

# The effectiveness of pneumoreduction for intussusception



Ann. Ital. Chir., 2014 85: 459-463  
pii: S0003469X14021320

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## The effectiveness of pneumoreduction for intussusception

**INTRODUCTION:** To detect the effectiveness of pneumoreduction (PR) in intussusception, which is one of the most common reasons of abdominal pain in infancy and childhood.

**METHODS:** The records of patients treated in our clinic for intussusception between January 2005 and June 2012 were reviewed retrospectively. There were 150 patients aged between 2 months – 12 years of age; 48% (72) were girls, 52% (78) were boys.

**RESULTS:** The most common complaint and clinical findings were abdominal pain (94.6%), vomiting (82.6%), rectal bleeding (81.3%), and discomfort (70.9%). An abdominal mass was observed in 73.3% of patients. PR was successfully performed in 86% of patients. It was carried out once in 86% of these patients and twice in 8.1%. PR was unsuccessful in six patients and they underwent surgery. Manual reduction (31 or 67.4% of operated patients) and resection – anastomosis (15 or 32.6 % of patients) were performed by surgery. Perforation occurred in two patients (1.3%) during manual reduction.

**CONCLUSION:** PR is an effective method in the treatment of intussusception with a high success ratio and a low complication ratio. It was possible to perform the procedure especially in patients who came in the early stage of the condition.

**KEY WORDS:** Bowel obstruction, Child, Children, Pneumoreduction, Intussusception

## Introduction

Intussusception is invagination of the proximal bowel into the distal bowel. It is frequently found at ileocolic level <sup>1</sup>, in children aged 6-24 months in autumn and spring <sup>2</sup>. Patients have symptoms like abdominal pain, bilious vomiting, and rectal bleeding <sup>3</sup>.

Intussusception is one of the most common causes of acute abdominal pain in children. Between 2-12% of these patients have a leading point. Infections, Meckel's diverticulum, and in older children lymphoma, appendix, polyps, carcinoid tumor and gastrointestinal duplications are some of the causes that lead to intussusception. Meckel's diverticulum, an lymphadenitis at ileum level, is the most common cause. <sup>1,2,3</sup>

Medical history, X – ray and ultrasonography (US) are important for diagnosis. Target sign at ultrasonography is a typical finding in intussusception. The condition can be treated by minimally invasive methods in the early stages however, if diagnosed late, intestinal necrosis, perforation, and sepsis can occur <sup>1-3</sup>.

To treat intussusception hydrostatic or pneumatic reduction can be performed. If reduction is unsuccessful or

Pervenuto in Redazione Febbraio 2013. Accettato per la pubblicazione Maggio 2013

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patients are diagnosed late, surgery is the preferred choice of treatment <sup>4</sup>. If intussusception is not diagnosed complications like necrosis, perforation, fluid – electrolyte imbalance due to vomiting and fluid loss can occur <sup>5</sup>. The aim of this study was to examine the treatment choices for intussusception, one of the most common causes of abdominal pain in infancy and childhood, in particular the effectiveness of PR that we use in our clinic.

## Methods

We assessed the records of patients with intussusception who were treated in our clinic between January 2005–June 2012. There were 150 patients; 72 (48%) girls and 78 (52%) boys, aged from 2 months – 12 years of age. If intussusception was diagnosed in the early stages, PR was chosen as the treatment method. Patients were laid on a C arm fluoroscopy table after sedation and analgesia. A 16-Fr Foley catheter was placed in the rectum and its balloon was filled with 10 – 15 cc saline solution to avoid leakage of air during reduction. Air flow was achieved with a sphygmomanometer at a level of 80 mmHg in infants and 120 mmHg in children. At the same time we observed the reduction of the intussusception on the monitor (Fig. 1). The procedure ended when air passed into the small intestine. Recurrence was controlled with US after 5 – 6 hours (Fig. 2). Patients who could not be treated with air, came on the 3rd day or later, were older than 5 years of age and who had ileoileal intussusception were immediately operated on. Operations (manual reduction or resection–anastomosis) were performed by a median incision.



Fig. 1: Pneumoreduction (PR) procedure is shown.



Fig. 2: Ultrasonographic examination shows target sign.

## Results

Patients complained of abdominal pain (142 patients, 94.6%), vomiting (124 patients, 82.6%), rectal bleeding (122 patients, 81.3%), and discomfort (105 patients, 70%) (Fig. 3). There was a palpable mass at physical examination in 85 (56.6%) patients.

PR was carried out on 110 (73.3%) patients. The procedure was successful at the first attempt in 95 (86.3%) patients and at the second attempt in 9 (8.2%). It was not successful in 6 (5.5%) patients (Fig. 4).

Forty six patients were operated on. 22 of them were diagnosed late, 10 had ileoileal intussusception, 6 had unsuccessful PR and 8 were older than 5 years of age. Manual reduction was performed in 31 (67.4%) patients and resection – anastomosis was carried out done in 15 (32.6%). Necrotic bowel segments were found in 7 (46.6%) patients, Meckel's diverticulum in 5 (33.3%) and lymphoma in 3(20) in pathological examinations. Recurrence was seen in 13 (8.6%) patients 5 (3.3%) of them occurred the first in 48 hours and 8 in the first 5 months; PR was performed successfully in these patients.

No patients died in this series. Two patients (1.3%) experienced bowel perforation during reduction. Wound infection was seen in 2 (1.3%) patients and briden ileus in 2 years in 2 (1.3%) patients.

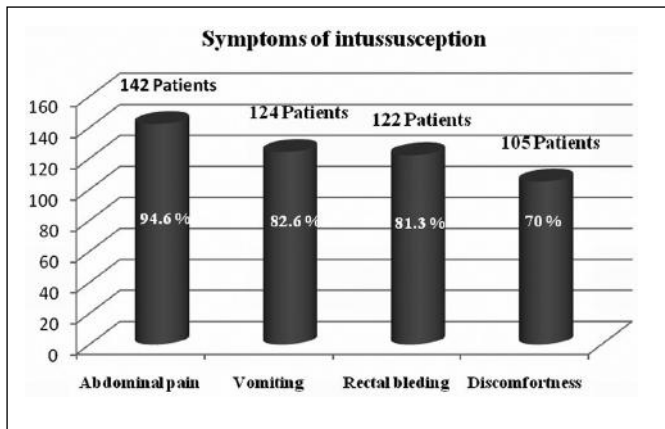


Fig. 3: Symptoms of patients with intussusception

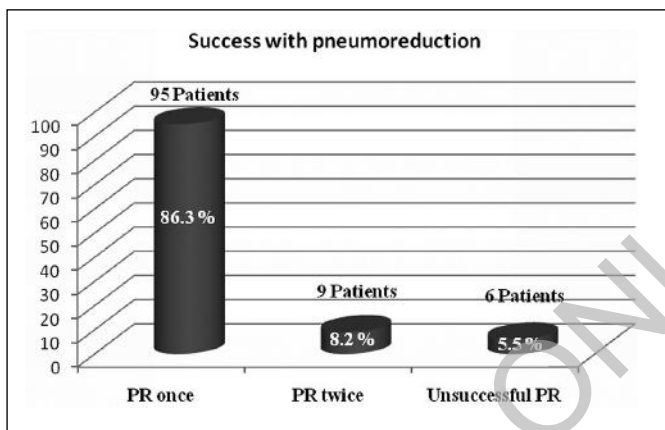


Fig. 4: Success with pneumoreduction(PR)

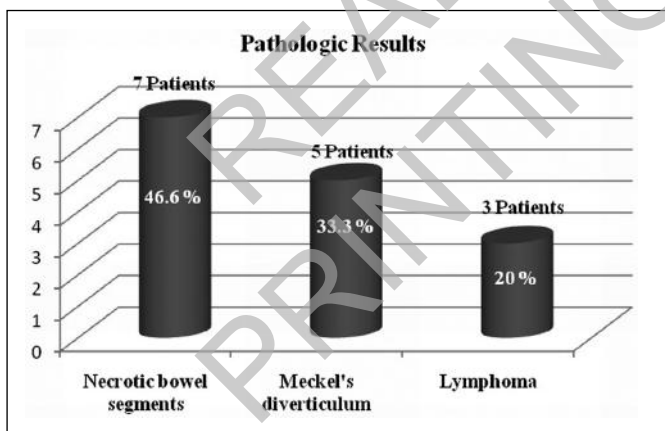


Fig. 5: Pathologic results.

## Discussion

Intussusception, especially seen in children with good digestions, is one of the most cause of common acute abdominal pain in children. Its incidence is 0.6-2.2/1000

in Europe <sup>6</sup>. Vomiting, abdominal pain, rectal bleeding, lethargy, and abdominal mass are the most common symptoms and findings. The patient experiences has discomfort, vomiting and crying when intussusception occurs. 84% of patients have abdominal pain <sup>7,8</sup>. Caliskan et al. <sup>9</sup> reported that all of the 20 patients in their study had colic abdominal pain, 18 of 20 patients (90%) had bilious vomiting and 6 of 20 patients (30%) had rectal bleeding. In our study 142 patients (94.6%) had abdominal pain, 124 (82.6%) had vomiting, 122 (81.3%) had rectal bleeding and 105 patients (70%) had discomfort. 130 of our patients (86.6%) had an infection a short time before intussusception occurred. Intussusception must be considered in differential diagnosis for children younger than 2 years old who have nonspecific symptoms like abdominal pain, vomiting, and discomfort.

Intussusception is an important cause of acute abdominal pain in infants and children and early diagnosis is a very important in this illness. US is the most commonly used imaging method <sup>10</sup>. Target sign on US is specific typical indication of intussusception <sup>11,12</sup>. In this study the success rate for US was 98% ( t showed the target sign in 147 of 150 patients).

In the literature intussusception at the ileocolic level was seen in 80-90% of patients, at the ileoileal level in 15% of patients and at the colocolic level in 2-3% of patients<sup>13</sup>. In this study intussusception was ileocolic in 136 patients (90.6%), ileoileal in 10 patients (6.6%) and colocolic in four patients (2.6%), similar to the literature. Patients with ileoileal intussusception did not have reduction and they were operated on immediately.

Nonoperative treatment is the preferred choice for intussusception; if this can not be done patients are operated on. Reduction with barium, air or fluid under US or fluoroscopy takes place in nonoperative treatment. Hadidi et al. <sup>15</sup> reported a 90% success rate for pneumoreduction, 90% for reduction with barium and 67% for reduction with fluid under US. Lui et al. <sup>16</sup> reported that the success rate for PR was 80-92%. The success rate for PR was 86.2% in another study <sup>17</sup> and the authors reported that the processing time was shorter and that the perforation and recurrence rate was lower in PR than in reduction with barium. PR was succesful in 104 of 110 patients (94.6%) in our study. The success rate of this method is due to careful selection of suitable cases for PR and care during the process.

The disadvantage of PR is exposure to X-rays for the duration of the process, but the X-ray dose has decreased with new fluoroscopy machines <sup>11</sup>. We took interrupted images in this study so patients were exposed less to X-rays.

One nonoperative treatment alternative is hydrostatic reduction with US. Tander et al. <sup>19</sup> reported the success rate of this method as 80%, whereas Hadidi et al. <sup>15</sup> reported this method' s success rate as 67%. Gloria del-Pozo et al. achieved a success rate of 76-95% with this

method. The advantages of this method are no exposure to X-ray, the ability to evaluate all abdominal organs and intestinal contents and low perforation potential (0.26%). The only disadvantage is that it requires experience<sup>19</sup>.

Reduction with air and fluid can cause perforation. The use of barium and saline solutions is becoming rare due to the risk of various complications. The risk of perforation in these methods is 0.8%<sup>11</sup>. However, peritonitis, adhesions and infection may occur in the event of this complication. There is no difference in the risk of perforation between air and fluid reduction methods<sup>20</sup>. Hadidi et al.<sup>15</sup> reported no perforations in the PRs they carried out on 50 of 147 patients. Perforations occurred in three of 50 patients who underwent reduction with barium and two of 47 patients with hydrostatic reduction. Definite contraindications for reduction are perforation and peritonitis. The risk of perforation is 0.1-3% and the risk of recurrence is 6-10% for hydrostatic and pneumatic reductions<sup>8</sup>. In this study, perforation occurred in two (1.3%) patients in whom reduction was performed after the 3<sup>rd</sup> day. Due to this finding, it can be said that the procedure be performed because the risk of perforation for PR rises after the 3<sup>rd</sup> day due to intestinal edema, fragility, and necrosis. If perforation occurs patients have overdistention of the abdomen and dyspnea. In this situation, the air in the abdomen must be released via a large lumen catheter until the patient is operated on. We did not experience any complications like peritonitis or infection due to perforation.

Operative treatment is carried out for patients in whom reduction with air and fluid are unsuccessful or who have findings like peritonitis and septic shock. The success of nonoperative treatment decreases in patients with a leading lesion. Operations can be performed either as an open procedure or laparoscopically. Kia et al.<sup>21</sup> compared open and laparoscopic surgery and reported that there was no significant difference in operation duration, price, hospitalization time and complication rate between the two methods. Operations can be performed by upper right, down transverse or median incisions<sup>21</sup>. Ekenze et al. operated on 71 patients and carried out manual reduction in 39 and resection-anastomosis in patients who could not have manual reduction or who had intestinal necrosis<sup>22</sup>. In our study we performed manual reductions in 31 (67.4%) patients and resection-anastomosis in 15 (32.6%). Manual reduction was performed by open surgery in 27 (87%) patients and laparoscopically in 4 (13%).

In the study of Caliskan et al. 5 (25%) of 20 patients were operated on<sup>9</sup>. Only one (20%) of them had Meckel's diverticulum. In our study 6 patients whose intussusception could not be reduced by air had manual reductions. The others were patients who had come to hospital in the later stages (22 patients, 43.4%), had ileoileal intussusception (10 patients, 21.7%) and were older than 5 years of age (8 patients, 17.3%). Surgery

was performed because air reduction is not successful in the later stages or in ileoileal intussusception, when there is a leading point, or in patients older than 5 years of age. The number of patients older than 5 was eight in our study and three (20%) of them had lymphoma. In addition 5 (33.3%) of 15 patients who had resection-anastomosis had Meckel's diverticulum.

Recurrence can occur at a rate of be 2-20% after air or fluid reduction<sup>23</sup>. In some studies it was seen to occur in the first 72 hours in 30-64% patients and in the first 6 months in others. Recurrence may occur more than once in the same patient. In one study there was a leading point in 10% of patients<sup>24</sup>. Recurrence occurred in 13 patients (8.6%) in our study, 5 (3.3%) of them occurred in the first 48 hours and the others (5.3%) in the first 5 months, all of them were resolved by air reduction.

The postoperative complications are ileus due to adhesions, wound infection, and anastomosis leakage. Mortality due to intussusception is lower than 1% with early diagnosis, correct patient selection and treatment<sup>25</sup>. In our study there were two (1.3%) cases of ileus and two (1.3%) of wound infections in the first two years in our study. There was no incidence anastomosis leakage or mortality.

## Conclusions

PR is an effective treatment method with a high success and low complication rate. It can be successfully performed in carefully selected patients in the early stages. Surgical treatment is preferred treatment for patients in the later stages of the condition

## Riassunto

Scopo dello studio è quello di definire l'efficacia della pneumo-riduzione (PR) nell'intussuscezione, che rappresenta una delle più comuni cause di dolore addominale nell'infanzia.

Per questo fine sono stati ricontrollate retrospettivamente le cartelle cliniche dei pazienti trattati nella nostra clinica per una intussuscezione tra il gennaio 2005 e giugno 2010. Si tratta di 150 pazienti dell'età compresa tra 2 mesi e 12 anni; 71 (48%) erano ragazze e 78 (52%) ragazzi. La causa più comune del ricovero e la sintomatologia clinica erano rappresentate da dolore addominale (94,6%), vomito (82,6%), rettorragia (81,3%), e disagio addominale (70,9%). Nel 73,3% dei pazienti è stata palpata una massa addominale.

La riduzione pneumatica è stata effettuata con successo nel 86% dei pazienti, nell'86% dei casi una sola volta, e nel 8,1% due volte.

La riduzione pneumatica si è dimostrata inefficiente in 6 pazienti, e questi sono stati sottoposti ad intervento

chirurgico. In 31 pazienti operati (67,4%) è stata effettuata intraoperatoriamente una riduzione manuale, in 15 pazienti (32,6%) la soluzione adottata è stata una resezione-anastomosi. Durante la riduzione manuale in due pazienti (1,3%) si è verificata una perforazione. La riduzione pneumatica si è dimostrata un metodo efficace per il trattamento dell'intussuscezione con una elevata incidenza di successo e bassa evenienza di complicanze. Essa si è dimostrata possibile specialmente nei casi di insorgenza più recente.

## References

1. Aschcraft K: *Intussusception*. In: Aschcraft K, Holter T (eds): *Pediatric Surgery*. Philadelphia: WB Saunders Co, 1993; 416-19.
2. Rosenfeld K, McHugh K: *Survey of Intussusception Reduction in England, Scotland and Wales: How and why we could do better*. *Clinical Radiology*, 1999; 54:452-58.
3. Young D: *Intussusception*. In: O'Neil JA, Rowe MI, Grosfeld JL (eds): *Pediatric Surgery*. St. Louis: Mosby, Year Book, 1998; 1185-198.
4. Kiristioğlu I: *Invajinasyonlarda tedavi yaklaşımları*. *The Journal of Current Pediatrics*, 2004; 2:131-33.
5. Bruce J, Huh YS, Cooney DR: *Intussusception: Evolution of current management*. *J Pediatr Gastroenterol Nutr*, 1987; 6:663.
6. Smyth R, McCallions WA, Paterson A: *Total Jejunoileal Intussusception: A Case Report and Literature review*. *Ulster Med J*, 2009; 78 (1):10-12.
7. Ein SH, Stephens CA, Minor A: *The painless intussusception*. *J Pediatr Surg*, 1976; 11:563-46.
8. Zorludemir Ü, Yücesan S, Olcay I: *Invajinasyon: 168 hastanın klinik de erlendirmesi*. *Journal of the Turkish Association of Pediatric Surgeons*, 1987; 2:81-89.
9. Çaliskan B, Güven A, Atabek A, et al.: *Çocukluk çağı invajinasyonları*. *Gülhane Medical Journal*, 2007; 49:236-39.
10. Melek M, Edirne Y, Beger B: *Çocuklarda invajinasyon: 26 Olgunun Gözden Geçirilmesi*. *Van Tip Dergisi*, 2008;15(3):81-86.
11. Basaklar AC, Türkyılmaz Z. *Invajinasyon*. In: Basaklar AC (ed): *Bebek ve Çocukların Cerrahi ve Ürolojik Hastalıkları*. Ankara, Palme Yayıncılık, 2006; 791-803.
12. Sarihan H, Din H, Abes M, et al.: *Invajinasyon tanısında ultrasonografinin yeri*. *Journal of the Turkish Association of Pediatric Surgeons*, 1996; 10(1-2): 32-35.
13. Cankorkmaz L, Köylüoğlu G, Arslan MS, et al.: *Our childhood cases with intussusception and pneumatic reduction*. *Turkish Journal of Trauma & Emergency Surgery*, 2010; 16 (4):363-66.
14. Daneman A, Navarro O: *Intussusception Part 2: An update on the evolution of management*. *Pediatr Radiol*, 2004; 34:97-108.
15. Hadidi AT, El Shal N: *Childhood Intussusception: A Comparative Study of Nonsurgical Management*. *Journal of Pediatric Surgery*, 1999; 34 (2): 304-307.
16. Lui KW, Wong HF, Cheung YC, et al.: *Air enema for diagnosis and reduction of intussusceptions in children: Clinical experience and fluoroscopy time correlation*. *J Pediatr Surg*, 2001; 36(4):79-81.
17. Rubí I, Vera R, Rubí SC, et al.: *Air reduction of intussusception*. *Eur J Pediatr Surg*, 2002; 12:387-90.
18. Tander B, Baskin D, Candan M, et al.: *Ultrasound guided reduction of intussusception with saline and comparison with operative treatment*. *Turkish Journal of Trauma & Emergency Surgery*, 2007; 3:288-93.
19. Del Pozo G, Albillos JC, Tejedor D, et al.: *Intussusception in Children: Current Concepts in Diagnosis and Enema Reduction*. *Radio Graphics*, 1999; 19: 299-319.
20. Kimberly E. Applegat.: *Intussusception in children: evidence-based diagnosis and treatment*. *Pediatr Radiol*, 2009; 39:140-43.
21. Kia KF, Mony VK, Drongowski RA, et al.: *Laparoscopic vs open surgical approach for intussusception requiring operative intervention*. *J Pediatr Surg*, 2005; 40:281-84.
22. Ekenze SO, Mgbor SO, Okwesili OR: *Routine surgical intervention for childhood intussusception in a developing country*. *Ann Afr Med*, 2010; 9:27-30.
23. Holcomb GW, Gheissari A, O'Neill JA: *Surgical management of alimentary tract duplication*. *Ann Surg*, 1989; 209:167.
24. Doody DP, Foglia RP: *Intussusception*. In: Oldham KT, Colombani PM, Foglia RP, Skinner MA (eds): *Principles and Practice of Pediatric Surgery*. Philadelphia: Lippincott & Williams & Wilkins, 2005; 1297-1305.
25. Bruce J, Huh YS, Cooney DR: *Intussusception: Evolution of current management*. *J Pediatr Gastroenterol Nutr*, 1987; 6:663.