Intussusception

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Intussusception is the invagination of one portion of the intestine, known as the intussusceptum, into the lumen of the adjacent intestine, referred to as the intussuscipiens. It is one of the most common causes of small bowel obstruction in infants and children. Although described in children of all ages, this disease is most commonly seen in children between 6 and 10 months of age. The majority of cases that affect children between 3 months and 3 years of age are idiopathic, meaning a specific pathologic lead point cannot be identified. While the true cause of idiopathic intussusception is not known, it is generally believed that a viral illness results in hypertrophied Peyer patches within the ileum. These thickened areas serve as the lead point of the intussusception. Other lead points causing an intussusception include Meckel's diverticulum, polyps, intestinal duplications, lymphoma, tumors, and in rare cases, the appendix. The incidence of a pathologic lead point ranges between 1.5 and 12 %, and the incidence increases in proportion to age, especially after 2 years of age. Ileocolic is the most common form of intussusception found in children, although enteroenteric intussusceptions are more common when a pathologic lead point is present.

Ultrasound has become the preferred first imaging modality for the diagnosis of intussusception. Air-contrast enema reduction is the initial treatment of choice for reduction given its high success rate. Multiple attempts at reduction can be made safely. For patients who fail reduction, the next step in management is surgery. The overall recurrence rate is roughly 5 % after reduction, with approximately one-third occurring within the first 24 h and the majority occurring within 6 months of initial presentation.

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Diagnosis

Obtaining an adequate history and physical examination is critical to the diagnosis of intussusception in children. Patients typically present with sudden episodes of transient and severe abdominal pain during which the child may draw his or her legs up toward their abdomen. These episodes are sometimes associated with nausea and vomiting. Following these episodes, patients are often pain-free. Parents might note bloody or "currant jelly" appearing stool, which is reflective of blood clots and sloughing of the mucosa. This is usually a later finding and a harbinger of bowel ischemia. Abdominal physical findings include a "sausage-shaped" mass in the right upper quadrant (RUQ) or the "Dance sign," in which in addition to a sausage-shaped mass in the upper abdomen, the right lower quadrant (RLQ) feels empty on palpation.

With a history and physical examination concerning for intussusception, several imaging modalities are available for diagnosis including X-ray, ultrasound (US), contrast enema, CT, or MRI. US is currently the easiest and most accurate tool used to diagnose intussusception. While potentially useful, CT exposes children to unnecessary radiation while MRI takes longer, costs more, and often requires sedation in this age group. Three-dimensional imaging can be a powerful tool for the diagnosis of pathologic lead points, which is why they are often used in older children, in whom a pathologic lead point such as a tumor is more common and could be identified.

Abdominal US has replaced the contrast enema as the initial study of choice for diagnosis of intussusception. Findings on ultrasound suggestive of intussusception include a "target sign" or "donut lesion" which is reflective of the bowel wall

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and mesenteric fat telescoping within the intussusceptum (Fig. 53.1a). Another finding suggestive of intussusception is the "pseudokidney" sign in which the edematous walls of the bowel are observed within the intussuscipiens (Fig. 53.1b). If US findings are equivocal but the history and physical findings are suggestive of intussusception, additional imaging, usually a contrast enema, should be considered. Further, US can be used to evaluate for recurrence in patients with renewed symptoms after reduction.

Treatment

Initially, children with a suspected diagnosis of intussusception should be treated with intravenous fluid resuscitation and bowel rest. The diagnosis should be confirmed by US. Once confirmed, children without evidence of peritonitis should undergo an attempt at reduction using an air-contrast enema (Fig. 53.2). Historically, a dose of antibiotics would be administered prior to the enema for the treatment of "bacterial translocation." However, this is not necessary, as no clear benefit has been demonstrated. Furthermore, administration of antibiotics can delay the air-contrast enema and has been associated with complications. Some children referred for an air enema will ultimately be diagnosed with infectious colitis, not intussusception. The administration of antibiotics to these patients can have significant consequences. A single dose of antibiotics given to a child with *E. coli* O157:H7 can result in the development of hemolytic uremic syndrome. It is not our practice to administer antibiotics prior to this procedure.

During an air-contrast enema, a maximum pressure of 120 mmHg is delivered three separate times in an attempt to reduce the intussusception. Reduction is confirmed by fluoroscopy with free reflux of air into the small bowel. Perforation during an air-contrast enema is rare, observed in less than 1 % of patients, but can result in tension pneumoperitoneum and subsequent hemodynamic collapse. Thus, a member of our surgical team is made aware when these procedures are being performed so that they may be readily available for needle decompression. The American College of Radiology recommends that fluoroscopic guided intussusception reduction be performed with a surgeon readily available; however, surgical attendance is not required during the procedure.

If the initial air enema is successful, the child should be kept NPO for a period of 6–12 h, after which a diet may be started. The child may be discharged if tolerating a diet and is otherwise clinically well with resolution of abdominal pain. If the initial air-contrast enema is not completely successful in reducing the intussusception but some air is demonstrated refluxing into the small bowel, then the child should be kept NPO with intravenous fluids for 2–4 h, and the study is repeated. If the intussusception persists, the radiologist may perform repeated attempts at reduction. If enema reduction is ultimately successful, the child should be observed and kept NPO for 6–12 h before reintroducing a diet. Often the repeat air-contrast enema will demonstrate resolution of the intussusception. In our experience, these children either spontaneously reduce or we fail to capture the reduction on imaging. If the child does not experience a recurrence of symptoms over a 24 h observation period, has a benign abdominal examination, and tolerates a diet, the child may be discharged home (Fig. 53.3).

If the child demonstrates signs of peritonitis or repeated enemas fail to reduce the intussusception, the next step in management is operative exploration. We initially approach these cases laparoscopically. The trocars are positioned in a similar location to that of an appendectomy. Once laparoscopic access has been gained through an umbilical port, the intussusception is usually identified in the right lower quadrant. Following this, two additional trocars are placed, one in

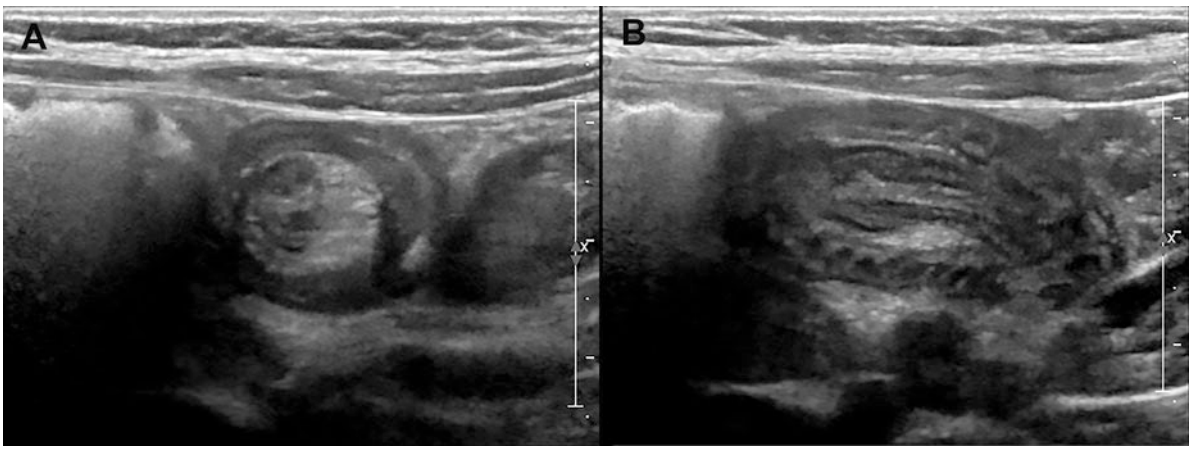


Fig. 53.1 Images from an abdominal ultrasound depicting (**a**) classic target sign and (**b**) a pseudokidney sign seen in intussusception

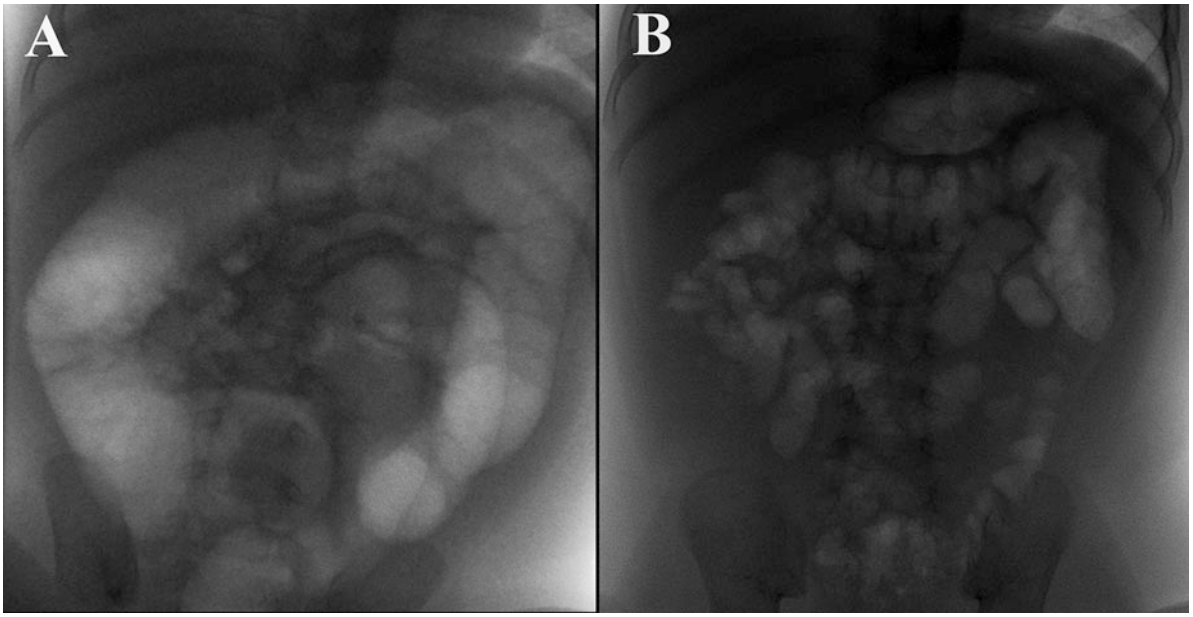
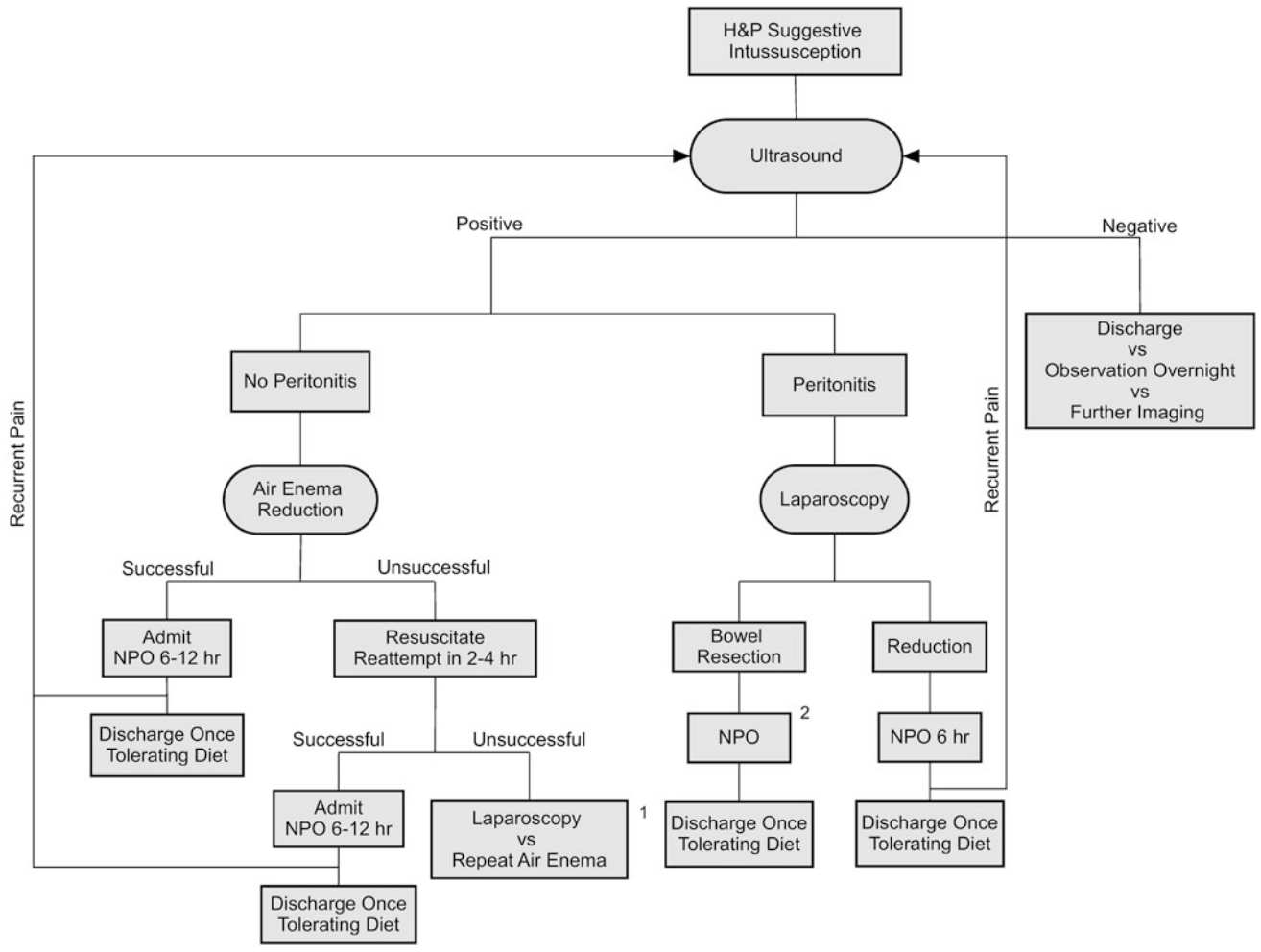


Fig. 53.2 Air-contrast enema for intussusception reduction (**a**) incomplete reduction. The intussusception is almost completely reduced to the end point at the cecum, (**b**) successful reduction. Air filling the small bowel at the end of the enema



1
Based on clinical picture and radiology resources repeat air enema may be attempted.
2
Advance diet per surgeon preference.

Fig. 53.3 Algorithm for the treatment of intussusception

the left lower quadrant and one in the suprapubic region. In patients for whom air-contrast enema was not successful at complete reduction, the intussusception is typically partially reduced and found in the ascending colon. In order to reduce the intussusception, gentle tension should be used to carefully pull apart the affected area of the bowel. Using two graspers, one stabilizes the intussuscipiens while the other is used to reduce the intussusceptum with gentle continuous pulling. The bowel may appear congested and edematous, but resection is not performed unless necrosis or frank perforation is present.

If the intussusception is unable to be reduced laparoscopically, then an accessory incision can be created. Depending on the location of the intussusception, either the umbilical incision can be extended or a separate right lower quadrant incision can be created. Once the intussusception has been delivered, manual reduction is attempted by squeezing the intussusceptum out of the intussuscipiens, similar to squeezing a tube of toothpaste. If the intussusception cannot be reduced after conversion to an open procedure, a limited bowel resection encompassing the area of intussusception is performed with a primary anastomosis.

We do not routinely perform an appendectomy with surgical reduction. Following any operation for intussusception, the child should initially be kept NPO until return of bowel function. Diet may be advanced as tolerated. If the child presents with recurrent symptoms of intussusception after surgical reduction, an US should be performed. If recurrent intussusception is identified, an air-contrast enema should be repeated.

Future Directions

Air-contrast enemas are the treatment of choice for intussusception, since they have a high success rate and are less invasive compared to surgical reduction. However, they expose the child to ionizing radiation. Ultrasound-guided hydrostatic reduction with normal saline is a relatively new method described for reduction of intussusception. Success rate of reduction has been reported to be greater than 80 % and does not expose the patient to radiation. With qualified operators and appropriate technology, it is conceivable that US-guided hydrostatic reduction could become the initial treatment of choice, especially in the current climate of concern regarding the long-term effects of radiation exposure in children.

While recurrence following enema reduction is a known risk for intussusception, there is lack of data to support the need for admission and observation following nonoperative reduction. Further studies are under way to answer the question as to whether children could be safely discharged from the ED (Emergency Department) following successful reduction of intussusception.

Editor's Comment

The "less is more" approach has clearly improved the management of intussusception. We are using less radiation to diagnose this problem, and US-guided reduction will almost certainly replace fluoroscopic reduction someday. We are less inclined to use antibiotics prior to hydrostatic reduction and more likely to discharge patients early after successful reduction, limiting their exposure to hospital-associated infections and limiting treatment costs. Finally, the new generation of pediatric surgeons has a laparoscopy-first mind-set, resulting in smaller scars and earlier discharge (besides nicely disproving yet another formerly sacrosanct surgical dictum: "never ever pull the bowel apart to reduce an intussusception").

The classic presentation of intermittent colicky pain is very well known, but a sizable minority of patients present with lethargy or obtundation, sometimes severe enough to suggest CNS injury or disease. Regardless of the presentation, it is not possible to exclude the diagnosis with certainty by any combination of history, physical examination, laboratory studies, or plain X-rays. In fact some teach that if intussusception is mentioned in any correspondence and no alternate diagnosis can be confirmed, one is duty-bound to obtain an US.

If the diagnosis is confirmed by US, the next step is contrast enema, the type of which (air or liquid) should be determined by the radiologist, not the surgeon. Some radiologists insist that a surgeon be present in case of a perforation, perhaps so that we might percutaneously evacuate air in the very rare case of a tension pneumoperitoneum, but in practice the typical child with a perforation needs to be resuscitated and properly prepared before going to the OR anyway. The most important role of the surgeon in these situations is to maintain a calm and commanding presence while the patient and parents are being prepared for a trip to the OR.

One might be tempted to perform a biopsy (or, worse, a resection) of the edematous or hemorrhagic "mass" that is often found in the wall of the cecum or ileum after successful operative reduction, but this should be avoided. Some still routinely perform an appendectomy, which, though probably unnecessary, is safe and, some believe, might prevent a recurrence. If resection is required, ileostomy should almost never be necessary, even after a perforation, as a primary anastomosis can almost always be done quickly and safely.

Children over the age of five and those of any age who develop multiple recurrences pose a challenge—while a diligent search for a lead point with US, CT, MRI, and endoscopy is reasonable, deciding whether laparotomy or bowel resection should be performed requires a great deal of clinical experience and good judgment. Small bowel and colonic intussusception, on the other hand, are very often a pathologic lead point and should prompt at least a diagnostic laparoscopy to rule out lymphoma, Meckel's diverticulum, polyp, tumor,

or vascular malformation. In stable patients with Henoch-Schonlein purpura (HSP) or postoperative intussusception, a 12–24 h period of close observation (assuming no signs of sepsis or peritonitis) is reasonable, as the intussusception often resolves spontaneously in these patients.

Suggested Reading

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