



Nasjonalt Senter for Gastroenterologisk Ultrasonografi

National Centre for Ultrasound in Gastroenterology
Haukeland University Hospital, Bergen, Norway

7 novel guidelines and clinical recommendation papers on GIUS. Focus on IBD

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The Gastro- Intestinal Landscape

-

a challenge
for GIUS !





EFSUMB Non-Liver Guidelines on CEUS

The EFSUMB Guidelines and Recommendations on the Clinical Practice of Contrast Enhanced Ultrasound (CEUS): Update 2011 on non-hepatic applications

Authors

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Affiliation addresses are listed at the end of the article.

Bibliography

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Thematic sections

	Thematic Section	Chairperson
1	Introduction	F. Piscaglia – C. Nolsoe
2	Generalities	D. Cosgrove
3	Equipment	H. P. Weskott
4	Investigator's training	O. H. Gilja
5	Terminology	F. Piscaglia
6	Safety	G. ter Haar
7	Paediatric	C. Nolsoe
8	Pancreas	M. D'Onofrio
9	Endoscopic CEUS	C. F. Dietrich
10	Gastrointestinal tract	O. H. Gilja

List of Abbreviations

AAA=Abdominal Aortic Aneurysm
AUC=Area Under the Curve
CE=Contrast Enhanced
CECT=Contrast Enhanced Computed Tomography
CEMRI=Contrast Enhanced Magnetic Resonance Imaging
CEUS=Contrast Enhanced Ultrasound
CE-TCCS=Contrast Enhanced Transcranial Colour-Coded duplex Sonography
CE-EUS=Contrast Enhanced Endoscopic Ultrasound

Cited over 1200 times (google scholar)

Ultraschall/EJU 2012



GIUS – EFSUMB guidelines on Gastro-Intestinal Ultrasound

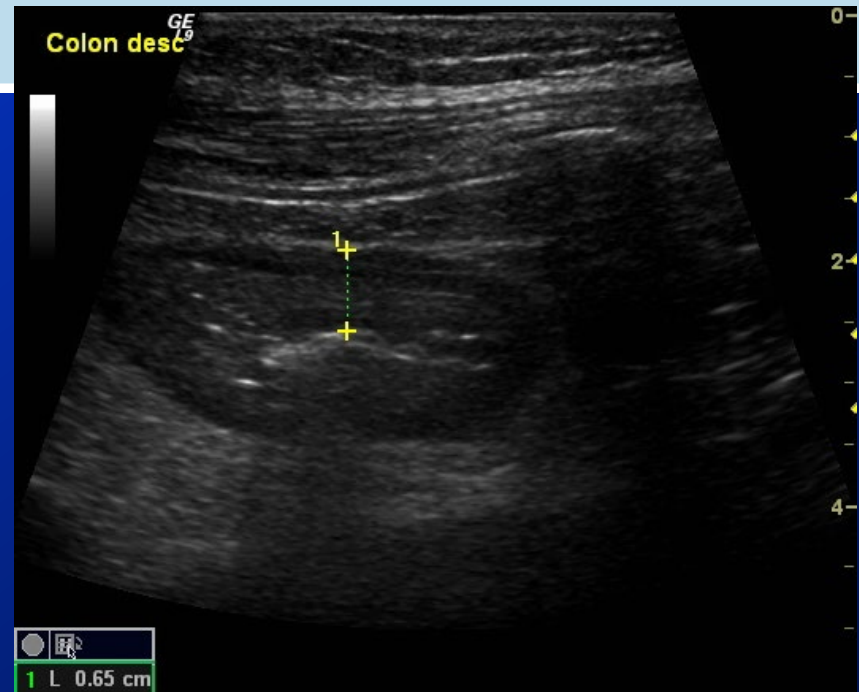
- Task Force Group of over 20 experts from Europe
- Started at UEG Week in October 2014
- 7 guideline/position paper publications:
 - 1. Methodology and examination technique (published EJU 2016)
 - 2. IBD (Published – EJU 2018)
 - 3. Perineal and transrectal US (Published- UIO - 2019)
 - 4. Acute appendicitis and diverticulitis (Published EJU 2019)
 - 5. Misch./ Coeliac / Upper GI (Published Med Ultrason -2019)
 - 6. Intestinal Emergencies (Published EJU 2020)
 - 7. Functional Disorders (In press, UIO 2021)



New EFSUMB Guidelines on GIUS

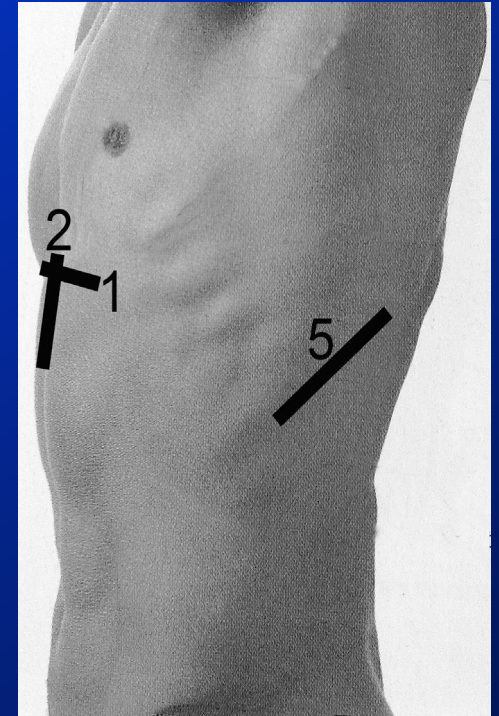
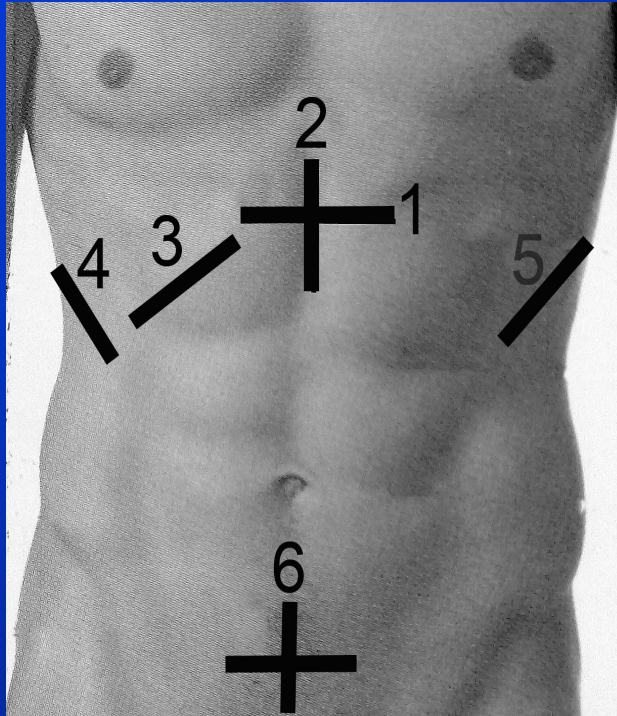
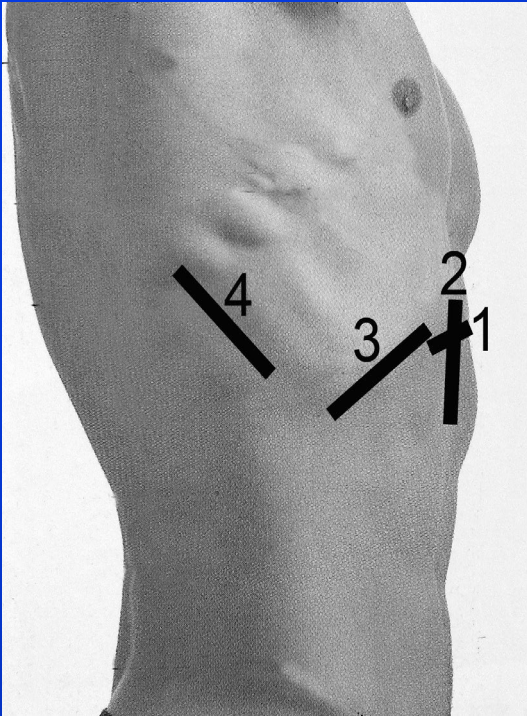
Recommendations:

1. For a complete examination of the bowel both a low and high resolution probe are needed, LoE 5, GoR C, Strong consensus 13/13
2. A probe with a frequency above 5 MHz should be used when measuring wall thickness, LoE 4, GoR B, Strong consensus 13/13





6+ A Systematic approach to Abdominal Ultrasound

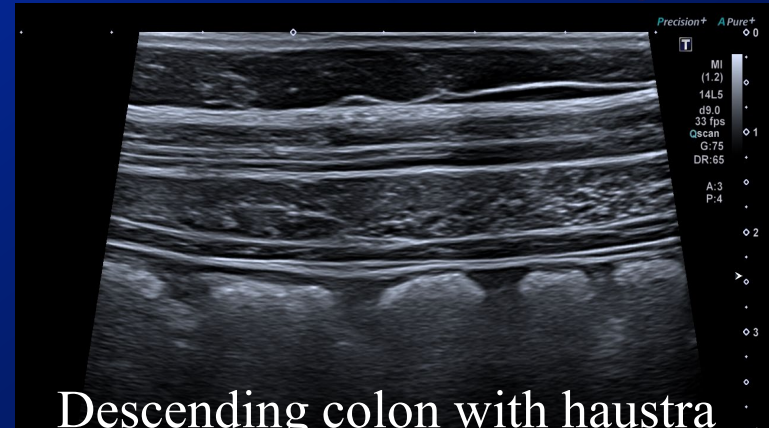


6 + stations to have good access to intraabdominal organs
The “+” refers to large and small intestinal scanning



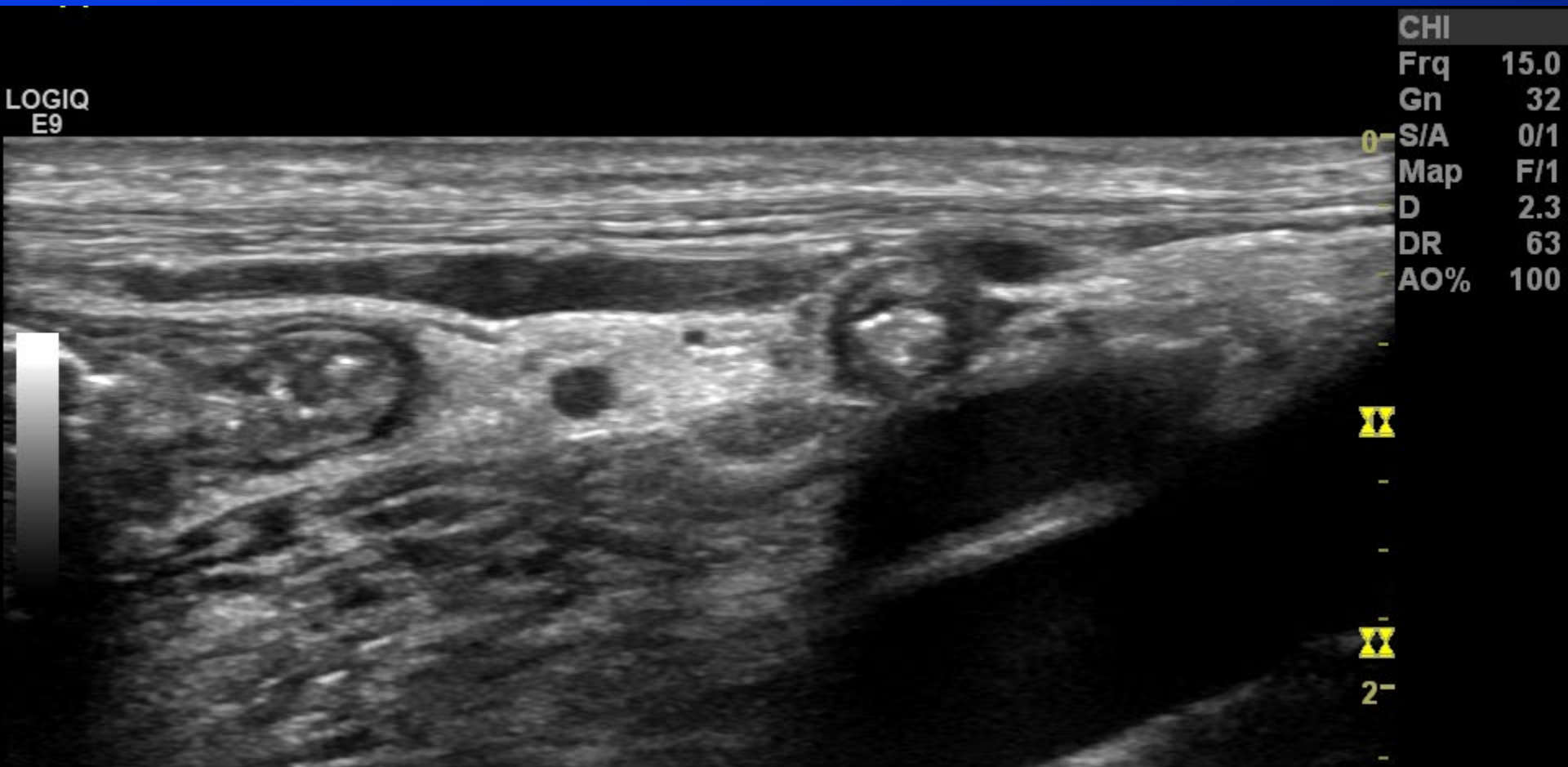
Examination technique -Colon

- Start: rectum with low-f probe
- Continue with high-f probe in the right fossa iliaca
- Identify terminal ileum and coecum
- Appendix seen in 50%
- Flexures often seen intercostally
- Transversum crosses at various levels





Sonoanatomy – Right Fossa il.

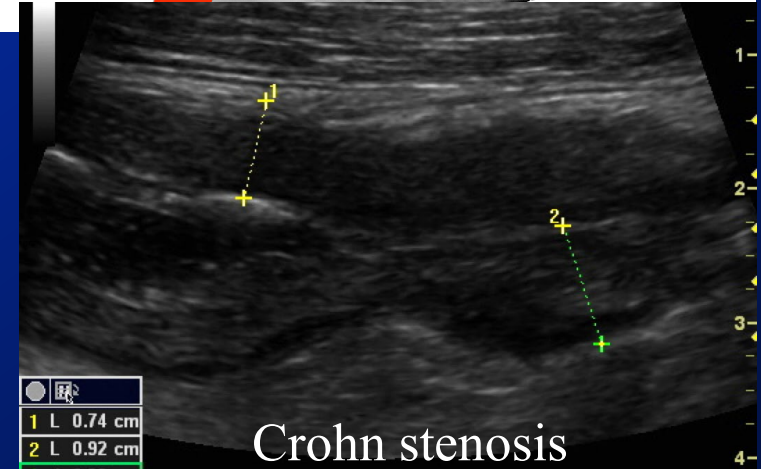
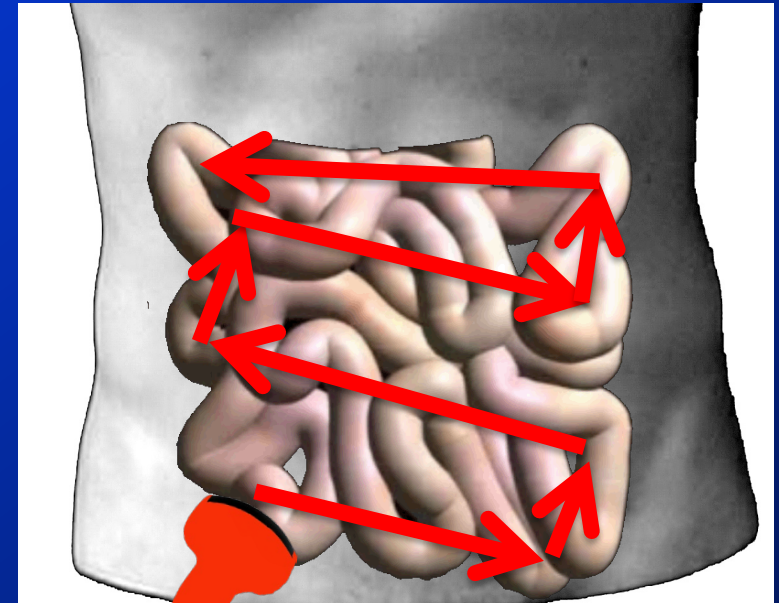




Examination technique

-Small intestine

- Start: terminal ileum
- Distal → Proximal
- Scan systematically
 - Mowing the lawn !
- Use probe pressure to improve visualization in deeper parts
- Look for thickened wall or distended loops





Be aware signs of severe pathology

Pseudo-Kidney Sign

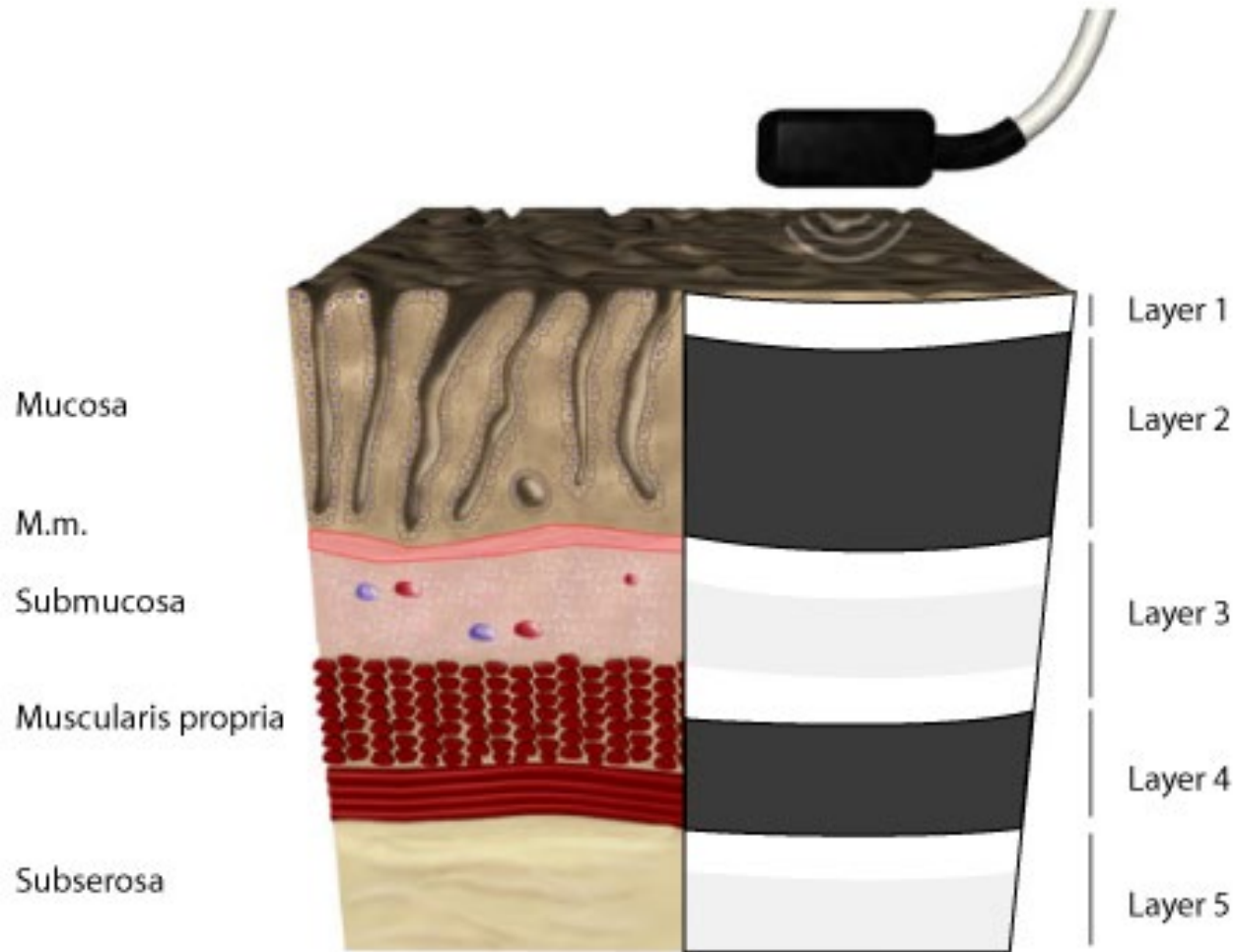


Target Lesion





GI Wall Layers





No 2: GIUS in IBD

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

EFSUMB-Empfehlungen und klinische Leitlinien für den gastrointestinalen Ultraschall (GIUS) bei entzündlichen Darmerkrankungen

Authors

Giovanni Maconi¹, Kim Nylund², Tomas Ripolles³, Emma Calabrese⁴, Klaus Dirks⁵, Christoph F. Dietrich⁶, Alois Hollerweger⁷, Ioan Sporea⁸, Adrian Saftoiu⁹, Christian Maaser¹⁰, Trygve Hausken¹¹, Antony Higginson¹², Dieter Nürnberg¹³, Nadia Pallotta¹⁴, Laura Romanini¹⁵, Carla Serra¹⁶, Odd Helge Gilja¹⁷

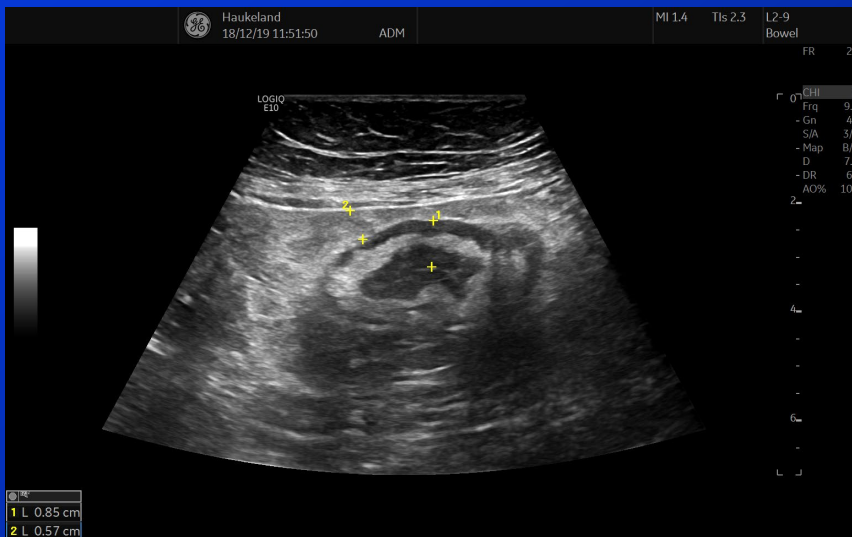
Ultraschall in Med 2018; 39: 1–19



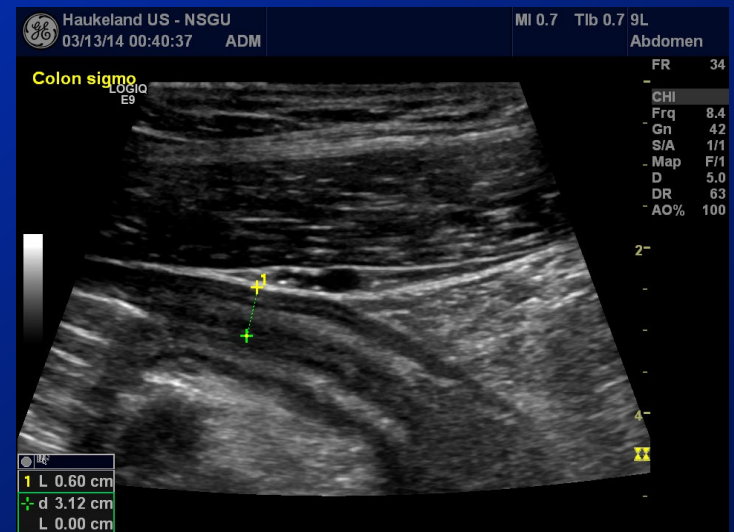
IBD detection at first presentation

RECOMMENDATION

1. GIUS is recommended to be used to detect IBD at its first presentation, and to assess CD location, activity and possible complications [LoE 1a, GoR A]. Consensus levels of agreement: A+ 17/17;



Distal ileum



Sigmoid colon



RECOMMENDATIONS

2. Bowel wall thickening measured by GIUS can be used to accurately evaluate Crohn's disease, in particular when located in the small bowel [LoE 1a, GoR A].

Consensus levels of agreement: A+ 14/17; A- 2/17; I 1/17

3. Bowel wall thickening > 3 mm as measured with GIUS should be used as a cut-off for the detection of Crohn's disease when a high sensitivity is preferred while bowel wall thickening > 4 mm should be used when a high specificity is preferred [LoE 1a, GoR A].

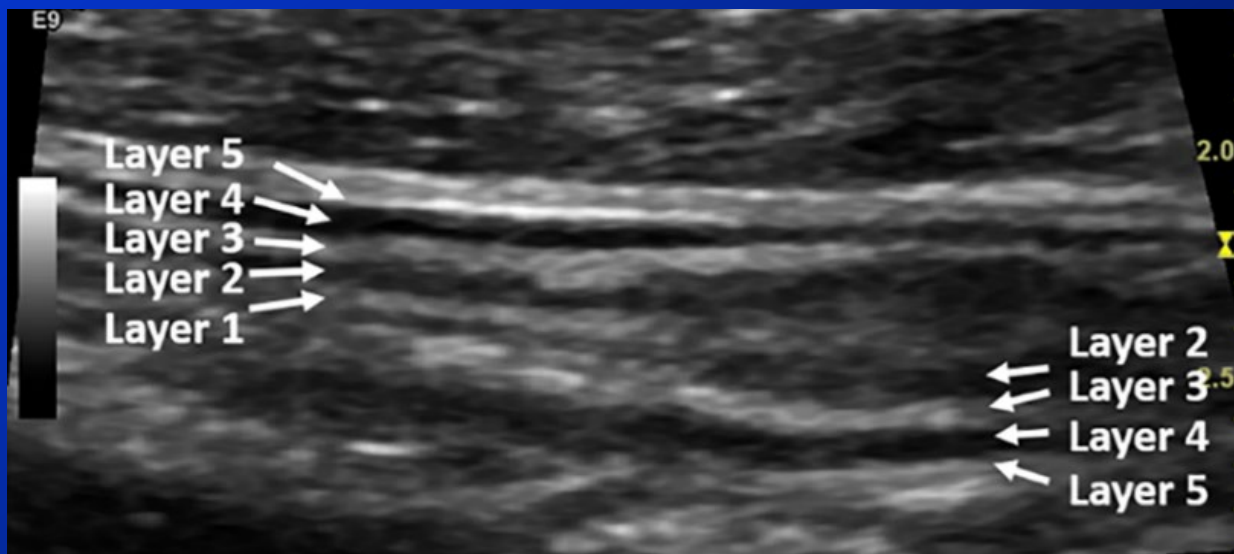
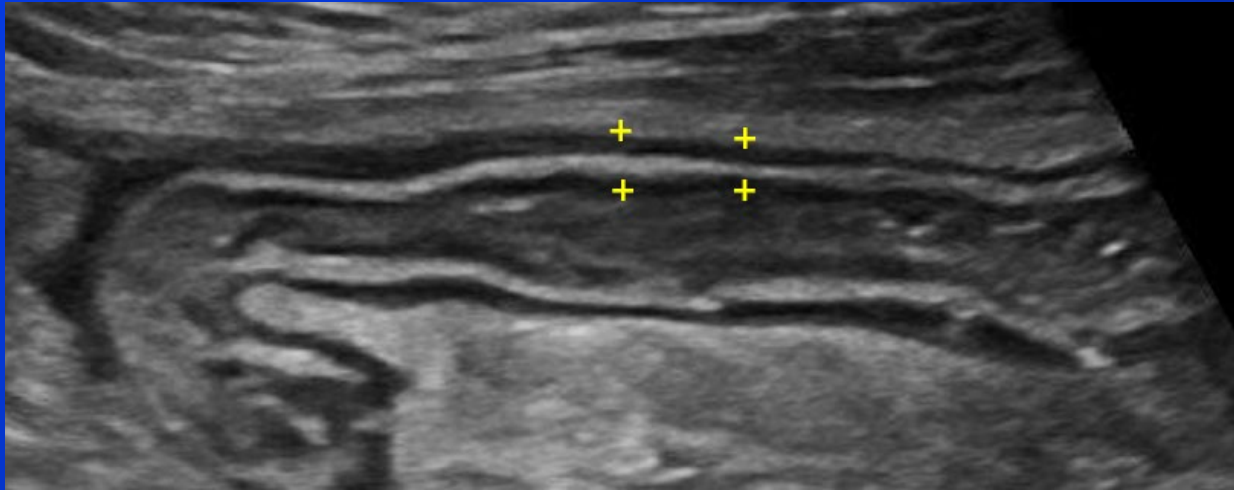
Consensus levels of agreement: A+ 15/17; A- 1/17; D- 1/17

4. Clinical disease activity in Crohn's disease is correlated with bowel wall thickness and can be estimated using GIUS [LoE 2b, GoR A].

Consensus levels of agreement: A+ 14/17; A- 1/17; D- 2/17

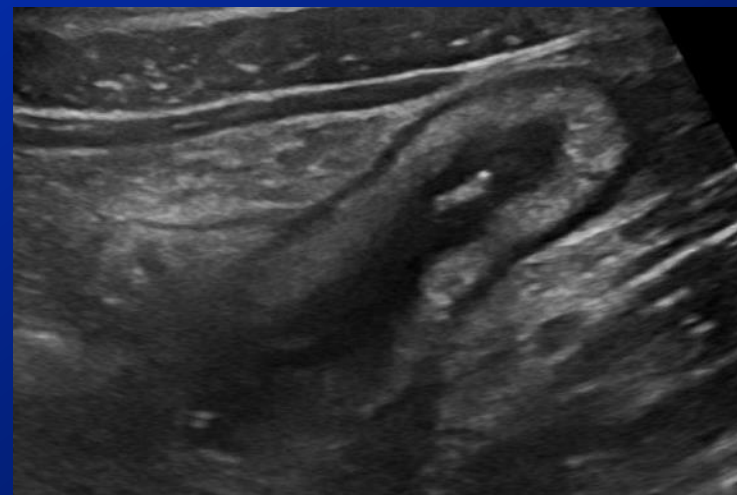
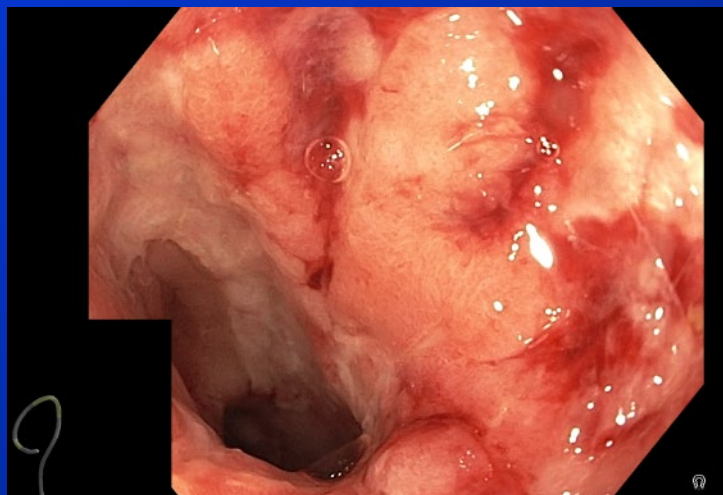
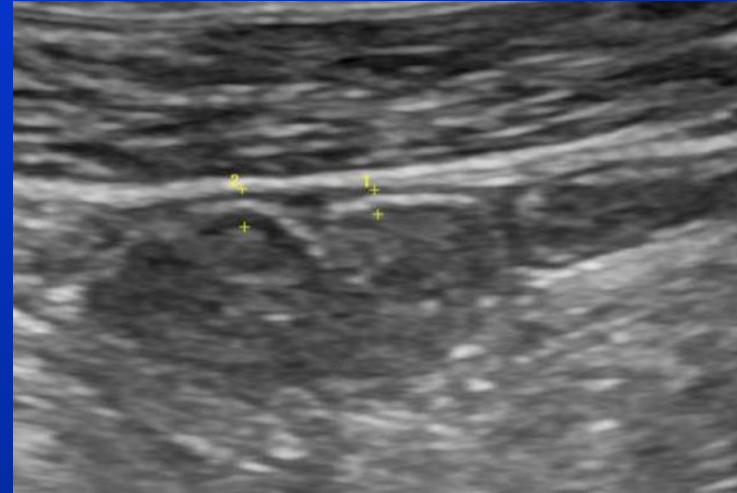
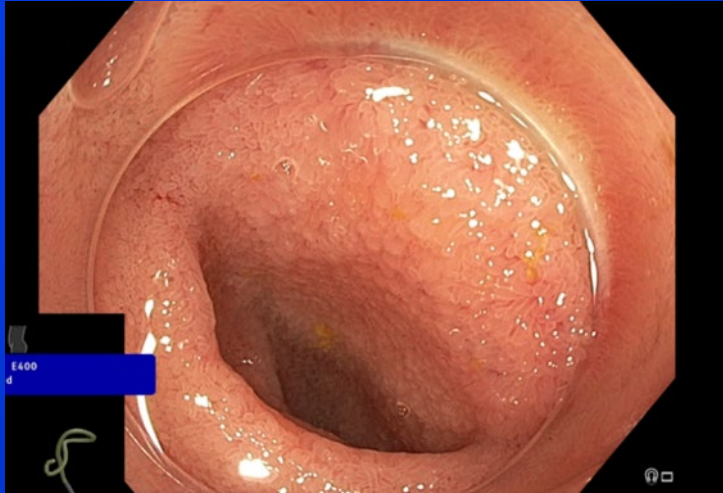


How to measure BWT ?



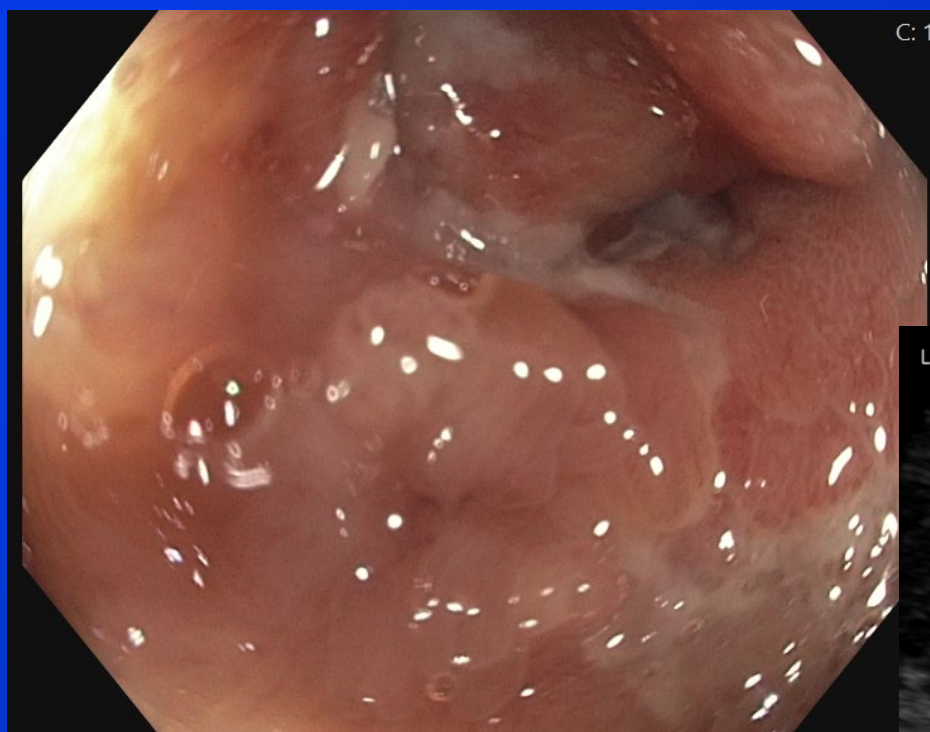


Normal vs. Crohn ileum



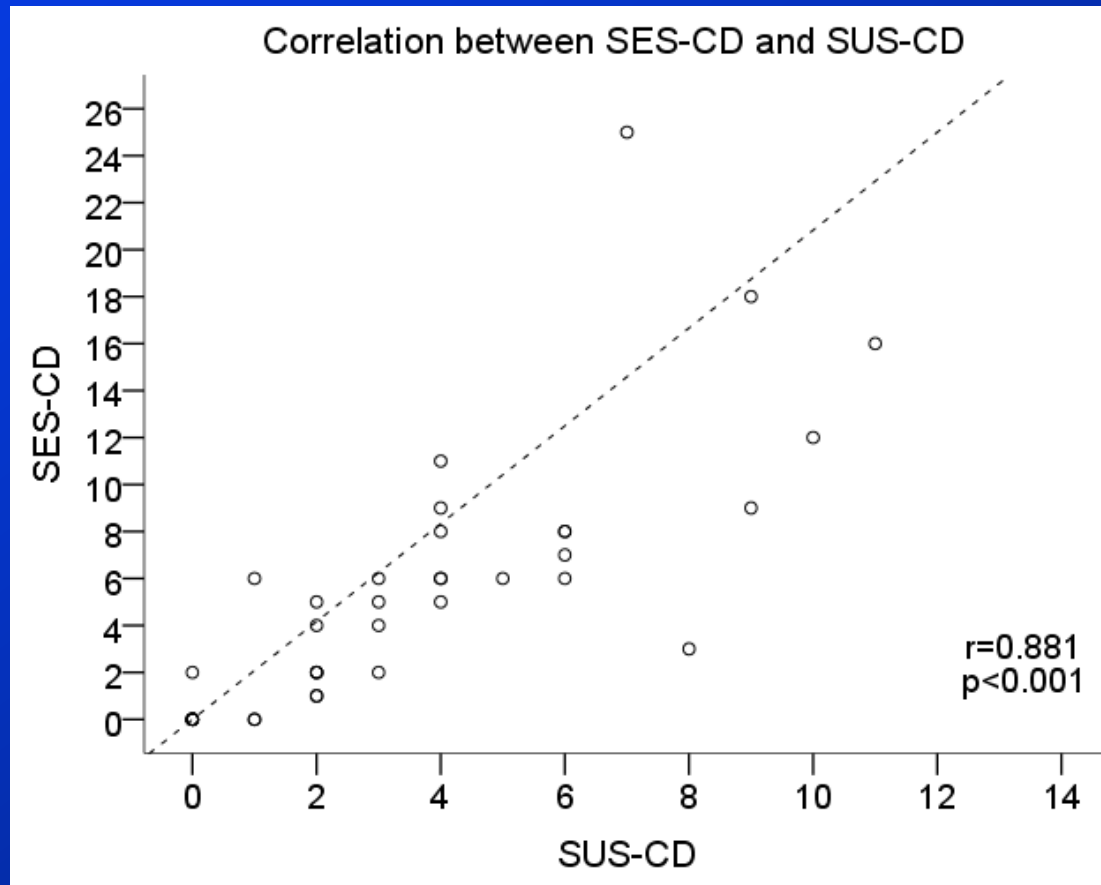


Stenosis in the ileum in CD





Association between endoscopy and ultrasound

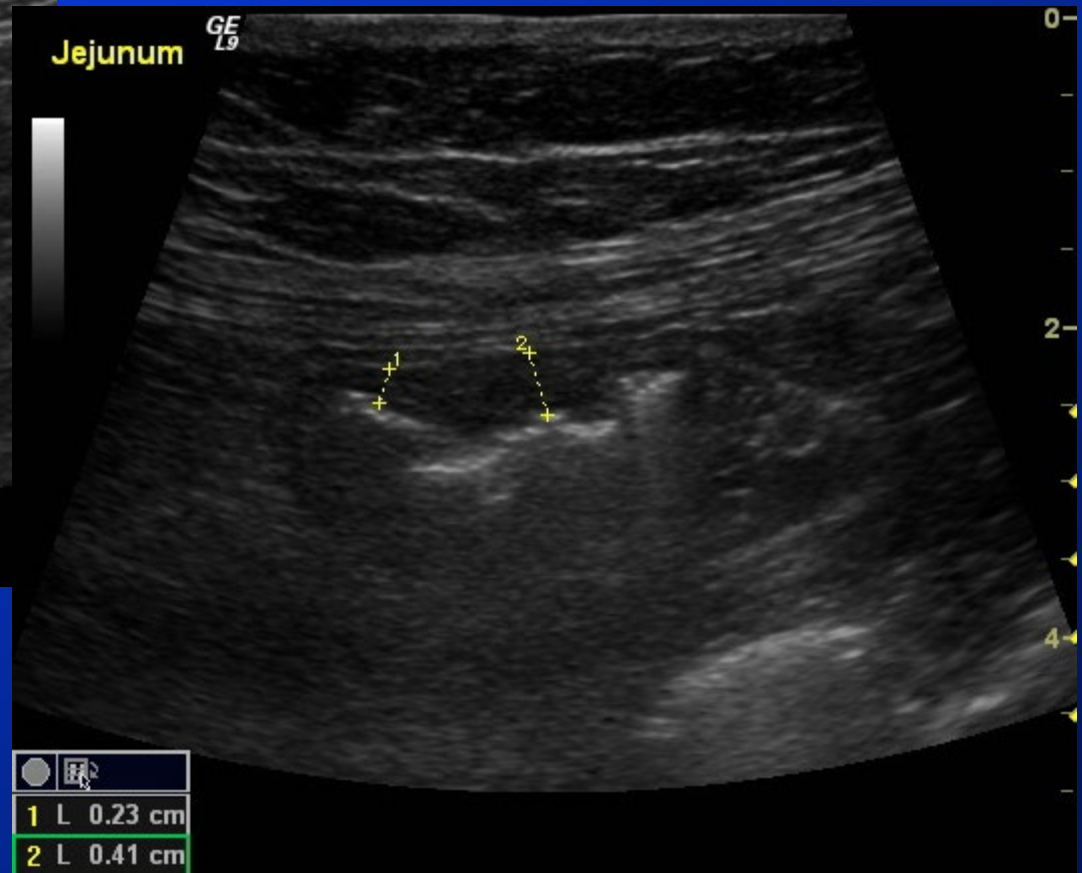
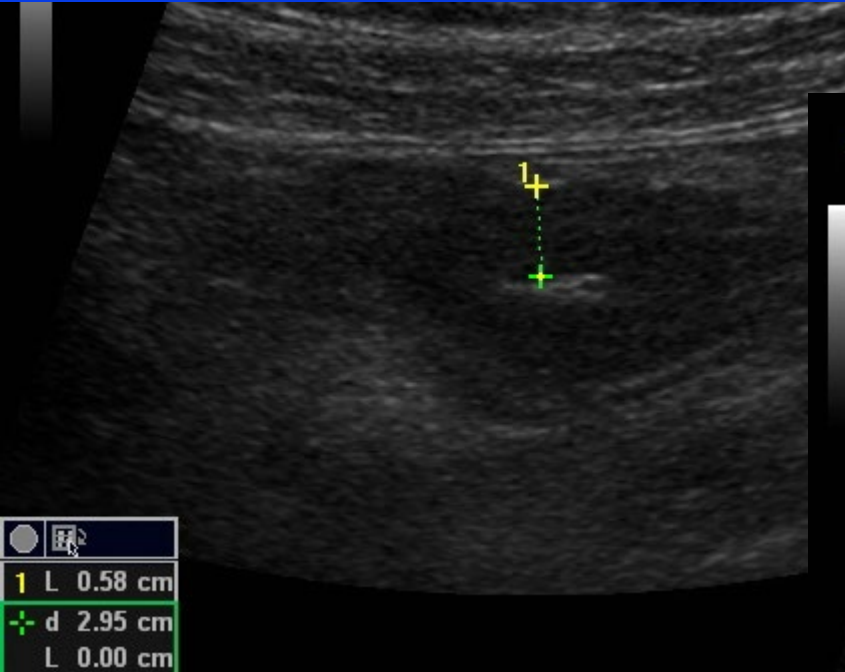


Sævik et al., J Crohn Col 2021



Crohn only of the Jejunum

Ultrasound makes the difference

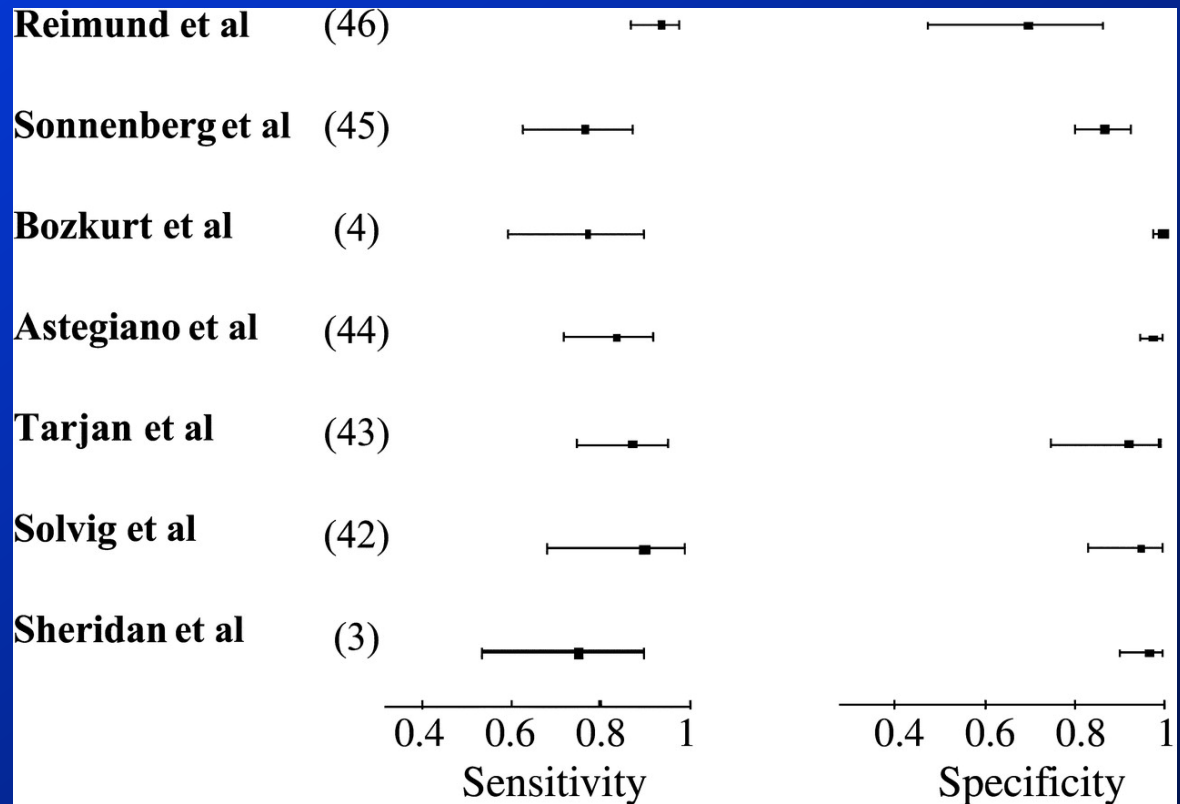


A 45 year old female with oedema, malabsorption and epigastric pain
Normal upper and lower endoscopy and MRI of small intestine



Meta-analysis of US in Crohn's Sensitivity and Specificity

Graph shows the sensitivity and specificity of US in the detection of Crohn disease reported for the seven studies. Reimund et al (46) and Sonnenberg et al (45) were case-control studies; the other five studies were prospective cohort studies. Mean values (■) and 95% confidence intervals (error bars) are indicated; the heterogeneity of the results prevented the calculation of a cumulative value.





RECOMMENDATIONS

5. GIUS can demonstrate preserved or disrupted stratification of a thickened bowel wall in Crohn's disease [LoE 4, GoR C]

Consensus levels of agreement: A+ 16/17; A- 1/17

6. The focal or extensive disruption of bowel wall layers can be detected by GIUS and suggests severe disease, possibly with ulcerations [LoE 4, GoR C]

Consensus levels of agreement: A+ 15/16; A- 1/16

7. Increased bowel wall thickening and loss of stratification as detected by GIUS suggest a higher risk of surgery in patients with Crohn's disease [LoE 4, GoR C]

Consensus levels of agreement: A+ 15/17; A- 1/17; D- 1/17



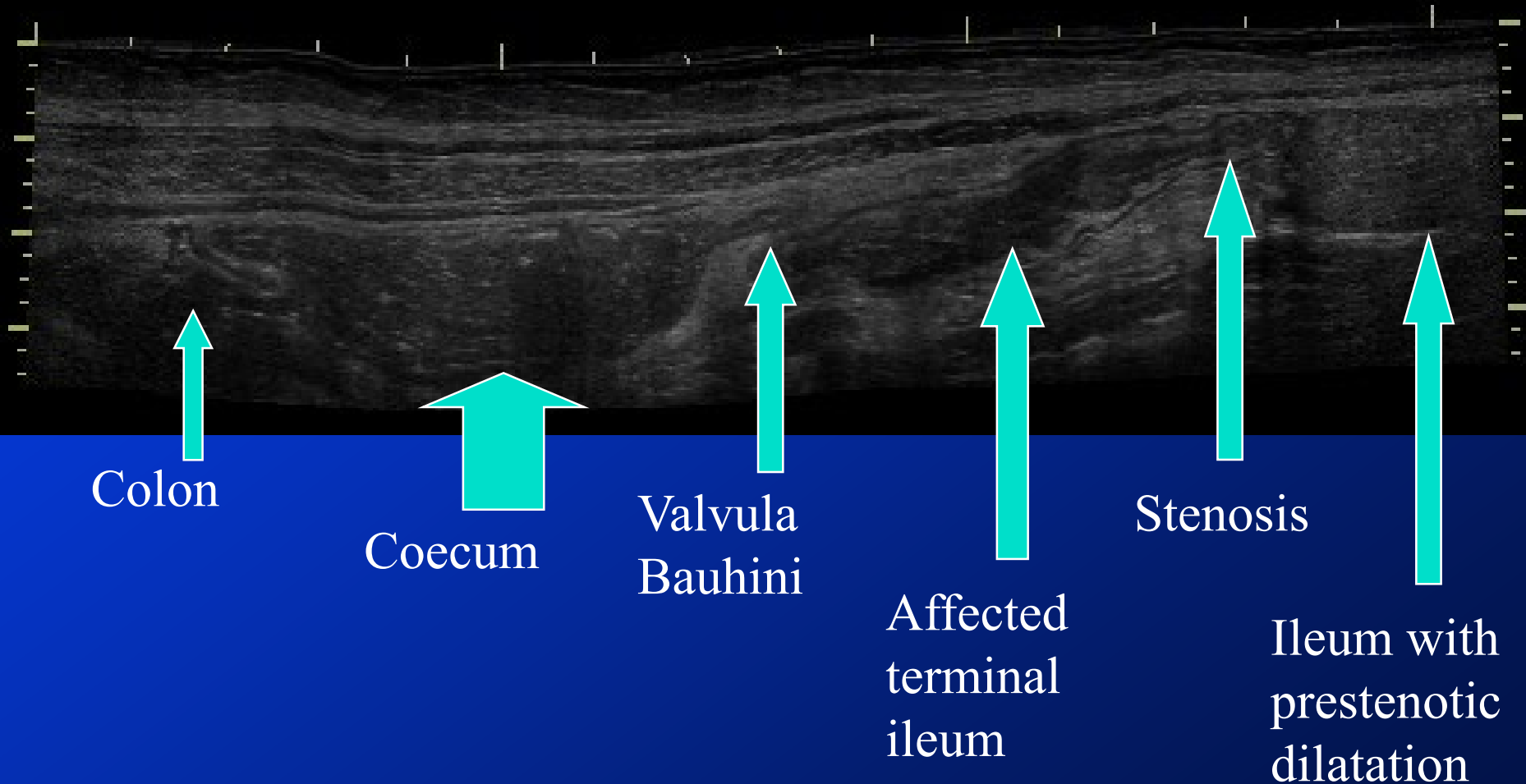
Disruption of the bowel wall with transmural infiltrate





Extensivity of disease

Crohn in Ileum and Colon asc





RECOMMENDATION

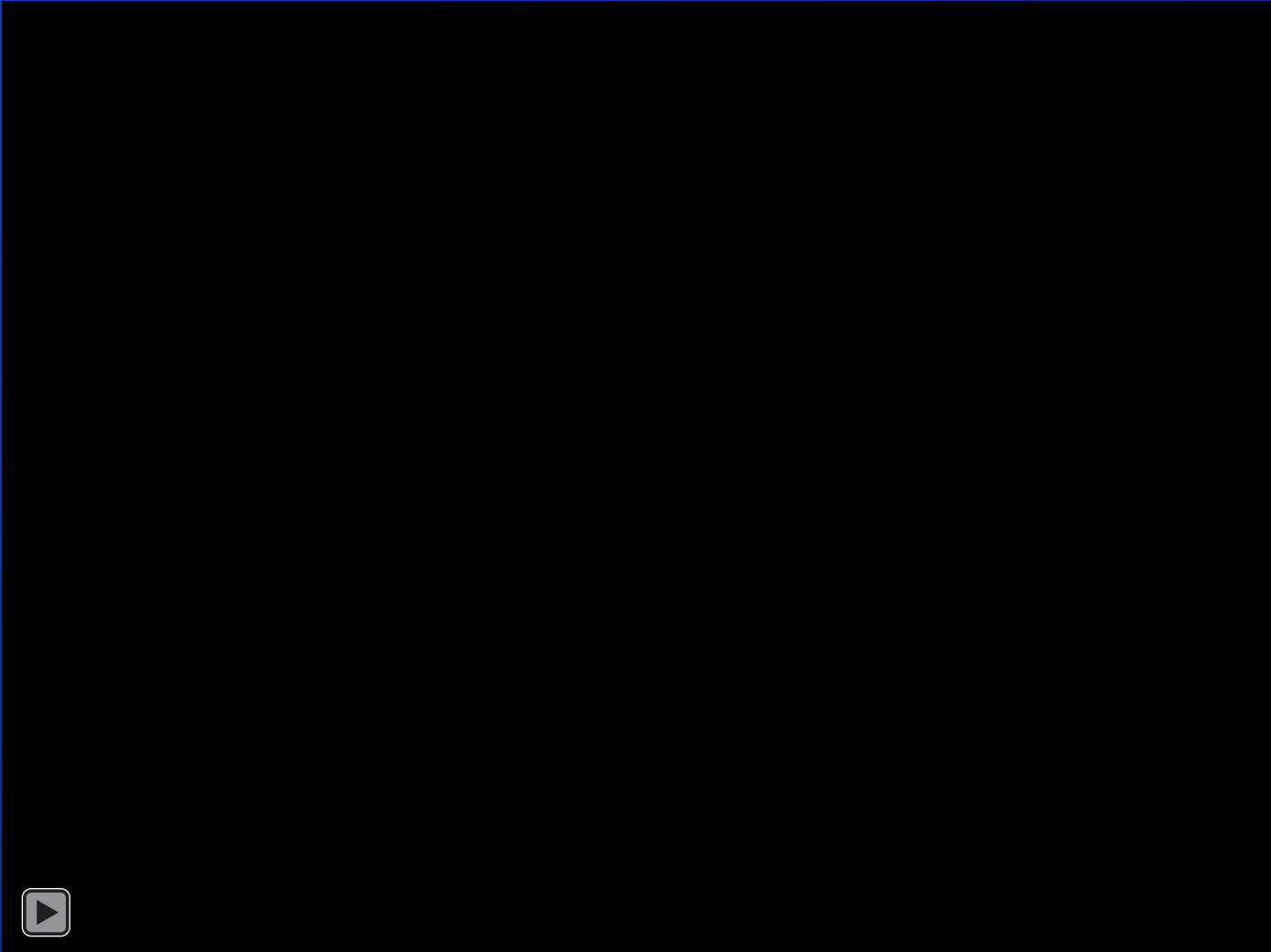
9. Semi-quantitative assessment of bowel wall vascularity using color Doppler techniques is useful to evaluate Crohn's disease activity [LoE 2b, GoR B]

Consensus levels of agreement: A+ 16/17; A- 1/17



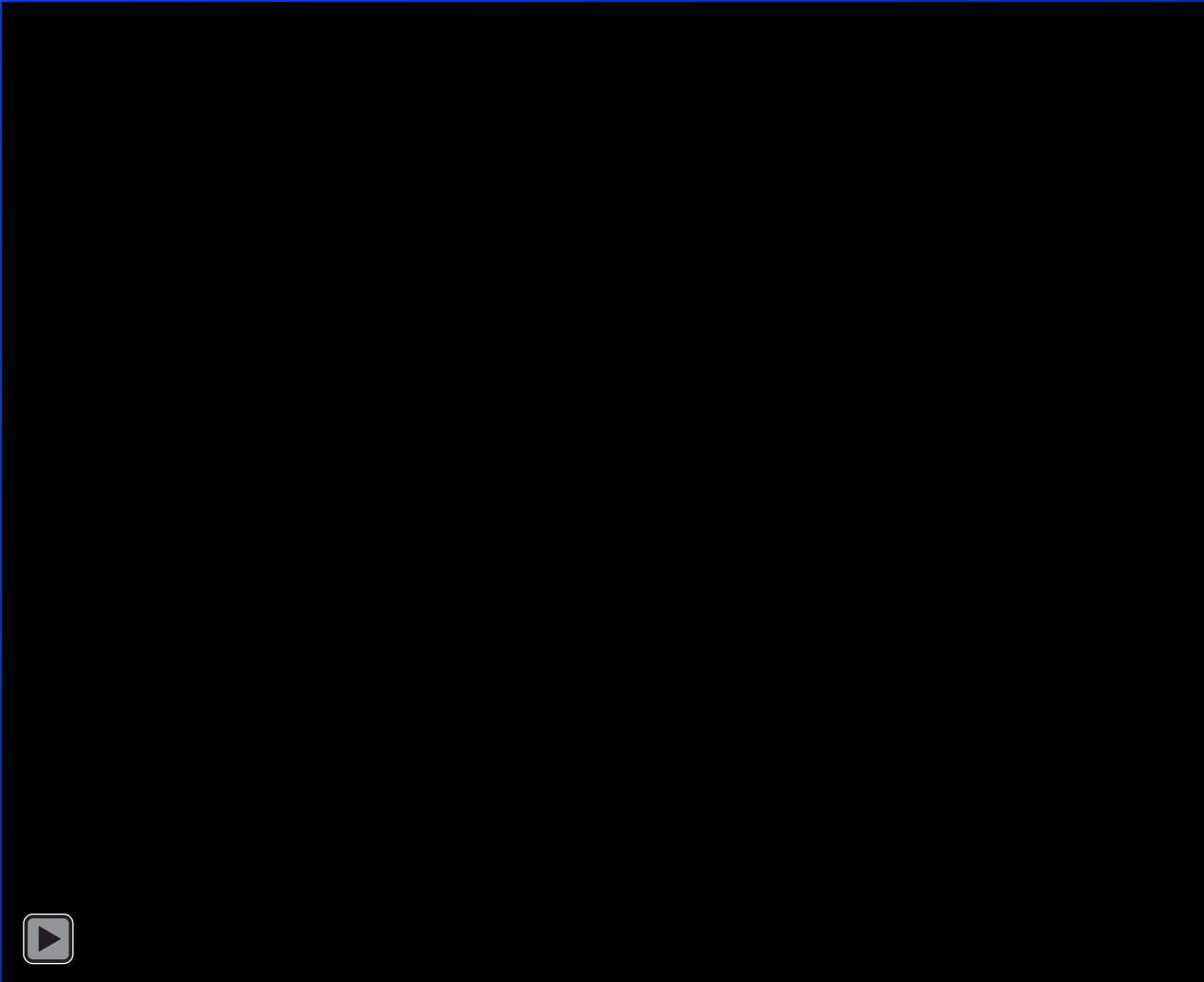


High flow in a Crohn Stenosis





Low flow in a Crohn Stenosis





RECOMMENDATIONS

10. CEUS of the bowel may be used to estimate endoscopic activity in Crohn's disease [LoE 1b, GoR A]

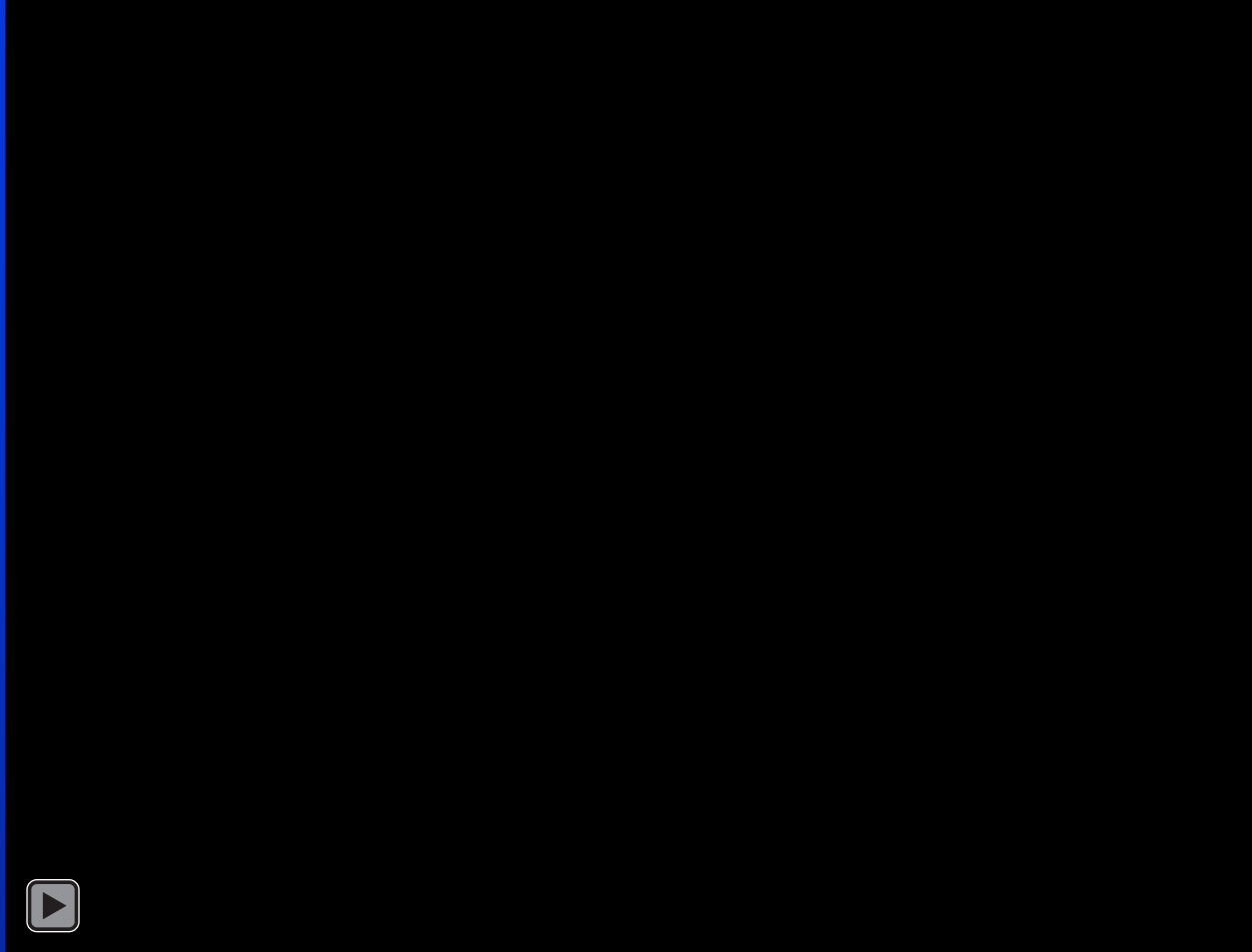
Consensus levels of agreement: A+ 11/16; A- 4/16; D+ 1/16

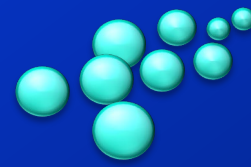
11. CEUS methods and parameters for assessing Crohn's disease are heterogeneous and should be kept stable over time when monitoring disease activity [LoE 2b, GoR A]

Consensus levels of agreement: A+ 16/16

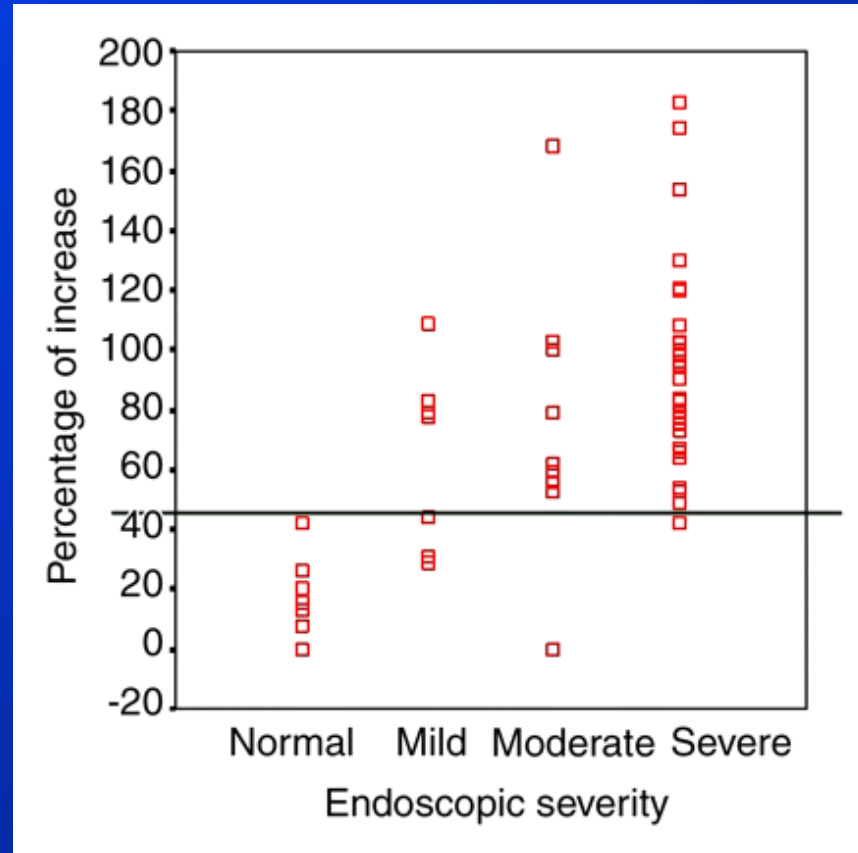


CEUS showing detailed intestinal perfusion in Crohn's disease





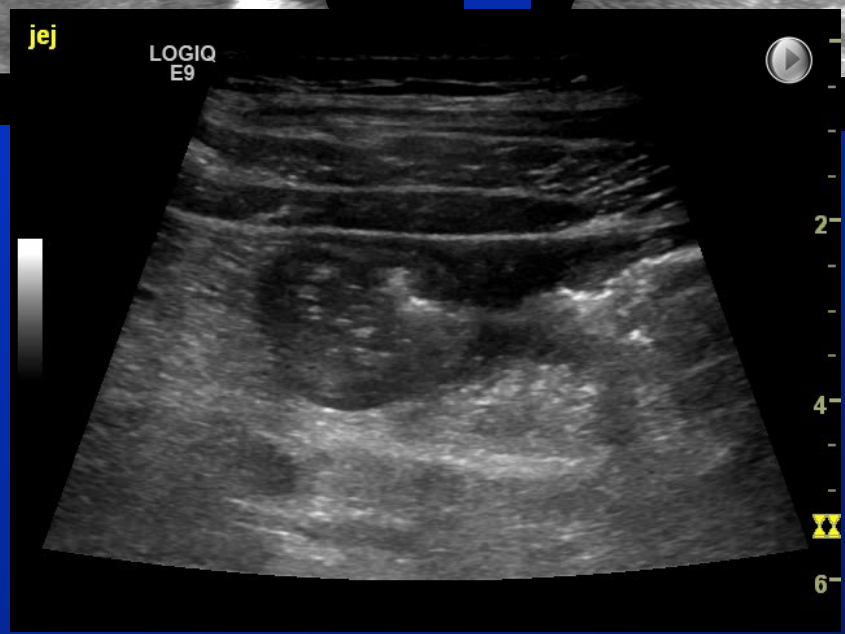
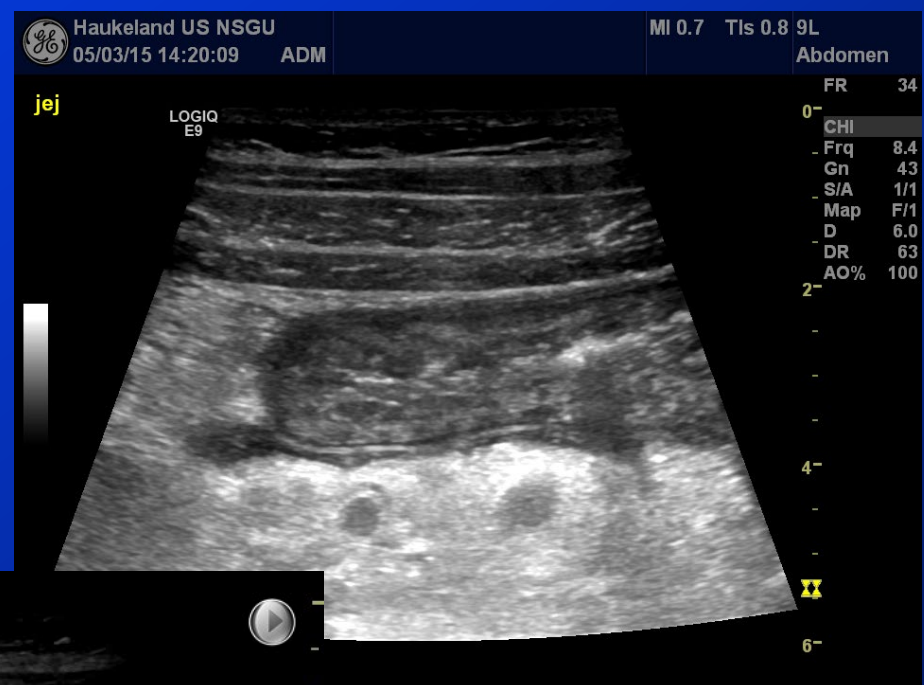
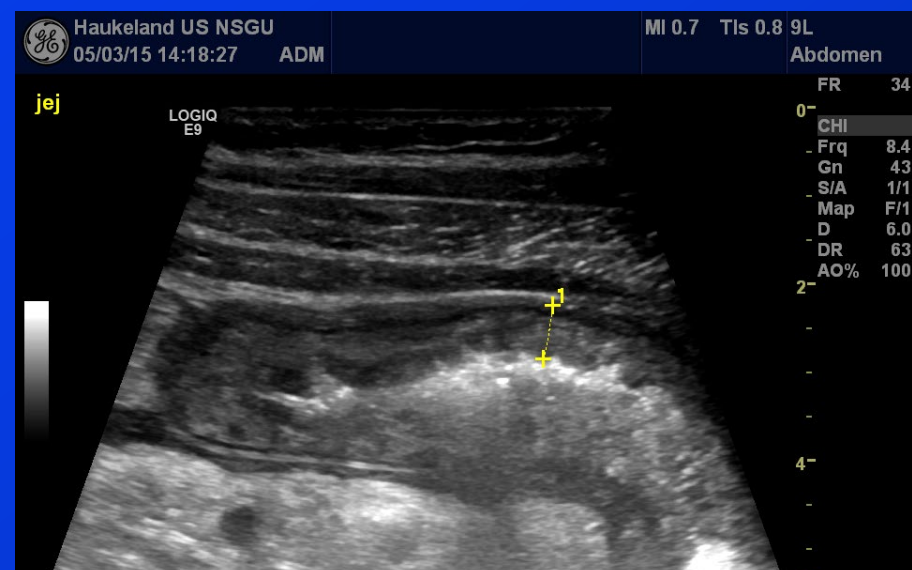
Correlation between Endoscopy and CEUS



Scatterplot of percentage of increase in wall brightness versus four grades of severity at endoscopy in 61 patients who underwent colonoscopy. All patients with normal results at colonoscopy had values of percentage of increase less than 46%.



Crohn Patient





CEUS of Jejunal loop and surrounding tissue



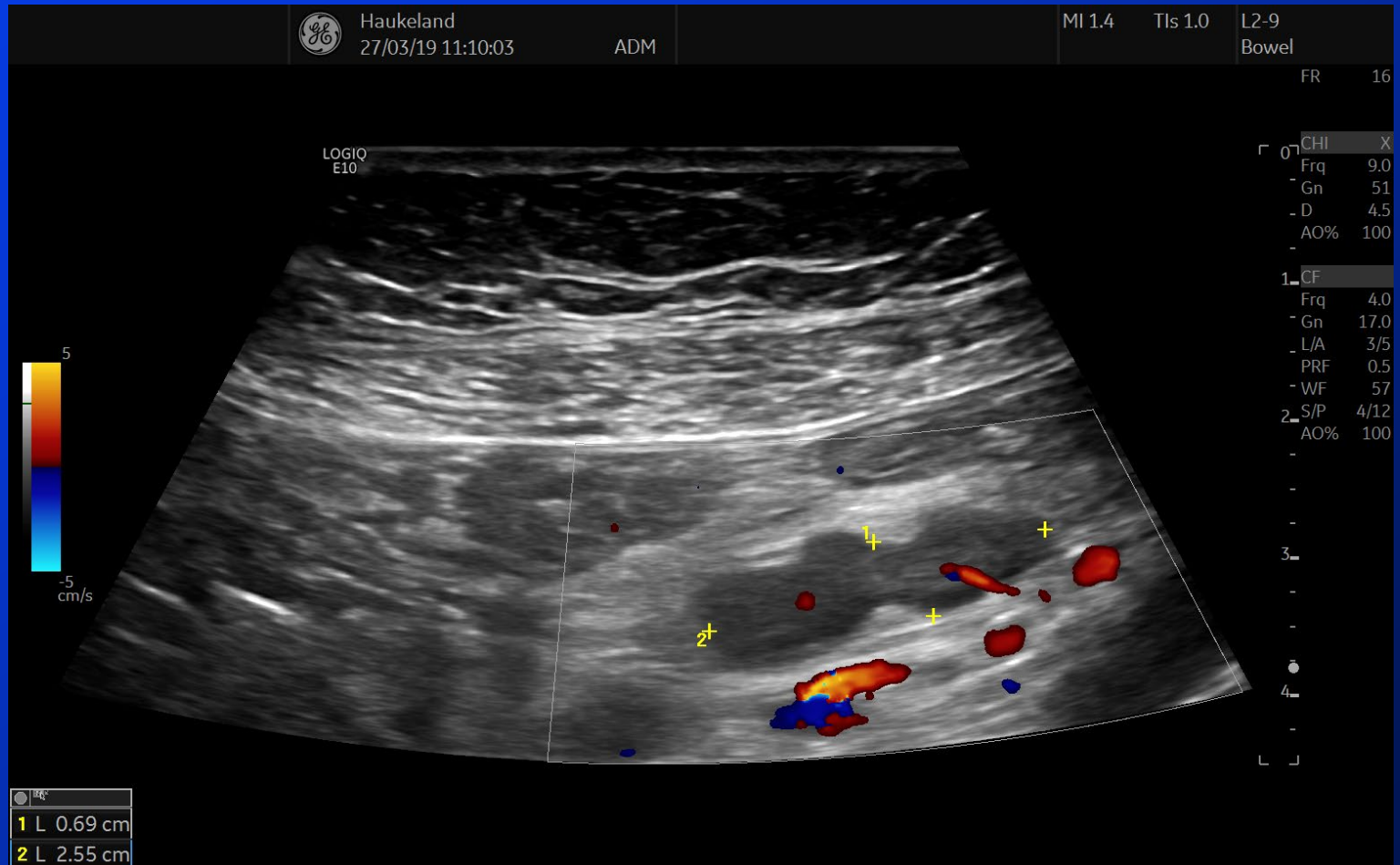


RECOMMENDATION

12. Regional mesenteric lymphadenopathy is a common but non-specific sonographic finding in early Crohn's disease and can be detected by GIUS [LoE 3b, GoR C]
Consensus levels of agreement: A+ 15/17; A- 1/17; D+ 1/17



Lymph nodes in Crohn's disease

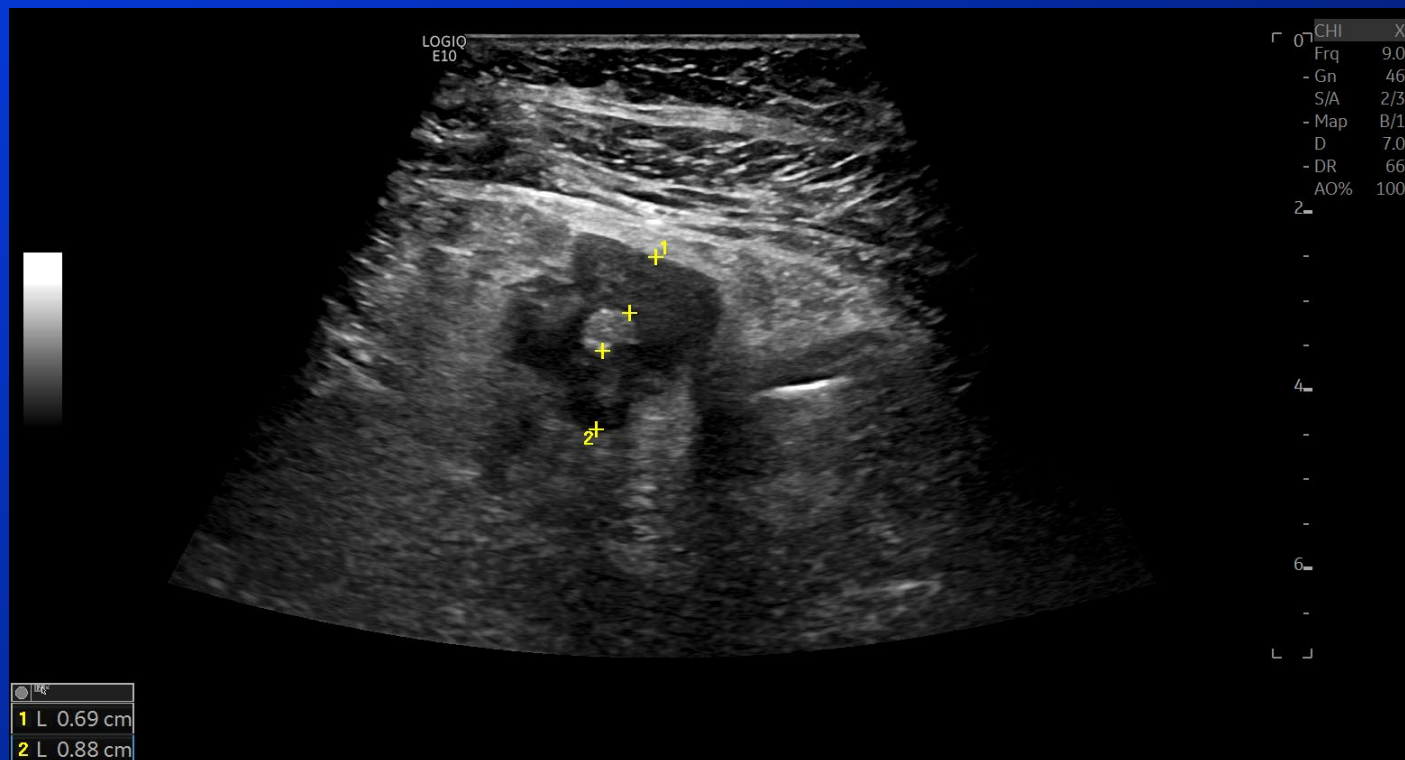




RECOMMENDATION

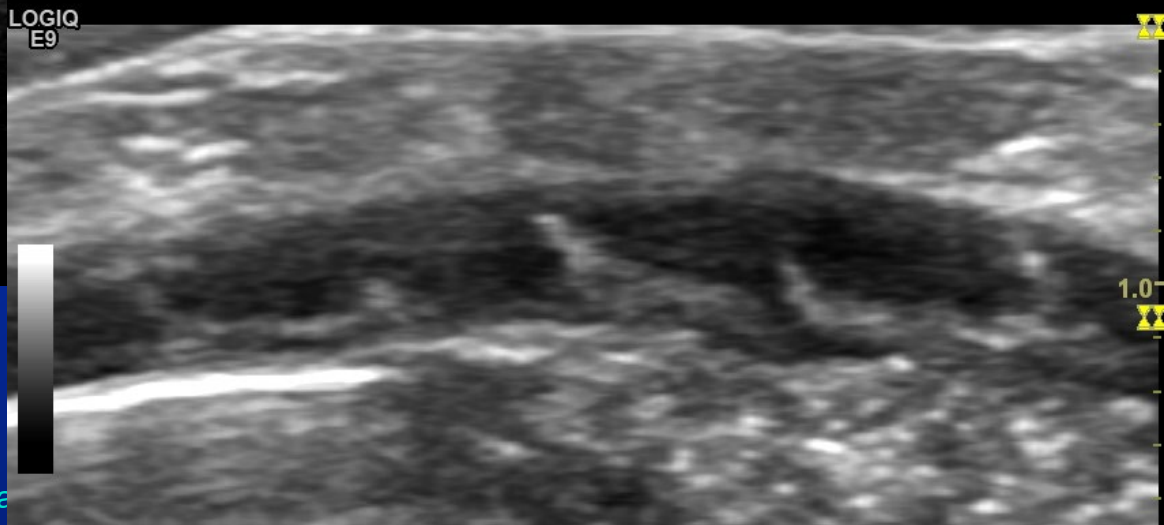
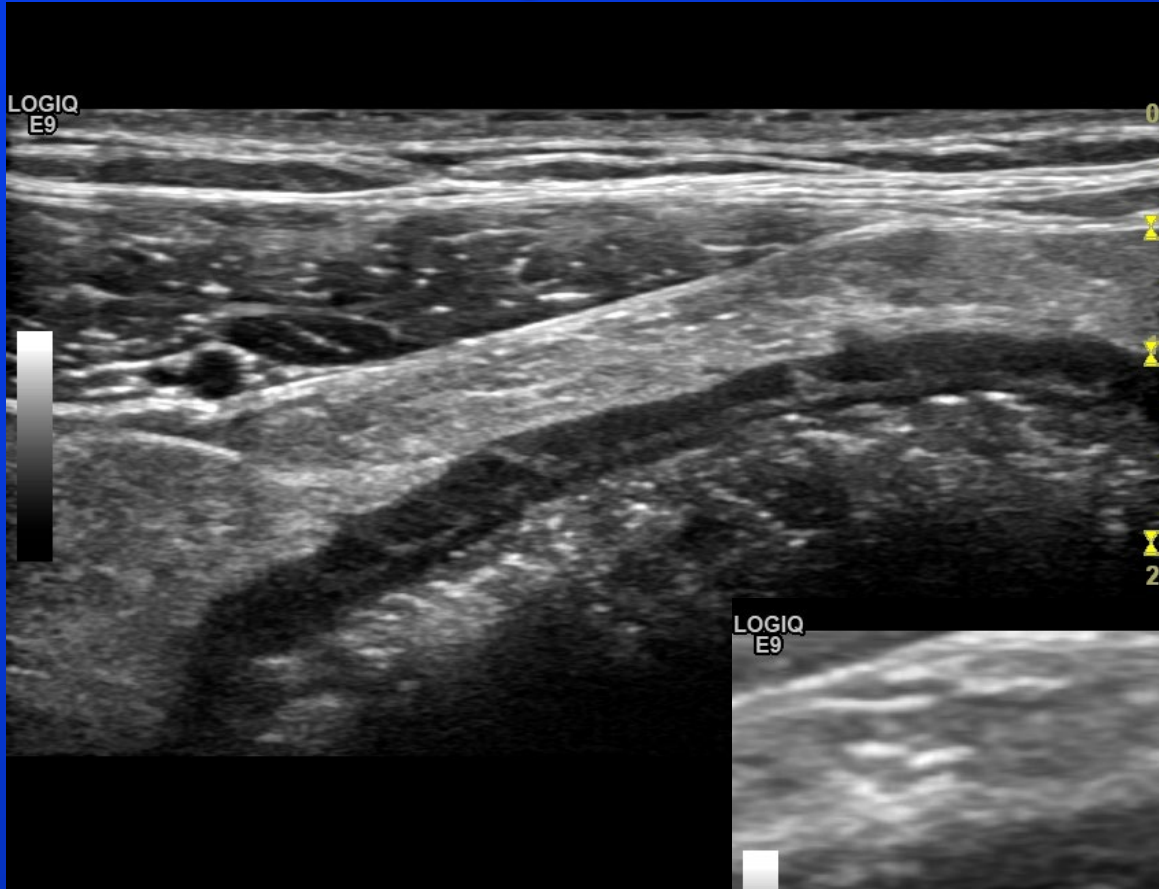
13. Mesenteric hypertrophy can be detected by GIUS as hyperechoic tissue or “mass effect wrapping” around the diseased bowel and reflects clinical and biochemical disease activity [LoE 3b, GoR C]

Consensus levels of agreement: A+ 15/17; A- 1/17; I 1/17





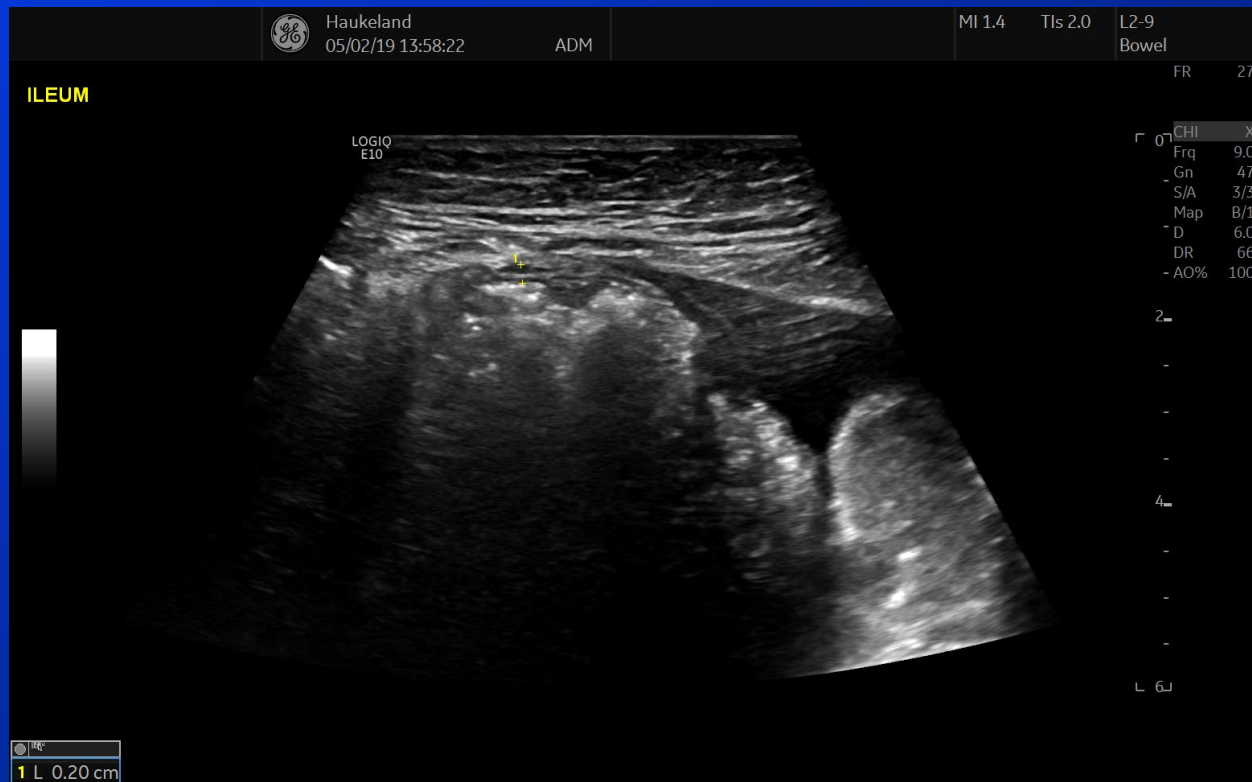
Hyoerechogenic strands reaching through the proper muscle layer





RECOMMENDATION

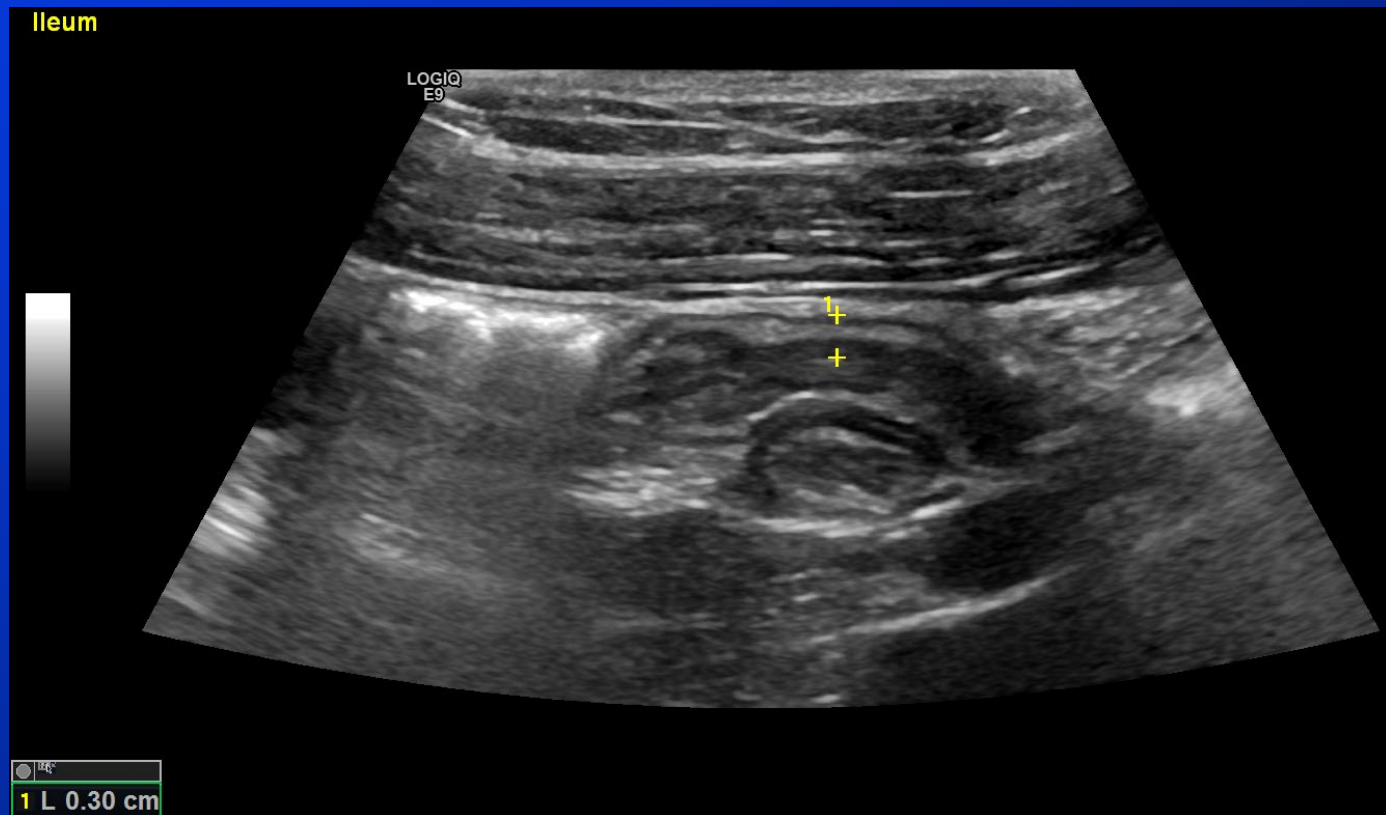
14. Free fluid in the abdomen can be detected using GIUS and is a nonspecific finding with no clear significance in Crohn's disease [LoE 4, GoR C]
Consensus levels of agreement: A+ 17/17





RECOMMENDATION

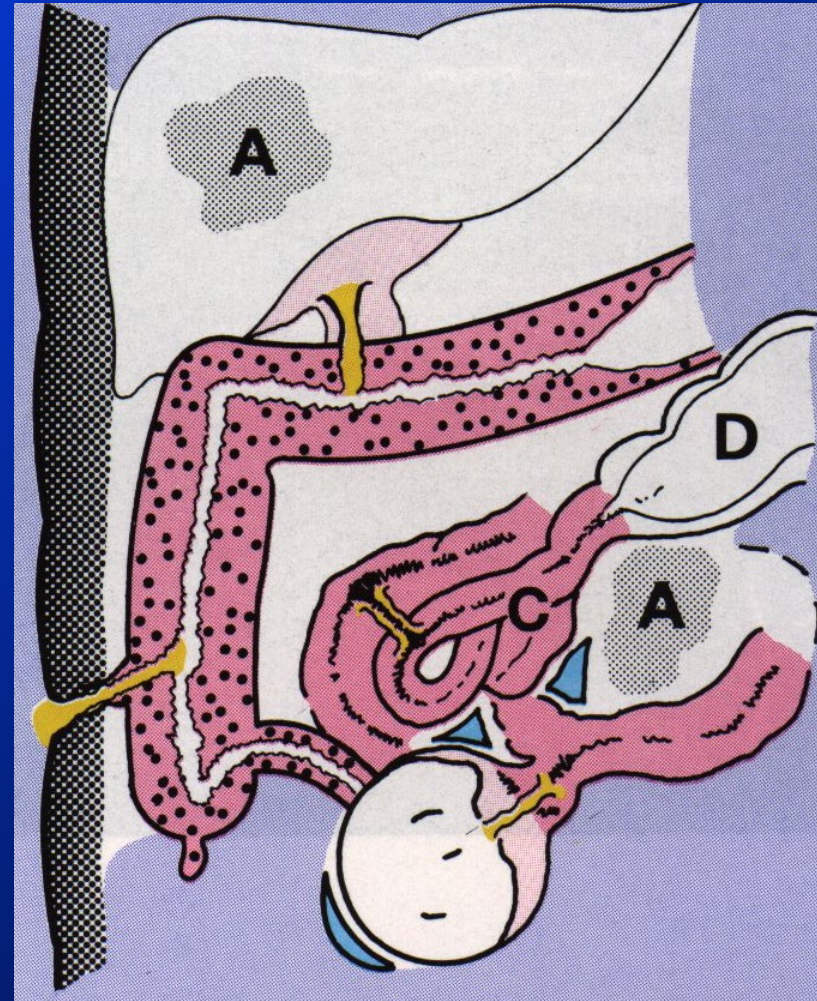
15. Appendiceal involvement in Crohn's disease may be observed by GIUS and is commonly seen in combination with involvement of the terminal ileum and cecum [LoE 4, GoR C]
Consensus levels of agreement: A+ 17/17





Complications of Crohn's

- Abscess
- Fistulas
- Stricture
- Malignancy
- Other findings:
 - Ascites
 - Mesenteric lymphnodes
 - Fatty infiltration
 - Focal cystitis





RECOMMENDATIONS

16. Stenoses can be visualized by GIUS as segments of bowel wall thickening with luminal narrowing and pre-stenotic dilatation [EL 2a, GoR A].

Consensus levels of agreement: A+ 16/17; I 1/17

17. Oral contrast agents may be applied to increase the accuracy of GIUS to diagnose patients with Crohn's stenoses, particularly those with multiple stenoses [EL 2a, GoR A].

Consensus levels of agreement: A+ 16/17; A- 1/17

18. a. Loss of stratification, hyperemia on color Doppler US or CEUS of the bowel wall, at the level of the stricture, suggest its inflammatory nature.

b. Stratification or hypovascularization of the bowel wall, at the level of the stricture, suggests a higher degree of fibrosis [EL 2a, GoR A].

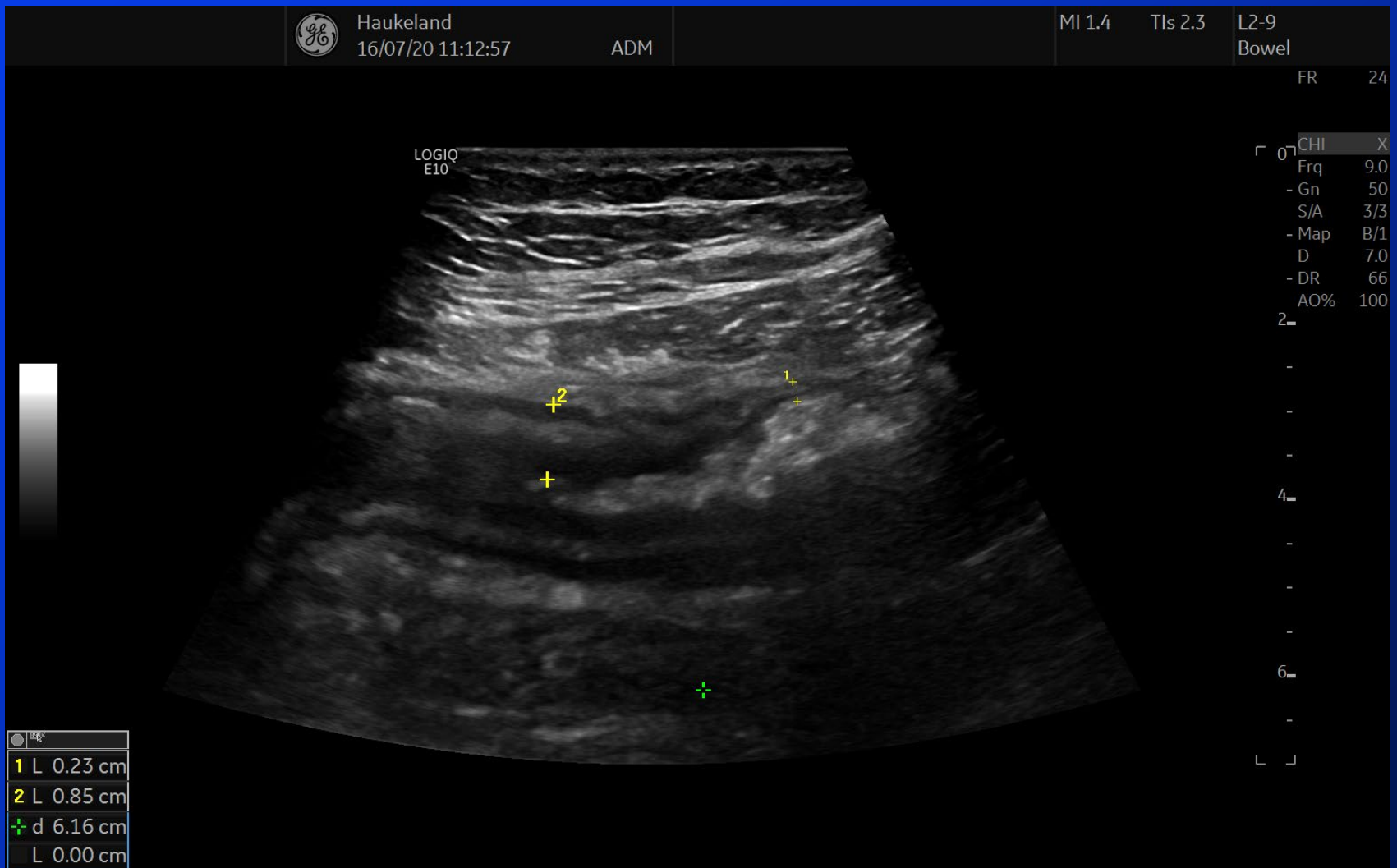
Consensus levels of agreement: A+ 14/16; A- 1/16; I 1/16

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



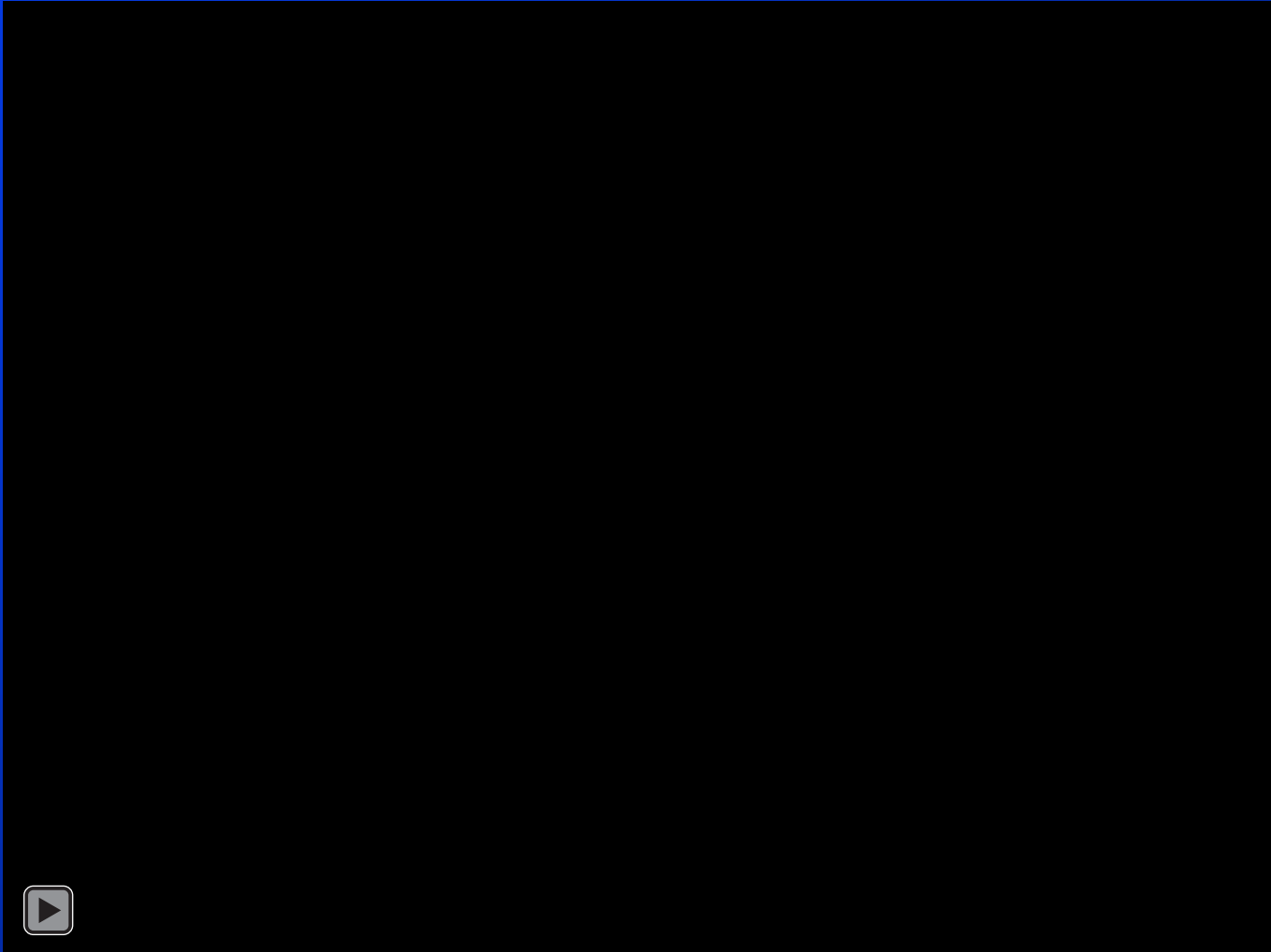
The proximal end of a stenosis



Crohn's disease of the ileum

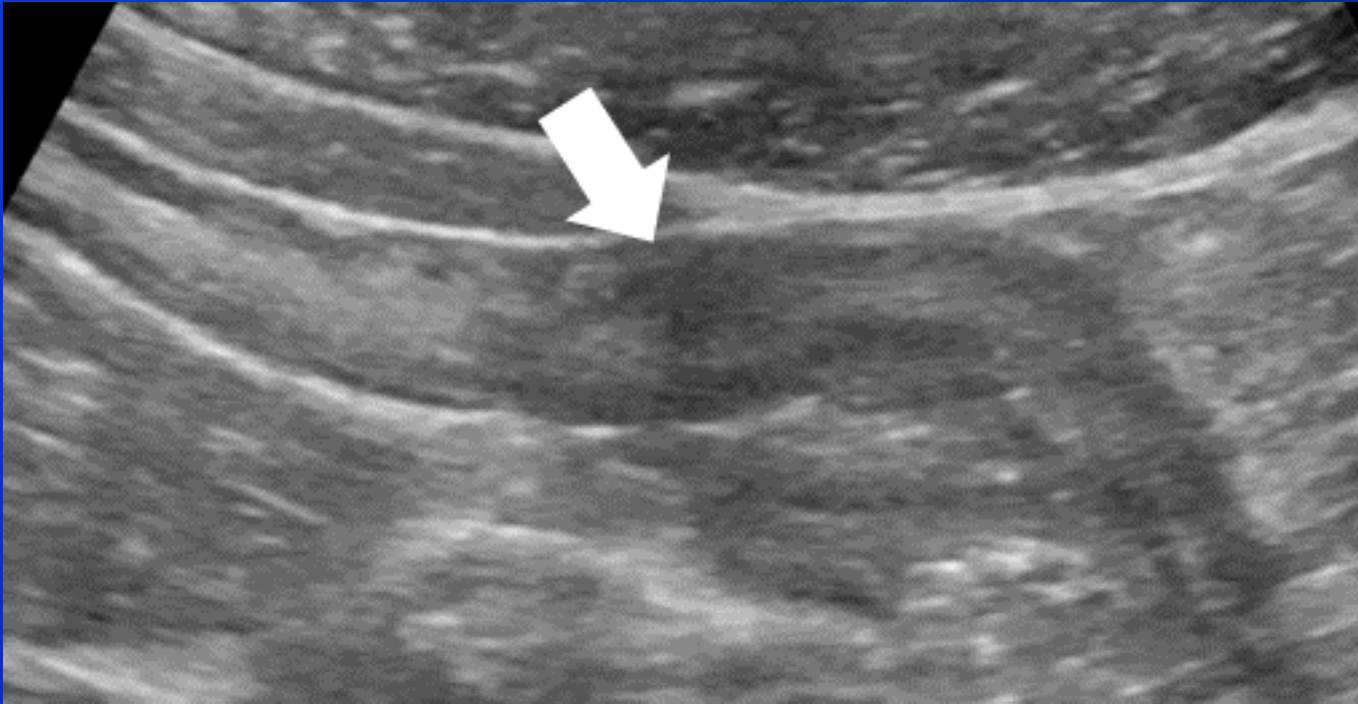


Stenosis with prestenotic dilatation in small intestine





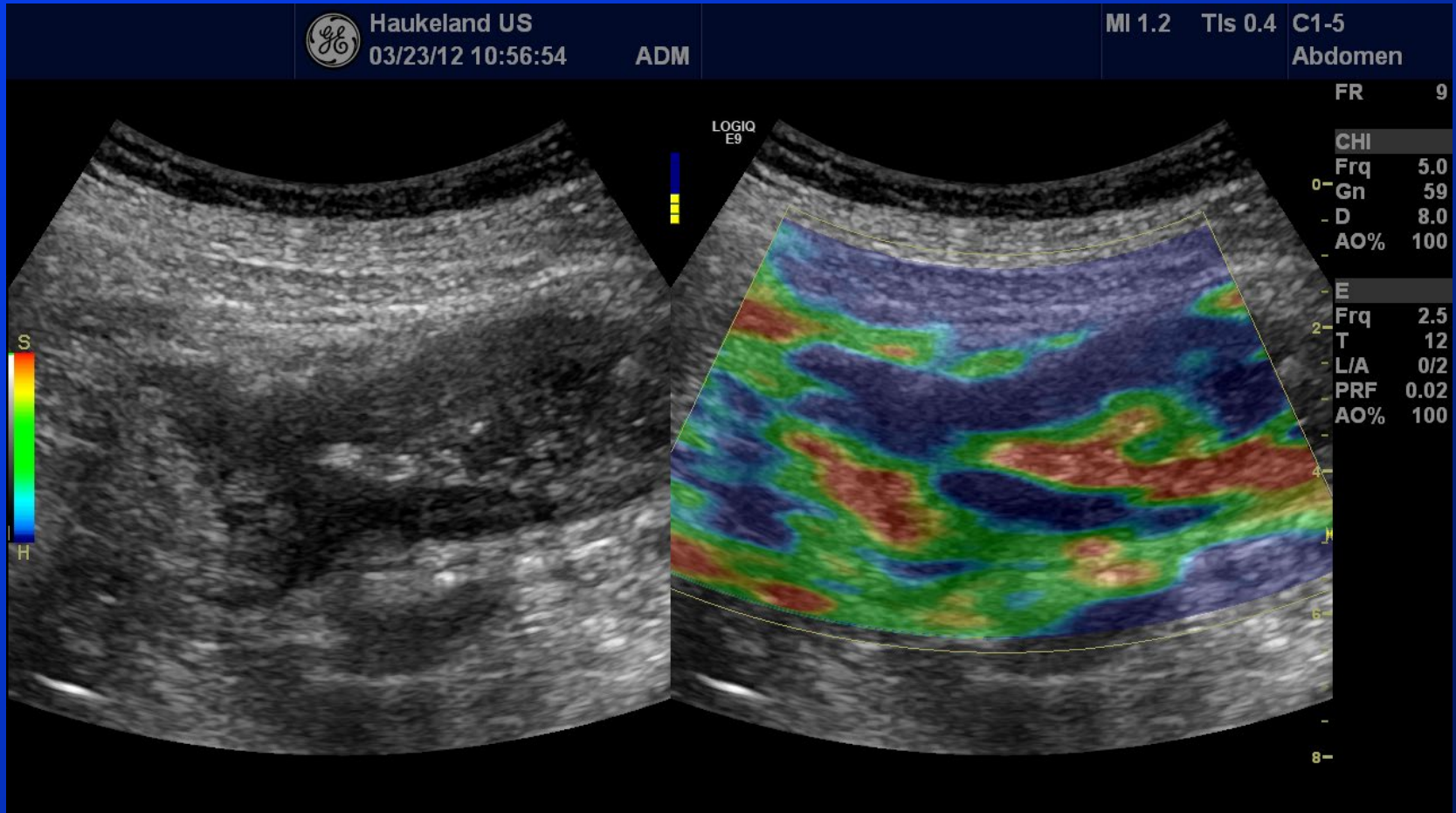
R18: Loss of stratification



Note how 5 wall layers to the left are reduced to 1 dearranged layer (white arrow)



Elastography of Crohns stenosis



Ultrasonogram (left) and elastogram (right) in a patient with Crohn's disease scanned with 5,0 MHz frequency. The patient has a clearly thickened wall of the terminal ileum (white arrow) with a stenosis (green asterisk). In the right panel, a corresponding blue color in the anterior wall indicate hard tissue (fibrosis) in the GI wall.



RECOMMENDATIONS

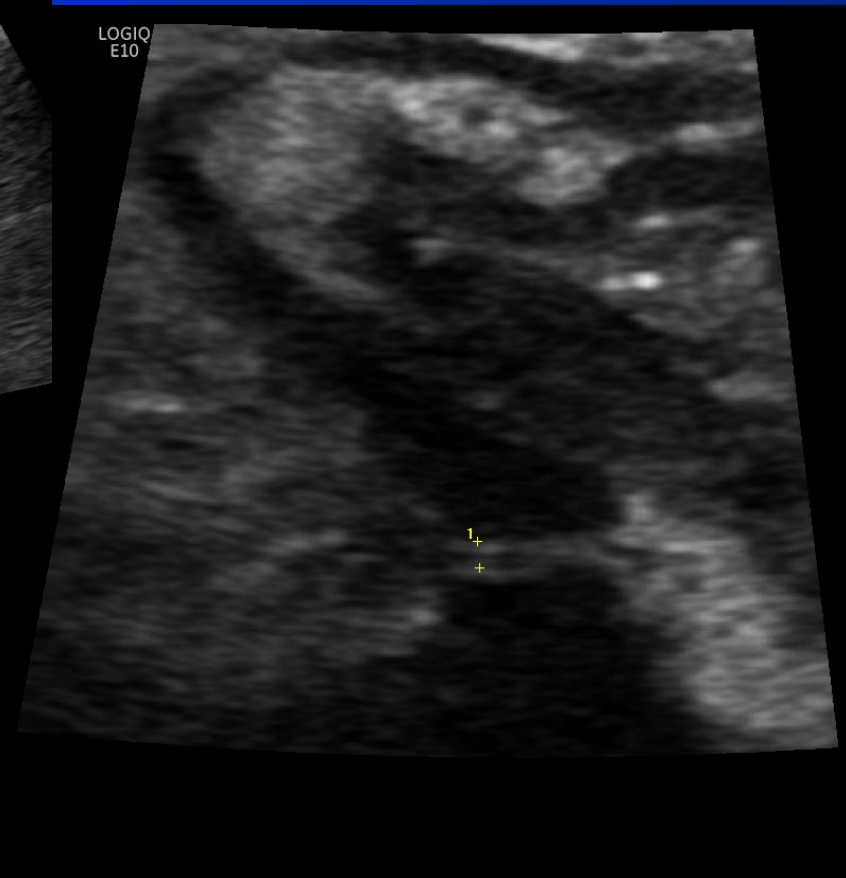
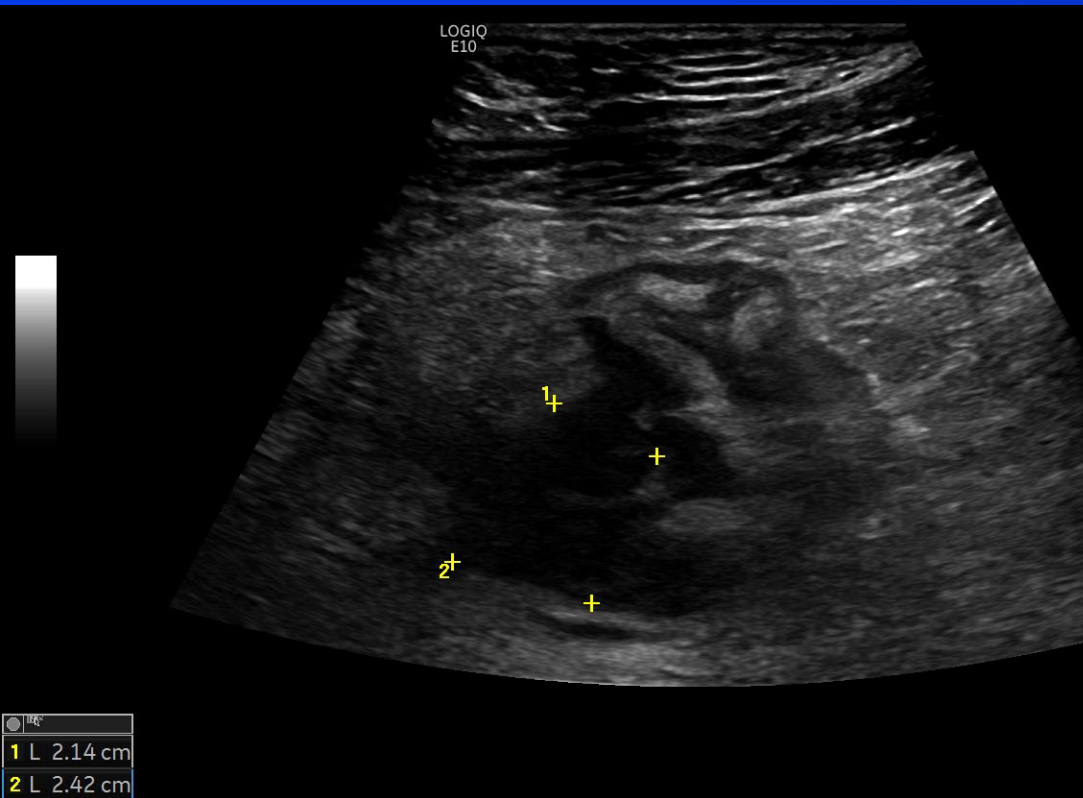
20. Fistulae in Crohn's disease can be identified by GIUS as hypoechoic tracts with or without air bubbles [LoE 2b, GoR A]
Consensus levels of agreement: A+ 17/17
21. GIUS can be applied with high sensitivity and specificity, comparable to CT or MRI, for the detection of CD fistulas [LoE 1; GoR A]
Consensus levels of agreement: A+ 14/17; A- 3/17



*Fistula between
2 intestinal loops
In Crohn's disease*

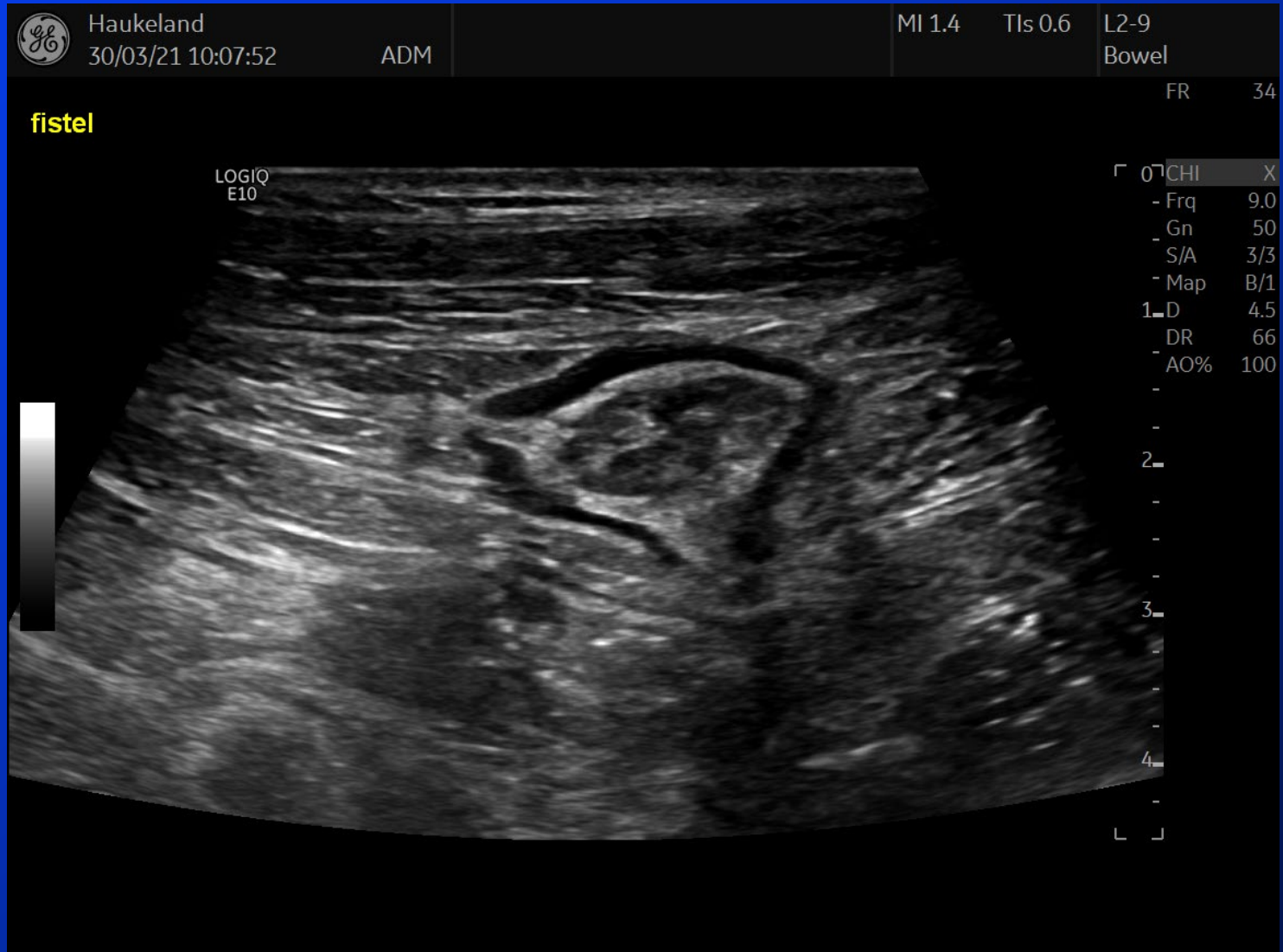


Fistula to abscess cavity





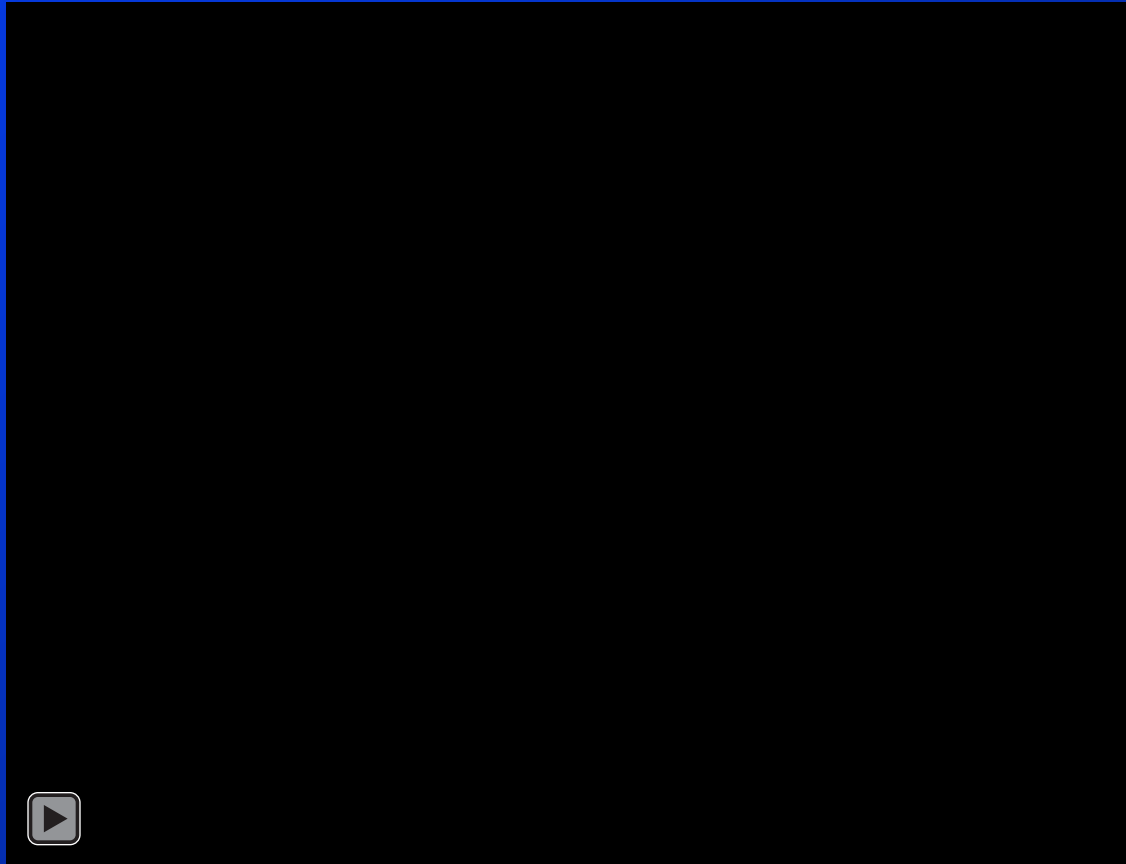
A healed fistula in Crohn's disease





CEUS detection of Fistulas

Injecting CA into the ext. opening

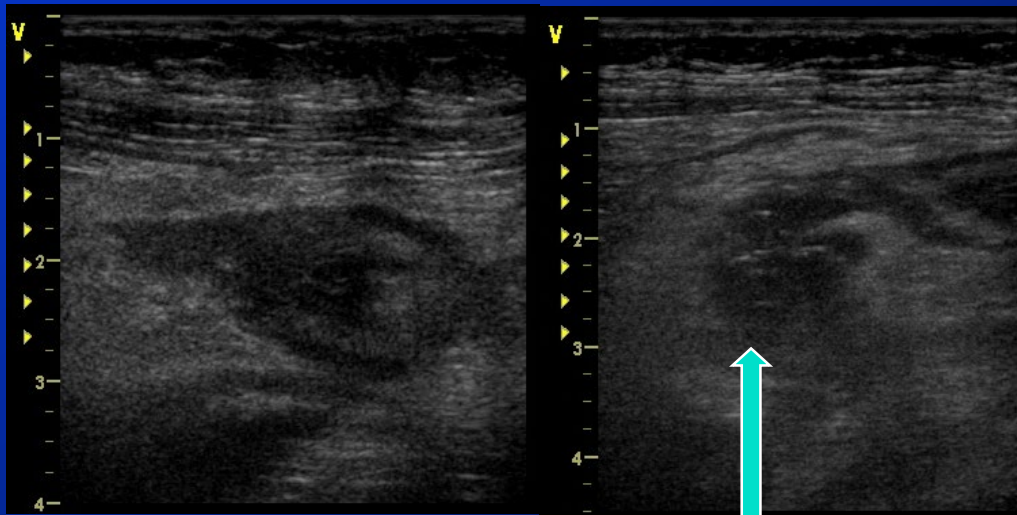


Cine loop in a patient with Crohn's disease and an enterocutaneous fistula located at the left lower quadrant connecting at least two loops of the small intestine. Note the long extension of the hyperenhancing fistula showing clearly the transmural penetration in the end of the loop. Courtesy: Dr Hans-Peter Weskott



RECOMMENDATIONS

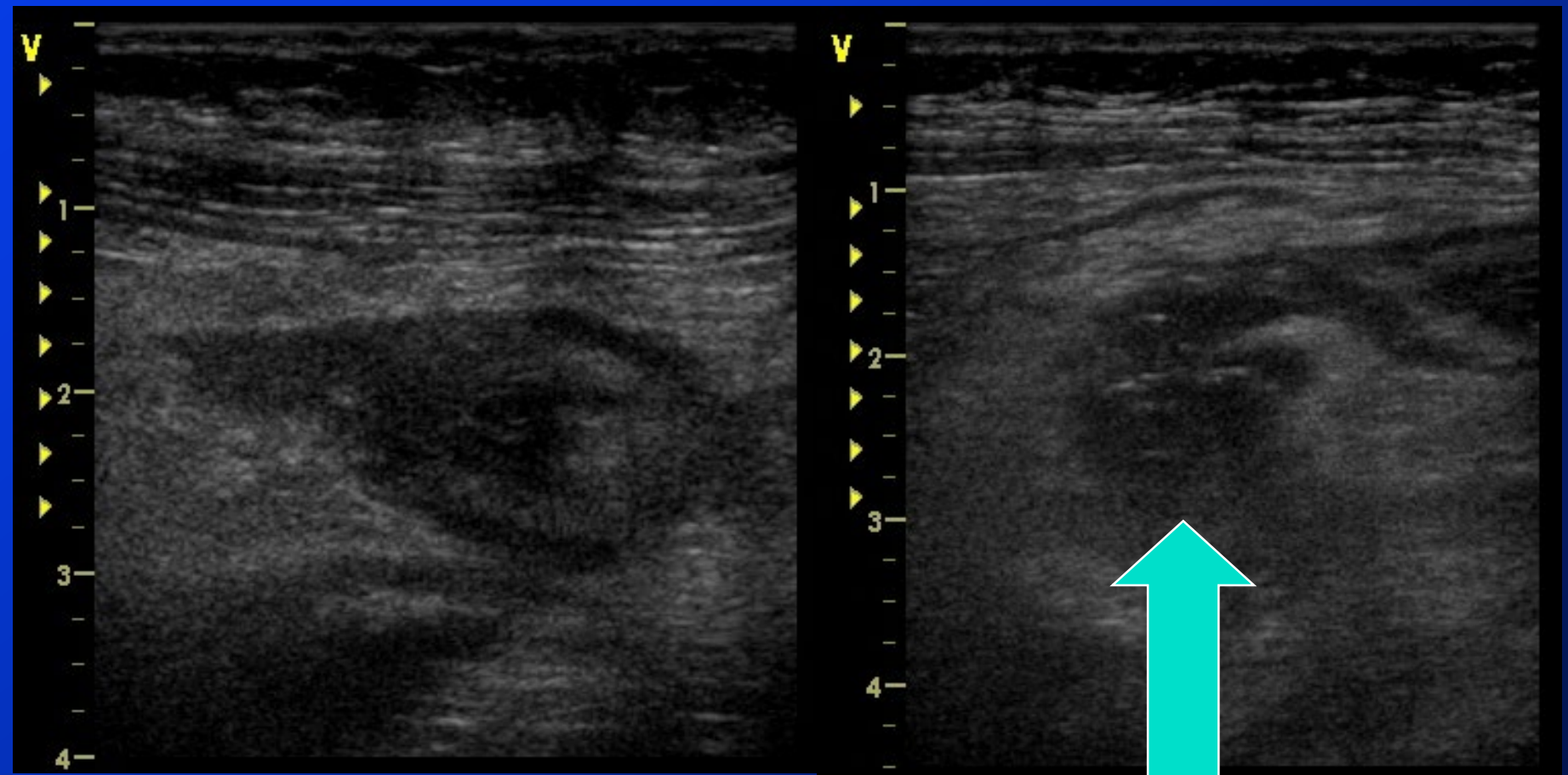
22. Abscesses can be detected using GIUS as organized fluid collections that may contain bubbles of gas [LoE 2a, GoR B]
Consensus levels of agreement: A+ 17/17
23. CEUS is useful for distinguishing between phlegmons and abscesses [LoE 2a, GoR B]
Consensus levels of agreement: A+ 17/17
24. GIUS may be applied with high sensitivity and specificity to detect Crohn's abscesses [LoE 2, GoR B]
Consensus levels of agreement: A+ 17/17



*Abscess close
to the ileum*



Abscess near the Ileum





Abscesses in Crohn's disease

Table III. Prospective studies assessing accuracy of bowel US in detection of intra-abdominal abscesses complicating CD

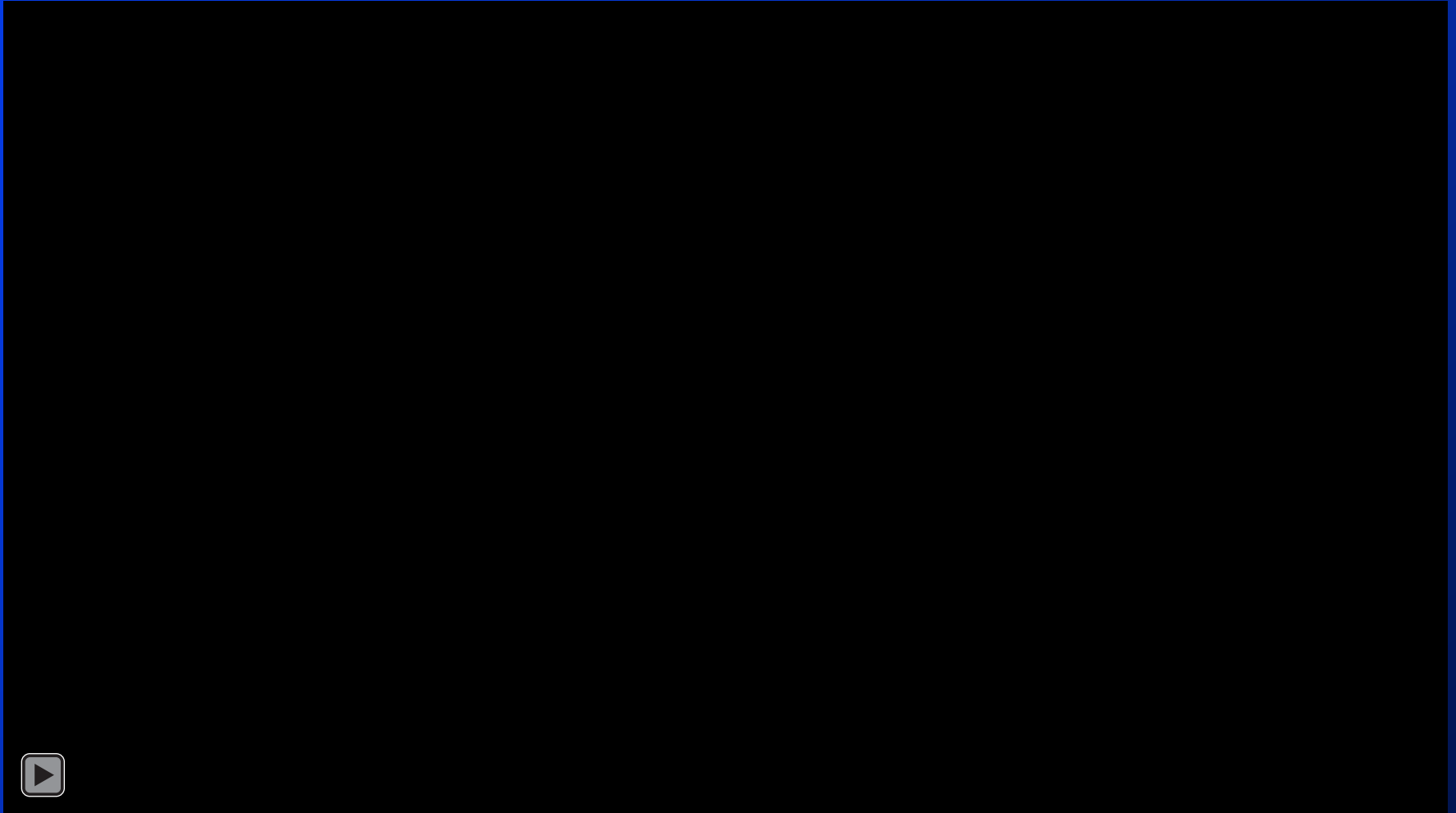
	No. of patients	Comparator	Sensitivity, %	Specificity, %
Schwerk et al. 1992 (13)	20	Surgery	92	100
Maconi et al. 1996 (19)	58	CT scan	83	94
Gasche et al. 1999 (20)	33	Surgery/pathology	100	92
Maconi et al. 2002 (25)	128	Surgery	91	87

- CT > US in deep abscesses (pelvis)
- US = CT in less deep abscesses
- US > CT in inflammatory infiltrates and abscesses that are close to the GI wall

Parente F, SJG 2002 (8)



Abscess detection in IBD



In right iliac fossa; note peritumoral hyperenhancement



RECOMMENDATION

27. Indexes and scores using GIUS may be a tool for predicting the risk of surgery and quantifying bowel damage [LoR 4 GoR C]

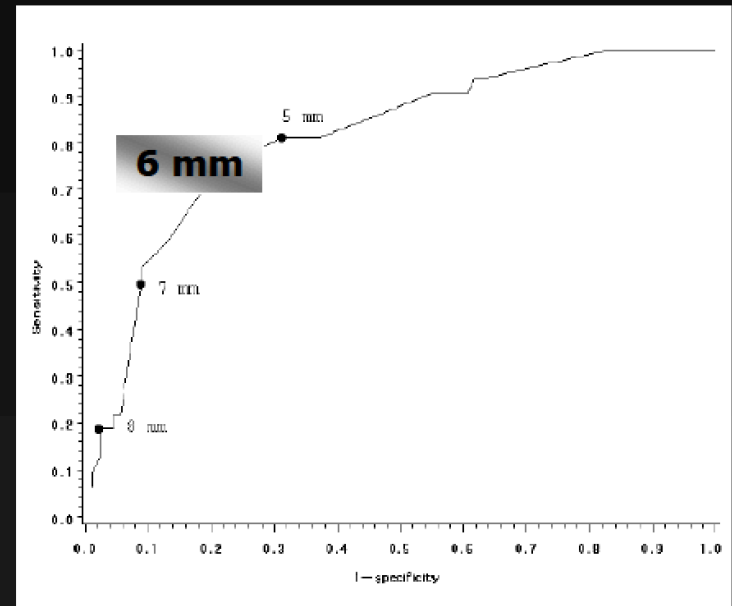
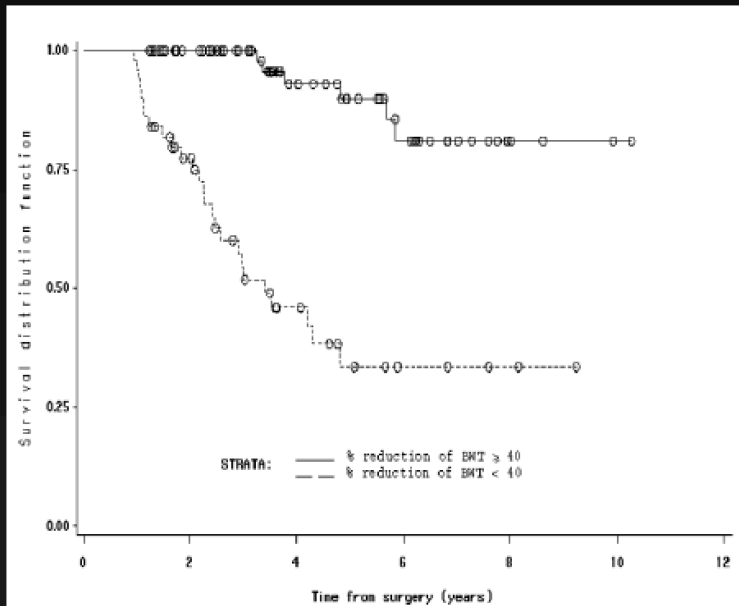
Consensus levels of agreement: A+ 14/16; A- 2/16





Outcome after conservative surgery

127 consecutive Crohn's disease (CD) patients undergone conservative surgery



BWT $>$ 6.0 mm at 12 months from surgery directly associated with the risk of Crohn's disease recurrence (HR 6.5; 95% CI: 2.8–15.4).

Parente, Aliment Pharmacol Ther 2004



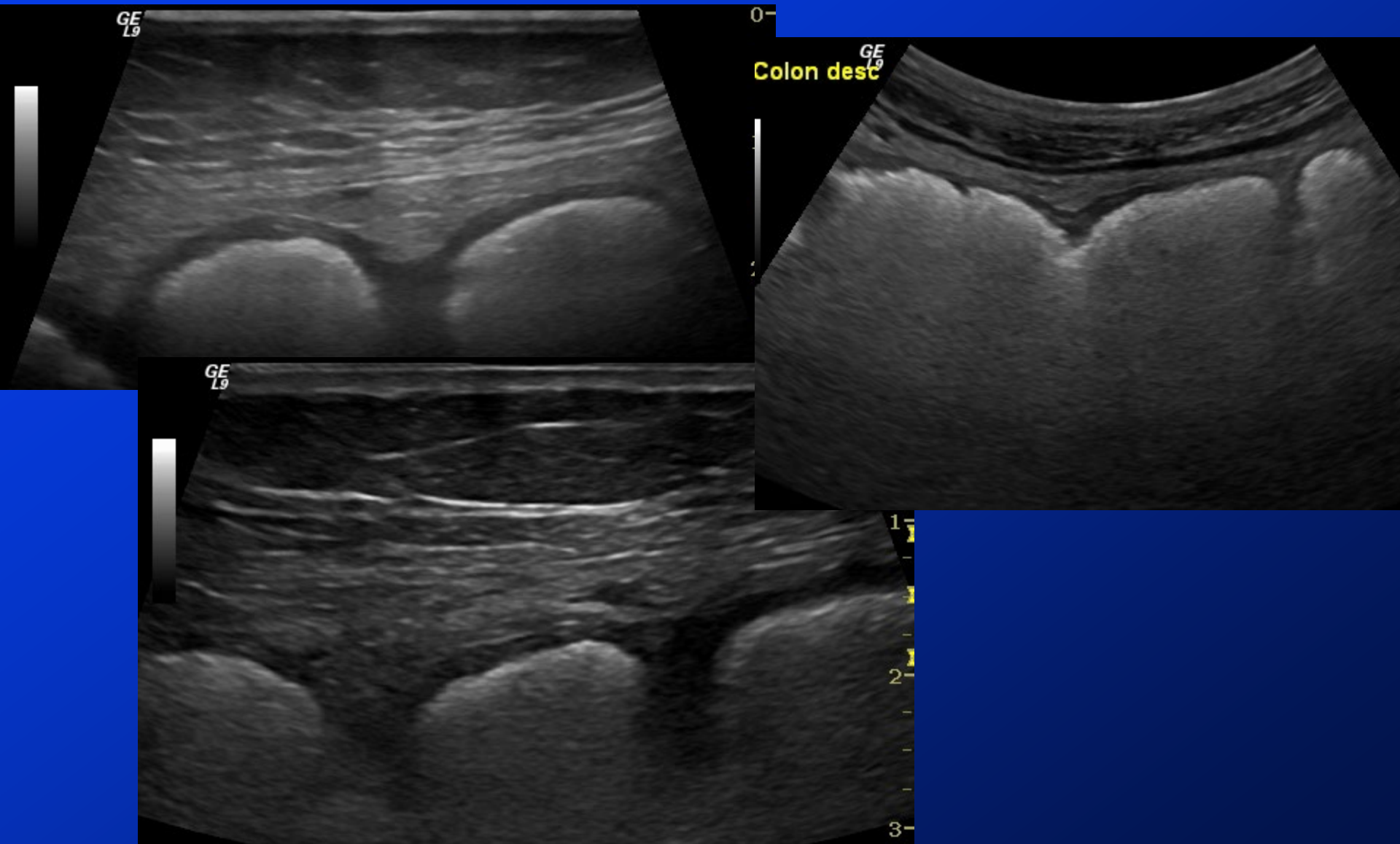
GIUS in Ulcerative colitis

RECOMMENDATIONS

28. GIUS can be used to estimate long segment thickening of the colonic wall, usually present in active UC [LoE 1b GoR A]
Consensus levels of agreement: A+ 17/17
29. In active ulcerative colitis the echo-stratification that can be visualized using GIUS may be preserved, except in severe disease. The thickening involves the mucosa and sub-mucosal layer [LoE 1b GoR B]
Consensus levels of agreement: A+ 17/17
30. Increased Doppler signals in the thickened bowel wall that can be observed using GIUS should be interpreted as a sign of active inflammation [LoE 1b GoR B]
Consensus levels of agreement: A+ 16/17; A- 1/17
31. CEUS highlights the inflammatory hypervascularity of the bowel wall and it can be used to evaluate therapy response [LoE 2b GoR B]
Consensus levels of agreement: A+ 15/17; A-1/17; I 1/17
32. GIUS can be used to differentiate between UC and CD based on the location of the disease, degree of wall thickening, preserved stratification, lack of surrounding fat involvement or penetrating complications [LoE 4 GoR C]
Consensus levels of agreement: A+ 16/17; A- 1/17



Wall Layers of Normal Colon



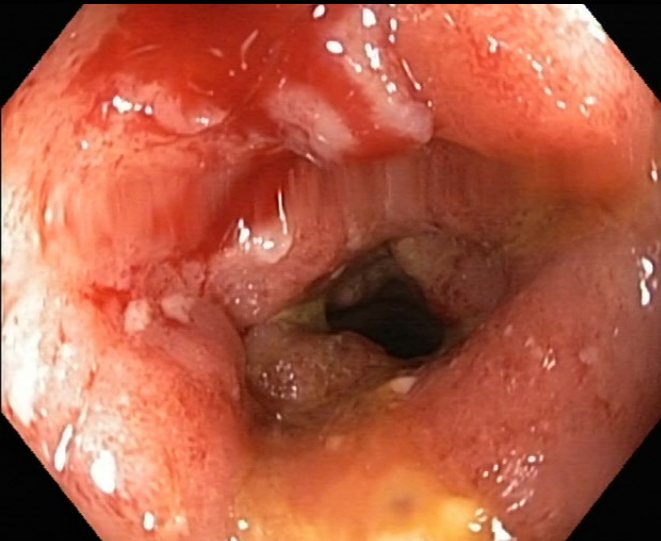
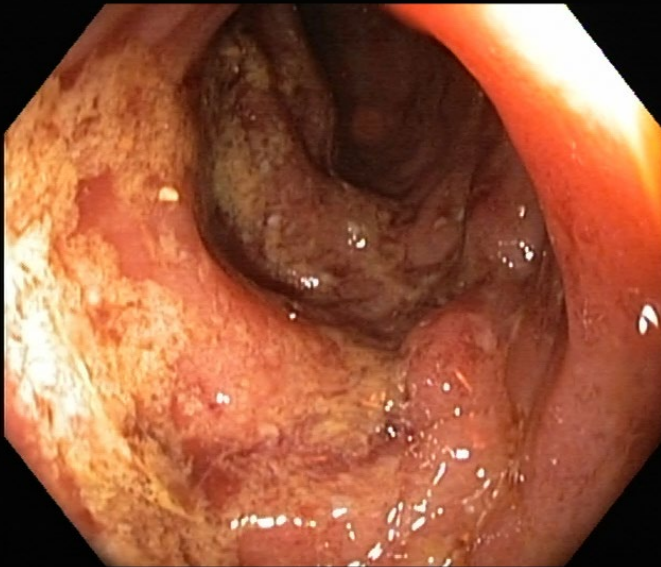


Sigmoiditis



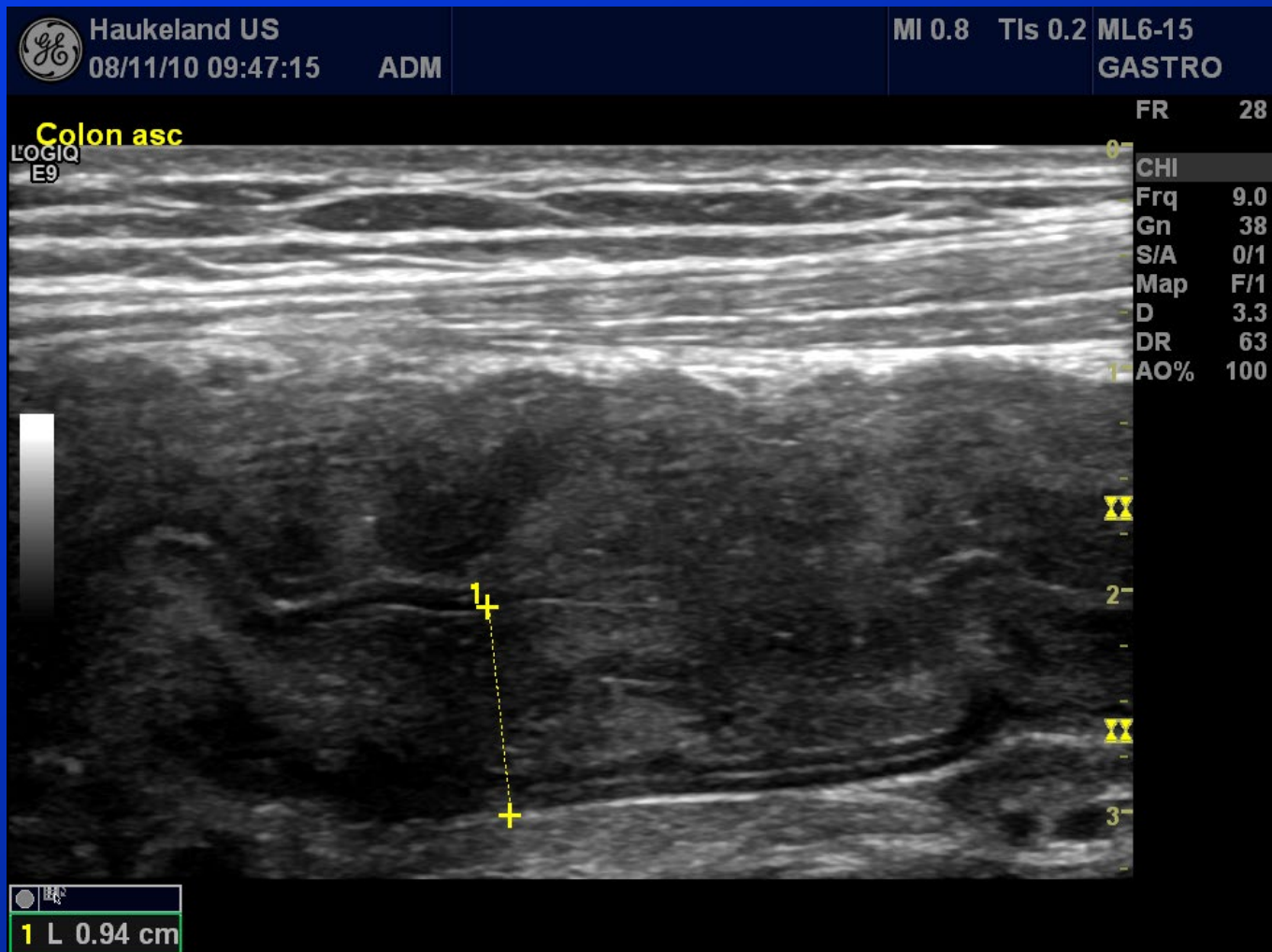


US in Ulcerative Colitis





Ulcerative Colitis





RECOMMENDATION

33. Intestinal complications of UC, like toxic megacolon, may show some specific features that can be observed by GIUS [LoE 4 GoR B]
Consensus levels of agreement: A+ 15/16; D- 1/16



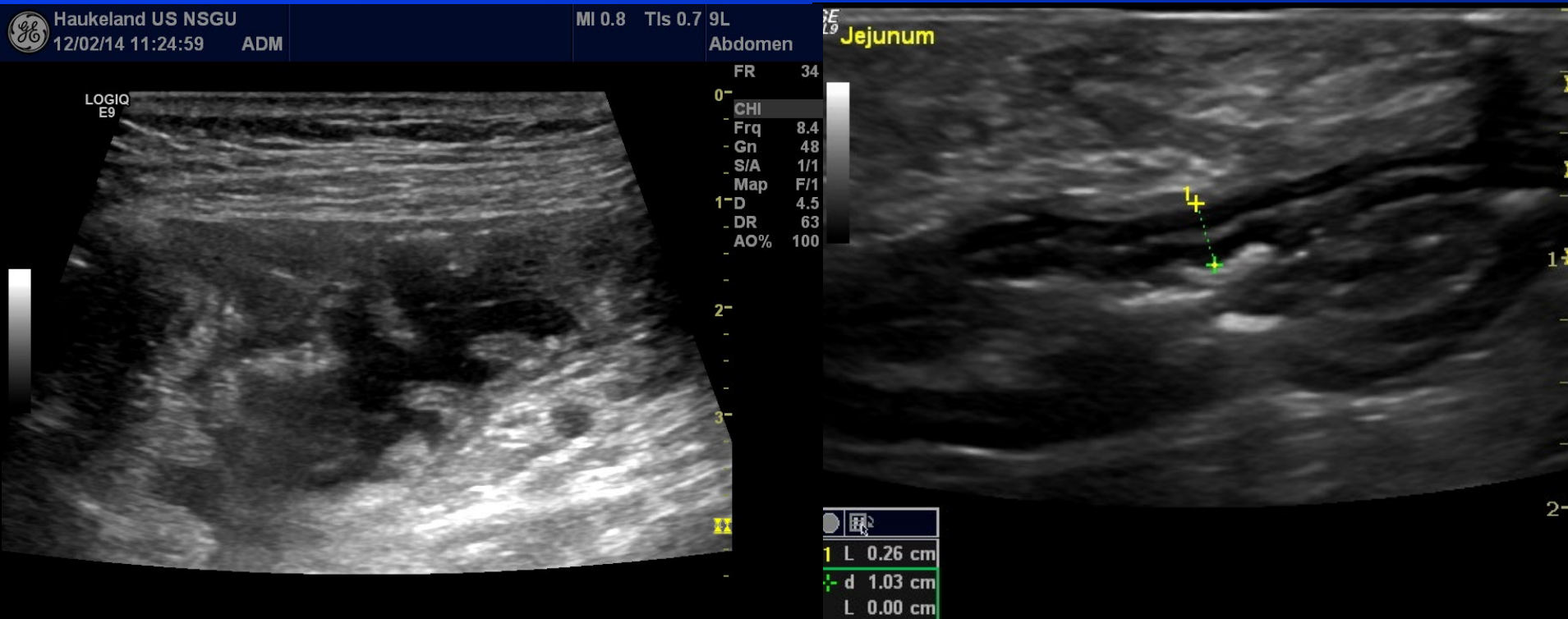
RECOMMENDATION

34. GIUS detection of specific features of the bowel, mainly the site of bowel involvement and peri-intestinal signs, can be used to differentiate Crohn's disease from ulcerative colitis and other intestinal conditions [LoE 4 GoR C]
Consensus levels of agreement: A+ 14/16; A- 1/16; I 1/16



IBS or IBD?

In the jejunum



Normal wall
Note valvula conniventes

Note thickened wall, no valvula,
and irregular luminal contour



IBS or IBD?

In the ileum



Normal ileum motility
Note thin wall

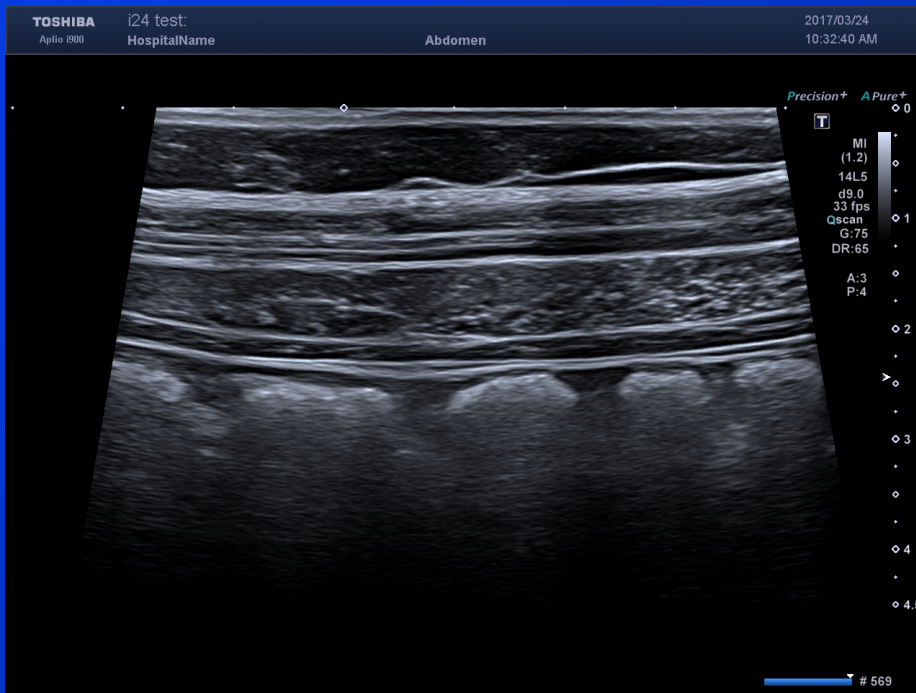


Dysmotility and thickened wall
In Crohn's disease

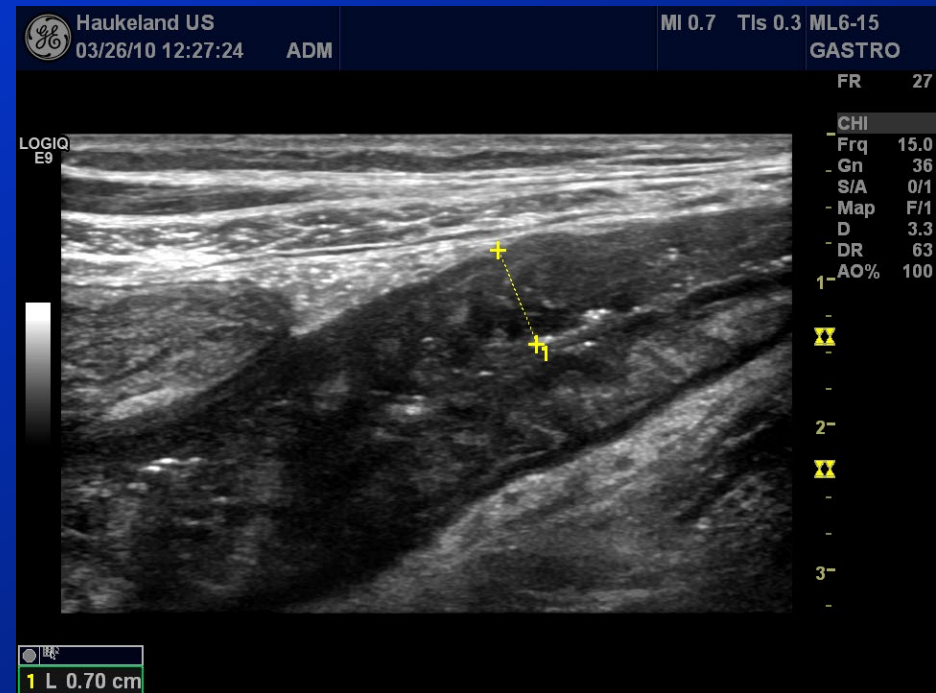


IBS or IBD?

In the colon



Normal descending colon



Thickened GI wall, loss of haustration, and dearranged wall layers in ulcerative colitis



Conclusion

- The 7 EFSUMB guidelines show that ultrasonography is a useful clinical tool for diseases of the GI-Tract
- "Pseudo-kidney sign" or target lesions indicate severe pathology of the GI-Tract
- GIUS can detect and characterize lesions and extension of disease in IBD
- CEUS and elastography can help distinguish between inflammatory and fibrotic strictures
- CEUS is useful when evaluating abscesses
- The EFSUMB GIUS guidelines sets a new standard for GI ultrasound imaging



Ultrasound takes you from vision to quick decisions



Just like the Lammergeier (bearded vulture) uses its Very sharp vision to pick out its prey.

Photo: OH Gilja

