

Current Success in the Treatment of Intussusception at Queen Sirikit National Institute of Child Health between 1999 and 2008

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Abstract

Back ground/Objective: Intussusception remains the most common cause of intestinal obstruction in children under 2 years of age. Results of the treatment of this disease have continuously improved with better outcome in the world literature. The aim of this study was to review the management outcome in children with intussusception at one tertiary hospital for pediatrics in Thailand.

Methods: Medical records of patients treated for intussusception from January 1, 1999 to December 31, 2008 (at Queen Sirikit National Institute of Child Health) were reviewed. Information about clinical manifestations, radiological findings and results of the treatment were obtained. The statistical differences were analyzed by the Chi-square test with significance at a p-value less than 0.05.

Results: A total of 572 patients with 605 episodes of intussusception were available for the review. Male to female ratio was 350:222 (1.5:1). About 78 % of the patients was under one year of age with the peak incidence at 6 months. The disease was found in every month of the year with the highest incidence in January. Vomiting was the most common symptom, being found in 92.4% of the patients. Mucous bloody stool, abdominal pain and palpable abdominal mass were noted in 73.2%, 71.6% and 68.1%, respectively. Radiological findings revealed complete intestinal obstruction and soft tissue mass in 52.7% and 24.3% of the cases. Pneumatic or air enema (AE) reduction was attempted in 496 episodes and found to be successful in 333 (67.1%) with a colonic perforation in 3 cases (0.6%). Surgical intervention was needed in 274 episodes. Of these, manual reduction was successful in 191 and intestinal resection was required in 64. Appendectomy only was done in the remaining 9 cases because complete reduction was noted during exploration. Pathologic lead points were recorded in 23 patients (4.0%). Intestinal polyps (13 cases) and Meckel's diverticulum (7 cases) were the most common causes. Of the total 572 patients, only one died due to mesenteric vein thrombosis and extensive ileocolic necrosis within one week after manual reduction and appendectomy. The overall mortality rate was 0.2%.

Conclusions: Management outcomes of intussusception have been continuously improved with the mortality rate less than 0.5 %. AE reduction should be the initial management, unless the patients had contraindications for such intervention. Adequate preoperative preparation and prompt definitive treatment, both AE reduction or surgical intervention, have much influence on the successful management outcomes of intussusception.

Key words: intussusception, pneumatic reduction, air enema reduction, pathologic lead point

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Intussusception is the most common cause of abdominal pain and intestinal obstruction in infants under 2 years of age^{1,2}. The etiology of intussusception in the majority of infants is unknown. This entity occurs when a more proximal portion of bowel, the intussusceptum, invaginates into more distal bowel, the intussusceptent. This results in venous compression and bowel edema, eventually leading to bowel necrosis, perforation and death if the patient is not immediately treated³.

Definitive treatments of intussusception include non-operative and operative procedures. Hydrostatic barium enema (BE) reduction was introduced in the United States of America in 1927 and this method was popularized by Ravitch and McCune⁴ in 1948. Air insufflation technique for intussusception reduction was described by Fiorito⁵, a Spanish radiologist, in 1959. 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 al⁶ from the People's Republic of China with a high success rate of reduction. Since then, pneumatic or air enema (AE) reduction is now gaining popularity everywhere as an alternative method to BE reduction. Operative treatment remains an important method for intussusception. Patients with failed non-operative reduction, severe clinical presentations, and recurrence of many episodes of intussusception require operative management. Recently, improvement of intussusception treatment was reported by many authors with very low mortality rate^{1,3,7}. This review attempted to delineate current outcome of the treatment of intussusception in children at a tertiary care hospital from Thailand. The aims of the present study were to determine the current success rate of radiologic reduction and the requirement for operative intervention in the recent 10-year period in a large population of pediatric patients.

METHODS

The study was approved by the Institutional Review Board of the Queen Sirikit National Institute of Child Health (QSNICH, Document No. 53-026). A retrospective review of patients treated for intussusception, from January 1999 to December 2008, was performed at the Department of Surgery, QSNICH. Medical records were reviewed for data on demographics,

presenting symptoms and signs, radiological findings and results of the treatment. The diagnosis of intussusception must have been verified by either imaging (plain films of abdomen, ultrasound, BE or AE) or surgical exploration. Patients were excluded from the study if the records could not validate the diagnosis of intussusception. The clinical data were statistically analyzed by the Chi-square test with the significance at a p-value less than 0.05.

RESULTS

Demographic data

A total of 572 patients with 605 episodes were treated for intussusception during the 10-year period. Male to female ratio was 350:222 (1.5:1). The median age at the first time of presentation was 9.5 months (ranging from 1.5 months to 13 years). Four hundred and forty-five patients (78%) were under one year of age (Fig. 1) with the peak incidence at 6 months (Fig. 2). The patients were evenly distributed throughout the entire year and the peak incidence occurred in January (Fig. 3).

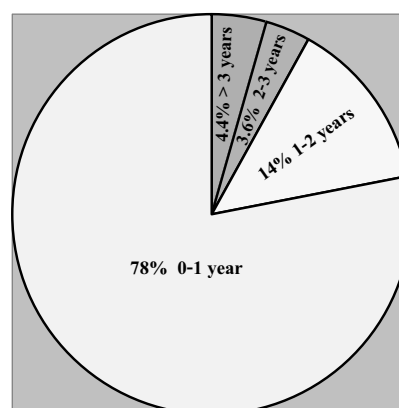


Figure 1 Age incidence of the 572 patients in the first episode of intussusception

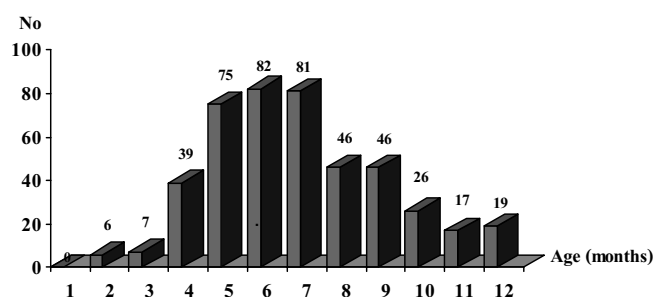


Figure 2 Incidence of intussusception in the first year of age

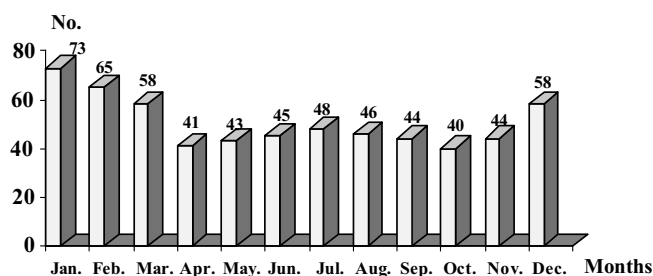


Figure 3 Incidence of intussusception in each month

Table 1 Symptoms and signs of intussusception in the total 605 episodes (572 patients)

Clinical presentations	Numbers	Percentage (%)
Symptoms		
Vomiting	559	92.4
Mucous bloody stool	443	73.2
Abdominal pain	433	71.6
Abdominal distension	166	27.8
History of upper respiratory tract infection	84	13.9
History of gastroenteritis	81	13.4
Lethargy	106	17.5
Convulsion	10	1.7
Signs		
Mucous bloody stool	437	72.2
Normal stool	94	15.5
Palpable abdominal mass	412	68.1
Rectal mass	50	8.3
Abdominal distension	270	44.6
Dehydration	285	47.1
Fever	152	25.1
Lethargy	113	18.7

Table 2 Classification of 605 episodes of intussusception

Types of intussusception	Numbers	Percentage (%)
Ileocolic or ileoileocolic	581	96
Enterointerotic or small bowel	18	3
Colocolic	6	1

Clinical presentations

Vomiting was the most common symptom in this study. Mucous bloody stool, abdominal pain and palpable abdominal mass were noted in 73.2%, 71.6% and 68.1%, respectively (Table 1). The classic triad, consisting of vomiting, abdominal pain and mucous bloody stool, was found in 255 of the 605 episodes

(43%). Surprisingly, about 15 % of the patients had normal yellow feces. Rectal mass was palpable by rectal examination in 8.3%. About one-third of the patients had a history of upper respiratory tract infection (URI) and diarrhea. Neurological disorders including drowsiness and convulsion were noted in 20%. Six patients developed postoperative small bowel intussusception; 4 after pull-through operation for Hirschsprung's disease, one after Ladd's procedure for malrotation and one after appendectomy. Ileocolic or ileoileocolic intussusception accounted for 96% of the total occurrences (Table 2).

Radiological findings

Plain films of the abdomen of the 605 episodes revealed complete intestinal obstruction in 52.7% and abdominal masses could be detected in 24.3% (Fig. 4). Normal findings of the plain abdominal x-rays were found in about 10% of the cases. Ultrasonography was studied in 192 cases and showed either target, doughnut or pseudokidney sign in 162 cases (84.3%).

Non-operative management

Four hundred and ninety-six episodes of intussusception underwent diagnostic and therapeutic attempts at AE reduction under fluoroscopy. AE reduction was successful in 333 of the 496 attempts (67%, Fig. 4). Of the 14 patients who had failure of BE reduction at other hospitals before referral,¹² had successful AE reduction at our institute. Patients with the evidences of complete intestinal obstruction in plain abdominal films had the successful AE reduction in 89 of the 244 cases (39.7%)

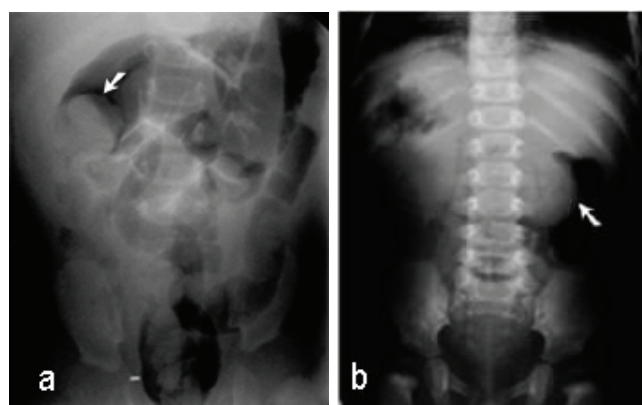


Figure 4 Soft tissue shadow (arrow) from abdominal x-ray at the hepatic flexure (a) and the left transverse colon (b)

Table 3 Results of air enema (AE) reduction

AE reduction	No. of attempted reduction	No. of successful reduction	Percentage (%)
Total	496	333	67.1
Correlations with onset of the symptoms			
1 day	323	223	69.0
2 days	115	75	65.2
3 days and over	58	35	60.3
Correlations with the sites of intussusception			
Cecum and ascending colon	59	54	91.5
Transverse colon	282	212	75.2
Descending colon	32	15	46.9
Sigmoid colon and rectum	120	49	40.8
Unknown	3	3	100

Patients who developed symptoms within 24 hours had a success rate of AE reduction higher than those with a longer symptom duration with no significance (69% vs. 65.2%, $p = 0.45$) (Table 3). Regarding the lowest site of intussusception, lesions at the cecum and ascending colon had a success rate by AE reduction that was significantly better than those of the transverse and the left colon (91.5% vs. 75.2%, $p = 0.04$).

There were intestinal perforation in 3 of the 496 attempted reductions (0.6%). All of the 3 cases survived after segmental intestinal resection.

Operative management

Two hundred and sixty-four patients underwent surgery over the study period. Ninety patients proceeded to surgery without attempted AE reduction and 6 of the 90 cases underwent surgery for a postoperative intussusception. One hundred and seventy-four cases had laparotomy after failure of AE reduction of the 264 operative procedures. Manual reduction was successful in 191 (72.3%) while intestinal resection was required in 64 (24.3%). In the remaining 9 cases (2.3%), laparotomy revealed already spontaneous reduction of intussusception and only appendectomy was performed. Nineteen patients (7%) developed postoperative complications. Anastomotic leak and wound infection with wound dehiscence were the most common complications (Table 4). Adhesive small bowel obstruction was noted in 4 or 1.5% of the surgical cases. Only one patient died after manual reduction of intussusception within one week. The cause of death was extensive mesenteric vein thrombosis with necrosis of the terminal ileum to the descending

Table 4 Results of the operative treatment (n = 264)

Operative treatment	Numbers	Percentage (%)
Manual reduction and appendectomy	191	72.3
Intestinal resection	64	24.3
Appendectomy only (spontaneous reduction)	9	3.4
Complications		
Anastomotic leak	11	4.2
Wound infection and dehiscence	5	1.9
Pneumonia and atelectasis	3	1.1
Septicemia	5	1.9
Adhesive small bowel obstruction	4	1.5
Acute renal failure	1	0.4
Congestive heart failure	1	0.4

Table 5 Pathologic lead points of the total 572 patients

Pathologic lead points	Cases
Intestinal polyp	13
Meckel's diverticulum	7
Small bowel duplication	2
Gastrointestinal stromal tumor (GIST)	1
Total	23 (4%)

colon and septicemia.

Pathologic lead points (PLP)

Twenty-three of the 572 patients (4.0%) were proven by surgery and pathological report to have PLP. These included polyps of small and large bowel, Meckel's diverticulum and duplication in 13, 7 and 2 cases, respectively (Table 5). A 5-month-old boy had a gastrointestinal stromal tumor (GIST) at the terminal

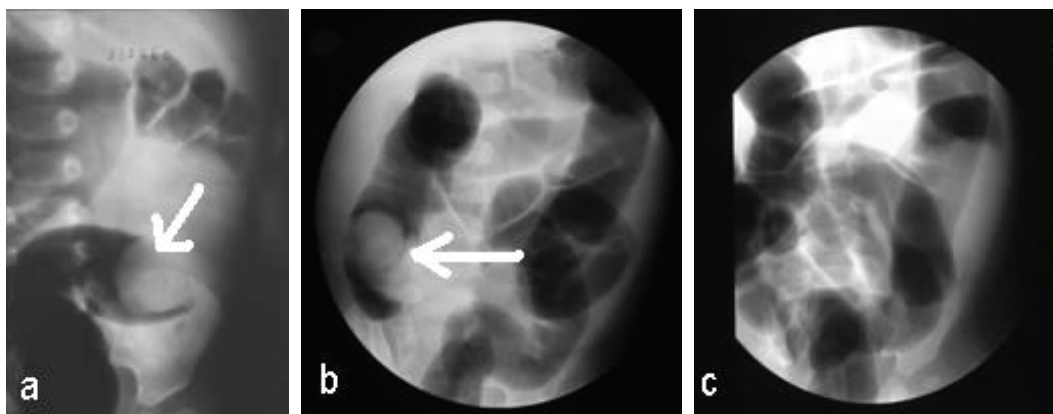


Figure 5 Air enema finding intussusception at the sigmoid colon (a), reduction to the cecum (b), and complete reduction (c)

ileum as a PLP. Six of the 23 cases (26%) were under 2 years of age while the remaining 17 patients (84%) were 2 to 13 years of age. This indicated that the older children had the incidence of PLP higher than the younger ones (26% vs 84%, $p < 0.05$).

Length of hospitalization

The length of hospital stay varied according to modes of the treatment. The average hospitalization was about 2.9 days after successful pneumatic reduction, 5.8 days after laparotomy and manual reduction, and 8.7 days after intestinal resection.

Mortality and recurrence

Only one of the 572 patients (0.17%) died on the seventh postoperative day. He developed abdominal distension, ascites and high-grade fever after manual reduction of the intussusception and appendectomy. The patient underwent re-exploration on the fifth postoperative day and the findings revealed extensive mesenteric vein thrombosis with necrosis from the terminal ileum to the upper sigmoid colon. Ileocolic resection with enterostomy was performed. He succumbed to septicemia and disseminated intravascular clotting (DIC) 2 days after surgery.

Regarding recurrent intussusception, 35 episodes of recurrence occurred in a 333 successful AE reduction (10.5%). Four recurrences occurred after 191 manual reductions (2.1%). There was no recurrence after 64 intestinal resections. Interval of the recurrence ranged from 1 day to 3 years (average 6 months). Pneumatic reduction was successful in treating 28 of the 35 recurrent episodes (80%). Of the 28 patients with

recurrent intussusception, only 4 cases were proven to have a pathologic lead point.

DISCUSSION

Intussusception can occur at any age, however, the vast majority of cases are observed between the age of 3 months and 2 years. About 80% of cases in the present study occurred within the first year of age and 14% of cases were between 1 and 2 years of age. Neither the exact incidence nor the etiology of intussusception is known. The incidence of intussusception in the Southeast Asian countries is approximated 30-35 : 100,000 live births^{8,9}, similar to those in USA¹⁰ and Switzerland¹¹. Information from the present study showed that the occurrence of intussusception was found more frequently in December, January, February (winter) and March (early summer). Children had symptoms of common colds and diarrhea during these months. Many authors strongly suggested that adenovirus and rotavirus from an URI or gastroenteritis might cause lymphoid hyperplasia in the wall of the terminal ileum¹²⁻¹⁶. Lymphoid hyperplasia could be the lead point in idiopathic intussusception, but it could not explain why some infants develop intussusception without exposure to similar environmental influences. About 30% of our patients had a history of URI and diarrhea before intussusception symptoms. Some authors suggested that the older the patient at presentation, the more likely a pathologic lead point will be found and recurrent intussusception often develops^{17,18}. Intestinal polyp, Meckel's diverticulum and duplication

are the common pathological lesions. Bruce et al¹⁸ reported a high incidence of 75% of the older children with intussusception having an underlying lead point, similar to our data from this study.

The classic symptom triad of intussusception including vomiting, abdominal pain and mucous bloody stool was reported ranging from 20% to 50%^{1,19-21}. This symptom triad was noted in about 43% of our patients. Mucous bloody stool is highly suggestive of intussusception for most physicians. However, normal yellow stool does not completely exclude intussusception especially in the older children. Some authors suggested that abdominal pain was more common than mucous rectal bleeding in the older patients with intussusception^{22,23}. Abdominal mass is palpable at any site along the course of the colon and could be found from 50% to 80%^{18,22}. The detection of a mass depends on the skill of the clinician and degree of abdominal distension²². Atypical presentation of neurological symptoms and signs results in delayed diagnosis and treatment of intussusception in infant under 2 years of age. Lethargy has been reported most frequently, but other neurological symptoms are also mentioned, including hypotonia, restlessness or irritability, convulsion and sudden alterations of consciousness^{3,24-28}. Several hypotheses including the absorption of toxic metabolic product from a strangulated bowel, the release of neuropeptides, dehydration and electrolyte imbalance, and endogenous opiate release have been proposed. However, none of these hypotheses has been proven^{11,25-28}.

The success rate of AE reduction varied widely from 50% to 94% with the recurrence rate about 10%^{3,6,29-36}. Success rate of AE reduction in our study was only 67% and lower than many reports from the literature (Table 6). The authors tried AE reduction even in cases with complete intestinal obstruction and duration of the symptoms over 3 days. The success rate of AE reduction was about 40-50% in these cases. Our experience from the present study indicated that non-operative reduction could be avoided in some patients with unfavorable presentations from laparotomy. The definite contraindications for AE reduction at our institute are intestinal perforation presenting with pneumoperitoneum, peritonitis, failed pneumatic reduction, poor clinical pictures such as high fever, marked abdominal distension, marked drowsiness, convulsion and respiratory insufficiency. Relative contraindications for AE reduction include multiple episodes of recurrent intussusception and in the older children with suspicion of pathologic lead points.

Operative treatment remains an important method in treating intussusception with many contraindications for non-operative reduction as mentioned. An operative manual reduction is successful in most cases. Recurrent intussusception after manual reduction is lower than those after AE and BE reduction in many series^{18-21,35,36}, similar to what is found in the present study. Recurrent intussusception did not usually occur after intestinal resection.

Mortality rate for intussusception is now reduced to less than 1%^{3,7,19}. If the patients with intussusception

Table 6 Comparison of the treatment with pneumatic reduction from the literature

Authors	No. of attempted AE reduction (cases)	Successful AE reduction (%)	Perforation (%)	Recurrence (%)	Mortality (%)
Guo ⁶ , 1986, China	6,396	94	0.1	-	0
Jinzhe ²⁹ , 1986, China	2,496	91	0.1	-	0
Tamanaha ³⁰ , 1987, Japan	207	81	0	7	0
Stringer ³¹ , 1990, Canada	145	80	1.1	8	0
Glover ³² , 1991, Australia	199	75	0.5	7	0
Shiels ³³ , 1991, USA	75	87	0	-	0
Palder ³⁴ , 1991, Canada	100	76	2	11.8	0
Renwick ³⁵ , 1992, Australia	170	74.7	0	8	0
Kaiser ³ , 2007, USA	125	52	0	1	0
Ramachandran ³⁶ , 2008, India	157	89	0.6	8	0
Present study, 2009, Thailand	496	67	0.6	10.5	0

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 required surgical intervention should most likely have a higher risk of complications and higher mortality rate.

CONCLUSIONS

Our available data from the present study has suggested that treatment of the intussusception in the present era has a better result than in the past decade. The mortality of 0.2% is one of the indications of improvement. Successful management of intussusception depends upon early diagnosis, aggressive resuscitation and prompt treatment of either AE or operative reduction.

ACKNOWLEDGEMENT

The authors would like to thank Dr. Siraporn Swasdivorn, the Director of Queen Sirikit National Institute of Child Health, for the permission to submit the manuscript; Dr. Vichao Kojaranjit for the statistical analysis.

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