

Original Article

Is Phosphate Enema Treatment Effective in Ileocolic Intussusception?

T ÖZTAŞ, G DEVECİ

Abstract

Purpose: In this study, we evaluated the therapeutic effects of phosphate enema and the factors affecting its effectiveness. We also aimed to determine the reduction rate in children diagnosed with ileocolic intussusception. **Methods:** The demographic and ultrasonography data and surgery reports of 41 patients diagnosed with ileocolic intussusception were evaluated in the present study. Intussusceptions with a length of 30 mm or less were regarded as short segment intussusception, whereas those larger than 30 mm were considered long segment intussusception. Phosphate enema was administered to the patients. **Findings:** The reduction rate with phosphate enema was 82.9%. In patients where the reduction was unsuccessful, ultrasound-guided hydrostatic reduction (4.9%) and surgery (12.2%) were performed. A statistically significant relationship between age, symptom duration, presence of blood in the stools, segment length, and phosphate enema reduction was observed ($p < 0.05$). **Conclusions:** The findings suggest that phosphate enema can effectively reduce the short segment intussusception in paediatric patients with short-segment ileocolic intussusception having symptom duration of 24 hours or less and no blood in the stools.

Key words

Ileocolic intussusception; Intussusception; Nonsurgical reduction; Phosphate enema

Introduction

Intussusception refers to the spontaneous telescoping of one intestinal segment into another.¹ It is a common cause of intestinal obstruction in children. There are three most common types of intussusception: ileocolic, small bowel to small bowel, and colocolic.^{2,3} Several methods, from conservative ones to surgery, are used in the treatment of intussusception, with a preference for non-surgical methods. Several factors, such as the type, length, and duration of the intussusception, may affect the success

of non-surgical reduction. Surgery is recommended for patients with findings of shock, peritonitis, perforation, or intestinal necrosis.⁴ Certain studies reported successful intussusception reduction with phosphate enema, and the treatment effectively contributed to constipation or colon cleansing.^{4,5} We evaluated the reduction rate and the factors affecting the success of reduction with phosphate enema in children diagnosed with ileocolic intussusceptions.

Methods

Demographic and ultrasonography (US) data of 121 patients between the ages of seven and 144 months who were diagnosed with intussusception in the emergency department of our hospital between October 2016 and June 2018 were evaluated retrospectively. Patients with findings of lethargy and peritonitis, abdominal distension, lead point intussusception, history of abdominal surgery, electrolyte disorder, or symptom duration of more than 48 hours were excluded from this study.

Department of Pediatric Surgery, University of Health Sciences
Diyarbakır Gazi Yaşargil Training and Research Hospital,
Diyarbakır/Turkey

T ÖZTAŞ MD

G DEVECİ MD

Correspondence to: Assist. Prof. T ÖZTAŞ
Email: tulinoztas@hotmail.com

Received April 21, 2021

Demographic characteristics such as age and gender, and other information, including abdominal pain, restlessness, vomiting, bloody stools, symptom duration, physical examination findings, leukocyte counts, electrolyte levels, US findings, administered treatment, and surgery reports of the patients, were recorded. Ultrasonography recorded the location of the intussusception, its length, pathological lead point, lymph node, and the presence of fluid in the abdomen. Intussusceptions were evaluated as small bowel, ileocolic, and colocolic according to their localisation. An intussusception of 30 mm or less was considered a short segment intussusception, and a long segment intussusception if its length was greater than 30 mm.⁶

The patients were taken to the observation room in the emergency department. Next, 67.5 mL of a solution containing sodium dihydrogen phosphate (3.5 g) + disodium hydrogen phosphate (9 g) in an applicator-tip squeezing bottle was administered rectally as 3.1 mL/kg (maximum 118 mL).^{6,7} The patient was mobilised and taken to the toilet when they felt the need for defecation. Ultrasonography was performed four hours after mobilisation. The patients where the reduction was confirmed by the US were discharged. The US-guided hydrostatic reduction or surgical treatment was applied to those without reduction. The patients were followed up at 24 hours, 48 hours, and six months after the discharge. The families of the patients were contacted by two physicians blind to this study. In addition, the presence of recurrence or complications was queried and recorded.

The present study was approved by the Clinical Studies Ethics Committee of Health Sciences University (25.05.2019 / No: 94).

Statistical Methods

The data were statistically analysed using SPSS Statistics for Windows, Version 22.0 (IBM Corp. Released 2013. Armonk, NY, USA) package software. Categorical variables were expressed as number (n) and percentage (%). The Kolmogorov–Smirnov test was used to examine the normal distribution of continuous data. Numerical variables with normal distribution were expressed as mean \pm standard deviation. Normally distributed numerical variables were compared using Student's t-test. Pearson's Chi-square test was used to determine the difference concerning categorical variables. Analysis of variance (ANOVA) was applied to evaluate the factors affecting the outcome of intussusception. A p-value of <0.05 was considered statistically significant.

Results

The findings obtained in this study showed that 70 patients had small bowel to small bowel intussusception and 51 patients had ileocolic intussusception. Of these 51 patients, 10 were excluded from this study due to Henoch-Schönlein vasculitis (n=2), symptom duration >48 hours (n=5), and signs of lethargy and peritonitis (n=3). Successful reduction with phosphate enema was performed in 34 of 41 patients. The control US showed no increase in the length of intussusception. Reduction with phosphate enema was unsuccessful in seven patients, in whom the US-guided hydrostatic reduction was performed. However, a successful reduction was obtained in only two patients (28.5%). Laparotomy and manual reduction were performed in five patients in whom reduction was unsuccessful. Bowel resection was not performed in any of these patients (Figure 1).

The patients' mean age was 39.9 ± 30.8 months (7-144 months); 56.1% of the patients were males, and 43.9%

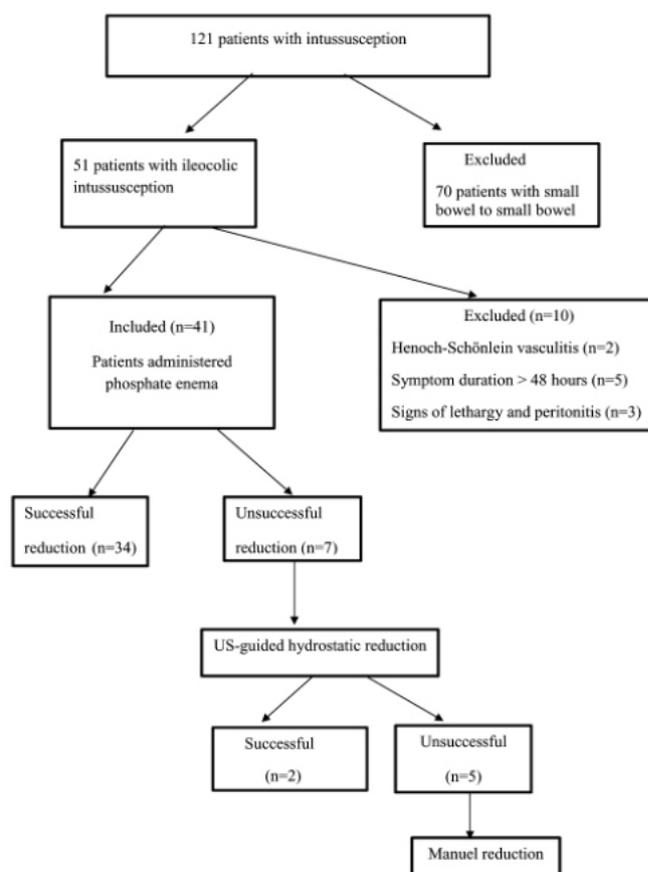


Figure 1 Flowchart study.

were females. Reduction with phosphate enema was less successful in younger patients ($p=0.011$). Of the patients who underwent reduction with phosphate enema, 2.9% had bloody stools, whereas 71.4% of the patients in whom reduction was not achieved had bloody stools. There was a statistically significant relationship between bloody stools and phosphate enema reduction ($p=0.004$). The mean symptom duration was 19.9 ± 10.5 hours (4-36 hours) in patients who were reduced with phosphate enema, whereas it was 31.4 ± 10.3 hours (20-47 hours) in patients without reduction. A statistically significant relationship was found between symptom duration and phosphate enema reduction ($p=0.001$). Short segment intussusception was found in 65.9% of the patients, and long segment intussusception in 34.1%. Reduction with phosphate enema was performed in 88.8% of short segment intussusception and 71.4% of long segment intussusception. A statistically significant relationship was found between segment length and phosphate enema reduction ($p=0.002$) (Table 1).

No recurrence or complication was reported during the telephonic conversation with the patients' families 24 hours, 48 hours, and six months following the treatment.

Discussion

Ileocolic intussusception is most commonly observed in children and treated either by surgical or non-surgical methods.^{2,8} The most commonly used non-surgical methods to treat intussusception are pneumatic and hydrostatic reductions. These treatments are associated with 85% to 90% reduction, 10% recurrence, and 1% perforation.^{2,3,9} Phosphate enema resulted in 88% to 90.9% reduction and 1.1% recurrence with no complications.^{4,5} Phosphate enema causes distension in the rectum and increases intestinal motility by increasing the water content and volume of stools with osmotic activity.^{5,10} Increased intestinal peristalsis contributes to reduction by shifting the outer wall of the distal segment over the invaginated segment.⁵ Phosphate enema did not lead to any complications in previously healthy children; however, metabolic disorders, such as dehydration, hyperphosphataemia, hypokalaemia, hypokalaemic acidosis, may occur in patients with comorbid diseases, such as renal failure and gastrointestinal motility disorder.^{7,10,11} Contrary to the previously published studies, small bowel intussusception was more frequently found in

Table 1 Characteristics of patients who were administered phosphate enema

Characteristic	Successful reduction (n=34)	Unsuccessful reduction (n=7)	P-value
Age (month, mean \pm SD)	43.1 \pm 31.8	24.7 \pm 19.2	0.011
Gender			0.688
Female	16 (47.1%)	2 (28.6%)	
Male	18 (52.9%)	5 (71.4%)	
Symptoms			
Abdominal pain	13 (38.2%)	3 (42.8%)	0.270
Vomiting	27 (79.4%)	6 (85.7%)	0.280
Restlessness	12 (35.3%)	3 (42.8%)	0.371
Bloody stools	1 (2.9%)	5 (71.4%)	0.004
Duration of symptoms			0.001
<24 hours	21 (61.8%)	0 (0%)	
24 hours	9 (26.5%)	2 (28.6%)	
>24 hours	4 (11.7%)	5 (71.4%)	
Length of intussusception			0.002
Short	24 (70.6%)	3 (42.8%)	
Long	10 (29.4%)	4 (57.1%)	

SD: standard deviation

our study. We suggest that more frequent small bowel intussusception may be diagnosed because of the frequent use of US for diagnosis in emergency services. The present study reported 82.9% successful reduction with phosphate enema treatment. Treatment with phosphate enema increased intestinal peristalsis and caused defecation. The increased intra-colon lumen pressure during defecation might have contributed to the reduction. No complication or recurrence was observed after reduction. These results demonstrated that phosphate enema could be a good alternative for treating ileocolic intussusception with easy applicability, absence of radiation exposure, no complications, and high reduction rate.

The age of the patient may affect the success of intussusception reduction. Certain studies have reported that the success of non-surgical reduction is not related to age.^{5,12,13} However, Shekherdimian et al¹⁴ reported that enema treatment was unsuccessful in young children. Muduli et al⁴ stated that non-surgical treatment was more successful in young children, and it was unsuccessful in older children due to the presence of lead points, which is consistent with the findings obtained in the present study. Classical abdominal pain, vomiting, and bloody stools were found in only one-third of the patients and that diagnosis was delayed because non-specific symptoms, such as nausea, loss of appetite, and restlessness, were observed in most of the patients.¹⁵ This study showed that young children received a late diagnosis. The long symptom duration in young children was correlated with reduced reduction with phosphate enema.

One of the factors believed to affect the success of intussusception reduction is blood in the stools. The presence of blood in the stools reduces the success of enema treatment, as also reported in our study.^{12,13,16} We believe that rectal bleeding is a symptom observed late when edema progresses in the intestine and circulation is impaired, resulting in intestinal peristalsis and no or limited reduction with phosphate enema. Some studies have reported that the symptom duration affects the results of reduction and the reduction fails as the symptom duration prolongs,^{5,12,13} whereas other studies have reported that the symptom duration is not related to the success of the reduction.^{9,17} In our study, the symptom duration was more than 24 hours in 80% of the patients, in whom reduction could not be achieved with phosphate enema. Our study support that reduction with phosphate enema may be used in patients with symptom duration of 24 hours or less.

The length of intussusception affects the success of the

reduction. Fike et al¹³ reported that the success rate of non-surgical treatment decreased as the length of the colon in the invaginated segment increased. A success rate of 90.9% was achieved with phosphate enema treatment in short segment intussusceptions.⁵ We observed that reduction with phosphate enema was more successful in short segment intussusception than in long segment intussusception. We suggest that phosphate enema-induced intestinal peristalsis is insufficient to provide a reduction in long segment intussusception.

Our study had certain limitations. This study was a retrospective study conducted at a single centre. Reduction with phosphate enema is an alternative to non-surgical methods in childhood ileocolic intussusception. However, prospective and multi-center studies are required to confirm the efficiency of reduction with phosphate enema.

The findings obtained in this study suggest, that phosphate enema is effective in patients with a short duration of symptoms, without rectal bleeding, and short ileocolic segments. Reduction with phosphate enema may be preferred over other non-surgical methods due to its advantages, such as ease of application, non-exposure of the patient to radiations, and low risk of complications and recurrence. The controlled US is required following treatment with phosphate enema. Thus, it should be used in institutions that have immediate radiologist support.

Declaration of Interest

There are no conflicts of interest in connection with this paper.

References

1. Mensah Y, Glover-Addy H, Etwire V, Appeadu-Mensah W, Twum M. Ultrasound guided hydrostatic reduction of intussusception in children at Korle Bu Teaching Hospital: an initial experience. *Ghana Med J* 2011;45:128-31.
2. Rasheed S, Win T, Fortier MV. Intussusception: it's not always ileo-colic. *Ann Acad Med Singapore* 2019;48:195-8.
3. Marsicovetere P, Ivatury SJ, White B, Holubar SD. Intestinal intussusception: etiology, diagnosis, and treatment. *Clin Colon Rectal Surg* 2017;30:30-9.
4. Muduli JK, Mitra M. A retrospective cross-sectional study of nonsurgical management of childhood intussusception in a tertiary care hospital. *Indian J Child Health* 2017;4:256-9.
5. Bilici S, Avci V. The use of phosphate enema in the treatment of short segment intussusception cases. *East J Med* 2019; 24:227-30.

6. Wang Q, Luo M, Xie X, Wu Y, Xiang B. Can intussusceptions of small bowel and colon be transient? A prospective study. *Eur J Pediatr* 2019;178:1537-44.
7. Anderson J, Furnival RA, Zhang L, et al. A comparison of the efficacy of enema solutions in pediatric emergency department patients. *J Emerg Med* 2019;57:461-8.
8. Goel I, Anand R, Choudhury SR, Agarwal S. Evolving concepts in ultrasonography of pediatric intussusceptions: unequivocal differentiation of ileocolic, obstructive and transient small-bowel intussusceptions. *Ultrasound Med Biol* 2020;46:589-97.
9. Tareen F, Ryan S, Avanzini S, Pena V, Mc Laughlin D, Puri P. Does the length of the history influence the outcome of pneumatic reduction of intussusception in children? *Pediatr Surg Int* 2011;27:587-9.
10. Mendoza J, Legido J, Rubio S, Gisbert JP. Systematic review: the adverse effects of sodium phosphate enema. *Aliment Pharmacol Ther* 2007;26:9-20.
11. Hansen SE, Whitehill JL, Goto CS, Quintero CA, Darling BE, Davis J. Safety and efficacy of milk and molasses enemas compared with sodium phosphate enemas for the treatment of constipation in a pediatric emergency department. *Pediatr Emerg Care* 2011;27:1118-20.
12. Tang P, Law EKC, Chu WCW. Pneumatic reduction of paediatric intussusception: clinical experience and factors affecting outcome. *Hong Kong J Radiol* 2016;19:200-7.
13. Fike FB, Mortellaro VE, Holcomb III GW, St Peter SD. Predictors of failed enema reduction in childhood intussusception. *J Pediatr Surg* 2012;47:925-7.
14. Shekherdimian S, Lee SL. Management of pediatric intussusception in general hospitals: diagnosis, treatment, and differences based on age. *World J Pediatr* 2011;7:70-3.
15. Caruso AM, Pane A, Scanu A, et al. Intussusception in children: not only surgical treatment. *Journal of Pediatric and Neonatal Individualized Medicine* 2017;6:e060135.
16. Kritsaneepaiboona S, Sangkhathatb S, Kanngurnc S. Pneumatic reduction of intussusception: factors affecting outcome in Thailand. *Asian Biomedicine* 2011;5:235-41.
17. Binkovitz LA, Kolbe AB, Orth RC, et al. Correction to: Pediatric ileocolic intussusception: new observations and unexpected implications. *Pediatr Radiol* 2019;49:76-81.