

Sonography of the Bowel



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KEYWORDS

• Ultrasound • Crohn disease • Appendicitis

KEY POINTS

- Ultrasound (US) is a safe, radiation-free, and noninvasive method of imaging the bowel.
- The high-resolution capability of US allows for superior visualization of bowel wall layers and pathology without requirement for contrast injection or other specialized techniques.
- The dynamic real-time capability of US allows for assessment of bowel content, caliber, and motion, improving particularly the prediction of bowel obstruction.
- Meta-analysis shows equivalent accuracy of US to computed tomography and magnetic resonance scan for the detection and diagnosis of inflammatory bowel disease.
- In this era of radiation and cost awareness, US should be a first choice for the evaluation of patients with inflammatory bowel disease and acute abdomen of other causes.

 **Videos of CD of Neoterminal ileum (NTI), CD of sigmoid colon, incomplete mechanical bowel obstruction, entero-enteric fistula shown between the thick abnormal terminal ileum in cross-section, perianal fistula shown on transperineal scan, normal and perforated appendix scans accompany this article at <http://www.ultrasound.theclinics.com/>**

INTRODUCTION

The benefits of superb spatial and temporal resolution, which have allowed ultrasound (US) to perform so well in the evaluation of the abdominal and pelvic solid organs, have not been widely shared for the evaluation of the bowel wherein concerns regarding gas artifacts and a fear of unsuccessful examinations have altered its acceptance. These beliefs are inaccurate and today there is keen awareness of radiation risk from computed tomography (CT) scan and cost of imaging tests, both of which have allowed a revival of interest in US of the bowel. This situation is excellent because US has incredible benefits for gut evaluation in multiple different clinical situations, described here.

The Gut Signature

The gut is a continuous hollow tube with 4 *concentric layers* (Fig. 1). From the lumen outward, they are mucosa, submucosa, muscularis propria, and the serosa or adventitia. These histologic layers correspond with the sonographic appearance, as depicted in Fig. 2: the *gut signature*, where up to 5 layers may be visualized. The sonographic layers appear alternately echogenic and hypoechoic: the first, third, and fifth layers are echogenic; the second and fourth layers are hypoechoic. Only US allows for routine resolution of the gut wall layers without the addition of contrast enhancement. In addition to its location, there are other morphologic features that allow recognition of specific portions of the gut, including the gastric rugae,

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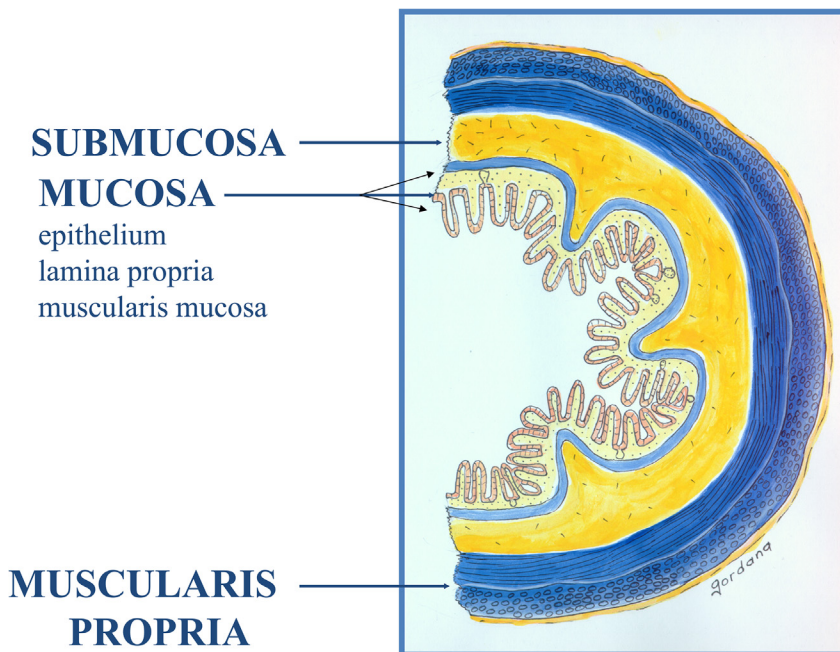


Fig. 1. Schematic depiction of the histologic layers of the gut wall. (From Wilson SR. The gastrointestinal tract. In: Rumack CR, Wilson SR, Charboneau JW, et al, editors. Diagnostic ultrasound. Philadelphia: Elsevier Mosby; 2011. p. 262; with permission.)

the valvulae conniventes, and the colonic haustrations (**Fig. 3**).

A tremendous unique benefit of sonography is its *real-time capability*, allowing for dynamic assessment of the status of the bowel, including its content, its caliber, and its motility, all of which may change with disease.

Gut Wall Pathology

Evaluation of thickened gut on sonography is far superior to the evaluation of normal gut for 2 important reasons. Thick gut, particularly if associated with abnormality of the perienteric soft tissues, creates a “*mass effect*,” which is easily seen on US. In addition, thickened gut is frequently relatively *gasless*, improving its sonographic evaluation. Recognized early was the association of gut pathology with characteristic sonographic appearances, especially the *target pattern*,¹ also described as a *pseudokidney sign*,² whereby the hypoechoic external rim corresponds to thickened gut wall, and the echogenic center relates to residual gut lumen or mucosal ulceration (**Fig. 4**), correctly denoting abnormal bowel in more than 90% of cases.

Identification of *thickened gut on sonography* may suggest a benign or malignant process. *Benignancy* is favored by long segment involvement with concentric thickening and wall layer preservation.

The classic benign pathology showing gut wall thickening is Crohn disease (CD). *Malignancy* is favored by short segment involvement with eccentric disease and wall layer destruction. The classic malignant pathology showing gut wall thickening is adenocarcinoma of the stomach or colon.

Gut wall masses, as distinct from thickened gut wall, may be intraluminal, mural, or exophytic, all with or without ulceration (**Fig. 5**). *Intraluminal gut masses* are mucosal and the most difficult because they may be hidden by gas or luminal content. In contrast, gut pathology creating an *exophytic mass* without or with mucosal involvement or ulceration may form masses that are more readily visualized, including most carcinoids and gastrointestinal stromal (GIST) tumors.

Technique

Routine sonograms of the gut are best performed following an *overnight fast*. In urgent or acute situations, the scan may be performed without any prior preparation. A *real-time survey* of the entire abdomen is first performed with a 3.5- to 5-MHz transducer and obvious masses or gut signatures are observed. The pelvis is scanned before and after bladder emptying. Areas of interest then receive detailed analysis, including *compression sonography* (**Fig. 6**),³ using high-frequency, 5- to 9-MHz, linear or convex linear probes. Normal

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