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Research Article

Utility of MR Enterography in the Evaluation of Crohn's Disease

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Abstract: ***Introduction:*** Crohn's disease (CD) is a chronic, relapsing inflammatory bowel disease with rising burden in India, characterized by transmural, discontinuous involvement that limits the diagnostic yield of colonoscopy alone. MR enterography (MRE) offers radiation-free, multiparametric assessment of bowel wall and extraluminal disease, using scoring systems such as the MR Enterography Global Score (MEGS) to grade activity. This study evaluates the role of MRE compared with colonoscopy and biopsy in Crohn's disease, and correlates MEGS with the Harvey-Bradshaw Index. **Objective:** Crohn's disease is a chronic, relapsing, transmural inflammatory bowel disease that requires repeated assessment over a patient's lifetime. This study aimed to assess the utility of magnetic resonance enterography (MRE) in the evaluation of Crohn's disease in comparison with colonoscopy and biopsy, and to correlate the MR Enterography Global Score (MEGS) with the Harvey-Bradshaw Index (HBI). **Methods:** In this cross-sectional study, 30 adults with biopsy-proven Crohn's disease were evaluated between May 2023 and October 2024 at hospitals attached to a tertiary care institute. After bowel distension with oral mannitol solution, MRE was performed on a 1.5-T system using HASTE, balanced steady-state free precession, and pre- and post-gadolinium T1-weighted gradient-echo sequences. Disease activity was assessed clinically with the HBI and radiologically with the MEGS. Colonoscopy with biopsy served as the reference standard. Data were analysed using SPSS version 23.0; a p-value <0.05 was considered significant. **Results:** The mean age was 39.37 ± 10.10 years, with a slight female predominance (56.7%). MRE showed fair agreement with colonoscopy (Cohen's kappa = 0.267, p = 0.042; overall agreement 66.7%). Against biopsy, MRE had a sensitivity of 83.3% (95% CI 65.3–94.4%), a positive predictive value of 100%, and an accuracy of 83.3% (p = 0.001). Skip lesions were present in 86.7% of patients, most commonly in the ileum. The mean MEGS was 28.62 ± 19.80 and the mean HBI was 4.67 ± 2.07. MEGS correlated modestly with HBI (Spearman's rho = 0.364, p = 0.048). Both lymph node involvement (p = 0.045) and creeping fat (p = 0.013) were significantly associated with higher MEGS scores, and creeping fat was also associated with higher HBI (p = 0.042). **Conclusion:** MRE is a reliable, radiation-free modality for diagnosing and characterising Crohn's disease, with specific features such as creeping fat and lymph node involvement serving as markers of disease activity that correlate with clinical severity.

Keywords: Crohn's disease; Magnetic resonance enterography; MR Enterography Global Score; Harvey-Bradshaw Index; Inflammatory bowel disease

INTRODUCTION

Inflammatory bowel disease (IBD) comprises a group of conditions characterised by long-term inflammation of the digestive tract, of which Crohn's disease (CD) and ulcerative colitis (UC) are the two principal entities. Although IBD has historically been less prevalent in India than in Western nations, its burden has risen sharply over the past several decades in parallel with changing dietary and environmental exposures [1]. India is estimated to have the second-largest IBD population globally, a reflection of both a genuine rise in incidence and the country's large population base [1,2]. Crohn's disease characteristically shows a bimodal age distribution, with one peak in adolescents and young adults and a second in older adults, and the inflammatory process tends to evolve towards either a fibrostenotic or a fistulising (penetrating) pattern over time [3].

Because Crohn's disease is a lifelong condition with a recurrent, relapsing course, accurate and repeatable assessment of disease extent and activity is central to management. Colonoscopy with biopsy remains the gold standard for evaluating mucosal disease activity and is essential to treatment decisions. However, it is invasive, is limited to the colon and the terminal few centimetres of the ileum, and provides little information about transmural and extra-enteric disease [4]. These limitations are particularly relevant in Crohn's disease, in which involvement is frequently transmural and discontinuous.

Cross-sectional imaging has therefore assumed an increasing role. Computed tomography (CT) enterography offers wide availability and excellent spatial and temporal resolution, but its reliance on ionising radiation is a significant drawback in a young population requiring lifelong, repeated imaging [5]. This concern is heightened by the recognition that patients with Crohn's disease are already at elevated risk of gastrointestinal malignancy [6]. Magnetic resonance imaging, being free of ionising radiation, has consequently emerged as the preferred cross-sectional

modality. The development of fast sequences such as half-Fourier acquisition single-shot turbo spin echo (HASTE) and true fast imaging with steady-state precession (True FISP), which are relatively insensitive to peristaltic motion, has enabled robust imaging of both intraluminal and extraluminal disease and its complications, allowing even subtle manifestations to be detected when the small bowel is adequately distended [7].

Two principal MR techniques exist: MR enteroclysis, which requires nasojejunal intubation and administration of a large volume of enteric contrast, and MR enterography (MRE), in which the patient drinks oral contrast to achieve luminal distension. MRE is substantially better tolerated and more widely accepted by patients, a preference strongly supported by recent literature [8]. MRE provides multiplanar, multiphasic, and multiparametric contrast-enhanced imaging with high tissue contrast, permitting comprehensive evaluation of the bowel wall and mesentery without ionising radiation.

The pathological hallmarks of Crohn's disease inform its imaging appearance. Early aphthous ulcers overlying lymphoid follicles coalesce into serpiginous ulcers that produce a cobblestone mucosa; discontinuous "skip" lesions separated by normal segments and mesenteric "creeping fat" wrapping the antimesenteric border are highly characteristic, while transmural inflammation predisposes to strictures, fistulas, and abscesses [9]. Clinically, disease activity is commonly graded with the Harvey-Bradshaw Index (HBI), a simplified, non-invasive score combining general well-being, abdominal pain, number of liquid stools, abdominal mass, and complications [10]. On MRE, the spectrum of active disease includes segmental mural hyperenhancement, wall thickening, intramural oedema (high T2 signal), restricted diffusion, the mesenteric "comb sign," simple and complex fistulas, fat wrapping, and reactive mesenteric lymphadenopathy [11,12,13]. Older modalities such as barium fluoroscopy have largely been supplanted owing to limited specificity and patient tolerance [14], while transabdominal ultrasound, using a bowel wall thickness cut-off of >4 mm, offers useful sensitivity and specificity but is operator-dependent [15]. To standardise activity assessment, several cross-sectional scoring systems have been proposed, including the simplified Magnetic Resonance Index of Activity (MaRIA) and the MR Enterography Global Score (MEGS), a composite index derived from mural thickness, T2 signal, contrast enhancement, disease length, and extraluminal features [16,17].

Against this background, the present study was undertaken with two objectives: first, to assess the role of MRE in the evaluation of Crohn's disease in comparison with colonoscopy and biopsy; and second, to correlate the MR Enterography Global Score with the Harvey-Bradshaw Index.

MATERIALS AND METHODS

Study design and setting

This was a hospital-based cross-sectional study conducted over the period from May 2023 to October 2024 at hospitals attached to Bangalore Medical College and Research Institute, Bengaluru. All MR enterography examinations were performed in the Department of Radiodiagnosis at Victoria Hospital. Institutional Ethics Committee approval was obtained before commencement, and written informed consent was obtained from every participant prior to enrolment.

Participants

Consecutive patients presenting to the attached hospitals who fulfilled the eligibility criteria were enrolled. Inclusion criteria were: (i) age above 18 years; (ii) willingness to provide informed consent; and (iii) proven Crohn's disease, with the diagnosis established on the basis of clinical, biochemical, endoscopic, and histopathological findings, including patients already on treatment. Exclusion criteria were: (i) contraindications to MRI, namely prostheses or pacemakers, metallic implants, or severe claustrophobia; (ii) pregnancy; (iii) previous surgical intervention in the form of bowel resection; (iv) renal impairment, active ischaemic heart disease, or advanced diabetes; (v) severe illness precluding breath-holding; and (vi) unwillingness to provide informed consent. All enrolled patients had Crohn's disease confirmed by biopsy, which served as the gold standard, and thus every participant was included in the final analysis with no exclusions after enrolment.

Sample size

The sample size was derived from the agreement analysis reported by Saha et al., in which the kappa statistic between ileocolonoscopy and MRE was 0.829 [18]. Assuming a two-sided alpha of 0.05, a population reliability value of 0.45, and a power of 80%, the sample-size formula for agreement in a single group yielded a required sample of 30 subjects. Thirty patients were therefore studied.

Imaging technique / protocol

Patients were instructed to fast for a minimum of six hours before the study; no laxatives or enemas were administered. On arrival at the department approximately one and a half hours before the examination, each patient drank 1.2–1.5 L of oral contrast (mannitol solution prepared in 1.5 L of water) over about 50 minutes. The contrast was given in two portions, each consumed slowly over roughly 25 minutes to achieve even distension of the entire small bowel. Imaging commenced one hour after the start of oral contrast ingestion, using a United Imaging UMR 570 1.5-T MR system. Immediately before image acquisition, 20 mg of intravenous hyoscine butylbromide

(Buscopan) was administered to minimise peristaltic motion artefact.

The protocol comprised a coronal single-shot fast spin-echo (HASTE) sequence (echo time 80 ms, slice thickness 5 mm) in coronal and axial planes, used first to confirm adequate distension of the terminal ileum; a balanced steady-state free precession (True FISP) sequence (echo time 4 ms, slice thickness 5 mm) in coronal, axial, and sagittal planes; and a pre-contrast T1-weighted thin-section gradient-echo (VIBE) sequence (echo time 1.1 ms, slice thickness 5 mm) in the coronal plane. Intravenous gadolinium was then administered at 0.1 mmol/kg body weight, followed by post-contrast T1-weighted gradient-echo sequences (echo time 1.1 ms, slice thickness 5 mm) in coronal and axial planes. Clinical disease activity was assessed for every patient using the Harvey-Bradshaw Index [10], and radiological activity was quantified using the MR Enterography Global Score [17]. C-reactive protein (CRP) was recorded as a serological marker of inflammation.

Statistical analysis

Data were entered in Microsoft Excel 2016 and analysed with IBM SPSS Statistics for Windows, version 23.0 (IBM Corp., Armonk, NY). Categorical variables were summarised as frequencies and percentages, and continuous variables as mean ± standard deviation. Differences between two independent groups were tested with the unpaired t-test or the Mann-Whitney U test, and differences across multiple groups with analysis of variance or the Kruskal-Wallis test, depending on the normality of the data. Associations between categorical variables were tested with the chi-square test or Fisher's exact test. Agreement between colonoscopy and MRE was assessed with Cohen's kappa, the diagnostic performance of MRE against biopsy with McNemar's test, and the relationship between MEGS and HBI with Pearson's and Spearman's correlation coefficients. A p-value <0.05 was considered statistically significant.

RESULTS

Thirty patients with biopsy-proven Crohn's disease were studied. Their demographic profile is summarised in Table 1. The mean age was 39.37 ± 10.10 years (median 39.5 years; range 25–59 years), and the majority of patients (63.4%) were below 40 years of age, indicating that Crohn's disease predominantly affected younger and middle-aged adults in this population. There was a slight female predominance, with 17 patients (56.7%) being female and 13 (43.3%) male.

Table 1. Demographic characteristics of the study population (N = 30).

Characteristic	Value
Age, mean ± SD (years)	39.37 ± 10.10
Age, median (years)	39.5
Age, range (years)	25–59
18–30 years, n (%)	8 (26.7%)
31–40 years, n (%)	11 (36.7%)
41–50 years, n (%)	7 (23.3%)
51–60 years, n (%)	4 (13.3%)
Male, n (%)	13 (43.3%)
Female, n (%)	17 (56.7%)

Table 2. Diagnostic agreement between colonoscopy and MRE (Cohen's kappa = 0.267, p = 0.042; overall agreement 66.7%).

Colonoscopy diagnosis	MRE: Crohn's	MRE: UC	MRE: UC/Crohn's	Total
Crohn's	17	2	0	19
UC	4	2	0	6
UC/Crohn's	4	0	1	5
Total	25	4	1	30

Table 3. Diagnostic performance of MRE for Crohn's disease against biopsy (McNemar's test p = 0.001).

Parameter	Value	95% CI
Sensitivity	83.3%	65.3%–94.4%
Positive predictive value	100%	86.7%–100%
Accuracy	83.3%	65.3%–94.4%

The diagnostic classifications assigned by colonoscopy and MRE before biopsy confirmation are compared in Table 2. Of 19 patients diagnosed as Crohn's disease by colonoscopy, 17 were concordantly diagnosed by MRE, while 2 were classified as UC. Of 6 patients labelled UC by colonoscopy, 2 were confirmed by MRE and 4 were reclassified as Crohn's. Among 5 patients considered indeterminate (UC/Crohn's) by colonoscopy, 4 were diagnosed as Crohn's by MRE and 1 remained

indeterminate. This yielded a Cohen's kappa of 0.267 (p = 0.042), indicating fair agreement, with an overall agreement rate of 66.7% (20/30); the statistically significant p-value confirms that the agreement was not due to chance.

Taking biopsy as the reference standard, the diagnostic performance of MRE is presented in Table 3. MRE demonstrated a sensitivity of 83.3% (95% CI 65.3–94.4%) and an accuracy of 83.3% (95% CI 65.3–94.4%) for detecting Crohn's disease, with a positive predictive value of 100% (95% CI 86.7–100%), meaning that every positive MRE result was confirmed by biopsy (Figure 6). Because all patients had biopsy-proven Crohn's disease, specificity and negative predictive value could not be calculated. McNemar's test yielded a p-value of 0.001, confirming that MRE is a reliable modality for diagnosing Crohn's disease relative to biopsy.

The distribution of key MRE imaging findings is shown in Table 4. Regarding mural thickness, 2 patients (6.7%) had normal wall thickness (<3.0 mm), 7 (23.3%) had grade 2 (3–5 mm), 14 (46.7%) had grade 3 (5–7 mm), and 7 (23.3%) had grade 4 (>7.0 mm) thickening, such that the majority (70%) showed moderate to severe (grade 3–4) mural thickening (Figure 7). Skip lesions, when analysed by location, were most frequent in the ileum (15 patients, 50%), followed by combined jejunum and ileum (4, 13.3%), duodenum (3, 10%), colon (3, 10%), and jejunum alone (2, 6%) (Figure 8). Overall, skip lesions were present in 26 patients (86.7%) and absent in 4 (13.3%), consistent with the characteristically discontinuous inflammation of Crohn's disease. Reactive lymph node involvement was present in 11 patients (36.7%), and creeping fat—mesenteric fat wrapping around inflamed bowel—was present in 10 patients (33.3%) (Figure 9). Representative MRE appearances of these findings in individual patients from the study are illustrated in Figures 1–5.

Figure 1. Coronal balanced steady-state free precession (True FISP) MR enterography image in a 32-year-old woman presenting with frequent loose stools, showing mural thickening of the ascending colon.

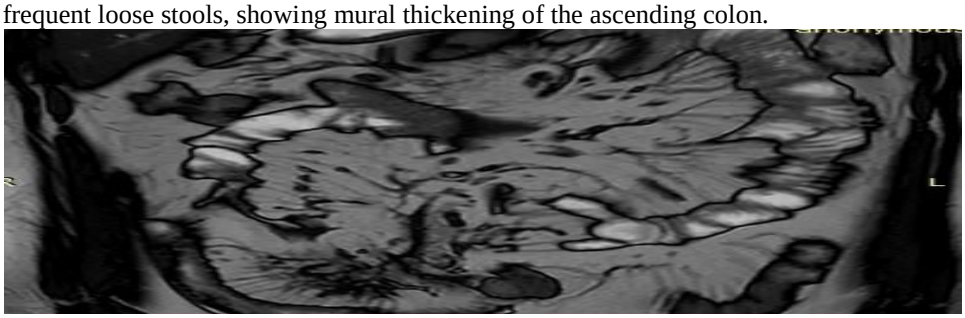

Figure 2. Coronal balanced steady-state free precession (True FISP) MR enterography image in a 42-year-old man with frequent loose stools, demonstrating the mesenteric comb sign (engorged vasa recta) adjacent to affected bowel loops.

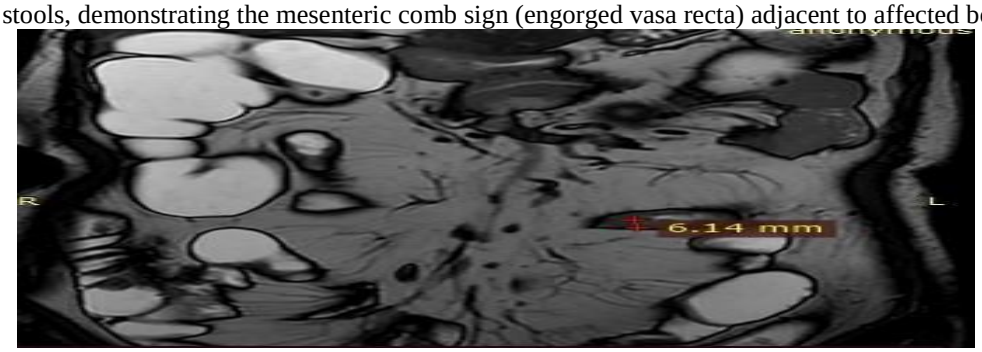

Figure 3. Coronal HASTE MR enterography image in a 40-year-old man with non-specific abdominal pain, showing mural thickening (measured at 6.14 mm) of a proximal jejunal loop.

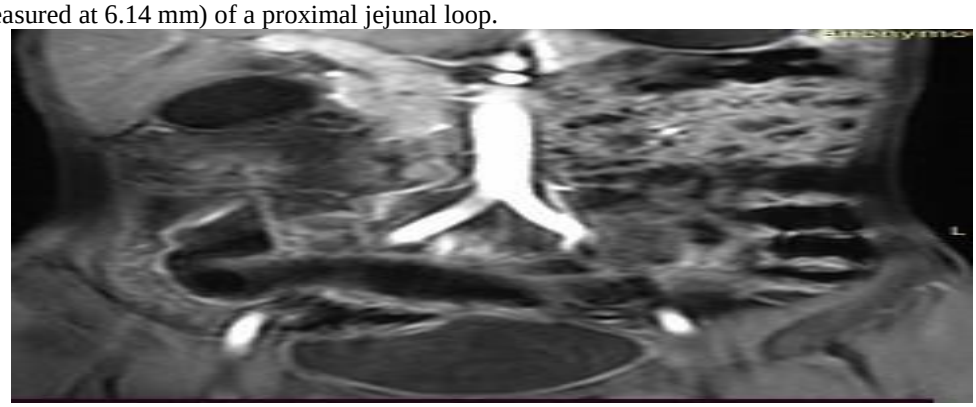

Figure 4. Coronal post-contrast T1-weighted VIBE MR enterography image in a 46-year-old man with a one-month history of abdominal pain and loose stools, showing mural hyperenhancement of the ascending colon.

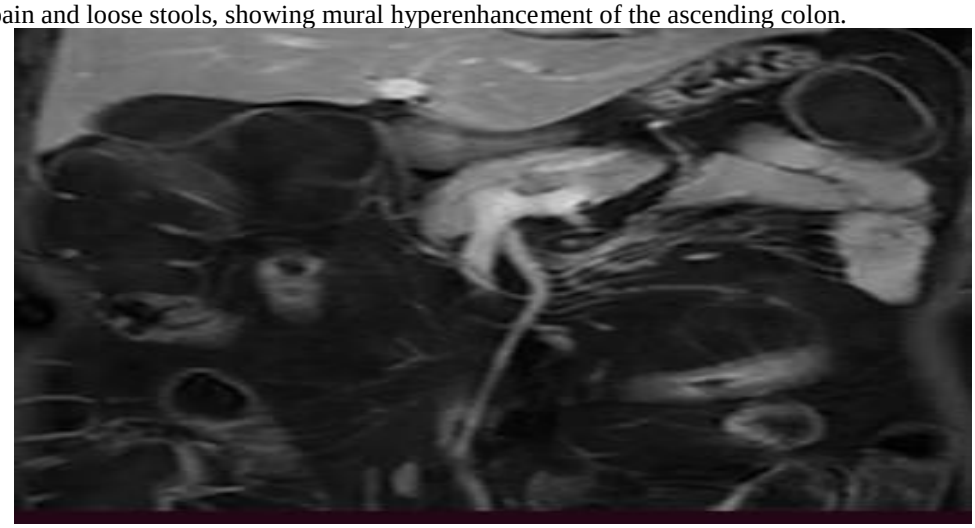

Figure 5. Coronal post-contrast T1-weighted VIBE MR enterography image in a 52-year-old woman with abdominal pain and weight loss, showing mural hyperenhancement of the proximal jejunum.

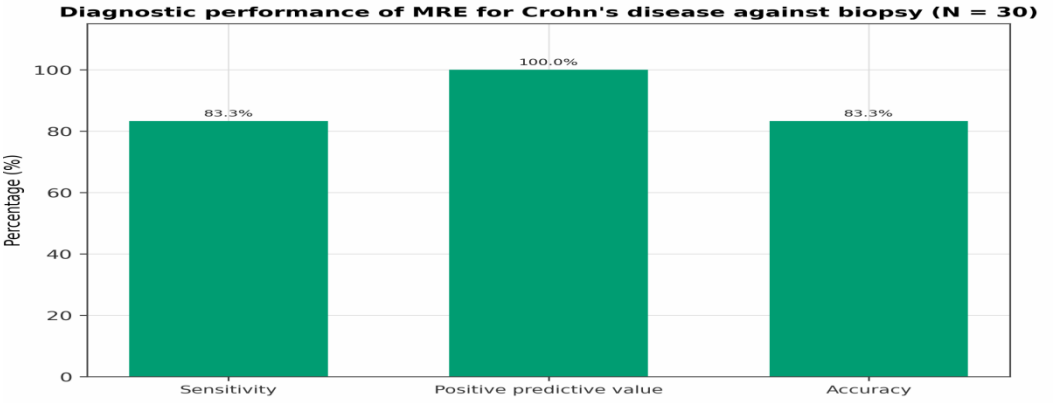

Figure 6. Diagnostic performance of MR enterography for Crohn's disease against biopsy as the reference standard, showing sensitivity (83.3%), positive predictive value (100%), and accuracy (83.3%) (data from Table 3).

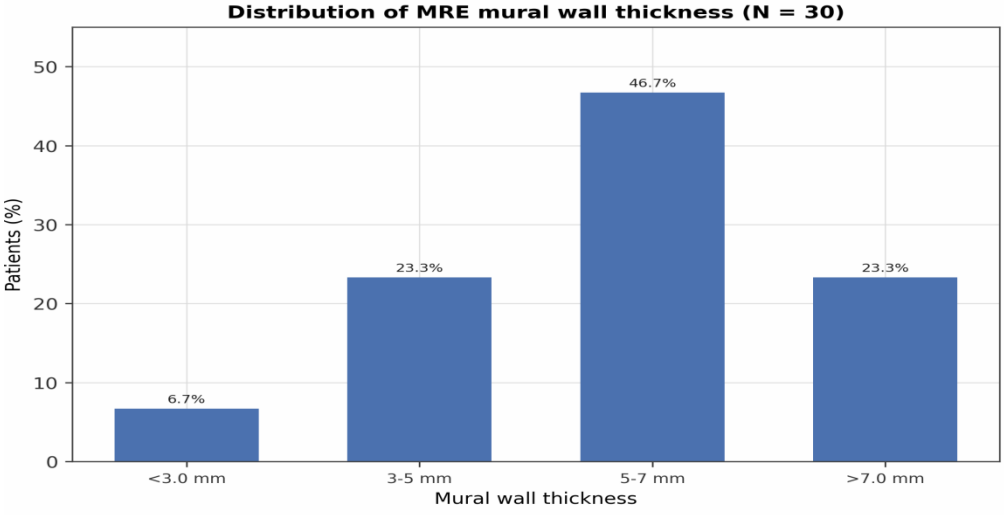

Figure 7. Distribution of mural wall thickness on MR enterography across the cohort, with most patients (70%) showing grade 3–4 (moderate to severe, 5 mm or more) thickening (data from Table 4).

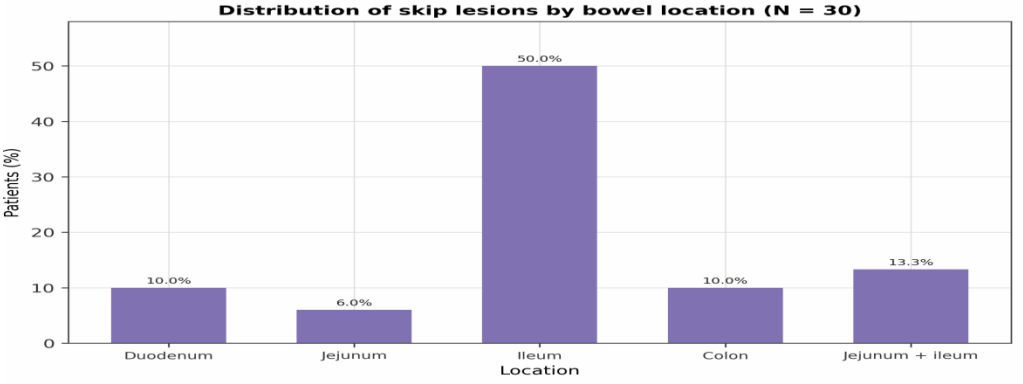

Figure 8. Distribution of skip lesions by bowel location on MR enterography, showing a clear ileal predominance (data from Table 4).

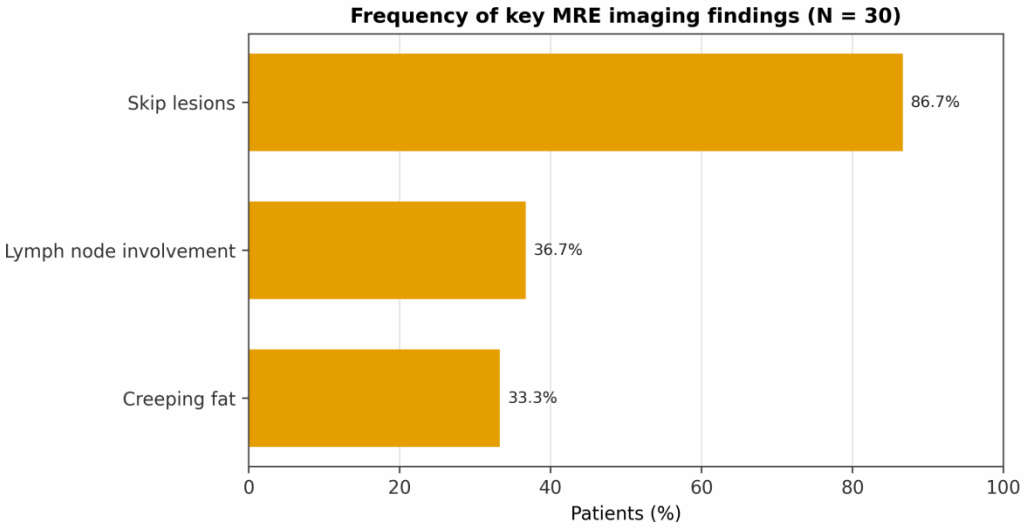

Figure 9. Frequency of key MR enterography imaging findings—skip lesions, reactive lymph node involvement, and creeping fat (data from Table 4).

Inflammatory activity as reflected by CRP is detailed in Table 5. The mean CRP was 242.77 ± 125.01 mg/L (median 221.0 mg/L; range 67–542 mg/L). When categorised, 1 patient (3.3%) had CRP below 100 mg/L, 13 (43.3%) between 100 and 200 mg/L, 7 (23.3%) between 201 and 300 mg/L, and 9 (30.0%) above 300 mg/L, indicating significant ongoing inflammation in almost all patients.

Table 4. Distribution of MRE imaging findings (N = 30).

Finding	Category	n (%)
Mural thickness	<3.0 mm	2 (6.7%)
Mural thickness	3–5 mm	7 (23.3%)
Mural thickness	5–7 mm	14 (46.7%)
Mural thickness	>7.0 mm	7 (23.3%)
Skip lesion location	Duodenum	3 (10%)
Skip lesion location	Jejunum	2 (6%)
Skip lesion location	Ileum	15 (50%)
Skip lesion location	Colon	3 (10%)
Skip lesion location	Jejunum and ileum	4 (13.3%)
Skip lesions	Present	26 (86.7%)
Skip lesions	Absent	4 (13.3%)
Lymph node involvement	Present	11 (36.7%)
Lymph node involvement	Absent	19 (63.3%)
Creeping fat	Present	10 (33.3%)

Creeping fat	Absent	20 (66.7%)

Table 5. C-reactive protein (CRP) levels (N = 30).

Parameter	Value
Mean ± SD (mg/L)	242.77 ± 125.01
Median (mg/L)	221.0
Range (mg/L)	67–542
<100 mg/L, n (%)	1 (3.3%)
100–200 mg/L, n (%)	13 (43.3%)
201–300 mg/L, n (%)	7 (23.3%)
>300 mg/L, n (%)	9 (30.0%)

Table 6. Distribution of the MR Enterography Global Score (MEGS) and Harvey-Bradshaw Index (HBI) (N = 30).

Score	Parameter	Value
MEGS	Mean ± SD	28.62 ± 19.80
MEGS	Median	25.5
MEGS	Range	5–83
HBI	Mean ± SD	4.67 ± 2.07
HBI	Median	4.5
HBI	Range	1–9
HBI	Remission (<5), n (%)	16 (53.3%)
HBI	Mild (5–7), n (%)	11 (36.7%)
HBI	Moderate (8–16), n (%)	3 (10.0%)
HBI	Severe (>16), n (%)	0 (0.0%)

The overall distributions of the radiological and clinical activity scores are given in Table 6. The MEGS had a mean of 28.62 ± 19.80 (median 25.5; range 5–83), the wide range reflecting the spectrum of radiological severity from minimal to extensive involvement. The HBI had a mean of 4.67 ± 2.07 (median 4.5; range 1–9); when categorised, 16 patients (53.3%) were in remission (HBI <5), 11 (36.7%) had mild disease (HBI 5–7), 3 (10.0%) had moderate disease (HBI 8–16), and none had severe disease, so that just over half the cohort was in clinical remission despite radiological evidence of disease. The mean activity scores by MRE-assigned disease type are shown in Table 7. Patients diagnosed with Crohn's disease by MRE (n = 25) had a mean MEGS of 30.08 ± 20.75, compared with 20.13 ± 8.08 in those labelled UC (n = 4) and 19.00 in the single indeterminate patient; this difference approached but did not reach significance (p = 0.071). The corresponding mean HBI values were 4.76 ± 2.15, 3.75 ± 0.96, and 7.00, respectively, without a statistically significant difference (p = 0.243).

Table 7. Mean MEGS and mean HBI by MRE-assigned disease type.

MRE diagnosis	Mean MEGS ± SD	Mean HBI ± SD
Crohn's disease (n = 25)	30.08 ± 20.75	4.76 ± 2.15
Ulcerative colitis (n = 4)	20.13 ± 8.08	3.75 ± 0.96
UC/Crohn's (n = 1)	19.00	7.00
p-value	0.071	0.243

Table 8. Correlation between MEGS and HBI.

Correlation measure	Value	p-value
Pearson correlation (r)	0.317	0.088
Spearman's rho	0.364	0.048

Table 9. Association of MRE features with mean MEGS and mean HBI scores.

Parameter	Category	Mean MEGS ± SD	MEGS p-value	Mean HBI ± SD	HBI p-value
Mural thickness	Grade 1 (n = 2)	34.75 ± 11.0	0.039	4.0 ± 2.83	0.128
Mural thickness	Grade 2 (n = 7)	38.71 ± 28.34		3.71 ± 1.50	
Mural thickness	Grade 3 (n = 14)	20.04 ± 10.60		4.57 ± 1.91	
Mural thickness	Grade 4 (n = 7)	35.36 ± 25.91		6.0 ± 2.58	
Skip lesions	Present (n = 22)	29.18 ± 20.36	0.842	4.91 ± 2.18	0.559
Skip lesions	Absent (n = 8)	26.94 ± 19.20		4.0 ± 1.69	
Lymph nodes	Present (n = 11)	38.95 ± 25.18	0.045	5.27 ± 2.24	0.186

Lymph nodes	Absent (n = 19)	22.68 ± 13.63		4.32 ± 1.95	
Creeping fat	Present (n = 10)	42.30 ± 23.89	0.013	5.70 ± 2.16	0.042
Creeping fat	Absent (n = 20)	21.78 ± 13.63		4.15 ± 1.87	

The correlation between the two activity scores is presented in Table 8. The Pearson correlation coefficient between MEGS and HBI was 0.317 (p = 0.088), which was not statistically significant, whereas Spearman's rho was 0.364 (p = 0.048), reaching statistical significance and indicating a modest positive relationship whereby higher MEGS scores tended to coincide with higher HBI scores.

Finally, the relationship between specific MRE features and the two activity scores is summarised in Table 9. Across mural thickness grades, mean MEGS scores were 34.75 ± 11.0 (grade 1, n = 2), 38.71 ± 28.34 (grade 2, n = 7), 20.04 ± 10.60 (grade 3, n = 14), and 35.36 ± 25.91 (grade 4, n = 7); this difference was statistically significant (p = 0.039) but did not follow a linear trend, and the corresponding HBI differences were not significant (p = 0.128). The presence of skip lesions was not significantly associated with either MEGS (29.18 ± 20.36 vs 26.94 ± 19.20; p = 0.842) or HBI (4.91 ± 2.18 vs 4.0 ± 1.69; p = 0.559). Lymph node involvement was significantly associated with higher MEGS (38.95 ± 25.18 vs 22.68 ± 13.63; p = 0.045) but not HBI (5.27 ± 2.24 vs 4.32 ± 1.95; p = 0.186). Creeping fat showed significant associations with both scores, being linked to higher MEGS (42.30 ± 23.89 vs 21.78 ± 13.63; p = 0.013) and higher HBI (5.70 ± 2.16 vs 4.15 ± 1.87; p = 0.042) (Figure 10).

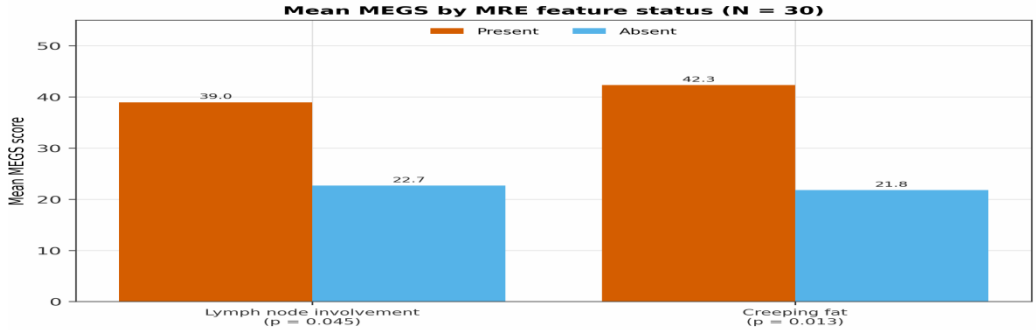

Figure 10. Mean MR Enterography Global Score (MEGS) stratified by the presence or absence of reactive lymph node involvement and creeping fat; both features were associated with significantly higher MEGS scores (data from Table 9).

DISCUSSION

Crohn's disease is a chronic, immunologically mediated inflammatory disorder that can involve any part of the gastrointestinal tract and produces abdominal pain, diarrhoea, weight loss, and fatigue. Its lifelong, relapsing course makes a non-invasive, radiation-free method of assessing disease extent and activity highly desirable, and the present study examined the utility of MRE for this purpose in a cohort of 30 patients with biopsy-proven disease.

The demographic profile of our cohort, with a mean age of 39.37 years and a predominance of patients under 40 years, is consistent with the recognised tendency of IBD to affect young adults in a bimodal distribution, as described by Borowitz [19]. The slight female predominance (56.7%) observed here aligns with epidemiological reports of a marginally higher prevalence in women, although the difference was not large enough to support firm conclusions about a gender predisposition.

Colonoscopy and MRE are the two principal investigations used to diagnose Crohn's disease and to assess its stage and treatment response, and our study demonstrated fair agreement between them (kappa = 0.267, p = 0.042). This complementary relationship echoes the retrospective review by Grand et al. of 310 patients, in which MRE compared favourably with colonoscopy for the non-invasive evaluation of known or suspected Crohn's disease, without the ionising radiation of CT enterography [20]. Similarly, Ali et al. found that while ileocolonoscopy detected more ulcerations and erosions, MRE was more useful in identifying abscess formation and lymphadenopathy, reinforcing the notion that the two modalities are complementary rather than competing [21].

MRE showed strong diagnostic performance in our study, with a sensitivity of 83.3% and a positive predictive value of 100% against biopsy. These figures are consistent with prior comparative work: Khater et al., in a group of 30 patients, reported a sensitivity and specificity of 76% and 90% for MRE in detecting small-bowel inflammatory changes, with an overall accuracy of 83% relative to capsule endoscopy [22], while Jakob et al., in 197 patients, found a sensitivity of 81% and a specificity of 70.2% for diagnosing Crohn's disease [23]. Our sensitivity falls squarely within this range, supporting the reliability of MRE as a diagnostic tool.

Skip lesions, a characteristic feature of Crohn's disease, were present in 86.7% of our patients and were most common in the ileum. This ileal predominance is plausibly related to the high density of Peyer's patches in

the terminal ileum. Qian et al., in a cohort of 404 patients, found that almost 60% had concomitant skip small-bowel lesions [24], and Solitano et al., in 202 patients, reported ileal skip lesions in 20% [25]. The higher prevalence in our series likely reflects the fact that all our patients had established, biopsy-proven disease.

Lymph node enlargement, a common accompaniment of the inflammatory process, was seen in about one-third (36.7%) of our patients. Maconi et al., in a cohort of 240 patients, found regional lymph node enlargement in 25% of cases, with only a weak correlation to clinical and biochemical activity but a strong association with internal fistulas and intra-abdominal abscesses [26]. In a separate retrospective study of 64 patients, the same group observed regional nodes in the jejunal mesentery in 20 patients, a finding suggestive of proximal jejunal involvement [27]. Notably, in our cohort lymph node involvement was significantly associated with higher MEGS scores, supporting its value as a radiological marker of disease burden.

Creeping fat, representing mesenteric fat wrapping around inflamed bowel, was present in 33% of our patients. Aggeletopoulou et al., in 90 patients, reported creeping fat in approximately 21%; although characteristic of inflamed mesentery, it is not entirely specific to Crohn's disease [28]. In our study, creeping fat was significantly associated with both higher MEGS and higher HBI scores, making it one of the more informative features linking radiological and clinical severity.

C-reactive protein was markedly elevated in our cohort (mean 242.7 mg/L, median 221.0 mg/L). Yang et al., in a group of 435 patients, similarly found elevated CRP in a substantial proportion, but cautioned that CRP reflects ongoing inflammation rather than serving as a reliable measure of disease activity or a basis for planning treatment response, particularly in ileal disease [29]. Our findings are in keeping with this interpretation, with CRP indicating active inflammation across the cohort.

The correlation between the radiological MEGS and the clinical HBI was modest, with a statistically significant Spearman's rho of 0.364 ($p = 0.048$) but a non-significant Pearson coefficient. This is closely comparable to the study by Jose et al. in 47 South Asian patients, which reported a modest positive correlation between MEGS and HBI ($r = 0.3$, $p = 0.043$), while segmental MEGS showed stronger correlations with endoscopic scores [17]. The modest correlation observed corroborates the complementary role of MRE in the management of Crohn's disease: radiological and clinical activity capture overlapping but distinct dimensions of the disease, as illustrated by the finding that more than half our patients were in clinical remission despite radiological evidence of active disease. Our mean HBI of approximately 4.6 (range 1–9) is consistent with the median HBI of 4 reported by Bennebroek Evertsz' et al. in around 181 patients, a level that can help distinguish active disease from remission [30].

STRENGTHS AND LIMITATIONS

The principal strengths of this study are its prospective, protocol-driven acquisition of MRE using a standardised 1.5-T technique, the use of biopsy as the gold standard for every patient, and the simultaneous assessment of both radiological (MEGS) and clinical (HBI) activity, allowing direct correlation between imaging and clinical severity. Several limitations should nonetheless be acknowledged. The sample size was small (30 patients), which limits statistical power for detecting weaker associations. Because the study enrolled only biopsy-proven cases of Crohn's disease, the utility of MRE in other inflammatory bowel diseases and in the very earliest stages of Crohn's disease could not be determined; MRE detected established rather than incipient disease, and specificity and negative predictive value could not be calculated in the absence of disease-negative controls. The cohort was also weighted towards mild-to-moderate disease. Larger, multicentre studies incorporating a broader spectrum of disease severity and disease-negative comparators would help to further define the diagnostic performance of MRE.

CONCLUSION

MR enterography is a highly valuable, non-invasive, radiation-free imaging modality for the evaluation of Crohn's disease. In this study it showed significant sensitivity and a high positive predictive value for diagnosing Crohn's disease, with fair agreement with colonoscopy, and provided detailed assessment of bowel wall inflammation, skip lesions, mesenteric lymphadenopathy, and creeping fat. The MR Enterography Global Score correlated modestly with the clinical Harvey-Bradshaw Index, and specific MRE features—particularly creeping fat and lymph node involvement—emerged as radiological markers associated with greater disease activity. By avoiding ionising radiation, MRE is especially suited to young patients requiring repeated imaging, and it plays a crucial role not only in initial diagnosis but also in monitoring disease activity, assessing treatment response, and detecting complications, thereby supporting more accurate and individualised management of Crohn's disease.

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