

MR Abdomen Protocol – Enterography

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Standard uses: Crohn's disease, ulcerative colitis, suspected inflammatory bowel disease (IBD), small bowel carcinoid evaluation, abdominal pain with inconclusive extensive work up.

Notes: If referring provider wants to assess for perianal fistula as well, then the exam will require two time slots (MRI abdomen for the enterography and MRI pelvis for the perianal fistula) or performed separately on different days.

Coverage: Position the coil such that there is signal from porta hepatis of the liver (where vessels enter liver) to the level of the perineum. Note, axial acquisitions may require 2 FOVs to assure adequate coverage. See appendix below.

Intravenous contrast: Single dose gadolinium @ 2 cc / sec (Gadavist, MultiHance if Gadavist is unavailable).

Oral contrast: Breeza or VoLumen (3 bottles); patient should be NPO for 4 hours prior to scan (meds and clear liquid diet OK in am if afternoon case). ED patients or if concern for bowel obstruction, may not necessarily be NPO. Give 3 bottles of oral contrast (Breeza or VoLumen) to the patient over course of 60 mins (approx. 1 bottle per 20 mins).

Note: Patients with Crohn's disease may not be able to tolerate 3 bottles of Breeza/VoLumen. Have patients drink as much as they can tolerate. If patient is unable to tolerate Breeza/VoLumen, have the patient attempt to consume a similar volume of water.

Anti-peristaltic agent: Glucagon, administered IM or SQ (deltoid/shoulder = preferred); do NOT administer IV

- Weight > = 100 lbs → 1 mg
- Weight < 100 lbs → 0.5 mg

Sequences:

1. Localizer

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2. Coronal T2 Balanced SE (TrueFISP, Balanced FFE, FIESTA, BASG, True SSFP)
 - a. CINE images covering from anterior abdominal wall to spine covering stomach to anus (include as much as stomach and perianal region as possible)
 - b. Make sure to correctly send images to PACS so CINE play correctly – *order by image location, not image number*

3. INJECT GLUCAGON

4. Coronal T2 Ultra fast SE (HASTE, SSFSE, FASE)
 - a. Multi-breath hold as needed
 - b. Complete front to back coverage
5. Axial T2 Ultra fast SE (HASTE, SSFSE, FASE)
 - a. Multi-breath hold as needed
 - b. Stomach to perineum (include as much of stomach and perianal region as possible)
 - i. Split into two series if necessary
 - c. Goal parameters
 - i. Slice thickness 6 mm, 0% gap
6. Axial T2 Ultra fast SE (HASTE, SSFSE, FASE) with fat suppression
 - a. Multi-breath hold as needed
 - b. Stomach to perineum (include as much of stomach and perianal region as possible)
 - a. Split into two series if necessary
 - c. Goal parameters
 - i. Slice thickness 6 mm, 0% gap
7. Coronal T1 Ultra fast 3D-GE with fat suppression (VIBE, LAVA, TIGRE) precontrast
 - a. Breath hold
 - b. Stomach to perineum (include as much of stomach and perianal region as possible)
 - c. Goal parameters
 - i. Slab slices \leq 3 mm
8. Axial T1 Ultra fast 3D-GE with fat suppression (VIBE, LAVA, TIGRE) precontrast
 - a. Breath hold
 - b. Stomach to perineum (include as much of stomach and perianal region as possible)
 - i. May need 2 stacks/slabs to cover abdomen and pelvis (split into 2 series if necessary)
 - c. Goal parameters
 - i. Slab slices \leq 3 mm
9. Coronal T1 Ultra fast 3D-GE with fat suppression (VIBE, LAVA, TIGRE) post-contrast: 3 total post-contrast sequences(2 back-to-back, 1 delayed)
 - a. Same coverage as 7
 - b. Goal parameters
 - i. Slab slices \leq 3 mm
 - ii. Post contrast to be done @ center of K-space
 - iii. Timing (**3 total post-contrast sequences**)
 - a. 1st post = 45 seconds

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- b. 2nd post = immediately after 1st completed
- c. 3rd post = 5-7 minutes

10. Axial T1 Ultra fast 3D-GE with fat suppression (VIBE, LAVA, TIGRE) postcontrast
 - a. Breath hold
 - b. Same coverage as 8
 - i. May need 2 stacks/slabs to cover abdomen and pelvis (split into 2 series if necessary)
 - c. To be performed after 2nd CORONAL post-contrast acquisition in #9, prior to the 3rd CORONAL post-contrast acquisition in #9

11. Axial DWI with ADC map
 - a. Free breathing
 - b. Same coverage as other axials (stomach to perineum)
 - c. Parameters
 - i. B-values of 0, 100, 500, 1000, and ADC map

Radiologists perspective:

MR Enterography (MRE) is an important tool for gastroenterologists and other providers, most often used in patients with Crohn's disease. MRE plays a vital role for assessing the "status" of patients with Crohn's disease, which in turn helps the referring provider determine the appropriate treatment. Crohn's disease can have many different manifestations and involve all segments of the GI tract.

"Active inflammatory disease" refers to the state of active inflammation affecting a segment or segments of bowel, most often the terminal ileum. Radiologists rely heavily on the early post contrast images to make this diagnosis. A coronal VIBE/LAVA/TIGRE acquisition allows for the quickest imaging of the entire small bowel. Axial imaging usually requires 2 separate breath holds, and thus the contrast delay in each "stack" is different, making it difficult to compare the relative "enhancement" or "inflammation" of different bowel segments. Also the terminal ileum is usually imaged at the margins of the imaged slabs, which are usually degraded by artifact. This is why we perform dynamic post contrast imaging in the coronal plane. Glucagon is essential to mitigate motion artifact from bowel peristalsis. Breeza/VoLumen is important in distending the small bowel so that we can see enhancement of the inner lining of the bowel.

In patients with long standing disease, areas of scarring can develop in the bowel resulting in obstruction. This is known as "chronic fibrostenosing disease." Drinking Breeza/VoLumen helps distend the loops of bowel upstream of a stenotic segment of bowel, thus making the obstructing segment more obvious.

In severe forms of the disease, fistulas and abscesses can develop, known as "penetrating disease." Although the diffusion weighted images may look ugly, they can show an

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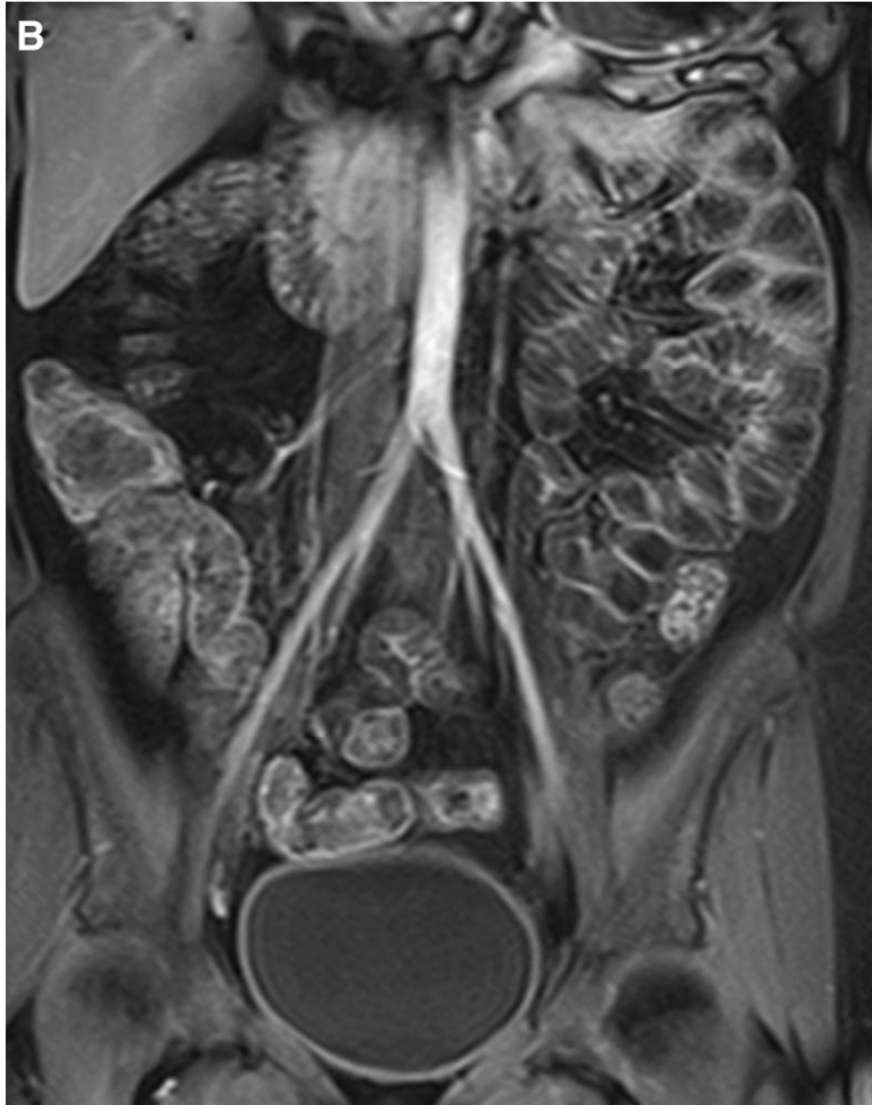
area of “diffusion restriction” (bright on the high b-value images), which may force us to go back and review the other sequences to look for an abscess that we may have mistook for bowel.

Please direct any questions or concerns to any of the body radiologists.

Appendix:

Notes on coverage: To include the small bowel, you **usually** do not need the domes of the diaphragm or the pubic symphysis. Use the axial HASTE/SSFSE/FASE images to narrow the anterior-posterior (AP) coverage of subsequent coronal acquisitions including the VIBE/LAVA/TIGREs. We do not need “skin to skin coverage” in the AP direction. This will help reduce the acquisition time and mitigate respiratory motion artifacts. An example is provided below.

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References

1. Grand, D. J., Guglielmo, F. F. & Al-Hawary, M. M. MR enterography in Crohn's disease: current consensus on optimal imaging technique and future advances from the SAR Crohn's disease-focused panel. *Abdom Imaging* 40, 953–964 (2015).