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Intussusception : Experience in 507 Thai Pediatric Patients

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Abstract

Background Purpose : **Intussusception remains an important cause of intestinal obstruction in children under the age of 2 years. Management of this disease has continuously improved with better outcomes. This study aims to review our experience in patients with intussusception at a referral center for children in Thailand.**

Methods : **Medical records of patients treated from January 1, 1988 to December 31, 1998 for intussusception at the Queen Sirikit National Institute of Child Health were reviewed. Information about clinical manifestations, radiological findings and results of treatment were obtained. The statistical differences were analyzed by the Chi-square and the Z-test.**

Results : **Five-hundred and seven patients with 549 episodes of intussusception were available for the review. Two-hundred and eighty-eight (56.8%) were male and 219 (43.2%) were female. About 80 percent of patients were under one year of age with the peak incidence at 6 months. The disease was found in every month with the highest incidence between January to March. Vomiting was the most common symptom, being found in 90 percent of the patients. Bloody stool, abdominal pain and palpable abdominal mass were found in 75, 72 and 57 percent respectively. Radiological findings revealed complete intestinal obstruction and soft tissue mass in 65 and 32 percent of the cases.**

Hydrostatic barium enema (BE) reduction was attempted in 211 episodes and found to be successful in 135 (64 %) with a colonic perforation in 3 cases. Pneumatic reduction was attempted in 243 episodes and found to be successful in 178 (73 %). Surgical treatment was needed in 234 episodes. Of these, manual reduction was successful in 158, intestinal resection was required in 68. Appendectomy only was done in the remaining 8 patients because complete reduction was noted during exploration. Leading points were recorded in 20 patients (3.9 %). Meckel's diverticulum (8 cases) and intestinal polyp (5 cases) were the most common causes. The overall mortality rate was 0.8 percent (4 cases) and all the deaths occurred after intestinal resection due to bowel necrosis and septicemia.

Conclusion : **Treatment outcomes of intussusception have continuously been improved. Non-operative reduction should be the initial management, unless the patients had contraindications for such intervention, because it has the lowest incidences of morbidity and mortality.**

Intussusception is the invagination of a portion of intestine into an adjacent segment of the distal intestine. It is one of the most common causes of intestinal obstruction in children under 2 years of age.[1,2] This entity was described by Paul Barette of Amsterdam in 1674 and the first successful operative reduction in a child was accomplished by Jonathan Hutchison in 1871.[3,4] Non-operative water enema reduction was reported by Hirschsprung of Copenhagen in 1876 and followed by saline enema reduction by Hisplay in 1926.[5,6] Hydrostatic barium enema (BE) reduction was introduced in the United States of America in 1927 and this method was popularized by Ravitch and McCune in 1948.[7] Air insufflation technique for intussusception reduction was described by Fiorito, a Spanish radiologist, in 1959.[8] However, hydrostatic BE reduction remained more popular than the others for over 40 years. In 1986, a report of air insufflation was introduced by Guo et al from the People's Republic of China with high success rate of reduction.[9] Pneumatic or air enema (AE) reduction is now gaining popularity everywhere as an alternative method to BE reduction. This study aimed to review the current management and outcomes of this disease at our institute in the recent decade.

Materials and Methods

Medical records of the patients who were treated in the Department of Surgery at the Queen Sirikit National Institute of Child Health (Children's Hospital) during January 1988 to December 1998 were reviewed. Five hundred and seven cases were available for the study. Data were collected from the existing medical records for clinical presentations, radiological findings, diagnosis as well as therapeutic procedures and results. The statistical differences were analysed by the Chi-square and the Z-tests.

Results

Incidence

A total of 507 patients were treated with 549 episodes of intussusception. Of these, 288 were male and 219 were female. The male to female ratio was 1.3:1. Age at presentation ranged from 1 month to 11 years with the peak incidence at 6 months (Figures 1 and 2). About 80 per cent (410 patients) were under one year of age. Almost all of them looked well nourished except for 3 cases, who were noted to have malnutrition. Monthly incidence appeared to be slight higher during January to March period (Figure 3).

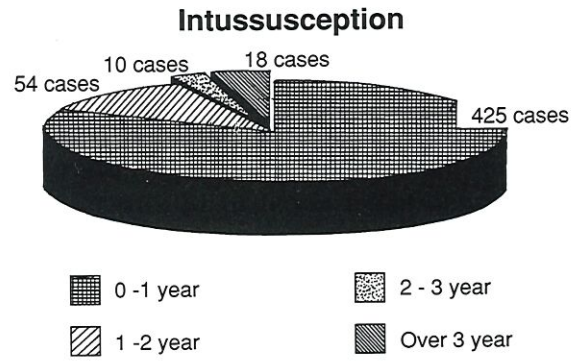

Fig. 1 Age incidence at the first episode.

Clinical Presentation

Among the common clinical features, vomiting was the most common symptom. Other manifestations included bloody stool (75.4 %), abdominal pain (71.9 %) and abdominal distension (32.8 %). A history of infection, including upper respiratory tract infection and gastroenteritis, was noted in about 20 per cent of the patients (Table 1). One-third of the patients were lethargic or irritable on admission. An abdominal mass was palpable in 57.4 per cent, and a rectal mass was palpable by rectal examination in 7.7 per cent. Despite the fact that 75 per cent of the patients had rectal bleeding, normal stool was noted in 13 per cent during rectal examination (Table 2).

Radiological findings

Plain film of the abdomen was available for study in 534 of the 549 episodes of intussusception. An abdominal mass could be detected in 174 episodes (32.6 %). Two-third of the roentgenograms (347 of the 534 episodes or 65 %) revealed complete intestinal obstruction. Ultrasonography was studied in 94 cases and showed either target, doughnut or pseudo-kidney sign in 91 cases (96.8 %)

Management

Intravenous fluid replacement, antibiotics administration and nasogastric decompression were accomplished in all of the cases. The patients who had

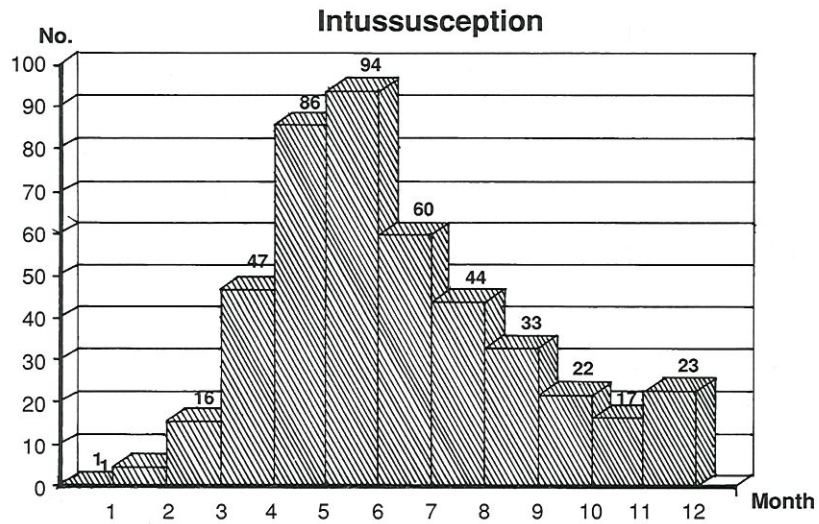

Fig. 2 Age incidence in patients under one year of age.

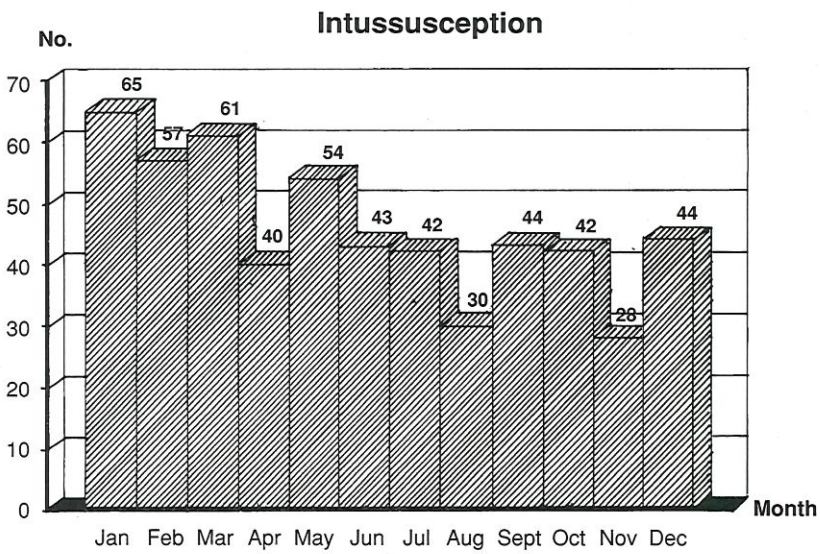

Fig. 3 Monthly incidence.

Table 1 Symptoms of the 549 episodes of intussusception

Symptoms	Numbers	Per cent
Vomiting	497	90.5
Bloody stool	414	75.4
Abdominal pain	395	71.9
Abdominal distension	180	32.8
URI	81	14.8
Diarrhea	45	8.4
Lethargy	104	18.9
Convulsion	15	2.7

Table 2 Physical findings

Signs	Numbers	Per cent
Bloody stool	411	74.9
Abdominal mass	315	57.4
Rectal mass	42	7.7
Dehydration	266	48.5
Abdominal distension	254	46.3
Fever	139	25.3
Lethargy	124	22.6
Normal stool	71	12.9

no contraindications for non-operative reduction underwent either BE or AE reduction after adequate resuscitation. During the period of 1988 to 1992, hydrostatic BE reduction was a routine procedure for the treatment of intussusception in this institute. Since 1992, pneumatic reduction has gained popularity in place of hydrostatic BE reduction. Sedation by diazepam (0.2 to 0.4 mg/kg/dose) was used in most cases for non-operative reduction.

Non-operative reduction was attempted in 454 of the 549 episodes (82.7 %). This was successful in 313 occurrences of intussusception (69 %). Hydrostatic BE reduction was attempted in 211 episodes and the intussusceptions were successfully reduced in 135 episodes (64 %). Pneumatic reduction was attempted in 243 episodes and the intussusceptions were successfully reduced in 178 episodes (73.2 %). The difference of the success rates by the two non-operative methods was statistically singnificant ($p<.05$). Correlations between duration of symptoms and the successful BE or AE reduction rate were shown in Tables 3 and 4.

Of the 234 patients who underwent laparotomy, manual reduction of the intussusception was successful in 158 patients (67.5 %). Intestinal resection was required in 68 cases (29 %) because of either bowel necrosis or a pathologic leading point. In the remaining 8 cases, laparotomy revealed complete spontaneous reduction of the intussusception and only appendectomy was done.

Ileocolic intussusception occurred in 531 of the 549 attacks (96.7 %). Small bowel intussusception (enteroenteric type) was found in 14 occurrences, 4 for leading points of Meckel's diverticulum (2) and ileal polyp (2), 9 following other operative procedures and one idiopathic jejunojejunal intussusception. A colocolic type was noted in 4 cases, 3 for colonic polyps and one idiopathic etiology.

Leading Points

Twenty patients (3.9 %) were proven to have leading points. These included Meckel's diverticulum in 8 cases, ileal polyps in 2 cases, colonic polyps in 3 cases and Peutz-Jegher polyp in one case. Two patients had non-Hodgkin lymphoma and one of the 2 cases was Burkitt's type. The remaining 4 cases were noted

Table 3 Correlation between duration of symptoms and successful hydrostatic BE reduction

Duration of symptoms	No. of attempted reduction	Successful BE reduction	
		No.	Per cent
within 1 day	122	93	76.2
2 days	33	16	48.5
3 days	32	15	46.8
4 days	14	7	50.0
5 days or over	10	4	40.0
Total	**211**	**135**	**64.0**

Table 4 Correlation between duration of symptoms and successful AE reduction

Duration of symptoms	No. of attempted reduction	Successful BE reduction	
		No.	Per cent
within 1 day	167	125	74.9
2 days	47	35	74.5
3 days	17	11	64.7
4 days	6	4	66.7
5 days or over	6	3	50
Total	**243**	**178**	**73.3**

to have tuberculous ileitis in 2, ectopic pancreatic tissue in the terminal ileum and ileal duplication in one case each. Fourteen of the 479 cases (2.9 %) with the age between 0-2 years were noted to have a leading point while 6 of the 28 patients (21.4 %) with the age over 2 years old were so. The older children had the incidence of leading points higher than the younger ones ($p<.01$).

Morbidity and Mortality

Major complications of the patients were summarized in Table 5. Colonic perforation occurred in 3 patients who were attempted hydrostatic BE reduction. In one case, the colonic perforation was recognized during the initial instillation of barium into the colon. This was believed to be a perforation before the attempt of reduction. The colonic perforation developed during attempting BE reduction in the remaining 2 cases. Four patients died in the postoperative period. The overall mortality rate was 0.8 percent. All of them succumbed after intestinal resection due to intestinal necrosis and septicemia.

Length of Hospitalization

The length of hospital stay varied according to modes of the treatment. The average hospitalization was about 3.5 days after successful hydrostatic BE reduction, 2.5 days after successful pneumatic reduction, 6.6 days after laparotomy and manual reduction, and 9.9 days after intestinal resection.

Recurrence Rate

Recurrence of intussusception developed in 32 patients with 42 episodes. The overal recurrence rate was 8.2 per cent (42 in the total 507 patients). Eighteen occurred after the 135 episodes of successful BE reduction (13.3 %). Seventeen occurred after the 178 successful pneumatic reductions (9.5 %). The operative treatment had the recurrence rate of 3.1 per cent (7 of the 226 operative procedures) and all the recurrences occurred after manual reduction of intussusception only. Twenty-seven patients with the age under 2 years old (27 in 479 or 5.6 %) had the recurrence attack while 5 of 28 patients (17.8 %) with the age over 2 years old did so. The older children had the incidence of recurrence higher than toddlers and infants ($p<.01$). Only 3 recurrent cases (9.4 % of the 32 patients with recurrences) had leading points: Meckel's diverticulum in a 10-month-old girl, ileal polyp in an one-year and 2-month-old boy and an 11-year-old girl. Of the 42 episodes of recurrence, 34 (80 %) were successfully treated by BE and AE reduction and the remaining 8 episodes (20 %) underwent laparotomy with manual reduction.

Table 5 Morbidity and mortality in the 507 patients

Morbidity and mortality	Numbers	Per cent
Intestinal necrosis	49	9.7
Sepsis	12	2.4
Respiratory failure	8	1.6
Postoperative convulsion	8	1.6
Postoperative adhesion	4	0.8
Intestinal perforation	3	0.6
Heart failure	3	0.6
Renal failure	3	0.6
Anastomotic leakage	2	0.4
Death	4	0.8

Discussion

Neither the exact incidence nor the etiology of intussusception are known. According to Reijnen et al,[10] population based studies in Europe estimated the rate of intussusception to be 1 to 4 per 1,000 live births. Bruce et al[5] suggested that the incidence of this disease in New York was about 2.4 per 1,000 live births. Many series supported a strong male predominence with a 2:1 male to female ratio but we found only a 1.3:1 male to female ratio in our institute, both in the previous review in 1984[11] and in this study. Idiopathic intussusception usually occurs at the age of 3 months to 2 years with the peak incidence between 4 to 8 months.[12-18] Many authors strongly suggested that adenovirus and rotavirus from an upper respiratory tract infection or gastroenteritis might be the cause of lymphoid hyperplasia in the wall of the terminal ileum.[12,14,19-22] Lymphoid hyperplasia could be responsible for the leading point in idiopathic intussusception but it did not explain why some infants developed intussusception without exposure to similar environmental influences. The incidence of intussusception decreased at the age over 2 years. Some authors suggested that the older the patient at presentation, the more likely a pathologic leading point will be found and recurrent intussusception often develops.[3]

Meckel's diverticulum, intestinal polyp and lymphoma are the common pathologic lesions. Bruce et al[5] reported high incidence of 75 per cent of the older children with intussusception having an underlying leading point, similar to our data from this study.

Most reports stated that the infants with intussusception were well nourished and only a few cases had underweight and malnutrition.[1,3,18] Vomiting was the most common symptom in infants while intermittent colicky pain was a frequent complaint in older children.[23] The initial vomiting might be clear gastric content because of reflex mechamism but later bilious vomiting developed due to the progressive intestinal obstruction. Mucous bloody or currant-jelly stool was passed in most cases with intussusception. However, a normal stool could be found in about 10 per cent of children with intussusception in our study. A normal stool was often found in the patients with recurrent, postoperative and small bowel intussusceptions.[24-30]

A palpable abdominal mass is one of the classical signs that may be discovered at any site along the line of the colon. The detection of a mass depends on the skill of the physician and degree of abdominal distension or relaxation in the patients. In most series, the incidence of a palpable abdominal mass varied from 50 to 80 per cent,[14,30] while a rectal mass was detected in about 3 to 13 per cent,[11,17] similar to this study.

Lethargy is one of the predominant presenting symptoms in infants that may display between bouts of abdominal pain. This presentation is more predominent than abdominal pain in some cases and it may minic the symptoms of meningitis or encephalitis. Hamby et al[3] suggested that the lethargy appeared to be unrelated to hypovolemia or electrolyte disturbances and it disappeared immediately after reduction of the intussusception. In our experience, the presenting symptoms of high fever, abdominal distension and lethargy indicated a grave prognosis of the patients with intussusception. The patients with these presentations require an immediate resuscitation and meticulous care.

Management of intussusception has undergone continuous evolution and refinement since the hydrostatic BE reduction was popularized by Ravitch in 1948.[7] The initial management has been changed from operation to BE reduction since Ravitch's advocation. The success rate of BE reduction varied from 40 to 80 percent.[31,32] Several authors appreciated the successful outcomes of BE reduction for over 40 years.[16,32-34] In the previous study at our institute in 1986, the success rate of hydrostatic BE reduction was about 60 per cent of the 95 attempts with one colonic perforation and the recurrence rate was 6 per cent.[35]

The technique of pneumatic reduction involves air insufflation with controlled pressure between 80 to 120 mmHg. The greatest success rate of AE reduction was reported by Guo in 1986.[9] Since then, pneumatic reduction has been the most popular procedure for non-operative management of intussusception. The success rate of pneumatic reduction for intussusception varied from 75 to 90 per cent.[9,36-41] Pneumatic reduction was first adopted at our institute in 1992 and it was previously reported to have a success rate of 69 percent without a colonic perforation.[42] In this study, we analyzed results of the treatments of both BE and AE reductions and found that there was a significant difference in the success rate but there was no statistical significance in the recurrence rates between the two non-operative approaches. However, an intestinal perforation occurred in 3 patients who were treated with hydrostatic BE reduction but no perforation was found in the patients who were treated with AE reduction. Many authors suggested that the use of pneumatic reduction resulted in easier reduction, less exposure to radiation, less hazard following bowel perforation during attempted reduction, and appeared to be cheaper and cleaner than BE reduction.[9,33,36-42] AE reduction is now the first choice of management for every case with uncomplicated intussusception at our institute.

Operative treatment is necessary for patients in whom radiological techniques are contraindicated or failed to reduce the intussusception, a leading point is suspected, or in the cases of multiple recurrences. Operative reduction and resection have been less frequently required in this era because of the increased attempts of reduction and improvement of the success rate of the two non-operative techniques. An operative manual reduction had the recurrence rate lower than BE and AE reduction in many series,[14,16,32,33,37,43] similar to this study. Recurrent intussusception did not usually occur after intestinal resection.

The mortality rate for intussusception is now reduced to about 1 per cent.[5,23] If the patients were

early diagnosed and successfully treated with non-operative reduction, they should have a shorter hospitalization, reduction of the cost of the treatment and absence of mortality. In contrary, the children with late diagnosis and requiring a surgical intervention should most likely have a higher risk of complication and higher mortality rate. Our available data from this study has suggested that treatment of the intussusception in this era is better than the results in the past decade. The mortality rate under 1 percent is one of the indicators of improvement. Successful management of intussusception depends upon early diagnosis, aggressive resuscitation and prompt treatment of either hydrostatic or operative reduction.

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