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# The Use of Phosphate Enema in the Treatment of Short Segment Intussusception Cases

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**ABSTRACT**

In the treatment of intussusception wide variety of surgical and non-surgical treatment modalities have been applied so far. Nowadays, it is usually treated with hydrostatic and pneumatic reduction. In this study, the reduction of short segment intussusception by using phosphate enema was used as a practical method which was not previously reported.
We retrospectively reviewed the cases of intussusception that is named reduction by phosphate enema applied by rectal administration in the pediatric surgery department. 88 patients were included in the study. Monobasic sodium phosphate + dibasic sodium phosphate containing 67.5 ml solution (Fleet Enema®) or Sodium Dihydrogenphosphate 3,5 gr + Disodium Hydrogenphosphate containing 67.5 ml solution (BT® Enema) was administered rectally in one shot. After defecation, the patients were reevaluated with ultrasonography.
The procedure was successful in 80 cases. Eight cases in which the procedure was unsuccessful were treated by ultrasound guided hydrostatic reduction.
During childhood, short segment intussusception cases can be managed successfully with phosphate enema, it is easy to apply and a practical treatment. We believe that this approach would be an acceptable treatment when it is validated with larger scale studies.

**Key Words:** Intussusception, phosphate enema, children

## Introduction

Intussusception which is the invagination of one part of the bowel into another was first described by Barbette in 1674 (1). A wide variety of surgical and non-surgical treatment modalities have been applied so far. Nowadays, it is usually treated with hydrostatic and pneumatic reduction (2,3). In this study, the reduction of short segment intussusception induced by phosphate enema treatment used as a practical method that was not previously identified was reported.

## Material and Methods

In this study cases of invagination which are reducted by rectally applied phosphate enema in pediatric surgery clinic between 2010 and 2017 retrospectively reviewed. Cases with 4 cm or less invaginated bowel segment length on ultrasonography (USG), patients with abdominal pain that continues less than 24 hours, with a good general conditions and normal vital signs were included to study. Cases with peritoneal irritation findings, abnormal electrolytes, rectal bleeding, abdominal distension and patients with air-fluid levels at the X-R abdomen were excluded from the study.

Hemogram and other biochemical tests were checked for all patients before reduction. After informed consent was obtained from the patient's family, the patient was placed on the right or left side or in the supine position by pulling his/her legs to the belly. After that, monobasic sodium phosphate + dibasic sodium phosphate containing 67.5 ml solution (Fleet® Enema, Kozmed Company, Ankara, Turkey) or Sodium Dihydrogenphosphate 3,5 gr + Disodium Hydrogenphosphate containing 67.5 ml solution (BT® Enema, Yenişehir Company. Ankara, Turkey) was administered rectally in one shot. After the application, the patient was mobilized and was sent to the toilet when he/she felt the need for defecation. After defecation, the patient was reevaluated with USG. USG guided hydrostatic reduction of intussusception with warm saline was performed in the case of an unsuccessful reduction. The patients were

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**Table 1.** Descriptive statistics and comparison results to success

| | | N | Mean | Min. | Max. | p* |
|---|---|---|---|---|---|---|
| Length of the segment | Successful | 80 | 2,50±0,84 | 1,00 | 4,00 | |
| | Unsuccessful | 8 | 3,25±0,80 | 2,50 | 4,00 | 0,01 |
| | Total | 88 | 2,56±0,86 | 1,00 | 4,00 | |
| Age | Successful | 80 | 3,65±2,18 | 0,17 | 10,00 | |
| | Unsuccessful | 8 | 3,00±2,18 | 0,42 | 6,00 | 0,42 |
| | All | 88 | 3,59±2,17 | 0,17 | 10,00 | |

N: number of patients Min: minimum Max: maximum
*:Mann-Whitney U test

**Table 2.** Descriptive statistics and comparison results to gender

| | | N | Mean | Min. | Max. | p# |
|---|---|---|---|---|---|---|
| Length of the segment | Male | 54 | 2,62±0,85 | 1,50 | 4,00 | |
| | Female | 34 | 2,47±0,87 | 1,00 | 4,00 | 0,40 |
| | All | 88 | 2,56±0,86 | 1,00 | 4,00 | |
| Age | Male | 54 | 3,77±1,90 | 1,00 | 8,00 | |
| | Female | 34 | 3,30±2,55 | 0,17 | 10,00 | 0,33 |
| | All | 88 | 3,59±2,17 | 0,17 | 10,00 | |

N: number of patients Min: minimum Max: maximum
**: Student t test*

observed for up to 24 hours to be aware of possible complications and recurrence.

This study is carried out in accordance with the principles of the Helsinki Declaration. Local ethics committee approval was obtained (approval No: 04). Also, informed consent was obtained from the legal guardians of all individual participants.

**Statistical Analyses:** Continuous statistical variables were expressed as mean, standard deviation, minimum and maximum values, whereas categorical variables were expressed with numbers and percentages. Student's t test and/or Mann Whitney U test was used for comparisons of continuous variables. Statistical significant level was considered as 0.05 and SPSS (version: 21.0, Armonk, NY: IBM Corp) was used for all statistical computations.

## Results

88 children (50 male, 38 female) were included into the study. The mean age was 3,59±2,17 years and the mean length of the invaginated segment was 2,56±0,86 cm. The procedure was successful in 80 cases. There was an inverse relation between invaginating segment length and reduction success (Table 1). Reduction was found to be more successful in cases with less length (P<0,05). However, gender and age did not have any effect on the success of the reduction in invagination (P>0,05) (Table 2).

Postreduction control hemogram and biochemical tests were normal in successfully treated patients. Eight cases in which the procedure was unsuccessful were treated by USG guided hydrostatic reduction. The segment size was 4 cm at the six cases and 3 cm at the two case in which the procedure was failed. A patient with recurrence within the first 24 hours was treated again by phosphate enema reduction. No complication was occurred in any patient. Except for the recurrent case, all cases were discharged at the latest 24 hours later.

## Discussion

Various methods and devices including ingestion of heavy metal, bloodletting, blowing, tobacco smoke through glyster pipe, electricity with fixed electrodes of abdominal wall or rectum, oral or topical medical drugs, buginage, manual reduction per rectum, surgical treatment, pneumatic reduction with air or other gases, hydrostatic reduction with liquid (water, salin, oil or barium) were used for the treatment of intussusception in the past (4). Today, it is usually treated with hydrostatic and pneumatic reduction (2,3).

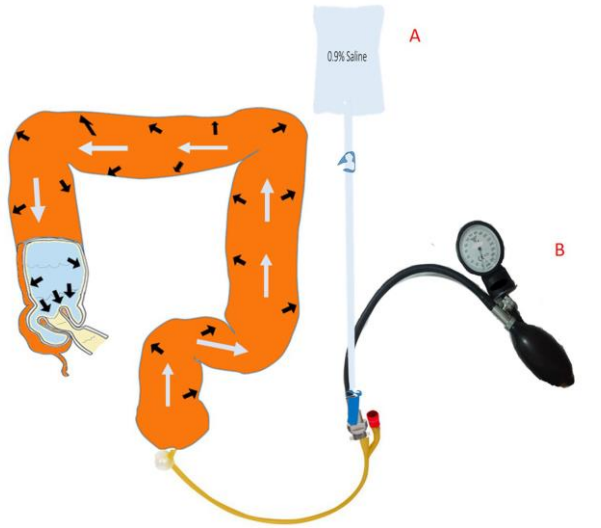


**Fig. 1.**
**A.** The liquid introduced into the rectum reducts the invaginated segment by creating pressure on the inner wall of the intestine
**B.** The air introduced into the rectum reducts the invaginated segment by creating pressure on the inner wall of the intestine

Surgical intervention is performed on patients with signs of peritonitis upon initial presentation, and in cases which hydrostatic or pneumatic reduction was not successful (2-4).

Hydrostatic and pneumatic treatments are performed by pushing the invaginated intestine with air and liquid pressurization applied through the intestine lumen. In the pneumatic reduction, air pressure is created in the colon by introducing air or carbon dioxide through the catheter placed into the rectum or the entering of the anal canal. The pressure is carefully increased to a maximum of 120 mmHg, which is reduced by pushing the invaginated segment (Figure 1) (5). Meanwhile, the reduction is controlled by fluoroscopy or ultrasound. In hydrostatic reduction, a Foley catheter is inserted into the rectum in the same manner. The hydrostatic pressure created by barium or saline is let to the free flow at 80-120 cm height, which is reduced by pushing the invaginated segment (Figure 1). The roles of saline and air enema in the reduction of childhood intussusception have been compared in numerous studies (3,6,7). Although both methods have been shown to be superior to another, both of them are widely used in clinical practice (6,7). Both methods are performed in either short and long segment intussusception independent of the length of the invaginated intestinal segment.

In this study, the reduction therapy with phosphate enema was used as an alternative treatment to other methods which can be easily

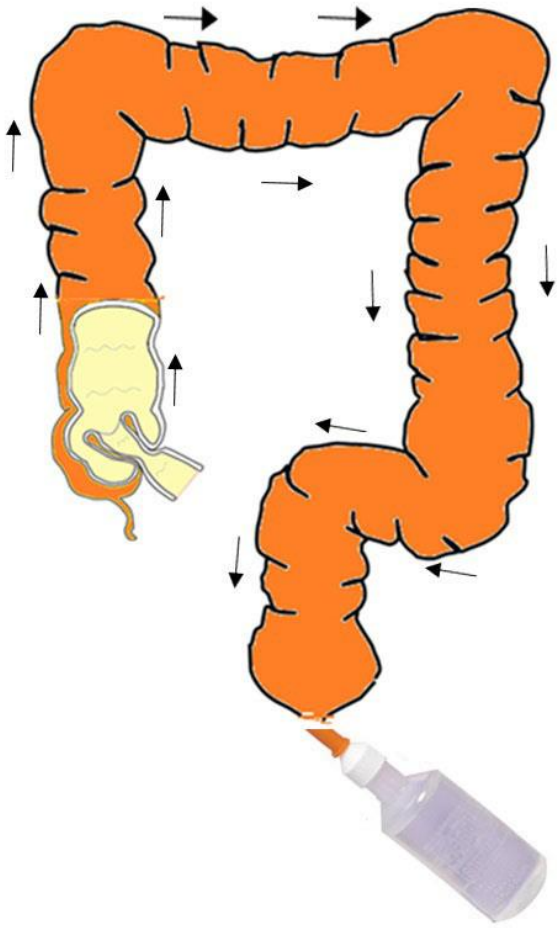

**Fig. 2.** The reduction of the invaginated segment due to colonic peristaltic waves induced by the phosphate enema application which leads to the migration of the outer layer over the inner layer of intestine

applied in short segment invaginations. The mechanism of action of the administered treatment is based on the reduction of the invaginated segment initiated by the colonic peristaltic wave caused by the phosphate enema. The segmentation is resolved by moving the wall of the outermost distal segment leading to slide over the invaginated segment (Figure 2). With this method, we successfully treated 80 (90.9 %) of 88 patients. In the case of short segment or early intussusceptions that have not yet developed edema, it is possible that the outer wall is resolved by sliding over the inner wall. However, during long segment intussusception and late events, circulatory disturbance and edema make this sliding difficult. For this reason, treatment is successful in short segment intussusceptions. In our study, 74 cases out of 76 with an invaginated segment length shorter than 4 cm were successfully treated (97.3%). The success was achieved in 6 out of 12 cases with a segment length of 4 cm (50%). These results show that the

method is more effective when the segment length is less than 4 cm (P<0,05). However, other treatment modalities have been recommended for long segment invaginations which are longer than 4 cm.

Phosphate enemas are used for the treatment of acute and chronic constipation and for colon cleaning in both children and adults. It increases motility by creating osmotic activity and distension in the rectum (8-11). For this reason, there is no risk of perforation which occurs in pneumatic reduction or hydrostatic method that is caused by intraluminal pressure increase. However, it has been reported that phosphate enema treatment is associated with metabolic disorders such as hyperphosphatemia, hypokalemia, hypokalemic acidosis (9-12). However, these adverse effects have usually been reported in cases with another underlying disease causing alteration in absorption or excretion (11). The cases we treated with phosphate enema were healthy children who were fed orally until a few hours ago before the procedure and their routine blood tests were normal. In any of our cases, there were no side effects such as the reported electrolyte imbalance of phosphate enema. However, the cases were discharged after a minimum of 12 hours and a maximum of 24 hours observation for a possible side effects and complications. This fast discharge procedure also shows us that the reduction with phosphate enema can be carried out easily in emergency conditions even without taking patients to the clinic.

Consequently; in childhood, the use of phosphate enema in the reduction of short segment intussusception is successful, easy to apply and a practical treatment. According to our knowledge, this is the first study showing that phosphate enema can be used as an alternative method for the treatment of short segment intussusception. We also believe that this approach would be an acceptable treatment when it is validated with larger scale studies.

**Conflicts of Interest:** None

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