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Sonographic rectal enema (“hydrocolon”) for diagnosing large bowel pathologies in infancy – pictorial review to demonstrate feasibility and value

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Abstract

Bowel pathologies encompass a large diversity of diseases with commonly confusing and overlapping clinical presentations. Sonography has a leading role in diagnosing these disorders, especially in small children. However, in some cases, baseline sonography does not deliver a satisfactory result on the suspected pathology. To increase the sensitivity and specificity of the standard bowel ultrasound technique, complimentary ultrasound enema may be performed, which is also referred to as “hydrocolon” in the literature. This paper summarizes the technique of sonographic enema, as well as some bowel pathologies from our case series where sonographic enema proved to be helpful in the diagnostic work-up.

Introduction

Pathologies of the large bowel in infancy include several different entities with commonly overlapping clinical presentations. The diagnostic algorithms are mostly based on an institutional consensus, and the evidence is limited⁽¹⁾. The role of sonography as the first-line modality is unquestionable. However, if baseline sonography does not deliver satisfying results, a complimentary ultrasound (US) enema (also referred to as “hydrocolon”) may be conducted⁽²⁾.

For the “hydrocolon” procedure, pre-warmed saline is applied via a small rectal non-balloon-tip tube by low-pressure drip infusion or

manually by a syringe. The filling volume is variable, depending on age and the degree to which the colon needs to be distended. During the enema, the progress of colonic filling and distension is monitored continuously. For therapeutic enemas, slightly higher filling pressures may result in backwash through the ileocecal valve into the terminal ileum. For diagnostic purposes, no anal occlusion is needed. This prevents overpressure, and thus, the risk of perforation is negligible. With isotonic saline, no significant fluid shifts occur.

The fluid-filled state (Fig. 1) of the bowel enables a detailed examination of wall stratification, thickness, distensibility, and peristalsis. Moreover, any potential pathological content such as a polyp or meconium plug

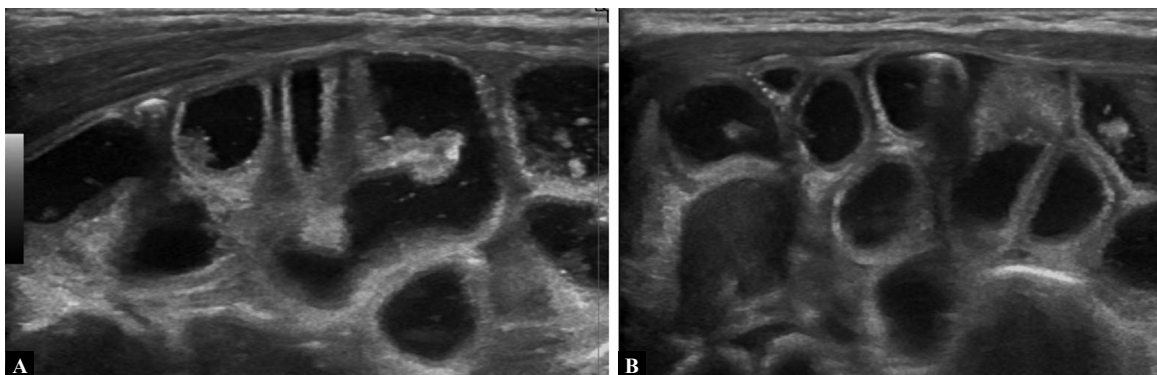


Fig. 1. Typical appearance of fluid-filled bowel loops after US enema in a 5-day-old girl born in the 37th week of pregnancy and presenting with intestinal transport problems, suspected malrotation, and suspicion of necrotizing enterocolitis. “Hydrocolon” was applied to rule out ileocecal intussusception in an atypical position

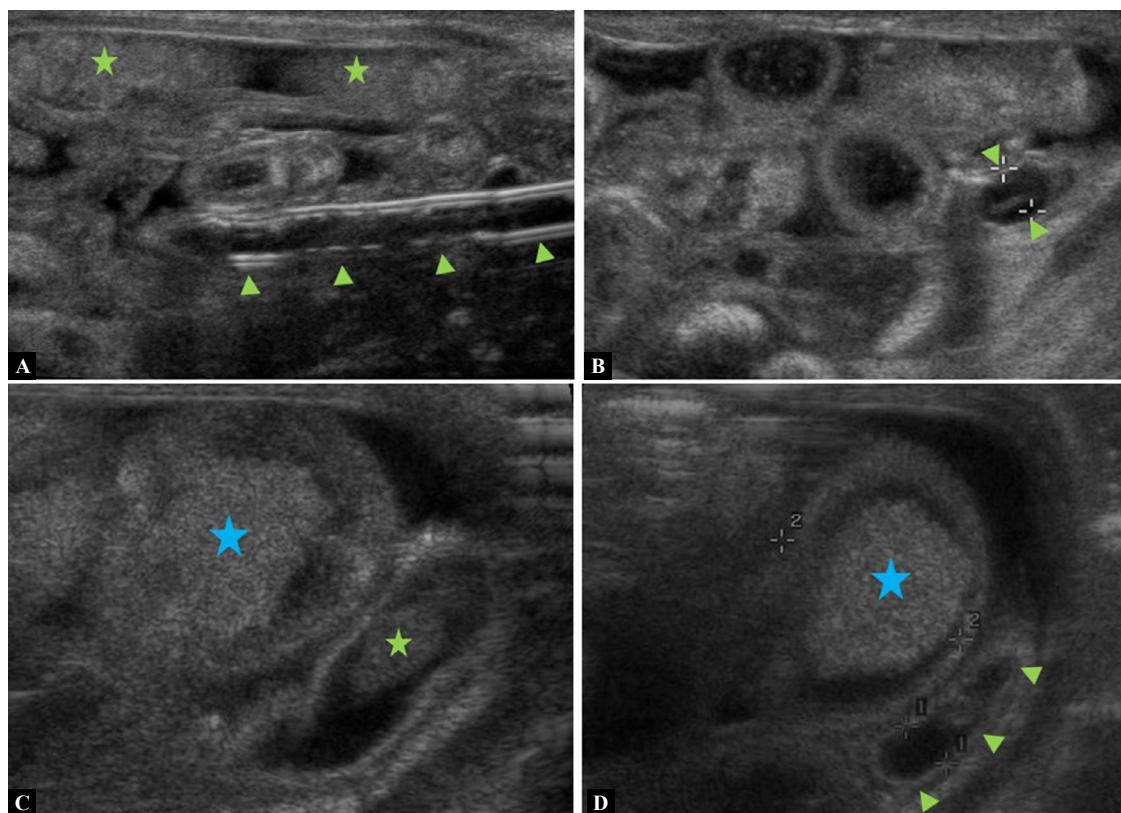


Fig. 2. Preterm babygirl (born at a gestational age of 24 weeks) with failure to pass meconium. Abdominal US showed dilated bowel loops with hyperechogenic meconium balls (green stars). To further specify the diagnosis, a complementary “hydrocolon” procedure was performed. A feeding tube was inserted (A, arrowheads), and saline was instilled under US monitoring (A–D). A small-sized left colon was found without any wall disturbances or meconium filling (arrowheads on B and D). The saline enema could reach the meconium-filled loops, which ruled out atresia. The bowel loops oral to the meconium plugs showed a marked dilatation (blue stars on C, D). The findings were consistent with meconium ileus and unused microcolon

can be depicted. In conditions like intussusception or meconium plug syndrome, US enema serves as a therapeutic option as well.

High-frequency linear or micro-curved abdominal transducers are applied for US enema, with typical settings for bowel imaging. Some experience of the investigator is advisable; in case of bowel perforation, US enema is contraindicated.

The purpose of this overview is to present common and less common bowel pathologies in neonates and infants, where performing US enema may prove useful.

This retrospective study was approved by the institutional review board (EK 31-506 ex 18/19); no written informed consent was required from the parents/guardians of study participants. The authors declare no conflicts of interest.

Meconium obstruction syndrome

Failure to pass meconium in the first 24 hours of life raises the suspicion of intestinal obstruction. Retained meconium might be associated with diverse pathologies, such as meconium obstruction syndrome, atresia, or Hirschsprung’s disease. In meconium ileus, sticky meconium accumulates in the distended (terminal) ileum. In

contrast to this, a collapsed terminal ileum and disproportionately dilated proximal small bowel loops can be found in ileal atresia. Both latter disease entities may be associated with microcolon. In meconium plug syndrome, meconium balls may occur in both small and large intestine, which is associated with small left colon and normal-sized rectum. In both conditions, a repeated “hydrocolon” can be utilized to mobilize meconium balls, as shown in Fig. 2. A diluted isotonic radiopaque contrast agent may be added to saline enema - not only to improve the therapeutic result but also for additional radiographic assessment. A transition zone to the microcolon or small left colon may also be delineated⁽³⁾.

Intussusception

In intussusception, a proximal bowel loop slips into the distal one. A cut-off diameter of 2 cm is commonly suggested to differentiate between ileoileal and -colic intussusception. The diagnosis is mostly straightforward, based on typical “pseudokidney” and “doughnut” signs (Fig. 3). However, sometimes, especially in recurrent intussusception, the US appearance can be confusing, and a “hydrocolon” procedure may be helpful for differentiation. Furthermore, high-pressure “hydrocolon” (hydrostatic US reduction) is a well-established method for the reduction of intussusception without radiation exposure⁽⁴⁾.

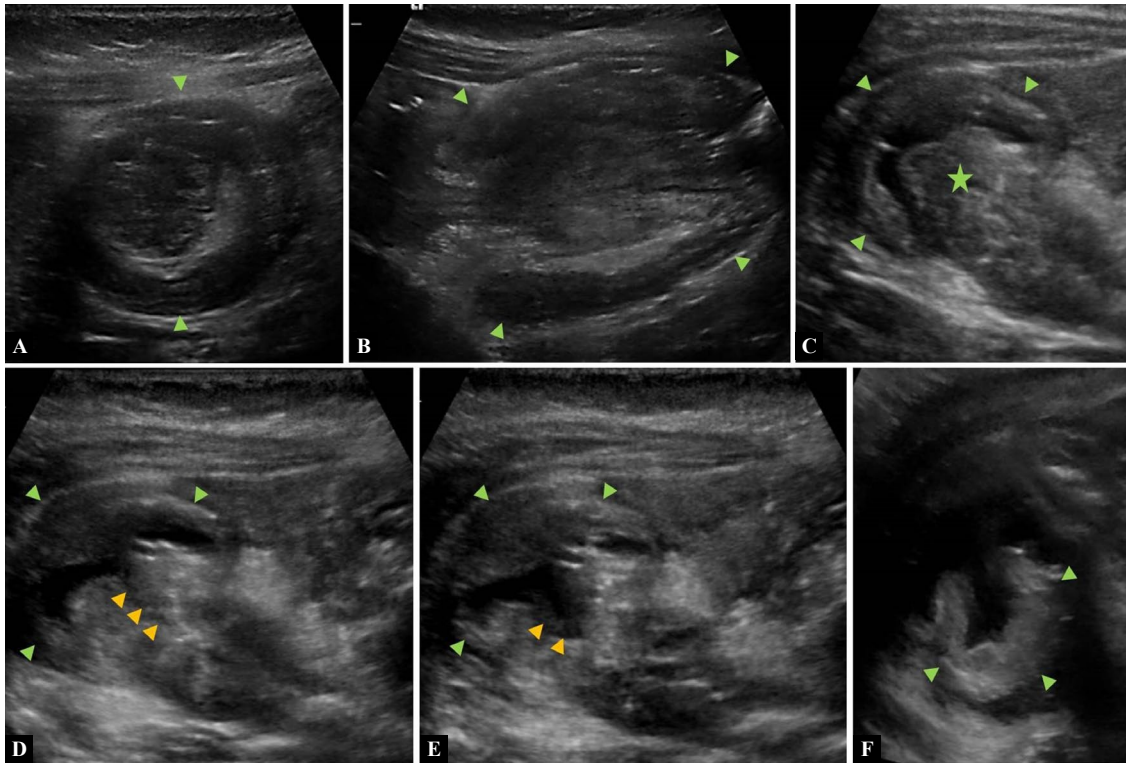


Fig. 3. Case of a 9-month-old infant with abdominal distension and currant jelly stool. In the initial examination, large ileocecal intussusception was diagnosed, and the patient underwent pneumatic reduction. The follow-up examination on the next day showed typical "doughnut" (A) and "pseudokidney" (B) signs indicating a recurrence, though a differentiation between ileoileal and ileocecal intussusception was not conclusive. US-guided saline enema was administered, revealing ileocecal recurrence, which was gently released by this US enema (C–E). At the end of the intervention, the ileocecal valve was still thickened (F). This case demonstrates how a diagnostic "hydrocolon" procedure can be switched to a therapeutic hydrostatic reduction, and repeated fluoroscopic decompression can be spared



Fig. 4. 3-year-old girl presenting with hematochezia. Baseline sonography (A) showed a pedunculated hypochoic mass in the left lower abdomen. US enema proved its intraluminal localization and unambiguously established the diagnosis of a colonic polyp (B, C). Saline enema also helped to rule out further polyps in the large bowel

Assessment of abdominal mass

The spectrum of abdominal masses comprises several entities. By clarifying the relationship between the mass and bowel, US enema may help to reduce the number of possible differential diagnoses.

Bowel polyps (Fig. 4) are rare findings in infants and have variable morphology and localization. They can appear sporadically or as part of a syndrome (e.g., juvenile polyposis). With the application of "hydrocolon", the intraluminal localization as well as the diagnosis can be clearly confirmed (Fig. 4).

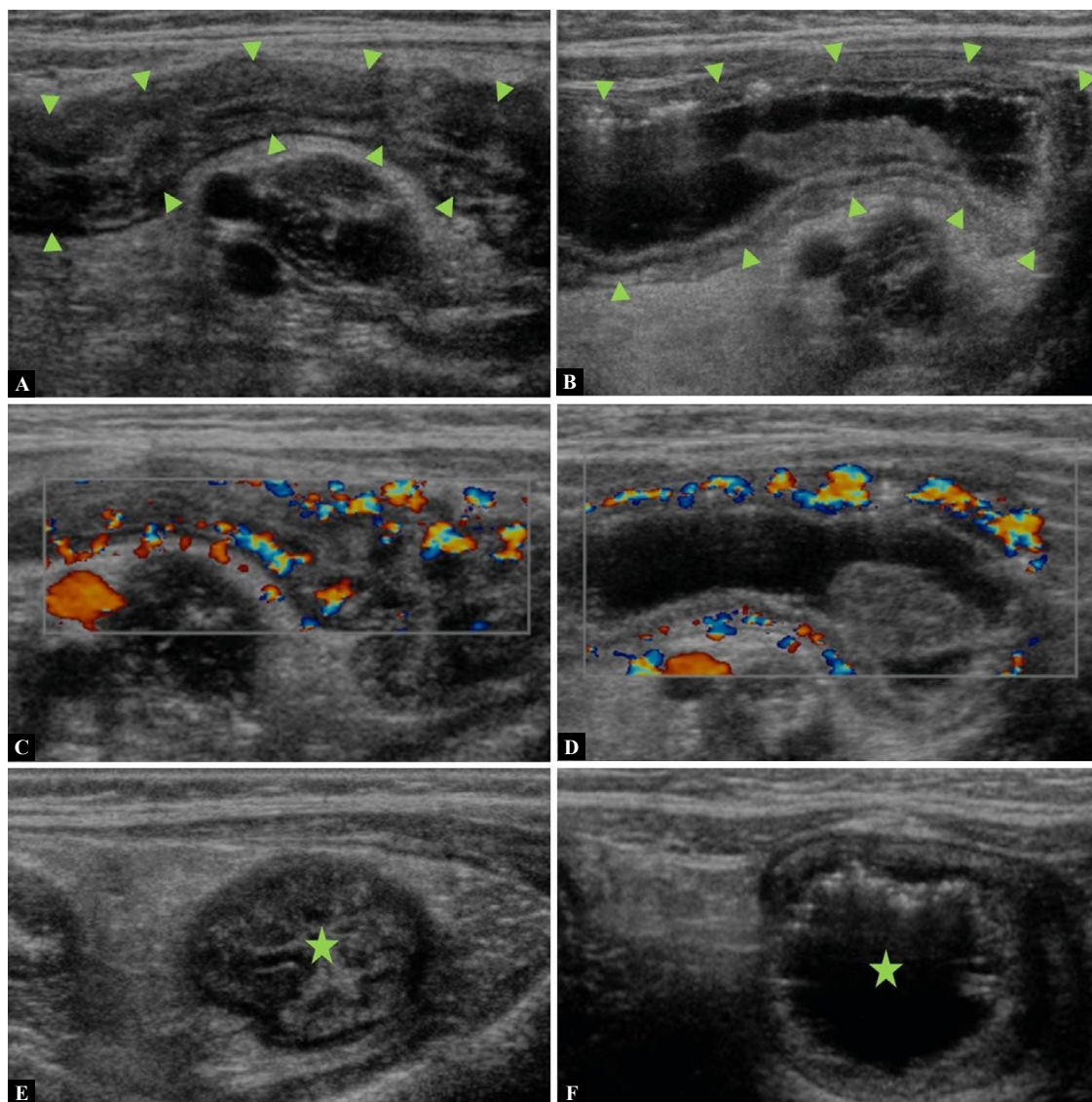


Fig. 5. 3-year-old boy presenting with hematochezia. Baseline sonography (A, C, E) showed collapsed thickened bowel loops (A: arrowheads, E: star) with marked hyperemia of the bowel wall (C, D). After US enema, the fluid-filled bowel loops enabled a closer evaluation of bowel wall structures (B, D, F). Further diagnostic work-up confirmed the suspected diagnosis of very early onset inflammatory bowel disease

Inflammatory bowel disease (IBD)

Infantile (<2 years) and very early onset (<6 years) IBD are rare conditions. Most commonly, these patients suffer under colonic mucosal and perianal disease. Complications such as mesenteric abscesses and higher fistulae are uncommon. Therefore, small-bowel imaging might be restricted to detecting inflammation⁽⁵⁾, which is reliably performed by US without anesthesia. US enema may increase the overall sensitivity of the imaging technique even in the distal colon and the rectum, where US is usually challenging to perform (Fig. 5).

Colonic stenosis

In (early) childhood, colonic stenosis is mostly a late complication of bowel inflammation (e.g., necrotizing enterocolitis); the congenital origin is rare. Fluoroscopy is widely used for assessing these conditions. The advantage of US over fluoroscopy is the possibility

to analyze the bowel wall and the surrounding structures; thus, a potential external compression can be assessed as well. Dynamic analysis during saline enema helps differentiating between colonic stenosis and transient localized spasm or collapse, as well as estimating the extension of the affected bowel segment (Fig. 6).

Discussion

Although US “hydrocolon” is not a new player in the diagnostic arsenal for bowel pathologies, there are just a few reports in the literature addressing this modality. In this review, the authors provide examples of bowel pathologies, where the use of US enema is diagnostically useful. This easy-to-access method may shorten the diagnostic work-up and spare radiation exposure as well as the use of contrast agents. However, the diagnostic performance highly depends on the experience of the performing radiologists.

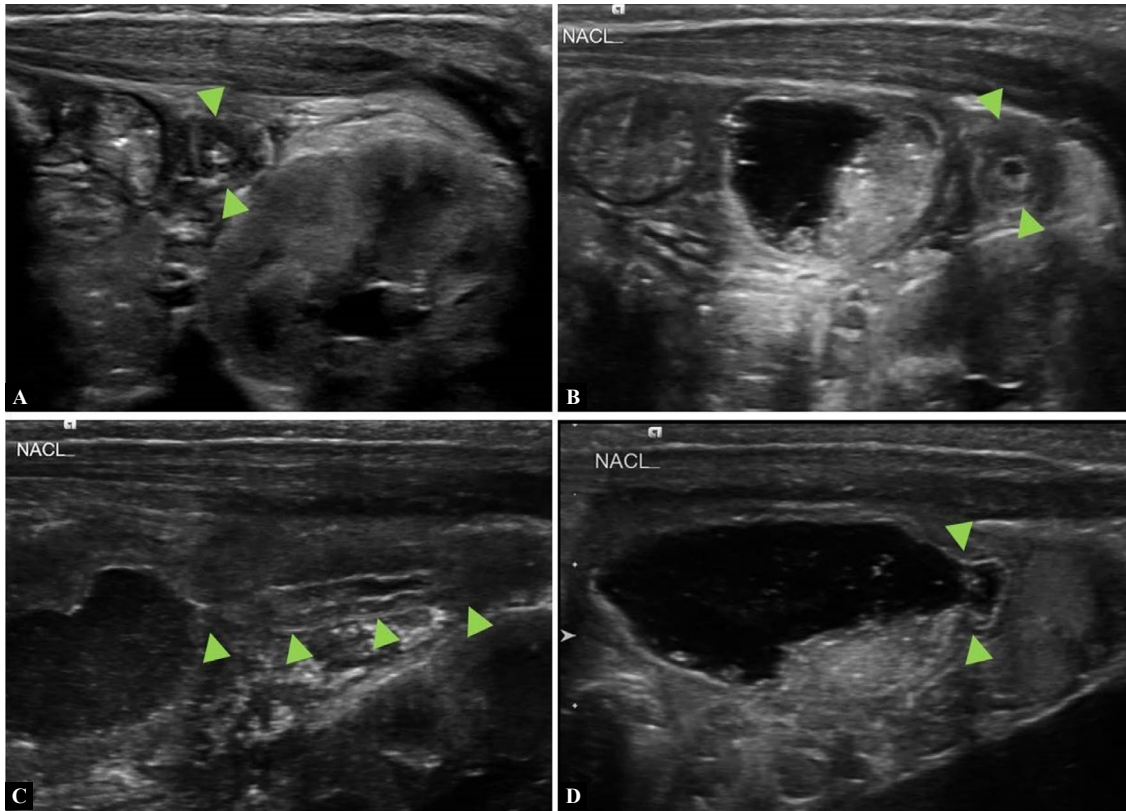


Fig. 6. 2-month-old preterm girl (born in the 34th week of pregnancy) was presented with vomiting and distended abdomen after she was successfully treated conservatively for necrotizing enterocolitis three weeks before. The stool was normal. On baseline sonography, a wall-thickened bowel loop was found in the middle to the left upper abdomen, with a constant circumscribed narrowing of the intraluminal bowel diameter (A). The finding was suspicious for a focal obstruction. Complementary "hydrocolon" (B–D) confirmed the suspected pathology by highlighting a subtotal short-segment colonic stenosis in the descending colon with regional thickening of the bowel wall

Conflict of interest

The authors do not report any financial or personal connections with other persons or organizations which might negatively affect the contents of this publication and/or claim authorship rights to this publication.

Author contributions

Original concept of study: EN, MR. Writing of manuscript: EN, MR. Final acceptance of manuscript: EN, MR. Critical review of manuscript: ST.

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