Originals

Pediatric Radiology

Pediatr Radiol (1995) 25: 104–107

Partially reduced intussusception: when are repeated delayed reduction attempts appropriate?

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Received: 18 May 1994/Accepted: 24 June 1994

Abstract. The imaging techniques for diagnosis and monitoring of reduction of intussusception by fluoroscopy and ultrasound continue to evolve. The common goal of all protocols is to reduce the intussusception by enema in as many patients as possible and avoid laparotomy with its potential morbidity. We report two infants in whom the initial attempt at reduction by air enema only achieved partial reduction, from the descending colon to the transverse colon in one, and from the splenic flexure to the caecum in the other. Both patients became asymptomatic and clinically stable. In light of the clinical stability, and in consultation with the surgeons, laparotomy was deferred. Sonography was used to confirm the persistence of the intussusception before repeat air enema several hours later. Following three further air enemas in each child, the intussusceptions were successfully reduced after 20 h and 24 h respectively. Both patients remained asymptomatic and did not require surgery. In infants with partially reduced intussusception we suggest that if the patient becomes asymptomatic and stable, surgery can be safely delayed to permit further attempts at enema reduction. Sonography has a valuable role in determining the persistence of the intussusception prior to repeat enema. Close cooperation with the surgeon and careful clinical monitoring of the patient are essential requirements for this proposal.

Intussusception has traditionally been considered a surgical emergency necessitating early radiological or operative reduction. Radiological reduction utilizes barium, or air under fluoroscopy, and more recently saline under ultrasound guidance [1, 2]. Air reduction has been practiced in China for approximately 40 years, with good efficacy, and has only in the last decade been gaining acceptance in North America and Europe [3, 4]. With these radiological techniques, intussusceptions may be completely reducible, partially reducible (i.e. reduce partly along the colon, and then get stuck), or irreducible (i.e. not move at all on the first enema). Surgery has been considered necessary for partially reducible or irreducible intussusceptions.

Second attempts at radiological reduction have been reported previously [5]. Repeat barium enema has been described to differentiate a swollen ileocaecal valve from residual intussusception and to achieve reflux into the terminal ileum [6, 7]. Repeat enemas and sonographic studies in the operating room under general anaesthesia (GA) have also been proposed prior to operative reduction [8].

We describe careful observation of patients with intussusception and multiple reduction attempts without GA in the radiology department, after a partial initial reduction. We report two infants successfully managed in this manner.

Case reports

Case 1

A 4-month-old girl presented with a 24-h history of abdominal pain, irritability and passage of blood per rectum. Physical examination revealed a listless infant with a soft abdomen and a mass in the left flank. Plain abdominal radiographs showed small bowel obstruction. After fluid replacement, an air enema was performed. An intussusception was encountered at the splenic flexure and was partially reduced without difficulty to the caecum, with a definite intussusception remaining in the caecum (Fig. 1 a). Prolonged persistent attempts failed to reduce it further. Fluoroscopy time was 3.8 min. The patient improved clinically with resolution of her abdominal pain and stabilization of her vital signs after the partial reduction. She was sent to the ward for close observation and returned to the radiology department 3 h later. Sonography showed a large bowel intussusception in the right iliac fossa (Fig. 1 b), with moderate free fluid and fluid-filled loops of bowel proximally.

Repeat air enema reduced the intussusception through the ileocaecal valve and into the terminal ileum for a distance of only 8 cm, where the ileoileal component became stuck (Fig. 1 c). Fluoroscopy time was 1.3 min. The infant remained asymptomatic and clinically stable. She continued to be closely observed. Repeat

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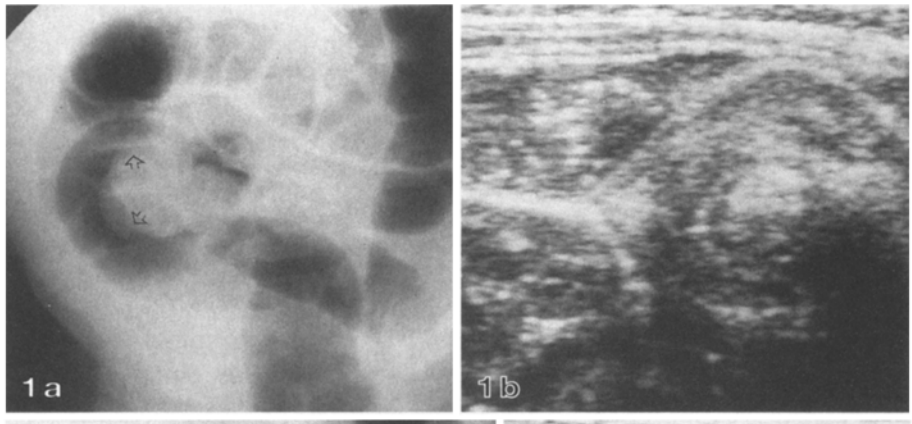


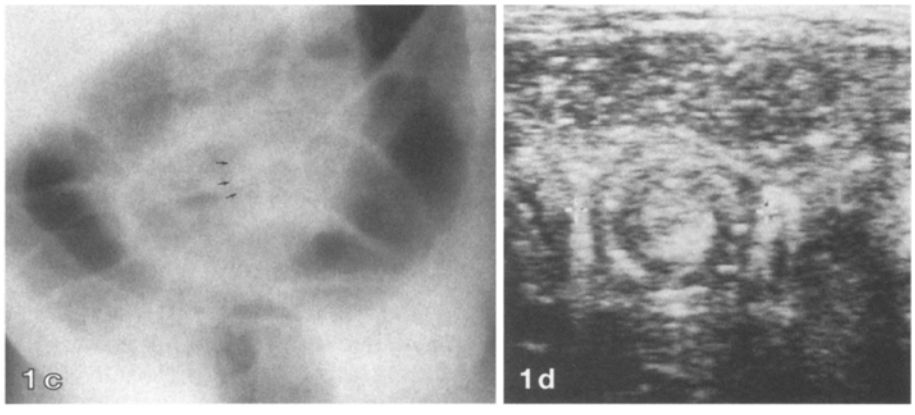
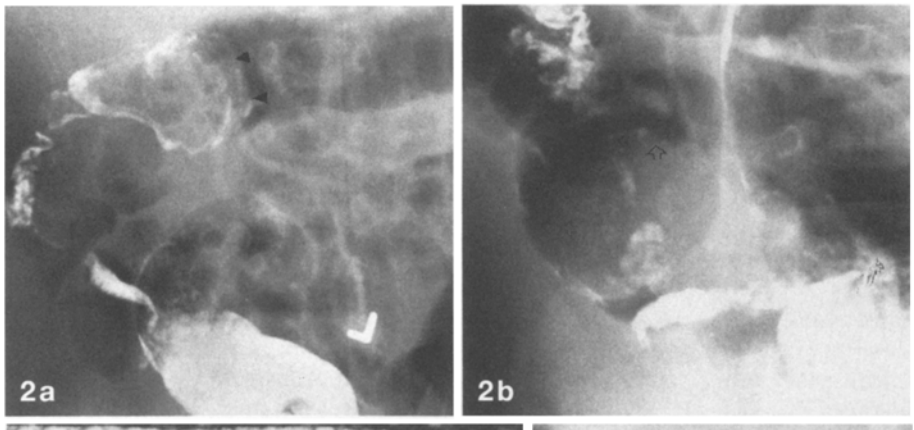


Fig. 1 a–d. Four-month-old girl with 24-h history of abdominal pain, irritability and blood per rectum. **a** Initial air enema showing an intussusception *(arrows)* at the level of the ileocaecal valve, as a soft tissue mass outlined by air. **b** Sonography 3 h later showing persistence of the large bowel intussusception, on cross section, identified in the right iliac fossa as a large doughnut lesion. **c** Repeat air enema after the sonogram showing reflux into the terminal ileum and outlining a residual small bowel intussusception *(arrows)* in the terminal ileum. **d** Sonography 3 h after the second air enema showing a small bowel intussusception, on cross section, in the right lower quadrant, which was subsequently reduced successfully with air



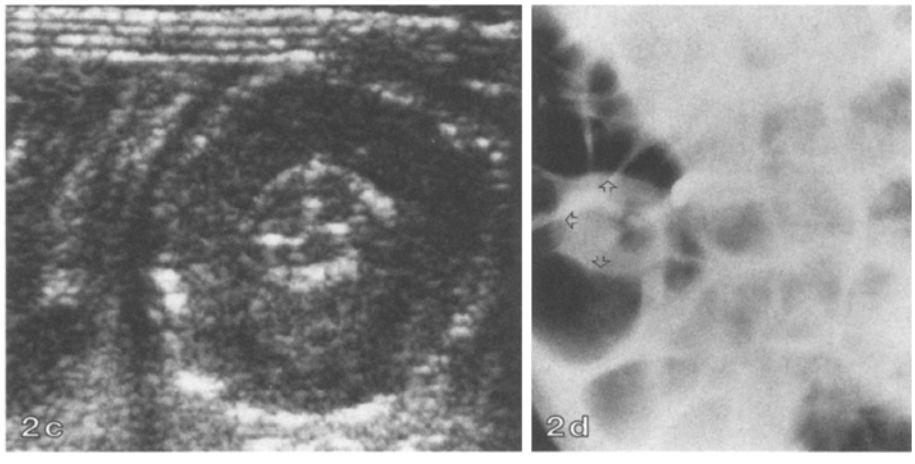


Fig. 2 a–d. Four-month-old girl with 24-h history of vomiting, abdominal pain and bloody stools. **a** Air enema 10 h after the first barium study showing residual barium. Air in the proximal transverse colon *(arrow)* outlines the persistent intussusception. **b** Air enema the following morning (12 h later) shows the intussusception *(arrows)* reduced as far as the proximal ascending colon. **c** Sonography after the second air enema shows a large bowel intussusception in the ascending colon prior to third reduction attempt. **d** Air enema 2 h after the sonogram achieves successful reduction of the intussusception, with reflux of air into the terminal ileum. Residual oedema of the ileocaecal valve present *(arrows)*

sonography 3 h later showed a small bowel intussusception (Fig. 1 d). Air enema at that time encountered a competent ileocaecal valve and the small bowel could not be filled with air. Fluoroscopy time on this occasion was 3.2 min. The patient was carefully observed for a further 12 h and repeat ultrasound then showed a persisting small bowel intussusception, which was completely reduced by air enema. Repeat sonography immediately following the enema showed no intussusception. The child did well and was discharged 24 h later, with no recurrence of her symptoms.

Case 2

A 4-month-old girl presented with a 24-h history of abdominal pain, one episode of vomiting and bloody stools for 12 h. An intussusception had been diagnosed at another institution where only partial reduction was achieved using barium. Her condition was stable, and she was transferred to this hospital where she was noted to be pale and tachycardic, with a soft abdomen and a mass in the right flank. Air enema was performed after her arrival, i.e. 10 h after the initial barium study. The intussusception was encountered in the mid-transverse colon (Fig. 2 a), and reduced to the proximal ascending colon. Fluoroscopy time was 7 min. Her condition improved and she became asymptomatic. She was closely observed overnight with monitoring of her vital signs.

A repeat air enema the following morning achieved further reduction to the ileocaecal valve (Fig. 2 b). A persisting mass in the caecum was suspicious for a residual intussusception, rather than an oedematous ileocaecal valve. Fluoroscopy time was 5 min. Sonography was performed which demonstrated the intussusception in the caecum with a thickened caecal wall (Fig. 2 c). Two hours later a repeat air enema achieved complete reduction (Fig. 2 d). Fluoroscopy time was 1 min. Post-procedural ultrasound showed residual oedema of the ileocaecal valve but was otherwise normal, without evidence of a mass or intussusception. The patient was discharged home well after 24 h. One week later she was readmitted with vomiting and diarrhoea. Air enema was negative and she was treated for gastroenteritis.

Discussion

It is standard practice that intussusception, once diagnosed, requires urgent reduction. Persisting intussusception results in oedema of the inner intussusceptum and causes stretching and thinning of the outer intussuscipiens, with resultant impairment of perfusion to the bowel wall and the risk of ischaemia or perforation [9]. Following complete reduction, perfusion of the bowel improves and oedema subsides. It has been suggested that this also happens to some degree following partial reduction [8].

Immediate surgery has been considered necessary for partially reduced or irreducible intussusceptions. However surgery and GA are not without complications [6, 9]. Furthermore, handling of the bowel during manual reduction risks serosal, and indeed mural tears in bowel that is already at risk because of compromised perfusion. Postoperatively there is the potential for adhesions and the development of small bowel obstruction and volvulus [6, 10–12]. Successful radiological reduction without surgery decreases the hospital stay as the patient is usually discharged the day after reduction. Nonoperative reduction, if possible, is therefore advantageous for many reasons.

Over the past two decades, different measures, have been tried all aimed at reducing the need for surgery and increasing the success rate of enema reduction. These include changing the height of the bag of barium, prolonging the length of time of maintaining pressure and the use of glucagon or sedation, and GA for second attempts [5–8].

We have described two infants in whom repeated delayed air enemas were performed in order to achieve complete intussusception reduction, without sedation or GA. Both infants improved clinically and remained stable following initial partial reduction. The interval between air enemas enables the infant to rest and fluid replacement to continue, and presumably allows oedema in the intussusception to subside (Figs. 1, 2). Subsequent attempts, therefore, may succeed in further reducing the intussusception. Such an approach to the management of intussusception should only be considered for a patient whose clinical condition is stable [5]. Regular monitoring of vital signs is mandatory. A deterioration in the patient's condition necessitates surgical intervention. This approach requires close liaison with one's surgical colleagues. In both these infants GA and laparotomy were avoided as nonoperative management was ultimately successful.

It is well recognized that intussusceptions can reduce spontaneously [13], and this may indeed occur before the repeat air enema. It is therefore important to confirm the persistence of the intussusception prior to repeat air enema. A sonographic examination can be performed in the fluoroscopy room so the patient does not have to move from room to room. The practice of sonography before each repeated attempted air reduction is useful.

We do not know the optimum time interval before sonography should be performed if the child remains asymptomatic and stable following partial reduction. Experience with larger numbers of patients will help to determine the appropriate interval.

Essential criteria for this form of management include: no sign of peritonitis, initial partial reduction of the intussusception, clinical improvement and stable vital signs. This group, therefore, may be quite few in number and represent a small percentage of all intussusceptions. However, the advantage of avoiding laparotomy in any particular patient is significant.

We conclude that active observation of the partially reduced intussusception should be considered, in a clinically improving and stable child, with repeated attempts at air enema reductions aimed at avoiding surgery, and sonography preceding the air enema. This approach deserves careful consideration and implementation.

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