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Assessment of Hydrostatic Enema Reduction under General Anesthesia in Treatment of Primary Intussusception in Children

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ABSTRACT

Background: Intussusception represents a common abdominal emergency, to which most of the cases of intestinal obstruction in early childhood are attributed, coming second after pyloric stenosis.

Objectives: To evaluate the efficacy of hydrostatic enema reduction in idiopathic pediatric intussusception cases.

Patients and methods: This was a cross sectional research performed on 33 children diagnosed with intussusception in the Pediatric Surgery Unit at Suez Canal University Hospital. All of them were subjected to hydrostatic enema reduction.

Results: There were multiple predisposing factors that are believed to play a role in the pathophysiology of intussusception in children. Intussusception was diagnosed through the utilization of conventional abdominal radiographs, sonography, or contrast enema examinations of the colon, which might include air. Intussusception was successfully reduced in thirty-one patients (94%), whereas operative intervention was required in two individuals (6%). Duration of symptoms was found to be significantly related with success rate of reduction; the shorter the duration, the higher the rate of success. Bleeding per rectum was found to be unrelated to the success rate of reduction.

Conclusion: Fluoroscopy-guided hydrostatic reduction is highly recommended in kids with intussusception. This procedure is characterized by being non-invasive, easy, highly successful, and has the lowest rate of recurrence, morbidity and mortality.

Keywords: Hydrostatic Enema, Intussusception, Pediatric

INTRODUCTION

Intussusception represents a common abdominal emergency, to which most of the cases of intestinal obstruction in early childhood are attributed, coming second after pyloric stenosis [(1)]. This process can occur in both the small and the large bowel; however, it commonly arises in the junction between the ileum and the caecum which is called the ileocaecal intussusception representing about 90% of all cases. There is other, yet uncommon, types of intussusceptions such as the ileoileal and the colocolic types, representing 10% of the intussusception cases [(2)].

Particularly in developing nations, the incidence of intussusception can reach even higher figures, ranging from 0.24 to 2.4 per 1000 live births [(3)].

Typically, idiopathic factors are responsible for pediatric intussusception; a discernible precipitating lesion is observed in a mere ten percent of cases. The propensity of pediatric patients to develop intussusceptions may be facilitated by specific anatomical characteristics of the gut during development [(4)]. Furthermore, infection in the pediatric population is thought to be one of the factors contributing to the development of intussusception. To illustrate, Infection is thought to cause hypertrophy of Peyer's patches, resulting in an intussusceptum. Adenoviruses and rotaviruses are common viral illnesses that cause intussusception. Additionally, a seasonal variation of intussusception was found and was correlated with seasonal variation of viral gastroenteritis [(5)].

However, because of the variability and the non-specificity of the symptoms of intussusception, the diagnosis is challenging. Additionally, the classic triad of signs connected with intussusception (intermittent colicky pain, red currant jelly stool, and palpable mass) is noted only in less than 1/2 of individuals [(6)].

Operative and non-operative management are two options in the treatment of intussusception. Surgery is a confident traditional option; however, it has its problems due to invasiveness, handling of the bowel during attempted manual reduction, and anesthetic problems [(7)].

A successful reduction of ileocolic intussusception, the most prevalent kind in children, can be achieved using an ultrasonography-guided or fluoroscopic pneumatic or hydrostatic enema, which is effective in between 85 and 90 percent of instances. Surgical intervention is likely necessary for persistent small bowel intussusception since it has been linked to lead points or intestinal necrosis. The indication for surgery for intussusception, regardless of its form, is when enema reduction or close surveillance is ineffective [(8)].

Individuals who are stable and do not have a clear justification for surgical intervention (peritonitis, pneumoperitoneum) often have an attempted radiologic reduction. The success rate of enema reduction is lower in patients who are younger, have more blood per rectum, and experience symptoms for a longer period of time [(9)].

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The aim of present research was to assess effectiveness of the hydrostatic enema reduction in idiopathic pediatric intussusception cases.

PATIENTS AND METHODS

This was a cross sectional research performed on 33 children diagnosed with intussusception in the Pediatric Surgery Unit at Suez Canal University Hospital. All of them were subjected to hydrostatic enema reduction.

Inclusion criteria

All children under the age of 3 years with confirmed intussusception were involved in the research.

Exclusion criteria

Kids had signs and symptoms that might indicate shock, whereas radiologic findings of free intraperitoneal air could indicate intestinal perforation. Additionally, many kids showed characteristics of peritonitis.

METHODS

All patients enrolled in the study were subjected to Before the procedure:

Complete history from the parents, clinical examination and imaging **(**Plain X-ray, abdominal U/S and color Doppler).

Procedure [10]

At the outset, all patients who were confirmed to have intussusception underwent resuscitation and stabilization. Following this, a brief general anesthesia was administered. A well-lubricated Foley catheter, measuring 16-18 F, was inserted rectally for 6-9 cm. To prevent contrast leakage, the buttocks were manually pinched together and taped. With the child in the left lateral position, an enema-can containing 500 ml of room temperature normal saline was maintained at 100-120 cm above the table top for three minutes periodically. Under fluoroscopic guidance, normal saline was infused into the rectum from the enema-can. The movement of the fluid column was monitored until it reached the mass, which represented intussusceptions. After observing the mass for three to five minutes, the procedure was repeated a total of three times (each repetition was regarded as an attempt at enema reduction performed under real-time fluoroscopy). The ingress of saline into the distal ileum and small colon was the sole criterion for determining reduction. We performed operative management if reduction failed and there were indications of peritonitis.

Monitoring after procedure

Child was kept nil orally and under observation for 24 hours, U/S (at 6, 12, and 24 hours after procedure): to detect the recurrence, vital signs monitoring and clinical examination to detect the possible complication such as bowel perforation or sepsis.

Ethical Considerations:

This study was ethically approved by Department of General Surgery, Suez Canal University, Egypt, and the Research Ethics Committee of the Faculty of Medicine, Suez Canal University. Written informed consent of all the caregivers of the participants was obtained. The study protocol conformed to the Helsinki Declaration, the ethical norm of the World Medical Association for human testing.

Statistical analysis

Statistical analysis was made utilizing suitable tables. Data entry and analysis were done using "SPSS 22.0" for windows program. Continuous numerical variables were presented as mean±SD. Forms of frequency and percentage were used to represent categorical variables. For continuous variables, the one-way ANOVA was implemented. Chi-square was used for categorical variables. The results were considered statistically significant if the p-value was less than 0.05.

RESULTS

There were 21 children (64%) who met the classical diagnostic criteria of intussusception consisting of colicky abdominal pain, red currant stool and sausage-shaped palpable abdominal mass. Characteristics of patients were tested for association with rate of success, only residency was significantly related. Children who live in rural areas had higher success rate of reduction **(Table 1)**.

Table 1: Comparison of patient characteristics and outcome of reduction

Variables	Successful reduction (N=31)	Failed reduction (N=2)	P value
Age (Years)	1.5±0.5	1.7±0.6	0.59
Sex			
Male	21 (67.7%)	2 (100%)	0.3
Female	10 (32.3%)	0	
Urban	6 (19.4%)	2 (100%)	**0.01***
Rural	25 (80.6%)	0	
Socioeconomic status			
Low	16 (51.6%)	0	
Medium	14 (45.2%)	2 (100%)	0.3
high	1 (3.2%)	0	
Parents education			
Low	11 (35.5%)	0	
Medium	19 (61.3%)	2 (100%)	0.5
high	1 (3.2%)	0	

Regarding the symptomatology of included patients, all children had intermittent colicky pain, and almost all of them had vomiting. While red currant jelly stool was evident among only 23 cases **(Table 2).**

Table 2: Clinical presentation of patients

Variables (N=33)	N	%
Intermittent colicky pain	33	100
Vomiting	31	93.9
Red currant jelly stool	23	69.7
Abdominal mass	21	63.6
Constipation	2	6.1
Dehydration	2	6.1
Lethargy	2	6.1
Symptoms of infection		
Symptoms of gastroenteritis	24	72.7
Symptoms of URTI	9	27.3

URTI: Upper Respiratory Tract Infection.

There were 21 children (64%) who met the classical diagnostic criteria of intussusception consisting of colicky abdominal pain, red currant stool and sausage-shaped palpable abdominal mass **(Figure 1).**

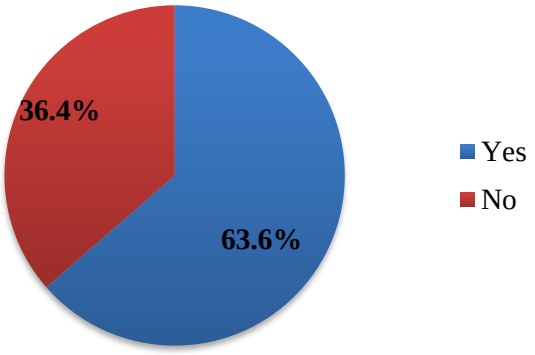

Figure 1: Presence of the classical clinical triad of intussusception.

The mean hours spent between presentation to intervention was approximately 19 hours. The majority of children had duration of 12 to 18 hours between onset of symptoms till intervention time **(Table 3).**

Table 3: Details of the procedure

Duration of symptoms till intervention time (Hours)	12-18 N=33	18-24 N=33	> 24 N=33	P value
Participants N (%)	19 (58)	12 (36)	2 (6)	**0.02***
Duration of procedure in minutes (mean ± SD)	15 ± 2.4	20 ± 3	45 ± 1.6	**P=<0.001*** **P1=<0.001*** **P2=0.8747** **P3=0.8747**
Duration of symptoms till intervention time in hours (mean ± SD)				18.9 ± 3.6

P:P value between three groups, P1: P value between group 1 and 2, P2: P value between group 1 and 3, P3: P value between group 2 and 3.

Large number of patients spent less than 48 hours post-reduction in the hospital. Incidence of complications or recurrence was zero **(Table 4).**

Table 4: Follow-up details

	N=33	%
Length of hospital stay		
48 hours	31	93.9
>48 hours	2	6.1
Complications of reduction	0	0
Recurrence	0	0

Bleeding per rectum was found to be unrelated to the success rate of reduction **(Table 5).**

Table 5: Presence of red currant jelly stool and outcome of reduction

	Successful reduction N=31	Failed reduction N=2	P value
Yes	21 (67.7%)	2 (100%)	0.3
No	10 (32.3%)	0	

DISCUSSION

It is well established that hydrostatic reduction has a high success rate ranging between 58% and 96% [(11)]. In our research, the success rate of hydrostatic reduction was 94%. This rate is comparable to another study by **Ahmad *et al.*** [(12)] where the success rate of hydrostatic reduction was 90%. Nevertheless, higher success rates were reported by **Sanchez *et al.*** [(13)] who found that the success rate of ultrasound-guided reductions was 100%. On the other hand, fluoroscopy-guided reductions had lower success rates; 82%. After all, ultrasound guided reductions are preferred to guarantee safety and effectiveness.

Success rate is highly dependent on patients' characteristics such as age, presence of complications, and duration of symptoms. Higher success rates can be attained with critical choice of the candidates. For instance, **Krishnakumar *et al.*** reported a 96% success rate, which is considered high in comparison to previous studies. This high success rate is attributed to their highly selective inclusion criteria; less than 48 hours of symptoms, no toxicity, no complications, or previous operations [(14)].

Of the 33 patients in our study, all of them were younger than 3 years old, none of them had features of toxicity, peritonitis or intestinal obstruction, and 93.9% of them had less than 24 hours duration of symptoms. That confirmed our hypothesis that categorizing patients favors better prognosis.

Many studies claimed that young age has a higher success rate [(15,16)]; however, we found no significant

difference between study participants. May be because there was no age variability among study groups; all of our participants were already younger than 2 years old. Similarly, **Avci and his colleagues** did not find association between age and successful reduction where all children were below 3 years as well [17]. Correlation between young age and success rate is hypothesized because it has been thought that older children have a higher incidence of lead point [17].

Short duration of symptoms is mostly associated with fewer complications such as intestinal obstruction or development of toxicity [18]. Many studies augment this theory. We also found that children with short-standing symptoms (<24 hours) had better prognosis.

This agrees with **Krishnakumar *et al.* and Xiaolong *et al.*** findings, the former found that success rate was higher among children with duration of symptoms less than 24 hours, while the latter found duration of less than 48 hours is significant among children with successful reduction [14,15].

In contrast, **Khorana *et al.*** and **Flaum *et al.*** found that period of signs had not affected reduction success rate [19,20].

Bloody stool seems to be one of the poor prognostic factors for successful reduction**. Khorana *et al.*** and **He *et al.*** found that most of the failed cases had bloody stool [19,21]**.** In contrast, in our study, bleeding per rectum-bloody stool- did not affect success rate significantly. Isolated bloody stool might be misinterpreted as gastroenteritis or other local causes of bleeding. This leads to misdiagnosis and delay of reaching an accurate diagnosis and proper management [15].

Similar to **Ahmad *et al.*** our patients had no complications. Examples for potential complications of non-operative procedures are bowel perforation and peritonitis [12].

On the other hand, operative interventions are associated with more serious complications especially postoperatively such as anastomotic leak, incisional hernia, ileus, intestinal obstruction and wound infection, in addition to higher mortality rate reaching 4.3% [22].

It is worth mentioning that the current fluoroscopy techniques have been evolving to produce more safe and efficient outcomes. Such novelties include pulsed fluoroscopy, further screening using 0.1- or 0.2-mm copper, and enhanced digital picture methods (final picture hold, frame grabber). Furthermore, the incessantly improvement in this technology, in addition to proper training of radiologist would further yield less radiation hazards to both the patient and the surgical team [23].

Concerning hospital stay, we found that 93.9% of our patients stayed at hospital less than 48 hours post-reduction. This agrees with results of **Ekenze and his colleagues** who reported that hydrostatic reduction has lesser average hospital stay than operative options (2.4 versus 10.6 days, respectively) [22]. This longer duration is mainly spent on recovery and management of possible complications co-occurs with operative procedures.

CONCLUSION

Fluoroscopy-guided hydrostatic reduction is highly recommended in children with intussusception, especially among young children, presenting early, with no complications. This procedure is characterized by being non-invasive, easy, highly successful, and has the lowest rate of recurrence, morbidity and mortality. The research was characterized by multiple strengths points that favored better outcome and high success rate of hydrostatic enema.

DECLARATIONS

- **Consent for publication:** I certify that each author has granted permission for the work to be submitted.
- **Funding:** No fund
- **Availability of data and material:** Available
- **Conflicts of interest:** No conflicts of interest.
- **Competing interests:** None

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