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ORIGINAL ARTICLE

Gastroenterology: Inflammatory Bowel Disease

Role of noncontrast enhanced abdominal ultrasound in the diagnostic assessment of pediatric inflammatory bowel disease

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Abstract

Objectives: Assessment of small bowel involvement when diagnosing inflammatory bowel disease (IBD) delineates clinical subtype and disease extension. The gold standard for small bowel assessment is magnetic resonance enterography (MRE), but MRE is not always feasible for children. Standard, non-contrast enhanced abdominal ultrasound is an acceptable alternative. The study aimed to evaluate the utility of ultrasound in the diagnostic work-up of pediatric IBD to identify small bowel involvement.

Methods: A retrospective study was conducted among children (< 18 years) who had abdominal ultrasound during assessment for IBD (2019–2023) at Christchurch Hospital, New Zealand. Descriptive analysis compares small bowel ultrasound to MRE, endoscopy and histology.

Results: The cohort comprised 47 children, mean age 9.9 years (± 4.1), 23 (49%) males and 42 (89%) with Crohn's disease. All had endoscopy and histology data available for comparison, and 26 had MRE. Fourteen (30%) had no small bowel disease on ultrasound, MRE, endoscopy, or histology. Ultrasound confirmed small bowel disease diagnosed by other modalities for 12 (26%). Ultrasound identified small bowel disease for 7 (15%) that had not been seen during the diagnostic process by MRE, endoscopy or histology, possibly due to the limitations of endoscopy and time-delays between diagnosis and MRE. Small bowel disease was not picked up on ultrasound for 14 (30%) children, disease locations being duodenum ($n = 6$), TI ($n = 5$), proximal ileum ($n = 3$), and jejunum ($n = 2$).

Conclusions: Abdominal ultrasound is a valuable resource for assessing disease extent in suspected pediatric IBD. This study highlights the clinical benefit and feasibility of a multi-modal diagnostic approach.

KEYWORDS

children, Crohn's disease, diagnosis, small bowel, ultrasonography

1 | INTRODUCTION

Inflammatory bowel disease (IBD) is an immune-mediated disease of the gastrointestinal (GI) tract, with an increasing global prevalence.[1] Diagnosis of IBD requires an endoscopic and histological examination of the bowel mucosa, with cross-sectional imaging techniques playing an important role to visualize the parts of the small bowel that are inaccessible with routine ileocolonoscopy and esophagogastroduodenoscopy.[2] Defining the presence of small bowel disease is important in differentiating between the sub-types of

IBD, known as ulcerative colitis (UC) and Crohn's disease (CD). This also enables the delineation of the extent of bowel involvement in individuals with CD, as approximately 70% of people with CD have small bowel involvement.[3] Furthermore, imaging can be used to detect and define disease complications, such as strictures, and assist in evaluating the need for surgical intervention.[2] Inadequate or delayed delineation of small bowel involvement may slow the introduction of appropriate interventions and may further increase the risk of developing disease complications.[4]

Magnetic resonance enterography (MRE) is the recommended imaging modality to establish small bowel involvement at diagnosis.[5] One of the key advantages of MRE is the provision of cross-sectional images of the small bowel without radiation exposure—especially relevant in a growing child who might need repeated imaging over time. However, undertaking a MRE can be challenging in some children, especially those in the first decade of life, due to the duration of the scanning, the enclosed space, loud noise, and the importance of staying motionless.[6] MRE scanning may also be delayed pending availability and cost. Consequently, other means to assess the small bowel, such as abdominal ultrasound scanning, have been considered. The advantages of ultrasound scanning include ease of completion, high patient/caregiver satisfaction,[7] minimal discomfort, along with avoidance of radiation exposure.[8,9] Abdominal ultrasound scanning has been shown to identify clinically significant bowel disease.[10,11] It shows comparable sensitivity and specificity to computed tomography (CT), MRE and endoscopy for localizing disease,[12] for assessing disease extent and severity, and identifying complications such as strictures, abscesses, and fistulas.[7,8,13,14]

For adults with IBD the use of contrast-enhanced ultrasound has been shown to effectively increase the capacity and precision of abdominal ultrasound to evaluate disease activity and complications.[15] However, safety concerns regarding use of the contrast for children have prevented this being implemented among pediatric cohorts and few studies are available that provide evidence of the utility of using contrast enhanced ultrasound among children.[16] In addition, the requirement of needing intravenous access to administer the contrast further reduces acceptability for children.

However, standard noncontrast enhanced ultrasound for assessment of disease activity still requires evidence of accuracy for children with IBD.

The objective of this study was to compare the results of standard abdominal ultrasound against endoscopic, histological, and MRE findings among a cohort of children being assessed for IBD. The aim of the study was to identify whether standard abdominal ultrasound findings concurred with other diagnostic modalities, and whether it's use could enhance the clinical picture of small bowel assessment in this cohort.

What is Known

- Assessment of small bowel involvement during the diagnosis of pediatric inflammatory bowel disease is vital.
- Magnetic resonance enterography (MRE) is not always feasible in the pediatric population.
- Ultrasound provides an acceptable alternative to MRE, but accuracy and utility is poorly understood.

What is New

- Ultrasound can add to the clinical diagnostic picture by identifying disease location and complications not seen by other diagnostic modalities.
- Ultrasound is an important tool in the diagnostic toolkit for pediatric IBD when MRE are not feasible.

2 | METHODS

2.1 | Study design and population

A retrospective case-note review was conducted at Christchurch Hospital, Christchurch, New Zealand. Study data were collected on participants diagnosed with IBD between January 1, 2019 and December 31, 2023 who had undergone standard abdominal ultrasound (point-of-care testing ultrasound was not available during the data collection period). Diagnosis of IBD in the center where the study took place was via ileocolonoscopy and esophagogastroduodenoscopy, with additional radiological tests carried out to determine small bowel involvement.

Study participants were defined by the following criteria:

Inclusion: children aged ≤17 years with a diagnosis of IBD who had undergone standard abdominal ultrasound as part of their diagnostic work up. Patients were included if they had a diagnosis of CD, UC, or IBD-unclassified (IBDU), defined as per international guidelines.[17]

Exclusion: Patients with abdominal ultrasound performed more than 60 days before or after their IBD diagnosis.

2.2 | Patient data

Data were collected within the following categories:

1. Demographics: Age, sex, comorbidities, and family history of IBD.
2. Presenting symptoms: Type and duration.
3. Disease activity: As appropriate using the Pediatric Crohn's Disease Activity Index (PCDAI)[18] or Pediatric Ulcerative Colitis Activity Index (PUCAI),[19] and Physician Global Assessment (PGA).
4. Inflammatory markers: Fecal calprotectin (FC), serum C-reactive protein (CRP), and erythrocyte sedimentation rate (ESR).
5. Phenotype: Paris classification.[20]
6. Body mass index (BMI): z score.

2.3 | Radiology data

All radiological tests were carried out by radiographers/ultrasonographers using departmental protocol and reported in standard practice by pediatric radiologists. Findings for standard ultrasound or MRE were defined as abnormal when any of the following features were present: transmural inflammation, bowel wall thickening (BWT), proximal dilatation, hyperemia, presence of penetrating disease, disrupted peristalsis, irregular mesenteric features, and altered echostratification.

Echostratification was used to identify and describe body tissues or organs seen on ultrasound, and any abnormalities defined by their altered echogenicity that indicated inflammation and bowel damage.[21] Abnormal findings on MRE or ultrasound within the parameters of abnormal peristalsis or mesenteric features indicated IBD complications such as strictures, fistulas, abscesses, or phlegmon and were noted.

2.3.1 | Ultrasound

The indication for undertaking abdominal ultrasound was retrieved. Sonographic variables for each bowel segment of the small bowel (ileocecal valve [ICV], terminal ileum [TI], ileum, jejunum, and duodenum) were acquired to assess disease activity. All ultrasound scans were done without contrast.

2.3.2 | MRE

MRE involved the use of oral and intravenous contrast. Results were accessed to extract all findings relating to small bowel imaging.

2.4 | Outcomes

Primary outcome: To identify and summarize abnormal features seen on small bowel ultrasound during diagnosis of IBD in children. Secondary outcome: To compare abdominal ultrasound findings to MRE, endoscopy and histology, and define the additional utility of ultrasound to other imaging methods in the diagnostic process of IBD.

2.5 | Statistical analysis

Descriptive analyses were undertaken. Median and inter-quartile range (IQR) were presented for linear variables, and the number (percent) for categorical variables. Cohort comparisons between those with normal/abnormal findings were carried out using Analysis of variance if evenly distributed, Mann-Whitney U tests if skewed, and contingency tables with Pearsons Chi squared test (χ^2) analysis. A p-value < 0.05 was taken to indicate statistical significance, and 95% confidence interval (CI) presented. Data analyses were performed using SPSS for Windows Version 29.0 (IBM Corp, Armonk, New York, US).

2.6 | Ethical approval and participant consent

This study was approved by the University of Otago Human Ethics Committee (Health) (HD23/085) and locality approval granted by Te Whatu Ora, Waitaha Canterbury, to be carried out at Christchurch Hospital, Christchurch, New Zealand (RO23200).

3 | RESULTS

3.1 | Participant characteristics

During the study period 47 children had abdominal ultrasound scanning within 60 days of diagnosis of IBD to assess small bowel involvement, the majority of whom had CD (Table 1, Supporting Information: Table 1). The most common presenting symptoms were diarrhea (62%), hematochezia (53%), abdominal pain (55%), and weight loss/static weight (38%). The mean duration of symptoms was 5.5 months for GI symptoms, 4.1 months for extra-intestinal manifestations (EIM), and 2.6 months for general symptoms.

Ultrasounds were requested for 49% of the cohort due to MRE being unsuitable or unavailable, with the child being too young (number (N) = 16, 34%), for developmental reasons (N = 2, 4%) or being geographically inaccessible to a center with

TABLE 1 Baseline characteristics of children with IBD at diagnosis.

Variable	Category	Cohort (*N* = 47) *N* (%), *median [IQR]
Age (years)	Years (SD, range)	9.9 (4.1)
Sex	Male	23 (49)
	Female	24 (51)
Comorbidities	Yes	11 (23)
	No	36 (77)
Disease type	CD	42 (89)
	UC	4 (9)
	IBDU	1 (2)
Family history of IBD	Yes	6 (13)
	No	41 (87)
BMI z score	Mean (SD)	−0.56 (1.1)
	Range	−2.68 to 1.8
*Inflammatory markers	Fecal calprotectin (ug/g)	800 [479–1123]
	CRP (mg/L)	37 [5–60]
	ESR (mm/hr)	32.5 [18–46]
Pediatric Crohn's Disease Assessment Index (PCDAI)	Overall PCDAI	32.5 [27.5–42.5]
	Remission (<10)	2 (4)
	Mild (10 – 27.5)	12 (26)
	Moderate (30 – 37.5)	13 (27)
	Severe (≥40)	15 (32)
Pediatric Ulcerative Colitis Assessment Index (PUCAI)	Overall PUCAI	45 [30–45]
	Remission (<10)	0 (0)
	Mild (10–34)	2 (4)
	Moderate (35–64)	3 (6)
	Severe (≥64)	0 (0)
Disease severity index: All	PGA	2 [2–2]
	Remission	0 (0)
	Mild	6 (13)
	Moderate	32 (68)
	Severe	9 (19)
EIM present		16 (34)

Note: Some data percentages do not total 100% due to rounding of data.

Abbreviations: BMI, body mass index; CD, Crohn's disease; CRP, C-reactive protein; EIM, extraintestinal manifestations; ESR, erythrocyte sedimentation rate; IBD, inflammatory bowel disease; IBDU, inflammatory bowel disease unclassified; IQR, interquartile range; N, number, PGA, Physician Global Assessment; SD, standard deviation; UC, ulcerative colitis.

MRE ($N = 5$, 11%). Further reasons included for pre-endoscopy planning ($N = 13$, 27%), to promptly assess small bowel involvement post-endoscopy ($N = 7$, 15%), and investigating abdominal pain ($N = 4$, 8%). All children had endoscopy and histology reports available for comparison with the ultrasound findings, and 26 (55%) had MRE available for comparison.

3.2 | Ultrasound findings—Disease location

Fourteen (30%) of the 47 children had no small bowel disease noted by any diagnostic modality; five with UC/IBDU and nine with CD. Of the remaining 33 (70%) children with evidence of small bowel disease; 19 (58%) were diagnosed by endoscopy, 19 (58%) by histology, 11 (33%) by MRE, and 19 children (40%) had evidence of small bowel disease on ultrasound. Only four children had evidence of small bowel disease seen by all four diagnostic modalities and normal ultrasound scans were noted in 14 (30%) children despite abnormal findings on other evaluations (Table 2). Abnormal findings were seen on ultrasound in seven (15%) participants who had normal MRE, endoscopy or histology. Small bowel disease was confirmed on ultrasound when also diagnosed by other modalities for 12 (26%) but added to the clinical picture by identifying disease location others had missed for distal ($n = 3$) or proximal ($n = 1$) ileum, TI ($n = 1$), and ICV ($n = 1$) (Table 2).

Overall, the cohort with abnormal findings on ultrasound did not differ according to age (median difference (MdD) −0.8 years, $p = 0.90$, CI −3.5 to 1.6) or sex (χ^2 1.9, $p = 0.24$). Those with abnormal ultrasounds had lower BMI z scores (more underweight) than the cohort with normal ultrasound findings (mean difference (MnD) 0.8, $p = 0.03$, CI 0.07–1.3), however, there was no difference in the distribution of those considered within the parameters of thinness, normal, or overweight between the groups (χ^2 2.8, $p = 0.24$). Those participants with abnormal ultrasound findings had slightly worse disease activity within the parameters of fecal calprotectin (MdD −403, $p = 0.06$), and CRP (MdD −25, $p = 0.05$), PGA (χ^2 5.1, $p = 0.08$), and higher ESR levels (MdD −16, $p = 0.008$).

When disease activity was assessed for the cohort of children with abnormal findings on ultrasound that were not seen using other diagnostic modalities ($N = 7$), compared with those with abnormal findings by multiple modalities ($N = 12$, Table 2) there was no difference in FC (MdD 198, $p = 0.5$), CRP (MdD 3.5, $p = 1.0$), ESR (MdD 12.0, $p = 0.2$), or PGA (χ^2 0.8, $p = 0.6$).

TABLE 2 Location of small bowel involvement on USS, MRE, endoscopy, and histology (those with no small bowel disease not presented, $N = 14$).

ID	USS	MRE	Endoscopy	Histology
1	Distal ileum, TI, ICV	Distal ileum	ICV	No SB disease identified
3	No SB disease identified	-	Duodenum	No SB disease identified
4	No SB disease identified	-	No SB disease identified	Duodenum, TI
5	Proximal ileum	-	ICV	No SB disease identified
8	Distal ileum, TI	-	TI	No SB disease identified
9	TI	-	No SB disease identified	No SB disease identified
10	No SB disease identified	-	TI	TI
11	LUQ	-	No SB disease identified	No SB disease identified
13	TI	-	TI	TI
14	No SB disease identified	Proximal ileum, TI	Duodenum	Duodenum
15	TI	-	No SB disease identified	No SB disease identified
16	TI	No SB disease identified	No SB disease identified	No SB disease identified
19	Distal ileum, TI, ICV	-	No SB disease identified	TI
20	No SB disease identified	-	No SB disease identified	Duodenum
21	No SB disease identified	-	No SB disease identified	Duodenum
22	TI	-	No SB disease identified	No SB disease identified
23	No SB disease identified	TI	Duodenum, TI	TI
24	No SB disease identified	TI	TI	TI
28	No SB disease identified	-	Duodenum	Duodenum
29	Mid+distal ileum	-	No SB disease identified	No SB disease identified
30	Distal ileum, TI	Distal ileum, TI	Duodenum	No SB disease identified
34	RIF	-	No SB disease identified	No SB disease identified
36	No SB disease identified	Jejunum, proximal ileum	Duodenum	No SB disease identified
38	RLQ	TI	TI, ICV	TI
39	Undefined	No SB disease identified	Duodenum	No SB disease identified
40	No SB disease identified	-	Duodenum	Duodenum
41	Distal ileum, TI	-	Duodenum, TI	Duodenum, TI
42	Distal ileum, TI, ICV	Distal+proximal ileum, TI, ICV	Duodenum, TI	TI
44	No SB disease identified	Jejunum	No SB disease identified	Duodenum, TI
45	No SB disease identified	-	No SB disease identified	Duodenum
46	TI	Distal ileum	TI	TI
47	TI	-	TI	TI
50	No SB disease identified	Ileum	No SB disease identified	TI

Abbreviations: CD, Crohn's disease; IBDU, inflammatory bowel disease unclassified; ICV, ileocecal valve; ID, study identification number; LUQ, left upper quadrant; MRE, magnetic resonance enterography; RIF, right ileac fossa; RLQ, right lower quadrant; SB, small bowel; TI, terminal ileum; UC, ulcerative colitis; USS, ultrasound scan; -, MRE not performed.

TABLE 3 Ultrasound findings of the small bowel for 19 children with abnormal results.

ID	Disease location	Abnormal BWT segment length	Inflammation	Proximal dilatation	Hyperemia	Motility	Mesenteric features	Intestinal features
1	Distal ileum, TI, ICV	20 cm	Continuous	Yes	Yes	Decreased peristalsis	Hyperechoic nodules, spicules	Nil
5	Proximal ileum	20 cm	Continuous	No	No	Normal	Echogenic	Nil
8	Distal ileum, TI	15 cm	Continuous	No	Yes	Normal	Nil	Nil
9	TI	Undefined	Continuous	No	No	Normal	Echogenic	Nil
11	LUQ	Undefined	Continuous	No	No	Normal	Nil	Nil
13	TI	Undefined	Continuous	No	No	Normal	Nil	Nil
15	TI	Undefined	Continuous	No	No	Normal	Nil	Nil
16	TI	3.5 cm	Continuous	No	Yes	Normal	Nil	Nil
19	Distal ileum, TI, ICV	21 cm	Continuous	Yes	No	Normal	Nil	Nil
22	TI	Undefined	Continuous	No	No	Normal	Edematous	Nil
29	Distal ileum	15 cm	Skip lesion	No	No	Aperistalsis	Echogenic	Nil
	Mid-ileum	38 cm		No	No	Normal	Nil	Nil
30	Distal ileum, TI	18 cm	Continuous	Yes	Yes	Aperistalsis	Nil	Phlegmon
34	RIF	Undefined	Continuous	No	No	Normal	Nil	Nil
38	RLQ, TI	Undefined	Continuous	No	Yes	Normal	Nil	Nil
39	Undefined	Undefined	Continuous	No	No	Decreased peristalsis	Nil	Nil
41	Distal ileum, TI	Undefined	Continuous	No	No	Normal	Nil	Nil
42	Distal ileum, TI, ICV	5 cm, 10 cm	Skip lesion	No	Yes	Normal	Nil	Nil
46	TI	Undefined	Continuous	No	No	Normal	Nil	Nil
47	TI	Undefined	Continuous	No	No	Normal	Nil	Nil

Note: 'Undefined' indicates BWT was seen but length of segment undefined.

Abbreviations: BWT, bowel wall thickness; cm, centimetres; ICV, ileocaecal valve; ID, identification number; LUQ, left upper quadrant; RIF, right iliac fossa; RLQ, right lower quadrant; TI, terminal ileum.

3.3 | Ultrasound—Additional findings

When the ultrasound results for the 19 children with abnormal findings were examined, it was seen that the most identified disease location was of the TI, apparent in 14 (75%) children (Table 3). Continuous bowel inflammation was observed for the majority ($n = 17$, 89%), and BWT was increased in all participants. The length of bowel affected by BWT was identified in eight (42%) children, ranging from 3.5 cm to 38.0 cm. Additional sonographic findings reported included proximal dilatation ($n = 3$, 16%), hyperemia ($n = 6$, 32%), decreased or absent peristalsis ($n = 4$, 21%), irregular mesenteric findings ($n = 5$, 26%), and phlegmon in one child (Table 3).

4 | DISCUSSION

The results of the present study showed that abdominal ultrasound identified involvement of the small bowel in 40% of this group of children with IBD during their diagnostic work-up. In addition, abdominal ultrasound identified the presence and location of small bowel disease not seen on MRE or endoscopy/histology and was able to add detail to the diagnostic picture.

The European Society for Pediatric Gastroenterology, Hepatology and Nutrition (ESPGHAN) Revised Porto Criteria for the Diagnosis of Inflammatory Bowel Disease in Children and Adolescents recommends small bowel imaging to complement endoscopic assessment,[17] with the endorsement of ultrasound as a feasible modality that should be done in conjunction with other more sensitive imaging such as MRE. The current study demonstrated that 49% of children were not able undertake a MRE due to expected challenges, especially age. The use of ultrasound when MRE is deemed unsuitable/inaccessible is therefore a valuable alternative to assess presence and extent of small bowel involvement.[22] In addition, ultrasound can be a valuable screening tool for small bowel disease when wireless capsule endoscopy is unavailable, not feasible, or contraindicated.[23,24]

The most frequent location for small bowel disease on abdominal ultrasound in the current study was of the TI, with BWT evident in more than two thirds of these children. This finding concurs with the wider literature stating that the TI was the most identified site of small bowel disease in children.[6] The TI is considered easily accessible to ultrasound and visualization of the right iliac vessels can be used as a point of reference amongst the freely movable small bowel.[25] A systematic review by Panés et al.,[8] found that ultrasound sensitivity at diagnosis of CD was influenced by disease location in adults and children, and accuracy compared with reference standards was highest for detecting disease of the TI and lowest for the upper small bowel.

In the current study, all children found to have abnormal small bowel findings on ultrasound had increased BWT, the most consistent sonographic variable reported in children with CD.[26] The significance of BWT in children is well-understood, representing an important feature of inflammation,[12,16] and may be considered the best parameter to detect CD in the small bowel.[27] The measurement of BWT has limitations, including the challenge depicting a depth value when the inflamed bowel is far from the abdominal surface and in individuals with overweight or obesity.[28] Although ultrasonographical methods can be adjusted to account for this, stool contents and bowel distention can interrupt measurement.[16] In the current study the measurement of BWT depth was not defined for any children with abnormal findings, which may be a result of these challenges. Thickening is associated with increased disease activity and is less frequently seen in those with milder disease.[29] BWT is the most significant predictor of recurrence after IBD surgical resection,[30] providing an additional prognostic role of ultrasound, allowing increasing follow-up in high-risk patients, and aiding the decision to perform surgery.[31]

The current study showed that small bowel disease extent on ultrasound differed from other diagnostic imaging modalities. MRE scans reported at least one skip lesion in 11% of children that were not noted on ultrasound. This is an important finding as discontinuous lesions are characteristic of CD.[32] Detailed recognition of the number and location of diseased segments facilitates a treat-to-target approach involving medical and surgical intervention and may guide prognosis.[33]

Furthermore, in the current study endoscopy and histology findings indicated involvement of the duodenum in 39% of children while ultrasound reported no abnormal findings. This concurs with a study by Hosokawa et al.,[34] which evaluated the use of ultrasound for gastroduodenal ulceration in children. The authors noted that ultrasound had low sensitivity for detecting duodenal wall thickening. It has also been observed that difficulty reporting pathological changes of the duodenum, particularly of the horizontal segment and duodenal-jejunal flexure, may be due to interference of the aorta, inferior vena cava and tail of the pancreas.[35]

In recent years point-of-care testing intestinal ultrasound in the out-patient or bedside setting has been shown to correlate accurately with endoscopic disease activity in children,[29,36] with clinicians being able to carry out the procedure with comparable accuracy to radiologists.[37] While all ultrasounds in the current study were carried out in the radiology department of a tertiary care hospital, studies have shown that ultrasound can be performed at the point-of-care, guiding immediate clinical decision-making such as treatment choice to adequately control inflammation.[13] There is also potential for its use during routine follow-up appointments to monitor disease activity of the small bowel, with gastroenterologists increasingly using ultrasound during outpatient clinic appointments.[38] Nagarajan et al.[39] concluded that its use in such settings should be encouraged. Furthermore. Zelinkova et al.[40] reported benefit for the role of ultrasound to detect abnormalities in asymptomatic patients during routine outpatient appointments.[41] A systematic review by Panés et al.[8] showed that ultrasound scanning had high accuracy for detecting postoperative recurrence of CD in adults, thereby identifying a potential area for further research in children as their risk of surgical recurrence increases over time.[42] Use of abdominal ultrasound as a bedside tool also positively contributes to patient disease specific education, engagement, and may improve therapy adherence.[43,44] However, resource limitations may hinder widespread uptake due to the associated cost of equipment, and the time and cost required for training gastroenterologists would be required.[45] As such, implementation of intestinal ultrasound is limited by resources and capacity of trained gastroenterologists and standard abdominal ultrasound scanning overcomes these issues.

There were a number of study limitations. The cohort in the current study resides in the South Island of New Zealand and as such the generalizability of these findings to other geographic locations/centers may be limited by resource availability, expertise of radiological personnel, infrastructure, and perceived utility of ultrasound for IBD. The study sample size was small, but all children having ultrasound within the stated timeframe were included in the study. Whilst ultrasound scans were completed soon before or soon after endoscopic assessments in most of the children, there was a time delay between ultrasound scanning and MRE in that subset of children who had both modalities. A recognized limitation of ultrasound for patients with IBD is interobserver reliability among sonographers and those reporting on findings. However, given the retrospective nature of the study this was an unavoidable source of bias and should be addressed with future prospective studies that incorporates interobserver reliability into the methodology. Insufficient data were available to implement an ultrasound scoring system, which help standardize practice and provide an accurate assessment of inflammatory activity of the small bowel.

The strengths of the study lie in the fact that the role of ultrasound and its value during diagnosis of IBD in children is less well understood in Oceania, and as such this study adds valuable information for the region. All children diagnosed with IBD in the South Island of New Zealand are assessed at Christchurch Hospital, therefore, the data in the current study provides an overview of all children being diagnosed within a large geographical region.

To conclude, standard noncontrast enhanced abdominal ultrasound is a valuable resource for assessing disease extent in the diagnostic work-up of suspected IBD in children. Ultrasound may identify small bowel disease that is not able to be identified on endoscopy or when MRE is not feasible and may provide prompt information on the presence of small bowel involvement when young age or geographical factors limit or delay the completion of MRE. This may contribute to the definition of disease location and severity at diagnosis to aid the initial treatment decision in children with IBD. Further work on the safety and efficacy of contrast-enhanced ultrasound for children with IBD will add to the growing body of evidence in this field, and data on validity and feasibility of point-of-care ultrasound also help address barriers to this being considered an effective and accessible testing strategy.

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CONFLICT OF INTEREST STATEMENT

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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