

## Study on Some Effective Factors for Successful Non-Surgical Reduction in Intussusception among Children

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### Abstract

#### Background

Intussusception is the main cause of bowel obstruction and one of the most common surgical emergencies that can occur during childhood. That is why this study investigates the effective factors for non-surgical reduction in patients who have experienced successful reduction in intussusception to determine the effective factors.

#### Materials and Methods

This retrospective study was performed between 2011 and 2017. The following subjects, including age, gender, degree of reduction, leukocyte level, symptom onset interval, Appearance of Signs and the Visit of Children, presence of blood in stool, free abdominal fluid in ultrasound, and length of the intestinal tract involved in ultrasonography, were extracted.

#### Results

A total of 217 patients with intussusception had visited the emergency department. The average of the leukocyte level of children with successful intussusception non-surgical reduction was lesser the children with unsuccessful intussusception non-surgical reduction and there was a significant difference ( $P < 0.0001$ ). The average distance between the appearance of signs and the visit of children was  $1.66 \pm 0.4$  days for successful intussusception non-surgical reduction and  $4.31 \pm 0.6$  days for unsuccessful intussusception non-surgical reduction. There were 30 instances (21.6%) of blood in stool positive and 109 (78.4%) instances of blood in stool negative.

#### Conclusion

The success rate of non-surgical reduction is relatively high and has a significant relationship with age, leukocyte level, and the distance between the beginning of signs and visit, the existence of blood in stool, and the length of the involved intestine.

**Key Words:** Children, Intussusception reduction, Surgery, Ultrasound.

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## 1- INTRODUCTION

Intussusception is the main cause of bowel obstruction and one of the most common surgical emergencies that occur during childhood, with a peak of emergence between the ages of four and 10 years (1). Although it has been reported at all ages and even during the foetal stage (which has later resulted in intestinal atresia), intussusception is the most common abdominal emergency and the second most common cause of intestine obstruction in children under two years of age; it can happen in different parts of the small intestine and the colon (2). Sixty to 80 percent of instances of intussusception occur in children between the ages of three months and 3-year-old, and it is rare in children under three months old and children over three years old (3).

Males are affected by intussusception three times as many times as females and with an increase in age, this rate reaches eight times (4). The diagnosis of intussusception is based on health history and clinical examination (5). Symptoms include intermittent cramping abdominal pain, vomiting, and stool with blood. This triad can happen simultaneously at the beginning of the disease in less than 15 percent of the instances (6). In later stages, stool can be found mixed with blood and in the final stages after intestinal ischemia, dark red mucus or red currant jelly can form (7). Intussusception is the plunging one part of the intestine into another. More than 80 percent is ileocolic (8).

In developed countries, the death rate caused by intussusception is less than 1 percent (9). The experience of healthcare professionals and reducing the side effects after enema plays an important role in medical success. The relapse of intussusception in different studies ranges from 4 to 11 percent (10, 11). Intussusception, if diagnosed early and treated in time, can have a good prognosis; however, if it is left untreated, it can cause

death in 2–5 days. In fact, effects of intussusceptions are directly related to the time when the symptoms start to show as well as the treatment time (12). Children who are treated within 24 hours fully recover, but they will have problems. Delaying treatment can lead to more damage, such as irreversible texture damage, intestine perforation, infection, and death (13). If patients who cannot be treated with the reduction method are on determined using laboratory and clinical radiology criteria, we could prevent useless procedures, extra costs, and reduce complications. This is why this study investigates the effective factors for non-surgical reduction patients.

## 2- MATERIALS AND METHODS

### 2-1. Design and Setting

This retrospective study was conducted according to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Statement (14).

### 2-2. Inclusion Criteria of Study

Children who were diagnosed with ultrasonography were initially subjected to non-surgical resuscitation and the information from the files was fully and properly recorded in consecutive emergency department patients who had enrolled between 27 June 2011 and 15 November 2017.

### 2-3. Exclusion Criteria of Study

Children, who underwent surgery for the first time because of the risk of nonsurgical relief from the outset, had clear signs of peritonitis, hypovolemic shock symptoms, abdominal gas abnormalities, childhood clinical instability, and perforation in the intestine.

### 2-4. Methods and Measurements

In order to collect information, all the files of children with intussusception were considered within the specified time period. The subjects included age, gender,

degree of reduction, leukocyte level, symptom onset interval, Appearance of Signs and the Visit of Children, presence of blood in the stool, free abdominal fluid in ultrasound, and length of the intestinal tract involved in ultrasonography. The information was extracted from the records according to the criteria of entry and exit of the study and was recorded in the checklist.

## 2-5. Data Analysis

The variables were described with the SPSS software version 22.0 and then to study the correlation between the variables, the chi-squared test and the independent sample t-test were used. The significance level of 0.05 was considered for the statistical tests.

## 2-6. Ethical approval

This study was approved by Ethics Committee of Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran.

## 3- RESULTS

### 3-1. Characteristics of Cases

In this study, a total of 217 patients with intussusception had visited the emergency department and were treated with nonsurgical intussusception reduction (**Figure.1**). In total, 34.6 percent (n=75) of the study subjects were female. Out of all the successful non-surgical reductions, there were 90 cases who were male (64.7%) and 49 were female (35.3%). Out of the unsuccessful non-surgical reductions, there were 52 cases who were male (66.7%) and 26 were female (33.3%). The mean age of the children with successful reduction was  $50.5 \pm 9.5$  months old and the mean age of children with unsuccessful was  $49.2 \pm 3.8$  months old (**Table.1**). In total, after surgery, 69.6 percent of the intussusception treatments were successful and 30.4 percent were unsuccessful. The average age of children

with successful was lesser than the children with unsuccessful reduction ( $P=0.009$ ). There was no significant relationship between the gender of the children with intussusception and the success of non-surgical reduction ( $P= 0.8$ ).

### 3-2. Level of Leukocyte

The average leukocyte level of children with successful intussusception non-surgical reduction was lesser than the leukocyte level of children with unsuccessful non-surgical reduction intussusception; a significant difference of ( $P<0.0001$ ) was observed. Thus, the average level of leukocytes in children with significant intussusception non-surgical reduction was significantly lowers (**Table.2**).

### 3-3. Appearance of Signs and the Visit of Children

The average distance between the appearance of signs and the visit of children was  $1.66 \pm 0.4$  days for successful reduction and  $4.31 \pm 0.6$  days for unsuccessful reduction. The average distance of the beginning of the signs in children with successful reduction was less than the children with unsuccessful reduction and there was a significant difference ( $P<0.001$ ). Therefore, the average distance of the beginning of the signs in children with successful intussusception non-surgical reduction was significantly less (**Table.2**).

### 3-4. Blood in the Stool

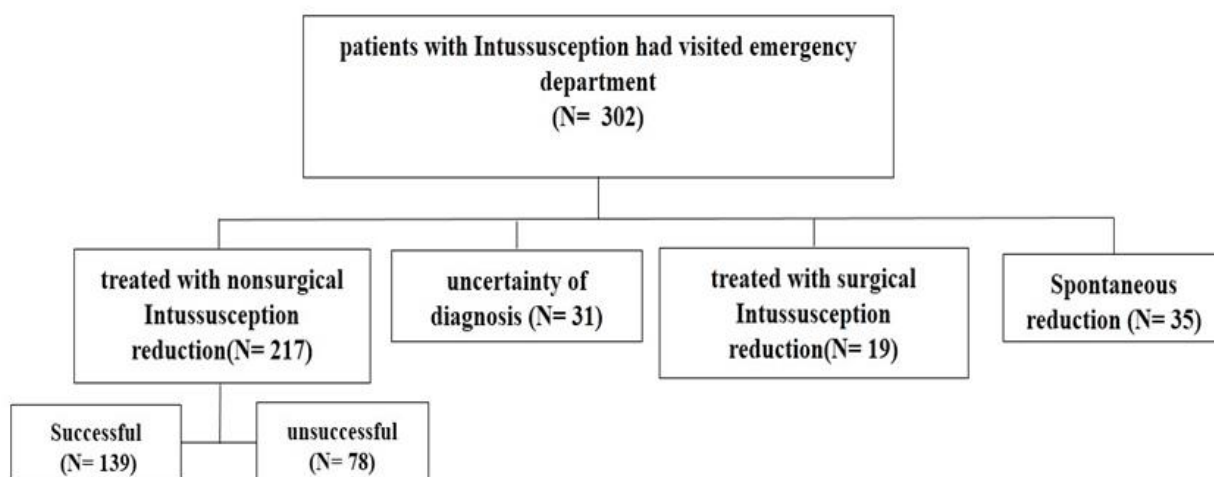
In general, out of successful intussusception non-surgical reductions, there were 30 instances (21.6%) of blood in stool positive and 109 (78.4%) instances of blood in stool negative. There is a significant relationship between the existence of blood in the stool of children with intussusception non-surgical reductions and successful intussusception non-surgical reductions ( $P<0.0001$ ) (**Table.2**).

### 3-5. Abdominal Free Fluid

Generally, out of the successful non-surgical reductions, there were 72 instances (51.8%) of abdominal free fluid positive and 67 instances (48.2%) of abdominal free fluid negative. Out of the unsuccessful non-surgical reductions, there were 65 instances (83.3%) of abdominal free fluid positive and 13 instances (16.7%) of abdominal free fluid negative. There was no significant relationship between the abdominal free fluid in children with intussusception and the success of non-surgical reduction (P=0.5) (Table.2).

### 3-6. Average Length of the Involved Intestine

The average length of the involved intestine in children with successful intussusception non-surgical reduction was  $37.25 \pm 11.18$  mm and it was  $54.77 \pm 15.12$  mm in unsuccessful intussusception non-surgical reduction. The average length of the involved intestine in children with successful intussusception non-surgical reduction was lower in comparison to unsuccessful intussusception non-surgical reduction and it was a significant difference (P<0.0001). Thus, the average length of the involved intestine in children with successful intussusception non-surgical reduction was significantly less (Table.2).



**Fig.1:** Flow diagram chart of patients with Intussusception had visited emergency department.

**Table-1:** Demographic characteristics clinical diagnoses intussusception had visited emergency department.

| Age                          | (Months)    |
|------------------------------|-------------|
| Unsuccessful Intussusception | 49.2±3.8    |
| Successful Intussusception   | 50.5±9.5    |
| Gender                       | N (%)       |
| Girl                         | 75 (34.6)   |
| Boy                          | 142 (65.4)  |
| Intussusception              | N (%)       |
| Unsuccessful Intussusception | 78 (35.9%)  |
| Successful Intussusception   | 139 (64.1%) |

**Table-2:** Clinical, and laboratory variables in children intussusception.

| Subjects  | Total (n=217) | Successful reduction (n= 139) | Unsuccessful reduction (n= 78) | P-value |
|---|---------------|-------------------------------|--------------------------------|---------|
| Level of leukocyte (Cell/dl)                        | 10.63±2.63    | 9.8±2.14                      | 12.11±2.95                     | 0.0001  |
| Appearance of Signs and the Visit of Children (Day) | 2.61±0.7      | 1.66±0.4                      | 4.31±0.6                       | 0.0001  |
| Blood in the stool                                  |               |                               |                                |         |
| Yes   | 73 (33.6%)    | 30 (21.6%)                    | 43 (55.1%)                     | 0.0001  |
| No  | 144 (66.4%)   | 109 (78.4%)                   | 35 (44.9%)                     |         |
| Abdominal free fluid                                |               |                               |                                |         |
| Yes   | 137 (63.1%)   | 72 (51.8%)                    | 65 (83.3%)                     | 0.5     |
| No  | 80 (36.9%)    | 67 (48.2%)                    | 13 (16.7%)                     |         |
| Average length of the involved intestine (mm)       | 34.47±13.83   | 37.25±11.18                   | 54.77±15.12                    | 0.0001  |

#### 4- DISCUSSION

In general, there were intussusception non-surgical reductions that were carefully studied according to the variables. Among these, 139 children (64.1%) had successful non-surgical reductions. On average, almost two thirds of the reductions were successful. In different studies (13, 15), the success rate of children with reductions was described as high and it was considered one of the principal actions for children with intussusception. These results show that the success of intussusception non-surgical reduction is relatively high. Which rate in societies with lower socioeconomic status and overcrowded societies is relatively higher (16). The average age of children with successful intussusception non-surgical reduction was lower than children with unsuccessful intussusception non-surgical reduction. The difference in these two means is significant; that is, typically, children with intussusception at lower ages had higher successful intussusception-reduction rates. One can clinically conclude that in children younger than one year, it is better that treatment be performed because it will provide better and more suitable clinical results. Age was not mentioned as a significant factor in the

effect on intussusception non-surgical reduction (17, 18). The results from this study that were considered significant only indicate the epidemiological source of it and cannot have specific clinical values.

The average leukocyte level in children with successful intussusception non-surgical reduction was lower than in children with unsuccessful intussusception non-surgical reduction. The difference between these two means is significant; that is, usually, children with intussusception with lower levels of leukocyte have higher rates of success in reduction. Thus, in case of low levels of leukocyte, it is better that reduction is performed; in the event of failure during the first attempt, the procedure should be repeated so that it can become successful. In these studies, the results concerning leukocytes were different. In a study by Kritsaneepaiboon et al. (2011), high leukocyte content led to a decrease of the success of reduction and prognosis in patients; this finding is similar to the finding of the present study (13). In the works of Farshidmehr et al. (2011) and Yalcin et al. (2009), however, there was no relation found between leukocytose and leukocyte level, and the success of reduction and the prognosis of the patient (18, 19). The Appearance of Signs and the

Visit of Children in children with successful intussusception reduction was less than the children with unsuccessful intussusception reduction. The difference between these two means was significant. This means that, in general, children with intussusception, who visited earlier since the beginning of the signs, had a higher success rate of reduction. Thus, health education provided to mothers and children should consider that the event of alarming signs, such as severe abdominal pains (severe crying in infants and specific positions in older children), lower gastrointestinal bleeding, bile vomiting, and other signs, calls for an immediate visit to a health center.

According to the results and the lower complications of reduction without surgery as well as the education of families about health in this regard, it is better to be included in the educational priorities of societies. In the work of Tareen et al. (2011), it was mentioned that due to the decrease in the success of reduction in later stages (from the beginning of the signs to visit and diagnosis), reduction should be used as a form of primary treatment because it still has a high probability of success and can avoid surgical interventionist actions (15).

The existence of blood in the stool of children with unsuccessful intussusception reduction was relatively higher than children with successful reductions and the difference was significant. According to the previous instance, the existence of signs and a late visit, and the appearance of an increasing number signs decreases the success of reduction. Thus, visiting and performing the reduction before more severe signs (lower gastrointestinal bleeding and blood in stool) can significantly improve the success of reduction. The average length of the involved intestine in children with successful intussusception reduction was less than children with unsuccessful

intussusception reduction. The difference was significant. As a result, the lesser the involvement length, the greater the success rate of non-surgical reduction. In the work of Bartocci et al. (2015), it was argued that ultrasound in children with intussusception before medical actions, such as nonsurgical reduction, and patients' follow-ups after reduction in choosing the treatment and performing it as well as checking the medical status after treatment is very effective (20). The use of ultrasound is also effective in determining the amount of the involvement of the intestine and performing nonsurgical reduction in a way that employs lower involvements with fewer intestine segments; in this case, the success rate of nonsurgical reduction is far higher and patients experience better prognosis. These findings demonstrate the importance of quicker medical intervention and checking the status of the patient through radiologic actions.

## 5- CONCLUSION

According to the results, the success rate of non-surgical reduction is relatively high and has a significant relationship with age, leukocyte level, and the distance between the beginning of signs and visit, the existence of blood in stool, and the length of the involved intestine.

**6- CONFLICT OF INTEREST:** None.

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