

Comparative Study between Hydrostatic Reduction of Infantile Intussusception by Saline and Air Under Sonographic Guidance in Assiut University Hospital

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Abstract

Background: Intussusception is the invagination of one bowel segment into another, Once the diagnosis is settled, reduction of intussusception is an emergency procedure to be carried out immediately, reduction is done either by saline or air enema [1].

Patients and Methods: Our study included 40 cases with infantile intussusception to evaluate the safety and efficacy of reduction of intussusception by using either air (group A) or saline enema reduction (group B) from November 2016 till April 2017 in General Surgery Department, Assiut University Hospital.

Results: Successful reduction was achieved in 90% of group A (pneumatic reduction) and 85% of group B (hydrostatic reduction), group A show less complication rate than group B as there is only one perforated cases in group A while 2 perforation in group B.

Conclusion: Pneumatic reduction under US guidance avoid the exposure to radiation as with fluoroscopy and also can identify if there is any recurrence or residual intussusception. Pneumatic reduction is safe in 95% of cases and effective method of reduction of intussusception with less complication rate than that with hydrostatic reduction.

Keywords: Intussusception – Hydrostatic – Pneumatic – Sonographi guidance.

Introduction

INTUSSUSCEPTION is the invagination of one bowel segment into another. Intussusception is the most common cause of intestinal obstruction in infants and children between 3 months and 6 years of age. The vast majority of cases are idiopathic (primary). While the minority are secondary to pathologic lead points such as a tumor, polyps or

Meckel's diverticulum are more common in neonates and children older 5 years or in cases of small intestinal intussusception [2].

Early diagnosis of intussusception is essential to avoid treatment delay which may be life threatening owing to development of bowel ischaemia, necrosis and their complication. Patients with intussusception classically present with triad of abdominal pain, red currant jelly stool and palpable abdominal mass. however this classic triad is often absent.

The traditional diagnostic approaches to intussusception have been plain radiography and enema examination. But ultra sonography is now more commonly recommended [3]. Once the diagnosis is settled, reduction of intussusception is an emergency procedure to be carried out immediately after rapid preparation of patients by fluid or blood infusion to correct shock and electrolyte to replace losses.

Reduction is done either by enema saline reduction or by air (pneumatic) reduction. When there is clinical evidence of peritonitis with abdominal distension especially for 48 hrs or longer non surgical reduction should not be done because of the risk of perforation and surgical reduction should be done [4].

Patients and Methods

This randomised controlled study which done in General Surgery Department, Assiut University Hospital from November 2016 till April 2017 include 40 cases with infantile intussusception and was conducted to evaluate the safety and efficacy of reduction of intussusception by using either air

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or saline enema reduction. Patients were divided into two equal groups.

• *Inclusion criteria:*

All cases of infantile intussusception.

• *Exclusion criteria:*

- 1- Small bowel intussusception.
- 2- Neglected or late cases of intussusception (history after 48hrs).
- 3- Complicated cases of intussusception (by perforation or septic shock).

• *Preparation of patients:*

All patients were resuscitated by ryle insertion, IV fluids, antibiotic as combination of metronidazole and cefotaxime, anti oedematous drugs as dexamethasone 4mg amp 0.5mg/kg/dose & Alphachymotrypsin amp and complete laboratory investigations.

After resuscitation, the patients were subjected to reduction under ultrasonography guidance by either pneumatic (air) or hydrostatic (saline) enema reduction.

• *Reduction technique:*

a- Pneumatic reduction:

The equipment used for the reduction was custom-made consisting of pressure gauge, which was connected to sphygmomanometer handbulb from one side and foley catheter from the other side. The child was placed in the supine position then sedated using ketamine hydrochloride at 1-2mg/kg body weight. The patient's respiratory rate and the colour of his/her lips were monitored during the procedure. The catheter end of our pneumatic reduction equipment with size range from (10-18F) was inserted into the rectum and the balloon of the catheter was then inflated with 7-10ml of water. The handbulb of the equipment was then squeezed intermittently to release air into the large bowel (The pressure was carefully monitored using the pressure gauge and not allowed to be raised above 80 to 120mmHg). Each procedure continued for 3min with a total of 3 attempts, if the mass was not released the procedure was stopped and another trial after 2 hours was done. If the intussusception mass was not reduced or any complication occurred the procedure was stopped and failure of procedure was considered [5].

b- Hydrostatic reduction :

A Foley catheter with size range from (10- to 18-F) was inserted into the rectum, and the balloon was gently inflated. Saline solution, warmed to

body temperature at a height of 100-120cm above the table was infused at constant pressure by the effect of gravity into the Foley catheter. During reduction, the intussusceptum was observed under continuous US guidance as it proceeds to the cecum. The procedure was repeated to a maximum of three times, each time last for 3min after which the procedure was terminated. If the intussusception mass was not reduced or complication occurred, the procedure was stopped and failure of procedure was considered [6].

• *Follow-up:*

Following successful reduction of intussusception, patients were kept under observation for a 24-hour for resolution of symptoms and for potential development of possible complications such as recurrence or perforation. Patients were started oral feeding shortly after reduction and follow-up US was done after 4 hours. If patient tolerated oral feeding and US was free the patient was discharged after 24 hrs. If the follow-up US showed recurrent intussusception then another trial of reduction was done, if failed the patient was considered for surgical exploration.

The data was analyzed using SPSS statistical software (SPSS Inc; version 22.0). Quantitative values with normal distribution expressed as mean \pm SD. Qualitative values expressed as percentage of total number of cases. The student *t*-test and Chi-square test were used in the analysis of statistical differences, *p*-value ≤ 0.05 was accepted as significant.

Results

This study include 40 cases; 28 patients males (70%) and 12 patients females (30%) at ratio 2.3:1, the mean age of the patients was 12.6 months ± 10.74 SD.

• *Efficacy of reduction:*

Successful reduction was achieved in 18 (90%) cases of group A (pneumatic reduction), while 2 cases (10%) failed. Successful reduction was achieved in 17 cases (85%) of group B (hydrostatic reduction) while 3 cases (15%) failed.

This successfully reduction was achieved from the 1st trial in 16 (88.9%) out of 18 successfully reduced cases of group A, while 2 cases (11.1%) were reduced after 2nd trial. Successful reduction was achieved from the 1st trial in 14 (82.35%) out of 17 successfully reduced cases of group B while 3 cases were reduced from more than one trial

(17,64%) 2 cases by 2nd trial and 1 case by three trials.

From 20 cases done by pneumatic reduction, one case was complicated during the procedure by perforation while from 20 cases done by hydrostatic reduction, two cases were complicated during the procedure by perforation.

Table (1): Age and sex of cases.

	Pneumatic reduction	Hydrostatic reduction	<i>p</i> -value
<i>Sex:</i>			
Males	14	14	0.00
Females	6	6	0.00
<i>Age group:</i>			
<4 ms	0	1	0.3
4-12ms	14	15	0.3
>12 ms	6	4	0.2

Table (2): Efficacy of reduction.

	Pneumatic reduction	Hydrostatic reduction	<i>p</i> -value
Successful reduction	18 (90%)	17 (85%)	0.3
Failed reduction	2 (10%)	3 (15%)	0.3

Table (3): Number of trials of reduction.

	Pneumatic reduction	Hydrostatic reduction	<i>p</i> -value
One trial	16/18 (88.9%)	13/17 (82.35%)	0.5
More than one trial	2/18 (11.1%)	3/17 (17.64%)	0.3

Table (4): Number of perforated cases.

	Pneumatic reduction	Hydrostatic reduction	<i>p</i> -value
No perforation	19/20 (95%)	18/20 (90%)	0.3
Perforation	1 (5%)	2 (10%)	0.3

Discussion

Intussusception is one of the most common abdominal emergencies in pediatric age group. This condition has been recognized for more than 200 years but the etiology of most intussusception is still unknown [7].

The incidence of this condition has shown a striking geographic and annual variation [8]. Intussusception occur when intussusceptum invaginate into adjoining part (intussusceptum), the intussusceptum is propelled further into the intussusceptum

by peristalsis and eventually becomes thickened, edematous, and swollen, leading to blockage of its lumen (occlusion) and subsequent pinching off of its mesentery (strangulation).

The management of intussusception include non operative and operative management. Non operative management include pneumatic or hydrostatic reduction and should be done in every case if there is no contraindication.

Hipsley used hydrostatic pressure to reduce intussusception and proposed the technique of pressure reduction [9]. In 1986, a large intussusception study was conducted in people's republic of china including 6.396 cases over a 13 year period whom were successfully reduced by air reduction with success rate of 95% [10].

Successful hydrostatic reduction of intussusception by saline under ultrasonographic guidance was first described by Kim et al., [11].

Pneumatic reduction under fluoroscopic guidance is quick, safe and clean and it has been reported to have high success rate [12]. However fluoroscopy uses ionizing radiation, and it may not detect lead points and residual ileoileal intussusception. In our study we did pneumatic reduction under ultrasonographic guidance to avoid radiation exposure, also US can identify any recurrence and any residual ileoileal intussusception unlike fluoroscopy.

Our study included 40 cases with intussusception with mean age 12.6 months comparable to Jiraporn K et al., study which was done on 170 patients with mean age 9 months [13] and to Debashish N et al., study which was done on 102 patients with mean age was 15.6 months [14].

The most common age for intussusception in our study was 4-12 months where 29 (72.5%) patients were in this age group followed by 10 patients (25%) were older than 12 months and one patient (2.5%) was younger than 4 months. This was nearly the same found by Saleh G et al study which was done on 20 patients where they had 15 patients (75%) in the age group 6-12 months followed by 4 patients (20%) younger than 6 months and one patient (5%) older than 12 months [15].

Our study show 18 successful reduction achieved by pneumatic reduction from out of 20 cases with a success rate (90%) and 17 successful reduction achieved by hydrostatic reduction from out of 20 cases with a success rate (85%) which is higher than Jiraporn et al., [13] study which had

success rate of pneumatic reduction (61.3%) and success rate of hydrostatic reduction (44%). Their study was done on 111 cases whom performed pneumatic reduction and 59 cases who received hydrostatic reduction.

Our success rate regarding pneumatic reduction is nearly the same as the results obtained by Hasan et al., with success rate (84.4%) and done on 45 cases [16].

Our results regarding the pneumatic reduction (90%) are same to the results found by Pratap et al., study [17] which have done on 25 cases and 22 cases were successfully reduced with success rate (88%).

Although Niramis et al., [18] had success rate of 63.6% with hydrostatic reduction. The success rate of this study regarding the hydrostatic reduction was 85% on 20 cases near similar to results previously obtained by Debashish N et al., [14] which success rate 81.4% done on 102 patients.

Successful pneumatic reduction was achieved in 16 cases (88.9%) from the 1st trial and only 2 cases reduced by more than one trial (2 trials) (11.1%) while successful hydrostatic reduction was achieved in 14 cases (82.35%) from the 1st trial and three cases by more than one trial.

This study had successful pneumatic reduction in 16 cases out of 18 cases from the 1st trial with rate 88.9%, two cases (11.1%) from 2nd trials while Hassan et al., [16] study had 38 successful pneumatic reduction out of 45 cases from the 1st trial with rate 78.9%, four cases (10.52%) from 2nd trials, three cases (7.89%) by three trials and one case (2.6%) by fourth trials.

The high success rate of pneumatic reduction compared to hydrostatic reduction was due to inherent compressible effect of air that results in air dissecting between the intussusceptum and intussusciens. This effect facilitate and expedites the reduction [12] and this is compatible with our study but without statistical significance.

Our study show one recurrent case (5.6%) in the pneumatic group which is similar to Alehossei et al., [19] study which was done on 17 cases who underwent pneumatic reduction, 9 cases were successfully reduced and show one recurrence (11.1%) and Hassan et al., which have no recurrence with pneumatic reduction [16].

Our study showed one recurrent case (5.8%) out of 17 cases successfully reduced in hydrostatic group which was higher than the results previously

obtained by Debashish et al., [14] who had 4 recurrent cases (4.8%) out from 83 cases successfully reduced by hydrostatic reduction.

Bowel perforation is a known complication in both air and saline reduction, if perforation occur when saline is used, contamination of peritoneal cavity with fecal mixed saline is more detrimental than pneumoperitoneum caused when air is used [20].

This study show perforation in one case (5%) of pneumatic group which is higher than the results obtained by Jiraporn et al., [13] who also had only one perforation (0.9%) in his study from 111 cases done by pneumatic reduction. However our study have perforation rate lower than Supikakritsaneepaiboon et al., [20] study which had higher perforation rate in their study.

This study also show perforation in 2 cases (10%) out of 20 cases done by hydrostatic reduction. This percentage was higher than the percentage obtained by Debashish et al., [14] study who had only one perforated case (0.98%) out of 102 cases done by hydrostatic reduction.

Conflicts of interest:

No conflict of interest has been declared.

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مقارنة بين أرجاع تداخل الأمعاء بالاطفال عن طريق حقن محلول ملح او الهواء تحت الأشعة التلفزيونية

مقدمة: يعتبر تداخل الأمعاء من أشهر أسباب انسداد المعوى عند الأطفال. وهو عبارة عن انزلاق جزء من الأمعاء - إما الأمعاء الدقيقة او القولون - ضمن جزء آخر من الأمعاء، حيث يؤدي هذا الانزلاق الى انسداد الأمعاء ومنع الطعام أو السوائل من العبور خلالها، كما يؤدي أيضاً الى انقطاع التروية الدموية للجزء المصاب من الأمعاء. تداخل الأمعاء يسبب انسداد معوى مع آلام بالبطن مصحوبة بمغص وانتفاخ بالبطن مع قيء. تداخل الأمعاء ممكن أن يحدث فى أى سن لكنه أكثر انتشاراً فى أول سنتين من عمر الطفل وذروة حدوثه ما بين الشهر الثالث والشهر التاسع من الولادة. حدوث التداخل يتراوح ما بين ١.٥ الى ٤ حالات من كل ألف طفل سنوياً مع نسبة إصابة الاولاد ثلاثة الى اثنين. حدوث التداخل فى مصر يتزايد كثيراً فى فصل الصيف و الخريف نتيجة كثرة حالات النزلة المعوية للأطفال فى هذه الأوقات من السنة

يحدث تداخل الأمعاء نتيجة تضخم بالأنسجة الليمفاوية الموجودة بالغشاء المبطن للأمعاء نتيجة عدوى حديثة غالباً بالجهاز التنفسى العلوى والجهاز الهضمى فى الأسبوع السابق لحدوث التداخل.

يوجد اربعة من التداخل:

١- الأمعاء الدقيقة مع الغليظة.

٢- الأمعاء الدقيقة مع نفسها ثم الأمعاء الغليظة.

٣- الأمعاء الغليظة مع نفسها.

٤- الأمعاء الدقيقة مع نفسها.

مع العلم أن أكثر الأنواع شيوعاً هى الأمعاء الدقيقة مع الغليظة مسؤولة عن أكثر من ٨٠٪ من الحالات. يوجد اسباب مرضية تسبب التداخل مثل زائدة ميكيل او الاورام الحميدة أو الخبيثة بالأمعاء و لكن مثل هذه الأسباب لا تمثل أكثر من ١٠٪ من الحالات.

التشخيص الكلينيكى لتداخل الأمعاء عند الأطفال: يعانى الطفل المصاب بتداخل الأمعاء من مغص متقطع بالبطن وضع الساقين نحو الصدر نتيجة ألم البطن الذى يعانى منه. من الممكن ان توجد كتلة محسوسة بالبطن غالباً ما بين نويات ألم البطن عند ما يبتنى فحص الطفل. غالباً ما يوجد قيء وأحياناً يكون هذا القيء يحتوى على سائل معوى. غالباً ما يوجد دم بالبراز شبيه بالجيلى لأنه يحتوى على مخاط نتيجة سقوط الغشاء المبطن للأمعاء. كل هذه الأعراض توجد فى اقل من نصف الحالات ومن الممكن ان لا يوجد اى ألم بالطفل اثناء الفحص.

هدف الدراسة: تقييم فاعلية وامن أرجاع تداخل الأمعاء عند الاطفال عن طريق حقن الهواء أو محلول ملح من فتحة الشرج.

المرضى والطرق: هذه الدراسة هى دراسة عشوائية لتقييم امان و فاعلية أرجاع تداخل الأمعاء عن طريق حقن أو محلول ملح من فتحة الشرج عند الاطفال.

هذه الدراسة سوف تشمل ٤٠ حالة من تداخل الأمعاء للأطفال وتنقسم الى مجموعتين متساويتين :

١- عن طريق حقن الهواء.

٢- عن طريق حقن محلول ملح .

الحالات المشمولة فى الدراسة: كل حالات تداخل الأمعاء بالأطفال .

الحالات المستثاه من البحث:

١- تداخل الأمعاء الدقيقة.

٢- حالات التداخل المهمة او متأخرة فى التشخيص.

٣- حالات التداخل التى حصل لها مضاعفات مثل انفجار الأمعاء .

نتائج الرسالة : تم حقن الهواء عن طريق جهاز خاص به ٢٠ مريض من ضمن ٤٠ مريض شملهم البحث وتم استخدام حقن محلول الملح فى ٢٠ حالة الأخرى.

كانت نسبة نجاح أرجاع تداخل الأمعاء عن طريق حقن الهواء ٩٠٪ حيث انه تم أرجاع ١٨ حالة بنجاح من اصل ٢٠ حالة.

كانت نسبة نجاح أرجاع تداخل الأمعاء عن طريق حقن محلول الملح ٨٥٪ حيث انه تم أرجاع ٧ حالة بنجاح من اصل ٢٠ حالة.

حدثت مضاعفات فى حالة واحدة فقط نتيجة حقن الهواء و حدثت مضاعفات فى حالتين نتيجة حقن محلول الملح.