international bowel ULTRASOUND GROUP

KUWAIT GASTROENTEROLOGY ASSOCIATION
رابطة الجهاز الهضمي والكبد الكويتية

Complications in IBD

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Disclosures of potential conflicts of interest

- **Consultancy honoraria:**
  - Takeda pharmaceutical, Pfizer pharmaceutical, Janssen pharmaceutical, Bristol- Mayers Squibb pharmaceutical, Ferring pharmaceutical, Hikma pharmaceutical, Eli Lilly pharmaceutical.
- **Speaker honoraria:**
  - AbbVie pharmaceutical, Janssen pharmaceutical, Takeda pharmaceutical, Hikmah pharmaceutical, Bristol- Mayers Squibb pharmaceutical, Pfizer pharmaceutical, Ferring pharmaceutical, Hikma pharmaceutical, GSK pharmaceutical, Eli Lilly pharmaceutical.

Objectives

01 The importance of imaging in IBD.

02 Intestinal ultrasound (IUS) in detecting Crohn's disease (CD) complications:

- Strictures (inflammatory and fibrosis).
- Abdominal fistulas.
- Inflammatory Masses (Abscess and phlegmon).

03 Advanced tools for better IUS accuracy.

04 IUS in acute severe ulcerative colitis (ASUC).

Updated Goals of IBD Management

STRIDE-II Stated:

- Cross-sectional imaging, using **ultrasound**, contrast-enhanced computed tomography, & magnetic resonance enterography, has been increasingly used in addition to endoscopic assessments.
- The use of bedside **bowel ultrasound** has revolutionized our ability to assess the degree of inflammation in IBD.
- It allows frequent assessments & has the advantage of assessing the entire gastrointestinal tract, including transmural healing.

Journal of Crohn's and Colitis, 2025, **19(7)**, jjaf106
https://doi.org/10.1093/ecco-jcc/jjaf106
Advance access publication 31 July 2025
ECCO Guideline/Consensus Paper

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

Active IBD

Anatomical

Histological

Recommendation 20 We recommend cross-sectional imaging (MRE, IUS, or both) to detect small-bowel strictures (EL1). Active inflammation within strictures should be assessed using MRE, IUS, or both (EL2). Currently, no imaging technique is sufficiently accurate to quantify fibrosis (EL3). Cross-sectional imaging criteria have low sensitivity for detecting small-bowel cancer complicating CD (EL3). (97% agreement)

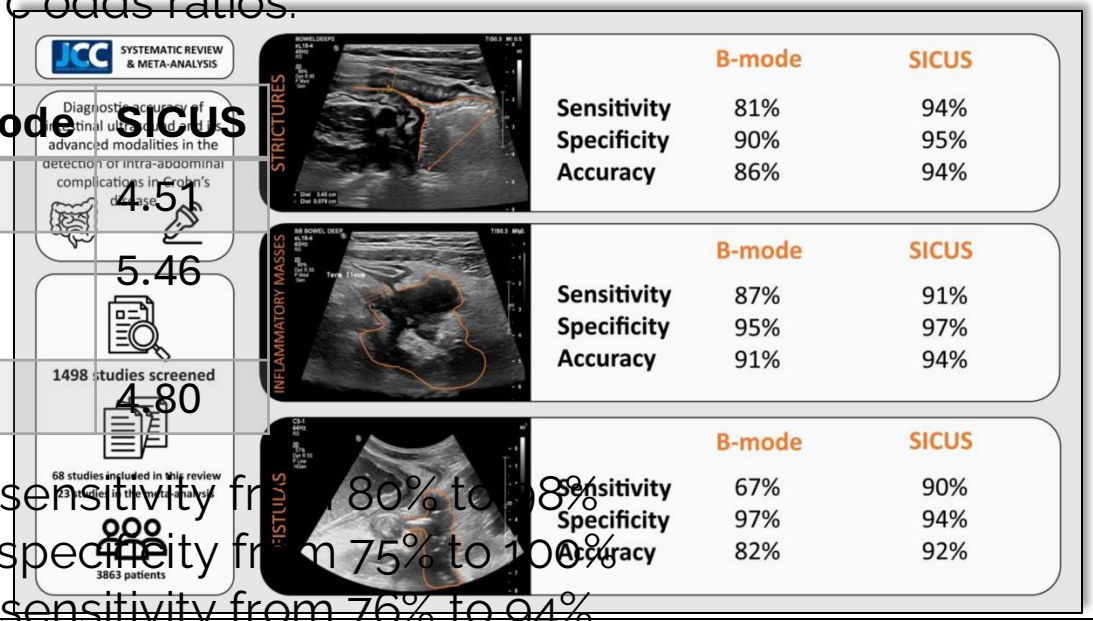
Recommendation 21 We recommend cross-sectional imaging (MRE, MRI, IUS, or combinations thereof) to detect penetrating disease and intra-abdominal abscesses in CD (EL1). If the first test is inconclusive in the presence of high clinical suspicion, we suggest performing additional cross-sectional imaging (MRI, CT, IUS, or combinations thereof) (EL4). (97% agreement)

- Gastroenterology-AGA STRIDE-II April 2021
- Turner D, et al. Gastroenterology. 2021;160:1570-1583.
- ATKINSON et al. WJG, 2017
- Torsten Kucharzik et al. ECCO-ESGAR-ESP-IBUS Guideline, 2025

IUS in the Detection of Intra-Abdominal Complications

- Meta analysis. 1498 studies.
- Pooled overall log diagnostic odds ratios:

	B-mode	SICUS
Stricture	3.56	4.51
Inflammatory mass	3.97	5.46
Fistula	3.84	4.80



- Adding 250mL PEG 4000: ↑ sensitivity from 80% to 98%
  specificity from 75% to 100%
- Adding 375mL PEG 3350 ↑ sensitivity from 76% to 94%

Table 2. Pooled sensitivity, specificity, and accuracy for all reference standards.

Complication	Exam type	Included studies [n]	Patients [n]	Sens	95% CI	I^2 [%]	χ^2	Spec	95% CI	I^2 [%]	χ^2	Acc
Stricture	B-mode	18†	2002	0.808	0.775–0.838	83.1	100.89*	0.902	0.885–0.917	83.4	102.21*	0.855
Stricture	SICUS	4	202	0.935	0.865–0.976	0.0	2.42	0.945	0.884–0.980	55.2	6.7	0.940
Inflammatory mass	B-mode	9	513	0.867	0.779–0.929	0.0	7.65	0.948	0.922–0.967	31.6	11.69	0.908
Inflammatory mass	SICUS	3	133	0.913	0.720–0.989	50.7	4.06	0.973	0.922–0.994	46.1	3.71	0.943
Fistula	B-mode	13	817	0.665	0.598–0.727	65.6	34.91*	0.973	0.957–0.985	11.0	13.48	0.819
Fistula	SICUS	3	134	0.900	0.782–0.967	39.5	3.3	0.940	0.867–0.980	0.0	0.61	0.920

- M. Pruijt et al. Jl of Crohn's and Colitis. Jan 2024

Crohn's disease complications

1. **Strictures:**
   - **(Inflammatory vs Fibrosis)**
2. **Abdominal Fistulas.**
3. **Inflammatory Masses:**
   - **(Abscess vs Phlegmon)**

Current role of IUS in IBD
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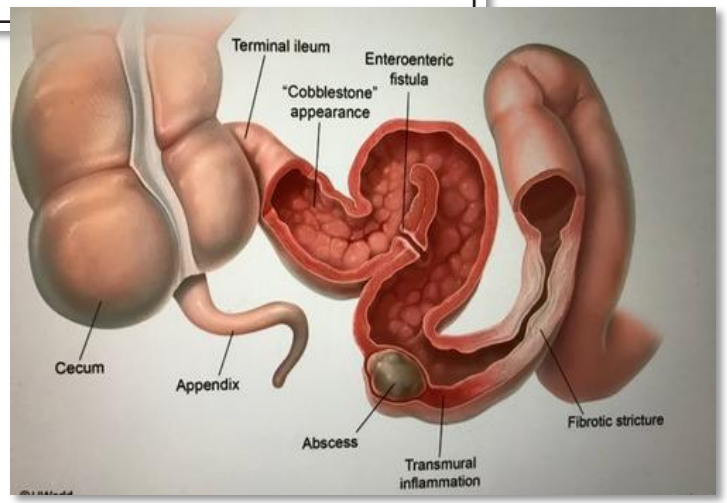
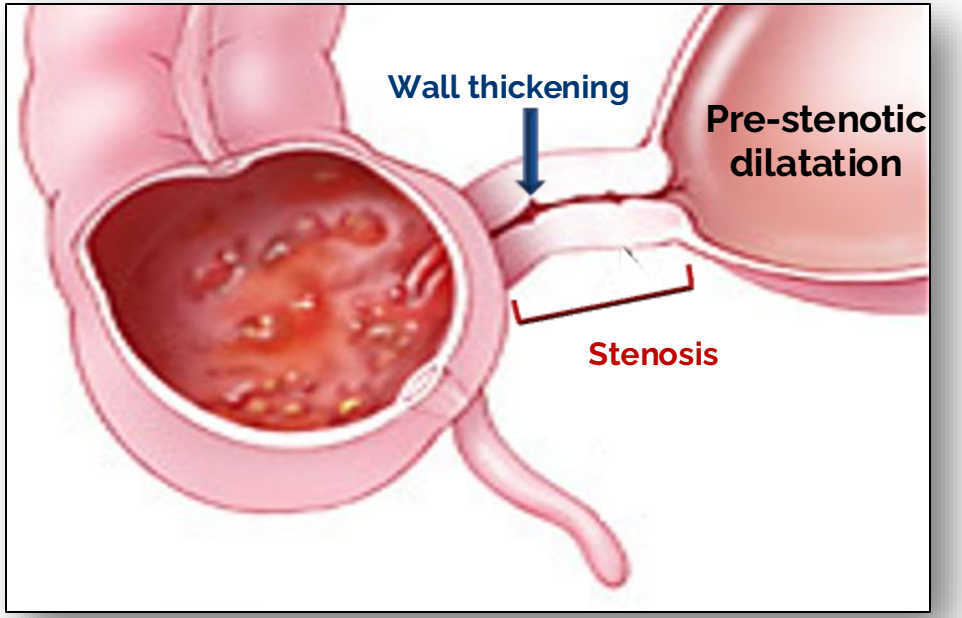
Monitoring response to therapy in IBD



Stricture

- > 50% of patients with CD develop strictures over their lifetime. The terminal ileum is the most common stricture location.
- Strictures develop >30-35 % of patients in the first decade of a diagnosis of CD.
- Strictures are characterized by different degrees of inflammation & fibrosis.
- Identification of these two components can improve the quality of IBD management.

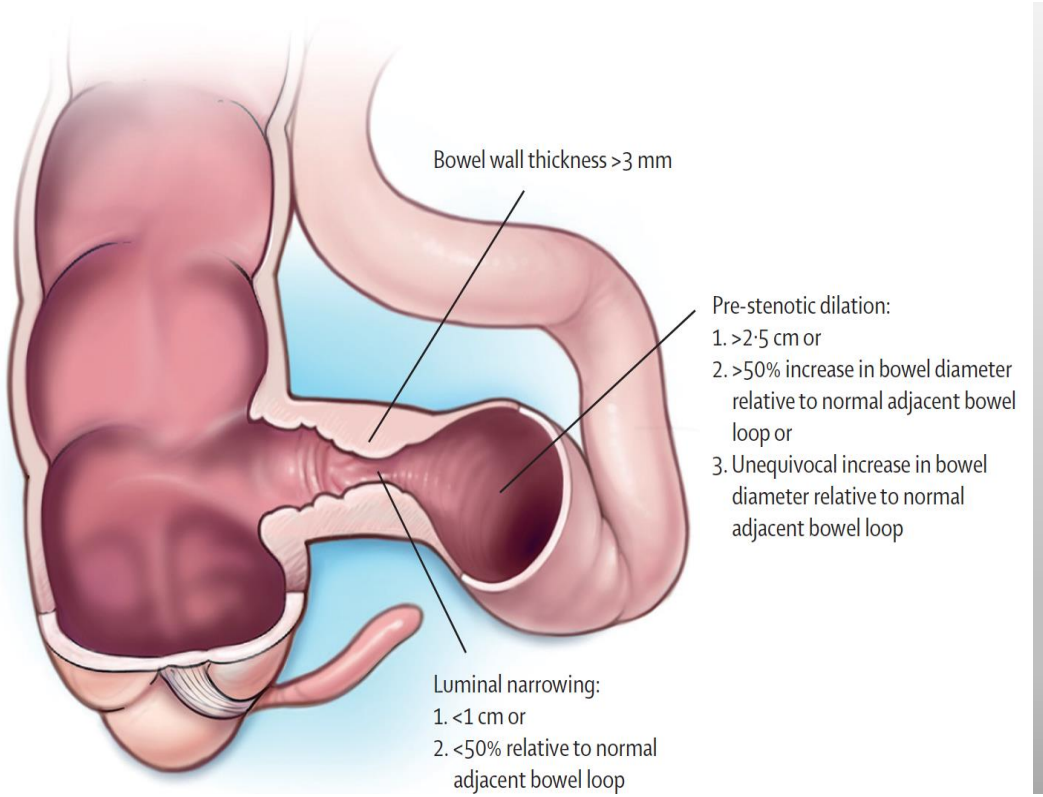


- Zishan Liu et al, UEG J,ournal March 2024
- C. Lu et al, Aliment Pharmacol Ther. April 2024

IUS parameters & diagnostic criteria for stricture (B-mode)

International expert guidance for defining & monitoring small bowel strictures in CD on IUS: a consensus statement

1. Bowel wall thickness (>3 mm).
2. Luminal narrowing (Diameter < 1 cm) or luminal diameter reduction of > 50% in the narrowest area and relative to a normal adjacent bowel loop.
3. Pre-stenotic dilation (increase in lumen diameter or absolute diameter of > 2.5 cm) or an increase in bowel diameter relative to a normal adjacent bowel loop.



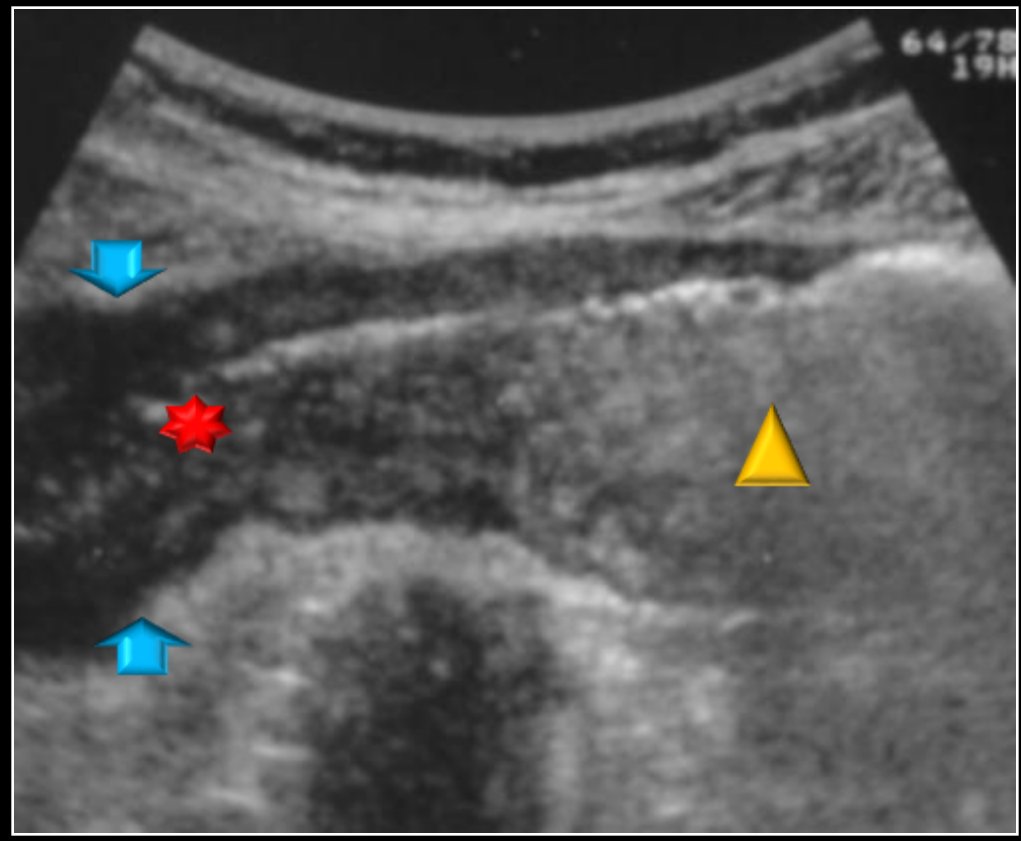
- C. Lu et al, LANCET, Dec. 2024
- C. Lu et al, Aliment Pharmacol Ther. April 2024

Standard IUS parameters & diagnostic criteria for stricture (B-mode)

Guidelines and Recommendations

EFSUMB Recommendations and Clinical Guidelines for Intestinal Ultrasound (GIUS) in Inflammatory Bowel Diseases

- Thickened & stiff bowel wall (>3 mm).
- Narrowing of the lumen (diameter < 10 mm).
- Proximal dilatation (> 25 – 30 mm).
- Hyperperistalsis of the pre-stenotic gut.



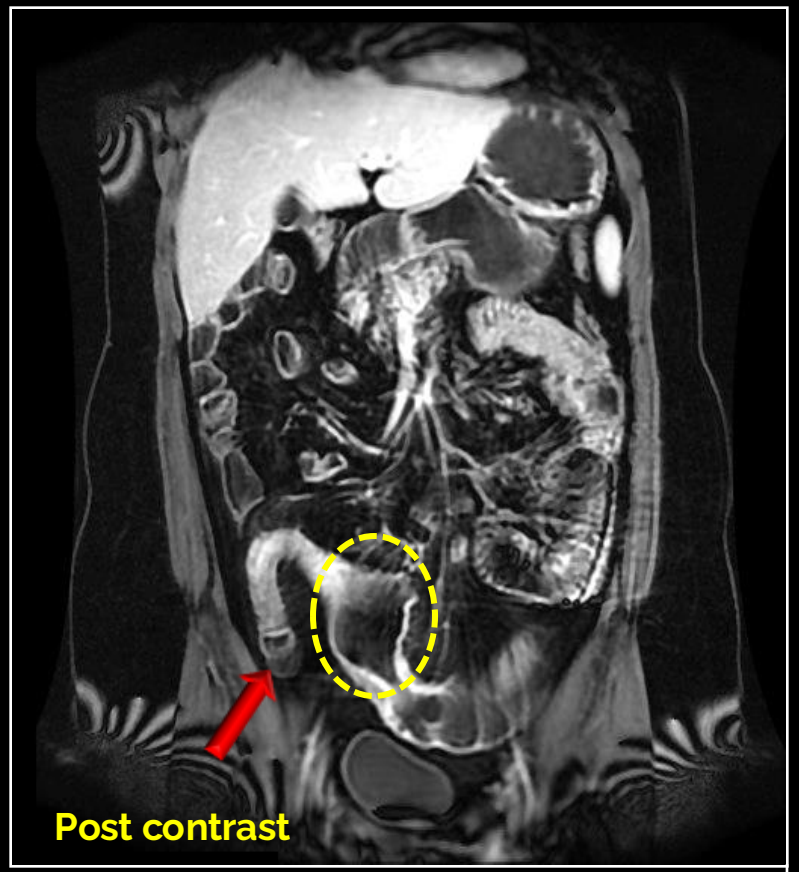
IUS to detect CD complications (stricture)

Case 1:

- Mr. E is a 31-year-old gentleman, smoker, was diagnosed as a case of Terminal ileal Crohn's disease for > 3 years.
- On biological agent.
- Presented to clinic with recurrent symptoms of lower abdominal pain, bloating & mild abdominal distention.

IUS to detect CD complications (stricture)

- Long segment of stenosis 11 cm.
- Thickened bowel wall > 10 mm.
- Pre-stenotic dilatation.
- Abnormal Peristalsis.



MRI: 11 cm long Segment of ileal loop stricture fibrotic with localized up stream focal pouch like dilatation with retained content

Crohn's disease complications

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   - **(Abscess vs Phlegmon)**

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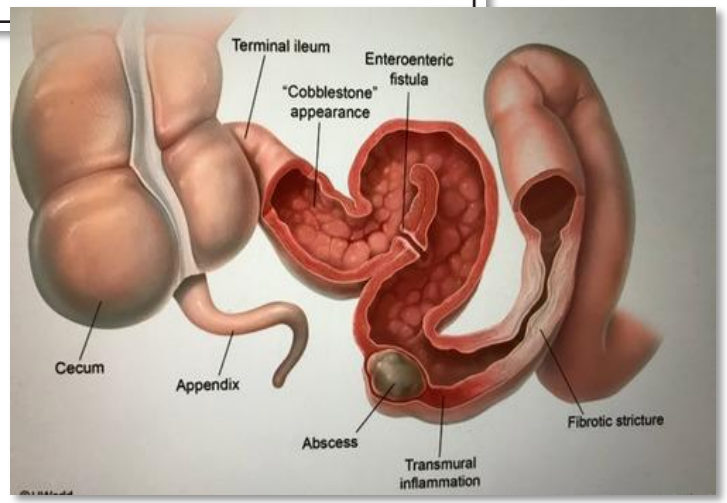
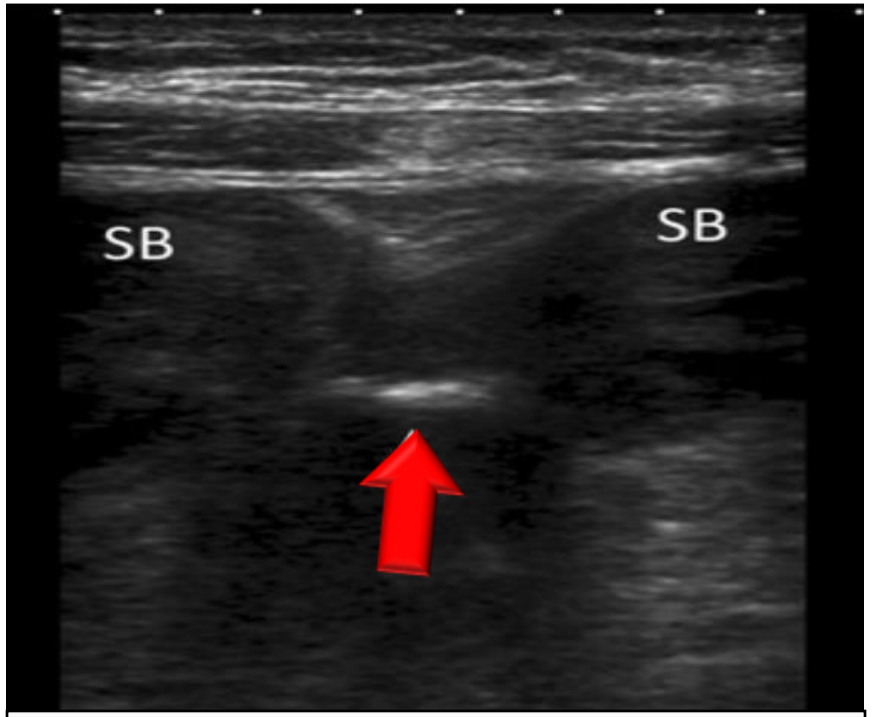


Standard IUS parameters for fistula (B-mode)

- **The IUS diagnostic criteria of sinus tracts & fistulae are similar:**

1. Hypoechoic areas or tracts between **ileal loops** with or without internal gaseous artifacts.
2. Hypoechoic **peri-intestinal** tracts with or without gas within.
3. Hypoechoic peri-intestinal areas with a **diameter < 2 cm**.



IUS shows an entero-enteric fistulae. Linear communication between two thickened small bowel loops which contains air (arrow)

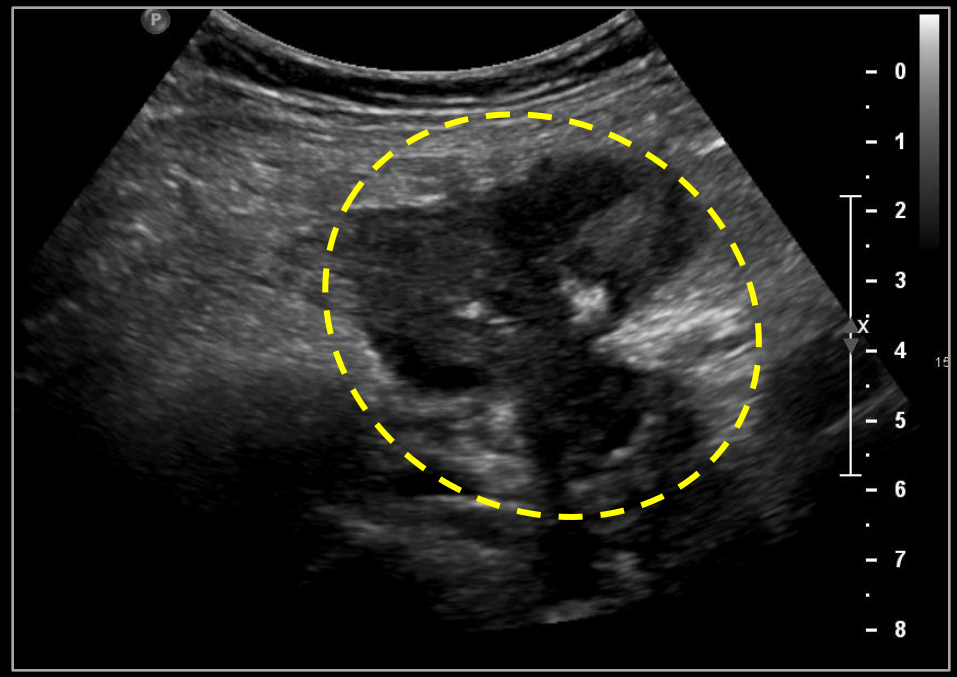
- Maconi G et al. EFSUMB Recommendations 2018
- Pan.s J, et al. Systematic review. AP & T 2011 Jul
- C. Maaser et al. ECCO-ESGAR guideline, 2018

IUS to detect CD complications (Fistula)

Case 2

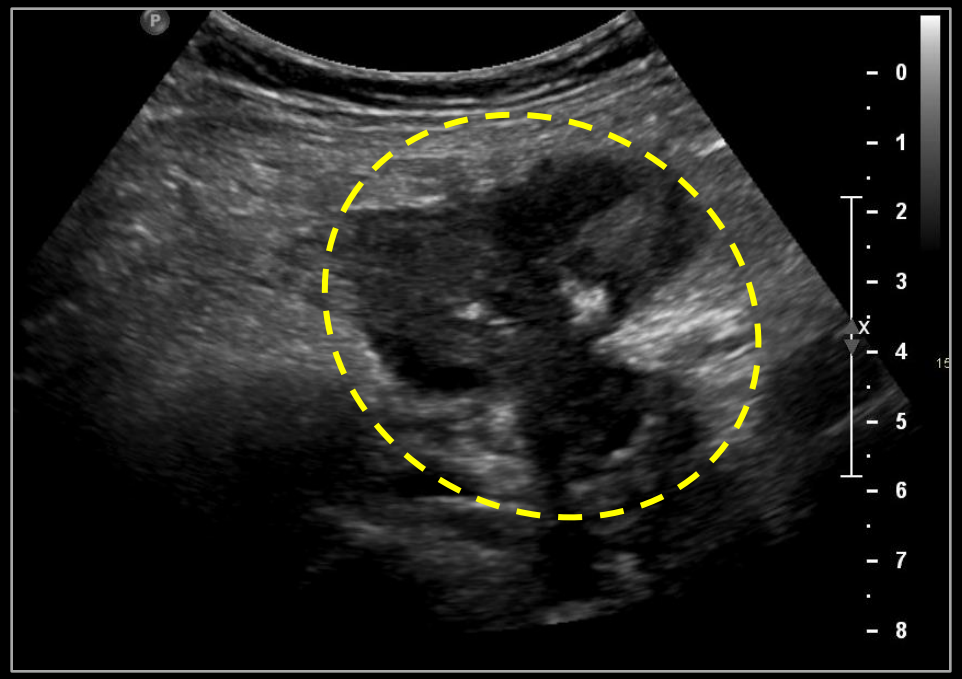
- Mrs. M is a 43-year-old lady, was diagnosed on 2018 as a case of inflammatory terminal ileal CD, was on anti-TNF then she decided to stop it and start herbal medications.

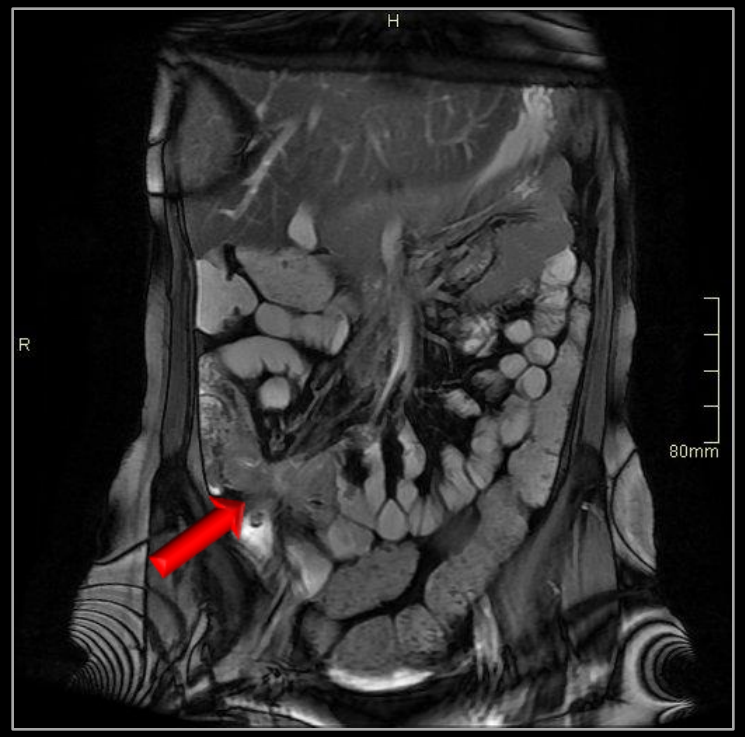
- Missed follow up for 4 years. Presented with severe abdominal pain.



IUS to detect CD complications (Fistula)

- MR- Enterography:

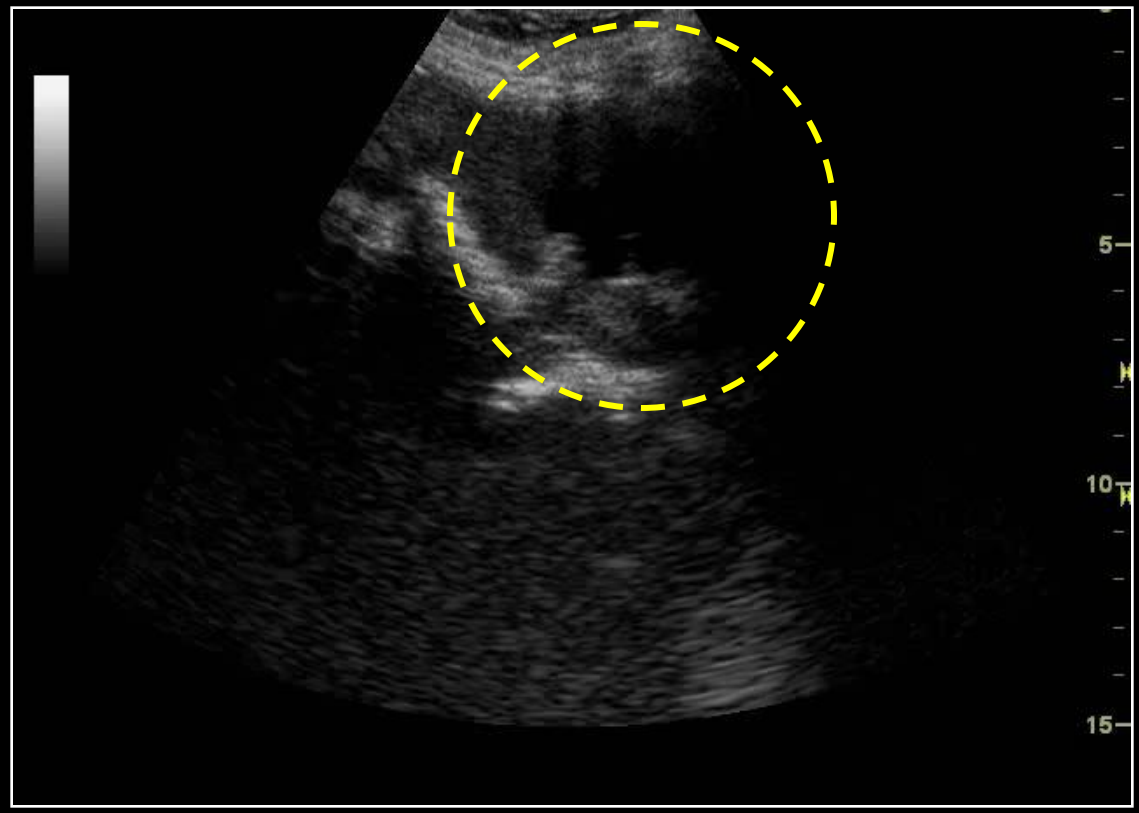




IUS to detect CD complications (Fistula)

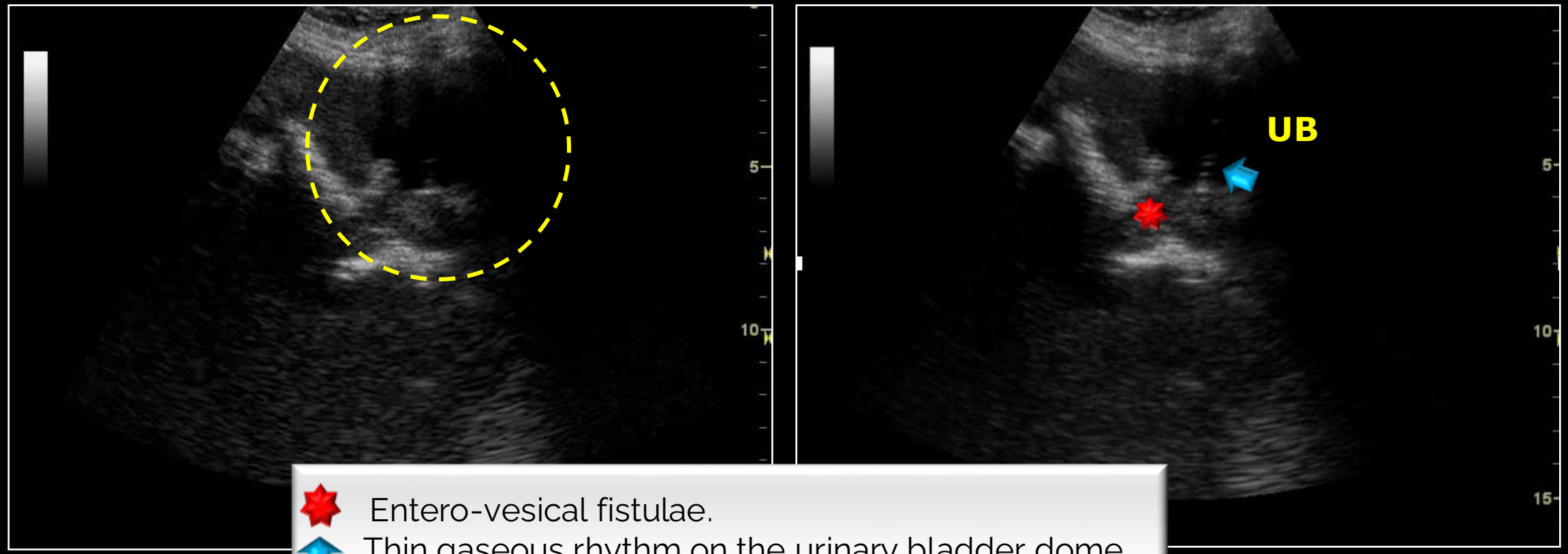
Case 3

- Ms. F is a 25-year-old lady, was diagnosed on 2020 as a case of ileocolonic CD.
- On biological therapy.
- Presented with abdominal pain, turbid color urine and recurrent UTI.



IUS to detect CD complications (Fistula)

Case 3



Entero-vesical fistulae.

Thin gaseous rhythm on the urinary bladder dome.

Crohn's disease complications

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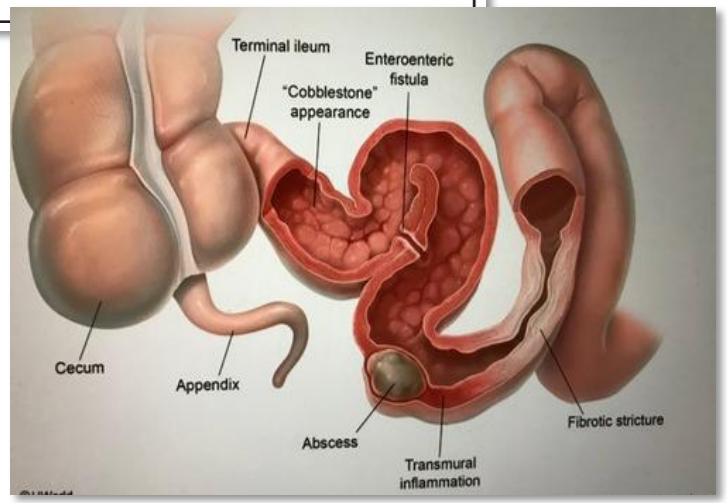
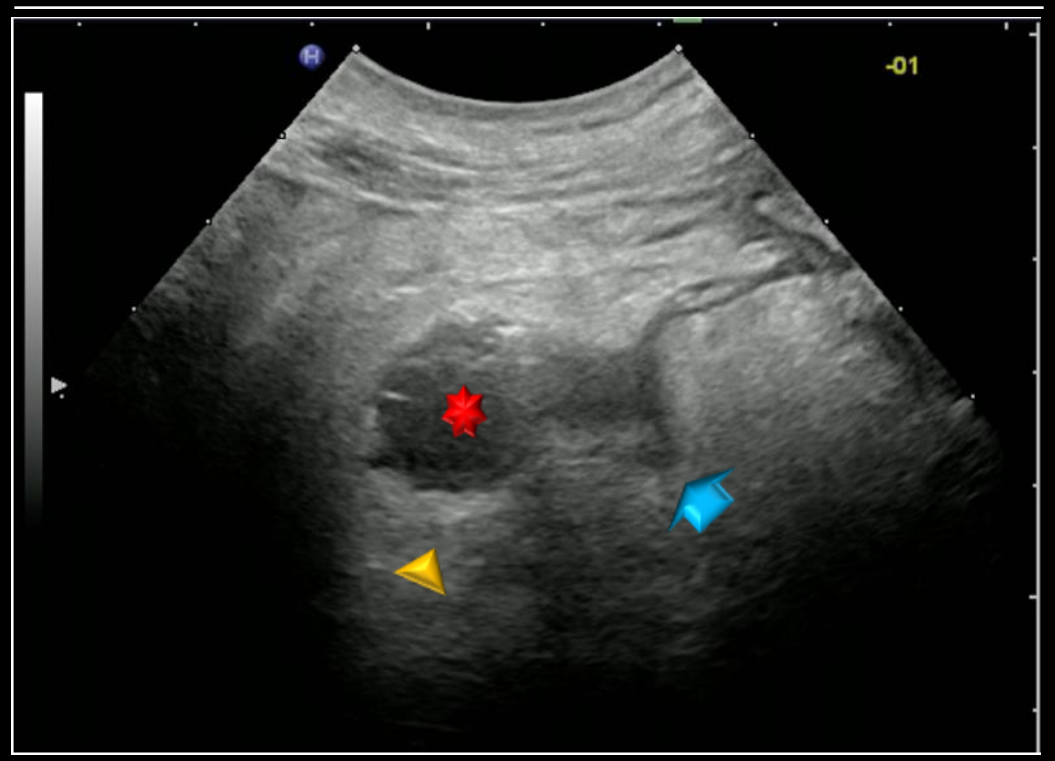


Standard IUS parameters for Inflammatory Masses (B-mode)

- **The US diagnostic criteria:**

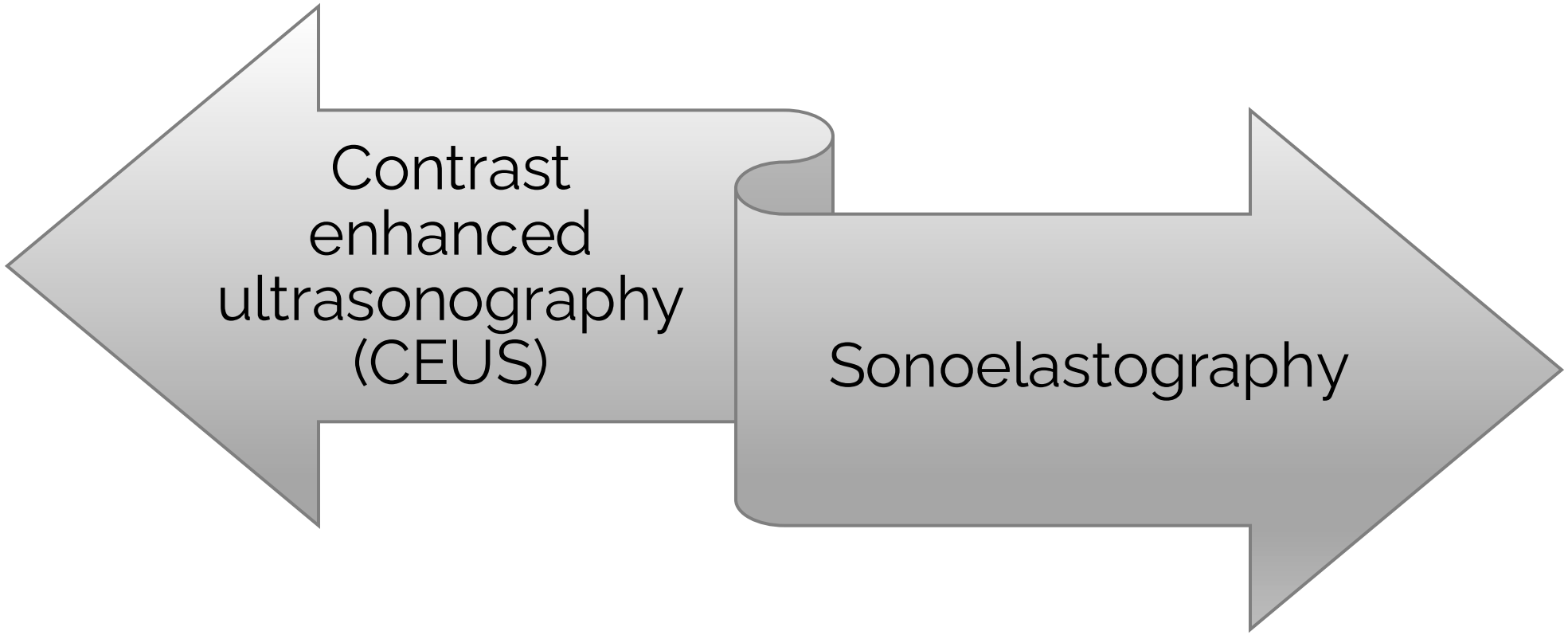
  - Hypo-anechoic lesions containing fluid & gaseous artifacts.
  - Posterior wall echo enhancement.
  - Surrounded by hypertrophic mesenteric fat.



- Pan.s J, et al. Systematic review. AP & T Jul 2011
- C. Maaser et al. UEG J, Feb 2022

Advanced IUS Techniques

- Other types of IUS examinations may increase the accuracy of the technique.



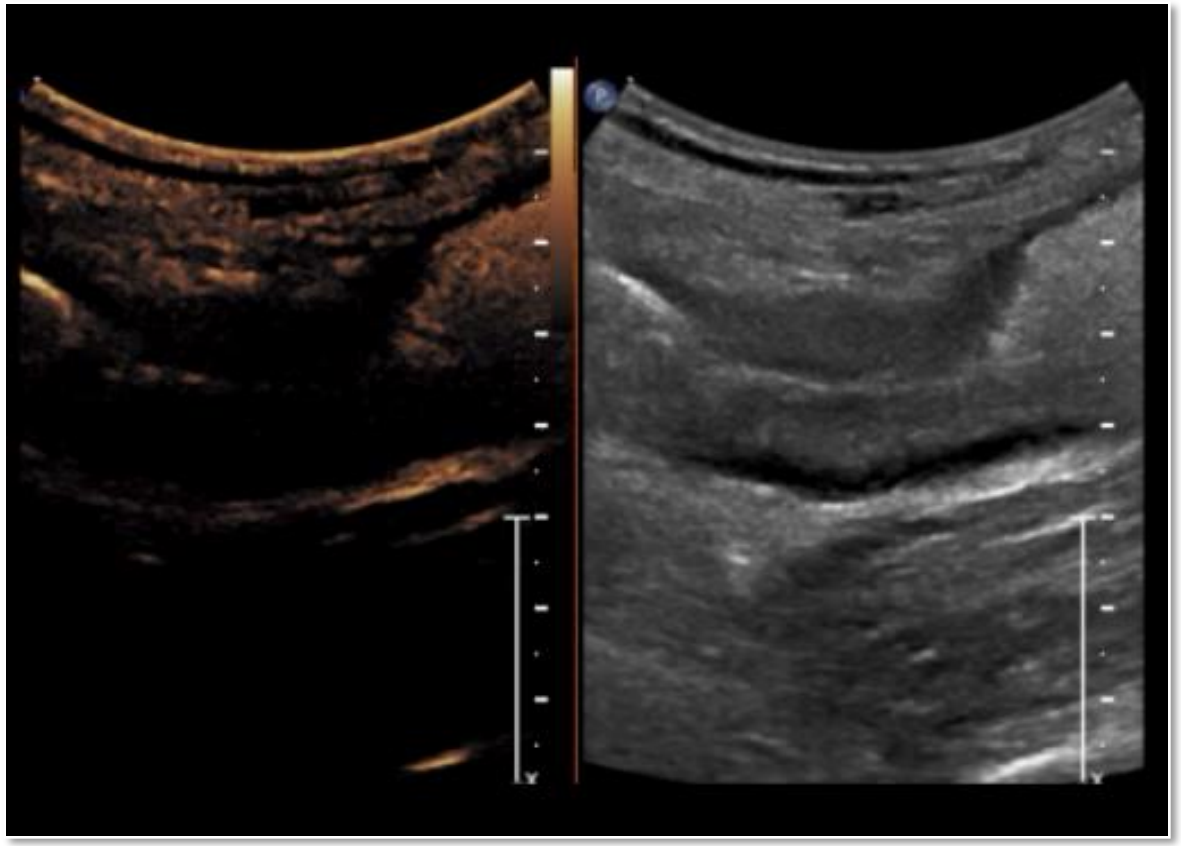
Use of CEUS in CD related strictures

Usage in CD complications:

- Provide bowel wall & mesentery enhancement parameters that reflect inflammation & assess disease activity.
- Help in differentiation between of inflammatory vs fibrotic intestinal strictures.
- Rule in the differentiation of inflammatory masses as either phlegmon or abscess

How is CEUS Performed?

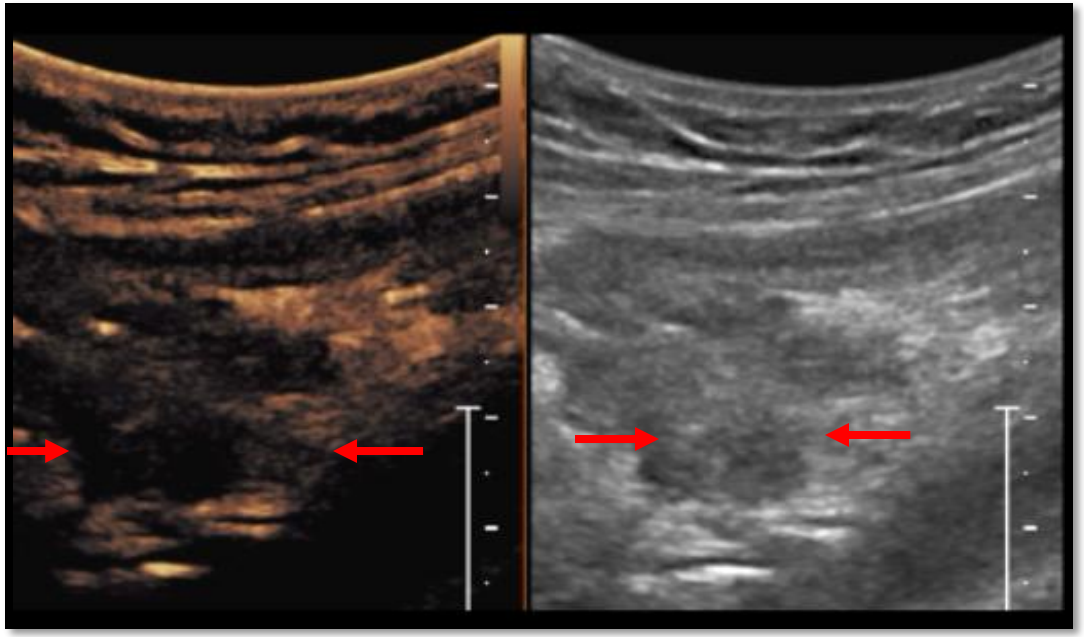
- Gas-filled microbubbles with a phospholipid shell.
- Microbubbles remain within capillaries & oscillate in the bloodstream in response to application of an ultrasound field, producing non-linear harmonic frequencies that are detected at CEUS.
- 2 Minutes video file. Followed by Quantification with raw linearized data



- Maconi G et al. EFSUMB Recommendations 2018
- Nylund K et al. EFSUMB Recommendations 2017
- Medellin et al. Abdom Radiol 2018.
- C. Maaser et al. UEG J, Feb 2022

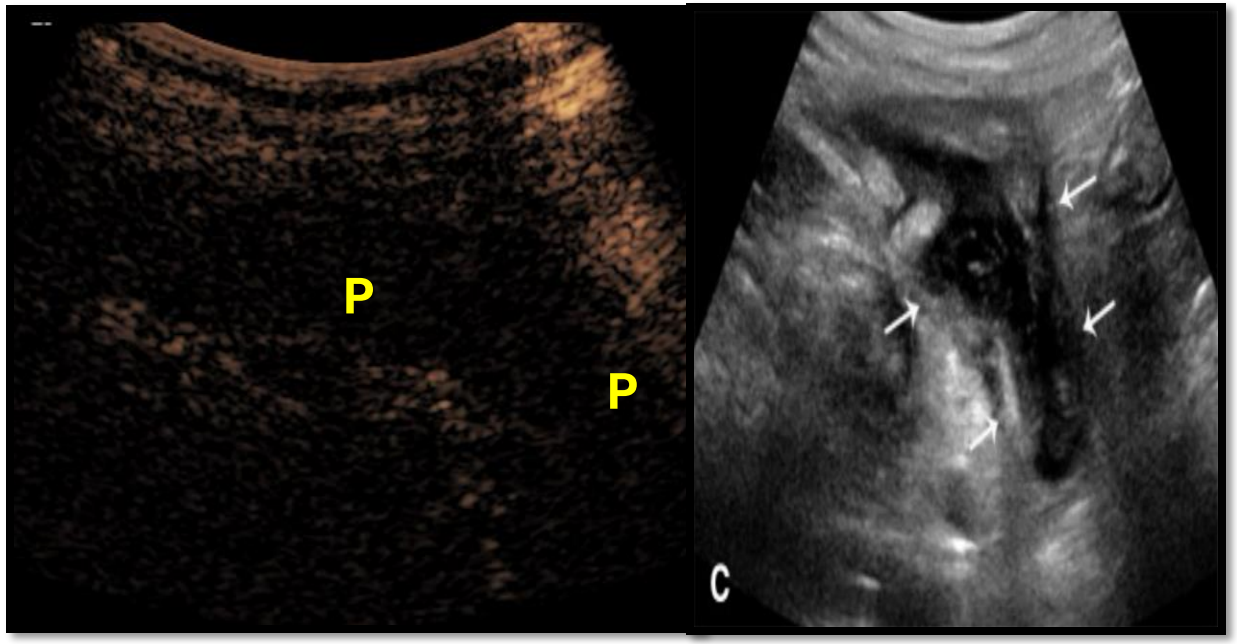
Use of CEUS in CD related inflammatory masses

- **Phlegmonous masses:**
  - Diffuse hyperenhancement reflecting acute inflammatory changes.



Abscess:

- Regions of avascularity corresponding to pockets of pus with peripheral areas of enhancement.
- Reflective of reactive inflammation & the abscess wall.

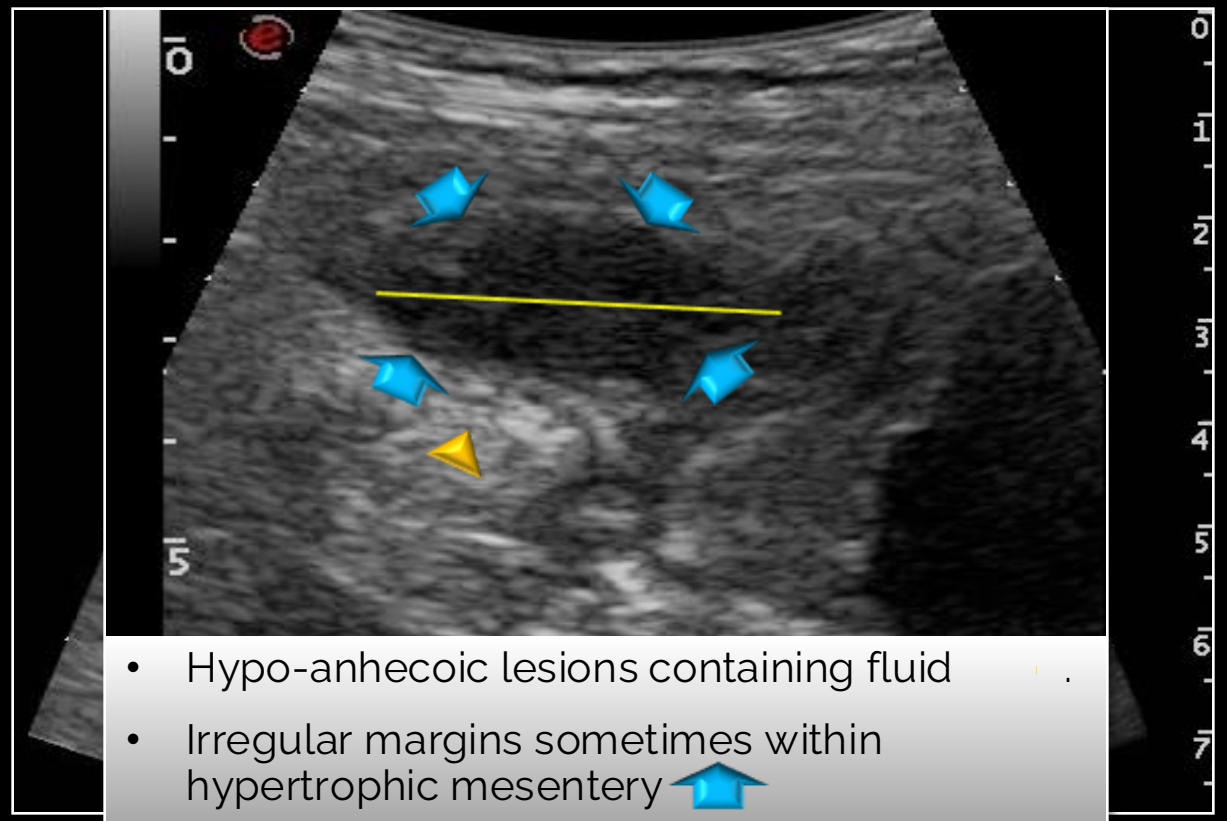


- Medellin et al. Abdom Radiol 2018.
- C. Lu et al. J Ultrasound Med 2019
- C. Maaser et al. UEG J, Feb 2022

Use of CEUS in CD related inflammatory masses

Case 4

- Mrs. K is a 26-year-old was diagnosed as a case of Terminal ileal CD for > 5 years.
- She was refusing to start biological agent & non complaint to her immunomodulator therapy (Azathioprine).
- She received many steroid doses during the disease flares.
- Presented to hospital complaining of lower abdominal pain & fever.



- Hypo-anhecoic lesions containing fluid
- Irregular margins sometimes within hypertrophic mesentery
- Posterior wall echo enhancement

Use of CEUS in CD related inflammatory masses

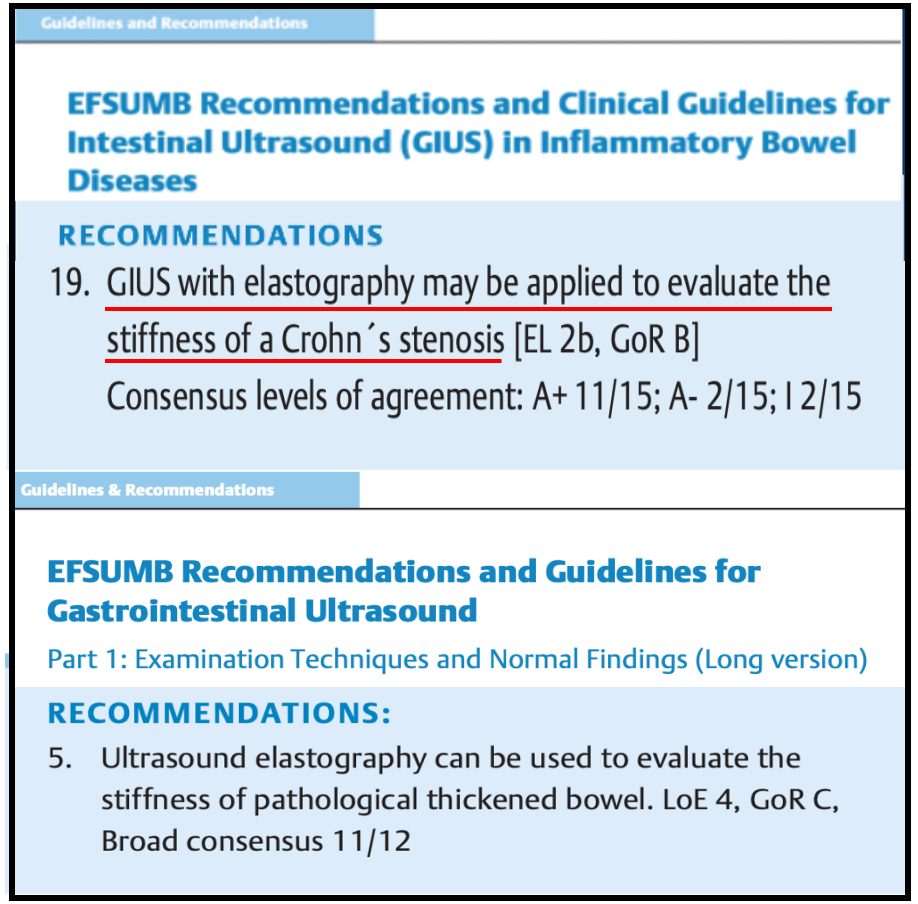
Case 4

- **Abscess**:
  - Avascular mass with peripheral areas of enhancement.

Sonoelastography

Advantage

- Estimate tissue elasticity & asses stiffness by:
  - US force propagation wave into the tissue.
  - Wave velocity depends on tissue mechanical properties. (mainly tissue elasticity).
  - Provide information on histological features & the presence of wall fibrosis.



Guidelines and Recommendations

EFSUMB Recommendations and Clinical Guidelines for Intestinal Ultrasound (GIUS) in Inflammatory Bowel Diseases

RECOMMENDATIONS

19. GIUS with elastography may be applied to evaluate the stiffness of a Crohn´s stenosis [EL 2b, GoR B]
Consensus levels of agreement: A+ 11/15; A- 2/15; I 2/15

Guidelines & Recommendations

EFSUMB Recommendations and Guidelines for Gastrointestinal Ultrasound

Part 1: Examination Techniques and Normal Findings (Long version)

RECOMMENDATIONS:

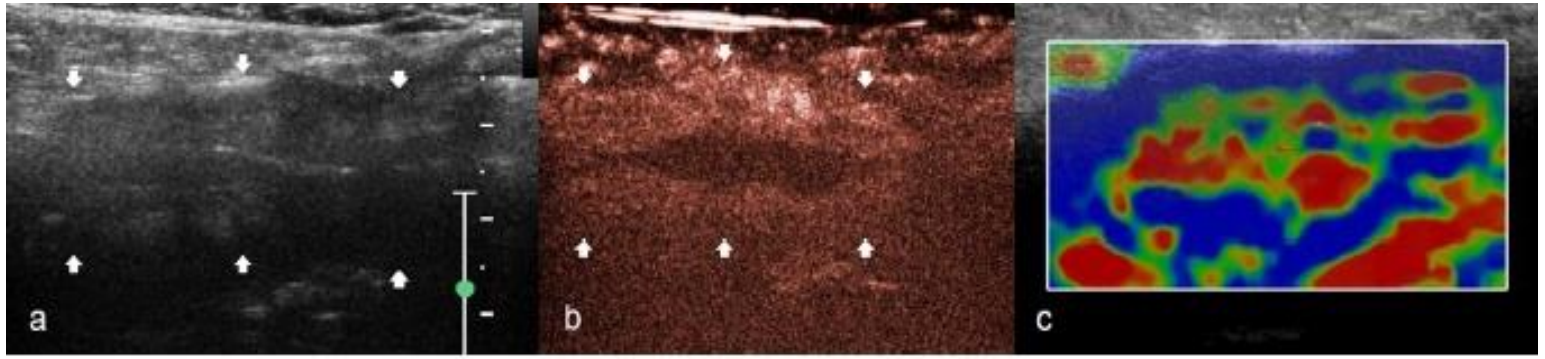
5. Ultrasound elastography can be used to evaluate the stiffness of pathological thickened bowel. LoE 4, GoR C, Broad consensus 11/12

- Ferretti et al. Front. Pharmacol. 2021
- Nylund K et al. EFSUMB Recommendations 2017
- Maconi G et al. EFSUMB Recommendations 2018

Strain elastography

A. Strain Elastography

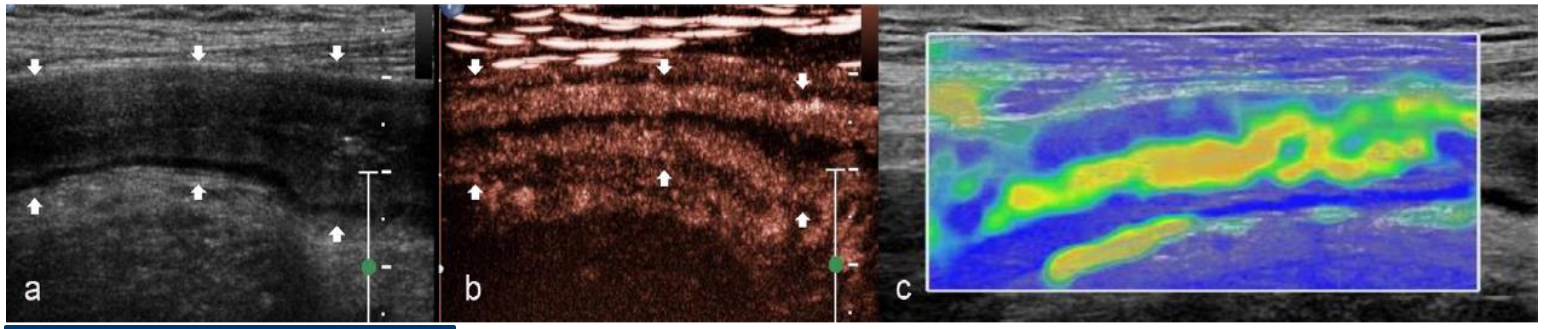
- **Compressive** force applied to tissues with repeated pulses to measure stiffness.
- Qualitative assessment:
  - Color scale
    - **Red** → Soft
    - **Blue** → Hard
- Quantitative assessment:
  - Wall-to-mesenteric fat strain ratio.



B-mode: thickened bowel wall with loss of bowel layers.

CEUS: Transmural contrast enhancement

SE: stiff stratified mural fibrosis with inflammatory component



B-mode: thickened bowel wall with intact of bowel layers.

CEUS: Submucosal contrast enhancement

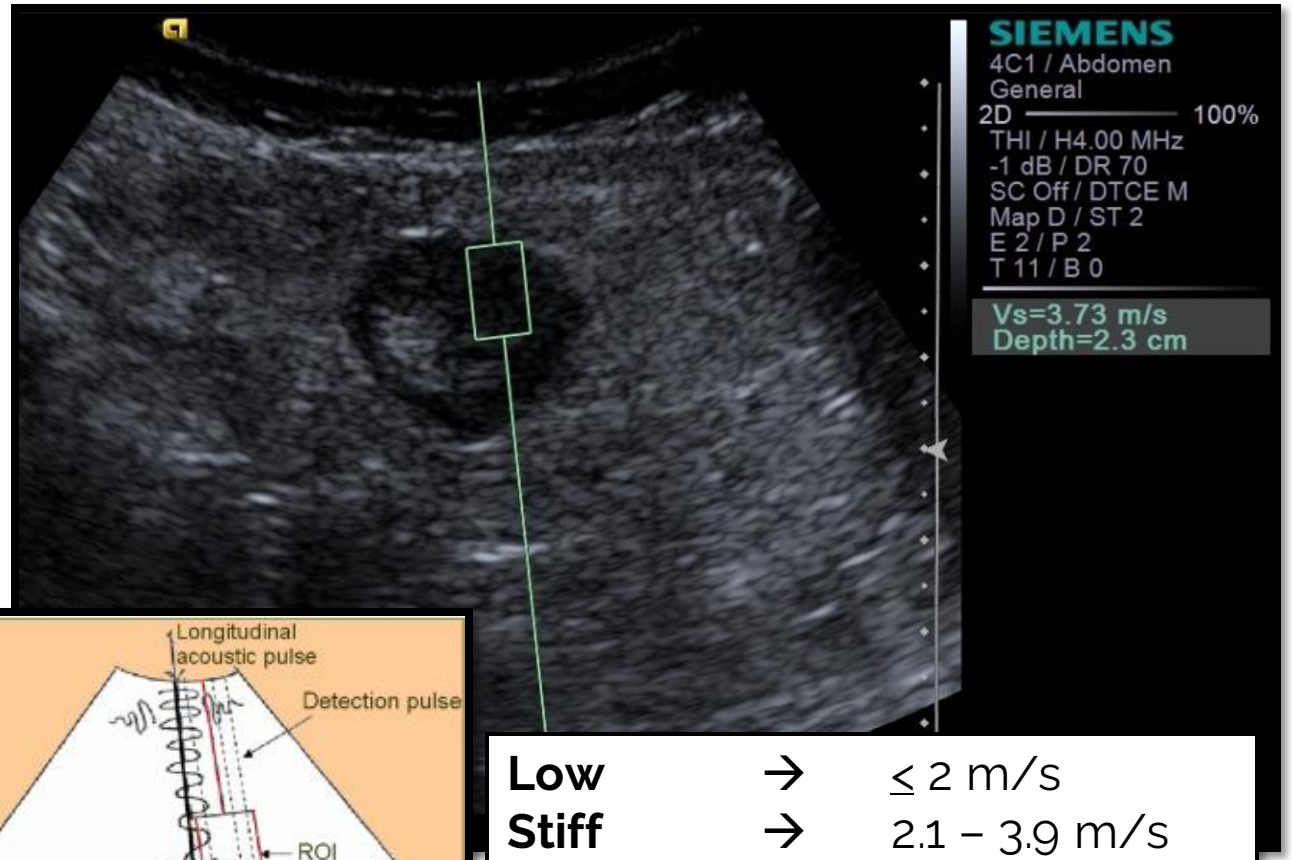
SE: stiff pattern with transmural blue color

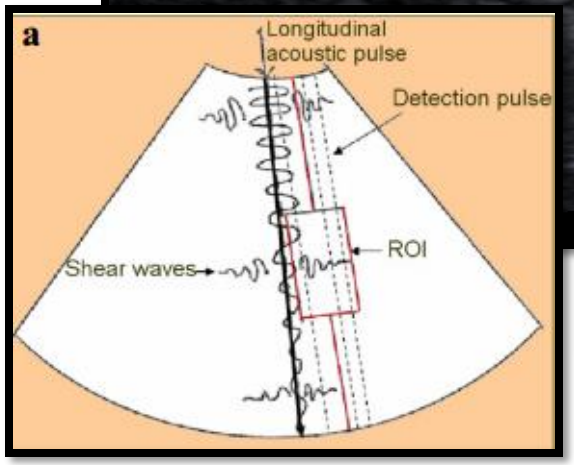
- Ferretti et al. Front. Pharmacol. 2021
- Nylund K et al. EFSUMB Recommendations 2017
- Maconi G et al. EFSUMB Recommendations 2018
- E. Quaia et al. Ultrasound in Medicine & Biology.2018

Shear wave elastography (SWE)

B. Shear wave Elastography

- **Acoustic radiation** force impulse (ARFI)
  - Measure SW propagation speed within the tissue.
  - SW propagate faster in hard than soft tissue. (Qualify stiffness)
    - Less fibrosis: **LOW SWE**
    - More fibrosis: **HIGH SWE**
- Qualitative assessment:
  - Color-scaled image.
- Quantitative assessment:
  - Determine maximum elasticity value in kPa or m/s.





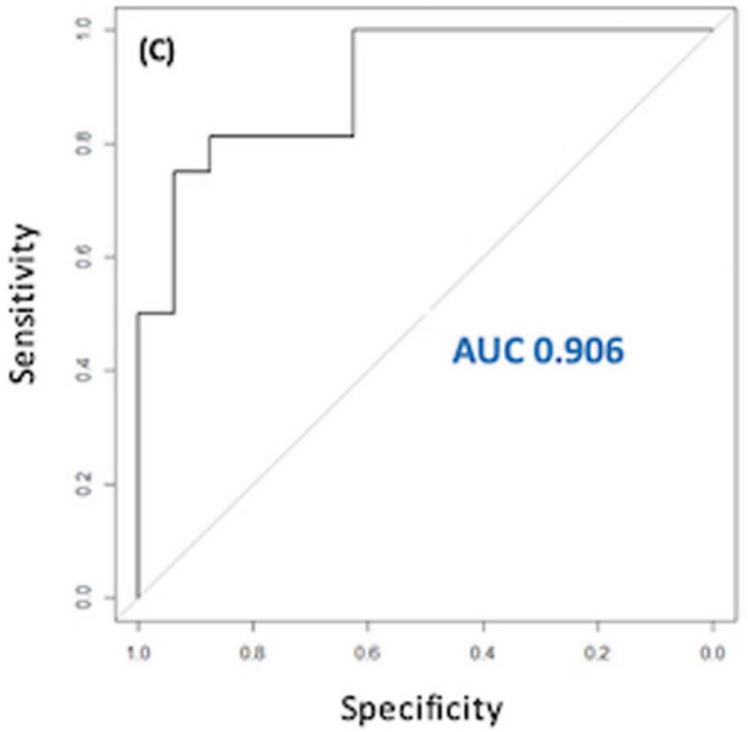
Low	→	≤ 2 m/s
Stiff	→	2.1 – 3.9 m/s
Very Stiff	→	≥ 4 m/s

- Ferretti et al. Front. Pharmacol. 2021
- Nylund K et al. EFSUMB Recommendations 2017
- Maconi G et al. EFSUMB Recommendations 2018
- Dillman JR, Stidham RW, et al. Radiology. 2013.
- Frulio et al. BMC. 2014

Reduction of BWT & CDS as early as 36 hours predicts corticosteroid response in Acute Severe Ulcerative Colitis:

- Multi-center prospective observational cohort study of adult ASUC.
- N= 32 pts with ASUC. (16 steroids responders & 16 required rescue therapy).
- IUS performed at Day 0, Day 3 and discharge.

- **Results:**
  - A reduction in BWT of <1.40mm or <20% from day 0 to day 3 → predicted CS non-response and need for rescue therapy well. (AUROC 0.75, AUROC 0.78.
  - Combined reduction in BWT + absence of doppler activity at day 3 further enhanced the predictive accuracy (AUROC 0.91).

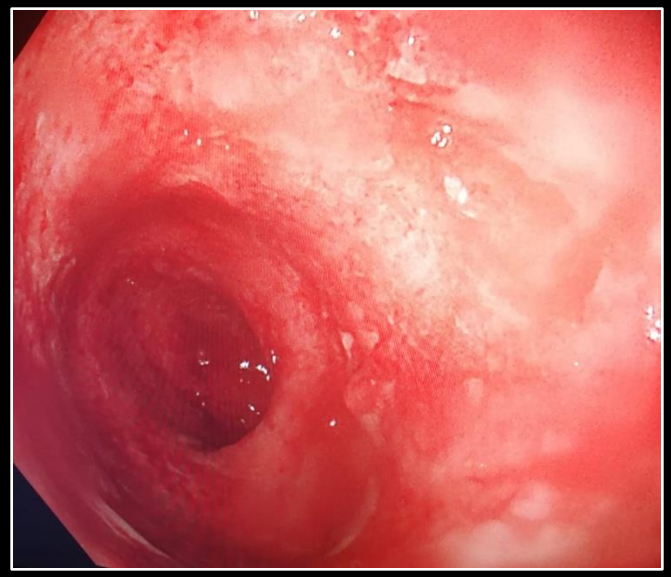


- Y.K. An et al, Journal of Crohn's and Colitis, 2023

IUS in acute severe ulcerative colitis (ASUC)

CASE 5

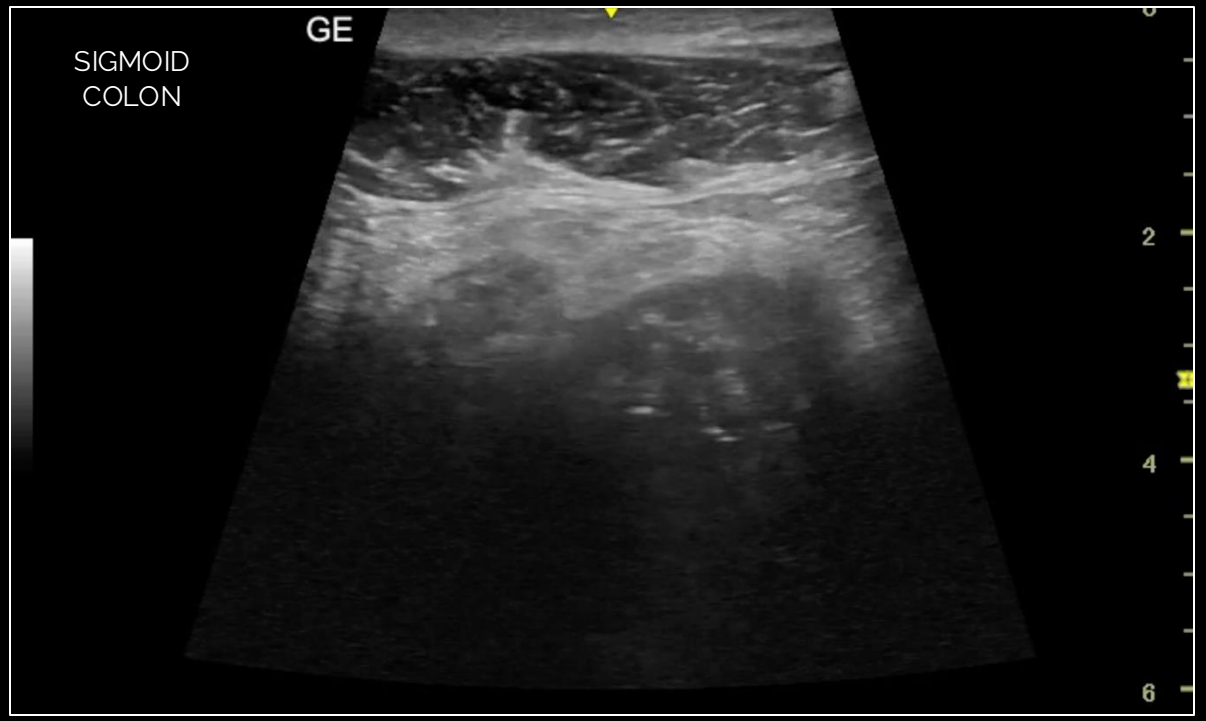
- Mr. R is a 39-year-old gentleman known case of UC, presented to ER with 8 weeks duration of bloody diarrhea (8 times/day), abdominal pain, fever and weight loss.
- Blood investigations showed elevated fecal calprotectin (>2000 ug/g), CRP 31 mg/dL and anemia. Stool C/S: -ve
- Sigmoidoscopy done:



IUS in acute severe ulcerative colitis (ASUC)

CASE 5

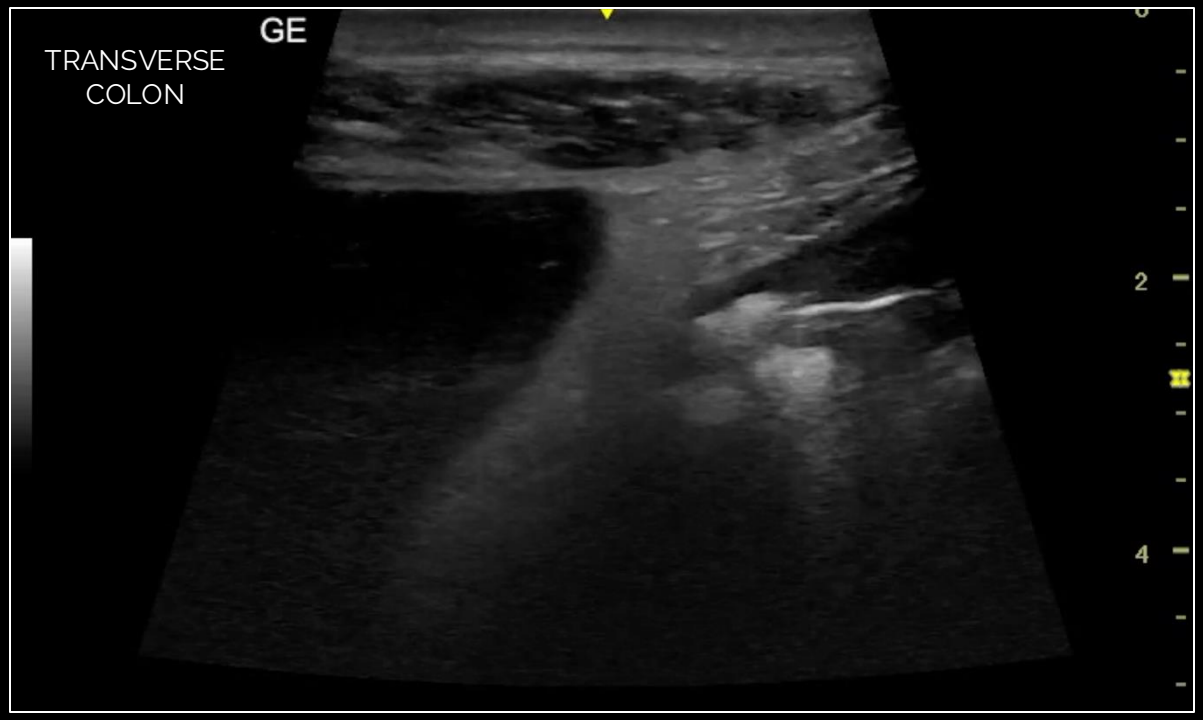
- Started on steroids but no response. Shifted for Infliximab. Day 0



IUS in acute severe ulcerative colitis (ASUC)

CASE 5

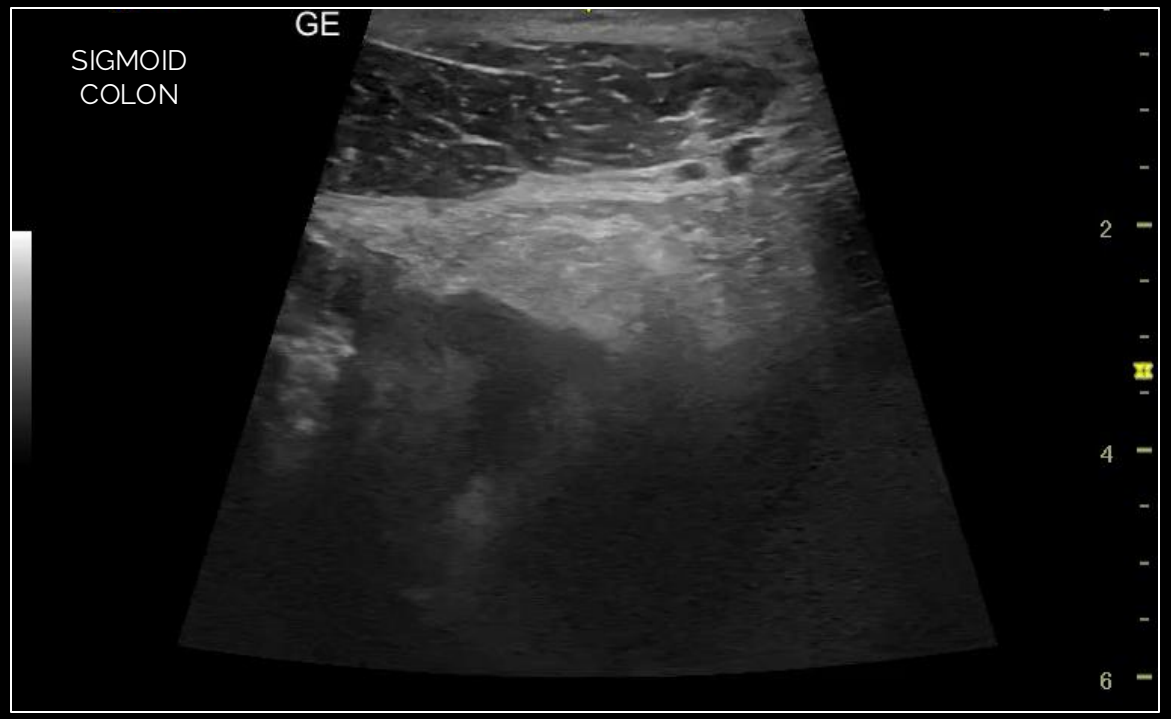
- Started on steroids but no response. Shifted for Infliximab. Day 0



IUS in acute severe ulcerative colitis (ASUC)

CASE 5

- Started on Infliximab. Day 5.
- Still symptomatic and started to vomit.



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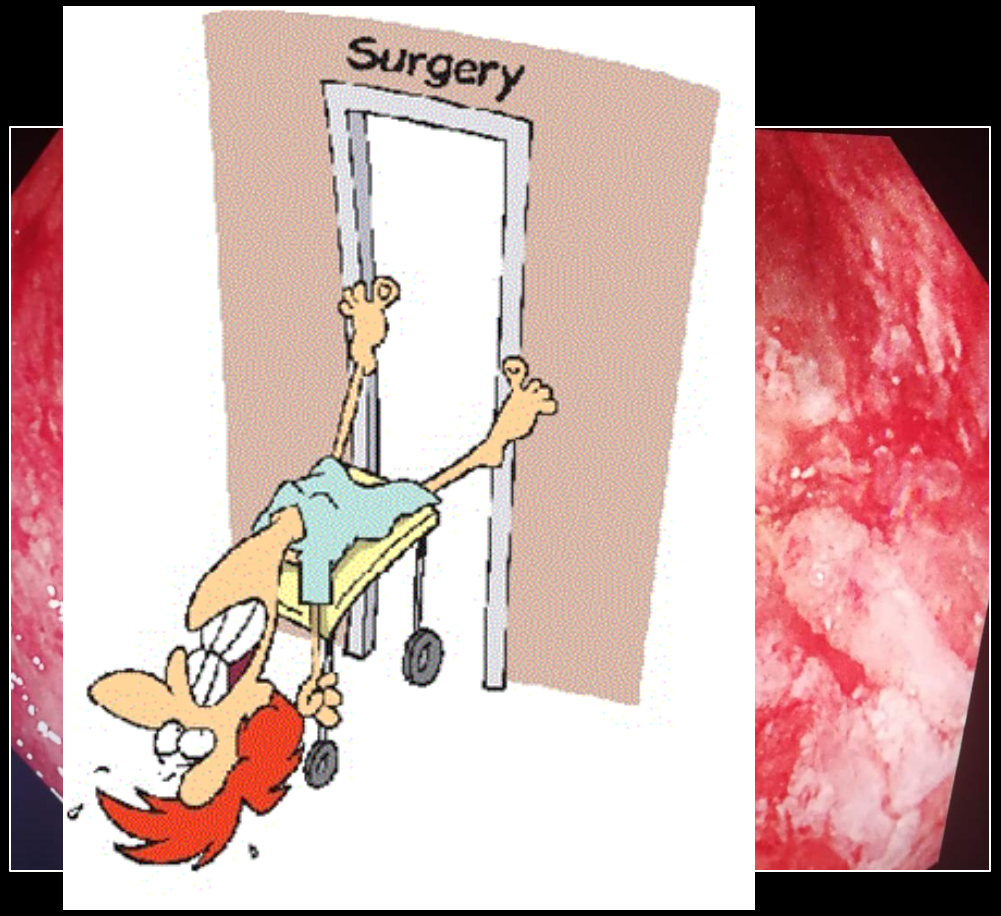

IN CONCLUSION

- Intestinal ultrasound (IUS) is a valuable, non-invasive tool that can effectively detect IBD-related complications such as strictures, fistulas, and abscesses.

- Its accuracy has been further enhanced by advanced techniques like contrast-enhanced ultrasound (CEUS) and ultrasound elastography, which give even clearer images and more detailed information about the bowel.

- In fact, the use of IUS is now included in clinical guidelines for IBD management, highlighting its growing importance and reliability in both diagnosis and monitoring.

AL-AMIRI HOSPITAL

THANK YOU VERY MUCH