

Diagnosis of small bowel obstruction and acute appendicitis with USG

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Introduction

- Small bowel obstruction is a common challenge for the emergency physician
- These patients comprise approximately 2% of all abdominal pain visits to the emergency department
- Abdominal pain, abdominal distension, nausea, vomiting, and past history of intra-abdominal surgeries causing adhesions should raise the EP's suspicion.

Diagnostic imaging for SBO

- Plain radiographs: Air-fluid levels and dilated loops of bowel
- CT: The location of the transition point and potential causes
- MRI; Requires significant time out of the ED, not readily available, significantly increased cost.

USG for SBO

- The use of ultrasound for the diagnosis of SBO is a relatively new concept
- In a recent meta-analysis, it is reported that US had better test characteristics than radiographs, CT or MRI.
- The LR + was 14.1 for radiology US and 9.55 for clinical US, compared to 1.6 for radiographs, 3.6 for CT, and 6.8 for MRI.

(Taylor MR, Lalani N. Adult Small Bowel Obstruction. Acad Emerg Med. 2013;20:528-44.)

USG- advantages

- The ability to perform at the bedside
- Visualize abnormal peristalsis,
- Low cost,
- Fast,
- Repeatable,
- Easy to learn,
- Lack of contrast or radiation exposure...

Technique

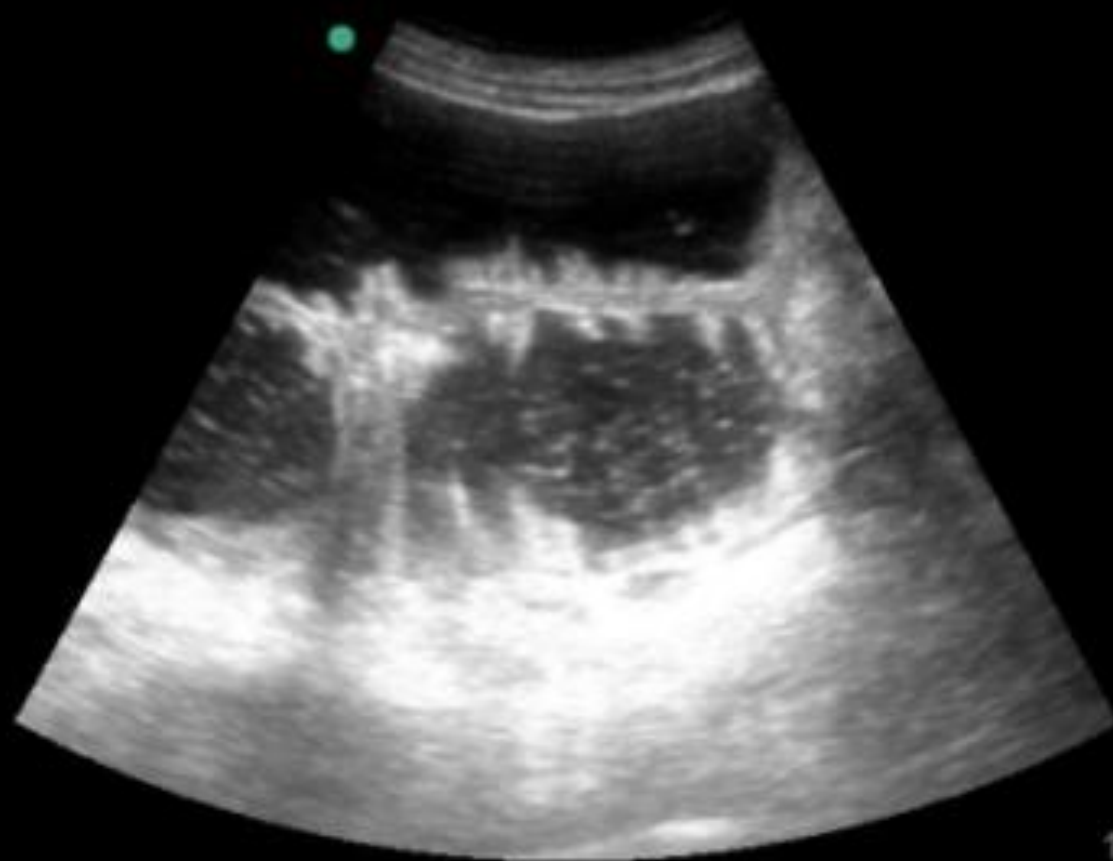
- Either the curvilinear or phased-array probes can be used.
- High-frequency linear probes have also been used successfully to diagnose intestinal obstructions.
- Multiple regions of the abdomen should be assessed, including the epigastrium, bilateral colic gutters, and suprapubic regions.



Is it jejunum or ileum?

- Jejunum will have prominent and numerous valvulae conniventes,
- The ileum will lack valvulae conniventes.

THI
MB



USG- Pathological findings

- Fluid-filled and dilated small bowel loops (>2.5 cm)
- Increased intestinal contents (fluid and echogenic material within the lumen of the bowel)
- Increased peristalsis of the dilated segment
- To-and-fro or whirling motion of the bowel contents
- *The most sensitive and specific sonographic finding is the presence of dilated small bowel loops*

USG- Pathological findings

- Fluid-filled distended bowel with **extraluminal free fluid** between bowel loops or;
- No peristalsis
- Bowel **wall thickening > 3mm**



- *May suggest bowel ischemia/infarction requiring even more urgent surgical evaluation and intervention.*

TANGA SIGN



The relevance of free fluid | X

← → ↻ Güvenli | https://www.ncbi.nlm.nih.gov/pubmed/15093230

Eur J Radiol. 2004 Apr;50(1):5-14.

The relevance of free fluid between intestinal loops detected by sonography in the clinical assessment of small bowel obstruction in adults.

Grassi R¹, Romano S, D'Amario F, Giorgio Rossi A, Romano L, Pinto F, Di Mizio R.

⊕ Author information

Abstract

INTRODUCTION: The main role of the radiologist in the management of patients with suspicion of small bowel obstruction is to help triage patients into those that need immediate surgical intervention from those that require medical therapy or delayed surgery. Ultrasound examination is usually considered not helpful in bowel obstruction because of air in the intestinal lumen that interferes the evaluation of the intestinal loops, however recently some Authors attested the increasing important role of sonography in the acute abdominal disease. Aim of our report is to demonstrate the value of free fluid detected by US in differentiating between low and high-grade small bowel obstruction.

MATERIALS AND METHODS: The study is based on 742 consecutive patients who presented symptoms of the acute abdomen; all patients had undergone initial serial abdominal plain film and US examinations prior to any medical intervention. We reviewed the imaging findings of 150 cases in whom small bowel obstruction was clinically suspected and confirmed at surgery. We consider the following radiographic and US findings: dilatation of small bowel loops; bowel wall thickness; presence of air-fluid levels; thickness of valvulae conniventes; evidence of peristalsis; presence and echogenicity of extraluminal fluid. We looked at the value of extraluminal peritoneal fluid at US examination in differentiating low and high-grade small bowel obstruction based on the surgical outcome.

RESULTS: In 46 patients altered peristaltic activity, thin bowel walls, fluid filled loops with hyperechoic spots in the bowel segment proximal to obstruction were noted at US, whereas radiographic features were: moderate dilatation of small bowel loops, with thin bowel wall and evidence of numerous and subtle valvulae conniventes; presence of air-fluid levels was also noted. In 70 other patients, US examination revealed all the findings described in the precedent cases and also the presence of free extraluminal fluid; abdominal plain film showed an increased dilatation of small bowel loops with moderate thickened wall and air-fluid levels. In 34 other patients US examination revealed the presence of thick-walled loops, hypoperistalsis and a larger amount of free extraluminal fluid. Radiographic findings in these patients were: horizontal featured and markedly dilated small bowel loops presenting parietal thickness, presence of intraluminal fluid stasis and evidence of thickened, sparse and incomplete valvulae conniventes. At surgery etiology of small bowel obstructions was various, but most of cases related to adhesions (70 cases). The presence of extraluminal fluid were confirmed at surgery in 104 patients.

CONCLUSIONS: Our experience using sonography in suspicion of SBO (small bowel obstruction) suggests the usefulness of this imaging modality to differentiate a functional or obstructive ileus, demonstrating the evidence of intestinal peristalsis. Furthermore, the presence of a large amount of fluid between dilated small bowel loops suggests worsening mechanical small bowel obstruction, that requires not a medical therapy but immediate surgery.

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Eur J Emerg Med. 2010 Oct;17(5):260-4. doi: 10.1097/MEJ.0b013e328336c736.

Ultrasonography by emergency medicine and radiology residents for the diagnosis of small bowel obstruction.

Ünlüer EE¹, Yavaş O, Eroğlu O, Yılmaz C, Akarca FK.

Author information

Abstract

OBJECTIVE: Our objective was to study the accuracy of emergency medicine [(EM) bedside ultrasonography (BUS)] and radiology residents performed ultrasonography (RUS) in patients with suspected mechanical small bowel obstruction (SBO).

METHODS: After a 6-h training program, from January to June 2009, four EM residents used BUS to prospectively evaluate the patients presenting to the emergency department with suspected SBO. Then, patients underwent RUS. Outcome was determined by surgical findings if they were operated upon or self-reported the condition upon telephone follow-up at 1-month. BUS and RUS results were compared with chi2 testing.

RESULTS: Of the 174 enrolled patients, 90 patients were BUS-positive. Of these, surgical findings agreed with the BUS findings in 84 patients. In 78 cases, BUS was negative, and 76 of these patients had benign clinical courses. Six patients were excluded from the study. The sensitivity, specificity, positive predictive value, negative predictive value, and likelihood ratio for BUS were 97.7, 92.7, 93.3, 97.4, and 13.4%, respectively. Sensitivity, specificity, positive predictive value, and negative predictive value for RUS were 88.4, 100, 100, and 89.1%, respectively. The diagnostic accuracy of BUS and RUS were not statistically different from each other (kappa=0.81). The presence of dilated small bowel loops (>25 mm in jejunum or >15 mm in ileum) was the most sensitive (94%) and specific (94%) sonographic finding for SBO.

CONCLUSION: Abdominal sonography for the diagnosis of SBO is a new application of BUS in the emergency department. EM residents can diagnose SBO using BUS with a high-degree of accuracy, comparable with that of radiology residents.

PMID: 20216422 DOI: 10.1097/MEJ.0b013e328336c736

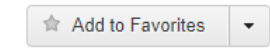
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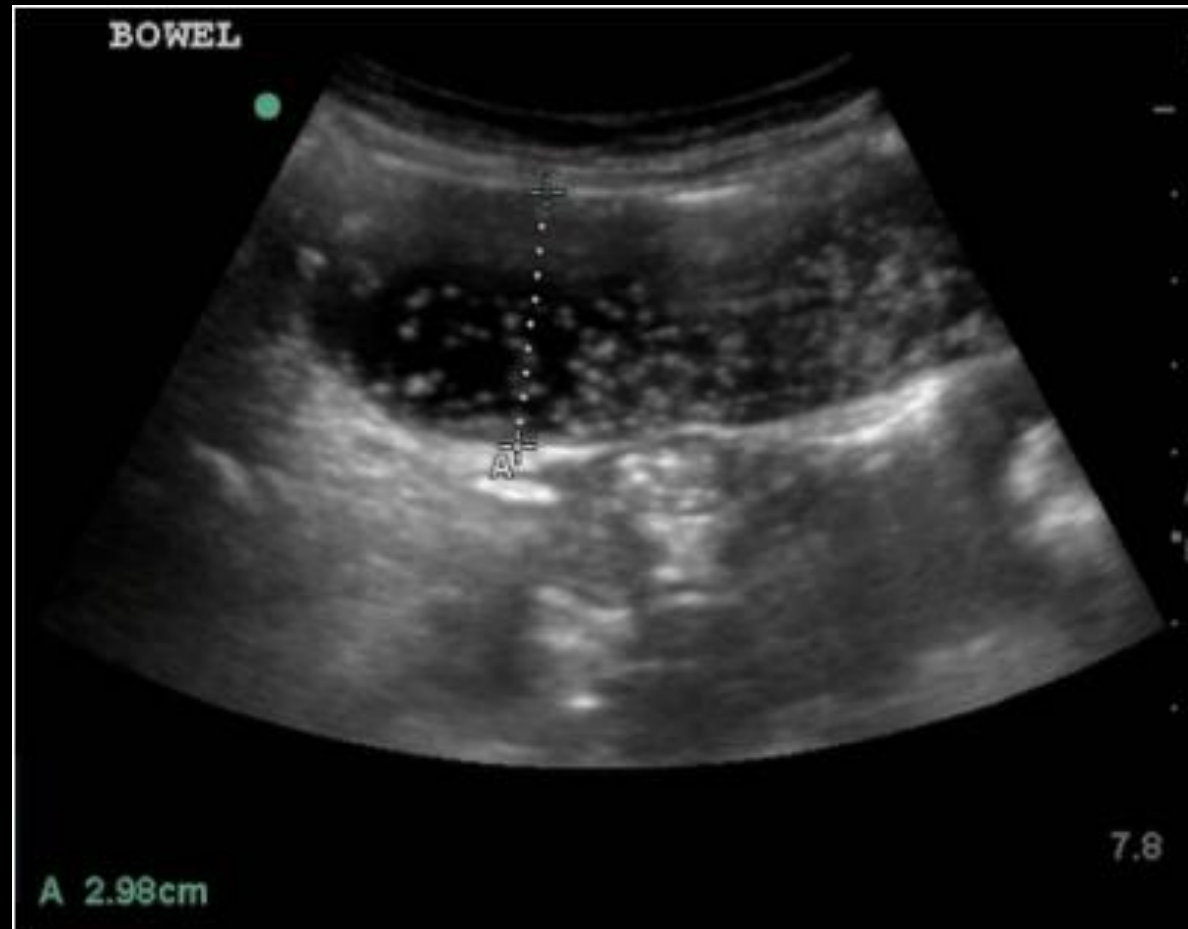
Limitations

- Partial SBOs may be more difficult to identify on US
- It is usually not possible to identify the location of obstruction and the transition point.
- Specific cause of the SBO may not be adequately evaluated

BOWEL



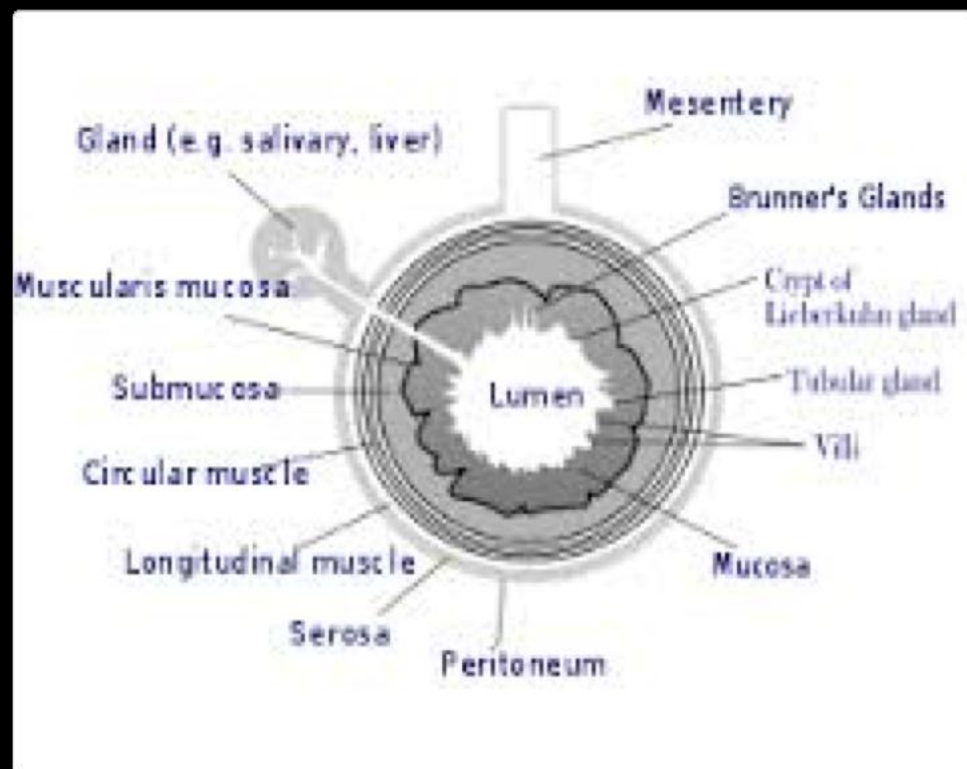
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Appendicitis

Layers of appendix wall

- Identical with intestinal layers
- Serosa: connective tissue
- Muscularis: circular and longitudinal muscular tissue
- Submucosa; vessels and lymphatics
- Mucosa; In contact with intraluminal content



Acute Appendicitis

- Most commonly seen in children and young adults
- Clinical features: Generalised abdominal pain, and then pain migrates to right lower quadrant
- nausea
- Rebound tenderness if there is peritoneal irritation
- fever
- leucocytosis
- Pain on “McBurney’s point”

Appendicitis and USG

- Appendicitis can be visualised using USG in 50% of patients
- If patient has clinical features, sensitivity is better (up to 90%)
- If patient has not clinical features, sensitivity is lower
- false negative: retrocecal app, some of perforated app and some of pregnant patients
- false positive: dilated tuba of uterus, tubo-ovarian abscess or Crohn's disease

Acute appendicitis

- Diagnosis made clinically in 70% of the patients
- Additional exam is required in 30% of the patients
- In large prospective trials:
Clinical findings: 70-85%, USG: 87-95%, CT: 93-98% diagnostic
- Factors that raise the accuracy of USG: children, thin patient and experienced physician

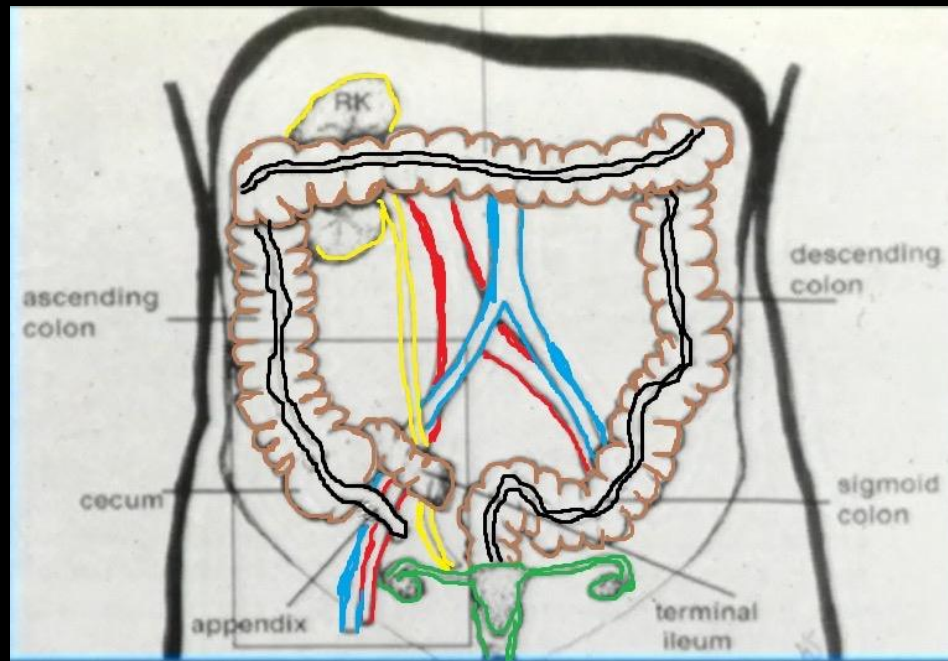
USG and appendicitis

- Abdominal plain radiograph may be ordered to see appendicolith and to exclude intestinal obstruction
- If clinical features are indeterminant, USG may be performed
- Abdominal/Pelvic CT may be ordered if there is severe pain, ascites and severe obesity

USG Protocol

- Linear transducer with high resolution and frequency may be used (Pre-scanning may be performed with 3-5 mHz curved array probe)
- Scanning may start from the low- edge of liver and continue till ilio-cecal valve
- Iliac artery and vein may be localised
- Cecum may be found

USG Protocol



USG Protocol

- Graded compression should be applied to right lower quadrant
- Normal outer diameter of appendix is 6mm or less

USG diagnostic criteria

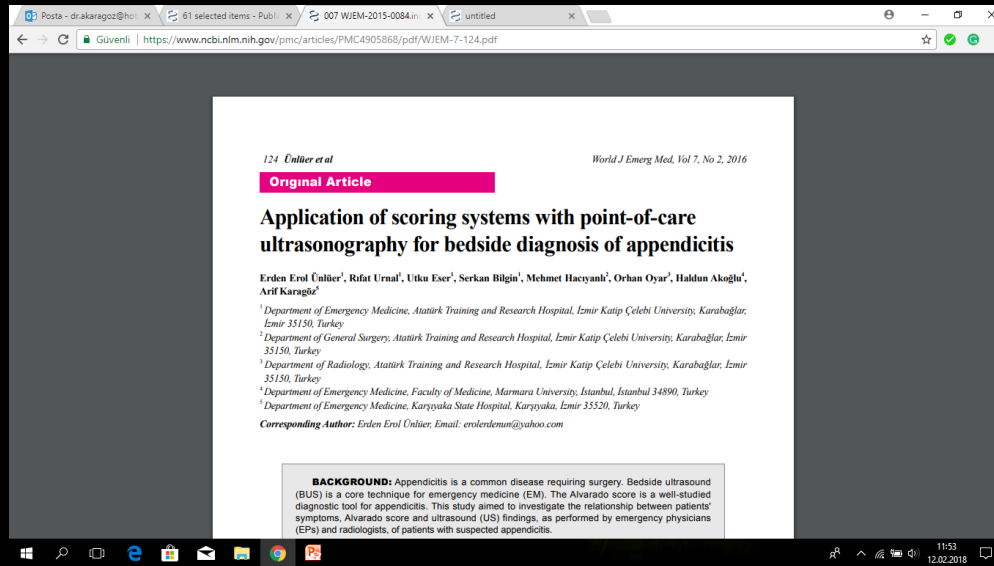
- **Appendiceal outer diameter more than 6 mm.**
- **Wall thickness more than 3 mm**
- **Non-compressible appendix**
- Absence of peristaltism
- Presence of fecalith image and shadow artifact
- Positive physical exam

Appendix and Doppler

- 'Color' or 'power' Doppler modes
- To show increased blood flow 'hyperperfusion'
- Cause: Increased needs of the tissue

Differential diagnosis

- Appendiceal abscess
- Women; tubo-ovarian abscess, ovarian torsion, ruptured cyst
- appendiceal calculus
- mucocel
- Crohn's disease
- Neoplasm



- USG is more reliable to “rule out” acute appendicitis
- Better results when combined with clinical scoring systems (Alvarado etc.).

mindray

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Thyroid

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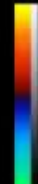
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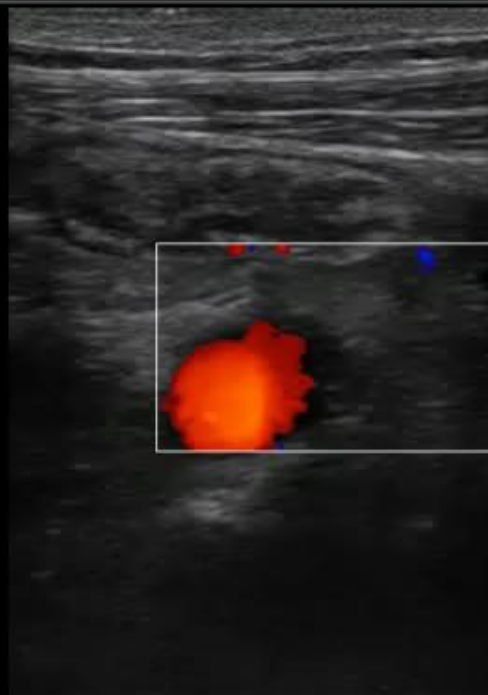
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