Peds@CA2 e-News



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The Use of Ultrasound in the Diagnosis of Crohn's Disease

A few years ago, a prominent pediatric gastroenterologist asked me to get involved with a project involving ultrasound of the small bowel in children with Crohn's Disease. Crohn's disease, an autoimmune condition of the gastrointestinal tract, may affect any part of the GI tract, and 80% of pediatric patients have ileal involvement. I was initially a bit pessimistic about the ability of ultrasound to image the small bowel reliably. If one thinks about all of the emergent ultrasound studies performed for appendicitis, one immediately recalls the challenges that are faced: body habitus, ileus or bowel distention with gas, guarding and often the appendix is not imaged reliably. However, after several years of study experience in the patient with Crohn's disease, this imaging modality turns out to be surprisingly useful!

According to the American College of Radiology (ACR) ultrasound may be appropriate in children and adults, citing operator dependence and body habitus as potential limitations of the study. Studies of choice, according to the ACR, are either CT or MR enterography.[13] These modalities give a great overall picture of the contents of the abdomen and pelvis, and reliably detect diseased segments, abscesses, fistulae and bowel obstructions. Moreover, they are able to reliably image

areas that might be hindered by bowel gas even in the morbidly obese patient. However, these screening methods also have notable drawbacks such as high cost, radiation (with CT), limitations in stricturing disease and significant time requirements.

A large volume of literature supports the use of small bowel ultrasound as a first line imaging technique in other parts of the world. Several studies in Europe and Canada have demonstrated small bowel ultrasound to be an effective screening tool with a sensitivity of 77-95% in detecting mucosal involvement in patients with Crohn's disease[1-4]. Other studies demonstrate that it is at least as comparable to those other forms of imaging, including CT and MR. [5,6]

The normal bowel wall demonstrates interfaces between the bowel lumen and mucosa, sub mucosa, muscularis propria along with interfaces between the mesenteric fat and serosa. In patients with Crohn's disease, thickening and loss of bowel stratification can be seen, and a bowel wall thickness >3mm on ultrasound has been shown to be associated with disease[7]. In addition, fibro-fatty proliferation separating the diseased segments of bowel away from the normal loops and the presence of free fluid also aid in imaging. Other sonographic markers of disease in Crohn's patients include stricture or dilation of intestinal lumen, and extra-intestinal abscesses, fistulas, or enlarged lymph nodes. Additionally, the use of Doppler shows actively inflamed segments in the fasting patient.[8-11]

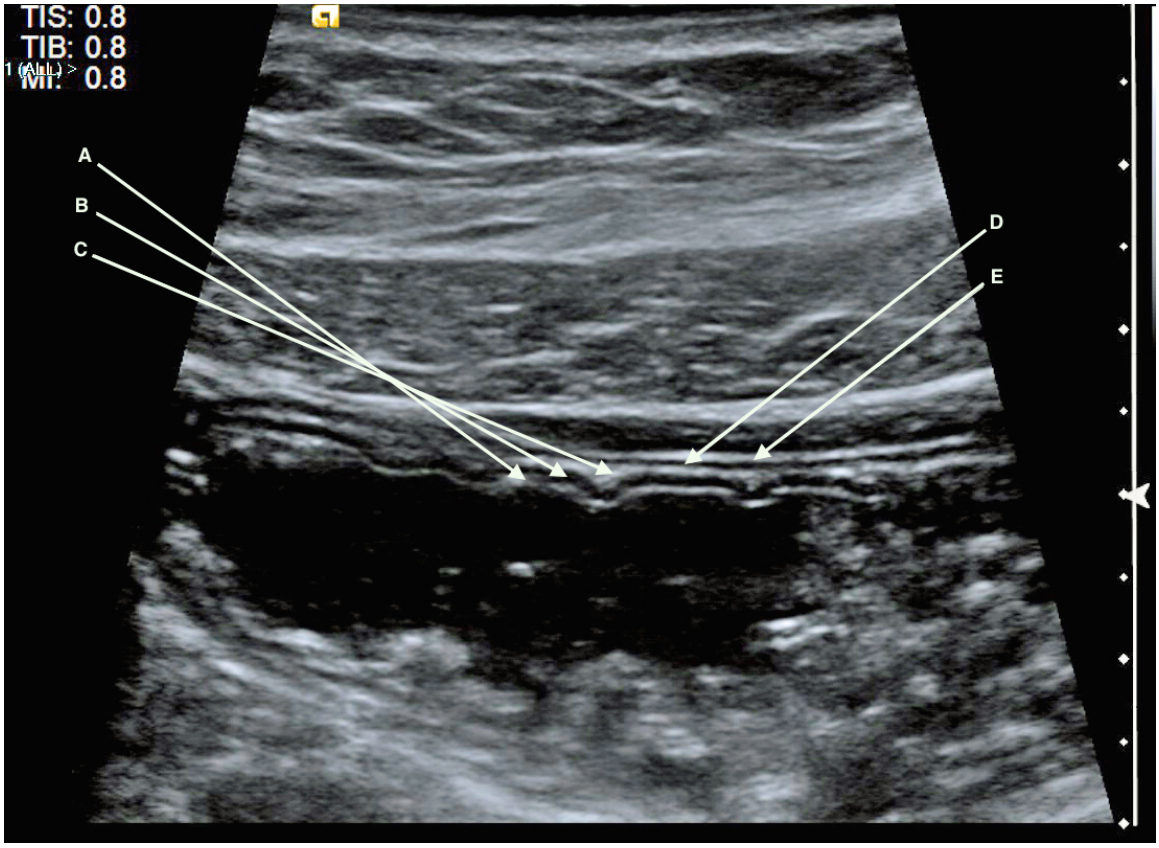


FIGURE 1. Image of the normal stomach demonstrating the normal layers of bowel in general: (A) Innermost echogenic line representing the interface between bowel lumen and mucosa. (B) Hypoechoic mucosa. (C) Hyperechoic submucosa. (D) Hypoechoic muscularis propria. (E) Echogenic Serosa interface with adjacent fat.

Intravenous contrast enhanced ultrasound has been used in Europe with a high degree of sensitivity and specificity identifying diseased segments of bowel, with chronic fibrotic strictures demonstrating less contrast enhancement[12]. Recently, the FDA approved the use of a single ultrasound contrast agent for the use in liver imaging. One hopes that this approval will be expanded to other areas of imaging thereby further reducing the need for ionizing radiation.

Recently, we completed a research study evaluating the use of small bowel ultrasound in Crohn's disease following bowel resection, and the findings of disease on ultrasound were consistent with those on endoscopy. Currently, we are using small bowel ultrasound to evaluate disease status in Crohn's disease patients before

and after initiating medical therapy. Following therapy with biologic therapy in Crohn's patients, with the use of ultrasound, we are seeing a return of the bowel wall stratification and less free fluid. Doppler is routinely used and should it prove to be positive for hyperemia, portends a return of inflammation. Inflammatory strictures with dilated loops of bowel upstream may also be seen.

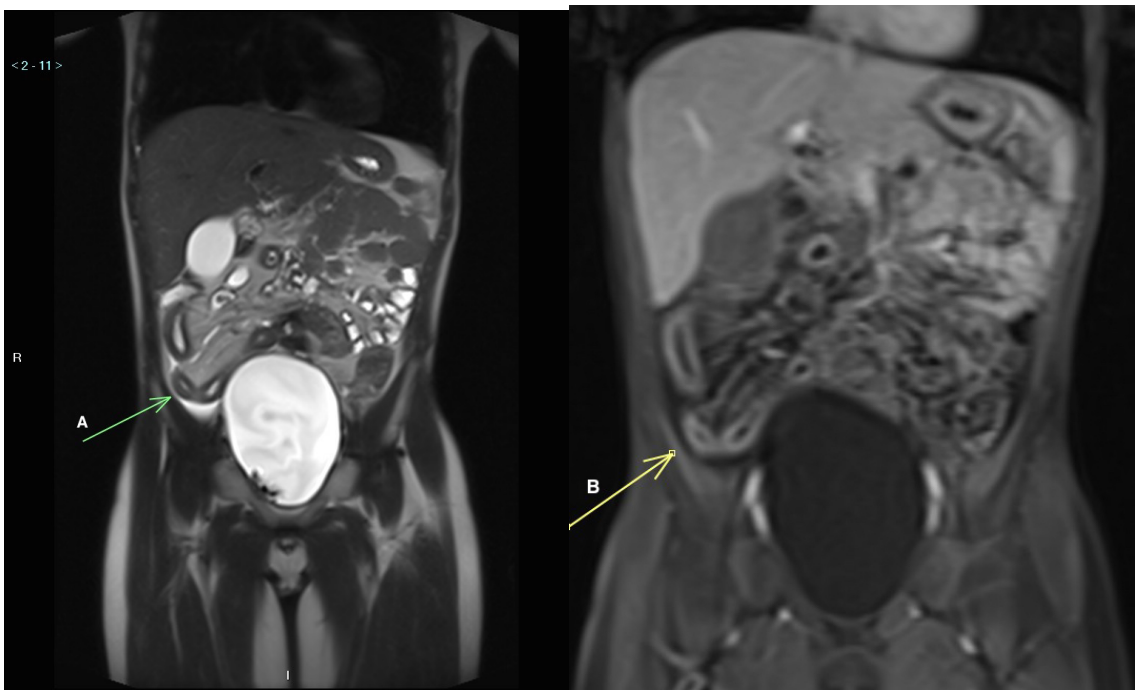
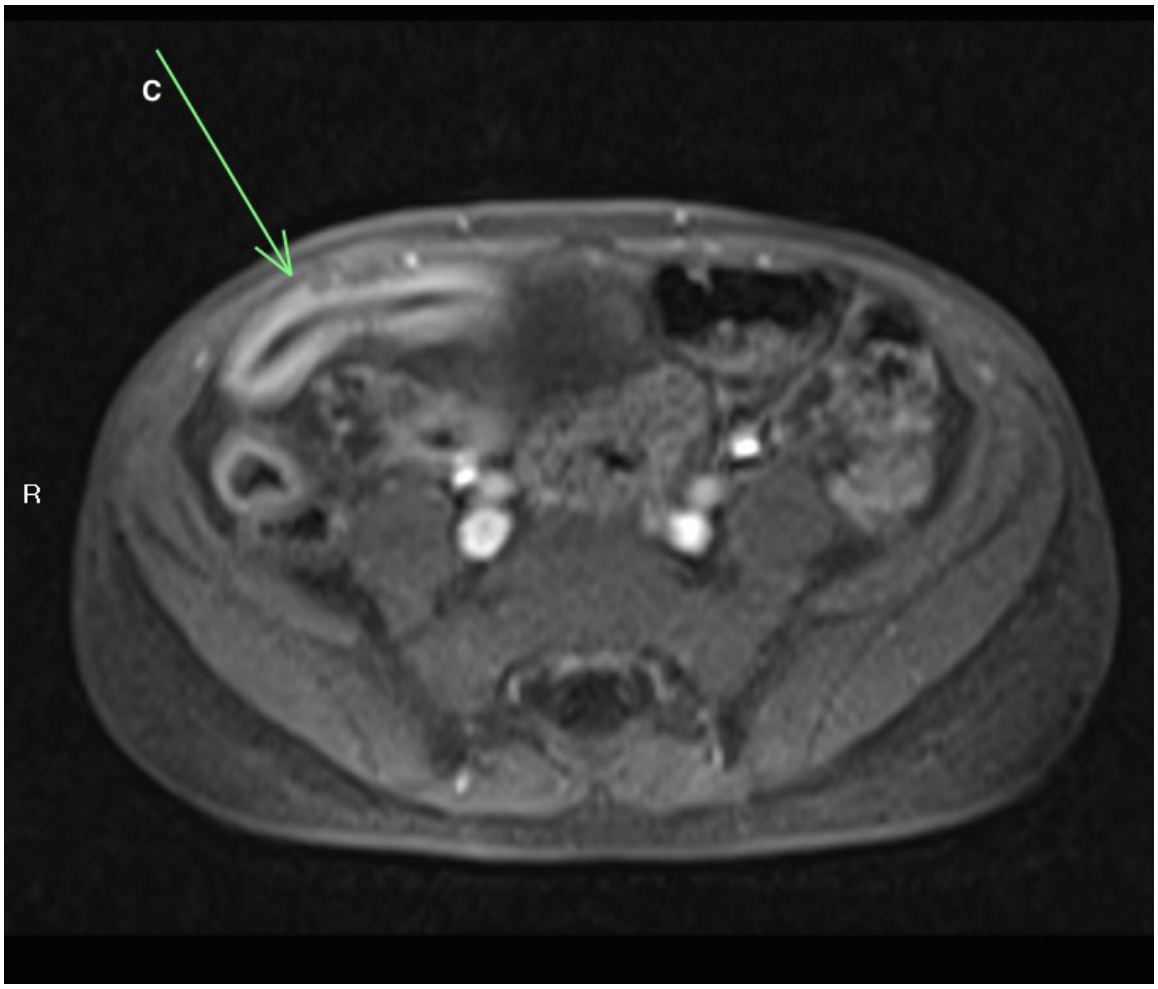


Figure2. MRE of patient with Crohn's Disease. T2 and T1 fat saturated coronal images following gadolinium enhancement. Arrow pointing to affected segment of terminal ileum with adjacent free fluid (A) and abnormal bowel enhancement (B & C).



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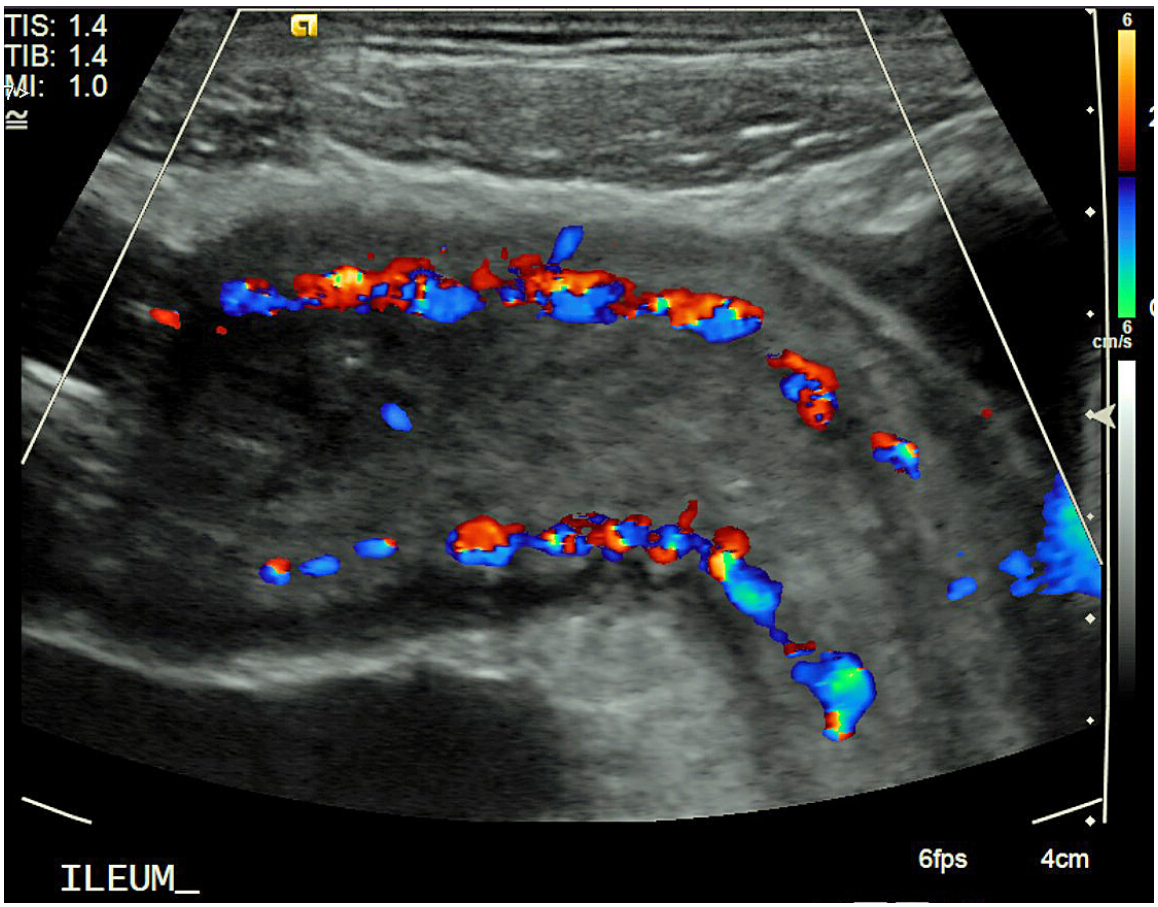

Figure 3. Ultrasound with color Doppler of same patient with Crohn's Disease prior to medical therapy. Note loss of bowel wall signature and hyperemia. This loop of bowel is surrounded by free fluid.

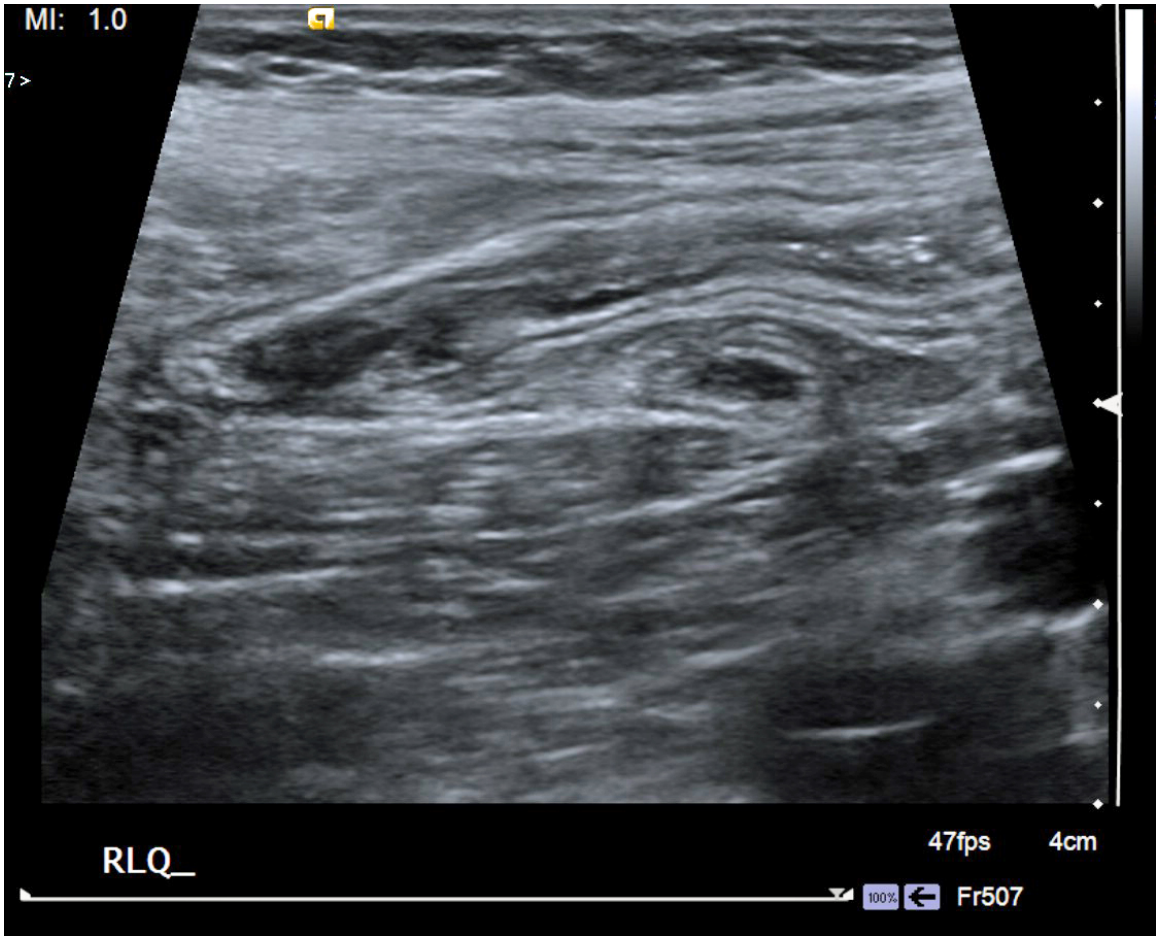

Figure 4. Week 14 after medical therapy. Note return of normal bowel wall signature and the absence of free fluid.

Bowel ultrasound does have a learning curve and requires a radiologist's input. However, with the renewed interest of bowel imaging, our ultrasound technologists are making more concerted efforts to evaluate patients with abdominal pain. They are readily seeing abnormal segments of bowel, thereby making more expeditious diagnoses and improving the quality of patient care. We see the use of small bowel ultrasound as complementary to first imaging studies, and as a non-invasive, cost-effective disease-monitoring tool in Crohn's disease patients.

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