

Original Research Article

Outcome of ultrasound guided reduction of intussusception in children by saline enema

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ABSTRACT

Background: Intussusception is a common cause of acute intestinal obstruction in children and contributor of morbidity and mortality in children. The purpose of this study was to evaluate efficacy of hydrostatic reduction of intussusception over operative reduction using normal saline enema in children and to identify procedure related complications.

Methods: All patients presenting to us with features of intussusception clinically and confirmed by ultrasonography between June 2015 to November 2017 were included in study. Depending on haemodynamic stability of patient and surgeon's preference, patients were subjected to trial of hydrostatic reduction by normal saline enema or operative procedure. Patients with failure or partial reduction were taken for surgery.

Results: The mean age was 21.07 months with a male preponderance. Of 53 patients attending the institute, 32 were given a trial of hydrostatic reduction which was successful in 28. Thus success rate was 87.5%. 1 patient succumbed resulting in 1.4% mortality rate after the procedure. It was observed that longer duration of symptoms reduced chances of reduction. 88% patients with successful hydrostatic reduction were discharged within 4 days of admission.

Conclusions: We conclude that ultrasound guided saline enema is simple, safe and effective method of treating intussusception in children with low rate of complications and can be strongly recommended as first line of treatment of intussusception in select group of paediatric patient, especially those reporting early to the hospital.

Keywords: Intussusception, Hydrostatic reduction, Saline enema, Children

INTRODUCTION

The word intussusception is derived from Latin words *intus* meaning within and *suscipere* meaning to receive.¹ Intussusception is defined as the condition wherein one part of bowel becomes invaginated into immediately adjacent segment of bowel mostly proximal into distal.² Intussusception is most commonly seen in children and 90% cases are idiopathic.² The data from India in an isolated study had incidence of 18 per 100,000 infant years.³ All studies had a higher male preponderance.^{3,4} The peak age of incidence of intussusception was from 4 months to 8 months of age.⁴

Diagnosis of intussusception can be done clinically and ultrasonographically with an accuracy of more than 90%. The common differential diagnosis of intussusception include acute gastroenteritis, Henoch Schonlein Purpura and Meckel's diverticulum.⁵ Both operative and non operative procedures (in the form of enema reductions) have been tried for many years for intussusception management. Although surgery is a definitive treatment modality, it has its morbidity and mortality due to invasiveness, handling of the bowel during attempted manual reduction with serosal and mucosal tears, anaesthetic and post operative complications. Conversely, non operative reduction is associated with less patient

discomfort, shorter hospital stay, hence lower hospital charges, and decreased risk of subsequent complications. Non operative procedures that can be used are: air enema under fluoroscopic guidance, reductions using barium enema and sonographically guided hydrostatic saline enema reductions. These techniques of managing intussusception are the gold standard in many institutions in developed countries as diagnosis is made early unlike in the developing countries where the diagnosis is made quite late due to late presentation leading to difficulty in reduction, non availability of fluoroscopy and ultrasonography and lack of requisite expertise in non operative reduction of intussusception in most centres.

The study aims at studying non operative versus operative management of intussusception in paediatric age group and to determine the success of non surgical versus surgical outcome in management of intussusception in a tertiary care hospital in a developing country.

METHODS

The subjects were children presenting with intussusception at Government Medical College, Aurangabad in Maharashtra (India).

Study design, duration and source of data

Current study is a prospective interventional study conducted from June 2015 to November 2017 on all patients presenting with signs and symptoms of intussusception at this centre were taken as subjects for the study. Diagnosis of intussusception was derived from a detailed clinical history and examination and confirmed by ultrasonography. All the recordings were made in proforma of the study. Subsequently the patients were subjected to non operative saline enema reduction or surgical intervention. Risks, benefits and possible outcomes of both procedures were fully explained and written consent was obtained from parents/guardians/relatives.

Inclusion criteria and exclusion criteria

Patients below 12 years of age admitted to surgical units with intussusceptions were included in the study and patients more than 12 years of age, patients who were haemodynamically unstable with signs of peritonitis and shock and patients not consenting were excluded from the study.

Procedure

Information for the study was collected from each patient on the basis of clinical findings like pain, vomiting, fever and red currant jelly stools. The signs which were looked for in per abdominal examination palpable abdominal lump, Dance's sign, red currant jelly stools. Overall general condition including hydration, temperature, urine output were taken into account while examining a case of

suspected intussusceptions and then the patient was shifted for ultrasonography and xray abdomen after securing intravenous access and starting intravenous fluids. Pre procedure preparation consisted of adequate resuscitation, prevention of hypothermia, nil by mouth, nasogastric tube insertion, dose of antibiotic (intravenous injection of cefotaxim). Hydrostatic reduction was performed in all patients of our unit except the patients with signs of peritonitis, shock and those who were haemodynamically unstable. However for patients admitted in other surgical units, the decision of whether to manage conservatively or by operative means was based on surgeon's preference. The patients who were to be subjected for ultrasonography monitored hydrostatic reduction were initially resuscitated in ward and then shifted to radiology suite for saline enema. Written informed consent was obtained from parents for this procedure. With patient in supine position, a 16-18 Fr non lubricated Foley's catheter was inserted per rectally and the bulb was inflated with 15 ml normal saline. Then Foley's was slowly pulled out till the bulb snugly fitted the rectum and the buttocks were taped together to maintain anal seal. The radiologist used high resolution ultrasound Prosound (Philips) to image the intussusception. A resident from department of surgery performed the procedure. The parents were asked to hold the child to facilitate the procedure. The enema was performed by holding the bottle of normal saline at a height of about 100-150 cm above the child and allowing the fluid into the rectum by an intravenous infusion set. The normal saline used was pre warmed to body temperature. No pump was used and no pressure monitors were connected to this circuit. The entire procedure lasted about 15- 20 minutes. 1000 -1500 ml normal saline was used in a single sitting. During the course of the procedure, ultrasonography was performed to check for reduction and to visualize the dynamic movements of the bowel. Complete reduction was confirmed by disappearance of and free flow of fluid into the terminal ileum. After the reduction of intussusception, the bowel was decompressed by same Foley's and fluid was drained. During the entire procedure the room temperature was maintained to keep the child warm and also during shifting care was taken to avoid hypothermia in the child. The patient was shifted back to surgery ward and kept nil by mouth. Review ultrasound was done after 12 hours to check for recurrence. If nasogastric aspirate was nil, bowel sounds had returned; patient was started on orals after 24 hours of reduction and subsequently discharged. In some patients, while patient was resuscitated and being shifted to radiology unit for hydrostatic reduction, the intussusception disappeared clinically and confirmed on ultrasonography. Review ultrasound was done after 12 hours to check for recurrence. Patients with shock or peritonitis or patients with partial or no reduction & non consenting patients were taken for operation after required pre operative investigations and resuscitation were done. In these cases after opening the abdomen, manual reduction was attempted by milking. After achieving the reduction

viability of bowel was checked. If bowel was healthy, appendectomy was done and abdomen was closed. However, in cases with doubtful viability resection anastomosis or stoma was done depending on the general condition of the patient. Patients with resection anastomosis had to be kept nil by mouth for longer duration compared to patients managed by simple manual reduction. Appendectomy was performed in all operated patients.

Post operative complications

Post operative complications that were observed in current study were wound infection, wound dehiscence, electrolyte imbalance, paralytic ileus, anastomotic leak and death. If the patients did not develop any complications they were discharged 8-9 days after operation. All patients whether operated or managed by non operative means were called for follow up after 1 month.

Statistical analysis

All the statistical calculations were done through SPSS for windows (version 20.0).



Figure 1: Material required for hydrostatic reduction.

RESULTS

It can be seen that most common age group of intussusception is 0-12 months in both male and female with a male preponderance of 2.1:1 (Table 1). The mean age of the subjects was 21.075 months (SD=23.77 months). Of the 28 patients who had successful reduction, 15 presented within 24 hours of symptom onset. In all 23 patients presented in first 24 hours of symptom onset, 17 were given trial of hydrostatic reduction and 15 had successful reduction giving it success rate of 88%. Of patients presenting between 24 to 48 hours (18), 11 were

given trial of reduction and all reduced successfully giving it a success rate of 100%. There was 1 patient who was given trial of hydrostatic reduction had no evidence of intussusception intra operatively. The intussusception may have reduced spontaneously in the peri-operative period. This patient was included in group of patients with successful reduction. In the third group 12 patients presented >48 hours after symptom onset, of which 4 patients were given trial of hydrostatic reduction out of which only 2 that is 50% succeeded. Hence patients presenting upto 48 hours of onset of symptoms can be managed by hydrostatic reduction. However surgery is required in most of patients presenting 48 hours after onset of symptoms.

Table 1: Age and sex incidence (n=53).

Age	Male; N (%)	Female; N (%)
0-12 months	18 (33.9)	9 (16.9)
1-5 years	13 (24.5)	8 (15)
5-12 years	5 (9.4)	0
Total	36	17

Of 35 cases managed by non operative means, 28 were successfully managed by hydrostatic reduction and 3 had spontaneous reduction. So, in patients managed by non operative means, a small but significant number of patients had spontaneous reduction indicating that in selected patients, nasogastric decompression, npo and intravenous antibiotics alone may suffice and such patients may not require intervention at all. However, close monitoring both clinical and ultrasonographic is required in these patients.

Overall, 32 patients were given a trial of hydrostatic reduction, of which 28 successfully reduced, hence success rate is 87.5%. 1 patient had negative laparotomy. This patient was included in successful reduction group. In remaining 4, 1 required resection anastomosis and in other three, the intussusception was reduced by milking. The primary surgical cases are cases taken directly for operation due to either instability of patient or surgeon's preference. Of these, 1 patient had spontaneous reduction that is there was no intra operative evidence of intussusception. In rest (17), 11 were managed by milking and 5 had to undergo resection anastomosis. In 1 patient ileostomy was done. This patient presented with complaints of 5 days duration and had poor overall general condition on admission. Secondary surgical intervention is operative intervention in patients given a trial of hydrostatic reduction and in whom ultrasonography indicated intussusceptions to be partially reduced or not reduced. There were total such 5 patients. Of these, 1 patient had no intra operative evidence of intussusception. The intussusception had partially reduced on the attempt of hydrostatic reduction and may have completely reduced while the patient was being prepared and shifted for operation. Of remaining 4, 3 were managed by manual reduction by milking and 4th patient had to undergo resection- anastomosis. Hence

majority of patients operated were managed by milking procedure. Majority of cases of intussusceptions managed

by hydrostatic reduction could be managed by 1000-1500 ml of normal saline enema.

Table 2: Correlation between duration of onset of symptoms and intervention used either operative or non operative depending on general condition of patients (n=53).

Duration (in hours)	Spontaneous N (%)	Hydrostatic N (%)	Surgery N (%)	Surgery after hydrostatic reduction failure N (%)
0-24 (23)	2 (3.77)	15 (28.30)	4 (7.54)	2 (3.77)
24-48 (18)	1 (1.89)	11 (20.75)	6 (11.32)	0
>48 (12)	0	2 (3.77)	8 (15.09)	2 (3.77)
Total	3	28	18	4

Table 3: Number of patients who were given trial of non operative reduction and the number in which successful reduction was achieved (n=35).

Treatment given	N (%)
Spontaneous reduction without intervention	3 (8.6)
Successful hydrostatic reduction	28 (80) of 32
Patients requiring surgery after hydrostatic reduction failure	4 (11.4)

In the patients of hydrostatic reduction only one complication was noted in the form of hypothermia leading to death of the patient. No other complication was noted making complication rate to be 3.8%. However, in operated patients, 10 of 23 patients had complications, leading to complication rate of almost 43%. The complications ranged from wound infection to dyselectrolytemia and death. 2 patients had surgical site infection with wound dehiscence managed by secondary healing. 1 had convulsions 4hours post-operative and ultimately death. 10 patients managed by operation had prolonged ileus leading to delayed commencement of orals and hence longer hospital stay. In post operative cases the subjects requiring hospital stay of more than 4 days were significantly higher compared to those managed by hydrostatic reduction. In post operative cases 95.24% patients required hospital stay of >4 days,

whereas 88.89% patients in hydrostatic reduction group were discharged <4 days.

DISCUSSION

Harald Hirschsprung of Denmark used enema to reduce intussusception in 1876, but it largely went unnoticed.⁶ In 1952, Ravitch and McKune published a famous landmark series from John Hopkins Hospital in USA; they used barium sulphate enema to diagnose as well as reduce intussusception, calling this hydrostatic reduction. They reported 73.6% success rate, no deaths and 5.55% recurrence rate in their original article.⁷ It took time for the surgical community all over the world to recognize the potential advantages of non operative method like hydrostatic reduction. The age and sex incidence of intussusception in our study compared to various studies has been shown in following table of demographic data.⁷

The mean age of intussusception in our setting was 21 months, the youngest patient being 3 months old and oldest 8 years old. This is found to be higher than the mean age in other studies. This is explained due to the fact that these studies have included patients of the toddler age group, viz; Debashish et al had children upto 4 years of age; Ahmad et al had children upto 5 years of age; Alamdaran et al included children upto 8 years and Mensah et al included children upto 4 years.¹¹

Table 4: Operative procedures done in operated cases of intussusception (n=23).

Parameters	Spontaneous N (%)	Milking/Manipulation N (%)	Bowel resection/Stoma N (%)
Primary surgical (N=18)	1 (4.34)	11 (47.8)	6 (26.09)
Secondary surgical (N=5)	1 (4.34)	3 (13)	1 (4.34)
Total (n=23)	2 (8.68)	14 (60.8)	7 (30.43)

However, in our study we included children upto 12 years of age and hence the mean age of presentation is found to be higher. But, even in our study a significantly higher number of patients are found in 0-12 months of age group. Considering the male to female ratio, our findings corroborate with the rest of the studies, where males have a higher incidence of intussusception than females. The average duration of signs and symptoms (in hours) with which patient presented has been compared with duration

of presentation in studies by other authors.⁸ The above table shows that, the mean duration of presentation of patients to our hospital from the onset of signs and symptoms is about 44 hours that is approximately 2 days. The other studies shown in above table included evidently show early presentation of patients. The late presentation in our study can be accounted by the fact that patients sought hospital facilities late from the onset

of symptoms, with patient presenting as late as 96 hours from onset of symptoms.

Table 5: Common complication in non operated and operated patients.

Complications	Hydrostatic	Surgical
Wound infection	0	2
Wound dehiscence	0	2
Sepsis	0	0
Ileus	0	10
Electrolyte imbalance	0	1
Hypothermia	1	0
Death	1	1

Table 6: Duration of hospital stay.

Duration (days)	Hydrostatic reduction (%)	Operative (%)
<4	24 (88.89)	1 (4.76)
>4	3 (11.11)	20 (95.24)
Total	27	21

This can be attributed to illiteracy and the underdeveloped status of this region. As it is known, more delayed the presentation, the patient do not respond to hydrostatic reduction and thus late presentation in our study also supports the relatively higher number of surgeries performed in our setup while treating patients of intussusception.

Table 7: The age and sex incidence of intussusceptions in our study compared to various studies.

Parameters	Debashish et al	Ahmad et al	Alamdaran et al	Mensah et al	Our study
Age	15.62 months	18 months	16.44 months	11.7 months	21.07 months
Male:female	1.7:1	1.8:1	3.2:1	2.6:1	2.1:1

Table 8: Average duration of signs and symptoms with which patient presented compared with duration of presentation in other studies.

Parameter	Debashish et al	Ahmad et al	Alamdaran et al	Our study
Duration of presentation (in hours)	16.59 hours	17.02 hours	22 hours	44.6 hours

Table 9: The success rate of hydrostatic reduction by normal saline of our study in comparison with other studies.

Parameters	Debashish et al	Ahmad et al	Alamdaran et al	Mensah et al	Our study
Success rate	81.3%	90%	78.8%	75%	87.5%

Table 10: Recurrence and mortality rate of intussusceptions in our and other studies.

Parameters	Debashish et al	Ahmad et al	Alamdaran et al	Mensah et al	Our study
Recurrence rate	4.8%	2.6%	3.8%	11.1%	3.8%
Mortality	1.2%	0	0	0	2.8%

The success rate for hydrostatic reduction in our study was 87.5%. This finding corroborates with findings of other studies wherein all studies have achieved a success rate of around 80%. 2 other studies conducted, 1 by Shahul et al from Kerala and other by Sahoo et al in Orissa achieved a reduction rate of 96% and 94% respectively.^{12,13} Thus in our country majority of patients were managed by hydrostatic reduction with reduction rate ranging from 81% to 96 % which is consistent with our study. The recurrence rate in our as well as other studies in cases reduced by hydrostatic reduction is less than 5% except Mensah et al.¹¹ All these cases of recurrence were managed by means of hydrostatic reduction in our as well as other studies and the reduction was successful. Our patients had recurrence 3 and 4 months after the first episode of intussusception and were managed again by hydrostatic method successfully. The mortality in our series was 1 each in hydrostatic reduction and operated patient group. The patient who had a hydrostatic reduction deteriorated in an hour, went into

shock and died in 5 hours most probably from hypothermia.. In the operated case, the baby developed convulsions probably due to dyselectrolytemia and died within 4 hours of the operation.

Limitations

Limitations of current study are small sample size and difficulty in follow up.

CONCLUSION

From the study it can be concluded that in select paediatric patients presenting with intussusception, ultrasound guided hydrostatic reduction by saline enema is a simple, safe, effective and radiation free method of treating intussusception with low rate of complications. It is less time consuming, cost effective and is associated with almost no complications and a minimal hospital stay whereas operative intervention is time consuming with

more morbidity, mortality leading to increased hospital stay and hence a costly intervention. Thus hydrostatic reduction by saline enema can be strongly recommended as first line management of intussusception in children as it can avoid unwanted radiation, surgery, anesthesia and morbidity, mortality associated with it.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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