

To determine the value of MR Enterography in small bowel disease and to correlate the findings with endoscopy, histopathology and laboratory findings

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Abstract

Aim: The aim of the present study was to determine value of MR Enterography in small bowel disease and to correlate the findings with endoscopy, histopathology and laboratory findings.

Methods: The present study was conducted Department of Radiodiagnosis at Aster CMI Hospital, Bengaluru, Karnataka. The study population was patient who came to Aster CMI OPD with bowel complaints from January 2019 to December 2019. Patients who were admitted in the ward, patients who came to OPD with recurrent episodes colicky abdominal pain, diarrhoea, weight loss and anaemia were enrolled in the study.

Results: In the present study, minimum age was 15 and maximum age was 79 years of age. There were 35 (70%) males in the present study as compared to females 15 (30%). Among 50 total subjects, 13 subjects have normal MR enterography study and 37 subjects have abnormal MR enterography findings. In the present study, 74% were abnormal and 26% were normal. In the present study, among 40 patients having abnormality, diagnosis made in MR enterography are Crohn's disease in 31 patients (62% of total subjects), Nonspecific imaging findings in 2 patients (4%), Ulcerative colitis in 2 patients (4%), Polyps in 2 patients (4%), Celiac disease in 2 patients (4%) and TB in 1 patient (2%).

Conclusion: MR enterography is a great problem-solving diagnostic imaging modality in patients suspected to have small bowel disease. Particularly young subjects with chronic symptoms, MR enterography is modality of choice as there is no radiation risk involved. As patients often refuse invasive procedure as a screening tool, MR enterography can be used as a screening tool in those patients.

Keywords: MRI, Enterography, small bowel disease

Introduction

Magnetic resonance enterography (MRE) is a radiological technique that has evolved in the last decade. It involves the use of magnetic resonance imaging (MRI) to assess the small bowel, following distension with an oral contrast agent. The small bowel imaging is tough because of its length, twisting and peristalsis. For decades the most common radiologic

modality for evaluating small bowel diseases is conventional small bowel follow through.

Appropriate therapy for a disease is based on its precise diagnosis and assessment. CD is a long-standing chronic IBD. With the recent advent of effective medications, “mucosal healing” is considered as the target of therapy for IBD ^[1]; this requires detailed disease assessment on the basis of not only clinical symptoms but also the findings of imaging modalities.

Small bowel imaging is fundamental for comprehensive phenotyping of Crohn’s disease and essential to direct therapeutic strategy ^[2]. Barium fluoroscopy has long been the bedrock of small bowel investigation, providing detailed mucosal assessment ^[3].

Of the available modalities, MRE and ultrasound are preferred ^[4] since they avoid irradiating generally young patients who require repeat imaging ^[5]. Enteric ultrasound is longer established ^[6], requires little patient preparation and the technology is widely available.

CD may affect any portion of the gastrointestinal tract.

Three-quarters of patients with CD have small intestinal lesions ^[7]. However, due to the difficulties of endoscopic or cross-sectional approaches for imaging the small intestine, assessment of CD was mainly based on clinical symptoms use of scoring systems, such as the CDAI. Recent progress in modalities, such as capsule endoscopy (CE) ^[8], balloon assisted endoscopy (BAE) ^[9] as well as cross-sectional imaging, such as CT enterography (CTE) and magnetic resonance (MR) enterography (MRE) enables direct assessment of the lesions deep within the small intestine that cannot be accessed by standard ileocolonoscopy. The cross-sectional imaging can acquire the information of not only the mucosal lesion but also the inflammation in the deep layers of the bowel wall and extraluminal complications, such as abscess and fistula ^[10].

The advantage of MSCT and MR Enterography is to permit the diagnosis of CD, the visualization of the whole length of the small intestine, without overlapping loops, with the benefit of the assessment of the site, severity of disease, mural, submucosal and extramural extent, and to diagnose complications such as stricture, obstruction, bowel tethering, perforation, entero-enteric, entero-vesical and perianal fistulae and abscess formation, to be compared with the endoscopic severity ^[11, 12].

The aim of the present study was to determine value of MR Enterography in small bowel disease and to correlate the findings with endoscopy, histopathology and laboratory findings.

Materials and Methods

The present study was conducted Department of Radiodiagnosis at Aster CMI Hospital, Bengaluru, Karnataka. The study population was patient who came to Aster CMI OPD with bowel complaints from January 2019 to December 2019. Patients who were admitted in the ward, patients who came to OPD with recurrent episodes colicky abdominal pain, diarrhoea, weight loss and anaemia were enrolled in the study. A written informed consent was obtained from the patient before enrolment into the study. The clinical history was taken according to Performa. Old reports if any available are seen.

Inclusion criteria

- Patients who undergo MR enterography.
- Suspected to have small intestinal/ileocecal tuberculosis.
- Suspected to have inflammatory bowel disease.
- Unexplained abdominal pain, anemia and weight loss.
- Recurrent diarrhea.

Exclusion criteria

- Patient with general contraindication for MRI.
- Poor quality study.
- Too sick patients.
- Patients in whom definitive diagnosis could not be made.

Bowel preparation

- Patient should be instructed to minimum 6 hours of fasting prior to study.
- Patients are allowed to take liquid food.
- No enema given prior to the study.

Oral ingestion protocol**Divided dose preparation**

137.15gm of PEGLEC is mixed with 1.5 to 2 liter of water in a container, stirred well to dissolve the PEGLEC completely. Patients asked to drink 450-500ml of water in every 15 minutes. 45 minutes after the commencement of oral contrast ingestion patient is imaged on 3 Tesla MRI (PHILIPS INGENIA-3.0T) using phased array abdomen coil in supine position. Patient is instructed with breathing instructions.

Images will be obtained and evaluated for bowel wall thickening, enhancement, mesenteric involvement, lymph nodes, strictures and complications if any. Results will be followed up with clinical follow up and histopathological findings wherever it is possible.

Observations

- The study was done on total 50 cases who comes under inclusion criteria. The following observations are made.
- The total examination time was about 20 minutes, which can take upto 30 minutes depending on patient's compliance.
- Most of the patients well tolerated the oral contrast solution and only three patients had diarrhea after drinking the contrast. These patients have managed to complete the study.
- In few patients study could not be completed in first time as the orally given biphasic contrast did not reach the terminal ileum, thus the study was repeated on the same day after 10-15 minutes.
- One patient had susceptibility artifacts from colostomy bag, the bag was removed and the study was repeated.
- In few patients artifacts produced from bowel peristalsis, which was compensated by well visualized of those segments on other/repeat sequences.
- Normal thickness of well distended small bowel is 3mm. Thickness more than this is abnormal.

Images are analyzed and looked for

- Bowel wall thickening-Circumferential or asymmetrical.
- Narrowing of the affected segment.
- Signal on T2W images-Hyperintense signal suggesting active inflammation, whereas hypointensity suggests fibrosis.
- Length of involvement.
- Skip lesions.

- Perienteric fluid/ fat stranding-suggesting inflammation.
- Mesenteric Phlegmon and abscess.
- Prominent/enlarged lymph nodes.
- Fibrofatty infiltration, mesenteric vessel engorgement.
- On post contrast images, pattern of wall enhancement is noted-homogenous, heterogeneous and stratified.
- Complications such as fistula formation that is enterocolic fistula, enteroenteric, perianal fistula.

Luminal narrowing is graded on MRI as

- Absent.
- Mild-One third reductions in luminal distension.
- Moderate-two third reductions in luminal distension.
- Severe-Total narrowing.

Results

Table 1: Age and Gender distribution of the study

Descriptive Analysis				
	Minimum	Maximum	Mean	SD
Age	15	79	40.28	13.56
Sex	Number		Percent	
Female	15		30	
	35		70	

To correlate the findings with endoscopy, histopathology and laboratory findings.

In the present study, minimum age was 15 and maximum age was 79 years of age. There were 35 (70%) males in the present study as compared to females 15 (30%). (Table 1)

Table 2: Normal and abnormal MR enterography findings

Normal	Abnormal	Total
13	37	50
26%	74%	100%

Among 50 total subjects, 13 subjects have normal MR enterographic study and 37 subjects have abnormal MR enterography findings. In the present study, 74% were abnormal and 26% were normal.

Table 3: Diseases among abnormal subjects

Disease	Number	Percentage
Crohn's disease	31	77.5%
Non-specific	2	5%
Ulcerative colitis	2	5%
Polyp	2	5%
Celiac disease	2	5%
TB	1	2.5%

The table explained that among 40 patients having abnormality, diagnosis made in MR enterography are Crohn's disease in 31 patients (62% of total subjects), Nonspecific imaging findings in 2 patients (4%), Ulcerative colitis in 2 patients (4%), Polyps in 2 patients (4%),

Celiac disease in 2 patients (4%) and TB in 1 patient (2%).

Table 4: Anaemia and Abnormal fecal calprotectin in patients with small bowel diseases-Gender distribution

Sex	Anaemic	Not Anaemic	Chi-square value	P-value
Female	6(75%)	2 (25%)	.33	.431
Male	14(56%)	11(44%)		
Sex	Abnormal	Normal	Chi-square value	P-value
Female	2(100%)	0(0%)	.34	.571
Male	13(68.4%)	6(31.5%)		

75% of female were anaemic whereas 56% of males were anaemic. All females who had done faecal calprotectin had elevated fecal calprotectin, whereas 68% of males had elevated faecal calprotectin.

Table 5: Correlation of small bowel disease on MR enterography with colonoscopy and histopathology

Small bowel Radiology Diagnosis	Small bowel colonoscopy	
Positive	33(89.18)	4(10.8)
Negative	5(50)	5(50)
Small bowel Radiology Diagnosis	Small bowel histopathology	
Positive	34	1
Negative	8	4

Patients who underwent MR enterography are correlated with colonoscopy findings. In 4 patients MR enterography showed findings and the colonoscopy was negative. Small bowel diseases on MR Enterography correlated with histopathology. In one patient, radiology showed positive result whereas histopathology was negative.

Table 6: Comparison of Crohn's disease on MR enterography with colonoscopy

Crohn's radiology	Crohn's Colonoscopy	
Positive	29 (90.62)	3(9.37)
Negative	7(46.6)	8(53.3)

Discussion

The management of symptomatic CD patients depends upon the presence of inflammatory activity to decide medical or surgical treatment. Up till now, endoscopy is still considered the gold standard method for diagnosing active CD and staging disease activity^[13].

Both CTE and MRE have significant sensitivity and specificity in the diagnosis and staging of CD and so achieved a great improvement in the radiological investigations. Unfortunately, CTE disadvantage is ionizing radiation exposure with a consequent increase in the lifetime risk of malignancy which is much higher in a younger population, making MRI a preferable tool for long-term safety issues^[14]. As well, MRE provides a better soft tissue characterization that helps to differentiate between intestinal fibrosis and inflammation and it seems to be better than CT scanning^[15].

Recently, MRE has shown increase usage and importance in CD evaluation and follow-up as it was accurate in diagnosing CD activity. The criteria involved in the evaluation of MR study were similar to those of the endoscopic score like: monitoring the extent of affected surface, edema, stenosis and also other radiological findings not applicable for endoscopy, such as bowel wall thickness, enhancement following gadolinium injection and extra-intestinal

findings, as they are also important findings to predict the disease activity [16]. The relation between radiological signs of inflammation (examined by either CTE or MRE) and disease activity in CD was comparable. Maccioni *et al.* [17] studied the relation between MR signs of activity (as stranding of the perienteric fat, mural thickening, contrast enhancement) and biological activity score including white blood cells, CRP and orosomucoid levels in 20 CD patients. They found a significant correlation between them.

Enhancement is associated with the clinical grade and the sensitivity of contrast-enhanced MRI is very high for diagnosing patients with active disease [16]. However, factors affecting enhancement are complex and not just inflammation as it may lead to overstage CD [18]. The hypothesis behind this is that in chronic disease activity, there is increased enhancement due to increased permeability of the involved microvascular surface area [19]. As a result of this, in our results; more falsely interpreted active disease depending on the post contrast T1-w images but without high T2 signal. So chronic disease with fibrotic tissue may be present if there is bowel wall thickening and contrast enhancement without an increased signal on the T2-w images however, increased T2-w signal indicated edema related to active inflammation. Many studies reflect the significance of evaluating the pattern of contrast enhancement of bowel wall to assess the disease activity [20]. Dambha *et al.*, in a study in 2014 point out that intense mucosal enhancement after intravenous gadolinium administration is typical for active disease and that gadolinium administration identifies acute inflammatory changes [21].

In chronic Crohn's disease, evidence of fatty infiltration of the bowel wall occurs. It can be seen in obese healthy individuals. So this should be interpreted in the context of clinical presentation and other imaging findings. In order to differentiate between submucosal fat from wall edema, fat-saturated and non-fat-saturated T2-weighted HASTE sequences are required with wall edema is showing persistent high signal intensity in both sequences. Whereas in submucosal fat, the wall signal intensity will be reduced on fat saturation due to the presence of fat. Chemical shift artifact due to the intramural fat can be detected on Gradient-echo (FISP) sequences [22].

Our study used MRE score of Girometti *et al.* [14] Different MRI parameters were estimated and the patients were classified into inactive (0-2), mild activity (3-6), moderate to severe activity (> 7) and were compared to the simple endoscopic scoring system.

Conclusion

MR enterography is a great problem-solving diagnostic imaging modality in patients suspected to have small bowel disease. Particularly young subjects with chronic symptoms, MR enterography is modality of choice as there is no radiation risk involved. As patients often refuse invasive procedure as a screening tool, MR enterography can be used as a screening tool in those patients. Various small bowel diseases along with few large bowel diseases are detected in this study. The range of indications for MR enterography are wide and include vomiting, colicky abdominal pain, diarrhoea and chronic anaemia. Thus, MR enterography is an excellent modality that has adequate transmural visualization of the small bowel, providing optimal information about exact location, distribution, activity and complications.

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