SONOGRAPHICALLY GUIDED HYDROSTATIC REDUCTION OF CHILDHOOD INTUSSUSCEPTION IN UTTARADIT HOSPITAL [1]

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ABSTRACT

Over 10-year period, real-time ultrasound (US) were performed in 33 intussusceptions (32 cases). 21 cases were undergone immediate reduction procedure after the diagnosis. The reductions were performed under US-guided using normal saline as enema fluid under pressure control of 80-110 mmHg. The height of the enema bag is about 3feet above the table top as usual. 4 cases were successfully reduced. Complete reductions could not be confirmed in another 3 cases but follow up revealed complete recovery. 14 cases were operated. 12/14 operated cases underwent manual reductions and 2/14 got bowel resections. Surgical findings were as followed: 1 gangrenous bowel,1 polyp in the terminal ileum,1 inflamed appendix, 3 ileo-ileocolic intussusceptions, 3 ischemic changes, 4 long intussusceptions, 4 small residual intussusceptions and 1 negative for intussusception (more than one findings in one case).

Success rate of reduction is 19.05% (n=21). Factors influencing incomplete reductions were poor general conditions, massive rectal bleeding, small bowel obstruction and rectal-sealed problem.

Potential improvement can be made to achieve better result. The seal problem can be avoided by inflation of the Foley's balloon and controlling the reduction time not longer than 15 minutes. The poor general conditions should be improved prior reduction attempted. Although this method has not yet been shown to be as good as those conventional ones, the obvious benefits are radiation free effect and being more friendly to the atmosphere. Sonogram is operator dependent and the US-guided saline enema reduction needs time for learning curve to become more accepted procedure.

Index term: Children intussusception, hydrostatic reduction, US-guided.

INTRODUCTION

Intussusception is one of the most common causes of the acute abdomen in early childhood. Intussusception occurs when a portion or the digestive tract becomes telescoped into the adjacent bowel segment. This condition usually occurs in children between 6 months and 2 years of age.[1]

In the past, intussusception could be a severe condition with high morbidity and mortality rates. Currently, prompt diagnosis and effective treatment lead to favorable outcomes in most cases. In fact, there are mild cases that may reduced spontaneously.[2,3]

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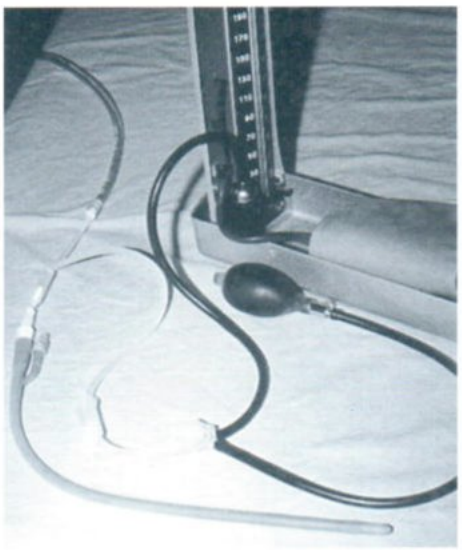
Radiologists play roles in the diagnosis and therapy of the suspected intussusception. US has been reported to achieve a sensitivity of 98.5-100% in the diagnosis of intussusception.[15-16] Several studies have emphasized the value of sonography as an initial screening procedure in patients with suspected intussusception.[12-13] Some authors do not recommend US as a routine screening method because US signs, most commonly used as diagnostic criteria of intussusception, are not pathognomonic.[12,14-17] Fluoroscopy guided barium enema and pneumatic reduction techniques are widely used. However, both methods are under ionizing radiation. There is no consensus as to which technique is superior.[4] Recently, sonographically guided hydrostatic reduction has been used with different types of enema fluid.[5-10]

This article describes the author experience of US-guided hydrostatic reduction of intussusception. The purpose of the article is to first report of this technique in Thailand and to encourage the procedure usage.

MATERIALS AND METHODS

Over a period of 10 years (May 1997-Apr 2007) 33 intussusceptions (including 1 case of recurrence) were diagnosed with sonogram study.[21] consecutive unselected patients underwent hydrostatic reduction with US monitoring. The procedure as well as the equipment followed those of the Queen Sirikit National Institute of Child Health (Children Hospital) Bangkok Thailand with addition of enema bag to the system11 (Fig.1). They were 10 boys and 11 girls ranging in age from 2 to 39 months(average 13.6 months). 12/33 intussusceptions were excluded due to incomplete information (6 cases) and reduction by other techniques (6 cases). US examinations were performed with 5-8 MHz convex and linear transducers (Aloka 650, BK 3535 and BK 2000 Panther advanced imaging). All cases were diagnosed upon sonographic findings. The signs of intussusception including target sign, pseudokidney sign and multiconcentric ring sign were demonstrated (Fig.2). The reduction attempts upon agreement of attending physician and surgeon immediately followed the diagnosis of intususception. All cases showed no sign of peritonitis. Those cases with leading points demonstrated were proceeded for surgery. Plain films of abdomen were performed in some cases. Reduction was performed without sedation, antispasmodic nor intentional external pressure on the abdomen. The process of reduction demonstrated by ultrasonography was shown in figures 3a-3f (Fig.3). There is warm, friendly atmosphere in the US room with parents, clinicians, nurses, circulating personals as well surgeons. Patient vital signs and general appearance were easy to access during the procedure than under the fluoroscopic screen that overshadowed the small patient.

The reduction started with insertion of a Foley's catheter, as largest diameter as possible, into the rectum. Two years experience with sealing problem has led to the use of balloon-type catheter to provide an effective airtight seal. The patient's arms and buttocks were held closely together with cloth and adhesive tape. The buttocks also pressed together manually during the procedure. The enema fluid (normal saline 400 to 1000 ml) at body temperature was introduced (controlling pressure between 80-100 mmHg) via Y tube connection by inflated rubber bulb of a sphygmomanometer (Fig.2a). Some authors place the enema bag at 80-100 cm above the supine patient to create hydrostatic pressure of 83-104 cm water which is equivalent to 61-77 mmHg (A 1cm water column is equivalent to a 0.74 mm mercury column).[6]



a

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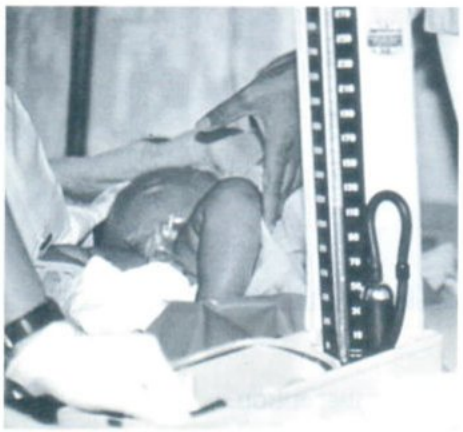

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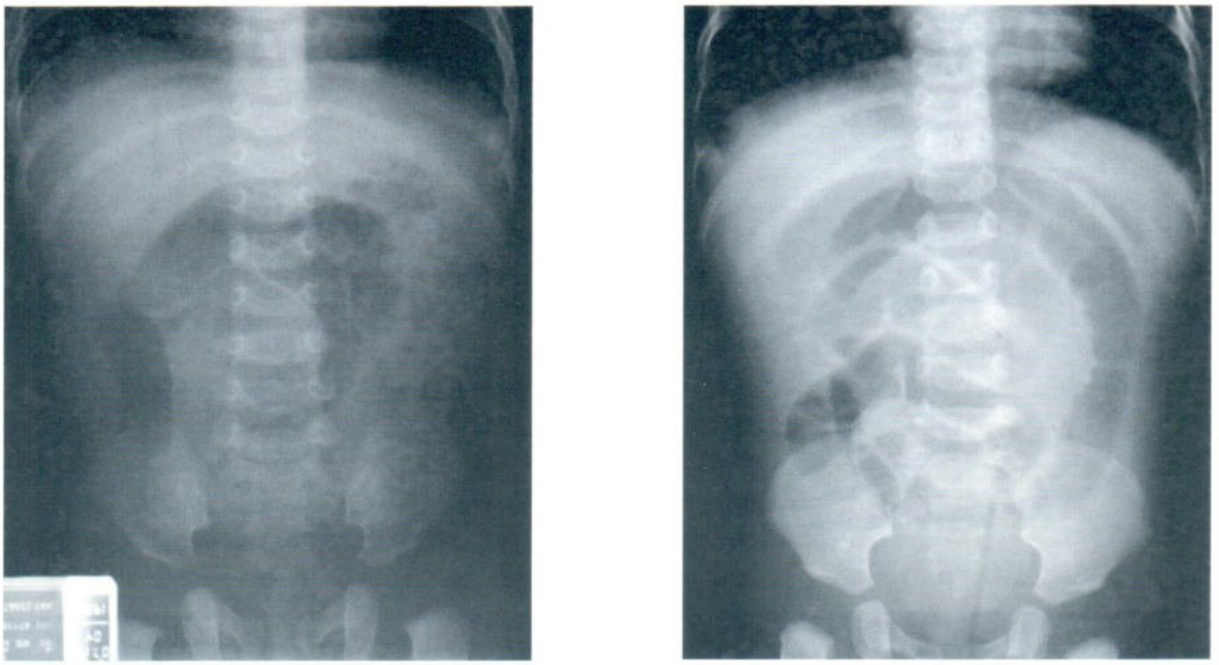
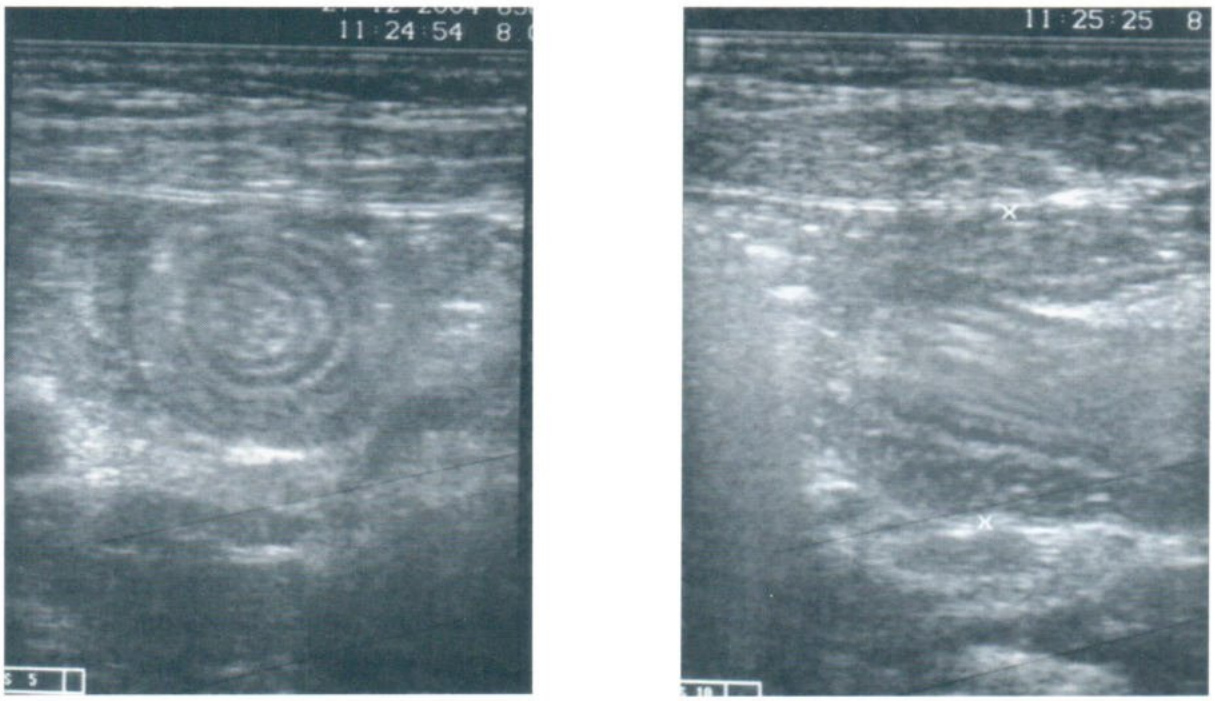
Fig.1 a & b system of rectal catheter sphygmomanometer and saline enema bag;

Fig.1c & d the patient hands and knees were wrapped with clothes; fig.1e reduction was monitored under ultrasound by radiologist.



a b

Fig.2 a&b plain films of abdomen in two patients showing bowel dilatation and absent of rectal gas. No sign of pneumoperitoneum.



a **b**

Fig.3 a&b sonogram shows the target and pseudokidney signs of intussusception.

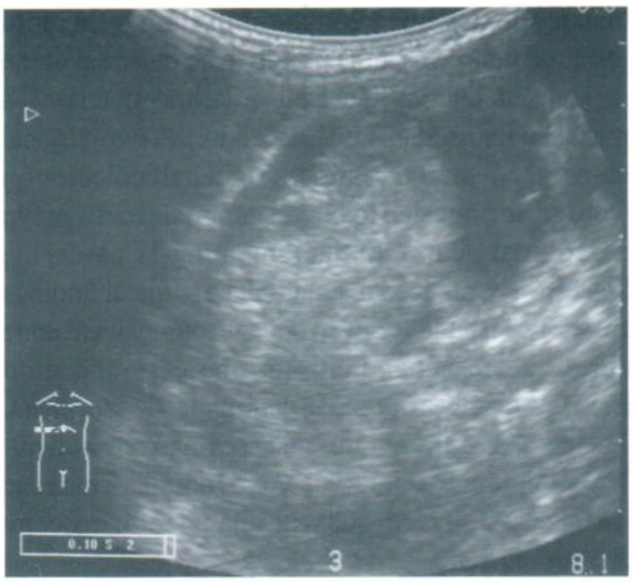


Fig 3c shows saline enema reduction with intussusceptum outlining by fluid.

Fig 3d shows disappearance of intussusceptum from the cecum.

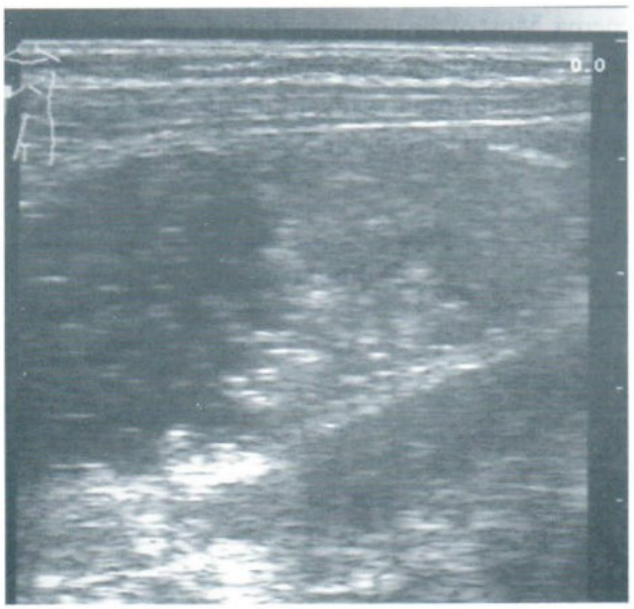


Fig.3e shows residual mucosal edema in cecum.

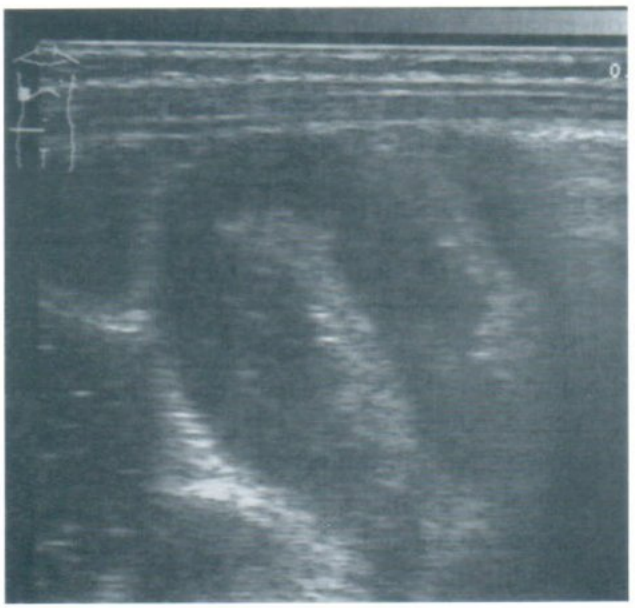


Fig.3f shows complete reduction, confirmed by unequivocal fluid filling the terminal ileum.

During reduction, the retrograde progression of the installed fluid was monitored. When the head of intussusceptum was outlined by the fluid, the contour and position change of the intussusceptum was observed while the procedure was on going until there was fluid filled terminal ileum and the intussusceptum disappeared. The peritoneal cavity was inspected intermittently for possible perforation indicated by sudden increased in fluid within the cavity or disappearance of fluid in the colonic lumen. The sonographic criteria for successful reduction are (a) complete disappearance of the intussusceptum from the large bowel and (b) unequivocal retrograde filling of the distal small bowel with fluid. Clinical recovery

was assured when the patients passed stool without mucus bloody stained and were free of symptoms. The reduction attempt was terminated if there was no progression of the intussusceptum after 3-5 minutes and the clinical status was unfavorable.

RESULTS

None of the 21patients displayed any clinical and/or radiographic contraindications to the reduction. The number of attempt was once in 17 cases and twice in 4 cases. The average time required for all reductions was 12.8 minutes (ranging from 5 to 20 minutes).

Reduction was successful in 4 cases (19.05%), as confirmed with US and the resolution of signs and symptoms of intussusception. There were 3 cases the results of which were uncertain but conservative follow up showed complete clinical recovery. Of the 14 cases underwent surgery, one also revealed no intussusception at surgery 5 hours after termination of hydrostatic reduction. These could be late spontaneous reductions or fluid reflux into terminal ileum was not enough to be detected or the residual edematous ileocecal valve and mucosa was mistaken for residual intussusception. In two surgical cases, segmental resections (right half colectomy) were performed due to bowel gangrene and a polyp in terminal ileum. In the remaining 11 cases, the bowels were reduced manually. The surgical findings are shown in table 1. Seven appendectomy were done due to acute appendicitis in one case and mild ischemic changes or mild inflammation in the others. There was recurrent intussusception in one patient. The symptom free interval was 5 months. This case was successfully reduced with air under fluoroscopy on the recurrence.

All patients have had no complication during or after hydrostatic reduction with normal saline enema. Most of the unsuccessful reduction cases who underwent surgery were terminated because of poor general conditions. A few of them were due to non progression of the intussusceptum.

Table 1 Clinical summary results

Clinical parameters	Number
US diagnosis of intussusception	33
Saline enema US-guided reduction	21
Success reduction	4
Conservative follow up	3
Surgical treatment	14
Manual reduction	11
Right half colectomy	2
- Gangrenous bowel	1
- A large polyp interminal ileum	1
appendectomy	7
No residual intussusception	1

DISCUSSION

The treatment of intussusception has long been a varied and controversial issue. Non-surgical reduction of an intussusception was first reported by Samuel Mithchell in 1836. Two years later, John Garham reported five cases treated by means of rectal insufflations of air. In 1876, Horald Hirschsprung

reported reduction of an intussusception by means of a hydrostatic enema with trans-abdominal manipulation.[19] After discovery of x-ray, radiography has been the method of choice for monitoring hydrostatic reduction of intussusception. This remains true despite the modern use of US for diagnosis. Most Thai radiologists are trained in this traditional way. In Eastern-Europe and North-America, barium sulfate suspension continues to be the contrast-enhancing enema solution used. It was only gradually and mainly in Western-Europe that barium began to be replaced by water-soluble contrast medium mixture in order to reduce complications in the event of perforation and to increase the success rate of non-surgical reduction. However, nowadays barium sulfate suspension remains the most widely used enema solution. The main reasons for this are probably conservative attitude and financial control. The retrograde insuflations of air or oxygen has been undergoing a renaissance in Western-Europe and being increasingly used in North-America for the reduction of intussusception. Although the method often requires shorter reduction time than with use of barium sulfate, the method still requires the use of fluoroscopy,

Performance of an enema with normal saline and US control for the hydrostatic reduction of childhood intussusception was first described by Kim et al in 1982. Thereafter, some authors report its efficacy in the non-operative management of intussusception with the use of saline solution or water of Hartmann solution.

However, there is continuing debate without general agreement about which is the best for reduction. The few randomized studies that have been performed did not show statistically significant differences in reduction and perforation rate between air and liquid enema.

In Thailand, reduction by air enema under fluoroscopy was introduced by Dr. Pantipa in 1982, at Queen Sirikit National Institute of Child Health (Children's Hospital) and has been performed as the standard reduction procedure at this institute until present (274 cases in 346 cases).[11] There is no report on the use of ultrasound controlled reduction of intussusception. In fact US is quite useful. Us is used not only for the diagnosis of intussusception but also for monitoring its reduction. Avoidance of ionizing radiation is the main advantage. The reduction success rate was 19.05% (4/21) with saline enema under US in this study. This result was less than the achievement of the other treatments that have shown a high reduction rate (76%-95%) with few complications (one perforation in 825 reports cases). The low success rate may be due to factors such as young experience, problem of colonic pressure control and the patient selection criteria which may have some roles in this study. The author believe that with increasing experience along the usual learning curve, it should be able to improve the success rate.

Analysis of unsuccessful 14 patients who underwent later surgery revealed that 9/14 had absolute surgical indications (table 1) while 5/14 did not. These cases without surgical indications might had been successfully reduced by non surgical reduction with improvement of technique.

The principal advantage of US-guided hydrostatic reduction is the lack of radiation exposure. As a result, there is no limitation to the procedure time allowing visualization of all components of the intussusception as well as easier recognition of leading points and residual intussusception. The evaluation of residual intussusception should be concluded with caution for beginner. There has been no report of serious complication during or after hydrostatic reduction with US guidance. Low perforation rate (0.26%) without mortality was reported. There has been no complication in our series.

Although high pressure values reported in pneumatic reductions lead to an increased success rate to more than 90% as well as offer an easy and clean technique, they need more x-ray exposure time, visualize only intraluminal contrast and produce a high rate of perforation. There is no complication in those

unselected patients in Uttaradit Hospital. Raising the instillation pressure with caution in some suitable patients together with increasing experience with the technique may result in a further increase in the success rate.

In conclusion, US is a simple and reliable modality for diagnosis and monitoring hydrostatic reduction of intussusception. New trainees and experien ced practitioners alike should be encouraged to be familiar with the usage of this new technique.[4] In the future, this radiation-free reduction method should become more widely accepted.

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