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Original Article

Is Hospital Admission Unnecessary After Successful Reduction in Paediatric Patients with Intussusception?

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Abstract ***Purpose:*** This study aimed to describe demographic characteristics of hospitalised children with successful reduction of intussusception and their early outcomes, and assess the frequency of hospital-level interventions, to determine the necessity of hospitalisation through hospital-level intervention assessment. ***Methods:*** We conducted a retrospective review of children aged 0-18 years with ileocolic intussusception, who presented to emergency department between March 2010 and December 2017. ***Results:*** Sixty-three patients with successful reduction were included. Median patient age was 23 (7-75) months. Signs and symptoms of intussusception were currant jelly stool in 19 cases (30.2%), a palpable mass lesion in 15 (23.8%). Median length of stay was 2 (1-8) days. Intussusception recurrence during hospital admission occurred in 9 patients (14.3%). Of the 63, 25 (39.7%) received at least one intervention. ***Conclusions:*** Approximately 25% of patients underwent hospital-level radiologic studies to diagnose the possibility of recurrence during inpatient observation. Hospitalisation post-successful reduction may be helpful for early recurrence detection and prevention of post-reduction complications.

Key words Hospitalisation; Intussusception; Pneumatic reduction; Recurrence

Introduction

Paediatric ileocolic intussusception is a potentially serious condition where a portion of the intestine slides into an adjacent intestinal segment.[1,2] The potential complications include intestinal necrosis and perforation if the condition is not treated expeditiously.[3,4] Pneumatic or hydrostatic enema reduction has become the treatment standard in patients with noncomplicated intussusception. However, recurrence can occur after successful reduction in infants and children. The recurrence rate of intussusception has been reported to range from 7% to 13%;[4-8] therefore, admission to an inpatient unit for 24-48 hours after enema reduction is considered routine in most paediatric hospitals.[5,9-11] However, many recent studies have reported low rates of early recurrence and adverse events in patients discharged after short-term observation in the emergency department (ED) following successful reduction of intussusception.[2,7,12,13] Thus, there is currently a debate on whether inpatient treatment is necessary after successful reduction of intussusception.

The purposes of the present study were to describe the demographic characteristics of hospitalised children with successful reduction of intussusception and their early outcomes, and to assess the frequency of hospital-level interventions during inpatient observation. We aimed to determine the necessity of hospitalisation through the assessment of hospital-level interventions.

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Methods

This study was approved by the Research Ethics Board of the Inje university Haeundae Paik hospital. We conducted a retrospective review of children aged 0-18 years with ileocolic intussusception, who presented to the ED of a single centre between March 2010 and December 2017. Patients with incomplete medical records, those who did not undergo reduction (although the condition was diagnosed in another hospital), and those who had unsuccessful pneumatic reduction were excluded.

The medical charts were reviewed using a standardised data collection form that collected information on patient demographics, presenting signs and symptoms, radiographic studies performed and their findings, recurrence while in hospital, length of stay, and any complications or secondary interventions, such as repeat imaging, recurrence management, and administration of pain medications or antipyretics. The duration of symptoms was calculated from the beginning of abdominal pain or vomiting to the time of enema reduction. The time to diagnosis of re-intussusception was defined as the time from the completion of enema (time noted in the radiology report) to recheck ultrasound (time noted in the radiology report). Pneumatic reduction was attempted after ultrasound confirmation of ileocolic intussusception. All patients underwent a fluoroscopic-guided pneumatic reduction. A catheter was inserted into the rectum and air insufflation proceeded. The insufflation pressure was to be no more than 120 mmHg. The procedure was considered to be successful when the intraluminal filling defect disappeared and air filled into the distal ileum after pneumatic reduction. When the intussusception was not reduced, the procedure was repeated up to three times. The length of stay was defined as the period from the day when the patient was admitted to the hospital to the day when the patient was discharged (as mentioned on the reviewed chart). Hospital-level intervention was defined as in-hospital treatment, such as diagnostic imaging for possible recurrence, management of recurrence, and administration of intravenous medication.

Categorical data are reported as numbers and percentages, while continuous data are reported as means and standard deviations or medians and interquartile ranges (IQRs). Categorical variables were compared using the chi-square test, while continuous variables were compared using the Mann-Whitney test. All statistical analyses were performed using SPSS version 23 (IBM Corp., Armonk, NY, USA). All p-values were two-tailed, and a p-value <0.05 was considered statistically significant.

Results

A total of 84 patients were diagnosed with intussusception at our institution during the study period. Of these, 21 were excluded because of reduction failure, history of intussusception, or immediate surgery after diagnosis. Thus, 63 patients with successful reduction were included (Figure 1). The median patient age was 23 months (IQR, 7-75 months), and 61.9% of the patients were male (n=39) (Table 1). The signs and symptoms of intussusception were presence of currant jelly stool in 19 cases (30.2%), a palpable mass lesion in 15 cases (23.8%), and gastrointestinal issues, such as vomiting, diarrhoea, and anorexia, in 34 cases (54.0%). A high white blood cell

Table 1 Patient characteristics

Variable	n=63
Male gender	39 (61.9%)
Age (median(IQR), mo)	23 (7-75)
Rota vaccination	38 (60.3%)
Recent fever/URI	19 (30.2%)
Symptom durations >24 hours	12 (19.0%)
Current Jelly stool	17 (27.0%)
Abdominal pain/irritability	62 (98.4%)
GI symptoms (vomiting, diarrhoea)	34 (54%)
Abdominal mass	15 (23.8%)
Leukocytosis (WBC >10,000)	37 (58.7%)
Increased C-reactive protein	32 (50.8%)
Length of stay (median(IQR), day)	2 (1-8)
Recurrence	9 (14.3%)
Time to diagnosis of re-intussusception during admission (median(IQR), hour)	31 (8-47)
Time to recurrence after reduction <24 hours	3 (4.8%)
24 hours < time to recurrence after reduction <48 hours	6 (9.5%)
Operation (+)	3 (4.8%)
Intervention during admission	25 (39.7%)

IQR, interquartile range; URI, upper respiratory infection; GI, gastrointestinal; WBC, whole blood count

count and C-reactive protein level were identified in >50% of the patients. The median length of stay was 2 days (IQR, 1-8 days). Intussusception recurrence during hospital admission was noted in 9 patients (14.3%). The median time to the diagnosis of re-intussusception during admission was 31 h (IQR, 8-47 hours), and in 3 patients (4.8%), recurrence was diagnosed within 24 hours. Three patients received surgical management because of failed air reduction (Table 1). There was no statistically significant difference in variables between the patients who had recurrence during hospitalisation and those who did not.

Of the 63 patients, 25 (39.7%) received at least one intervention during admission (Figure 1). Sixteen patients (25.4%) had abdominal pain or irritability, and radiological studies were performed to diagnose the recurrence (Table 2). On comparing patients who received interventions and those who did not, it was found that most variables did not significantly differ, except for recurrence and length of stay ($p<0.001$ and $p=0.007$, respectively) (Table 3).

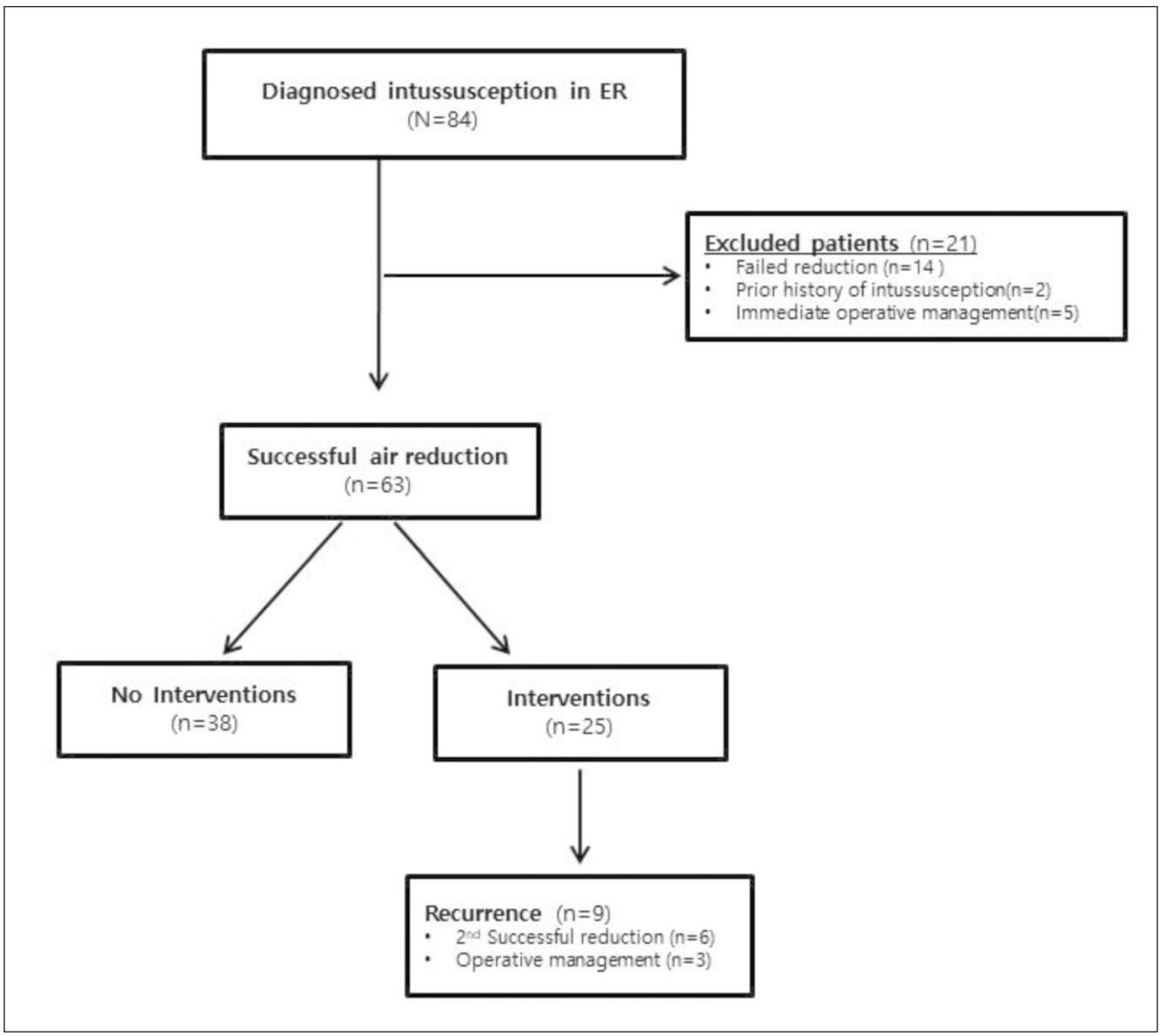

Figure 1 Flowchart for the selection of patient.

Discussion

The results of our study showed that approximately 25% of patients underwent hospital-level radiologic studies to diagnose the possibility of recurrence during inpatient observation; more than half of those who underwent imaging studies were diagnosed with recurrence. The traditional approach after successful reduction of intussusception includes admission for observation to ensure tolerance of enteral diet advancement and to monitor early recurrence of intussusception. The recurrence rate within the first 48 hours ranges from 0% to 7.1%.[14-17] Thus, in many institutions, patients are commonly placed under observation in the hospital for ≥2 days. However, there has been an increasing trend of discharge from the ED after successful reduction of intussusception in recent years. Kwon et al reported the effects of a practice guideline of post-reduction management in children with intussusception in the ED.[18] They observed the children in the ED after successful reduction, fed them 2 hours after reduction, and discharged them 2 hours after successful feeding according to their practice guideline. They suggested that the length of stay after successful reduction of intussusception could be reduced with the guideline, and there was no difference in the early recurrence rate. Mallicote et al reported similar results.[2] They retrospectively reviewed paediatric patients with ileocolic intussusception, who were managed with either 24-hour inpatient or 4-hour ED observation. They suggested that discharging patients following uncomplicated radiological reduction of ileocolic intussusception according to strict clinical criteria after a 4-hour ED observation period did not increase the occurrence of adverse outcomes or recurrence when compared with a 24-hour inpatient observation period. In the present study, we noted a recurrence rate of 14.3% within the first 48 h and a median time to the diagnosis of recurrence after the initial reduction of 31 hours (IQR, 8-47 hours) during the inpatient observation. In addition, the recurrence rate was higher after 24 hours (9.5%) than within the first 24 hours (4.8%).

Table 2 Type and number of interventions during admission

Type of intervention	Number of interventions
Radiologic imaging due to abdominal pain	16 (25.4%)
Antipyretic drug medication	9 (14.3%)
Recurrence and need for reduction	9 (14.3%)
Intravenous pain medication	8 (12.7%)
Hydration	2 (3.3%)

Table 3 Comparison of intervention with no intervention

Variable	Intervention (n=25)	No intervention (n=38)	P-value
Male gender	15	25	0.801
Age (mean±SD, mo)	22.9±11.7	26.4±14.7	0.315
Symptom durations >24 hours	5	7	0.876
Rota vaccination (+)	16	22	0.628
Recent fever/URI (+)	11	8	0.052
Current Jelly stool (+)	8	11	0.796
GI symptoms (+)	15	19	0.436
Abdominal mass (+)	6	9	0.977
Leukocytosis (WBC >10,000)	15	22	0.865
Increased C-reactive protein (+)	15	17	0.190
Recurrence	9	0	<0.001
LOS (mean±SD, d)	2.9±1.9	1.7±0.6	0.007

SD, standard deviation; URI, upper respiratory infection; GI, gastrointestinal; WBC, whole blood count; LOS, length of stay

Although early recurrence rates have been reported to be low in the literatures, non-operative treatment is not successful in all cases of recurrence. Whitehouse et al suggested that it is safe to discharge patients selectively from the ED after successful enema reduction.[13] However, one (25%) of four patients with recurrence received surgical treatment 36 h after reduction. In a study by Chien et al, one of two patients with recurrence 5 hours after successful enema reduction received surgical treatment.[17] In our study, three (33%) of nine patients with recurrence during in-hospital observation received surgical treatment. Even though the recurrence rate is low, surgical treatment is often necessary for recurrence after successful reduction.

The risk factors for recurrence after successful reduction of intussusception have been reported in several studies, but different factors have been reported across studies. Vo et al reported that persistent fever with a temperature >38°C and female sex were independently associated with early recurrence.[19] Guo et al reported that age (>1 year), symptom duration (≤12 hours), absence of vomiting, mass location (right abdomen), and pathological

lead points were significantly predictive of recurrent intussusception.[20] Lessenich et al found that proximal intussusception was associated with a five-fold increase in the odds of recurrence.[21] In a comparative analysis between recurrence and no recurrence of intussusception, Kim et al reported that age ≥2 years was a risk factor for early recurrent intussusception, and the median time for recurrence was 25 hours.[22] On the other hand, Yang et al and Champox et al reported that no factors were associated with recurrent intussusception.[23,24] We also did not identify any factors associated with recurrence.

However, many studies, except that by Lessenich et al,[21] were mainly focused on factors such as recurrence rates, risk factors for recurrence, length of stay, adverse effects due to early discharge, and so on after successful reduction. Thus, they did not provide details about hospital-level care, such as the frequency of diagnostic imaging for possible recurrence, management of recurrence or complications associated with the initial reduction, and administration of intravenous medication. Lessenich et al suggested that the frequency of hospital-level interventions is an important factor in the final success decision after successful reduction.[21] These authors believed that hospital-level interventions could be estimated by subsequent ED visits among patients discharged after reduction for reasons other than recurrence. Supporting the concept of hospital-level intervention, Somekh et al suggested that a febrile episode after manipulation of the intussuscepted bowel is often noted because of bacteraemia or the release of endotoxins or cytokines.[11] Their study showed that five patients had a rectal temperature of ≥38^{0}C within 24 hours after complete reduction. Vo et al reported that fever was independently associated with early recurrence.[19] In our study, fever was noted in nine patients (14.3%), and it was treated with antipyretics during inpatient observation. In a study by Lochhead et al, 102 children underwent air enema reduction with subsequent observation in the ED for at least 6 hours, and of those who were discharged home, the revisit rate was 21%, with episodes of recurrent abdominal pain/vomiting; most of them (69%) presented within the first week.[25] Abdominal pain after successful reduction is associated with the recurrence of intussusception. In such a situation, radiological examination is necessary for the rapid diagnosis of recurrence in both inpatient observation and ED observation. Al-Jazaeri et al reported that although a recurrence rate of <10% was identified among 74 patients with uneventful admission after successful reduction, 20 patients (27%) showed pain recurrence during admission, and repeat ultrasound examinations were performed in 24 patients (32%).[12] Similar to this previous study, our study noted that 16 patients (25.4%) underwent radiological examinations, such as simple abdominal X-ray or ultrasound, because of abdominal pain or irritability. Lessenich et al reported that 86 (18.5%) of 435 patients required at least one hospital-level intervention during admission.[21] Our study identified that at least one hospital intervention was performed in 39.8% of the patients, which is higher than the rate reported in other studies. Even though we excluded an administration of intravenous medication, which may be a potential provider bias, approximately 25% of the patients underwent hospital-based radiological studies to diagnose the possibility of recurrence due to abdominal pain or irritability. However, unlike the study by Lessenich et al, we could not identify the factors associated with hospital-level interventions.

The present study has several limitations. First, the data were retrospectively collected by medical chart review; thus, our study lacked randomisation and standardisation. Our study only analysed patients who received inpatient observation after successful reduction of intussusception. Therefore, we could not directly compare the treatment outcome of patients with ED observation. The hospital-level interventions were decided by multiple physicians, including residents, fellows, and professors, and it was not known whether the intervention decision was appropriate. This may have resulted in the high rate of hospital-level interventions. For accurate analysis, a protocol should be developed and ED observation should be analysed. Second, this study included a small number of patients, and the study was performed at a single centre. We could not find the factors associated with hospital-level interventions. To identify the associated factors in this study, a large-scale, multicentre study is required.

In conclusion, we found that approximately 25% of the patients underwent hospital-level radiologic studies to diagnose the possibility of recurrence during inpatient observation, and more than half of the patients who had undergone the imaging studies were diagnosed with the recurrence. Hospital-level intervention may quickly diagnose the recurrence and help prevent complications caused by recurrence. Although patients may be successfully discharged after the ED observation as reported in several publications, some interventions may be performed after discharge. Therefore, hospitalisation after successful reduction may be helpful for early detection of recurrence and prevention of the post-reduction complication.

Declaration of Interests

There are no conflicts of interest to declare.

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