Management of recurrent intussusception: nonoperative or operative reduction?

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Abstract
Purpose: The aim of this study was to determine how to manage children with recurrence of intussusception.
Methods: Medical records of patients treated for intussusception from 1976 to 2008 at the Queen Sirikit National Institute of Child Health were reviewed. Information on patients who developed recurrent intussusception was extracted to study patterns of recurrent attack and suitable management procedures. The statistical differences were analyzed by the χ^2 and the Student t test, with a P value < .05 considered significant.
Results: During the study period, 1340 patients were treated for 1448 episodes of intussusceptions, with an average of 40 cases per year. There were 108 episodes of recurrent intussusception in 75 patients (45 males and 30 females). The overall recurrence rate was 8%. Patient age at the first episode ranged from 3 months to 12 years (average, 14.9 months). The time interval before each recurrence ranged from 1 day to 3.2 years (average, 7.8 months). The number of recurrences ranged from 1 to 5 attacks. Recurrent intussusception occurred in 35 (15.8%) of 222 children following successful hydrostatic barium enema (BE) reduction and in 55 (11.4%) of 482 after successful pneumatic or air enema (AE) reduction. There was no statistical difference between the recurrence rates after the 2 nonoperative procedures (P = .08). Recurrent intussusception developed in 14 (3.0%) of 457 patients after operative manual reduction. Recurrence was not observed after intestinal resection for initial irreducible intussusception in 175 patients. The remaining 4 recurrent episodes occurred after spontaneous reduction. Of the 108 episodes of recurrence, BE and AE reductions were successful in 25 (96.2%) of 26 attempts and in 57 (92%) of 62 attempts, respectively. Seven patients had their first episode of intussusception treated surgically. All 7 when they recurred were successfully treated with either BE or AE reduction. Operative intervention was needed in 23 episodes of recurrent intussusception; 18 were reduced manually, and 5 required intestinal resection. Overall, 7 (9.3%) of the 75 recurrences had a pathologic lead point: colonic polyps in 4 cases and Meckel diverticulum in 3 cases. There were no deaths among the 75 patients with recurrent intussusception.

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Conclusions: Recurrent intussusception should be initially treated by nonoperative reduction. Laparotomy is needed in cases with failure of BE or AE reduction, in cases with suspicion of a pathologic lead point, and in selected cases with several episodes of recurrence. The treatment of recurrent intussusception, in general, should be similar to that of primary intussusception.

Intussusception is one of the most common abdominal emergencies in the pediatric age group. This condition has been recognized for more than 200 years, but the etiology of most intussusceptions is still unknown. The recurrence rate following surgical reduction is 1% to 3% [1-4], but intussusception may recur in as many as 10% to 15% of patients following initial nonoperative reduction [1,4,5-9]. The treatment of recurrent intussusception is still controversial. Some investigators have recommended surgical intervention after the first or second recurrence [1,3,5], whereas others have advocated repeated hydrostatic barium enema (BE), air enema (AE), or pneumatic reduction for recurrent episodes [2,4,7-9].

The purpose of this study was to review our experience of recurrent patterns and suitable treatment in a large number of children with intussusception from a single institute over a 33-year period. The authors analyzed the correlation of modes of treatment and their respective recurrence rates in an effort to determine how to manage recurrent episodes.

1. Methods

After obtaining institutional review board approval of the proposal (no. 53-026), a retrospective review was performed of all patients with intussusception treated between January 1976 and December 2008. Information evaluated included clinical presentation, radiological findings, and results of treatment. Patients admitted for more than one episode of intussusception were further assessed. The recurrence rates after various types of treatment were compared and correlated with modes of treatment of recurrent episodes. The data were analyzed by the χ^2 and the Student t test, with a P value < .05 considered significant.

2. Results

During the 33-year period, 1340 pediatric patients were treated for 1448 episodes of intussusception at the Queen Sirikit National Institute of Child Health. Approximately 40 new cases of intussusception were managed at our institute each year. Recurrent intussusception (108 episodes) was noted in 75 patients. The overall recurrence rate was 8.0%. Of the 75 patients that recurred, 45 were male and 30 were female (male to female ratio = 1.3:1). Age of the 75 patients at the first episode of intussusception ranged from 3 months

to 12 years (average, 14.9 months). Fifty-one patients (68%) were younger than 1 year (Table 1). The time interval before each recurrence ranged from 1 day to 3.2 years (average, 7.8 months). Approximately 70% of patients had a repeated intussusception within 6 months (Table 2). The number of recurrences ranged from 1 to 5 attacks (Table 3). The highest number of recurrent episodes was 5; these episodes occurred in 2 girls: one was 6 months old and the other 8 months old at the time of their first intussusception. These 2 girls were successfully treated by AE reduction in their first 4 recurrences but required operative manual reduction in their last episode. Neither of the girls had pathologic lead points. Eleven patients developed recurrence during the same admission after successful reduction by AE in 5, BE in 4, and laparotomy with manual reduction in 2 cases, respectively.

Vomiting, abdominal pain, and passage of mucous bloody stool were the most common clinical findings in recurrent intussusception. Comparison of clinical presentations between initial and recurrent attacks revealed no significant difference (Table 4). The average duration of the onset of symptoms before admission for the recurrent cases was 17.5 hours, compared with 36 hours for patients with an initial episode (P < .001).

Of the initial episodes in 1340 patients with intussusception, hydrostatic BE reduction was initially attempted in 349 cases, with reduction successful in 222 cases (63.6%) and with 35 recurrences (15.8%) (Table 5). Pneumatic reduction was attempted in 697 cases, and the intussusception was successfully reduced in 482 (69.1%) with 55 recurrences (11.4%). There was no statistical difference between the recurrence rate after the 2 nonoperative procedures (P = .08). Of the 457 patients who underwent laparotomy and manual reduction, recurrence developed in 14 (3.0%) patients. A recurrent attack did not occur after intestinal resection in 175 patients. The difference in the recurrence rate after nonoperative management (BE and AE reduction) and manual reduction of intussusceptions

Table 1 Age of the 75 patients at the first episode of intussusception

Age	No. of cases	Percentage
0-1 y	51	68
1-2 y	12	16
2-5 y	8	10.7
>5 y	4	5.3
Total	75	100

Table 2 Time interval of each recurrence (n = 108)

Time interval	Recurrent episodes (n)	Percentage
Within 1 d	9	8.3
1-7 d	9	8.3
7-30 d	10	9.3
1-6 mo	47	43.5
6-12 mo	21	19.5
1-2 y	7	6.5
2-5 y	5	4.6
Total	108	100

Table 4 Clinical presentations of the initial and recurrent episodes of intussusception

Clinical presentations	Initial episodes (n = 75)	Recurrent episodes (n = 108)	P value
Vomiting	68 (90.7%)	93 (86.1%)	.48
Abdominal pain	61 (81.3%)	92 (85.2%)	.62
Mucous bloody stool	60 (80.0%)	82 (75.9%)	.63
Normal stool	12 (16.0%)	20 (18.5%)	.81
Palpable abdominal mass	59 (78.7%)	83 (76.8%)	.91
History of viral infection	11 (14.7%)	10 (9.2%)	.37

was statistically significant (15.8% vs 3.0%, $P < .001$ and 11.4% vs 3.0%, $P < .001$). Spontaneous reduction was noted during operation in 26 (7.7%) of 339 cases with unsuccessful nonoperative reduction, and recurrence was not observed in any of the 26 patients. In addition, 4 patients were proven to have intussusceptions by clinical presentations of abdominal pain, vomiting, bloody stool, palpable abdominal mass, and ultrasonographic findings of mass with a target or pseudokidney sign. However, intussusceptions were not found during BE or AE reduction. We suspect that these lesions spontaneously reduced before the attempted nonoperative reductions. All of these 4 patients developed recurrent attacks later on.

Hydrostatic BE reduction was attempted in 26 episodes of recurrence and was successful in 25 (96.2%), a statistically significant higher success rate of BE than in the initial episode (96.2% vs 63.6%, $P = .001$). Four of the 25 successful BE reduction cases for recurrence had a history of operative manual reduction for the previous intussusception. Pneumatic reduction was attempted in 62 episodes of recurrent intussusception and was successful in 57 (92%) of the 62 episodes. This was significantly higher than the success rate of the initial episode (92% vs 69.1%, $P < .001$). In addition, 3 recurrent cases successfully reduced by pneumatic reduction had their previous intussusception treated with operative manual reduction. Two of 5 patients with failure of pneumatic reduction developed an intussusception in the mid small bowel. Overall, 24 patients required laparotomy: 6 after failure of BE and AE reduction, and the remaining 18 cases underwent primary surgical exploration. All of the 24 recurrent intussusceptions could be manually reduced. An ileocolopexy was performed in 7 cases as

judged by the surgeon to prevent a further recurrence. Six patients underwent intestinal resection because of a Meckel diverticulum in 3 cases, colonic polyp in 2, and multiple lymphadenopathies at the terminal ileum in 1 patient. The multiple enlarged lymph nodes in this last patient raised the question of malignancy during the procedure but were later proven to be histologically normal. Spontaneous reduction before definitive treatment was found in the remaining 2 patients.

Pathologic lead points were noted in 7 patients with colonic polyps (4 patients) and Meckel diverticulum (3 patients). Detailed information of the 7 patients is summarized in Table 6.

Of the total 108 recurrences, ileocolic intussusception occurred in 100 episodes, whereas the other types accounting for 8 episodes included 4 colocolic and 4 small bowel intussusceptions. There were no deaths among these 75 patients.

3. Discussion

Recurrent intussusception is a well-recognized sequel to successful management of an initial intussusception. Reported overall recurrence rates range from 8% to 15%

Table 3 Numbers of recurrent intussusception

Recurrent attack	No. of cases (%)	No. of episodes (%)
1 Episode	56 (74.7)	56 (51.9)
2 Episodes	9 (12)	18 (16.7)
3 Episodes	8 (10.7)	24 (22.2)
4 Episodes	0	0
5 Episodes	2 (2.6)	10 (9.2)
Total	75 (100)	108 (100)

Table 5 Correlation of modes of treatment in the first episodes and recurrence rate

Modes of treatment	No. of patients	Successful reduction	Recurrence [a]	P value
Nonoperative				
BE reduction	349	222 (63.6%)	35 (15.8%)	.08
AE reduction	697	482 (69.1%)	55 (11.4%)	
Operative				
Manual reduction	457		14 (3.0%)	.009
Intestinal resection	175		0	

[a] Recurrences after spontaneous reduction of the previous episodes of intussusception in 4 cases.

Table 6 Summary of 7 patients with pathologic lead points

No.	Sex	Age at initial intussusception	No. of recurrence	Time interval of recurrence	Types of initial and recurrent intussusception	PLP	Treatment of all episodes
1	F	10 y 9 mo	1	15 d	1. Colocolic 2. Colocolic	Colonic polyp	1. BE reduction (successful) 2. BE reduction (successful) 3. Colonoscopic polypectomy
2	M	10 mo	1	1 d	1. Ileocolic 2. Ileoileal	Meckel diverticulum	1. BE reduction (successful) 2. BE–intussusception not found 3. Laparotomy and segmental ileal resection
3	F	4 y 8 mo	1	11 d	1. Colocolic 2. Colocolic	Colonic polyp	1. BE reduction (successful) 2. Laparotomy and colonic resection
4	F	9 y	1	11 d	1. Colocolic 2. Colocolic	Colonic polyp	1. BE reduction (successful) 2. AE reduction (successful) 3. Laparotomy and polypectomy
5	F	12 y	1	1 mo 4 d	1. Ileocolic 2. Ileocolic	Meckel diverticulum	1. Spontaneous reduction 2. Laparotomy and segmental ileal resection
6	F	1 y 6 mo	1	2 y	1. Colocolic 2. Colocolic	Colonic polyp	1. BE reduction (successful) 2. Laparotomy and polypectomy
7	M	5 mo	1	1 d	1. Ileocolic 2. Ileocolic	Meckel diverticulum	1. BE reduction (successful) 2. Laparotomy and segmental ileal resection

[2,6,9-19]. There is a 1% to 3% recurrence rate after operative reduction [1-4] and a recurrence rate of 10% to 15% after barium or pneumatic reduction [1,4,5-9]. Operative reduction has a recurrence rate lower than nonoperative procedures [1,4,10-13]. Our experience was similar to those reported in the literature (Table 7). Adhesions created by the operative manual reduction may explain the lower recurrence rate after surgical reduction of intussusception. Indeed, ileocolic resection is claimed to virtually eliminate instances of recurrent intussusception.

Many authors have suggested that the use of pneumatic reduction offers several advantages over hydrostatic BE reduction because it allows easier reduction, less exposure to radiation, less morbidity following bowel perforation during attempted reduction, and a lower incidence of recurrence [7-9,12,13].

Information obtained from this study showed that 68% of the patients with recurrent intussusception were younger than 1 year at the first episode and that 70% of the recurrences developed within 6 months of the initial episode. It is probably related to the fact that the incidence of intussusception decreases significantly after the toddler period. With the exception of abdominal pain, patients presented with fewer symptoms and signs in the recurrent episodes. There was a shorter duration of time between the onset of symptoms and hospital presentation because parents had gained experience from the previous episode of intussusception [4,13,18]. The typical symptoms, especially abdominal pain and vomiting, raised the index of suspicion of the parents about a possible recurrence of intussusception.

Most of the initial episodes of intussusception were of the ileocolic or ileoileocolic variety, and the recurrences frequently developed at the same sites. In contrast, immediate recurrence after operative and nonoperative reduction in children with pathologic lead points may occur as a small bowel intussusception. Pathologic lead points were found in 7 (9.3%) of the 75 patients with recurrent intussusception compared with 48 (3.8%) of 1265 patients with intussusception that did not recur. This represented about a 3-fold increase in the incidence of lead points in children with recurrent intussusception. Ein [4] reported that intussusceptions secondary to lead points were not reducible by nonoperative reduction. This finding was in contrast to our study in which 2 cases with Meckel diverticulum and 4 with colonic polyps were first completely reduced by BE and AE reduction with disappearance of their symptoms but later recurred. Two cases with recurrent intussusception owing to colonic polyps were successfully treated by BE and AE reduction (Table 6). These findings are similar to the reports of Beasley et al [13] and Fecteau et al [18]. Two patients with Meckel diverticulum and an ileocolic intussusception were successfully reduced by BE reduction in their first episode, but BE failed to demonstrate an ileoileal intussusception in the recurrence in 1 patient. It is possible that the first intussusception was caused by hypertrophy of the Peyer patches and was not affected by the pathologic lead points. However, Meckel diverticulum was indeed the cause of the recurrent intussusception in these 2 patients.

In the past, some patients with recurrent intussusception underwent laparotomy to rule out the possibility of a pathologic lead point [1,3,5]. Current concepts suggest that the initial management of recurrent intussusceptions should be nonoperative treatment, even if they recur after previous operative reduction [4,6,8,9,12,13,19,20]. Our study demonstrated that the success rates after BE and AE reduction in recurrent cases were as high as 96% and 92%, respectively. The higher success rates of BE and AE reduction were perhaps possibly because of prompt

Table 7   Comparison of the recurrent intussusception from the literature

Authors	Year	Country	Recurrence rate (%) after successful reduction		
			BE	Pneumatic (AE)	Operative
Soper and Brown [1]	1964	United States	10	–	3
Ein [4]	1975	Canada	11	–	3
Gierup et al [10]	1972	Sweden	10	–	2.6
Sparnon et al [11]	1984	Australia	18.4	–	2.7
Liu et al [12]	1986	Ireland	10	–	4
Beasley et al [13]	1987	Australia	8.9	–	1.2
West et al [14]	1987	United States	12	–	0
Mackay et al [15]	1987	Australia	17	–	0
Kim and Rhu [16]	1987	Korea	10	–	5
Wilson-Storey et al [17]	1988	England	10	–	1.1
Stringer and Ein [7]	1990	Canada	11	8	–
Renwick et al [8]	1992	Australia	9	8	3
Champoux et al [6]	1994	United States	13	–	1
Fecteau et al [18]	1996	Canada	12.5	–	8.2
Eshel et al [19]	1997	Israel	10	5.9	0
Daneman et al [9]	1998	Canada	11	8	–
Kaiser et al [20]	2007	United States	–	13	1
Present study	2010	Thailand	15.8	11.4	3

recognition of symptoms by the parents owing to their previous experience and earlier diagnosis of the recurrent episode. At our institute, nonoperative reduction was always considered the initial treatment of choice for recurrent intussusception. Barium enema or AE reduction was attempted as early as 5 days after operative manual reduction and appendectomy in 2 cases. The reductions were both successful, and there were no complications. The number of recurrences that occur before the patient is subjected to operative intervention is still controversial. Some investigators have recommended surgical management after more than one episode of recurrence [1,5] in patients older than 2 years whose first episode was reduced by nonoperative reduction [21] and in those patients with suspicion of pathologic lead points [13]. These recommendations have not been totally substantiated by the present study. Operative treatment should be performed only in the patients with failure of BE or AE reduction, in cases with a suspicion of a pathologic lead point (especially in older children), and in some cases with several episodes of recurrence. In the present study, we decided to operate on 2 girls each with 5 recurrent episodes of intussusception at the age of 1.25 and 3.7 years old. In the younger patient, the reason for operation was the high frequency of 5 recurrences within 1 year and to alleviate her parents' anxiety. The second girl underwent operative intervention because she was in the older age group with a fifth recurrence and with suspicion of having a pathologic lead point such as malignant lymphoma. In both instances, however, there was no pathologic lead point observed.

In cases with a pathologic lead point, surgical excision or intestinal resection must be performed to eliminate the recurrent attacks. If there is no evidence of a pathologic lead point during laparotomy in patients with multiple recurrences, an ileocolopexy could be considered using the Burrington technique [22]. The ileocolopexy is performed according to the individual surgeon's judgment during the operation in an effort to prevent a further recurrence. At our institute, most of the pediatric surgeons perform an ileocolopexy in children requiring surgery because of failure of nonoperative reduction with more than one episode of recurrent intussusception. No recurrence was noted in any of the cases treated with operative manual reduction and ileocolopexy.

4. Conclusions

The majority of recurrent intussusceptions are idiopathic, and pathologic lead points are found in only 9.3% of cases. Initial management of recurrent intussusception should be nonoperative even if they recurred after previous operative reduction. Laparotomy should be performed in patients with recurrent intussusception only after failure of nonoperative reduction, in patients with a suspicion of having pathologic lead point, and in some cases with several episodes of recurrence. It is concluded that the principle treatment of recurrent intussusception, in general, should be similar to that of the primary intussusception.

Acknowledgments

Health, for permission to publish this paper and Dr. Vichao Kojaranjit for supporting of statistical analysis.

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