

## CASE REPORT

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# Sonographic assessment of inflammatory bowel disease in the emergency department: A case series and review of the literature

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## Abstract

The use of sonography for diagnosing inflammatory bowel disease (IBD) has been reported in the radiology literature but is not common practice in the hands of emergency physicians (EPs). We present a series of three cases where IBD was managed by an EP using point-of-care ultrasonography (POCUS), and discuss the sonographic features of IBD including bowel wall thickening, increased blood flow on color Doppler, infiltration of surrounding fatty tissue, and presence of intraperitoneal fluid. Complications such as bowel strictures and peri-colic abscess are also described. We suggest that the use of POCUS for the assessment of IBD patients in the ED may expedite both diagnosis and treatment, as well as minimize the use of additional imaging.

## KEYWORDS

abdomen, emergency department, inflammatory bowel disease, POCUS

## 1 | INTRODUCTION

Inflammatory Bowel Disease (IBD) is caused by a dysregulated immune response. IBD comprises two major disorders: Ulcerative Colitis (UC) and Crohn's Disease (CD). Patients with IBD often present to the emergency department (ED) with nonspecific complaints such as fever, abdominal cramping, painful or urgent defecation, bloody stools, and increased stool burden. IBD (mainly CD) may also cause complications such as intra-abdominal abscesses, strictures, fistulas, and perianal disease. Thus, patients with IBD presenting to the ED commonly require imaging, and currently, the selected modality is usually computed tomography (CT). The risk and dangers of cumulative ionizing radiation are therefore a source of concern in these patients.<sup>1</sup>

Transabdominal ultrasound (US) for investigating colonic pathology may not be common practice, but its utility has been described in the radiology literature since the 1970s.<sup>2</sup> US has been shown to be an accurate modality for the assessment of the bowel of IBD patients in many situations.<sup>3,4</sup> US does not involve the use of ionizing radiation, and it has, therefore, been suggested that it may be preferable for the reevaluation of the disease status of patients with IBD.<sup>3</sup> However, the

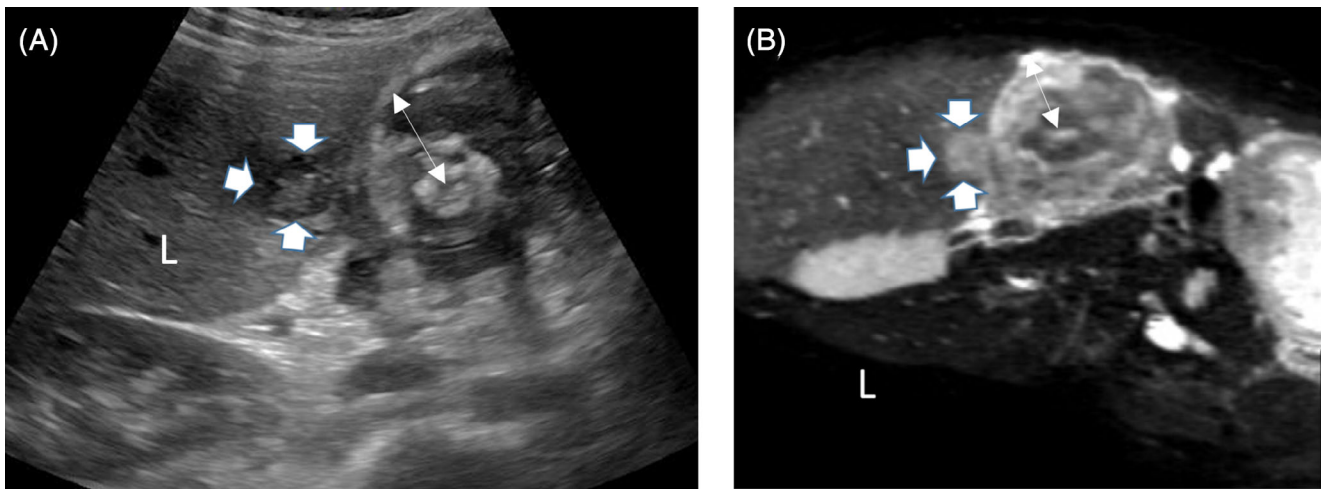
use of point-of-care ultrasonography (POCUS) by the emergency physician (EP) for the assessment of the acute symptoms of patients with IBD in the ED has not been well described.

The following is a series of three cases in which patients presenting with suspected IBD complications were assessed by an EP using POCUS. Ultrasound was performed at the bedside in the ED by the treating physician, using a 1 to 5 MHz curvilinear probe and/or a 4 to 12 MHz linear probe, connected to a LOGIQ e scanner (GE Healthcare, Wauwatosa, WI). All cases were eventually confirmed by computed tomography (CT) or magnetic resonance imaging (MRI). Following the case series, the existing literature describing the evaluation of IBD by US is discussed.

## 2 | CASE SERIES

### 2.1 | Case 1

A 34-year-old 14-weeks pregnant woman, with a history of CD presented to the ED with a 3-month history of recurrent RLQ abdominal



**FIGURE 1** A, Transverse sonogram of the hepatic flexure demonstrating a narrowed lumen, significant thickening of the bowel wall (*double arrow*), and heterogeneous echogenicities in the bowel wall, reflecting inflammatory changes. There is an adjacent hypoechoic, heterogeneous liver lesion suspicious for an abscess (*arrows*). L, liver. B, Abdominal MR fat-suppressed T2 axial image demonstrating similar thickening of the ascending colon (*double arrow*), narrowed lumen and adjacent liver lesion (20 mm in diameter) suspicious for an abscess (*arrows*). L, liver

pain, and fever of 38°C to 39°C. During the 3 weeks prior to her visit, she complained of weakness, sweating, 10 kg weight loss, arthralgias, and morning stiffness.

CD had been diagnosed 7 years earlier. CT performed at that time demonstrated an inflamed ascending colon. Colonoscopy showed mild stricture of the transverse colon, with aphthous ulceration. She was treated with a course of steroids and achieved clinical remission with no further medical treatment for CD until this ED visit.

Physical examination revealed abdominal tenderness with localized peritoneal signs in the right abdomen. Laboratory results were remarkable for a hemoglobin of 9 g/dL, a normal white blood cell count, and a CRP of 10 mg/dL (normal values: 0-0.5 mg/dL). POCUS examination demonstrated thickening of the ascending colon with perihepatic and pelvic intraperitoneal fluid, increased blood flow on color Doppler, and a hepatic lesion (suspected to be an abscess) (Figure 1A). MRI was performed a few hours later demonstrating similar findings (Figure 1B). She was treated for a prolonged period with intravenous antibiotics and total parenteral nutrition with clinical improvement. A follow-up MRI several months later showed resolution of the mass, thus confirming the diagnosis of hepatic abscess.

## 2.2 | Case 2

A 45-year-old woman presented to the ED following 1 month of watery diarrhea and episodes of vomiting. Her past medical history was notable for lymphoma in remission and asymptomatic CD diagnosed 3.5 years earlier on colonoscopy. She had not received any treatment for her CD.

Physical examination revealed a soft, nontender abdomen. Laboratory was notable for a CRP of 8.7 mg/dL. POCUS examination demonstrated small bowel loops distended up to 4 cm, a moderate amount of free fluid, wall thickening up to 7 mm, inflammation and

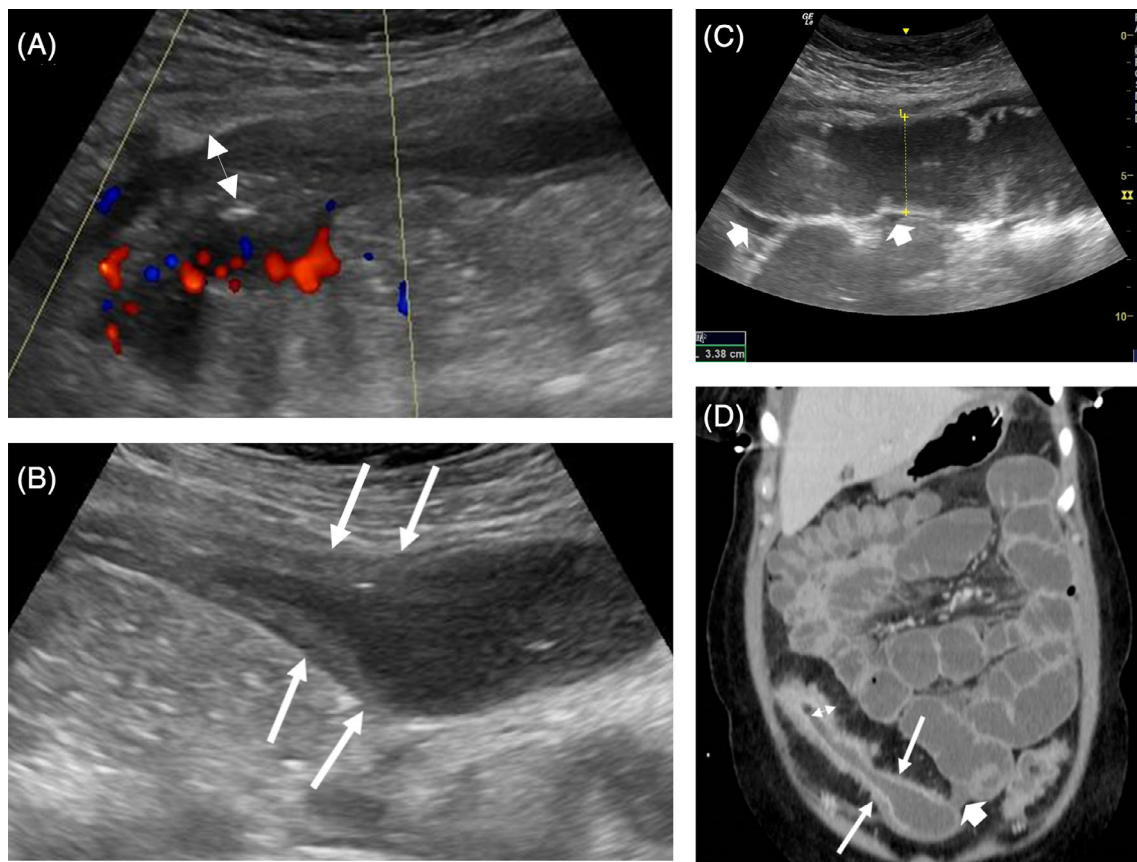
stricture of the ileum and ascending colon with prestenotic dilatation (Figure 2A-C). CT performed 2 hours after the POCUS examination, similarly demonstrated distended small bowel up to 3.5 cm, a moderate amount of free fluid, a stricture, wall thickening, and infiltration of the fatty tissue of the adjacent small bowel and distal ileum (Figure 2D).

The patient initially improved with antibiotics but subsequently relapsed. A colonoscopy was performed, demonstrating terminal ileitis with stenosis. Steroids and later adalimumab (an anti-TNF medication) were added to the treatment regimen. Eight months later the patient returned with similar symptoms. POCUS demonstrated similar findings as 8 months earlier, and it was therefore decided to forego further CT imaging. She improved with conservative treatment.

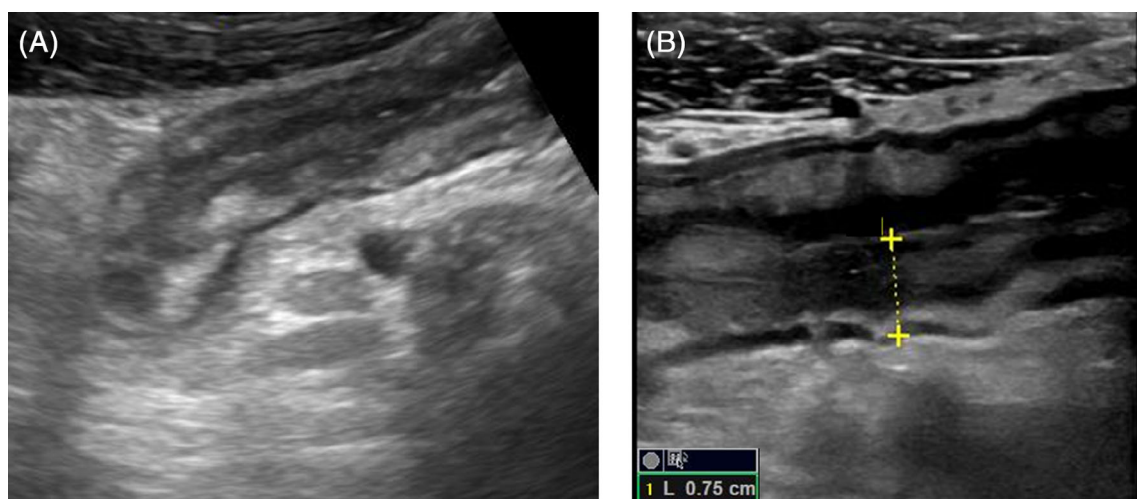
## 2.3 | Case 3

An 18-year-old male with a past medical history of UC that was diagnosed 3 years earlier, presented with 2 weeks of bloody diarrhea, nausea, pain in the left and lower abdomen, and rectal pain. He had been prescribed 5-aminosalicylic acid but was noncompliant with the medication for the past 6 months. On presentation, he was tachycardic, with diffuse abdominal tenderness, maximal in the left lower quadrant. Digital rectal examination was negative for blood, mucous, or signs of a fissure or abscess. POCUS demonstrated thickening of the descending and sigmoid colon up to 7.5 mm with increased echogenicity of the surrounding fatty tissue (Figure 3).

The patient was admitted to the hospital and improved with steroids and antibiotics. During his hospitalization an additional US was subsequently performed by a radiologist, demonstrating a thickened colonic wall without free fluid. Sigmoidoscopy demonstrated a hyperemic, bleeding mucosa, with flat ulcers up to 1 cm in diameter.



**FIGURE 2** A, Color Doppler sonogram of the right lower quadrant, demonstrating thickening of the terminal ileum wall (*double arrow*) with narrowed lumen. Note the bowel wall hyperemia. B, Sonogram shows the transition(*arrows*) between the stenotic terminal ileum and prestenotic dilatation of the distal ileal loop. C, Sonogram shows small bowel loop dilatation up to 3.4 cm with adjacent free peritoneal fluid (*arrows*). D, Reconstructed coronal CT image-demonstrating similar findings as described in A to C



**FIGURE 3** Sonograms of the left lower quadrant obtained with a 1 to 5 MHz curvilinear probe (A) and a 4 to 12 MHz linear probe (B) demonstrating thickening of the wall of the sigmoid colon up to 7.5 mm

### 3 | DISCUSSION

Various imaging modalities are used in the diagnosis and assessment of patients with a suspected exacerbation of IBD.<sup>4,5</sup> These may include CT of the abdomen and pelvis with IV contrast, CT enterography (CTE), MR enterography (MRE), and US. In the emergent setting, CT with IV contrast is generally considered the imaging modality of choice for most assessments needed for IBD patients,<sup>5</sup> as it is generally more readily available in the ED than MRI.

Due to the chronic and relapsing properties of IBD, such patients require recurrent imaging over their lifetime, and may thus be exposed to cumulatively high doses of radiation.<sup>1</sup> MRE and US both have the advantage of being radiation-free; however, MRE is expensive, time-consuming, and often not available in the ED.<sup>6</sup> US, on the other hand, is widely available, cost-effective, and can be rapidly performed at the bedside. Unlike other modalities, it does not require fasting or bowel preparation. It is noninvasive, provides real-time imaging, and is risk-free, thus allowing it to be repeated whenever necessary.<sup>7</sup> US can show both intraluminal and peri-intestinal lesions, and therefore is a particularly valuable tool for the detection of complications of CD, such as stenosis, fistulas, and abscesses.<sup>8</sup> US has been shown to be advantageous for the assessment of pregnant patients with IBD.<sup>9</sup> However, US does not provide a continuous and complete examination of the small and large bowel and cannot reliably visualize some areas.<sup>8,10,11</sup> US can generally be used to visualize the terminal ileum and the colon, but is less effective in visualizing the proximal small intestine and the rectum.

While US is user-dependent,<sup>5,12</sup> it has been shown to have a similar sensitivity and specificity in identifying the presence of IBD compared to MRE and CTE.<sup>3</sup> Comparison between studies is generally easier with other imaging modalities,<sup>4</sup> but some US signs used in IBD can be standardized, and most show fair to good reproducibility.<sup>8</sup> In particular, bowel wall thickness, one of the most relevant parameters for CD detection, has shown excellent reproducibility.<sup>13</sup>

POCUS of the abdomen is most commonly used by EPs to determine if there is evidence of intra-abdominal bleeding after trauma. It may also be used to evaluate for the possible presence of cholecystitis, cholelithiasis, hydronephrosis, or an enlarged abdominal aortic aneurysm. More recent applications include cases of suspected bowel obstruction, hernia, diverticulitis, pneumoperitoneum, and appendicitis.<sup>14</sup> However, the use of POCUS for the assessment of the patient with IBD in the ED is not considered common practice.

POCUS performed by gastroenterologists for IBD patients has been described in some studies. For example, in one report POCUS performed by a highly experienced gastroenterologist was shown to accurately detect trans-mural inflammation of the intestine, thus differentiating between patients with IBD and irritable bowel syndrome.<sup>15</sup> While commonly used by gastroenterologists in some countries, such as Germany and Italy, the dissemination of US for the assessment of IBD remains limited in the rest of the world.<sup>7</sup> Most studies describing the use of POCUS for IBD did not consistently report the experience or training of the clinicians performing the examination,<sup>3</sup> and large studies evaluating POCUS by ED physicians to assess IBD have yet to be performed.

A recent review has claimed that ultrasonography should not be considered a first-line imaging test in adults with CD presenting to the ED.<sup>16</sup> However, a previous case series describes the use of POCUS for the detection of all types of colitis in the ED, including one case suspicious for CD according to POCUS findings and later confirmed by pathology to be CD.<sup>17</sup> An additional recent case series demonstrated the utility of POCUS for the assessment of uncomplicated diverticulitis in the ED and suggested that POCUS may decrease the ED length of stay and the radiation exposure of such patients.<sup>18</sup> The current case series further demonstrates that POCUS may also be used in the ED for the assessment of patients with known IBD for the detection of complications, and to support clinical decision making at bedside. This case series suggests that the use of US may be advantageous at the patient's bedside in the ED, leading to an accurate, rapid diagnosis, as well as avoiding ionizing radiation.

In conclusion, while ED POCUS will not replace definitive imaging modalities for IBD patients, it may assist in ED decision making. It may shorten the assessment of these patients in the ED, and shorten the time to appropriate treatment. It may also reduce the need for radiation exposure in the ED (as demonstrated in Cases 1 and 3). Training of EPs in proper technique, along with future research of the use of POCUS in the ED for the assessment of patients with IBD is needed.

#### CONFLICT OF INTEREST

The authors declare no conflict of interest.

#### DATA AVAILABILITY STATEMENT

Data sharing is not applicable to this article as no new data were created or analyzed in this study.

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#### REFERENCES

1. Haas K, Rubesova E, Bass D. Role of imaging in the evaluation of inflammatory bowel disease: how much is too much? *World J Radiol.* 2016;8:124-131.
2. Fleischer AC, Muhletaler CA, James AE Jr. Sonographic assessment of the bowel wall. *AJR Am J Roentgenol.* 1981;136:887-891.
3. Horsthuis K, Bipat S, Bennink RJ, Stoker J. Inflammatory bowel disease diagnosed with US, MR, scintigraphy, and CT: meta-analysis of prospective studies. *Radiology.* 2008;247:64-79.
4. Panes J, Bouhnik Y, Reinisch W, et al. Imaging techniques for assessment of inflammatory bowel disease: joint ECCO and ESGAR evidence-based consensus guidelines. *J Crohns Colitis.* 2013;7:556-585.
5. American College of Radiology. ACR Appropriateness Criteria on Crohn's disease. <https://acsearch.acr.org/docs/69470/Narrative/> Accessed April 14 2020.
6. Maconi G, Bolzoni E, Giussani A, Friedman AB, Duca P. Accuracy and cost of diagnostic strategies for patients with suspected Crohn's disease. *J Crohns Colitis.* 2014;8:1684-1692.
7. Asthana AK, Friedman AB, Maconi G, et al. Failure of gastroenterologists to apply intestinal ultrasound in inflammatory bowel disease in the Asia-Pacific: a need for action. *J Gastroenterol Hepatol.* 2015;30:446-452.

8. Strobel D, Goertz RS, Bernatik T. Diagnostics in inflammatory bowel disease: ultrasound. *World J Gastroenterol*. 2011;17:3192-3197.
9. Leung Y, Shim HH, Wilkens R, et al. The role of bowel ultrasound in detecting subclinical inflammation in pregnant women with Crohn's disease. *J Can Assoc Gastroenterol*. 2019;2:153-160.
10. Parente F, Greco S, Molteni M, et al. Role of early ultrasound in detecting inflammatory intestinal disorders and identifying their anatomical location within the bowel. *Aliment Pharmacol Ther*. 2003;18:1009-1016.
11. Gomollón F, Dignass A, Annese V, et al. 3rd European evidence-based consensus on the diagnosis and Management of Crohn's disease 2016: part 1: diagnosis and medical management. *J Crohns Colitis*. 2017;11:3-25.
12. Moore CL, Copel JA. Point-of-care ultrasonography. *N Engl J Med*. 2011;364:749-757.
13. Fraquelli M, Sarno A, Girelli C, et al. Reproducibility of bowel ultrasonography in the evaluation of Crohn's disease. *Dig Liver Dis*. 2008;40:860-866.
14. Ultrasound guidelines: emergency, point-of-care and clinical ultrasound guidelines in medicine. *Ann Emerg Med*. 2017;69:e27-e54.
15. Novak KL, Jacob D, Kaplan GG, et al. Point of care ultrasound accurately distinguishes inflammatory from noninflammatory disease in patients presenting with abdominal pain and Diarrhea. *Can J Gastroenterol Hepatol*. 2016;2016:4023065.
16. Griffey RT, Fowler KJ, Theilen A, Gutierrez A. Considerations in imaging among emergency department patients with inflammatory bowel disease. *Ann Emerg Med*. 2017;69:587-599.
17. Granat N, Gabrieli S, Alpert EA. Point-of-care ultrasound to diagnose colitis in the emergency department: a case series and review of the literature. *J Emerg Med*. 2019;58:77-84. <https://doi.org/10.1016/j.jemermed.2019.08.035>.
18. Shokoohi H, Nasser S, Pyle M, Earls JP, Liteplo A, Boniface K. Utility of point-of-care ultrasound in patients with suspected diverticulitis in the emergency department. *J Clin Ultrasound*. 2020;48:337-342.

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