

## Role of Ultrasound Guided Pneumatic Reduction of Intussusception in Children Under 3 Years with Early Presentation

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### Abstract

### Original Research Article

**Background:** Intussusception remains the most common cause of intestinal obstruction in children under 3 years of age.

**Objective:** To evaluate the role of ultrasound guided pneumatic reduction of intussusception in children under 3 years with early presentation. **Methods:** This prospective interventional study was carried out at the Department of Pediatric Surgery in Dhaka Medical College Hospital, Dhaka from July, 2020 to June, 2022 for a period of 24 months. A total number of 22 patients with intussusception scheduled for Ultrasound Guided Pneumatic Reduction procedure to reduce intussusception were enrolled for this study after fulfilling the selection criteria. After Ultrasound Guided Pneumatic Reduction, patients were evaluated with duration of reduction, hospital stay and mass existence. **Results:** The mean age of the patients was  $1.28 \pm 0.83$  years, ranging from 4 months to 3 years. Of them, 54.5% were below or equal to 1 year and the rest, 45.5% were above 1 year. All patients had abdominal pain and 86.4% palpable abdominal mass. Most of the mass situated at right hypochondrium (59.1%). The mean duration of reduction was  $6.45 \pm 1.29$  minutes, ranging from 4 to 8 minutes. The mean duration of hospitalization was  $15.90 \pm 1.57$  hours, ranging from 14 to 18 hours. In 9.1% of cases, the mass remained after the procedure. **Conclusion:** Intussusception can be effectively treated using pneumatic reduction, which is also quicker, less messy, and risk-free.

**Keywords:** Intussusception, Ultrasound Guided Pneumatic Reduction.

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## INTRODUCTION

Intussusception is one of the most common pediatric surgical emergencies. In intussusception proximal bowel segment invaginates into the distal bowel by peristalsis. The mesentery of proximal bowel is drawn into distal bowel; it is compressed resulting in venous obstruction and bowel oedema. If reduction does not occur arterial insufficiency will ultimately lead to ischemia, necrosis and perforation. The most common type of intussusception in children are ileo colic which accounts for 42% and ileo colo-colic type which also accounts for 38% of cases [1]. Intussusceptions are more common in children at age group of 4 to 9 month. Although intussusception can be seen in all pediatrics age group from prenatal to late teens, 75% of cases occur

within first 2 years of life and 90% in children within 3 years of age. More than 40% are seen between 3 to 9 months of age. Intussusception is extremely rare below the age of 3 months [2]. It is more common in male with male female ratio of 1.8:1 [3]. The sudden onset of severe colicky abdominal pain which makes the baby pull up leg is the most common classic symptom of intussusception in about 85% of patient. Intussusception should be suspected with any of the two classic symptom like abdominal pain, vomiting or two classic sign like feeling of an abdominal mass, rectal bleeding [1]. More than 90% of intussusceptions are diagnosed by ultrasound as the primary diagnostic imaging modality. Treatment modality of intussusception include non-operative and operative procedure. One of the non-operative

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Treatment-Hydrostatic reduction was introduced in the USA in 1927 and this method was popularized by Ravitch and McCune in 1948. Another non operative treatment-pneumatic reduction was described by Fiorito, a Spanish radiologist in 1959 [4]. However, ultrasound guided pneumatic reduction is becoming the first line management for childhood intussusception [5]. Overall operative treatment complications are around (33.9%), wound side infections being the most common occurring in (15.4%). Anastomotic leak was reported in (1.54%) cases [6]. Operative treatment is important method for reduction of intussusception in patient with failed non operative reduction, severe clinical presentation (shock, perforation, peritonitis) and recurrence of intussusception. Pneumatic reduction of intussusception is quicker, less messy, easier to perform, more comfortable procedure perforation rate of pneumatic reduction is less than 1% [7]. Success rate of pneumatic reduction is 81% to 91% [8]. There is no study yet in our country regarding this. So this study was designed to clarify the role of ultrasound guided pneumatic reduction of intussusception in children under 3 years with early presentation to reduce the anxiety of parents for operation, operation related hazard and hospital stay.

## OBJECTIVES

### General Objectives:

- To evaluate the role of ultrasound guided pneumatic reduction of intussusception in children under 3 years with early presentation.

### Specific Objectives:

- To measure reduction rate
- To evaluate the complication of procedure
- To estimate the duration of hospital stay

## METHODOLOGY

This was a Prospective interventional study. The patients were selected purposively. A total of 22 patients were included in this study. The study was conducted in the Department of Pediatric Surgery, Dhaka Medical College & Hospital (DMCH), Dhaka, Bangladesh. At March, 2020 to June, 2022 for a period of 24 months.

### Inclusion Criteria

- Age: 3 months to 3 years
- Duration of symptoms <48 hrs

### Exclusion Criteria

- Radiographic evidence of perforation with free air before procedure.
- Patients having feature of dehydration, shock and peritonitis.
- Refuse to give consent for pneumatic reduction

## Study Procedure

The study was conducted at Department of Pediatric Surgery, Dhaka medical College Hospital, Dhaka from July, 2020 to June, 2022. All the patients scheduled for Ultrasound Guided Pneumatic Reduction with features of intussusception in the Department of Pediatric Surgery, DMCH were considered as study population. The subjects were selected on the basis of selection criteria. After selection of the subjects, the nature, purpose and benefits of the study were explained to each of the patients in details. They were encouraged for voluntary participation. They were allowed to withdraw their name from the study whenever they feel like, informed written consent was taken from the participants. Ethical clearance was obtained from Ethical Review Committee (ERC) of Dhaka Medical College. Before ultrasound guided pneumatic reduction all the patients were assessed by detailed history, clinical examination and investigation. All patients were investigated for routine hematological and other relative imaging investigations to confirm the diagnosis. The procedure was performed in the Radiology Department keeping ready to emergency OT The children were sedate with inj. Pethidine (0.5mg/kg I/M) or Inj. Pheneragan (0.5 mg/kg I/M). Baby was placed on supine position at USG table. A foleys catheter (Size- 15 to 20 Fr) was introduced into the child's rectum and the balloon was inflated with 15-25 cc of air to fill the rectum. Buttocks are tightly opposed to prevent air leakage. Manual inflation of the colon was carried out while the abdomen was viewed under USG. The pressure uses ranged between 80-120 mmHg, and was maintained as long as procedure was progressed. In case of no or partial reduction, the pressure was maintained for 3 minutes and then relieved for 3 minutes. A total of three attempts at one time, using the same time sequence, was allowed. On USG pseudo kidney sign and target sign was disappeared indicative of successful reduction. After successful reduction, patients were stayed at hospital overnight to be observed for possible recurrence or symptom relief and then discharged.

### Statistical Analysis

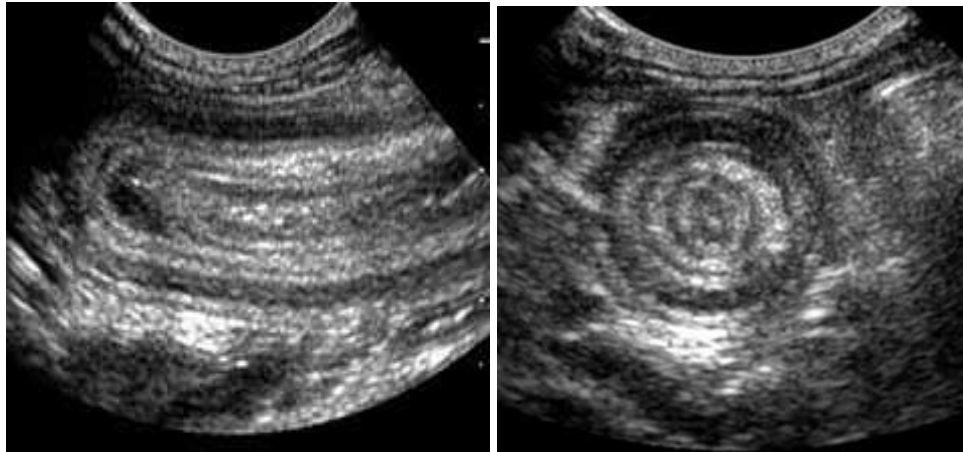
Data were collected, compiled and tabulated according to key variables and functional assessment scoring. The analysis of different variable was done according to standard statistical analysis. Qualitative data were expressed as frequency with percentage and quantitative data were expressed as mean with standard deviation. Quantitative data were analyzed by student t-test and qualitative data by Chi-square test. For all analysis level of significance was set at 0.05 and p-value <0.05 was considered as significant. Statistical Package for Social Science (SPSS) 23 was used for data analysis.

### Ethical Consideration

Ethical clearance of this study taken from the Ethical Review committee (ERC) of Dhaka Informed written consent from parents or legal guardian was taken after describing the study objectives.

**Diagnostic Criteria**

- The clinical diagnosis of intussusception was made when there was paroxysmal abdominal pain associated with repeated attacks of irritability and crying, vomiting, rectal bleeding, abdominal mass and peritonism.
- Two plain abdominal films (in the erect and supine positions) were obtained, and a soft tissue mass with a crescent of gas around it.
- USG findings pseudo kidney sign, target sign or doughnut sign considered indicative of intussusception.



Pseudo kidney

sign Target sign

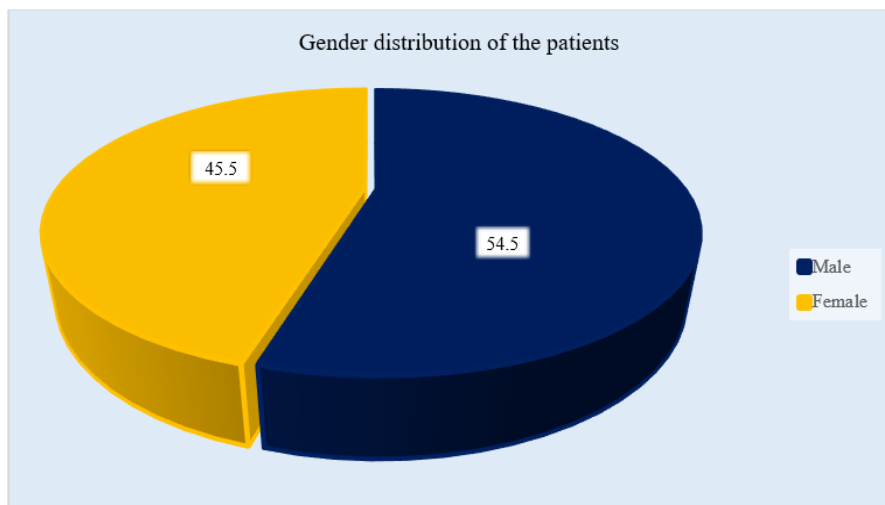
**RESULTS**

**Table 1: Demographic profile of the patients(N=22)**

Demographic profile	Frequency (n)	Percentage (%)
<b>Age (years)</b>		
≤1 Yrs.	12	54.5
>1 Yrs.	10	45.5
Mean ± SD	1.28 ± 0.83	
Min - max	4 months-3 years	
<b>Gender</b>		
Male	12	54.5
Female	10	45.5

Table 1 showed demographic profile of the study subjects. The mean age of the patients was 1.28 ± 0.83 years, ranging from 4 months to 3 years. Of them

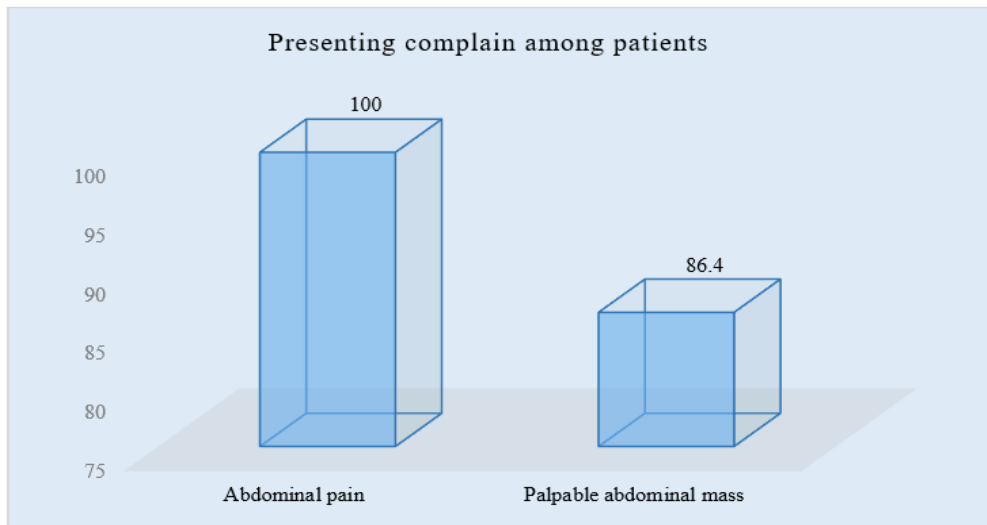
54.5% were below or equal to 1 year and the rest, 45.5% were above 1 year.



**Figure I: Pie chart showed gender wise patients distribution (N=22)**

**Table 2: Presenting complain of the patients (N=22)**

Presenting complain	Frequency (n)	Percentage (%)
Abdominal pain	22	100.0
Palpable abdominal mass	19	86.4

**Figure II: Bar chart showed presenting complain of the patients (N=22)****Table 3: Site of mass (N=22)**

Site of mass	Frequency (n)	Percentage (%)
Right hypochondrium	13	59.1
Epigastrium	1	4.5

Table 3 showed site of the mass. Most of the mass situated at right hypochondrium (59.1%).

**Table 4: Duration of reduction (N=22)**

	Mean $\pm$ SD	Min-max
Duration of reduction (minutes)	6.45 $\pm$ 1.29	4-8

Table 4 showed duration of reduction. Mean duration of reduction was 6.45  $\pm$  1.29 minutes ranging from 4 to 8 minutes.

**Table 5: Duration of hospital stay (N=22)**

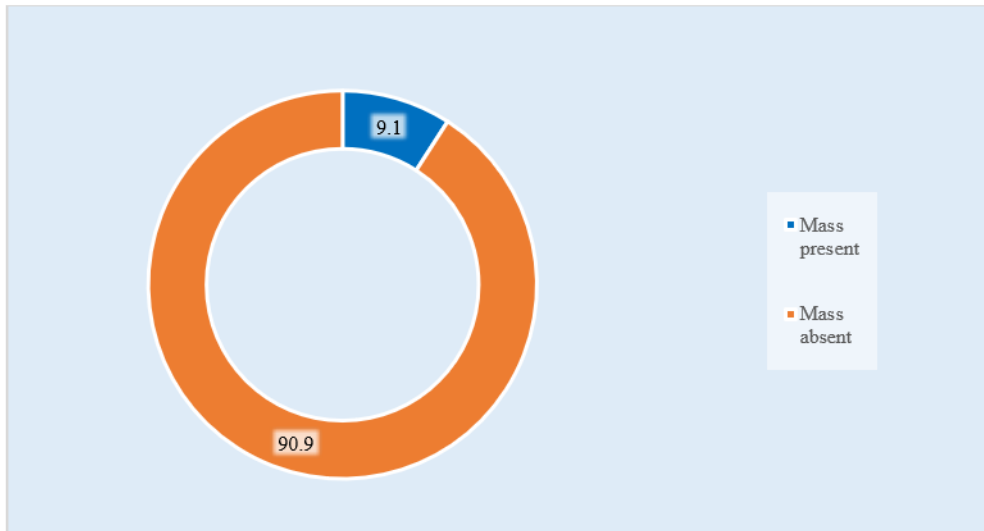
	Mean $\pm$ SD	Min-max
Duration of hospital stay (hours)	15.90 $\pm$ 1.57	14-18

Table 5 showed duration of hospital stay. Mean duration of hospital stay was 15.90  $\pm$  1.57 hours ranging from 14 to 18 hours.

**Table 6: Outcome of the patients (N=22)**

Mass	Frequency (n)	Percentage (%)
Present	2	9.1
Absent	20	90.9

Table 6 showed outcome of the study subjects. After procedure mass remained in 9.1% cases. The Mass was absent remained in 90.9% of cases after pneumatic reduction.



**Figure III: Ring chart showed outcome of the patients (N=22)**

## DISCUSSION

Intussusception can occur at any age, however, the vast majority of cases are observed between the age of 3 months and 2 years. 54.5% of the patients in the present study occurred within the first year of age and 45.5% of cases were between 1 to 3 years of age. Niramis *et al.*, (2010) [9] revealed about 80% of cases in the present study occurred within the first year of age and 14% of cases were between 1 and 2 years of age. Neither the exact incidence nor the etiology of intussusception is known. The incidence of intussusception in the Southeast Asian countries is approximated 30-35: 100,000 live births [10]. Information from the present study showed that the occurrence of intussusception was found more frequently in December, January, February (winter) and March (early summer). Children had symptoms of common colds and diarrhea during these months. Many authors strongly suggested that adenovirus and rotavirus from an URI or gastroenteritis might cause lymphoid hyperplasia in the wall of the terminal ileum [11]. Lymphoid hyperplasia could be the lead point in idiopathic intussusception. Nonsurgical management of intussusception in children is not new. It has gained acceptance in many parts of the world in the last five decades [12]. Different centers have chosen particular types of nonsurgical method of reduction based on their successful experiences. Although barium enema is the standard of care for the diagnosis and therapeutic reduction of intussusception, it has been challenged by alternative procedures. Among them, pneumatic reduction with fluoroscopic guidance is claimed to be quick, safe, and clean, and it has been reported to have a high success rate [12, 13]. High rates of success in non-operative treatment of intussusception were reported using pneumatic and hydrostatic reductions. The success rate of enema reduction varies widely, ranging from 70 to 95%, in pneumatic reduction [14-16]. In the present study, we found that successful reduction after the first trial was 90.9%, this can be explained by the fact that air completely surrounds the intussusceptum, exerting more

constant pressure, and may result in decreased friction and, in turn, easier reduction [17]. Yet, pneumatic reduction is easy to perform and can be carried out quickly, is less messy, is more comfortable, and results in smaller perforations and less peritoneal contamination (Stringer and Ein, 1990). In the present study, pneumatic reduction was found to be easier to perform as evidenced by the shorter time required for reduction. Although some authors claimed a higher risk of perforation with the use of air in treating intussusception [8], pneumatic reduction in the present study was devoid of complications. The effect of the duration of symptoms on the outcome of reduction is controversial. Some authors have claimed a significant lower success rate of reduction in patients presenting after more than 24 h [18,19], whereas others have denied the impact of delayed diagnosis on the outcome [20, 21]. These conflicting results are probably because of the type of statistical analysis used, not accounting for the adjusted effect of multiple factors. In the present study, delayed diagnosis (> 24 h) was the clinical parameter most closely associated with failure. However, a high success rate can be achieved after 24-48 h (58.3%). Although rectal bleeding has been used as an exclusion criterion for pressure reduction in some centers [22], other studies including our study have not revealed a significant trend toward higher failure rates in the presence of rectal bleeding or other symptoms of delayed presentation [23]. Pneumatic reduction of intussusception in children is a quick method of the management of intussusception. This was shown in Singh *et al.*, (2017) [24] study to take an average of 7 min (range 3–10 min for the whole procedure) for the reduction to take place, i.e., from the start of gas inflation to complete reduction. The short reduction time has also been reported in studies in many centers [25]. In this study, it took average 6.45 minutes for the reduction to take place. This means that it takes a much shorter time to complete one pneumatic reduction than for the patient to be ready for manual reduction by the surgeon in theater. The procedure is cheap and patients have a shorter hospital stay (2 days) with this



procedure. In this study average duration of hospital stay was 15.9 hours. Another issue worth noting is that even though surgery is the only means of managing both the intussusception and its complications, it does not offer any significant protection against future recurrence in patients who do not have lead points.

## LIMITATIONS

It was a single center small sample size study.

## CONCLUSION AND RECOMMENDATION

Pneumatic reduction is an effective treatment for intussusception that is easier to perform, faster, less messy, and free of additional risks. Further multicenter study should be done with large sample size

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