## MRI enterography: indications, technique and findings in 100 cases

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Learning objectives

After reading this poster the reader will:

- Understand the indications, advantages and limitations of MR enterography compared to other methods of imaging the small bowel.
- Understand how the technique is performed in terms of patient preparation and MR sequences used.
- Have gained an appreciation of the range of intrinsic small bowel and extraluminal findings commonly seen with this technique.
Background

Magnetic resonance (MR) imaging confers advantages over other small bowel imaging techniques. In comparison to CT it does not involve ionizing radiation. This is of particular relevance in the diagnosis and monitoring of inflammatory bowel disease which tends to present in a young age group and sufferers often require multiple follow up examinations throughout their lives. Furthermore, the lack of ionizing radiation allows multiphasic imaging which is of use in assessing temporal changes in small bowel distension to exclude the presence of strictures and assess bowel peristalsis. Soft tissue contrast is also improved compared to CT [1]. Like CT, MRI allows detection of pathology outside the small bowel which would not be demonstrated on barium studies.

Limitations of MRI compared to CT are that it is more time consuming, generally less widely available and relies on greater patient cooperation. Furthermore, the spatial resolution is inferior to CT [2].

In order to distend the small bowel, enteric contrast material is administered, this can take one of two forms. In MR enteroclysis this is done by means of a naso-jejunal tube inserted fluoroscopically. MR enterography, on the other hand, relies upon large volumes of enteric contrast material being ingested orally. Enteroclysis is reported to provide better and more reliable small bowel distension [3] but requires greater radiologist input for naso-jejunal tube insertion. For this reason in our institution MR enterography is the technique of choice.

In addition to enterographic contrast, spasmolytic agents are administered to reduce bowel peristalsis and thus artefact. Intravenous contrast material is also administered to allow assessment of bowel enhancement with areas of hyperenhancement indicating active inflammation.

The main indication for MR enterography is reported to be the diagnosis and monitoring of Crohn's disease. Findings indicative of Crohn's disease include segmental mural hyperenhancement, mural thickening and altered bowel motility [4]. Signs of active inflammation include mucosal hyperenhancement, mural stratification due to a combination of mucosal enhancement and sub mucosal oedema on contrast enhanced fat suppressed T1 images and mesenteric fat stranding [5]. Complications of Crohn's disease can also be demonstrated including fistulas, adhesions (manifesting as kinked and obstructed bowel loops) and abscesses [3].
Findings and procedure details

We have found the following patient preparation and imaging protocol to be effective in demonstrating the small bowel.

Patients follow a low residue diet for the 3 days prior to the scan. On the day of the scan only clear fluids are permitted up until 6 hours beforehand when they are kept nil by mouth.

In the hour prior to the scan the patient receives 10mg oral metoclopramide hydrochloride and they are asked to drink mannitol solution (30g in 1 litre of water) over 60 minutes.

Imaging is performed at 1.5 T. A T2 weighted single shot ultra fast spin echo sequence (SSH-TSE) is firstly performed to ensure the enteric contrast has reached the caecum and the small bowel is adequately distended. 20mg hyoscine butylbromide is then administered intravenously. T2 weighted balanced turbofield gradient echo (BTFE) coronal and axial sequences are performed. These are of particular use in assessing for mural thickening and extra luminal abnormalities.

Following administration of i.v. contrast medium (20mg gadoteric acid), 3D fat suppressed spoiled gradient echo, THIRVE (T1 weighted high resolution isotropic volume examination) coronal and axial sequences are performed. These are commenced 40 seconds after the injection of contrast and allow assessment of bowel enhancement with hyper-enhancing areas suggestive of inflammation. Finally diffusion weighted imaging is performed.

In our institution, since the introduction of the technique, approximately 600 MR enterography examinations have been performed. We analysed the demographic data, clinical indications and findings of 100 cases performed. Complete data was available for 98 cases. We found that the mean age of patient undergoing MR enterography was 44.5 years of age (range 19-91, SD=15.71).

The most common indications were to monitor disease progression or investigate for complications in patients with known inflammatory bowel disease (31 patients) or to aid in the diagnosis of suspected cases of inflammatory bowel disease (29 patients). Evaluation of nonspecific abdominal pain or alteration in bowel habit accounted for 17 examinations.

Positive small bowel findings were reported in 34 examinations, whilst 6 examinations had equivocal findings. The most common positive findings were small bowel hyper-
enhancement (14 patients) (Fig.1 and Fig.2), mural thickening (10 patients) and stricture (6 patients).

A range of extra-small bowel findings were also reported in 28 cases. Some of these were incidental such as renal, ovarian and hepatic cysts as well as gallstones (Fig.3 and Fig.4). Potentially significant findings requiring further investigation of hydronephrosis, colonic thickening and a lower oesophageal mass were each reported in 1 patient.
**Fig. 1:** Coronal THRIVE (T1 high resolution isotropic volume examination) sequence showing thickened and avidly enhancing terminal ileum in keeping with Crohn's disease.

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**Fig. 2:** Axial THRIVE (T1 high resolution isotropic volume examination) sequence showing thickened and avidly enhancing terminal ileum in keeping with Crohn's disease.

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Fig. 3: BTFE (Balanced turbofield echo) sequence showing numerous bilateral renal cysts.

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Fig. 4: BTFE (Balanced turbofield echo) sequence showing gallbladder stone.

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Conclusion

MRI enterography offers a means of evaluating the small bowel without the use of ionizing radiation. This is of particular benefit to patients with known or suspected inflammatory bowel disease who are generally of a younger age group and are the most common groups for whom the technique is employed in our institution. The technique has been used in our department to aid in the diagnosis and monitoring of Crohn's disease as well as detect clinically important findings outside the small bowel.
References


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