Application of bowel ultrasound in comparison to MRI: a case study

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Background

Crohn's disease (CD) is an inflammatory disorder affecting any part of the gastrointestinal tract. The incidence and prevalence of CD is rising.[1]

Imaging is pivotal in diagnosis and in monitoring disease activity. Although several imaging modalities are used, MR enterography is often preferred due to the high resolution of both bowel and relevant extraintestinal sites. However, drawbacks include lack of availability, patient preparation, and examination length which may be challenging for infants. Ultrasound offers advantages of being non-invasive, generally well-tolerated and providing a dynamic assessment of the bowel.[2]

Ultrasound	MR Enterography
No ionising radiation	No ionising radiation
Patients may prefer – non-invasive	May require sedation and bowel preparation
Cost-effective and readily available	More expensive and longer study
Operator dependence	Less inter-observer variability
Compliance difficulties (e.g. children)	Easier for patients with high BMI

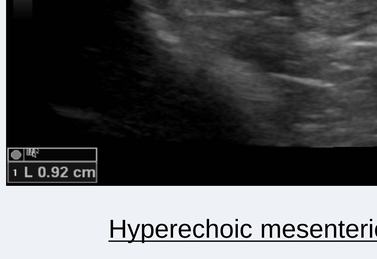
Table 1: Comparison of ultrasound and MR enterography

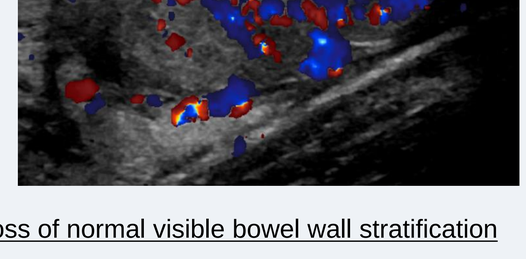
Case Report

A 14-year-old boy of Hungarian origin with known CD, asymptomatic on maintenance treatment, was found on examination at a routine appointment to have an 8-10 cm mass palpable in the right iliac fossa.

An ultrasound scan was arranged which showed presence of a grossly abnormal mass of bowel loops with at least three interloop fistulae (Figures 1 and 2), and markedly abnormal vascularity of surrounding mesentery. The terminal and distal ileum were thick-walled (Figure 3), with dilatation of the mid-ileum suggesting a stricture (Figure 4). An MRI small bowel study corroborated these findings (Figure 6).

He was commenced on biologic treatment and underwent an ileocaecal resection.





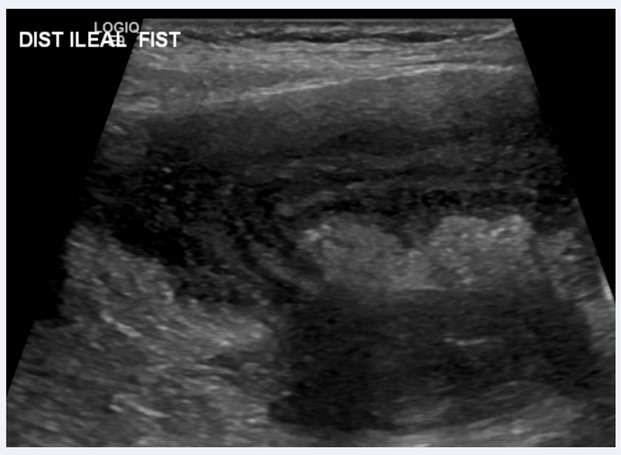


Figure 1: Ultrasound image demonstrating fistula between distal ileum and adjacent small bowel loop.

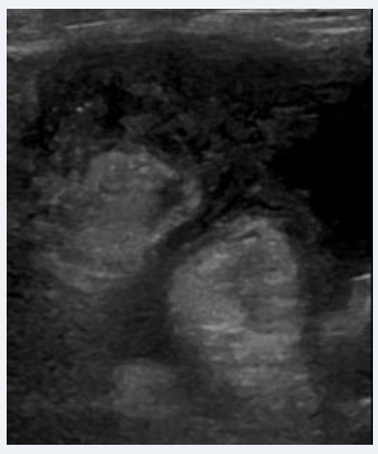


Figure 2: Further example of interloop fistula.

Figure 3: Ultrasound image demonstrating thickened distal ileum.

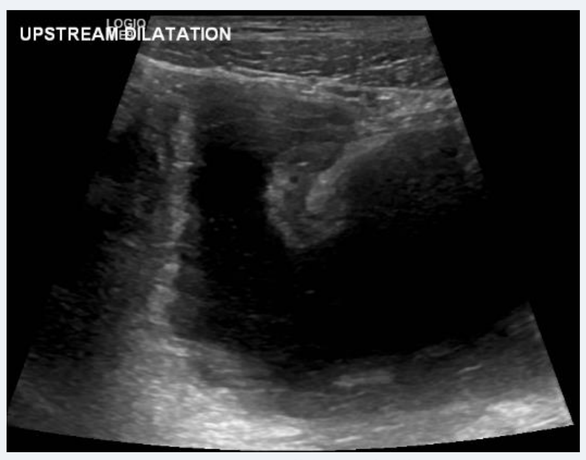


Figure 4: Upstream small bowel dilatation suggesting a stricture.

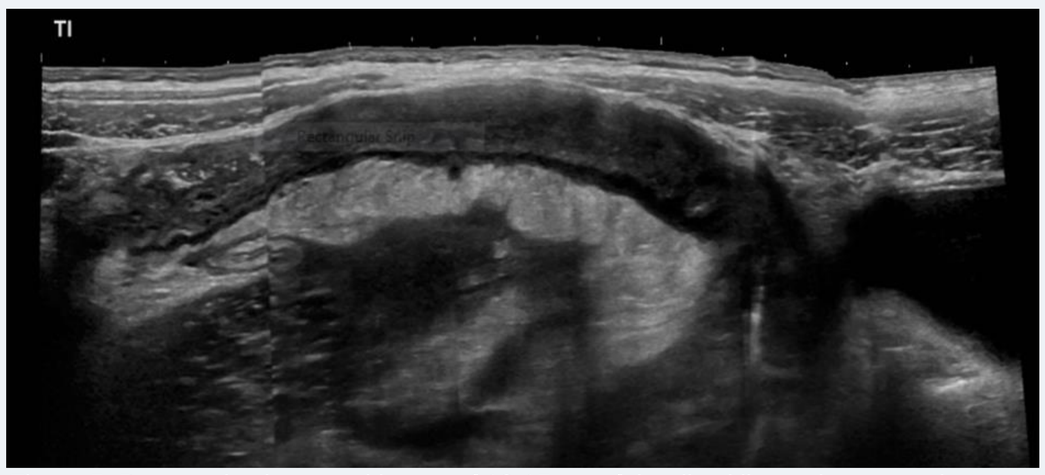
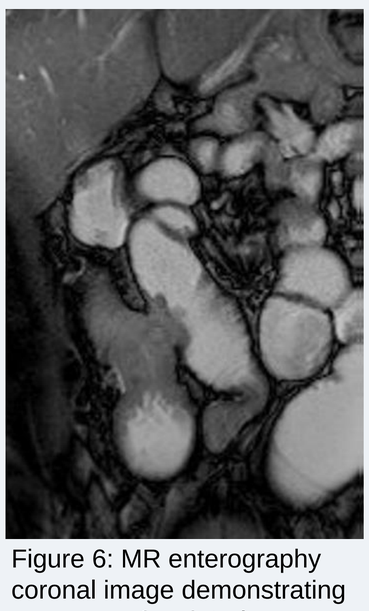


Figure 5: Panoramic ultrasound image of 10-15 cm of the distal ileum demonstrating marked mural thickening, mesenteric inflammation and associated lymphadenopathy in keeping with active inflammation.



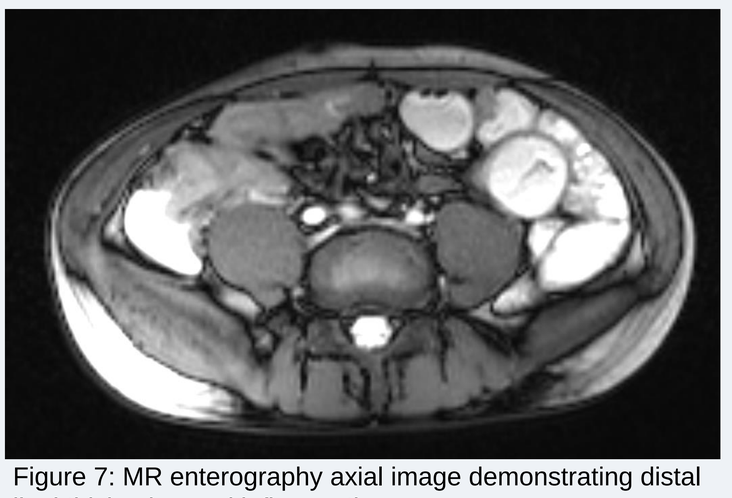


Figure 7: MR enterography axial image demonstrating distal ileal thickening and inflammation.

Figure 6: MR enterography coronal image demonstrating presence of an interloop fistula.

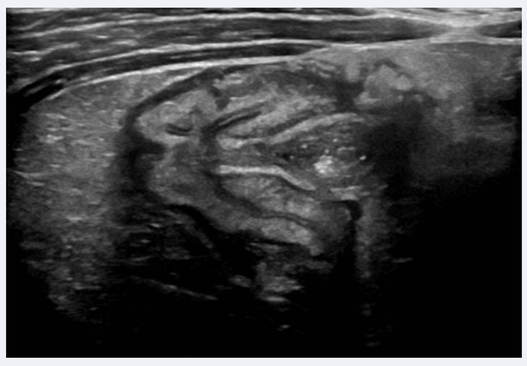
Key Features of Bowel Wall Inflammation on Ultrasound

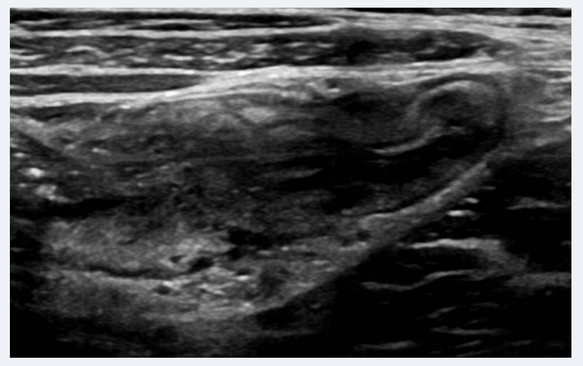
Bowel wall thickening

Bowel wall hyperaemia

Hyperechoic mesenteric fat

Loss of normal visible bowel wall stratification





Additional findings may include[3]:

- Absent/reduced peristalsis signifying a degree of stiffness
- Enlarged mesenteric lymph nodes
- Adjacent collections/abscesses, fistulae and strictures

Discussion

Our case, alongside other examples in our presentation, highlight potential advantages of using ultrasound as an adjunct to MRI in the surveillance of CD. In particular, recent studies have emphasised the utility of bowel ultrasound in the paediatric population in this cohort[4].

Sonographic assessment is reliable in detecting inflammatory changes within the colon and distal ileum - with our case clearly depicting interloop bowel fistulae - and may be particularly useful to confirm equivocal or unusual findings seen in other imaging modalities.

Bowel Ultrasound Approach

- Equipment:
  - High frequency linear transducer
  - Low frequency curvilinear transducer
  - B-mode and Doppler
- Patient Preparation:
  - Ideally fasted 2-4 prior to examination
  - Hydration with 100-500 ml of water before the scan to visualise proximal small bowel and help reduce bowel gas
  - Fill the urinary bladder to aid the visualisation of deep pelvic structures
- Approach::
  - Start with a low frequency curvilinear probe, assessing overall appearance of abdomen
  - Define the position of the caecum, terminal ileum and appendix
  - Examine the colon from caecum to sigmoid, and possibly the rectum behind a full bladder
  - Systematically review each quadrant of the abdomen for small bowel
  - Doppler assessment using a low velocity scale (5-10 cm/sec), ensuring the wall filer is low and adjusting the box size to a small field of view

References

1. Kammemeir J, Morris M, Garick V et al. Management of Crohn's Disease. *Arch Dis Child* 2015; 0:1-6.
2. Ahmad T, Greer M, Walters D et al. Bowel Sonography and MR Enterography in Children. *AJR* 2016; 206:173–181.
3. Casciani E, De Vincentiis C, Polettini E et al. Imaging of the small bowel: Crohn's disease in paediatric patients. *World J Radiol* 2014; 6 (6): 313-328.
4. Barber JL, Maclachlan J, Planche K et al. There is good agreement between MR enterography and ultrasound with regards to disease location and activity in paediatric inflammatory bowel disease. *Clin Radiol* 2017; 72 (7): 590-597.