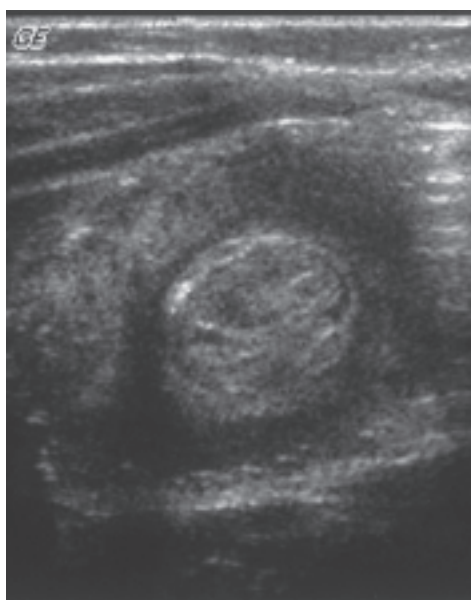


## Clinics in Diagnostic Imaging (80)

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**Fig. 1** Supine abdominal radiograph.



**Fig. 2** Transverse US image obtained in the right upper quadrant of the abdomen.

### CASE PRESENTATION

A three-year-old boy presented with intermittent, crampy abdominal pain and bilious emesis of two days duration. The patient was initially admitted to a local hospital and was felt to have a partial obstruction of the upper gastrointestinal tract. However, an upper gastrointestinal examination using barium was negative. The patient was then transferred to our hospital for further evaluation and treatment. No prodromal illness

or past medical history was noted. No gastrointestinal bleeding was noted. On initial physical examination, the child was comfortable. He was afebrile, well developed, well nourished and not in acute distress. The abdomen was soft and no mass was palpated. The patient was referred for abdominal radiographs (Fig. 1), and subsequently, based on the radiographical findings, ultrasonography (US) was performed (Fig. 2).

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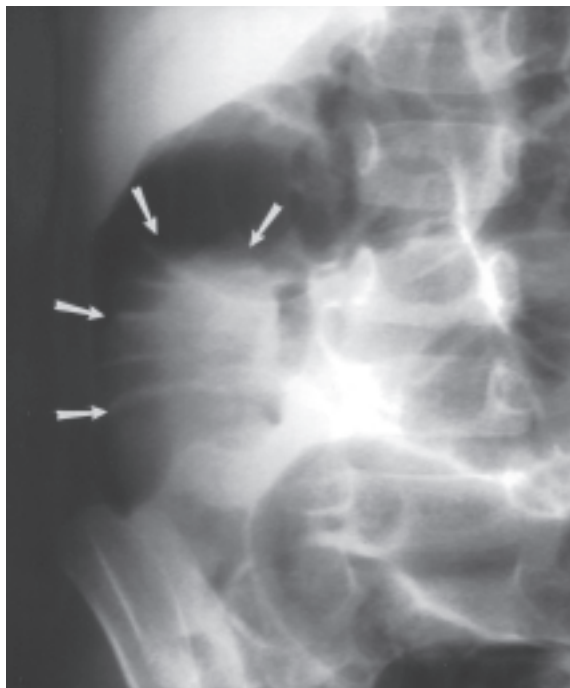
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**Fig. 3** Air contrast enema shows a soft tissue mass representing the intussusception (arrows) outlined by air in the ascending colon.



**Fig. 4** Barium enema shows the classic "coiled spring" appearance of an intussusception (black arrows) located at the mid-portion of the ascending colon. Nodular filling defects in the mass (white arrow) correlated with ileocecal valve hypertrophy seen on post-reduction images.

#### IMAGE INTERPRETATION

The abdominal radiograph (Fig. 1) shows a paucity of bowel gas in the right mid-abdomen. On US (Fig. 2), a round mass is seen in the right upper quadrant of the abdomen. The mass measured approximately 3 cm in diameter, and exhibited echogenic circular layers, consistent with a "target" sign. The appearance is that of a thick-walled "doughnut" with inner echogenic mesenteric fat. In this clinical setting, these findings are typical of intussusception. An air enema was then performed for both diagnostic and therapeutic purposes. A catheter was introduced into the rectum, and air was administered per rectum. An intraluminal mass was encountered at the ascending colon. The mass was easily reduced to the caecum (Fig. 3). The mass briefly

persisted at the medial aspect of the cecum. After several minutes delay, the mass reduced and reflux of air into the small bowel was noted. Reduction of the intussusception was felt to be complete. The patient, who was irritable throughout the study, became calm and sleepy after reduction of the intussusception was achieved.

#### DIAGNOSIS

Ileocolic intussusception.

#### CLINICAL COURSE

After the intussusception was successfully reduced, the patient was observed overnight as an inpatient. The patient, whose oral intake had been withheld, was shortly able to tolerate clear fluids. Approximately 12 hours after the intussusception was reduced, the patient again developed recurring crampy abdominal pain. On repeat US, a mass measuring approximately 3 cm in diameter was found in the right mid-abdomen. It had a "target" sign, consistent with intussusception. The mass was slightly lower in the right abdomen than on the previous US. This time, reduction was performed with barium. The classic "coiled spring" appearance of intussusception was encountered at the mid-portion of the ascending colon (Fig. 4). The intussusception was successfully reduced. Nodular filling defects in the mass that correlated with ileocaecal valve hypertrophy were seen on post-reduction images (not shown). After reduction, the patient was comfortable and slept well. The next day, the patient's oral intake was quickly advanced to clear liquids and then to solids. The patient continued to be afebrile and devoid of pain, and was discharged the next day. On follow-up, he has not had clinical evidence of recurrent intussusception for four months since discharge.

#### DISCUSSION

Intussusception is a common cause of an acute abdomen in infants and young children. Intussusception occurs most frequently between the ages of six months and four years. An early and correct diagnosis is necessary to reduce morbidity and mortality. Common symptoms are abdominal pain, vomiting and rectal bleeding<sup>(1)</sup>. An abdominal mass is palpable in the majority of patients<sup>(1)</sup>. With careful examination the classic clinical triad of recurrent pain, bloody stools and palpable abdominal mass is probably present in more than 50% of children with intussusception. Some children present in a more cryptic fashion. In fact, as many as 20% of cases may indeed be pain-free at the time of presentation<sup>(1)</sup>. The child may present with lethargy.

Clinical diagnosis may, therefore, be difficult. Delay may be life-threatening owing to the development of bowel necrosis and its complications.

Radiographs of the abdomen are useful and can suggest the diagnosis in many patients by showing a mass, usually located in the right upper quadrant, loss of the inferior hepatic margin, or bowel obstruction. Positional views, such as a right side up decubitus view, may be helpful. A stool organ-filled right colon and caecum is strong evidence against intussusception. In the child with intussusception, by the time the radiograph is obtained, it is likely that stool or gas located in the right colon and caecum would have moved distally due to bowel peristalsis.

US can be used to screen children with suspected intussusception. In the appropriate clinical setting, US has been reported to achieve a high sensitivity and specificity in the diagnosis of intussusception<sup>(2, 3)</sup>. The appropriate use of US in children with suspected intussusception obviates the necessity for diagnostic enema, and the use of the enema can then be limited to therapeutic purposes. The most common ultrasonographic signs used (i.e. "target" and "pseudo-kidney" signs), however, are not pathognomonic because they may also be seen in normal or pathological intestinal loops, and may suggest a false diagnosis. The differential diagnosis for the US findings includes any cause of bowel wall thickening, including neoplasm, oedema and haematoma. Stool or psoas muscle may rarely be mistaken for intussusception by an inexperienced operator.

Ultrasonographic findings of intussusception are complex. The intussusceptum invaginates into the intussusciens, and these bowel walls overlap within the mass. The intussusceptum is located at the centre of the intussusception and the intussusciens is located more peripherally. The intussusceptum drags its mesentery, which also becomes enclosed in the mass. This is seen as echogenic material centrally, as in the presented case. It is not unusual to also see mesenteric lymph nodes within the mass. Apart from diagnosis or exclusion of intussusception, US can be used effectively to obtain other information, including the occasional depiction of lead points or other alternative intraabdominal diagnoses unrelated to intussusception. Lead points occur in approximately 5% of intussusceptions in children. Alternative diagnosis made by US include appendicitis and genito-urinary abnormalities.

Air enema has replaced the barium enema at most institutions as the method of choice for the diagnosis and treatment of paediatric intussusception. The advantages of using air for reduction include smaller

colonic tears and less contamination of the peritoneal cavity when perforation occurs, less fluoroscopic time, lower radiation dose and less mess, if anal leak occurs<sup>(4)</sup>. As with barium, the rate of perforation with air enema is less than 1%<sup>(1)</sup>. When perforations do occur with air enema, they are usually smaller and do not have substantial faecal contamination of the peritoneum that can occur with barium<sup>(5)</sup>. Perforation with air can, however, lead to tension pneumoperitoneum, which can cause fatal respiratory distress. This rare complication is treated with needle decompression. Other occasional problems associated with pneumatic reduction include air passage into the small bowel despite incomplete reduction of the intussusception, and an oedematous ileocaecal valve that may be confused with a residual mass. The use of air also can result in missing a lead point of the intussusception or other conditions such as inflammatory disease of the colon and intramural haemorrhage. However, if underlying pathology is suspected, a non-emergency repeat enema, using barium, can be performed.

Recently, US-guided hydrostatic reduction of intussusception has been described and has been found to be an effective mode of treatment<sup>(6,7)</sup>. Advantages of this technique are that the reduction can be safely performed in the US suite promptly following diagnosis, with avoidance of ionising radiation. An added bonus of US-guidance hydrostatic intussusception is that differentiation between the ileoileocolic and ileocolic types of intussusception can be made during the reduction process<sup>(8)</sup>. If ileoileocolic intussusception is diagnosed and if initial attempts at reduction fail, then surgery should be performed without delay. In contrast, ileocolic intussusception can usually be effectively reduced under US guidance, with an expected success rate of over 90%<sup>(6,7)</sup>.

In a review of the literature, Stringer et al<sup>(1)</sup> found that reduction rates with air slightly exceeded reduction rates obtained with hydrostatic methods<sup>(1)</sup>. The reduction rates for air and liquid enemas are similar, and are in the order of 70%-80%. Consultation with the paediatric surgery service is usually made prior to therapeutic enema, in case the intussusception proves irreducible or in the unlikely event of perforation. Surgical treatment, if required, can thus be expedited.

#### ABSTRACT

**Intussusception is a common but life threatening gastrointestinal emergency that occurs in the infant or young child. A three-year-old boy presenting with abdominal pain and vomiting was diagnosed to have the target sign on**

**ultrasonography. An ileocolic intussusception was initially reduced using air enema. Recurrent intussusception 12 hours later was reduced by barium enema. In the proper hands, ultrasonography has a high diagnostic accuracy rate for intussusception. For treatment, air enema is usually preferred to barium enema. Air enema is a safe, rapid, and clean procedure that has been shown to achieve a high reduction rate, comparable to that of barium enema. Ultrasonographically-guided hydrostatic reduction of intussusception has also been recently described and is an effective alternative.**

**Keywords: Intussusception, ultrasonography, air enema, barium enema, intussusception reduction**

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