

Clinical Features and Outcome of Saline Hydrostatic Reduction in Patients with Intussusception in a Tertiary Care Centre

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ABSTRACT

Background: Intussusception is one of the most frequent causes of acute bowel obstruction in infants and toddlers. Abdominal sonogram is highly specific, accurate and is the first line diagnostic modality. The primary treatment options are non-operative hydrostatic or pneumatic reduction. In our institution, we use normal saline for reduction of intussusception under ultrasound guidance (USGR). The aim of the study is to analyse the clinical pattern and treatment outcome of intussusception.

Methodology: Retrospective analysis of all cases admitted with intussusception in our department during 2014-2018 was done.

Results: 785 cases (527 males: 258 females) with a mean age of 25 months and median of 16 months had abdominal pain (92.5%), vomiting (59%) and blood in stools (32%) as the predominant symptoms. 710/785 cases (90.4%) underwent successful USGR and 75/785 of the failed cases underwent surgery. Age group < 12 months, presence of blood in stools irrespective of its duration and prolonged vomiting >48 hours were found to be significant factors for failed USGR. Vomiting and blood in stools were found to be significantly higher in children <12 months of age ($p < 0.005$), whereas pathological lead points were more frequent in children >3 years of age.

Conclusion: With a high success rate and no significant complication rate, USGR is an effective non-operative treatment modality for intussusception. Age group <12 months, prolonged vomiting and presence of blood in

stool were found to affect the success rate of hydrostatic reduction.

Keywords: Intussusception, saline, ultrasound, hydrostatic reduction

INTRODUCTION

Intussusception is the invagination of one part of the intestine into another and is one of the most frequent causes of acute bowel obstruction in infants and toddlers with peak incidence between 3 months to 3 years.^[1] The classic presentation of intussusception in a young child is with intermittent abdominal pain, vomiting, red currant jelly stool and a palpable mass.^[2] Ultrasound is primary diagnostic investigation which is highly specific and accurate. Presently, treatment modalities have changed from operative to non-operative treatment which has resulted in decreased mortality and morbidity.^[3] Non-operative treatment modalities include ultrasound guided hydrostatic reduction (USGR), barium hydrostatic reduction under fluoroscopy and pneumatic reduction. Delayed diagnosis and intervention is a significant contributing factor for increased morbidity and mortality.^[4,5] In our institution, we use USGR with normal saline as the primary treatment. The aim of the study is to analyse the present clinical pattern of intussusception with respect to patient demographics, symptomatology and

treatment outcomes (non-operative/operative) in a tertiary care centre.

METHODOLOGY

Study design

This is a retrospective record based descriptive study

Study setting

All cases of intussusception admitted in Department of Paediatric Surgery, Government Medical College Thiruvananthapuram during the period from 2014 to 2018.

Study population

Inclusion criteria: All children up to 12 years of age with the diagnosis of intussusception were included in the study.

Exclusion criteria: Those who presented with features of complications like peritonitis, bowel gangrene or perforation were excluded from the study.

MATERIALS AND METHODS

Our hospital protocol for management of intussusception starts with initial confirmation of sonographic diagnosis by the radiologist, following which the child is admitted, kept nil per mouth and is hydrated. USGR is performed under sedation using intravenous Midazolam. A 16F foley catheter is inserted into rectum and bulb is inflated with 30ml distilled water. The buttocks are strapped together. The catheter is connected using an intravenous drip-set line to a Normal Saline bag, which is warmed to body temperature and kept at a height of 100cm from the pubis of the patient. Saline is allowed to flow freely and no external pressure is applied to the saline bag. The reduction is monitored using ultrasound, available in the department, performed by Paediatric Surgeon. The disappearance of intussusception mass, free flow of saline and filling of terminal ileal bowel loops which resembles honeycomb are taken as end point of successful reduction. Oral feeds are started 6 hours after the procedure and

child is discharged after 24 hours. Repeat USG is done only if child is symptomatic. If reduction is unsuccessful or incomplete, a repeat attempt is done after 4 hours. Maximum of 3 such attempts can be done in an otherwise stable child, provided there are no evidence of intussusception or procedure related complications. If there is no movement of intussusceptum during saline reduction, then no further attempts are made. Child is taken up for surgery if reduction is unsuccessful after repeated attempts. If child develops recurrent intussusception, the same procedure is repeated.

The following data were collected – patient demographics, details of symptoms (abdominal pain, vomiting and blood in stools), success rates of hydrostatic reduction and operative findings in cases of failed USGR. The data collection and analysis were done with Microsoft Excel and Jamovi v2.0 software. The data underwent t-test and Pearson chi-square test analysis and a p value <0.05 was considered to be statistically significant.

RESULTS

A total of 785 patients were studied during the period 2014 to 2018. There were 258 females and 527 males (male to female ratio of 2.04:1). The mean age was 25 months and median age was 16 months. The youngest patient was 1 month old and the oldest was 149 months old. Majority of the children were less than 3 years of age (Table 1). The most common symptom was abdominal pain (726 [92.48%]) followed by vomiting (464 [59.11%]) and bleeding per rectum (252 [32.10%]). None of them presented with features of peritonitis or perforation and hence all were subjected to hydrostatic reduction.

Of the 785 patients, successful saline reduction was achieved in 710 patients (90.4%). (Table 2) and the 75 cases (9.6%) with failed hydrostatic reduction underwent surgery. In the surgical group, 60/75 (80%) had ileocolic (IC) intussusception, 14/75 (18.67%) had ileo-ileocolic intussusception

and 1 had jejuno-jejunal intussusception following nephrectomy for Wilms tumour. A Pathological Lead Point (PLP) was found in 12 operated cases (16%). (Table 2). Meckel's diverticulum was the most common PLP, seen in 9 cases. 2 cases were due to tumour of ileo-caecal junction which

later turned out to be lymphoma. There was 1 case of polyp in ileum causing intussusception in a child with Peutz-Jeghers syndrome (PJS). Intestine was gangrenous in 6 cases of which 4 were having Meckel's diverticulum.

Table 1

	All cases	Successful hydrostatic reduction	Failed hydrostatic reduction
Mean age	25	25	20
Standard Deviation	25	24.4	29.8
Median	16	17	7
Range	1 -149	1 - 149	2 - 132
Males	527 (67%)	472	55
Females	258 (33%)	238	20
Age groups			
<12 months of age	322	265	57
>12 months of age	463	445	18
<3 years of age	614	555	59
>3 years of age	171	155	16

Table 2

Total cases = 785	
USG reduction successful = 710 (90.4%)	USG reduction failed = 75 (9.6%) - underwent surgery
	No PLP = 63/75
	PLP = 12/75
	Meckel's diverticulum = 9
	Tumor = 2
	Polyp = 1

outcome of hydrostatic reduction. However, when children <12 months of age were compared with those older than 12 months of age, the failure rate of hydrostatic reduction was significantly higher in the former group (p<0.00001). But no significant difference was found when children less than 3 years and more than 3 years of age were compared (p = 0.92) (Table3).

Analysis

Age, gender & age groups:

Age (p=0.18) and gender (p = 0.23) were not significant factors affecting the

Table 3

Age group	All cases	Successful hydrostatic reduction	Failed hydrostatic reduction	p value
<12months	322	265 (82.30%)	57 (17.70%)	<0.00001
>12 Months	463	445 (96.11%)	18 (3.89%)	
<3 Years	614	555 (90.39%)	59 (9.61%)	0.92
>3 Years	171	155 (90.64%)	16 (9.36%)	

Symptomatology:

We found no statistical difference in the failure of hydrostatic reduction when patients with more than 48 hours of overall

symptoms were compared with those having less than 48 hours of symptoms (p=0.7) (Table 4)

Table 4

	>48 hours of symptoms	<48 hours of symptoms	total	p value
Failed hydrostatic reduction	20	55	75	0.7
Successful hydrostatic reduction	175	535	710	
Total	195	590	785	

Abdominal pain:

726/785 cases had abdominal pain with 662/710 in the successful hydrostatic reduction group and 64/75 in the failed

reduction group having this symptom. Abdominal pain and its duration were not a significant factor in the outcome of hydrostatic reduction (p=0.46) (Table7)

Vomiting:

464/785 patients had vomiting, with 351 in the successful hydrostatic reduction group and 41 in the failed reduction group. Persistent vomiting of more than 48 hours was a significant factor for failed reduction

(p = 0.005) (Table 7). Age group of less than 12 months was found to be a significant factor for occurrence of vomiting as a symptom in intussusception (p=0.005) (Table 5)

Table 5

	<12 months of age	>12 months of age	Total cases	p value
Vomiting	209	255	464	0.005
No Vomiting	113	208	321	
Total	322	463	785	

Blood in stools:

Presence of blood in stools (BIS) was a significant factor for failed hydrostatic reduction (p<0.00001), irrespective of its duration (table 7). Age group of less than 12 months was a significant factor for occurrence of blood in stools (p<0.00001), with 179/ 252 (71%)

cases of BIS occurring in this age group (table 6), whereas 73/252 (29%) cases occurred in children >12 months. 179 out of 322 (56%) children <12 months had BIS, whereas 143/322 (44%) of children >12 months had no BIS. This correlates well with the reduced success rate in children <12 months.

Table 6

	<12 months of age	>12 months of age	Total	p value
Blood in stools present	179	71	250	<0.00001
No blood in stools	143	392	535	
Total	322	463	785	

Table 7

Symptom	Total	Successful	Failed	p value	
Abdominal pain (AP)					
AP<48	549	503 (91.62%)	46 (8.38%)	0.46	Not significant
AP>48	177	159 (89.83%)	18 (10.17%)		
Total cases with abdominal pain	726	662 (91.18%)	64 (8.82%)		
No Abdominal pain	59	48 (81.36%)	11 (18.64%)		
Vomiting					
Vomiting<48h	392	351 (89.54%)	41 (10.46%)	0.005	Significant
Vomiting>48h	72	56 (77.78%)	16 (22.22%)		
Total Vomiting	464	407 (87.72%)	57 (12.28%)		
No Vomiting	321	303 (94.39%)	18 (5.61%)		
Blood in stool (BIS)					
BIS <48	236	191 (80.93%)	45 (19.07%)	0.24	Not significant
BIS >48	16	11 (68.75%)	5 (31.25%)		
Total BIS	252	202 (80.16%)	50 (19.84%)	<0.00001	Significant
No BIS	533	508 (95.31%)	25 (4.69%)		

Analysis of pathological lead point (PLP) with age:

Mean age was higher in children with PLP (50.28), when compared with children with no PLP (14.55). Older age was significant factor for occurrence of PLP (p=0.029). PLP was present in 5 out of 56 cases (8.93%) in <12 months age and 7 out of 19 cases (36.84%) in >12 months age. PLP was present in 6 out of 60 cases (10%) in <3 years and 6 out of 15 cases (40%) in >3 years (p 0.005) (Table 8).

Table 8

	PLP	no PLP	p value
n	12	63	
Age			
Mean age	50.28	14.55	0.029
SD	49.30	20.46	
Median	41.50	6.9	
Range	2 - 132	2-102	
Sex			
Males	7	47	
Females	5	16	
Age Group			
<12m	5	51	
>12m	7	12	
Age Group			
<3 y	6	54	0.005
>3 y	6	9	

DISCUSSION

Intussusception is a leading cause of acute abdomen in children. Its incidence is 1-4 per 2000 infants with 90% cases in children less than 3 years.^[1] In our study, majority - 78% (614/785) were less than 3 years of age, with a peak incidence in the <12 months age group - 41 % (322/785). Children mostly present with abdominal pain which manifest as irritability or incessant cry (93%), vomiting (85%) and blood in stool (37%).^[2] In our study, the most common symptom was abdominal pain with an incidence of 92.48%, followed by vomiting (59.11%) and blood in stool (32.10%). In our study, incidence of blood in stool was higher in the age group <12 months compared to those >12 months.

Prompt diagnosis is necessary to avoid complications like intestinal gangrene, perforation, sepsis and shock. Ultrasonogram (USG) is the most commonly used diagnostic modality. It has a sensitivity of 98-100% and specificity of 88-100%.^[6] Previously all cases of intussusception were managed by laparotomy. In 1876, Harald Hirschsprung made the first attempt at hydrostatic reduction of intussusception using water. Kim et al first described hydrostatic reduction of intussusception under USG guidance.^[7] Now a days, intussusception is managed by minimally invasive procedures like hydrostatic (fluid) or pneumatic (air) reduction.^[8,9] Both procedures are widely used and superiority of each over the other is debated.^[10,11] We use hydrostatic reduction using normal saline under ultrasound guidance.

The one major advantage of this method is that, this procedure can be done by the treating paediatric surgeon, without any help from the radiologist. In our institution, we have been practising the same for the last 25 years. Surgical management is required only in those with failed hydrostatic reduction or those presenting with complication like intestinal perforation and gangrene. The advantages of USG guided hydrostatic reduction (USGR)

include its simplicity and easy availability, no radiation exposure, less complications and minimal hospital stay. Hydrostatic reduction is reported to have a success rate of 90-95%.^[12] Our success rate is found to be 90.4%.

A number of factors affect the success of hydrostatic reduction. The factors that are commonly studied are age, gender, history of vomiting, rectal bleeding, and abdominal pain, length of the invaginated segment measured on USG, bowel wall thickness, duration of symptoms, small bowel obstruction etc.^[13-15] Stein et al. reported that long duration of symptoms was a predictor of failure of pneumatic reduction.^[16] Rectal bleeding is an indicator of edema and circulatory impairment. Presence of rectal bleeding is found to reduce success rate of hydrostatic reduction.^[17] Similarly, in our study, blood in stools was a significant factor for failure of USGR. Also vomiting > 48hrs duration was a significant factor contributing to failure of USGR. Khorana et al. also reported that the success of the procedure was not affected within the first 48 h after the onset of symptoms, but the success rate started to decrease from the third day after the onset of the symptoms.^[18] In our study we couldn't find any statistically significant association of overall duration of symptoms with successful reduction, except for vomiting where children with duration >48hrs had increased failure rate (22.22% vs 10.46%).

Majority of the cases of intussusception are idiopathic. The incidence of intussusception caused by a PLP in an infant or child ranges from 1.5% to 12,^[1] with majority occurring in older children. Meckel's diverticulum is the most common PLP found in intussusception,^[19,20] which was also the case in our study (62.5%). Other lead points include lymphoma, polyps, duplication cyst and bowel wall tumours like lipoma, hamartoma, haemangioma and lymphangioma. A lead point can be diagnosed by ultrasound in only less than a

third of the cases.^[21] There's a high chance of failure of USGR in cases with PLP and most of the lead points are identified only during surgery for such failed non-operative cases.

CONCLUSION

Intussusception should always be suspected in infants and toddlers with colicky pain and vomiting. Palpation of the intussusceptum mass in an already distressed toddler is difficult. Blood in stools is a relatively less common and late symptom and its presence has a higher chance for failure of non-operative methods. With easy availability of sonogram, these cases can be diagnosed earlier and non-operative treatment with the highly effective ultrasound guided saline reduction can be done prior to the occurrence of complications.

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