

Sonographically guided hydrostatic reduction of childhood intussusception

Dubravka Vidmar, Alenka Višnar Perovič

Clinical Radiology Institute, University Clinical Centre Ljubljana, Slovenia

Background. Intussusception is the most common cause of bowel obstruction in children under two years of age. The proximal part of the bowel and its mesentery (the intussusceptum) enter within that part immediately beneath it (the intussusciptum). Being pulled by peristalsis the mesenteric vessels get compressed which result in ischaemia of the bowel wall. Most intussusceptions are ileocolic. The diagnosis can be confirmed by a contrast enema or ultrasound. Sonography demonstrates a so-called »target-within-a-target« pattern (in cross-section) with thickened edematous bowel wall with or without vascularisation and prestenotic dilatation with increased peristalsis. Therapeutic reduction can be attempted by a contrast enema (following diagnostic procedure) or by air, both under fluoroscopic monitoring, or by normal saline under sonographic guidance.

Patients and methods. We detected sonographically intussusception in three girls of 15, 16 and 18 months having typical clinical signs. We continued with hydrostatic reduction under the sonographic guidance. The reduction was attempted with a saline enema on body-temperature, introduced by the equipment for contrast enema. The bottle of normal saline was hung up 1 m over the examination desk. We needed few liters of saline to replace lost liquids due to the incomplete occlusion of rectum. Meanwhile we monitored the moving of the intussusceptum back into the proximal direction. Criteria for a successful reduction were the disappearance of the intussusceptum and the passage of fluid through the ileocecal valve.

Results. Success was proven in all three girls. No complications occurred and the pain relieved immediately after the procedure. There were no signs of intussusception on sonography after 2 and 12 hours. We saw a slightly edematous wall of ileocecal valve and terminal ileum. Due to their excellent clinical conditions they were discharged from hospital after a second sonography.

Conclusions. Sonographically guided hydrostatic reduction of intussusception in children is a method of choice because of its high efficiency and lack of radiation exposure. No complications have been reported to date.

Key words: intussusception-therapy-ultrasonography; child

Received 4 November 2004

Accepted 18 November 2004

Introduction

Correspondence to: Dubravka Vidmar MSc, MD, Clinical Radiology Institute, University Medical Centre Ljubljana, Zaloška 7, SI - 1525 Ljubljana, Slovenia.

Intussusception is the most common cause of bowel obstruction in early childhood, with the peak incidence between 6 months and 2

years of age.¹ It is typically presented with an acute onset of colicky abdominal pain. However, the clinical symptoms can be confusing, with recurring non-specific abdominal symptoms, especially when the bowel obstruction is not complete. Intussusception occurs when one segment of the bowel (the intussusceptum) becomes telescoped into the immediately distal segment of bowel (the intussusciens). Once trapped, the invaginated segment is propelled by peristalsis farther into the distal segment, pulling its mesentery along it. Intussusception can develop in any free-moving part of the bowel. However, the vast majority of childhood cases are ileocolic;² that is, the ileum becomes telescoped through the ileocecal valve into the cecum. The mesenteric vessels of the intussusceptum become compressed, which leads to ischemia and eventually bowel necrosis, particularly at the apex of the intussusceptum.

The diagnosis of intussusception is made by a contrast enema or ultrasound. At the time of diagnosis, a radiologist should attempt the reduction of intussusception. A therapeutic reduction can be attempted by a contrast enema (following diagnostic procedure) or by air insufflation, both performed under the fluoroscopic monitoring. Recently, a new technique - hydrostatic reduction with ultrasound guidance - has been recognized to be equally successful.

Patients and methods

Three female patients, 15, 16, and 18 months of age, with a severe colicky abdominal pain and clinically suspected intussusception were evaluated by sonography. The ileocolic intussusception was detected in all three cases. The examinations were performed with Toshiba PowerVision 6000 SSA-370A ultrasound scanner. A diagnostic procedure was continued with hydrostatic reduction under the sonographic guidance. The reduction was

attempted with a normal saline enema, warmed to body temperature, introduced by the equipment for contrast enema. To achieve the appropriate hydrostatic pressure within the bowel lumen, the bottle of normal saline was hung up 1 m above the examination desk. To form a tight seal and to reduce leakage of fluid, the catheter was placed in the rectum through the rubber ring, which was taped to gluteal region. However, the occlusion was still incomplete and we had to use several liters of saline to replace lost fluid. During the fluid instillation, we monitored how the intussusceptum proceeded in the proximal direction. The criteria for a successful reduction were the disappearance of the intussusceptum, followed by the reflux of fluid from the cecum through the ileocecal valve into the terminal ileum. The mean time of the reduction procedure was 15 minutes.

Results

All three attempts at sonographically guided hydrostatic reduction of intussusception were successful. No complications occurred. The pain relieved immediately after the procedure and the patients recovered quickly. The follow-up sonography scan was performed 2 and 12 hours after the procedure. In all three cases follow-up scans showed a slightly oedematous wall of ileocecal valve and terminal ileum and a small quantity of free intraperitoneal fluid. Due to the excellent clinical condition of the patients, they were discharged from hospital after the second follow-up sonography.

Discussion

Intussusception is the most common cause of bowel obstruction in early childhood, with the peak incidence between 6 months and 2 years of age.¹ It is typically presented with an

acute onset of colicky abdominal pain; however, when the bowel obstruction is not complete, the clinical symptoms can be confusing with the recurring non-specific abdominal symptoms. Intussusception occurs when one segment of the bowel (the intussusceptum) becomes telescoped into the immediately distal segment of the bowel (the intussuscipiens). Once trapped, the invaginated segment is propelled by peristalsis farther into the distal segment, pulling its mesentery along it. The mesenteric vessels of the intussusceptum get compressed, the ischemia and eventually bowel necrosis ensue. The apex of the intussusceptum is the part most prone to the development of pathologic changes. Most cases of intussusception are idiopathic, with no identifiable lesion acting as the lead point. Rarely, a mechanical lead point, such as intestinal polyp, Meckel diverticulum, duplication cyst or lymphoma, can be found. Even more rare is the intussusception in correlation with cystic fibrosis, Henoch-Schonlein purpura, hemophilia or intussusception after operative abdominal procedures.² Intussusception can begin in any free-moving part of the bowel; however, the ileocolic intussusception is the most common, with the ileum being telescoped through ileocecal valve into the cecum. Less frequently, small - intestinal (segment of small intestine enters into the immediately distal segment of the small intestine), colo-colic (analogous pathology in the colon) or ileocecal (ileocecal valve is the lead point) types can develop.

The diagnosis of intussusception is made by a contrast enema or ultrasound. Many pathologic conditions of the bowel wall produce the characteristic sonographic appearance of a »target« sign on transverse images. In intussusception this appearance is even more characteristic with a »target-within-a-target« sign on transverse images and »hayfork« sign on longitudinal scans (Figures 1, 2).

The inner target represents the intussusceptum and the outer target is produced by



Figure 1. Sonography (transverse scan): »target-within-a-target« sign.



Figure 2. Sonography (longitudinal scan): »hayfork« sign.

the intussuscipiens. The wall of the intussusceptum is oedematous and therefore hypoechoic on sonography scans. With Doppler imaging the presence of compromised/absent blood flow in the bowel wall can be demonstrated, which is important in differentiation from the acute inflammation. The bowel loops proximal to the »target-within-a-target« sign are dilated with increased peristalsis. In all three patients that we examined, the ileocolic intussusception was detected and the described characteristic signs were clearly visible. Ultrasonography is highly accurate in the diagnosis of intussusception with a specificity of 100% and a sensitivity of 88 - 93%.^{3,4}

After the diagnosis is made, the primary aim should be a non-operative reduction of the intussusception. Up until recently, the non-operative management included a contrast enema (barium) or air insufflation, both performed under the fluoroscopic monitoring. As ultrasound became the imaging modality more and more used also for bowel pathology, the conditions for sonographically guided reduction of the intussusception were formed. Free intraperitoneal fluid and signs of mechanical ileus are not contraindications for this procedure; the procedure is successful also in children with fluid in the peritoneal cavity.^{1,5} As the saline fills the colon, the apex of the intussusceptum is observed under the continuous ultrasound guidance as it proceeds in the proximal direction. The criteria for a successful reduction are the disappearance of »target-within-a-target« sign, visualization of ileocecal valve and reflux of fluid from the cecum into the terminal ileum (Figure 3).^{5,6}



Figure 3. Sonography: ileocecal valve and fluid within the ileum.

To achieve the appropriate hydrostatic pressure within the bowel lumen (at least 60 mmHg, not more than 120 mmHg), the canister used to run normal saline into the rectum

should be placed 1 m above the examination desk.¹ To avoid hypothermia, the fluid should be warmed to body temperature. Even though the catheter was placed in the rectum through the rubber ring, which was taped to gluteal region, the leakage of saline around the catheter was substantial in all three patients. We needed several liters of saline to replace lost fluid. All three attempts at a sonographically guided hydrostatic reduction of intussusception were successful, which was confirmed by two follow-up sonographic scans performed 2 and 12 hours after the procedure. According to published data, the sonographically guided hydrostatic reduction of childhood intussusception is curative in 76 - 93% of cases.⁶⁻¹⁰ Riebel *et al.* reported that, in comparison with other conservative methods of reduction, the success rate of sonographically guided hydrostatic reduction of intussusception was not substantially worse (versus that of pneumatic reduction) or was even higher (versus that of barium enema reduction).⁸

At both follow-up sonographic scans all three patients had slightly edematous wall of ileocecal valve and terminal ileum, which is in accordance with other studies.¹ No complications occurred. The pain relieved immediately after the procedure and the patients recovered quickly. The review of the available literature also did not reveal any complications of this procedure.^{1,6-10} The mean time of the reduction procedure was 15 minutes, which is similar to previously published reports.⁶

Conclusion

From our initial experience and review of the literature we can conclude that the sonographically guided hydrostatic reduction of childhood intussusception is a simple, safe and very successful technique that does not expose the child to ionizing radiation and can in many cases replace operative management.

References

1. Limberg B. Invagination. In: Limberg B, editor. *Sonographie des gastrointestinaltrakts*. Berlin: Springer Verlag; 1998. p. 93-7.
2. Eich FG, Willi UV. Acute abdomen in children. In: Krestin GP, Choyke P, editors. *Acute abdomen*. Stuttgart: Georg Thieme Verlag; 1996. p. 255-9.
3. Verschelden P, Filiatrault D, Garel L, Grignon A, Perreault G, Boisvert J, et al. Intussusception in children: reliability of US in diagnosis - a prospective study. *Radiology* 1992; **184(3)**: 601-2.
4. Bhisitkul DM, Listernick R, Shkolnik A, Donaldson JS, Henricks BD, Feinstein KA, et al. Clinical application of ultrasonography in the diagnosis of intussusception. *J Pediatr* 1992; **121(2)**: 182-6.
5. Feinstein KA, Myers M, Fernbach SK, Bhisitkul DM. Peritoneal fluid in children with intussusception: its sonographic detection and relationship to successful reduction. *Abdom Imaging* 1993; **18(3)**: 277-9.
6. Peh WC, Khong PL, Chan KL, Lam C, Cheng W, Lam WW, et al. Sonographically guided hydrostatic reduction of childhood intussusception using Hartmann's solution. *AJR Am J Roentgenol* 1996; **167(5)**: 1237-41.
7. Rohrschneider WK, Troger J. Hydrostatic reduction of intussusception under US guidance. *Pediatr Radiol* 1995; **25(7)**: 530-4.
8. Riebel TW, Nasir R, Weber K. US-guided hydrostatic reduction of intussusception in children. *Radiology* 1993; **188(2)**: 513-6.
9. Wood SK, Kim JS, Suh SJ, Paik TW, Choi SO. Childhood intussusception: US-guided hydrostatic reduction. *Radiology* 1992; **182(1)**: 77-80.
10. Crystal P, Farber B, Shabshin N, Barki Y. US-guided hydrostatic reduction of childhood intussusception. *EJU* 1999; **10(Suppl 1)**: 18S.