

Ultrasound-Guided Hydrostatic Reduction of Childhood Intussusceptions Using Water Enema

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Abstract

Conventional hydrostatic barium reduction or pneumatic reduction of intussusception is associated with considerable ionizing radiation. The aim of this study was to evaluate ultrasound-guided hydrostatic reduction for childhood intussusception using water enema. A total of 76 children who diagnosed as having intussusception were referred to Doctor Sheikh Children Hospital in Mashhad (northeast Iran) during a 4.5-year period from March 2002 to September 2006. Hydrostatic reduction of intussusception was performed under sonographic guidance in 66 patients, whereas, 10 patients were excluded due to clinical contraindications. The disease was observed mostly at the age of 5-9 months. In 53% of patients, there was a recent history of gastroenteritis or common cold. The most common site of intussusception was the transverse colon (49%) with the mean duration of 22.1 ± 17.3 hours. The overall rate of successful reduction was 78.8% and the mean reduction time of 14.8 ± 18.56 minute. The successful reduction rate would have been 94.5%, if the patients with gangrene were excluded. We conclude that ultrasound-guided hydrostatic reduction using water enema is an optimal, simple, and safe procedure for the treatment of childhood intussusception

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Keywords • Children • invagination • intussusception • water enema

Introduction

Intussusception is the most common cause of intestinal obstruction in early childhood.^{1,2} It may lead to bowel ischemia, perforation, peritonitis, or death if untreated.³ Reduction of intussusception is an emergency procedure that must be performed immediately after preparing the patients. Reduction can be done surgically, or non-surgically. Non-operative reduction of intussusception is currently the treatment of choice and more than 75% of cases without intestinal gangrene or peritonitis are treated non-surgically.⁴

The conventional barium reduction or pneumatic reduction of intussusception with fluoroscopic guidance is accompanied by considerable ionizing radiation. In recent years, various authors have described a new method for hydrostatic reduction of intussusception under sonographic control.^{2,5-8} Having considered its low cost and safety, the ultrasound-guided hydrostatic

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reduction is superior to other methods of reduction.⁹ The aim of this cross-sectional study was to evaluate the ultrasound-guided hydrostatic reduction of childhood intussusception using water enema.

Patients and Methods

A total of 76 children who diagnosed as having intussusception were referred to Doctor Sheikh Children hospital, in Mashhad, northeast Iran, during a period of 4.5 years period from March 2002 to September 2006. After confirmation of the intussusception by ultrasonography, written informed consents were obtained from the parents, and the patients were admitted to the surgery ward. An intravenous line was established to administer antibiotics. Blood samples were drawn for routine laboratory evaluation and cross-matching.

With the patients lying in semi-supine or left lateral position, an appropriate rectal tube (No.22-25) of the largest size was inserted into the rectum without lubricant, and the buttocks were pressed together by the parents. No sedative was used for the patients. Before therapeutic enema a pediatrician was consulted and asked to attend the procedure. Ultrasound-guided water enema reductions were performed by a radiologist in the radiology department. The parents usually assisted the radiologist by holding the child. Hydrostatic reduction of intussusception was performed under sonographic guidance in 66 patients. Ten patients were excluded from the study because of non-surgical reduction, such as the presence of signs and symptoms of peritonitis, perforation, shock, etc.

The reduction was attempted using a warm water reservoir at a height of 100-120 cm above the table-top with occasionally required higher heights (up to 150Cm). The vital signs and the abrupt accumulation of liquid in abdomen were controlled during the procedure. Reduction of intussuscepted loops was controlled by sonography using a 5-10 MHz transducer (Siemens, Sonoline Aldara; USA). The observed fluid surrounding the intussusception was gradually reduced through the ileocecal valve.

The procedure was continued until the intussusceptum disappeared completely and the distal ileum was filled with water. The reduction stopped for 10-15 minutes in those patients that the procedure failed after a 10-minute effort. Then procedure applied for maximum three times and manual abdominal palpation was applied in some patients to ease the reduction.

After successful reduction, the abdomen was re-examined to detect any lead point or recurrence of intussusception. The patients were then transferred to surgery ward and after 24

hours, regular oral diet began and the patients were discharged. Partially reduced cases of intussusception underwent surgical treatment. Fisher exact test is used for the assessment of the relation between intussusception sites and the hydrostatic reduction outcome and/or presence of gangrenous bowel.

Results

Demographic and clinical data of the patients are shown in Table 1. The average age of the patients was 16.44±19 months (range 3.5-102 months), and 86% being below 24 months. The disease was observed mostly in boys (76%). The mean time of symptoms duration before the treatment was 22±16.8 hours (range 2-72 h). Complete reduction was achieved in 52 of 66 patients (78.8%).

Hydrostatic reduction was impossible in 14 patients, bowel resection was performed in 12 patients and the intussusceptions were surgically reduced in two patients. The intussusceptum were located beyond the splenic flexure in 58% of these patients. In pathologic evaluations gangrene was confirmed in 11 out of the 12 bowel resected patients, but in one patient there was evidence of severe edema without gangrene. No clinical signs of gangrenous bowel were observed.

Table 1: Demographic and clinical data of patients with intussusception

Clinical data	n (%)
Blood in the stool	42 (64)
Fever	31 (47)
Associated disease	
None	30 (45.5)
Gastroenteritis	20 (30)
Upper respiratory tract infection	15 (23)
Trauma	1 (1.5)
Site of intussusception	
Hepatic flexure	8 (12)
Transverse colon	31 (49)
Splenic flexure	13 (20)
Beyond Splenic flexure	12 (19)

Hydrostatic reduction was successful in 78.8%. However, by exclusion of the patients with gangrenous bowel from the calculation, this rate would change to 94.5%. Successful hydrostatic reduction was achieved in 59%, 10.5% and 9.3% of patients with one, two and three attempts respectively. The mean reduction time was 14.8±18.5 min (at least 30 seconds, and maximum up to 40 minutes).

There was a significant relation between the site of intussusception and the hydrostatic reduction outcome and/or an increased incidence of gangrenous bowel ($P<0.001$). Recurrences occurred in two cases (3.8%) with successful attempts at re-reduction. No water intoxication, during or after hydrostatic enema were noted. In

one patient bowel perforation occurred, which was diagnosed immediately and the patient was referred to the surgeon and improved after surgery without any complication. The overall, surgery was required in 31.5% of patients.

Discussion

Intussusception is the most common abdominal emergency of early childhood for which non-operative reduction is currently the treatment of choice.¹ Kim et al. described hydrostatic reduction under ultrasound guidance.^{2,9} It is believed to be one of the most promising methods for non-operative treatments in pediatric intussusception.¹⁰ The advantages of this method are the absence of exposure to radiation, complete evaluation of the procedure with definite criteria for success, direct observation of the patient's condition, and immediate diagnosis of intestinal perforation or other complications. The concurrent diagnosis and the treatment of intussusception is highly time saving and has a valuable effect on patients' prognosis.^{9,11}

The clinical findings, age, sex, site of intussusception, and mean time of reduction in this study were comparable to those of other investigations.^{7,12} The history of viral gastroenteritis and upper respiratory tract infection has been reported in 20% of the patients,¹⁰ but in our study the concurrence of these infections with intussusception was observed in 53% of cases (Table 1). The success rate of ultrasound-guided hydrostatic reduction is more than 90%.^{5,10,13,14} However, the low rate of successful reduction in our study (78.8%) seemed to be due to the existence of high gangrene rate.

Although the geographic frequencies of intussusception are strikingly variable,¹² admission of 76 patients during a 4.5-year period in the only pediatric surgery center in north east of Iran with about 3 million population shows the low incidence of intussusception in this area. The relative low prevalence of childhood intussusception in our area could be the cause of low clinical expertise in work up of these patients and consequently delayed admission. It is the probable cause of our low success rate in this study.

Our results showed that patients' age, the duration of symptoms, and the site of intussusception were not contraindications for non-surgical reduction. According to the results of this study, in case of unsuccessful reduction, after three attempts, the possibility of bowel gangrene should be considered. High gangrene rate and ileo-ileal component were reported in patients with unsuccessful reduction.^{6,9}

In order to increase the rate of successful reduction, some researchers advise to reattempt the procedure after 0.5-4 hours.^{15,16} Gonzales

et al. reported that the rate of successful reduction was 81.9%, but it increased up to 88.2% at the second attempt.¹⁵

In our non-gangrenous patients the success rate of reduction was 94.5%. Therefore, in patients with unsuccessful reduction we do not recommend additional attempts, because most of these patients may have gangrenous bowel and further attempts may lead to bowel perforation.^{5,9}

In conclusion ultrasound-guided hydrostatic reduction using water enema is an optimal method for the treatment of childhood intussusception, because it is a simple and safe procedure with high success rate and without radiation exposure.

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