

EFFECTIVENESS OF ULTRASOUND-GUIDED HYDROSTATIC REDUCTION OF INTUSSUSCEPTION IN CHILDREN

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Abstract

Aim: To review the effectiveness of ultrasound-guided hydrostatic reduction of intussusception in children.

Methods: This prospective interventional study was done during one year period from January 2014 to December 2014 in the department of Radiology and Imaging of Dhaka Medical College and Hospital, Dhaka and included 30 children clinically and radiologically diagnosed as intussusception with symptoms $d > 48$ hours. They underwent ultrasound-guided hydrostatic reduction using normal saline and the effectiveness of this technique was reviewed.

Results: Majority of the study population were in the age group of 7-24 months with mean age of 9.04 ± 2.48 months. 100% patients who presented within 24 hours of their symptoms achieved successful reduction whereas success rate of reduction were 95% and 0% respectively in patients presented within 24-36 hours and after 36 hours of their symptoms. 60% cases required 5-10 minutes for successful reduction, 20% cases required 3-5 minutes and 10% patients needed > 10 minutes. Within 3 attempts, reduction happened in 90% cases whereas 10% cases failed to reduce. No case was tried for reduction after 3 attempts in consideration of the bowel pathology and complications. Only 10% patients developed negligible complications. No case showed recurrence.

Conclusion: Ultrasound guided hydrostatic reduction of intussusception is an effective non-operative treatment of intussusception in children because of its high success rate, less complications and recurrence rate.

Key words: intussusception, hydrostatic reduction.

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Introduction

An intussusception is the invagination of a segment of the proximal bowel (intussusceptum) into the lumen of the distal bowel i.e. intussusciens. Majority (90%) of the intussusceptions are ileocolic, while the remaining 10% are of the ileoileal or the colocolic types.¹ Intussusception of the GI tract can occur at any age but 75% occur below the age of two years. Although most cases are idiopathic (90%), intussusception is occasionally caused by an underlying lead point such as a Meckel's

diverticulum or duplication of the GI tract. An idiopathic intussusception is the most common cause of the small intestinal obstructions in the infant-toddler age group, with a peak incidence between 6 months to 3 years of life.¹⁻² The incidence of the intussusceptions outside this peak age group should always be observed suspiciously for the presence of some pathologic lead points such as enlarged lymph nodes, ileo-ileal intussusceptions, Meckel's diverticulum, swollen Payer's patches, polyps etc.¹⁻³

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Intussusception is a common abdominal emergency in infants and children⁴⁻⁷ and the most common cause of bowel obstruction in children less than two years of age. It is also a common paediatric health problem in Bangladesh. Acute intussusception is a surgical disease managed by the pediatric surgeon and radiologist as a team. USG plays an important role in both diagnosing and treating this condition. Ultrasound has a sensitivity of 98-100% and a specificity of 88% for detecting intussusceptions.⁸ Though intussusception was first described by Barbette⁴ it took over three centuries before its sonographic features were described in 1977.⁹ The diagnosis was made by visualization of a doughnut or target-shaped mass on transverse images (hypoechoic edematous bowel surrounding a central area of increased echogenicity) and a pseudo-kidney appearance on the longitudinal images.

Although surgery is a confident traditional modality, it has its mortality and morbidity due to invasiveness and anaesthetic problems. Hydrostatic reduction under US guidance was first described by Kim et al in 1982.¹⁰ Sonography has now been accepted as a non-operative method for guiding hydrostatic reduction of intussusception with tap water, normal saline or Ringer's lactate solution.^{5,9} It is a simple, less invasive, safe, economical and quick method. The other nonsurgical methods are reduction with barium or air with fluoroscopic guidance. The technique of ultrasound guided hydrostatic reduction of intussusception is the same as that for conventional hydrostatic barium reduction in which barium and fluoroscopy are replaced by water and real-time ultrasonography but the advantage of this method over the former one is the avoidance of ionizing radiation which is very important in children. It also decreases the potential risk of barium induced peritonitis in the event of iatrogenic perforation during attempted reduction. As there is lack of radiation exposure, there is no limit to the procedure time. It is associated with less morbidity and shorter hospital stay and can trace the change of the mass closely both on transverse and longitudinal scans and can provide a clear echogram, thus definite criteria

of reduction can be obtained. Ileo-colic intussusception can be diagnosed during reduction. One can easily assess changes in the child's general condition, including breathing and abdominal distension. Intestinal perforation during reduction can be accurately and promptly recognized. In cases where partial reduction is achieved, the operating time is markedly reduced. As US is often the first-line imaging modality for the diagnosis of intussusception, the procedure can be performed within the ultrasound room after the diagnosis is made. This saves time since the patient does not have to be taken to a different room for fluoroscopy. For these advantages, this study tried for the reduction of childhood intussusception using normal saline under US guidance.

The results of hydrostatic reduction of childhood intussusception have been described by various authors¹¹⁻¹⁶ but few studies have been carried out in Bangladesh.¹⁷ The aim of his study is to review the effectiveness of this technique in children using normal saline.

Materials and methods

This prospective interventional study was carried out in the Department of Radiology and Imaging of Dhaka medical College Hospital, Dhaka from January 2014 to December 2014. The study population comprised of 30 clinically and radiologically diagnosed cases of intussusceptions with age d" 10 years and with symptoms for < 48 hours without clinical and/ radiological features of non-viable bowel, peritonitis, perforation or shock. The procedure was explained to the parents of the patients and informed written consent was obtained. Initially abdominal ultrasound scan was done by using a Siemens-G20 machine with a linear 5 MHz probe to confirm the diagnosis. A saline bag with 1 liter normal saline of body temperature was hung on a drip stand at an initial height of 1 meter over the examination table and was connected to a rectal tube through a saline set. The rectal tube was then inserted into the rectum, the balloon inflated and the normal saline allowed to flow into the colon. Ultrasound scan was then used to monitor the reduction. Intussusception was

considered reduced if disappearance of the intussusception and visualization of the passage of fluid and air bubbles from the cecum into the terminal ileum through the ileocecal valve was observed. When reduction was achieved, the fluid was evacuated from the colon by connecting a drainage bag to the rectal tube and allowing the fluid to drain under gravity. The procedure was abandoned if the intussusception failed to reduce after three attempts. All the patients were reviewed after 24 hrs for recurrence.

Observations and results

Age of the study population ranged between 3 to 10 years with mean age of 9.04 ± 2.48 months. Highest numbers of patients were in the age group of 7-24 months. 23 (76.6%) were male and 7 (23.3%) were female. The most common clinical symptom was intermittent colicky abdominal pain followed by vomiting, blood mixed mucous stool and constipation. Sonographic finding of intra-abdominal mass with target sign and pseudo-kidney sign was noted in all patients. Other findings on sonography were dilated fluid-filled bowel and mesenteric lymphadenopathy. Most of the patients presented between 24-36 hours of onset of their symptoms. 100% patients who presented within 24 hours of their symptoms achieved successful reduction whereas success rate of reduction were 95% and 0% respectively in patients presented within 24-36 hours and after 36 hours of their symptoms. 60% cases required 5-10 minutes for successful reduction, 20% cases required 3-5 minutes and 10% patients needed > 10 minutes. Within 3 attempts, reduction happened in 90% cases whereas 10% cases failed to reduce. Only 10% patients developed negligible complications. No case showed recurrence.

Table I

Age distribution of the study population (n=30)

Age(months)	No. of patients (n=30)	Percentage (%)
03-06 months	08	26.66
07-24months	20	66.66
25months -10 years	02	6.66
Mean \pm SD	9.04 \pm 2.48	100

Table II

Sex distribution of the study population (n=30)

Sex	No. of patients	Percentage (%)
Male	23	76.6
Female	7	23.3
Total	30	100 .0

Table III

Clinical symptoms of the study population (n=30)

Symptoms	No. of patients	Percentage (%)
Intermittent colicky abdominal pain	30	100.0
Vomiting	25	83.3
Blood mixed mucous stool	25	83.3
Constipation	05	16.6

Table IV

Sonographic findings of the study population (n = 30)

Sonographic findings	No. of patients	Percentage (%)
Intra-abdominal mass	30	100
Target sign	30	100
Pseudo-kidney sign	30	100
Dilated fluid-filled bowel	20	66.6
Mesenteric lymphadenopathy	05	16.6

Table V

Duration of illness of the study population (n=30)

Duration of illness (hours)	No. of patients	Percentage (%)
Up to 24 hours	08	26.66
24-36 hours	20	66.66
36-48 hours	02	6.66
Total	30	100

Table VI

Duration of presenting symptoms with results of reduction (n=30)

Duration of illness (in hours)	Successful reduction	Failed reduction
00-24	08 (100%)	-
24-36	19 (95%)	01
36-48	0 (%)	02

Table VII

Time needed for the procedure

Required time (minutes)	No. of patients	Percentage (%)
3-5	06	20
5-10	18	60
>10	03	10
Total	27	100

Table VIII

Reduction outcome of the procedure:

Reduction outcome	Number of attempts			No. of patients	Percentage (%)
	1	2	3		
Successful reduction	24	02	01	27	90
Failed reduction	-	-	03	03	10
Total	24	02	04	30	100

Table IX

Pattern of complications

Pattern of Complications	Number of Complications		Complications rate Total	Complications rate (%)
	Yes	No		
Mild Rectal trauma	02 (6.6%)	28 (93.9 %)	3	10
Hyperthermia	01 (3.33%)	29 (96.66%)		

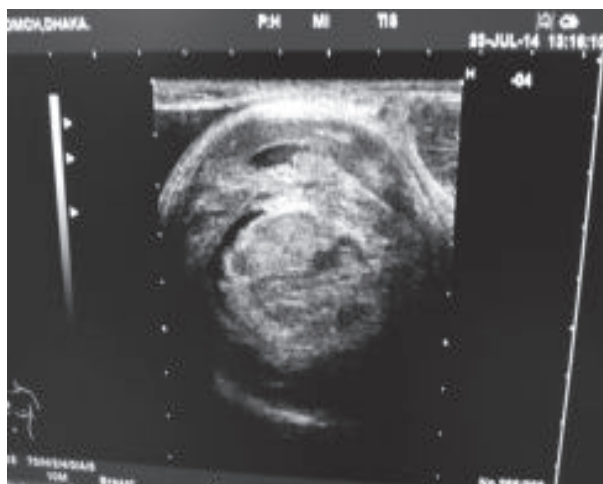


Fig.-1: Target sign of intussusception on transverse scan in a 10 months old male patient



Fig.-2: Scan of a 9 months old male patient of intussusception before hydrostatic reduction.



Fig.-3: Scan during hydrostatic reduction.



Fig.-4: Scan after hydrostatic reduction with free fluid in small gut.



Fig.-5: Procedure of hydrostatic reduction.

Discussion

Intussusception is the most common abdominal emergency of early childhood for which non-operative reduction is currently the treatment of choice.¹⁸⁻¹⁹ In this study, ultrasound-guided hydrostatic reduction of intussusception in children showed high success rate with negligible rate of complications with no recurrence. These findings prove that it is a safe and effective method.

In this study, majority of the patients (66.66%) were within the age group of 7-24 months followed by age group of 03-06 months (26.66%). Age of 6.66% patients ranged 25 month-10 years. Shastri et al²⁰ also found that most of the patients of intussusception aged between 06 months to 24 months. So findings regarding age distribution of patients in both studies are similar. Shastri et al observed male preponderance of the disease in their study which was about 66%. In our study, we also noticed that male children were more sufferers (76.6%) than their counterpart (23.3%).

In our study all patients presented with intermittent colicky abdominal pain. 83.3% cases presented with vomiting and blood mixed mucoid stool. Constipation was present in 16.6% patients. Symptoms including sudden onset of intermittent colicky abdominal pain, vomiting, blood with mucus in stools- classically mentioned as red currant jelly, were described by Marc.²¹ Another study done by Latha et al²² also showed that majority of the children presented with colicky abdominal pain and other symptoms similar to our study.

In present study, ultrasonographic findings of intra abdominal mass, target sign and pseudokidney sign were present in all patients. Dilated fluid-filled bowel and mesenteric lymphadenopathy were found in 66.6% and 16.6% patients respectively. USG is a very useful examination for the diagnosis of intussusceptions with sensitivity of 98-100% and specificity of 88-100% according to Delpoz et al²³. The 'target sign' described in literature is very useful and can be easily picked up by ultrasound transducer (7.5-10 MHz). Our study also showed 100% patient with sonological evidence of target signs and other signs as mentioned above.

Duration of presenting illness is a significant factor for successful outcome. Study of Khan et al²⁴ showed that successful hydrostatic reduction were achieved in 75.29% patients with duration of symptoms of \leq 48 hours while reduction were failed in 24.71% patients of late ($>$ 48 hours) presentation. Our study revealed that 100% patients who presented within 24 hours of their symptoms achieved successful reduction. Success rate of reduction were 95% and 0% respectively in patients presented within 24-36 hours and after 36 hours of their symptoms.

In current study, 60% cases required 5-10 minutes for successful reduction, 20% cases required 3-5 minutes and 10% patients needed $>$ 10 minutes. Within 3 attempts, reduction happened in 90% cases whereas 10% cases failed to reduce. No case was tried for reduction after 3 attempts in consideration of bowel pathology and complications. Study of Alamdaran et al²⁵ showed that the mean reduction time was at least 30 second and maximum up to 40 minutes and they also considered maximum 3 attempts for the procedure. The study result of Alamdaran et al is comparable with our current study.

In this study, 10% patients developed very negligible complications. As sonology is an operator dependent procedure, we considered major or minor complications as preparational or procedural default. Among 3 cases of complications, 2 cases developed mild rectal trauma one of which needed surgically correction. One patient who developed hyperthermia was treated accordingly. No patient showed recurrence after successful reduction in this study. Previous studied by Krishnakumar et al⁵ and Shastri et al²⁰ also showed complications in small number of patients with no case of recurrence. It indicates that hydrostatic reduction of intussusception is a safe and effective method.

Sample size of this study was small. No more than 30 subjects were feasible to be included in this study as the study period was short. This is a limitation of this study. With the provision of skilled radiologists ultrasonography-guided hydrostatic reduction of

intussusceptions would be an effective and alternative method of choice for treatment of intussusceptions in children. Well established organized training program might help to bring expectable success rate in this almost non invasive procedure. Emergency skilled surgical team should be available during procedure for the management of post procedural complication.

Conclusion

Ultrasound guided hydrostatic reduction of intussusceptions is a safe and effective method for the non operative treatment of intussusceptions in children because of its high success rate, less complications and recurrence.

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