

The Role of Saline Enema in Reduction of Intussusception Under Ultra Sonographic Guide a Study of 40 Patients in Alkarama Teaching Hospital

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Abstract

Background:

enema reduction of the intussusception under US guide is widely used as a useful alternative to surgical management. This procedure is simple with no radiational effect , less complication rate with good outcome and the parents can stay with their child during the whole procedure.

Aim of study :

We tried to present our experience in HRIUSG by the use of normal saline enema and to evaluate its safety, outcome and to identify the risk variables for enema failure.

Methodology :

From the 1st of June 2016 to 1st of January 2017, we received about 45 children at children welfare hospital (medical city complex) that confirmed sonographically to have intussusception. Five patients were excluded from the study because of contraindications (peritonitis, perforation and shock). 40 children were developed enema reduction under sonographic guide.

Results :

From 40 children underwent HRIUSG their age presentation range from 3 months to 32 month, 67.4 % had respiratory infection while 32.6 % had gastroenteritis. We had a successful rate about 79 % with a median of 1 trial and only 3 patients (9.3 %) developed recurrence within 1st 24 hr. from the 9 patients underwent surgery we had 8 patients had manual reduction and one patient underwent resection of the bowel. Only 3 patients had PLP. 1 patient (2.3%) was reported to have complication (perforation over sewn).

Age , gender , duration of symptoms not significantly affect the outcome P value < 0.05 while bleeding with stool, initial mass in the left colon and rectum , presence of free fluid and more trial numbers were a bad prognostic factors for enema failure .

Conclusion:

1. HRIUSG is simple, safe, less costly, practical, less messy ,no radiational exposure with a low complication rate
2. Age, gender, Duration of symptoms did not affect the outcome significantly.
3. Although bleeding with stool, left colon intussusception mass and free peritoneal fluid is a risk factor for failure of HRIUSG but they are not absolute contraindication.
4. The better scenario for enema reduction success is a patient presented with symptoms < 24 hr. with no bleeding stool and a mass in the cecum and ascending colon with no free peritoneal fluid.

Keywords: saline enema; reduction; intussusception ; ultrasound guide .

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INTRODUCTION

Intussusception is the most frequent cause of bowel obstruction in infants and toddlers. It is an acquired invagination of the proximal bowel (intussusceptum) into the distal bowel (intussusciens). It was first described in 1674 by Paul Barbette of Amsterdam, defined by Treves in 1899, and operated on successfully in 1873 by John Hutchinson.1,2

Although intussusception was accurately described by John Hunter in 1793, Hippocrates (born circa 490 BC) recommended that treatment of "ileus" consist of connecting a bellows to the anus and inflating the bowel with air if hydrostatic reduction, possibly with the use of oil, failed. The first successful operative reduction was performed by Jonathan

Hutchinson in 1871. Hirschsprung first described hydrostatic reduction of intussusception in 1876 and in 1905 described 107 patients successfully treated with this method. In the 1920s Scandinavian radiologists reported

the use of fluoroscopically controlled barium enema for reduction of intussusception. Ravitch's standardization of techniques with barium helped nonoperative reduction gain more widespread acceptance. In 1959 the use of air reduction was first reported, and, more recently, thousands of patients in China have been treated successfully this way³. The word intussusception is derived from the Latin words *intus* (within) and *suscipere* (to receive). Intussusception is the invagination of one part of the intestine into another (Fig. 1). Three cylinders of intestinal wall are involved. The inner and middle cylinders are the invaginated bowel (intussusceptum), and the outer cylinder is the recipient of the invaginated bowel (intussusciptiens).⁴

The lamina propria of the small intestine is a loose areolar network extending between intestinal glands and into the core of the villi, and containing scattered lymphocytes and isolated lymphatic nodules. These nodules are more numerous in the distal small intestine and may be sufficiently large as to occupy the whole mucosa. Visible masses of lymphoid tissue may occur along the anti-mesenteric border of the ileum, up to 2cm in length, and are known as Peyer's patches. Lymphoid hyperplasia within the intestine may result in enlarged Peyer's patches, which serve as the lead point for intussusception in 'idiopathic' cases.⁵

Each intussusception has the following pathologic anatomy: as the intussusception develops with its prograde bowel peristalsis, the proximal invaginated bowel (intussusceptum) carries its mesentery into the distal recipient bowel (intussusciptiens). The mesenteric vessels are angulated, squeezed, and compressed between the layers of the intussusceptum. This causes intense local edema of the intussusceptum, which in turn produces venous compression, congestion, and stasis leading to an outpouring of mucus and blood from the engorged intussusceptum, the classic red currant jelly stool. If this process continues unabated, bowel congestion and pressure increase and ultimately produce ischemic changes leading to bowel necrosis in the intussusceptum. In most cases, ischemic necrosis needs more than 72 hours to develop.

If the ischemic process goes undiagnosed, bowel obstruction, perforation, or sepsis leads to death within 5 days. In rare cases, the intussusceptum can become gangrenous, and slough and the bowel may fuse. No free perforation occurs, and the separated necrotic intussusceptum may pass out of the rectum.⁴

Material and methods :

A prospective study of 40 patients underwent HRIUSG was done in Alkarama teaching hospital in medical city complex from 1st June 2018 to 1st January 2019.

All patients were received from either outpatient clinic or emergency unit as a suspicion of intussusception, the following workup done for each patient:

- 1: A full history was taken regarding age, gender, duration of symptoms (screaming attack, vomiting, bleeding with stool etc....) and preceding symptoms like gastroenteritis or respiratory symptoms.
2. Full general and abdominal examination done for the patients seeking for signs of intussusception (presence of abdominal mass, site of the mass, per rectal examination for detecting bleeding with stool or palpable mass).
3. All patients sent for basic laboratory tests including CBP, RFT and serum electrolyte, blood group.
4. All patients were sent for erect abdominal X-ray.
5. All patients underwent abdominal sonography using ...sonographic criteria including (presence of an intussusception mass, site and size of the mass, presence of free fluid in the abdomen).

After confirmation of the diagnosis we explain to the parents their child condition and the sequences and the future plan for management regarding non-operative procedure and the risk of failure and probability of conversion to operative management.

We admitted the patients to the surgical ward for correction of dehydration and electrolyte disturbances and we took an informed consent from the parents about the procedure and risk of repeated attempts, perforation, failure and the need for surgery. Five of patients excluded from our study and they were in need for urgent laparotomy because of signs of peritonitis, perforation, hemodynamically unstable and suspicion of the presence of PLP (pathological leading point), patients younger than 3 months and older than 3 years were excluded.

While preparing for hydrostatic reduction, 10 of the patients (25 %) were received sedation diazepam 0.1 mg \ kg rectally while surgical team were ready for surgery .

The patient were taken to the sonographic examination room , saline enema were done using Foleys catheter [20 – 22 F] introduced in the rectum without lubricant up to 10 cm and the child putted in the left

lateral position while one of the parents close to him\her , the balloon was inflated up to 25 ml of distilled water with confirmation of its position close to the mass under ultrasonography using 5- 10 MHZ (Toshiba –japan) device and buttock plaster used .

A warm normal saline enema were used at a height of 100 – 120 cm (120 mmhg) above the child's table up to 1000 ml for up to 30 min. while the sonarist observing the flow of the enema and the reduction of the mass and detecting any sign of perforation (free fluid).

Signs of complete reduction are complete reduction of the mass and reflux of the enema into the terminal ilium.

After complete the procedure the enema filled the bowel were evacuated and the sonarist (before deflating

the balloon of the Foley's catheter) were confirming the reduction of the mass and assuring no perforation nor free fluid in the abdominal cavity found and searching for PLP and checking bowel peristalsis condition.

The patient then taken to the ward and kept nothing orally and under observation for 24 hr. then a formal abdominal ultrasound was done for confirmation of reduction and exclude recurrence after 24 hr.

Anderson darling test was done to assess if continuous variables follow normal distribution, if follow normal distribution than mean and standard deviation used, if did not follow normal distribution than median and interquartile range (25% to 75% percentile range) will be used to present the data (boxplot and whisker used to present them graphically).

Discrete variables presented using there number and percentage used to present the data, chi square test used to analyze the discrete variable or Fisher exact test used to analyze the distribution between 2 groups (used instead of chi square for 2x2 table, if total sample <20 and if 2 or more with expected frequency less than 5).

Mann Whitney U test used to analyzed the differences in median of two groups (if they do not follow normal distribution)

Binary logistic regression analysis used to calculate the odd ratio (OR) and their 95% confidence intervals, when the outcome can be categorized into 2 binary levels, and if appropriate probability plot used to present the relationship SPSS 20.0.0 software package used to make the statistical analysis, p value considered when appropriate to be significant if less than 0.05

1- outcome of HRIUSG .

In this study, we received 40 patients which presented as intussusception. All of them underwent HRIUSG, 32 patients had successful reduction done with up to 3 trials and 8 patients failed with a whole success rate 79%.

From the resolved group we had 9.3 % (3 of 32) developed recurrence in the first 24 hr . all of them had HRIUSG, 2 patients reduced and 1 patient failed and need surgery.

All of the 9 patients which failed to reduced underwent urgent surgical intervention , 8 patients were manually reduced while only 1 needed resection of the unhealthy bowel .there were 3 PLP (7.5%) lymphoma, polyp and Meckel's diverticulum, all of them underwent resection.

One patient developed perforation (2.3%) during the procedure and sewing of the perforation was done

2: Statistical presentation regarding to gender.

Of the 40 patients included in our study there was 25 male (62.5 %) and 15 female (37.5 %) .

3 – Statistical presentation regarding age, gender and its relationship to outcome.

From 34 success trials, 13 was female (38.2%) and 21 was male (61.8%) .

From 9 failed trials we had 2 female (22.2%) and we had 7 males (77.8%) as shown in table 2 and figure 7 .

We noticed that both age and gender did not affect the outcome

4- duration of symptoms (DOS) and type of infection and its relation to outcome.

From 43 trials we had 21 (48.8%) with DOS < 24 hr. with success rate (90.4 % [19 of 21]) and we had 22 (51.2 %) with DOS > 24 hr with success rate (68.1 % [15 of 22] .

Duration of symptoms did not differ significantly between patients with successful and failed outcome p value (0.132).

The type of infection also did not affect the outcome significantly, .

5- symptoms of the patients and their relation to the outcome .

Bleeding with stool is higher in patients with failed outcome (77.8% [7 of 9] vs 41.2% [14 of 34]) however this higher proportion did not reach statistical significance; both vomiting and screaming attacks did not differ significantly between both groups.

6- mass characteristics and ultrasound finding related to outcome .

From 43 patients, 9 (20.9%) had no palpable mass with success rate (26.5%) . from 43 patients we had 34 (79.1%) had a palpable mass with success rate 73.5%). from statistical point of view there is no relation between mass presence and outcome P value 0.83 .

Regarding the site of the mass , 30 patients (69.85%) had a mass in the cecum and ascending colon with a success rate 76 .5%.

Masses at the transverse colon level account for only 10 patients (23.3%) with success rate 23.5 %.

Masses reached the left colon and rectum account for only 3 patients (7 %) with high failure rate reaching 100%.

Regarding free fluid in the abdomen 10 patients (23.3%) had +ve free fluid associated with high failure rate 88.9 % . free fluid also significantly associated with failed outcome P value <0.001.

7- enema procedure characteristics and its relation to outcome.

Increase number of trials associated significantly with failed outcome, while trial time was lower in failed outcome (median 15 min versus 20 min) it did not reach statistical significance, amount of enema did not associated with outcome.

8- The no. of the trials and its relation to outcome.

Table 7 illustrate that as the number of attempts increase there is increase in the failure rate in which in the patients

with first attempt there was 4% failure rate, in the 2nd attempt there was 11.1% failure rate in the 3rd attempt the failure rate increase to 77.8% .

9- the use of sedative agents and the outcome.

The use of sedation did not associate significantly with outcome, however 8/10 of the patients who had been used sedation had successful outcome .

10- logistic regression analysis and risk factors :

free fluid was the strongest predictor of failure in outcome (128 folds), followed by increased trial number (10.7 folds), than bloody stool (5.0 folds), than longer than 24 hours duration of symptoms (4.4 folds), and transverse and descending colon location (4.1 folds) all these associated with failed outcome. Only free fluid presence was independent predictor of failed outcome;

Discussion

Ultrasonography can be used usefully as a diagnostic method for the intussusception with high sensitivity and specificity.⁵²

HRIUSG (hydrostatic reduction of intussusception under sonographic guide) is regarded promising, helpful non-operative method since its first described by Kim et al ⁵³ because it is very simple, less costly, effective, consuming less time with no radiation rate and less complication. The procedure associated with less morbidity and less probability of fluctuation in the intraluminal colonic pressure as in air enema, also less risk of peritonitis even with perforation like barium enema. There is no mortality rate was reported as in the air enema.^{54,55,56}

The success rates that were published ranging from (75% to 95% which seems to be similar to the results using air enema. ^{57,58,59,60}

In this thesis the success rate was 79% which seems to be not that different from other results that were published.

Some studies like Kim et al.⁵³and Bai et al.⁵⁹ they used a chlorpromazine medication before the enema reduction with success rate reaching 96%.while other studies like Rohrschneider's and Tröger's used (chloral hydrate or valium) with a success rate 90%.⁶⁷

In our study we had been used diazepam rectally in only 10 (43) cases 23.2% with success rate in 8 (10) 80 % .we thought that not using sedation in all of our patients may be contributing factor to our low success rate, and we plan for developing a suitable, practical strategy for sedating children before the procedure of HRIUSG.

In our department the procedure were done by residents under training period ,so it may be a factor for lower success rate and we plan to do a more formal protocol to decrease this variation. Crystal et al.⁶³ and Bai et al.⁵⁹found that there is correlation between the outcome and the experience of the radiologist and procedure operators.

Rohrschneider and Tröger ⁶⁷found that the longer the procedure, the more probability of reduction (the success rate can be increased up to 90% when more time spending for more than 45 minutes.in our study from statistical point of view we found in 34 success trial the median reduction time is 20 min with a range from(15 min. - 30 min). and a median enema amount of 650 ml with a range from (300 ml – 1000 ml).

In this study from statistical point of view we found that age, gender, vomiting, screaming attacks, preceding symptoms like gastroenteritis, respiratory infection shows no significant association P value > 0.05. as shown in table 2,3,4. He et al.⁶⁸discussed the risk factors for failed

HRIUSG, they found that age,gender,DOS were not affect the outcome significantly while mass localization (left colon and rectum) , free fluid in the abdomen , bleeding with stool were a risk variables for failure.³⁶

A DOS which prolonged more than 24 hr. in our study decrease the success rate but statistically not significant P value (0.132).Katz et al.⁶⁹found that DOS more than 12 hr. is a risk factor for reduction failure, while Fike et al.⁷⁰ found that any patient with DOS more than 24 hr. is a significant factor for unsuccessful enema reduction. we expect the reasons may be incapability of the patients to determine the exact time of symptoms or the parents error to clarify the time of symptoms precisely.

there is one study ⁷¹ of pneumatic reduction found there is no correlation between DOS and reducibility. in our study the patients that were presented with bleeding stool was 48.80% (21 of 43) with lower success rate (66.6 % [14 of 21]) and our multivariate analysis show it is a poor prognostic factor OR 5.0 and this is goes with He et al ⁶⁸. There is one study reported bleeding with stool as a risk factor for failure.⁷⁰

In this study we had only 7% (3 of 34) from the patients presented with distally located mass with high failure rate 100% (3 of 3) and P value < 0.02 , and in the multivariate analysis an intussusception reaches the left colon and rectum regarded as a bad prognostic factor with OR value of 4.062. There is some of the researches like Crystal et al.,Fike and Khanna et als ^{63,70,72} regarded that the initial mass location distally (left colon or rectum) is a poor prognostic factor.

The presence of free fluid in the abdomen was the main strongly poor prognostic factor in our research. The patients that presents with + ve free fluid in abdominal US account for 23.3% (10 of 43) with very high failure rate 80 % (8 of 10) with OR 128 in the multivariate analysis.our results are seeming similar to the results of Britton

and Wilkinson 73 which found that a success rate is better (up to 93 %) with the absence of free fluid in the abdomen and they regard the presence of trapped fluid within the mass is a poor prognostic factor which decreasing the success rate down to 25%. Some researches like Mirilas et al and Feinstein et al. regarded the presence of small amount of free fluid did not affect the reducibility.^{74,75}

In this study we had a recurrence rate 9.3% (3 of 32) .and our result is seems to be in the usual accepted range 10 - 15 %. Which is goes with Niramis et al.⁴⁴

in our study we had only one patient developed perforation 2.3% (1 of 43) which is similar to Tareen et al.⁷¹ so the enema reduction under US guide is so safe when we respect the inclusion criteria.

We used only three trials as a maximum no. in our study and we found increasing the failure rate with more trial numbers although we had 9 patients underwent 3 trials with a success rate 22.2 % (2 of 9).

Rohrschneider and Tröger ⁶⁷ were suggest trying the last trial on the operating theater under GA before surgery which could be a successful maneuver for increasing outcome. we plan to have a such facility in our management protocol to increase our success rate and improve outcome.

The limited experience of our center residents of the sonographic department overcame the using of more variables in our study like the thickness of the bowel wall⁷⁴, trapped fluid within the intussusceptum mass ⁷⁶, presence of lymph nodes within the mass⁷⁷ and the Doppler finding of the mass to assess vascularity and viability of the involved bowel as in Lim et al.⁷⁸

Conclusion and recommendations :

Conclusion :

1. HRIUSG is simple, safe, less costly, practical, no radiational exposure with a low complication rate
2. Age, gender, DOS did not affect the outcome significantly.
3. Although bleeding with stool, left colon intussusception mass and free peritoneal fluid is a risk factor for failure of HRIUSG but they are not absolute contraindication.
4. The better scenario for successful enema reduction is a patient presented with symptoms < 24 hr. with no bleeding stool and a mass in the cecum and ascending colon with no free peritoneal fluid.

Recommendations:

1. success rate can be increased using systemic sedation.
2. the procedure done by well-trained pediatric surgery team.
3. US done by well-trained radiologist using more variables.

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