

SONO case series: 59-year-old woman with abdominal pain and bloating

CASE PRESENTATION

A 59-year-old woman presents to the emergency department with 3 days of diffuse abdominal pain with profuse nausea and vomiting. The pain came on gradually and worsens after eating. The patient's last bowel movement was 3 days ago and she has not passed gas in a day. She has not had any fever, blood in her stool or vomit, or any urinary discomfort.

Past medical history—dyslipidaemia, hypothyroidism. Past surgical history—partial bowel resection after bowel obstruction 40 years ago. Medications—levothyroxine, ezetimibe, rosuvastatin, aspirin.

TRIAGE VITAL SIGNS

Blood pressure 140/77 mm Hg, heart rate 94 bpm, temperature 36.8°C, respiratory rate 18, oxygen saturation 96%.

PHYSICAL EXAMINATION

An uncomfortable appearing patient with mild tenderness to palpation in all abdominal quadrants, and maximal tenderness in the left lower quadrant without guarding. The patient's abdomen is non-distended but is tympanic to percussion.

QUESTIONS

1. What is the usefulness of point-of-care ultrasound (POCUS) in the evaluation for suspected small bowel obstruction (SBO)?

SBO is one of the most common intestinal emergencies, accounting for 15–20% of all patients admitted to surgical wards from the emergency department.^{1,2} CT is the 'gold standard' imaging modality for suspected SBO given its superior diagnostic accuracy, its ability to differentiate between ileus and obstruction, and its capacity to identify signs of intestinal ischaemia suggesting a need for emergent surgery.^{3–5} However, CT is costly and time intensive, exposes the patient to ionising radiation and may not be universally available. In view of these limitations, abdominal radiography is a commonly used examination for SBO despite being only 50–70% sensitive for detecting obstruction.^{1,6–9}

In contrast, bedside ultrasound has emerged as an ideal screening modality for SBO, with many studies demonstrating a sensitivity of 91–100% in comparison with CT.^{1,4,6,9,10} POCUS is more sensitive than radiography for detecting SBO, and can also identify findings such as decreasing peristalsis, bowel wall oedema and extraintestinal fluid collections, which may require urgent surgical intervention.^{7,11,12} In the hands of a trained operator, POCUS can also identify alternative causes of abdominal pain, such as renal stones, abdominal aortic aneurysm, appendicitis, cholecystitis or perforated viscus.^{4,5,13} The largest meta-analysis to date evaluating POCUS performed by emergency providers found that bedside ultrasound was 92.4% sensitive and 96.6% specific than radiography in detecting SBO, though specificity may be lower for novice sonographers.^{2,14} Bedside ultrasound may also be performed serially to evaluate the resolution of obstruction in patients being managed non-operatively.^{7,15}

2. What is the appropriate technique for performing a POCUS evaluation for suspected SBO?

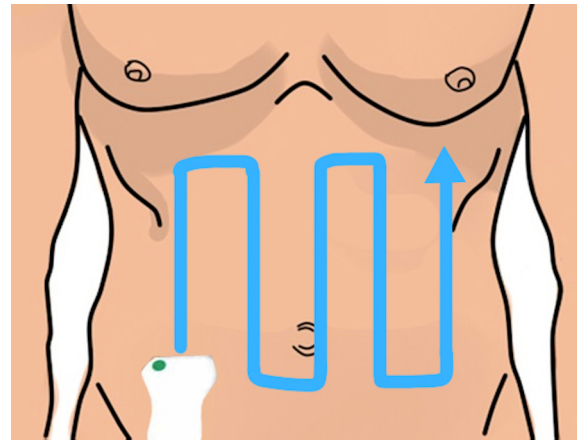
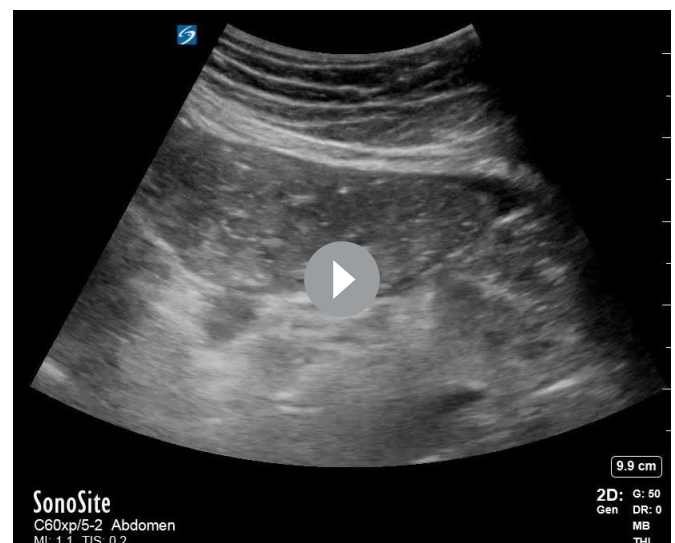


Figure 1 Lawnmower technique for abdominal sonography.

In most adults the intestines are best imaged using a low-frequency (2–5 MHz) curvilinear transducer, though a high-frequency (7–15 MHz) linear transducer may be appropriate for children or thin patients. With the patient recumbent or semi-supine, begin the examination by placing the probe over the patient's right lower quadrant with the probe indicator facing the patient's right side. A 'lawnmower' technique can be used to image the entire abdomen, moving the transducer vertically in a series of parallel columns (figure 1). Maintaining continuous downward pressure on the transducer helps to displace superficial bowel gas and improves visualisation. A normal small bowel will typically appear as a hypoechoic muscular wall surrounding a mixed collection of anechoic fluid and hyperechoic stool and bowel gas causing posterior shadowing (video 1). Once identified, small bowel segments should be measured from outer wall to outer wall (figure 2). A bowel measuring >2.5 cm is considered abnormally dilated.^{9,14} Any area of dilated bowel should be evaluated for secondary signs of obstruction, including abnormal peristalsis, bowel wall thickening, and extraintestinal fluid collections. A bowel wall measuring >3 mm is considered abnormally thickened and is suggestive of intestinal ischaemia.⁸ In SBO, the normal unidirectional intestinal peristalsis is altered. Hyperactive peristalsis is typically readily apparent proximal to the obstruction, with bidirectional flow of intestinal contents termed



Video 1 Dilated small bowel.



Figure 2 Dilated small bowel.

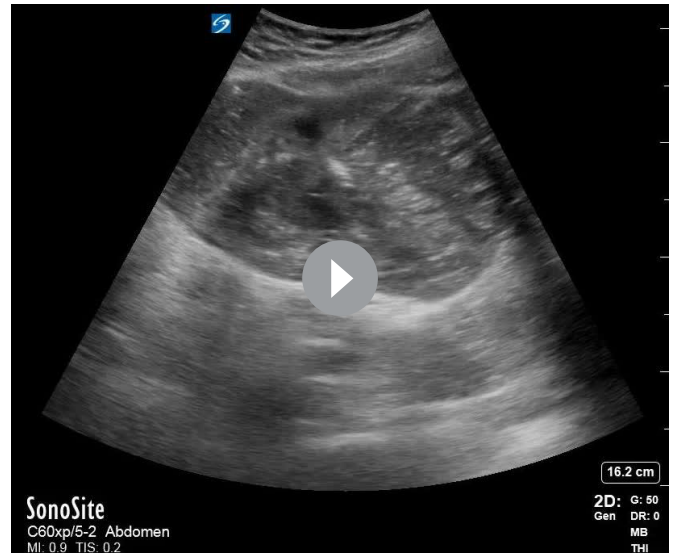
'to-and-fro' peristalsis (videos 2 and 3).^{19 16} In patients with a closed loop or severe obstructions or in those with a delayed presentation, peristalsis may be reduced or completely absent, indicating development of intestinal ischaemia.^{8 11} The presence of extraintestinal fluid collections, appearing as anechoic regions having sharp edges and dissecting between adjacent bowel loops, suggests intestinal infarction and a likely need for surgical intervention (videos 4 and 5).^{8 11 12}

3. What sonographic abnormalities are seen in this patient's study? (figures 2 and 3, videos 1–5)

Multiple dilated loops of the small bowel are found, measuring up to 3.6 cm in the lower abdomen with to-and-fro peristalsis (figure 2, videos 2 and 3). Multiple collections of anechoic extraluminal fluid are seen, dissecting the loops of the distended bowel (videos 4 and 5). The bowel wall appears prominent, but its measurement is at the upper limit of normal (3 mm; figure 3).

4. What is the most likely diagnosis?

The patient's ultrasound image is consistent with a diagnosis of high-grade SBO. The presence of some normal calibre loops of the small bowel containing air suggests (video 4) that a transition point exists, although none is definitively identified in this study. The patient underwent CT, which showed high-grade SBO with loops of the bowel measuring up to 4.2 cm and

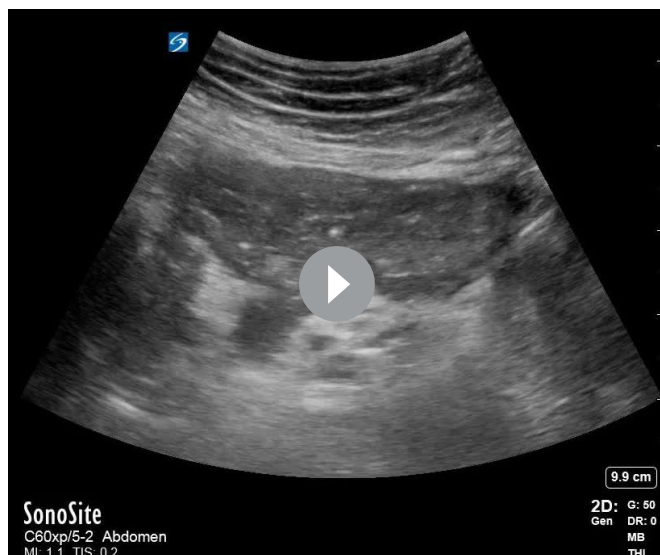


Video 3 To-and-fro peristalsis.

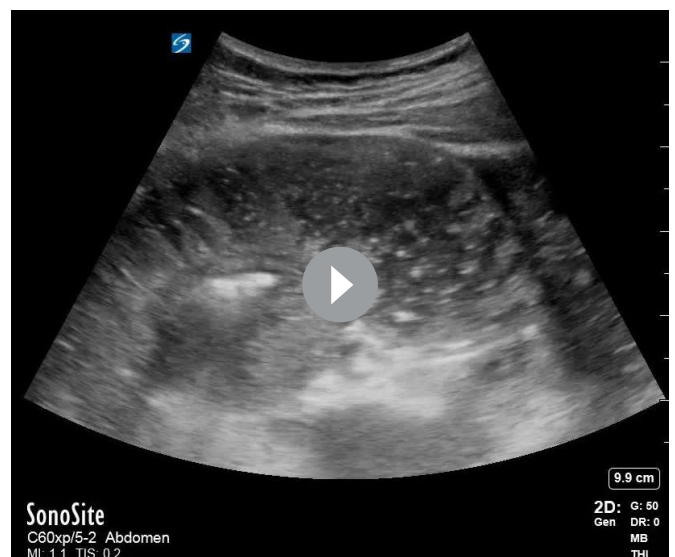
a transition point identified above the bladder. Interloop fluid was noted between distended bowel segments, though no focal bowel wall thickening or other evidence of bowel infarction was noted.

5. What pitfalls are commonly encountered in performing a bedside ultrasound examination for SBO?

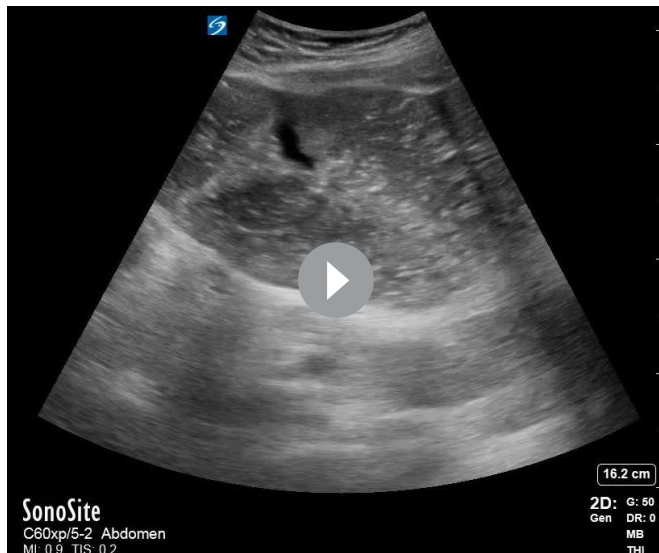
The major limitation of POCUS for SBO is its inability to differentiate accurately between ileus and obstruction, or to identify a cause of the obstruction in most cases.^{9 17} Therefore, although POCUS is useful in screening for SBO, it is not recommended as a primary diagnostic modality except where CT is unavailable or is otherwise contraindicated.^{3 9} It may be difficult to distinguish between small and large bowels on bedside ultrasound. Typically the small bowel can be differentiated from the large bowel by its smaller calibre, its more central location in the abdomen, and its peristaltic activity, which is not normally visible in the large bowel.¹⁸ Plicae circulares (figure 3; arrows) seen as luminal folds extending across the entire small bowel lumen can help to identify the duodenum and jejunum. The plicae are often



Video 2 To-and-fro peristalsis.



Video 4 Dilated small bowel with altered peristalsis anterior to normal calibre bowel. Extraintestinal fluid collection.



Video 5 Altered peristalsis. Extraintestinal fluid collection.

oedematous and more prominent when there is obstruction, and their presence within dilated loops of bowel may help to localise a transition point.^{8 9} In contrast, the haustra seen in the large bowel cause depressions in the outer bowel wall contour and do not extend across the entire lumen.¹⁸

As with all POCUS studies, the diagnostic accuracy of ultrasound for SBO depends on the skill and knowledge of the operator. Fortunately, the often strikingly abnormal findings and clarity of abdominal imaging that is afforded by the presence of copious intraluminal and extraluminal fluid in the setting of SBO can make this examination relatively easy to learn. A 2011 study found that after a 10 min training session and performance of five proctored bedside examinations, emergency medicine residents were readily able to detect SBO on POCUS with 94% sensitivity and 81% specificity.¹ Subsequent studies have found even more impressive accuracy by residents who performed scans after a single training session.¹⁹

CONCLUSION

Nasogastric decompression therapy was initiated in the patient, who was admitted to the general surgical service for monitoring. A non-operative approach to management was adopted given the patient's history of prior obstruction and resection, and she was discharged on hospital day 6 with

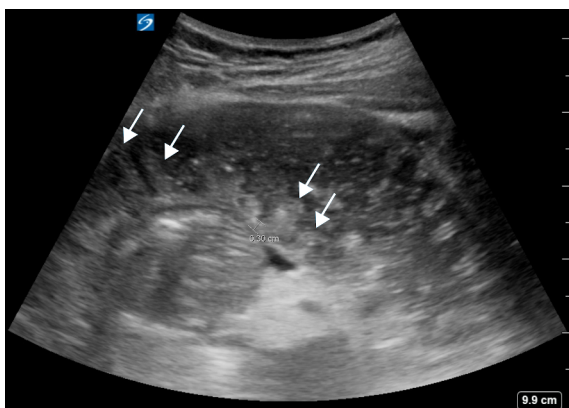


Figure 3 Plicae circulares and bowel wall thickness measurement.

successful resolution of the obstruction and return of normal bowel function.

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