

# A Comparison of Hydrostatic Reduction in Children with Intussusception versus Surgery: Single Center Experience

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**Abstract:** Background: Intussusception is the commonest cause of bowel obstruction in infancy and childhood. Early diagnosis and effective management have reduced its morbidity and mortality in developed countries (1). Non-surgical reduction remains the first line treatment of choice for intussusception (2). The major complication of air enema reduction is bowel perforation and portal venous gas (3). Objective: 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 (USG) and cases, which were surgically treated. Aim of the work: 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 management of intussusception. Patient 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 pediatric surgery, Zagazig university hospital. Patients were evaluated demographics, clinical presentation, management strategy, during the hospitalization and outcome. Results: This study include 100 patients diagnosed with intussusception, 60 male and 40 female, the age ranged between 1month and 7 years old. Ultrasound was applied for all patients as a part of diagnosis. Hydrostatic reduction under ultrasound guide was applied to 50 patients, successful hydrostatic reduction was seen in 30 patients and unsuccessful hydrostatic reduction was seen in 20 patients which admitted for surgery, we didn't do another chance of hydrostatic reduction for unsuccessful patients, open surgery was done for 70 patients, during surgery we found ileocolic intussusception in 40 patients, ileoileal in 20 patients, and colocolic intussusception in 10 patients. Leading point of intussusception was seen in 22 patients, Mickle's diverticulum in 10 patients, polyp in 5 patients and lymphoma in 7 patients. Manual reduction was done in 40 patients and resection anastomosis was done in 30 patients. No mortality in any case. Conclusion: Ultrasound guided hydrostatic reduction of intussusception is a safe technique which reduces duration of hospitalization and treatment costs.

**Keywords:** Intussusceptions, Hydrostatic reduction, Ultrasound

## 1. Introduction

Intussusception one of the most common causes of intestinal obstruction in children, recognizing and rapid treatment is important to prevent potentially fatal complications (4). Intussusception is the invagination of a portion of the intestine into itself, the etiology may be idiopathic or secondary to some pathology within the wall of the bowel (5). Children may be presented at any age but this occur most commonly in the first year of life (6). 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 (7). Ultrasound scan of abdomen has been used to aid diagnosis and is said to very reliable in experienced hands (8). Operative and non-operative reduction used for management of intussusception, there is a long history supporting non-surgical reduction of intussusception (9). With widespread of ultrasonography, many centers start using hydrostatic reduction with ultrasound guide for treatment of intussusception, the perforation risk of hydrostatic reduction has been reported as 0.1-3% (10). Despite of the advantages of hydrostatic reduction, in patients presented by clinical complaints have continued more than 48 hours and patients presented with ileus and peritonitis it is safer to admit patients directly for surgery (11). 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 (12). 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).

## 2. Patient 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 pediatric surgery, Zagazig university hospital. Patients were evaluated demographics, clinical presentation, management strategy, during the hospitalization and outcome. Following the physical examination of patients presenting with a preliminary diagnosis of intussusception, laboratory and biochemical testes and blood group were examined, ultrasonography and plain x-ray abdomen in erect position was done for all cases, patients with peritonitis, and ileus and delayed symptoms more than 48 hours admitted directly to surgical approach without attempting hydrostatic reduction. Also 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, IV fluids until the hydration was sufficient, we take the patients to ultrasonography 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 100cm. Retrograde administration of saline was guided and monitored by ultrasonography. The procedure was successful when the

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fluid administrated was seen to have passed the cecum 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 general status of the child and abdominal sensitivity .Patients with continued invagination of intussusception after hydrostatic reduction was 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 48hours 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, intravenous 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 visualized under ultrasonography 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 was done by using SPSS.The Mann-Whitney U-test and the Chi-square test were used in data evaluation<0.05 was accepted as statistically significant.

### 3. Results

This study was done on total 100 patients diagnosed with intussusception in department of pediatric surgery ,faculty of medicine Zagzig university hospitals.60 males(60%) and 40 females (40%),the age ranged between 1 month and 7 years old, age distribution was as follow, from 1 to 3 months 7 males (11.7%) and 6 females (15%),and from 4 to 7 months there was 15 males (25%) and 10 females (25%),and from 8 to 11 months ,there was 20 males (33.3%) and 14 females (35%),and from 1 to 2 years there was 8 males (13.3%)and 5 females (12.5%),and from 3 to 7 years , there was 10 males (16.7%)and 5 females (12.5%), there was no statistically difference between the groups in term of age[ Table 1].Abdominal ultrasonography and plain x-ray was 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 distention in 55 patients(55%),palpable abdominal mass was seen in 37 patients(37%),and absent bowel sound was seen in 17 patients(17%).Duration of symptoms was less than 48 h in 60 patients and more than 48 h in 40 patients, there is significant difference between patients presented before 48 hours and patients presented late after 48 hours in bilious vomiting and 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 value >0.05[ Table3].

Hydrostatic reduction was done in 50 patients presented early by intussusception with duration of symptoms was less than 24 hours, hydrostatic reduction was successful in 30 patients(30%) and failed in 20 patients(20%) ,the mean age at presentation for patients subjected to hydrostatic reduction was 12.5±0.5 months, surgical manual reduction was done in 40 patients(40%) , the mean age of patients was 22.5±0.4 months, and duration of symptoms was 24- 48 hours , resection anastomosis was done in 30 patients ,the mean age at presentation was 75.2±0.5 months, and the duration of symptoms was more than 48 hours, there is significant difference between three groups related to the age P value was 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, Mickle's diverticulum in 10 patients, polyp in 5 patients and lymphoma in 5 patients. The mean hospital stay in patients with hydrostatic reduction was 8±4 hours, and in manual reduction were 2±1 days, and in patients with resection anastomosis was 5±2days. The duration of medical treatment following the procedure was 5 days in hydrostatic reduction, and 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 value 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 3 patients (7.5%),and in patients with resection anastomosis the wound infection was seen in 4 patients (20%), and wound dehiscence in 3 patients (15%).

**Table 1: Age distribution**

| Age         | Male      | Female   | Total   | P value |
|-------------|-----------|----------|---------|---------|
| 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 value |
|-------------------------|----------------------|---------------------|---------|
|                         | <48 hours<br>(n=60)  | >48 hours<br>(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 distention    | 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 value |
|--------|--------------------|---------|
| 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.

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

#### 4. Discussion

Intussusceptions is 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 (intussuscipence). Invagination is most frequently observed in infants of 5 to 9 months old and more often in males (13). 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

914). 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 (14 ).The majority of finding in intussusception patients are non specific, but in our study most of the patients presented by abdominal pain and distention and delayed cases presented by rectal bleeding and manifestation of peritonitis and sepsis. These results match with other results in literature (15). Ultrasonography was done for all patients in our study which give sensitivity near 100%, other studies mentioned that the sensitivity of ultrasonography in diagnosis of intussusception reach to 70-85 % (16 ).Ileocolic intussusception is the most common type of intussusception in our study ,that represent 40% in all cases, but in another study done by Ocal S et al (16) it represent 88.9%.In our study the leading point of intussusception was seen in 22 (22%)of patients, in which Mickle's diverticulum was seen in 10 patients, polyp in 5 patients and lymphoma in 7 patients. From our study we found that the leading point of intussusception increase with age of the patients, in which the incidence of leading point was 5% in patients below the age of one year, this rate increase to 60% in patients above 4 years, in other study leading point of intussusception was seen in 3% of patients below age of one year, this rate increased to 57%in children with intussusceptions with age over 3 years (16 ). Hydrostatic reduction was done for 50 patients presented early, from which 30(60%) patients succeeded and 20 patients failed and admitted directly to surgery, these results was better than another study done by Tander et al (2), in which the rate of success of hydrostatic reduction was 30%, and in our study no cases was perforated during hydrostatic reduction but in reported cases the rate of perforation after hydrostatic reduction was 5%(17 ). Previous studies was recommended 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 70 patients ,20 patients

which failed after HR ,and another 50 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 40 patients in which there is no leading points and no perforation, resection anastomosis was done for 30 patients , with leading points in 22 patients and gangrenous loop in 8 patients. These results matched with previous literature, in which the incidence of resection anastomosis in patients with intussusception was ranged from 10% to 20%(16).The application of hydrostatic reduction is seen to reduce the socio-economic burden of both the hospital and the family by shortening the duration of hospitalization and the duration of medical treatment administrated, also the morbidity and mortality associated with anesthesia and surgery was reduced. Limitations of this study, number of patients is low also the only the information in the records was evaluated and the data collected from single center, therefore the results may not be representative of intussusception in other centers.

#### 5. 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 decrease duration of hospitalization and decrease cost of surgery.

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