

# A Comparison of Hydrostatic Reduction in Children with Intussusception Versus Surgery: Single-centre Experience

Mohamed El-sayed Eraki

Department of Paediatric Surgery, Faculty of Medicine, Zagazig University, Zagazig, Egypt

## Abstract

**Background:** Intussusception is the most common cause of bowel obstruction in infancy and childhood. Early diagnosis and effective management have reduced its morbidity and mortality in developed countries. Non-surgical reduction remains the first-line treatment of choice for intussusception. The major complication of air enema reduction is bowel perforation and portal venous gas. In recent years, several techniques have been recommended for intussusception treatment. In this study, an evaluation was made of intussusception cases that presented at our clinic and had reduction applied together with saline under ultrasonography and cases, which were surgically treated. Our aim of this study is to evaluate the results of hydrostatic reduction under ultrasound guided and to compare the results with patients treated by surgery for the management of intussusception. **Patients and Methods:** A retrospective study was done of the records of 100 cases treated for a diagnosis of intussusception between April 2011 and April 2013, in Department of Paediatric Surgery, Zagazig University Hospital. Patients were evaluated demographics, clinical presentation and management strategy, during the hospitalisation and outcome. **Results:** This study includes 100 patients diagnosed with intussusception, sixty males and forty females, the age ranged between 1 month and 7 years old. Ultrasound was applied for all patients as a part of diagnosis. Hydrostatic reduction under ultrasound guide was applied to fifty patients, successful hydrostatic reduction was seen in thirty patients and unsuccessful hydrostatic reduction was seen in twenty patients which admitted for surgery, we did not do another chance of hydrostatic reduction for unsuccessful patients, open surgery was done for seventy patients, during surgery, we found ileocolic intussusception in forty patients, ileoileal in twenty patients and colocolic intussusception in ten patients. Leading point of intussusception was seen in 22 patients, Meckel's diverticulum in ten patients, polyp in five patients and lymphoma in seven patients. Manual reduction was done in forty patients and resection anastomosis was done in thirty patients. No mortality in any case. **Conclusion:** Ultrasound-guided hydrostatic reduction of intussusception is a safe technique which reduces the duration of hospitalisation and treatment costs.

**Keywords:** Hydrostatic reduction, intussusceptions, ultrasound

## INTRODUCTION

Intussusception is one of the most common causes of intestinal obstruction in children,<sup>[1-3]</sup> recognising and rapid treatment is important to prevent potentially fatal complications.<sup>[4]</sup> Intussusception is the invagination of a portion of the intestine into itself; the aetiology may be idiopathic or secondary to some pathology within the wall of the bowel.<sup>[5]</sup> Children may be presented at any age, but this occurs most commonly in the 1<sup>st</sup> year of life.<sup>[6]</sup> There are no classic signs and symptoms that are common to all cases of intussusception, a situation that often leads to delay in diagnosis, the classic triad of vomiting, abdominal pain and passage of blood per rectum occurs only in a third of cases.<sup>[7]</sup> Ultrasound scan of abdomen has been used to aid diagnosis and is said to very reliable in

experienced hands.<sup>[8]</sup> Operative and non-operative reduction used for the management of intussusception, there is a long history supporting non-surgical reduction of intussusception.<sup>[9]</sup> With widespread of ultrasonography (USG), many centres start using hydrostatic reduction with ultrasound guide for treatment of intussusception, the perforation risk of hydrostatic reduction has been reported as 0.1%–3%.<sup>[10]</sup> Despite the advantages of hydrostatic reduction in patients presented by clinical complaints have continued more than 48 h and

**Address for correspondence:** Dr. Mohamed El-sayed Eraki,  
W. Wilson Hospital, P. O. Box 27483, Sharjah, United Arab Emirates.  
E-mail: moh\_eraky2@yahoo.com

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patients presented with ileus and peritonitis, it is safer to admit patients directly for surgery.<sup>[11]</sup> Before we performed manual reduction for all cases of intussusception, but recently, we have performed hydrostatic reduction with normal saline under ultrasound guided for patients presented early with intussusception.<sup>[12]</sup> Our aim of this study is to evaluate the results of hydrostatic reduction under ultrasound guided and to compare the results with patients treated by surgery (manual reduction or resection anastomosis).

## PATIENTS AND METHODS

A retrospective study was done of the records of 100 cases treated for a diagnosis of intussusception between April 2011 and April 2013, in department of paediatric surgery, Zagazig University Hospital. Patients were evaluated demographics, clinical presentation and management strategy, during the hospitalisation and outcome. Following the physical examination of patients presenting with a preliminary diagnosis of intussusception, laboratory and biochemical testes and blood group were examined, USG and plain X-ray of the abdomen in erect position were done for all cases, patients with peritonitis and ileus and delayed symptoms more than 48 h admitted directly to surgical approach without attempting hydrostatic reduction. Furthermore, patients with ultrasound diagnosis of leading point of intussusception prepared directly for surgery without trying of hydrostatic reduction. Resuscitation of all patients was done by nasogastric tube suction, urinary catheter, intravenous (IV) fluids until the hydration was sufficient, we take the patients to USG room, then after insertion of appropriate Foley catheter in the rectum of the patient in supine position, the saline was heated to 37°C injected in upright position and kept at a height of 100 cm. Retrograde administration of saline was guided and monitored by USG. The procedure was successful when the fluid administrated was seen to have passed the caecum and been distributed in the small intestine. Disappearance of target sign was not expected, and there was no time limit for the procedure, during the procedure, we monitored the general status of the child and abdominal sensitivity. Patients with continued invagination of intussusception after hydrostatic reduction were admitted to surgery; hydrostatic reduction was not attempted for the second time. After a successful reduction, the intestine was emptied, and the patient was kept under observation, patients with complaints, and finding more than 48 h, they underwent open surgery, during surgery manual reduction was done for patients without leading point of intussusception with viable bowel, resection anastomosis done in patients with perforation, and in patients with leading point of intussusception in the wall of the bowel. An antibiotic was administrated to all patients before and after hydrostatic reduction to prevent bacterial translocation; IV administration was done before hydrostatic reduction and the patients continued on oral antibiotics for 5 days. The measurement of successful reduction was evaluated as the heated saline administrated through Foley catheter being visualised under USG passed to the proximal

of the invaginated segment. In this study, comparison was done between hydrostatic reduction of intussusception with surgical manual reduction and resection anastomosis. Data collection and evaluation were done using SPSS IBM 2009. Mann–Whitney U-test and Chi-square test were used in data evaluation;  $P < 0.05$  was considered statistically significant.

## RESULTS

This study was done on total 100 patients diagnosed with intussusception in the Department of Paediatric Surgery, Faculty of Medicine, Zagazig University Hospitals. Sixty males (60%) and forty females (40%), the age ranged between 1 month and 7 years old, age distribution was as follows: from 1 to 3 months, there were 7 males (11.7%) and 6 females (15%), from 4 to 7 months, there were 15 males (25%) and 10 females (25%), from 8 to 11 months, there were 20 males (33.3%) and 14 females (35%), from 1 to 2 years, there were 8 males (13.3%) and 5 females (12.5%) and from 3 to 7 years, there were 10 males (16.7%) and 5 females (12.5%); there was no statistical difference between the groups in terms of age [Table 1]. Abdominal USG and plain X-ray were done for all patients. Abdominal pain was seen in 90 patients (90%), bilious vomiting in 37 patients (37%), rectal bleeding in 26 patients (26%), abdominal distension in 55 patients (55%), palpable abdominal mass was seen in 37 patients (37%) and

**Table 1: Age distribution**

Age	Male (%)	Female (%)	Total (%)	P
1-3 (months)	7 (11.7)	6 (15)	13 (13)	0.062
4-7 (months)	15 (25)	10 (25)	25 (25)	0.054
8-11 (months)	20 (33.3)	14 (35)	34 (34)	0.071
1-2 (years)	8 (13.3)	5 (12.5)	13 (13)	0.065
3-7 (years)	10 (16.7)	5 (12.5)	15 (15)	0.054

**Table 2: Clinical features and duration**

Clinical features	Duration of symptoms		P
	<48 h, n=60 (%)	>48 h, n=40 (%)	
Abdominal pain	50 (83.3)	40 (100)	
Bilious vomiting	7 (11.6)	30 (75)	0.001*
Rectal bleeding	6 (10)	20 (50)	0.001*
Abdominal distension	20 (33.3)	35 (87.5)	0.741
Palpable abdominal mass	12 (20)	25 (62.5)	0.852
Absent bowel sound	2 (3.3)	15 (37.5)	0.042*

\*Statistically significant ( $P < 0.05$ )

**Table 3: Seasonal variation of intussusceptions**

Season	Number of patients (%)	P
Spring	19 (19)	0.654
Summer	30 (30)	0.723
Autumn	28 (28)	0.561
Winter	23 (23)	0.645

**Table 4: Comparison between hydrostatic reduction and surgical manual reduction and resection anastomosis**

Type of procedure	Hydrostatic reduction	Manual reduction	Resection anastomosis	P
Number of patients				
Successful	30	40	30	0.07
Failed	20			
Mean age at presentation (months)	12.5±0.5	22.5±0.4	75.2±0.5	0.002
Duration of symptoms (h)	<24	24-48	>48	0.06
Leading point	No	No	Yes, Meckel's diverticulum in 10, polyp 5 and lymphoma 7	0.001
Hospital stay	8±4 (h)	2±1 (days)	5±2 (days)	0.005
Duration of medical treatment (days)	5	7	14	0.04
Post-operative complications	No recurrence	Wound infection in 3 patients (7.5%)	Wound infection in 4 patients (20%) + wound dehiscence in 3 patients (15%)	0.001

absent bowel sound was seen in 17 patients (17%). Duration of symptoms was <48 h in sixty patients and more than 48 h in forty patients, there is a significant difference between patients presented before 48 h and patients presented late after 48 h in bilious vomiting, rectal bleeding and absent bowel sound, but there is no significant difference in other symptoms [Table 2]. According to seasonal variation, 19 patients seen in spring, 30 patients seen in summer, 28 patients seen in autumn and 23 patients seen in winter, and there is no any significant difference in seasonal variation  $P > 0.05$  [Table 3].

Hydrostatic reduction was done in fifty patients presented early by intussusception with duration of symptoms was <24 h, hydrostatic reduction was successful in thirty patients (30%) and failed in twenty patients (20%), the mean age at presentation for patients subjected to hydrostatic reduction was  $12.5 \pm 0.5$  months, surgical manual reduction was done in forty patients (40%), the mean age of patients was  $22.5 \pm 0.4$  months, and duration of symptoms was 24–48 h, resection anastomosis was done in thirty patients, the mean age at presentation was  $75.2 \pm 0.5$  months, and the duration of symptoms was more than 48 h, there is a significant difference between three groups related to the age  $P = 0.002$  [Table 4]. There are no leading points in patients subjected to hydrostatic reduction and manual reduction, but in patients with resection anastomosis, there is a leading point, Meckel's diverticulum in ten patients, polyp in five patients and lymphoma in five patients. The mean hospital stay in patients with hydrostatic reduction was  $8 \pm 4$  h, and in manual reduction was  $2 \pm 1$  day, and in patients with resection, anastomosis was  $5 \pm 2$  days. The duration of medical treatment following the procedure was 5 days in hydrostatic reduction, 7 days in patients with manual reduction and 14 days in patients with resection anastomosis, and there is a significant difference between patients with hydrostatic reduction and with patients with resection anastomosis,  $P = 0.04$  [Table 4]. According to post-operative complications, there is no complication in patients subjected to successful hydrostatic reduction, but in patients with surgical manual reduction, there is wound infection in three patients (7.5%), and in patients with resection anastomosis, the wound infection was seen in four patients (20%) and wound dehiscence in three patients (15%).

## DISCUSSION

Intussusceptions are the acquired invagination of one portion of the intestine into the adjacent bowel; it is described by the proximal, inner segment of intestine (intussusceptum) first and the outer distal, receiving portion of intestine (intussusciptens). Invagination is most frequently observed in infants of 5–9-months old and more often in males.<sup>[13]</sup> The age of patients in our study was ranged from 1 month to 7 years old, with little higher than the mean age reported in literature.<sup>[14]</sup> In our study, there is no difference in the frequency of intussusception between seasons, but in reported studies, there is a peak incidence of intussusception occurred in summer and winter months following respiratory and gastrointestinal infections.<sup>[14]</sup> The majority of findings in intussusception patients are non-specific, but in our study, most of the patients presented by abdominal pain and distension and delayed cases presented by rectal bleeding and manifestation of peritonitis and sepsis. These results match with other results in literature.<sup>[15]</sup> USG was done for all patients in our study which give sensitivity near 100%, other studies mentioned that the sensitivity of USG in the diagnosis of intussusception reach to 70%–85%.<sup>[16]</sup> Ileocolic intussusception is the most common type of intussusception in our study that represents 40% in all cases, but in another study done by Ocal *et al.*,<sup>[16]</sup> it represents 88.9%. In our study, the leading point of intussusception was seen in 22 (22%) patients, in which Meckel's diverticulum was seen in ten patients, polyp in five patients and lymphoma in seven patients. From our study, we found that the leading point of intussusception increases with age of the patients, in which the incidence of leading point was 5% in patients below the age of 1 year, this rate increases to 60% in patients above 4 years, in other study, leading point of intussusception was seen in 3% of patients below age of 1 year, this rate increased to 57% in children with intussusceptions with age over 3 years.<sup>[16]</sup> Hydrostatic reduction was done for fifty patients presented early, from which thirty (60%) patients succeeded and twenty patients failed and admitted directly to surgery, these results were better than another study done by Tander *et al.*,<sup>[2]</sup> in which the rate of success of hydrostatic reduction was 30%, and in our study, no cases were perforated during hydrostatic reduction, but in reported cases, the rate of perforation after

hydrostatic reduction was 5%.<sup>[17]</sup> Previous studies were recommended the use of antibiotics before and after hydrostatic reduction to prevent bacterial translocation; therefore, we used antibiotics in all patients subjected to hydrostatic reduction. Surgery was done for seventy patients, twenty patients who failed after heart rate and another fifty patients admitted to surgery from the start, due to late manifestation and patients presented with peritonitis from the start and patients with obvious leading points, manual reduction during surgery was done for forty patients, in which there are no leading points and no perforation, resection anastomosis was done for thirty patients, with leading points in 22 patients and gangrenous loop in eight patients. These results matched with previous literature, in which the incidence of resection anastomosis in patients with intussusception was ranged from 10% to 20%.<sup>[16]</sup> The application of hydrostatic reduction is seen to reduce the socioeconomic burden of both the hospital and the family by shortening the duration of hospitalisation and the duration of medical treatment administered, also the morbidity and mortality associated with anaesthesia and surgery was reduced. Limitations of this study were number of patients is low also the only information in the records was evaluated and the data collected from a single centre; therefore, the results may not be representative of intussusception in other centres.

## CONCLUSION

Hydrostatic reduction is a safe alternative technique for the management of intussusception, especially with early presentations and with age ranged between 1 month and 3 years old, hydrostatic reduction also decreases the duration of hospitalisation and decreases the cost of surgery.

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## Conflicts of interest

There are no conflicts of interest.

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