

ADVANCES IN IBD

Current Developments in the Treatment of Inflammatory Bowel Disease

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The Role of Ultrasound in the Management of Inflammatory Bowel Disease



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G&H What are the main applications of ultrasound in the management of inflammatory bowel disease?

SW There are many applications, and they encompass every aspect of inflammatory bowel disease (IBD). An excellent time to perform an ultrasound is when a patient presents with symptoms and there is a question of whether he or she has IBD. Ultrasounds will generally be abnormal in patients who do have IBD and normal in patients for whom there is a different cause for their symptoms. In patients who have received a diagnosis of IBD, for example via colonoscopy or computed tomography (CT) scan, ultrasound is excellent as a staging test to show how much disease there is, where it is located, and how active it is. IBD is a chronic disease and, thus, requires lifetime monitoring; a noninvasive and safe surveillance imaging modality such as ultrasound is ideal to look at the course of a patient's disease over time. When patients have IBD, they are treated with medications to control and hopefully alter the course of their disease. These medications are expensive and are not completely without complication; thus, it would be unconscionable not to know whether patients are responding to these medications or not. An ultrasound can also be performed when patients present with a clinical flare and to evaluate whether patients have complications of disease.

G&H What are the main advantages of using ultrasound in IBD patients?

SW Ultrasound is an excellent test for IBD. It is very accurate for looking at disease activity or intestinal inflammation. It provides exceptional information both about the status of the bowel and the presence of any complications. In my experience, it is very infrequent that magnetic resonance (MR) or CT scans produce findings that are very different from those seen on ultrasound. In addition, ultrasound is very appealing to patients; it does not hurt them, and it is easy to undergo. In fact, patients can undergo ultrasound as many times as needed without any concern.

G&H In your experience, how well does ultrasound correlate with endoscopy and histology?

SW The correlation is good. There has always been an ambition on the part of gastroenterologists to have an imaging test that can replace colonoscopy so that patients do not need to undergo endoscopic study every time they have symptoms. However, it is difficult to obtain corresponding endoscopic and imaging results temporally related without intervention. When a patient presents with symptoms, for example an acute exacerbation of disease, the patient may undergo an ultrasound as well as an endoscopy at the same time. In between these tests, however, there is often an interval during which the patient may be placed on intravenous corticosteroid therapy, which may affect the results of the subsequent test.

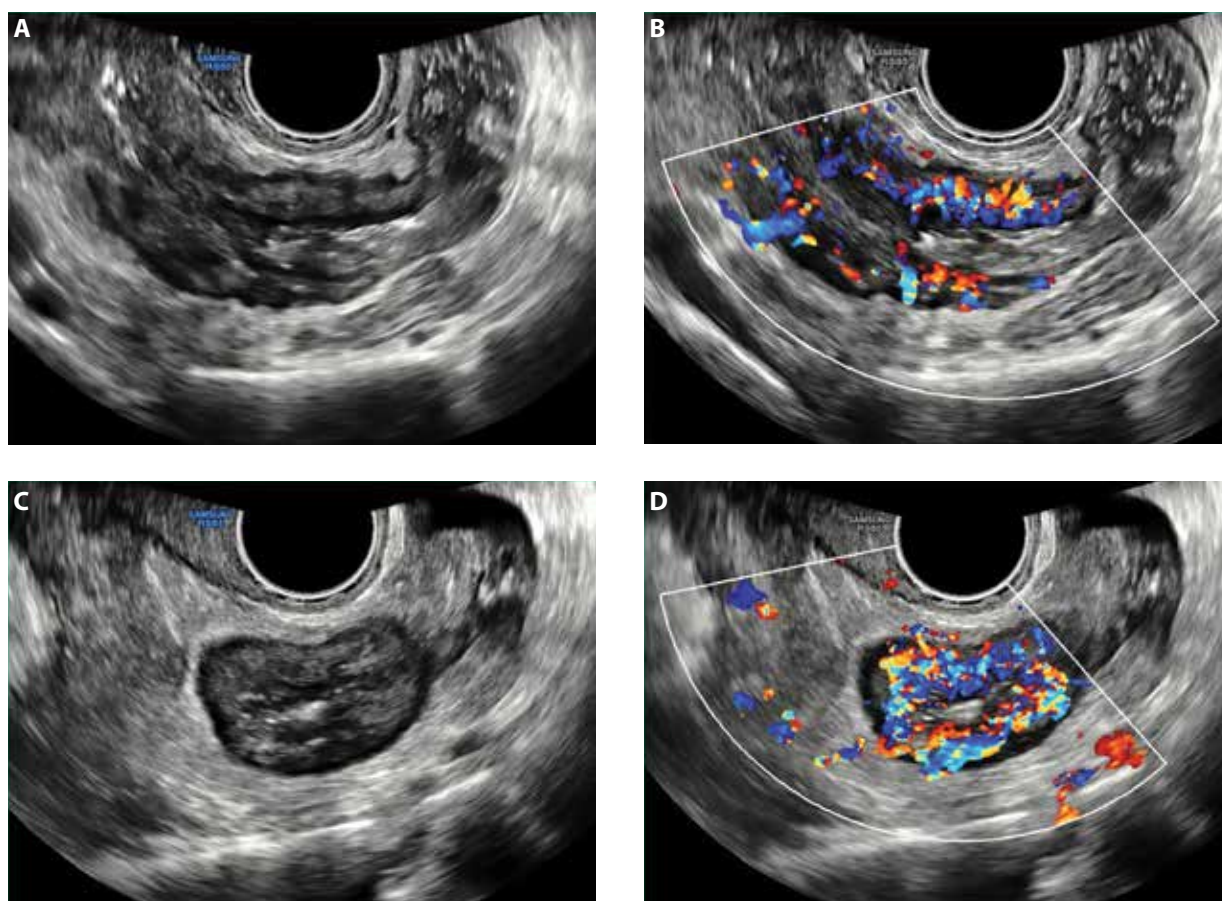


Figure. A young woman with Crohn's disease presents with bloating and abdominal pain. **A** and **C** are greyscale images of the terminal ileum. **B** and **D** are the same images with the addition of color Doppler. In all, the bowel wall is very thick with a spiculated margin. The luminal surfaces are in apposition. There is surrounding echogenic inflammatory fat, and the vascularity, as reflected by the color signals, is profuse. All of the observations increase with escalating inflammatory activity. These images suggest severe active disease.

G&H How does the information provided by an ultrasound compare with the information provided by an endoscopy?

SW In an endoscopic evaluation, the bowel is examined via an instrument that is placed within the bowel lumen, but that instrument cannot see through the bowel. Such evaluation can reveal the status of the lumen as well as of the mucosa, and can show whether there are any mass lesions or ulcerations that affect the mucosa. For example, endoscopic evaluation is good at showing that the lumen is narrowed and that the endoscope cannot pass any further.

An ultrasound provides a transmural evaluation of the bowel. Without needing a contrast agent or radiation, an ultrasound enables visualization of the entire bowel wall from the mucosal surface through to the serosa. It allows for measurement of the thickness of the

bowel wall as the most sensitive feature of inflammatory activity. It also shows luminal apposition, if present, and allows for addition of color Doppler imaging to show the degree of vascularity of the bowel as a reflection of inflammatory activity (Figure). Critically, an ultrasound also shows the status of the perienteric tissues, such as the soft tissues that surround the bowel. Thus, an endoscopy and an ultrasound look for the same type of information but do not look at the same things.

G&H How can ultrasound help differentiate Crohn's disease from ulcerative colitis?

SW There is a long list of features that are specific to Crohn's disease and a shorter list of features that are more specific to ulcerative colitis. Ulcerative colitis is a colonic disease, whereas Crohn's disease can affect any part of the

gastrointestinal tract. During ultrasound evaluation, multiple features are examined, including the distribution of the colonic inflammation, the thickness of the bowel wall, the amount of the blood supply seen with conventional color Doppler imaging, and the status of the perienteric fat and lymph nodes.

Having said that, there is no question that there is an overlap between the diseases, especially when patients have an acute episode of inflammation in their colon. Thus, even though we have good criteria for analysis, they are not always correct. A patient may be thought to have ulcerative colitis and has his or her colon removed and a J-pouch created, but years later the diagnosis may be changed from ulcerative colitis to Crohn's disease. The diagnosis is only a guesstimate. If a person has a secondary diagnosis of Crohn's disease 10 or 15 years later, it is unknown whether the person always had Crohn's disease, despite the helpful information that imaging such as ultrasound can contribute regarding inflammation.

G&H How can ultrasound be used to evaluate response to therapy?

SW Some clinicians have a methodic approach to looking after their patients and follow a time table. When patients are sick and are newly placed on medication, they might come back 6 or 12 weeks later for evaluation of their disease activity. Nonresponders to medication show the same level of disease activity, or worse, unlike patients who respond to their medication. In addition to asking patients how they feel and what their symptoms are, we look at the patients objectively, for example at their bowel wall thickness, inflammatory fat, and the amount of blood flow. Then, we can practically graph the change in patients who are responders. These patients can go from having very severe disease on imaging to, after several years of successful biologic therapy, having scans that may nearly return to normal.

G&H What is the role of ultrasound in terms of detecting postoperative recurrence?

SW There have been multiple articles on this issue. Ultrasound is very good at detecting postoperative recurrence, just like it is at detecting new disease. When a patient undergoes a successful surgical resection, it is very common for the patient to return for a baseline postoperative scan between 3 and 6 months later. This would be a patient who had an uneventful surgery, is improving, and may or may not be back on his or her medication. On the baseline scan, we look to see whether the patient has normal findings or whether there is disease recurrence. The disease has a very strong propensity to return right at

the anastomosis, where the surgery was performed; the disease does not return in a random location. Thus, we know where to look.

G&H How does ultrasound compare with MR or CT enterography?

SW My hospital performs a good deal of MR enterography and, for the last 5 to 7 years, a diminishing amount of CT enterography because of radiation concerns. There are circumstances in my own practice in which I think that using MR enterography might be helpful. However, I am a passionate proponent of ultrasound, and, in my opinion, it is an unusual situation that a person is not well served by undergoing this test. In general, I prefer ultrasound. Although MR enterography is a very good test, it is much more expensive and patients do not like it as much as ultrasound. MR enterography is also more uncomfortable than ultrasound. Some doctors only use MR enterography and consider it to be the gold standard, but I disagree. I think that ultrasound does exceptionally well compared to MR enterography, especially considering their prices.

Doctors also like the results that can be obtained from ultrasound, and its use in IBD has increased. When I came to my hospital, ultrasound was not being used to look at the bowel. Now, 10 years later, the radiology department is extremely busy performing ultrasound examinations in IBD patients and receives referrals from hundreds of doctors not just from Calgary but from the entire southern half of the province.

G&H Which IBD patients are ideal candidates for the aforementioned applications of ultrasound?

SW There is no question that thinner people are more ideal for ultrasound, and heavier people are often scanned well with CT and MR enterography without any significant difference. Occasionally, there may be a struggle using ultrasound with large patients, and North America is experiencing an obesity epidemic. Although IBD patients are not as obese as the general population, they may gain weight on biologic medications and when their symptoms improve and they feel better. Having said that, it is quite unusual that a good ultrasound scan is not possible.

G&H How might a contrast agent help enhance ultrasound?

SW As discussed, disease activity can be estimated by looking at the bowel wall thickness, inflammatory fat,

lymph nodes, and blood flow seen on color Doppler imaging. The addition of a contrast injection allows for a more objective measurement of disease activity. The contrast is injected intravenously into a patient's arm, and enhancement of the bowel is measured using software calculation. For example, a contrast agent can be used to numerically measure a patient's severe active disease at the first visit. When follow-up scans are performed later, the doctor does not need to depend on his or her subjective feelings about whether or not the patient is improving; it is possible to quantify and measure whether the patient is actually improving. There is currently a large emphasis on data and objective measurement in diagnostic imaging.

G&H Are there any disadvantages or risks to using ultrasound in IBD?

SW The risks of any type of ultrasound examination are almost negligible. It is a very safe scan. One disadvantage is that it is not always possible to obtain a good examination. However, that occurs only in rare circumstances, and CT and MR scans do not always produce a good examination either. For example, MR is highly vulnerable to motion artifact; thus, breathing, peristalsis, and patient movement can disrupt an MR scan. CT is more durable than MR in terms of producing those complications, but CT also comes with radiation concerns from patients.

G&H Have there been any recent advances or new techniques involving ultrasound use in IBD patients?

SW Stricture and bowel obstruction are common complications of Crohn's disease. When a patient has symptoms of a stricture (bloating, vomiting, abdominal pain), the clinician wants to know if there is a stricture and whether it is inflammatory, in which case the bowel might respond to medication, or whether it is chronic (ie, related to muscularization or fibrosis of the bowel), in which case medication will not help; the stricture needs to be removed with surgery. When a patient comes in for MR enterography or ultrasound with symptoms suggestive of bowel stricture, it is thus very important to determine whether the stricture is inflammatory or chronic. The ultrasound technique of elastography can be used to try to determine the stiffness

of the stricture. In addition, contrast-enhanced ultrasound can be used to determine the amount of the blood supply in the strictured loop of bowel. My colleagues and I have found, and have published, that bowel that is very stiff is not generally inflamed, so there is no point in treating it medically; it will not improve. It might as well be removed. If, however, the bowel is soft and inflamed, the patient should be placed on aggressive medical therapy to see whether the bowel will respond and improve.

G&H What are the future directions for ultrasound use in IBD patients?

SW Future directions for ultrasound use in IBD will incorporate traditional greyscale and color Doppler imaging with the advanced biomarkers of contrast-enhanced ultrasound and shear wave elastography. The abilities to noninvasively show disease and to predict response to therapy are invaluable. As discussed, ultrasound is safe and provides excellent diagnostic capability in a highly available and cost-competitive technique.

Disclosures

Dr Wilson has no relevant conflicts of interest to disclose.

Suggested Reading

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