



A Nine Case Series of Ultrasound-Guided Hydrostatic Reduction of Intussusception by Saline Enema

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Abstract

Non-surgical reduction of the intussusception is the first line treatment in children with intussusception. Among various radiological reduction techniques, barium enema reduction of the intussusception under fluoroscopy has been widely used in Thailand while pneumatic reduction under fluoroscopy has become popular in teaching hospitals. To our knowledge, ultrasound-guided hydrostatic reduction of the intussusception by saline enema (UGHSE) has never been used in Thailand. We reported 9 cases using UGHSE with 100% success rate without complication.

Introduction

Intussusception is the invagination of one bowel segment into the lumen of the other. It is a common cause of the intestinal obstruction in infants and children. It frequently occurs in well-nourished infants, mostly are 4 to 12 months old¹. The majority of the causes are idiopathic². The remaining causes are the pathologic lead points such as polyp, Meckel's diverticulum, duplication cyst^{1,2}. US is the modality of choice for the diagnosis of intussusception³. The traditionally barium enema was used to diagnose and reduction of intussusception¹. If the attempt of reduction was failed, surgery was subsequently indicated. There have been various techniques mentioned in the literature that improved the success rate and less perforation rate⁴⁻⁶. The advantages and disadvantages of each technique has been discussed^{2,4-6}. The technique of radiological reduction in daily practice depends on the radiologist's preferences⁷. In Thailand barium enema reduction of intussusception under fluoroscopy has been widely used and pneumatic reduction under fluoroscopy is popular in teaching hospitals, while UGHSE has never been used.

Case series

From January 1, 2011 to July 31, 2013, we performed UGHSE in 9 children. The detail of each patient is shown in table 1. There were 5 boys and 4 girls, aged 4-36 months (average 19.6 months). All except one patient had no fever on the presentation. The most common symptom was abdominal pain (56%), followed by fever (44%), vomiting (33%), diarrhea (22%), and bloody stool (22%). The maximum duration of the symptoms was 6 days, average 2.28 days. Seven out of 9 nine (78%) patients had negative physical examinations. White blood count

was done in 8 patients. All of them showed no leukocytosis or neutrophil shift. Five patients had abdominal radiographs but intussusception was suspected in only two (22%). All the intussusceptions was diagnosed by US, showing target sign in short-axis view. The most common locations of the intussusception apices was hepatic flexure in 7 (78%).

The average axial diameter of the intussusception was 2.41 cm (range 1.9-3.2 cm). Reduction was successful by the first attempt in 7 of 9 (78%) and the second attempt in 2 (22%). All children was free from complication or recurrence in at least 48-hour follow up.

Technique

We informed parents, pediatricians with/or without surgeons before the procedure. The procedure was performed in the US room. An enema bag was filled with 1,000 ml of normal saline that was warmed at the temperature of 37°C and was kept at 100-120 cm above the table top. The upper end of the saline bag remained open. A well-lubricated Foley's catheter (12-16 F was introduced transrectally) with balloon inflation. The buttocks was firmly taped together with adhesive tape and by manually during the procedure. No sedation, muscle relaxant or prophylaxis antibiotic was administered. The reduction was observed under the guidance of US by using a 5-12MHz linear transducer (Toshiba Aplio, XG SSA-790A, Japan). Successful reduction was determined when the IC valve and terminal ileum were visualized associated with fluid reflux into the small bowel. During the reduction, we intermittently observed US findings of perforation including sudden collapse of the colon, and rapid increased intraperitoneal free fluid.

Table 1. Details of 9 patients.

Case No.	Sex	Age (mo)	Symptoms	BT (°C)	PE-abdo men	WBC/N	Abd film	US intus location+ size	Successful reduction
1	M	5	Fever+ vomiting 1 day	36.9	neg	14600 (N 59 , L39 , Mo 2)	Suspected mass at RUQ	Hepatic flexure 2.1 cm	1 st attempt
2	M	34	Abdominal pain 9 hours	36.1	Mass ?	8900 (N 42 L 47 Mo 11)	-	Mid ascend 2.2 cm	1 st attempt
3	F	4	Fever 3 days, Bloody stool + vomiting 1 day	36.9	neg	3800 (N 60 L 32 Mo 7)	Unremarkable	rectosigmoid	1 st attempt
4	M	25	Abdominal pain 1 day	37.2	neg	5500 (N 73 L 23 Mo 3)	-	Hepatic flexure 2.1 cm	1 st attempt
5	M	36	Abdominal pain 4 days	36.0	neg	10300 (N 49 L 47 Mo 3)	-	Hepatic flexure 3.1 cm	1 st attempt
6	F	26	Abdominal pain + vomiting 2 days, diarrhea ? day	37.0	neg	11600 (N 46 L 51 Mo 3)	Suggestive of intussuception	Hepatic flexure 2.7 cm	1 st attempt
7	M	10	Abdominal pain 1 day	36.5	neg	9400 (N 54 L 39 Mo 7)	-	Hepatic flexure 2.1 cm	2 nd attempt
8	M	28	Fever 6 days, diarrhea 2 days	39.1	neg	3400 (N 25 L 61 Mo 13)	-	Hepatic flexure 2.3 cm	2 nd attempt
9	F	8	Fever + bloody stool 2 days	36	RLQ mass	-	Unremarkable	Hepatic flexure	1 st attempt

Note : abdominal film - 5 cases in written part, but show only 4 cases in table

Discussion

There is a wide variation in the techniques of non-surgical reduction of the intussusception⁷. Variation refers in two aspects. The first variation depends on guidance method either fluoroscopy or US. The other variation depends on material used either liquid or gas. Pneumatic reduction under fluoroscopy has become popular nowadays because of higher success rate than barium^{5,6}. However it still has radiation hazard. Hydrostatic reduction by saline enema is quite popular in Eastern world². In the large series of Bai YZ et al.², they reported

UGHSE in 5218 cases and the success rate was 95.5% with 0.17% perforation rate. The only disadvantage of US is operator dependent. Thus learning curve is needed to perform with confidence. Newer techniques such as US-guided pneumatic reduction⁸, external manual reduction with US assistance⁹ have been presented recently. The best technique has not been in consensus yet. US criterion for successful reduction were disappearance of the intussusceptions, and fluid reflux into the terminal ileum². We observed that visualization of the IC valve made us more confident in distinguishing between

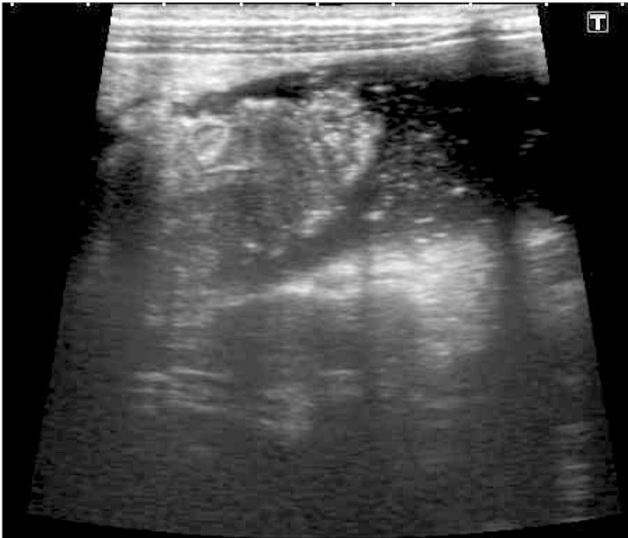


Fig. 1 Normal saline at the apex of intussusception

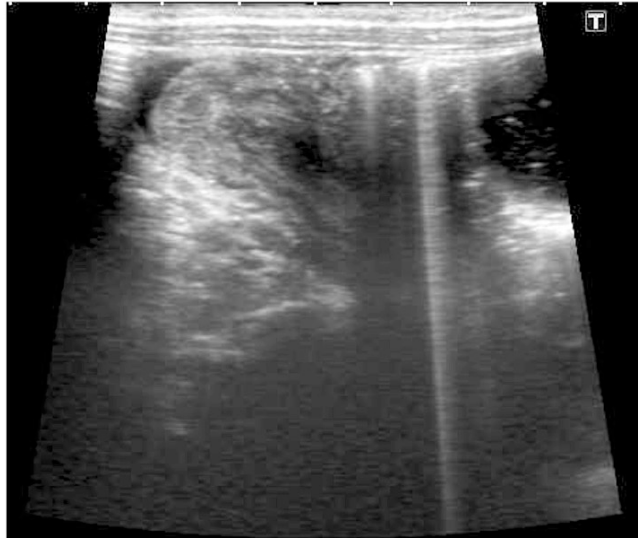


Fig. 2 Intussusceptum at IC valve



Fig. 3 Intussusceptum passing IC valve



Fig. 4 Intussusceptum almost passed IC valve

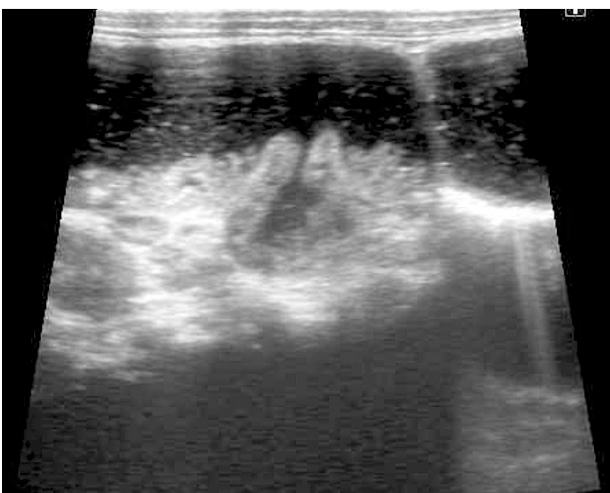


Fig. 5 IC valve post reduction

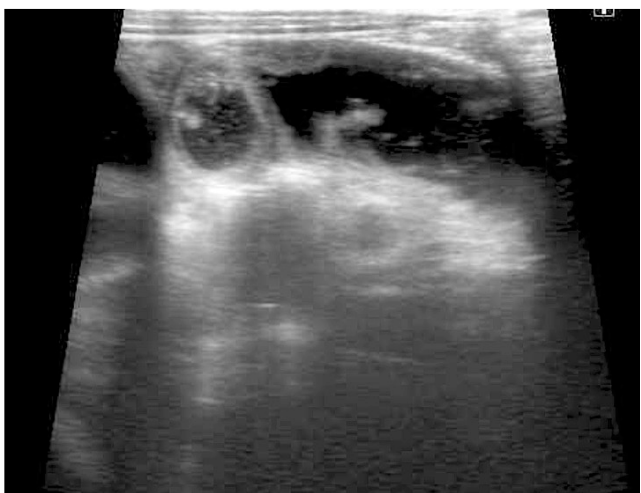


Fig. 6 Swollen terminal ileum with gradual transition to normal wall

colon and ileal loops. Yoon CH, et al.⁸ proposed the other criteria as abrupt transition between the swollen terminal ileum and the proximal normal ileal loop in long-axis scan could rule out any residual ileoileal intussusception.

We did not use any sedation in this our series as well as in the report of 194 cases by Gonzalez-Spinola, et al.¹⁰ which showed success rate in almost 90%. However In the recent report of Ilivitzki A, et al.¹¹ claimed that using deep sedation with propofol during reduction of intussusceptions was safe and effective.

Conclusion

In our 9 case series, UGHSE is feasible with high success rate without complication. The benefit is no radiation which is a point of our concern. We would like to encourage radiologists to perform this technique. If we have enough number of patients, we can generalize the advantages or disadvantages of this technique.

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