Small intestinal contrast ultrasonography performs equally well as MRE in the assessment of Crohn's disease activity

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Conclusion

• SICUS (small intestinal contrast ultrasonography) demonstrated a highly statistically significant correlation with MRE regarding the detection and quantification of Crohn's disease activity of the terminal/neoterminal ileum.

• SICUS can serve as a feasible, cost-effective, and reliable alternative to MRE.

• Although we found a significant correlation between the two modalities, there were occasional outliers with clear discrepancies in the enumeration of disease activity. It is uncertain whether these differences reflected true differences in disease activity given a time-lag between the examinations.

Background & Aim

• Assessing inflammatory activity in patients with Crohn's disease (CD) is crucial in therapy optimization.[1]
• Magnetic resonance enterography (MRE) is the gold standard radiological investigation to evaluate the small bowel in patients with CD.[2] However, MRE is constrained by its high cost, extensive acquisition time, and limited availability.
• Small bowel contrast ultrasonography (SICUS) is an easily available, practical, safe, and low-cost cross-sectional imaging method.[2] Since the implementation of SICUS in monitoring inflammatory activity in CD has not been as widespread as other cross-sectional imaging modalities, further investigation is justified.
• The need for oral contrast in bowel ultrasound is debated, and likely the use of contrast should be selected for specific situations rather than applied as a general routine.
• The aim of this study was to compare SICUS to MRE in terms of evaluating disease activity in patients with CD.

Material and methods

• SICUS (Figures 4-6) was planned to be performed within 2-6 weeks after MRE had been done. During this lagtime, clinical disease activity was monitored using Physician's Global Assessment (PGA). Only patients without a change in the PGA score were included.

• The degree of disease activity, as visualized by MRE, was quantified by two different scoring systems, i.e. the Crohn's Disease Magnetic Resonance Inflammation Severity (CDMRIS) subscore for the small bowel [0-14 points] and the Radiological Crohn's Disease Activity Score (RCDAS) [0-22 points], respectively (Table 1).

• The SICUS was quantified using the Simple Ultrasound Score (SUS-CD) for the terminal ileum [0-5 points] (Table 1).

• Spearman's rank correlation analysis was used for comparison of the two examination modalities.

Table 1. Scoring systems applied in the study.

CDMRIS - Radiological items
Mild-moderate enhancement at T1 sequences (MMT1)
Severe enhancement at T1 sequences (ST1)
Deep ulceration, no fistula (DU)
"Comb sign" (CS)
Inflammation with fistula, any type (F)
Inflammation with abscess (A)

RCDAS - Radiological items
Enhancement
Asymmetry
Stratification
Multiple segments involved
Wall thickening (mm)
Intramural edema
Stricture (cm)
Ulceration
Sacculation
Comb sign
Lymphadenopathy
Abscess
Perforation with fistulae

SUS-CD - Ultrasound items
Bowel wall thickness (BWT), mm
Colour Doppler (CD), vessels per cm²

Table 2. Demographics.

Demographics	
Crohn's disease patients	40
Age (years), Median (range)	47 (30-58)
Male:Female ratio, n	20:20
Body mass index, Mean (SD)	26.37 (4.67)
Montreal classification, n (%)	
Age at diagnosis	
A1 (<17 years)	2 (5.0)
A2 (17-40 years)	27 (67.5)
A3 (>40 years)	11 (27.5)
Disease location	
L1 (terminal ileum±cecal disease)	30 (75.0)
L2 (colonic)	0 (0.0)
L3 (ileocolonic)	10 (25.0)
L3L4 (ileocolonic and upper GI tract)	2 (5.0)
Disease behaviour	
B1 (uncomplicated)	17 (42.5)
B2 (stricturing)	19 (47.5)
B3 (penetrating)	0 (0.0)
B2B3 (stricturing, penetrating)	3 (7.5)
P(perianal)[a]	3 (7.5)
Baseline data	
Faecal calprotectin (ug/g), Median (IQR)	89 (31.5-200.8)
Harvey-Bradshaw Index, Median (IQR)	4.0 (2.0-4.0)
Current IBD treatment, n (%)	
Without any IBD therapy	9 (22.5)
Azathioprine or 6-mercaptopurine	10 (25.0)
Methotrexate	3 (25.0)
Peroral steroids /Prednisolon	2 (5.0)
Budesonid	8 (20.0)
Anti-TNF alfa	16 (40.0)
Integrin receptor antagonists	2 (5.0)
IL-12, IL-23 antagonists	1 (2.5)
Prior surgical treatment	
Ileocecal resection	13 (32.5)

Abbreviations: CRP, C-reactive protein; IBD, inflammatory bowel disease; IQR, interquartile range; n, number of patients
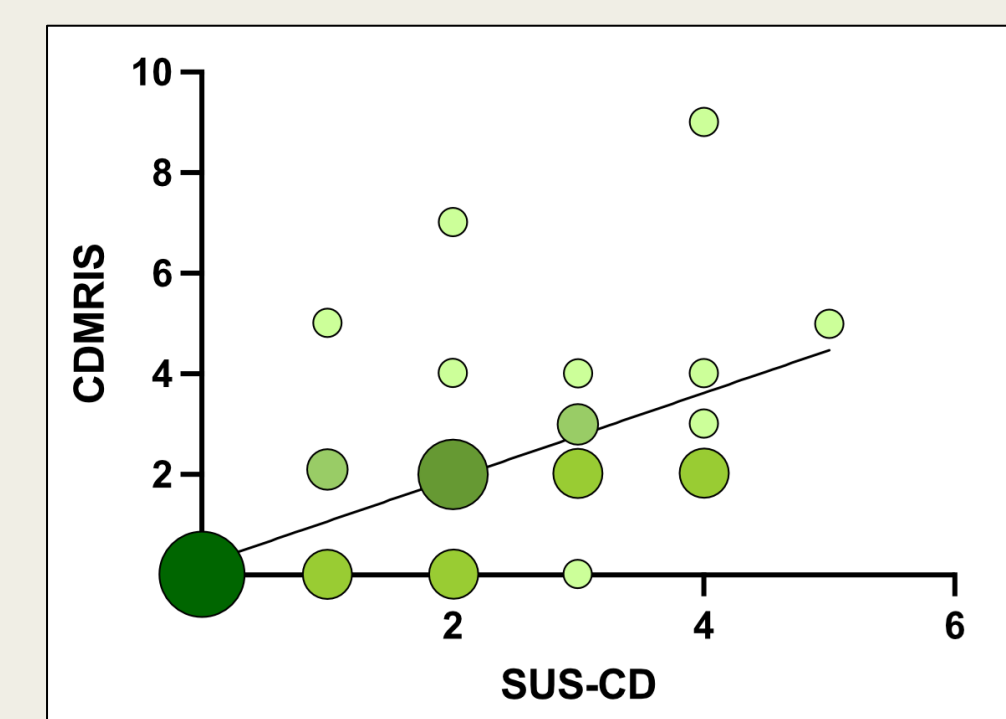[a]May coexist with B1-B3

Figure 2. Scatter diagram of correlation between CDMRIS and SUS-CD (r=0.67, p<0.0001).
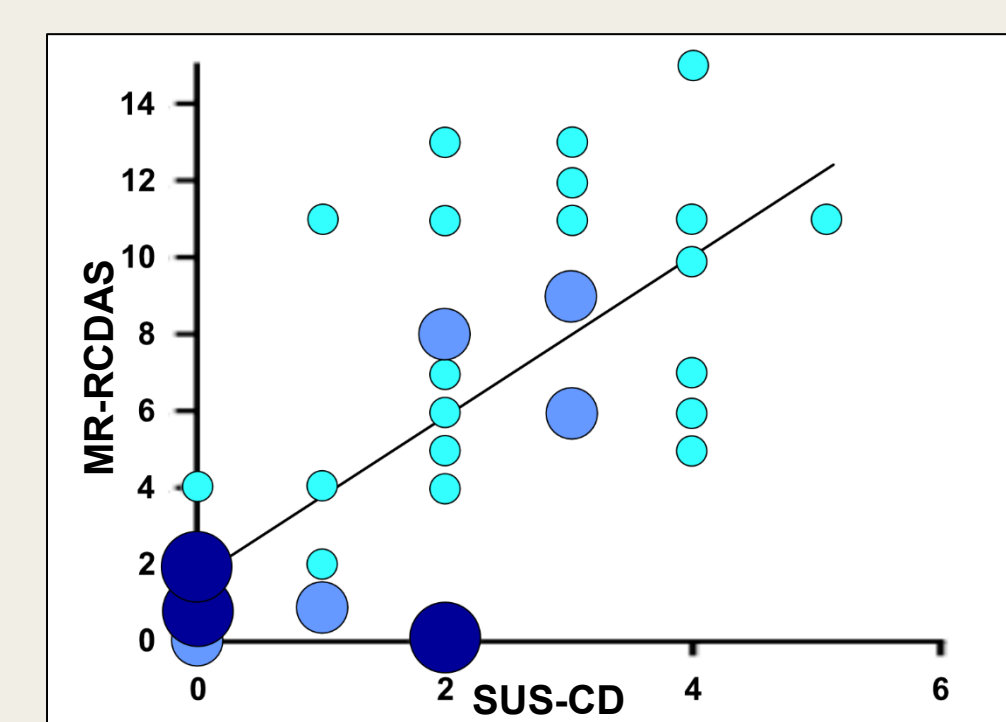

Figure 3. Scatter diagram of the correlation between RCDAS and SUS-CD (r=0.67, p<0.0001).

Results

• A total of 40 patients with established CD (mean age 47 [SD 28] years; female:male ratio 1:1) were included. SICUS was performed at a mean of 34 days [SD 27.5] after the MRE (Table 2).

• The two medical imaging modalities were compared applying the Spearman's rank correlation analysis. The correlation coefficient was 0.67 (p<0.0001) when comparing SICUS to CDMRIS; and 0.67 (p<0.0001) when comparing SICUS to RCDAS. Thus, exactly the same numbers for both comparisons (Figures 2-3).

• An important observation was that there were some, albeit few, outliers where the two modalities showed clear differences in the enumeration of disease activity. Of note, differences may potentially be attributed to true differences in disease activity since the two examinations were performed with some time-lapse. Finally, depending on which radiological score that was used for quantifying the findings on MRE, the level of disease activity differed substantially in a few patients.
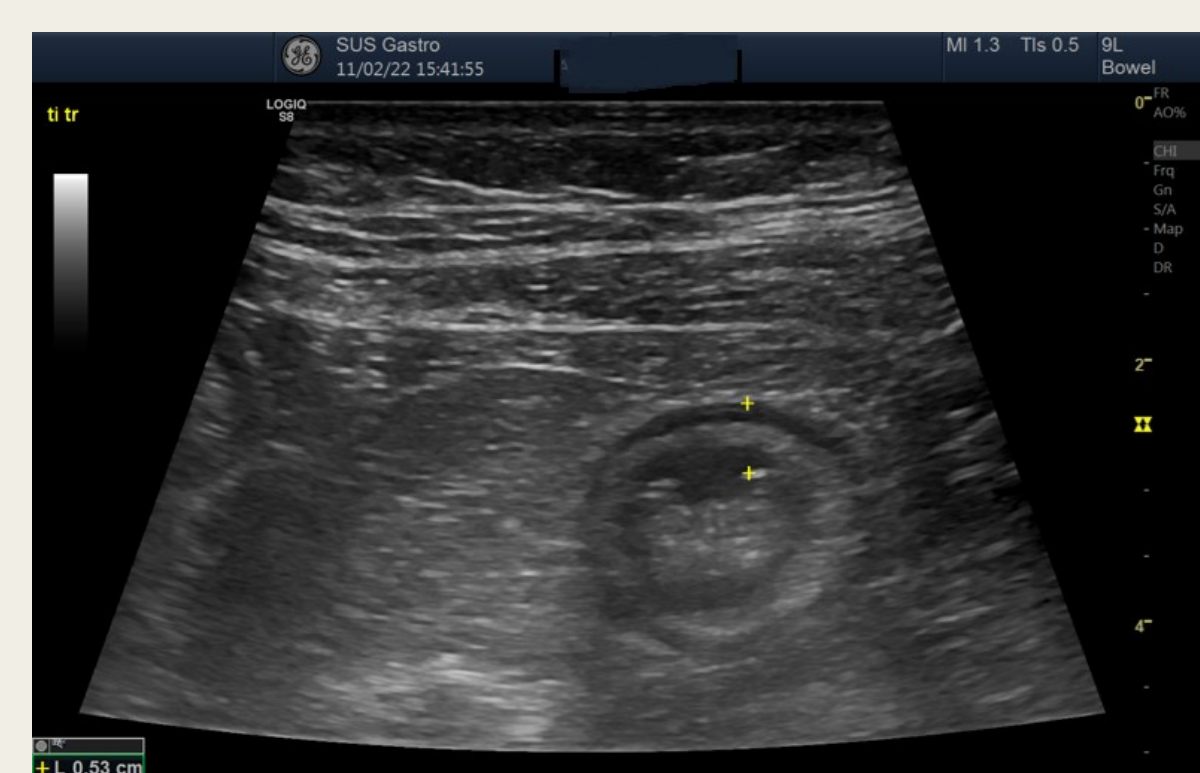

Figure 4. SICUS; Cross-sectional image of the terminal ileum, showing bowel wall thickness of 5.3 mm.
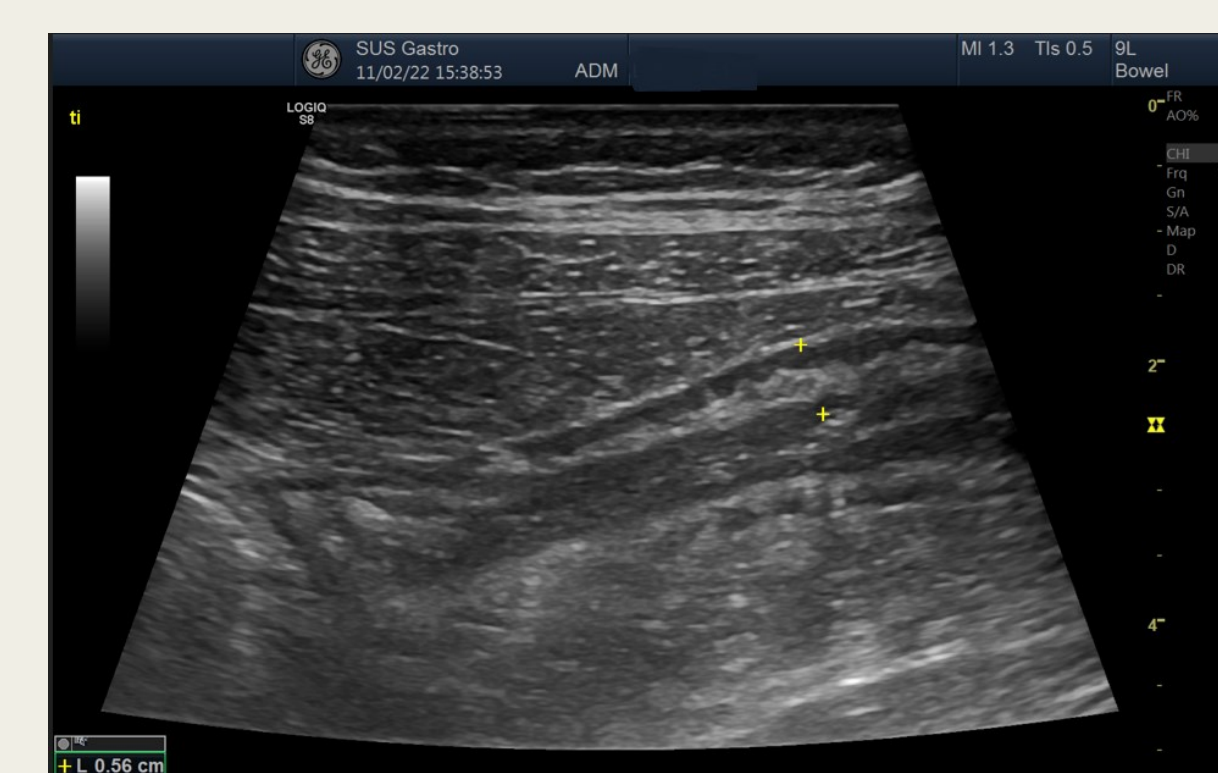

Figure 5. SICUS; Longitudinal section image of the terminal ileum showing bowel wall thickness of 5.6 mm.
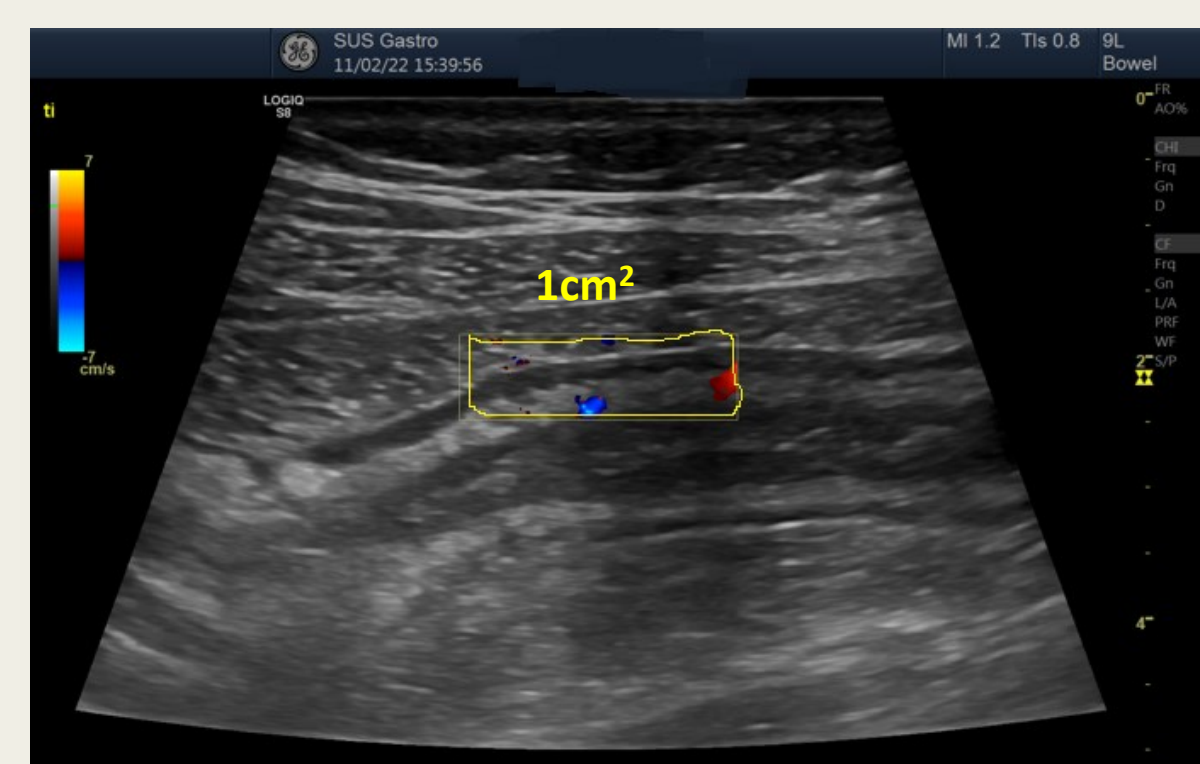

Figure 6. SICUS; Longitudinal section of the terminal ileum showing CD evaluation in an area of 1 cm². Two visible vessels are seen corresponding to a score of 1.

SICUS was performed in patients having fasted, and with 300 ml of macrogol oral solution administered 30 minutes before the procedure. The patient was scanned in the supine position. The ultrasound examination was performed using a 1-6 MHz convex and a 3-8 MHz linear array probe.

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2. Rispo, A., et al., *David Against Goliath: Direct Comparison of Handheld Bowel Sonography and Magnetic Resonance Enterography for Diagnosis of Crohn's Disease.* Inflamm Bowel Dis, 2023. **29**(4): p. 563-569.

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