

# Comparative Evaluation of Magnetic Resonance Enterography and Ileocolonoscopy in Crohn's Disease: Experience in a Tertiary Care Hospital of Eastern India

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## ABSTRACT

**Background:** Inflammatory bowel disease is an immunologically mediated systemic disorder with chronic inflammation primarily affecting gastrointestinal tract. Crohn's disease and Ulcerative colitis are the two major types. Previously ileocolonoscopy was the gold standard investigation for diagnosis. Repeated CT scans expose the patients to a substantial cumulative dose of harmful ionizing radiation. The aim of this study was to evaluate the role of Magnetic resonance enterography (MRE) in assessing the disease activity and extent in Crohn's disease and to compare it with ileocolonoscopy findings in terms of segmental bowel involvement. **Methods:** We included 100 patients attending gastroenterology department with diagnosed or clinically suspected Crohn's disease. They had undergone MRE and ileocolonoscopy. MRE were analyzed for disease activity, extent and extra luminal manifestations and it was compared with ileocolonoscopy findings in terms of segmental bowel involvement. **Results:** Terminal ileum was the most common bowel segment involved in Crohn's disease. Segmental bowel wall thickening with abnormal contrast enhancement was the primary MRE finding in Crohn's disease. Based on imaging findings, MRE was capable of identifying disease activity in patients with Crohn's disease and classifying then into three categories. It has shown comparable result to that of ileocolonoscopy in terms of segmental bowel involvement. **Conclusions:** MRE is a very useful cross sectional study in Crohn's disease in assessing the disease activity and to look for various complications without risk of ionizing radiation. In our experience, it has shown comparable results to that of ileocolonoscopy in identifying segmental bowel involvement.

**Keywords:** Crohn's Disease, Ileocolonoscopy, Magnetic resonance Enterography.

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## INTRODUCTION

Inflammatory bowel disease (IBD) is an immunologically mediated chronic inflammatory systemic disorder primarily affecting gastrointestinal tract. Crohn's disease and ulcerative colitis are the two major types (IBD) with a prevalence of approximately one in 500, and the number has increased in the past 50 years.<sup>[1]</sup> There are two peaks for Crohn's disease: one in adolescents, young adults between 15 - 25 years of age and another second shallow peak in 50–80 years age group.<sup>[2]</sup> Crohn's disease can affect any region of the gastrointestinal tract and is not curable completely. Histologically, it affects all the layers of bowel wall, in contrast to ulcerative colitis, which affects the mucosal layer only. Because of this characteristic transmural involvement, a group of patients with Crohn's disease develop complications during the course of the disease, such as stenosis, fistula, intra-abdominal abscesses and phlegmon.<sup>[3]</sup> Initially upper and lower GI endoscopy along with conventional radiological imaging were the standard investigations.<sup>[4]</sup>

However, recent studies have proven the role of CT and MR Enterography in the diagnosis and monitoring of the disease.<sup>[6,7]</sup> Capsule endoscopy is a new modality which shows good results and is well accepted by a significant group of patients.<sup>[5]</sup> Since Crohn's disease is a lifelong condition with recurrent chronic relapsing course, CT is a less than ideal diagnostic tool for follow-up due to concerns over the hazards of cumulative radiation exposure.<sup>[6]</sup> MRE on the other hand, provides a multi-planar, multi-parametric and multiphasic contrast-enhanced imaging with high spatial resolution and very high tissue contrast allowing comprehensive evaluation of intra-abdominal pathologies, without risk of ionizing radiation.<sup>[7]</sup> MRE has the advantage of complete evaluation of mural and extramural manifestations of CD with the ability to differentiate between active inflammation and chronic disease. This helps to plan for the most suitable treatment and thus achieving better outcome.<sup>[7]</sup> The aim of our study was to evaluate the role of MRE in assessing suspected or already diagnosed cases of Crohn's disease and finally to compare it with ileocolonoscopy findings in terms of segmental bowel involvement.

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## MATERIALS & METHODS

It was a cross-sectional study done in a tertiary care hospital of eastern India in the Department of Radio

diagnosis and Department of Gastroenterology. 100 patients, either already diagnosed or suspected cases of Crohn's disease, attending OPD of Gastroenterology department for a period of one and half year, were included in the study. We performed MRE in all the patients in the department of Radio diagnosis to assess the disease activity and classified the patients into three groups i.e. active disease, chronic disease and active inflammation in chronic disease. Ileocolonoscopy could be successfully completed in 94 patients in the Department of Gastroenterology. So, we compared the results of MRE and Ileocolonoscopy statistically (kappa statistics) in terms of segmental bowel involvement in 94 patients only.

**Inclusion Criteria:**

1. Histopathologically diagnosed cases of Crohn's disease undergoing investigations to look for disease extent or assessment of disease activity, complications etc.
2. High clinical suspicion of having Crohn's disease, based on clinical examination and other investigations (biochemical, radiological or colonoscopy).
3. Patients who have given proper informed consent.

**Exclusion Criteria**

1. Contra-indications to MRI (Patients having neurostimulators, cochlear implant, pacemaker, metallic implants, severe claustrophobia etc.)
2. Patients with history of renal impairment, active ischaemic heart disease, acute glaucoma, benign prostatic hyperplasia etc.
3. Severely ill patients not able to hold breathe.
4. Patients who can't drink adequate amount of oral contrast agent, required for MRE imaging (acute intestinal obstruction, vomiting etc).

Ileocolonoscopy was performed in the department of gastroenterology. MRE was performed in a 3.0 Tesla MRI machine, GE Healthcare, SIGNA 3T HDxt with body coil (Torso phased array coil- 16 channel). Patient preparation: The patients were advised to drink up to 2 liter of biphasic (biphasic agents have low signal intensity on T1-weighted images and high signal intensity on T2-weighted images) oral contrast agent over 30 to 35 minutes. MR imaging were performed in supine position. We used 200 ml of mannitol 20% and 1400 ml of drinking water to prepare oral contrast. Patients refrained from eating and drinking 4 hour before the exam. One hour prior to the exam, the patient started drinking the mannitol–water solution in aliquots of 1 cup every 5 min.

After proper patient preparation and proper positioning, MR Enterography was performed using the sequences as mentioned below.

CorT2RTr

I/V Hyoscine butyl bromide

CorT2RTr, Ax T2FSRTr, Ax T2RTr, Ax DWI, CorT2FS.

Pre-contrast LAVA (axial and coronal)

I/V Hyoscine butyl bromide

Post-contrast LAVA (axial and coronal)

**RESULTS**



Figure 1: Multiple Skip Lesions: Characteristic of Crohn's Disease



Figure 2: "Comb" Sign with Skip Lesions: Typical of Crohn's Disease

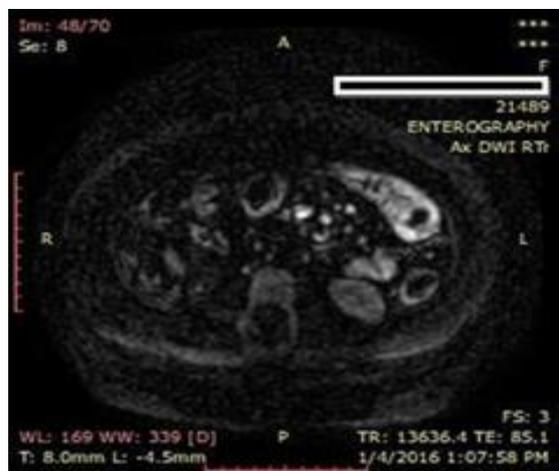


Figure 3: True Diffusion Restriction of Segmental Bowel Lesion



Figure 4: Segmental Bowel Wall Thickening With Abnormal Enhancement



Figure 5. Enterocutaneous Fistula

Crohn's disease can affect any age group, with only a few cases below 20 years of age and above 50 years of age. Males are more commonly affected than females (male: female ratio being 61:39).

Terminal ileum and ileo-cecal junction was the most commonly involved segments and was present in 56% of cases, followed by sigmoid colon and rectum involved in 34% cases. Descending colon, segment of ileum, ascending and transverse colon were involved in decreasing order of frequency (22%, 18% and 14% respectively). Only small bowel involvement was found in 38% cases and only large bowel in 20% cases, whereas both small and large bowel involvement was found in 34% cases.

In 27 patients luminal stenosis was found, however total number of stenosis was 33. One patient had five (i.e. skip lesions) segmental stenosis; two in ileum,

one in terminal ileum, one in transverse and descending colon each (Figure-1). Two patients had two segments of stenosis; both having stenosis at terminal ileum and sigmoid colon. In 73 patients we did not find any luminal stenosis.

Extra intestinal complications were present in 13% of patients, most common being perianal fistula, found in 6 patients comprising of 46% of total extra intestinal complications. Inflammatory phlegmon and enterocutaneous fistula (Figure- 5) were present in 3% and 2% patients respectively and comprising of 23% and 15% of total extra intestinal complications. Gluteal abscess was found in one patient.

Indicators of active inflammation were evaluated. Marked post contrast enhancement of bowel wall was seen in 72 patients. However true diffusion restriction, mesenteric inflammation/comb sign, reactive adenopathy were present in 42, 24 and 22 patients respectively. Signs of chronic inflammatory bowel disease such as minimal post contrast enhancement, stricture and mesenteric fibro-fatty tissue proliferation were present in 20, 26 and 16 patients respectively. According to the presence of these signs, Crohn's disease is classified into three categories as disease with active inflammation (41%), chronic disease (20%) and active inflammation on chronic disease (31%). In 8 patients (8%) we did not find any radiological signs of inflammation.

In our study on 100 patients, 6 patients had incomplete ileocolonoscopy evaluation; 2 of them due to significant stenosis in recto-sigmoid region, 1 each due to rectal polypoidal mass, hemorrhoids, colo-colic intussusception and patient intolerance to colonoscopy respectively. So, correlative study of MRE and ileocolonoscopy in assessing segmental bowel lesions could be performed in 94 patients. According to MRE, total number of bowel segments involved were 131. Of them, terminal ileum/IC region, ascending colon, transverse colon, descending colon and recto-sigmoid colon was involved in 56.4%, 14%, 13%, 22%, and 34% of patients respectively. On the other hand, according to ileocolonoscopy, total number of bowel segments involved was 125. Of them, terminal ileum/IC region, ascending colon, transverse colon, descending colon and recto-sigmoid colon was involved in 52%, 15%, 15%, 23% and 28% of patients respectively. As per kappa statistics, MRE and ileocolonoscopy findings in terms of segmental bowel involvement showed very good agreement.

Table 1: Segmental Bowel Involvement as detected in MRE and Ileocolonoscopy

Involved Segment	MRE	Colonoscopy
Terminal Ileum and IC (Ileo-cecal)	53 (56.9%)	49 (52%)
Ascending colon	13 (14%)	14 (15%)
Transverse colon	12 (13%)	14 (15%)
Descending colon	21 (22%)	22 (23%)
Recto-sigmoid region	32 (32%)	26 (28%)

**Table 2: Comparative Evaluation of MRE and Ileocolonoscopy for Segmental Bowel Involvement**

Agreement Analysis For Terminal Ileum AND IC		MRE		Total	Kappa statistics
		Positive findings	Negative Findings		
Ileocolonoscopy	Positive findings	47	2	49	0.829 (95% CI 0.716-0.942) Very Good
	Negative findings	6	39	45	
Total		53	41	94	
Agreement Analysis for ascending Colon		MRE		Total	Kappa Statistics
		Positive findings	Negative findings		
Ileocolonoscopy	Positive findings	12	2	14	0.870 (95% CI 0.727-0.981) Very Good
	Negative findings	1	79	80	
Total		13	81	94	
Agreement Analysis for transverse Colon		MRE		Total	Kappa Statistics
		Positive findings	Negative findings		
Ileocolonoscopy	Positive findings	12	2	14	0.911 (95% CI 0.789-1) Very Good
	Negative findings	0	80	80	
Total		12	82	94	
Agreement analysis for descending Colon		MRE		Total	Kappa Statistics
		Positive findings	Negative findings		
Ileocolonoscopy	Positive findings	19	3	22	0.849 (95% CI 0.721-0.977) Very Good
	Negative findings	2	70	72	
Total		21	73	94	
Agreement Analysis for recto-Sigmoid Colon		MRE		Total	Kappa statistics
		Positive findings	Negative findings		
Ileocolonoscopy	Positive findings	26	0	26	0.851 (95% CI 0.737-0.965) Very Good
	Negative findings	6	62	68	
Total		32	62	94	

## DISCUSSION

One hundred patients, already diagnosed or clinical suspicion of having Crohn's disease, were included in our study. Ileocolonoscopy was performed in department of Gastroenterology and MR Enterography in department of Radio-diagnosis.

Based on segmental bowel wall thickening with abnormal contrast enhancement (marked or mild enhancement) we identified segmental distribution of lesions in small and large bowel loops.<sup>[8-11]</sup> We also studied complications and extra-intestinal manifestations like, segmental luminal stenosis with proximal dilatation, fistulae, intra-abdominal inflammatory phlegmon and abscess formation. We categorized the patients into disease with active inflammation, chronic disease and chronic disease with active inflammation. Patients having true diffusion restriction [Figure3] of bowel lesion,<sup>[12,13]</sup> marked post-contrast enhancement [Figure4] "comb sign" (engorged vasa recta) [Figure2]/ mesenteric inflammation or reactive adenopathy (lymph node edema seen as hyper intense signal in FS HASTE and homogeneous post-contrast enhancement) either in isolation or in combination were categorized as disease with active inflammation. On the other hand, patients having mild post-contrast enhancement of bowel lesions, fibro-fatty mesenteric proliferation, and fibro-stenosis, singly or in combination were categorized as having chronic inflammation.<sup>[8-11,14-19]</sup> Patients with MRE features of both active inflammation and chronic disease were categorized as having active inflammation in chronic disease.

We compared MRE and ileocolonoscopy findings in terms of segmental bowel involvement from terminal ileum up to recto-sigmoid region.

Peak age of onset of CD ranges between 15-30 years of age but it can affect people of all ages. It is estimated that up to 20% of people with IBD are diagnosed during childhood.<sup>[20,21]</sup> In our study, majority of patients were in the age group of 15 to 35 years of age (55%). A small second peak was seen around 50 years (25%). There is no major gender predominance.<sup>[20]</sup> In our study, 61% of affected patients were male and 39% were female. There is small bowel involvement in about 70-80 % of patients with CD, and in about 20-30 % the disease is only involving the small bowel. The colon can be affected either with (50 % of cases) or without (15-20 %) the involvement of the small intestine.<sup>[22]</sup> In our study, in about 72% of patients there was small bowel involvement and large bowel involvement was seen in 54% of patients. Only small bowel and only large bowel involvement was found in 34% and 20% of patients respectively. Extra-intestinal lesions and complications can be well assessed by MRE due to its multiplanar capability and high soft-tissue contrast resolution. Fistula formation is not uncommon in CD, affecting 17 % to 50 % of patients.<sup>[23]</sup> We found 10% fistulae, out of them, 6% were ano-rectal fistulae, 1% being entero-enteric fistulae and 2% entero-cutaneous fistulae. Morphology of perianal fistulae were clearly seen on MRI. We found that a dedicated high-resolution perianal MR protocol study is much more superior in detection of the small tracts. Abscess is a frequent complication in CD, occurring in 10 to 30% of patients over the course of the disease.<sup>[17]</sup> The clinical challenge is twofold. First, the clinical and laboratory signs of abscess are often masked by immunosuppressant drugs administered in these patients. Second, abscess is a direct contraindication to biologic agents (including anti-TNFs) and

corticosteroids.<sup>[24]</sup> We found abdominal inflammatory phlegmon in 3% of patients and abscess in 1% of patients. The distinction between acute and chronic disease is crucial for planning management, particularly in patients with symptoms of acute exacerbation. Findings consistent with inflammation may be medically managed, whereas findings related to stricture or fibrosis usually ends up with surgical intervention.<sup>[25]</sup> In our study, 33% patients showed acute exacerbation on top of chronic disease, 19% cases showed only chronic changes and 40% cases showed only acute changes.

In our study on 100 patients, 6 patients had incomplete ileocolonoscopy evaluation- 2 of them due to significant stenosis in recto-sigmoid region, 1 each due to rectal polypoidal mass, hemorrhoids, colo-colic intussusception and patient intolerance respectively. So, correlative study of MRE and ileocolonoscopy in assessing segmental bowel lesions was performed in 94 patients. According to MRE, total number of bowel segments involved was 131. Of them, terminal ileum/IC region, ascending colon, transverse colon, descending colon and recto-sigmoid colon was involved in 56.4%, 14%, 13%, 22%, and 34% of patients respectively. On the other hand, according to ileocolonoscopy, total number of bowel segments involved was 125. Of them, terminal ileum/IC region, ascending colon, transverse colon, descending colon and recto-sigmoid colon was involved in 52%, 15%, 15%, 23% and 28% of patients respectively. In kappa statistics, MRE and ileocolonoscopy findings in terms of segmental bowel involvement showed very good agreements.

In a study on 30 patients of Crohn's disease conducted by Nivan Hany Khater et al,<sup>[26]</sup> terminal ileum/IC region, ascending colon, transverse colon, descending colon and recto-sigmoid colon was involved in 66.6%, 4%, 4%, 8% and 12% of patients according to MRE, whereas involvement of bowel segment in the same order was seen in 70%, 8%, 4%, 8% and 16% of patients according to ileocolonoscopy. Ileocolonoscopy assesses mucosal abnormality in IBD, whereas MRE has capability of assessing transmural bowel involvement in IBD. However, MRE has its own limitations due to insufficient small bowel distension in some cases (caused mainly due to inadequate intake of oral contrast) along with tendency of MRE towards missing small lesions and early ulcerations as compared to colonoscopy. These facts in combination may contribute to the cause of apparent discrepancy between MRE and ileocolonoscopy findings in assessing segmental bowel involvement.

## CONCLUSION

Crohn's disease is common in adolescent and young adults with slight male predominance. Segmental bowel wall thickening with abnormal contrast

enhancement is the primary MRE finding in IBD and terminal ileum being the most common bowel segment involved. MRE is able to identify different complications/extra-intestinal manifestations of IBD. Based on different imaging features, MRE is capable of assessing disease activity and categorizing patients into disease with active inflammation, chronic disease and active inflammation in chronic disease. Finally, MRE has shown comparable result to ileocolonoscopy in identifying segmental bowel involvement in IBD patients.

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