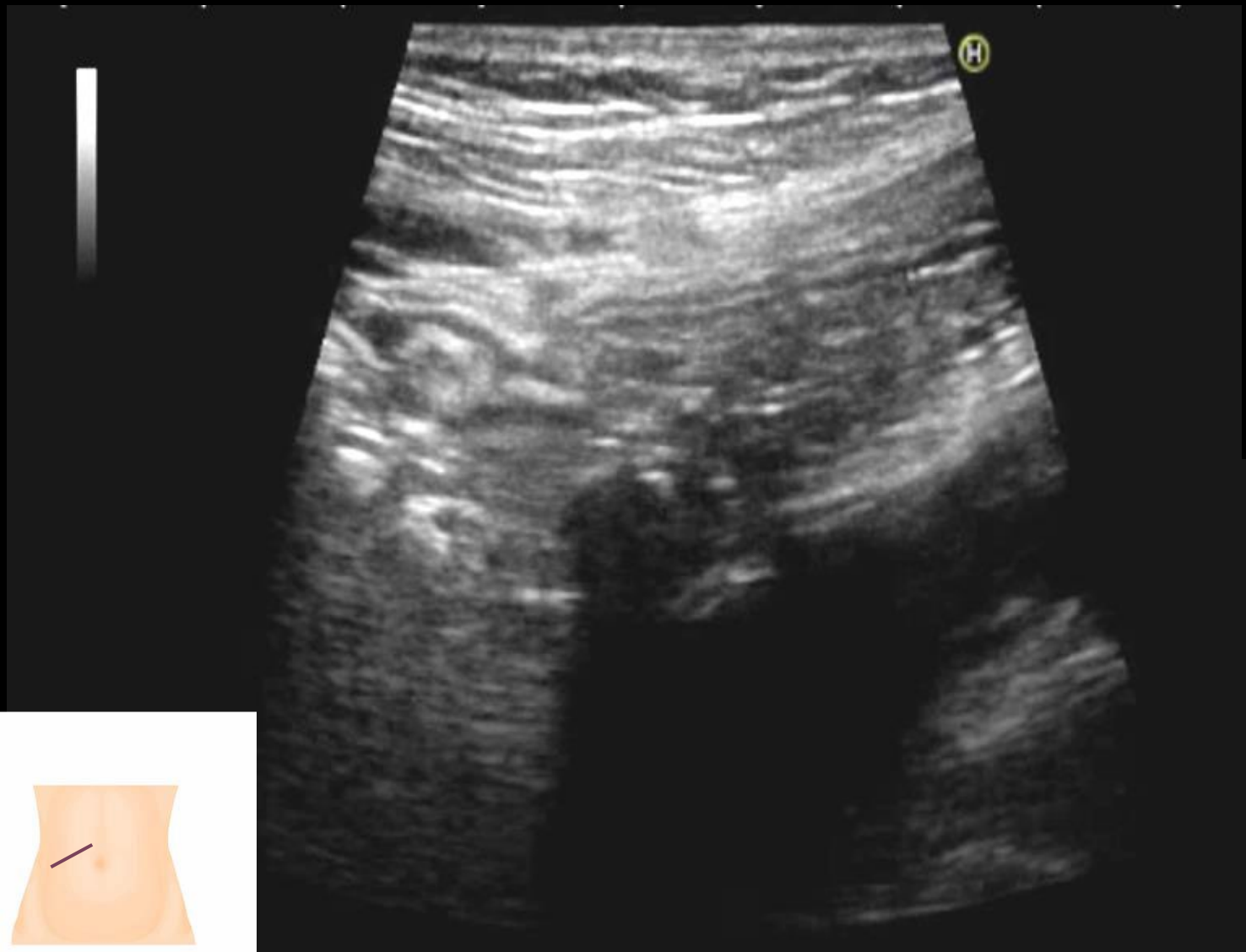
Case 10

Patient: Female, 26 years

Diagnosis: Crohns (Ileocolonic disease: Short segment, inflammatory)

Therapy: Ileocolic resection 1 year before; started on Azathioprine due to low risk of recurrence

Symptoms: recurrent pain





Rutgeerts i3



Take-home messages

- ✓ Non-invasive monitoring (IUS+FC) may avoid colonoscopy
- ✓ Anatomy, anatomy, anatomy
- ✓ Reviewing prior imaging will help you FIND the anastomosis
- ✓ Break the anastomosis down into components where possible:
 - Colonic side (if there is one)
 - Ileal side/ blind side
 - Outlet
 - NTI (proximal small bowel)



Thank you

