

# Intussusception in children: not only surgical treatment

Anna Maria Caruso, Alessandro Pane, Andrea Scanu, Alessandro Muscas, Roberto Garau, Franco Caddeo, Luigi Mascia

Pediatric Surgery Unit, A.O. Brotzu, Cagliari, Italy

## Abstract

**Introduction:** Intussusception is the commonest cause of acute intestinal obstruction in children. Failure of timely diagnosis and treatment results in a surgical emergency leading to fatal outcome. The classic triad of symptoms is seen in less than one-third of the children affected. Aim of this study was to evaluate the comprehensive management of intussusception in children, evaluating the outcome of conservative treatment with hydrostatic ultrasound reduction and surgery.

**Material and methods:** A retrospective analysis was conducted including pediatric patients (up to 14 years old) with diagnosis of bowel intussusception. The management and treatment depended on the patients' situation: for children in good general conditions initial hydrostatic reduction under continuous ultrasonographic monitoring was attempted; if severe dehydration and/or septic shock was observed, the conservative treatment was contraindicated and direct surgical treatment was performed.

**Result:** A total of 44 pediatric patients were included in the study. The most frequent symptoms observed were paroxysmal abdominal pain (100% of cases) and vomiting (72%); only 29% of patients presented with the classic triad of symptoms (abdominal pain, palpable mass and blood stained stools). 28 patients (64%) were managed conservatively with ultrasound hydrostatic reduction. 10 patients (23%) required primary surgical intervention because of clinical conditions; 6 patients (14%) were operated after failure of conservative approach. The total percentage of operated patients was 36%, with lead points identified in 12 cases.

**Conclusion:** Our data confirm that hydrostatic reduction is a simple, real time procedure, free of radiations, non invasive and safe. Age had no impact on the reducibility whereas bloody stool, a prolonged duration of symptoms and the presence of lead point were risk factors of failure.

## Keywords

Bowel intussusception, abdominal ultrasound, hydrostatic reduction, pediatric surgery, pathological lead point, emergency.

## Corresponding author

Anna Maria Caruso, PhD, MD, Pediatric Surgery Unit, A.O. Brotzu, Cagliari, Italy; phone: 320 4070522; email: annacaruso2@libero.it.

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## Introduction

Intussusception is the commonest cause of acute intestinal obstruction in infancy and early childhood. Failure of timely diagnosis and treatment leads often to a surgical emergency due to development of intestinal ischemia, perforation and peritonitis leading to fatal outcome [1]. Intussusception is often seen in children aged four months to two years with a peak of incidence between four and nine months of age. Etiology of intussusception is reported to be idiopathic in about 90% of cases and rarely it is associated with pathological lead points such as Meckel's diverticulum, appendix, intestinal polyp, solid bowel lesions and intestinal lymphoma [2-4]. The classic triad of symptoms consisting of abdominal pain, vomiting and blood in stools is uncommon and seen in less than one-third of the children affected. Cases often present with non-specific symptoms, including emesis, pain, irritability, decreased appetite and lethargy, making diagnosis of intussusception difficult [5-7]. Successful management of intussusception depends on early recognition and diagnosis, fluid resuscitation, antibiotic therapy and prompt reduction [8]. Abdominal ultrasound is the mainstay for its diagnosis. Non-surgical management includes hydrostatic reduction (HR) by air, liquid or contrast enema. Surgical management usually involves exploratory laparotomy with manual reduction and bowel resection may be necessary in some children if the blood supply is compromised.

Aim of this study was to evaluate the comprehensive management of intussusception in children, evaluating the outcome of conservative treatment with ultrasound HR and surgery.

## Material and methods

### *Patients*

A retrospective analysis of the last three years (2013-2016) was conducted in our center; all pediatric patients (up to 14 years old) hospitalized with diagnosis of bowel intussusception were included in the study. The clinical records included: age, gender, signs, symptoms (type and onset), number of any previous episodes of intussusception and their treatment, concomitant pathologies and intolerance, ultrasound data, laboratory parameters and performed treatment. We evaluated risk factors of HR failure.

### *Management*

An ultrasonography was performed when patients presented suspicion symptoms and signs of intussusception, in order to confirm the diagnosis and exclude other causes. Diagnosis was based on the presence of the "target sign" on cross section and the "sleeve sign" on vertical section on ultrasound images. The collected ultrasound image data included: location and diameter of the intussusception, free fluid in abdomen, intestinal dilatation at the proximal end and presence of visible pathological lead point.

Electrolytes and smooth muscle relaxants were given intravenously if diagnosis was confirmed. The management and treatment depended on the patients' situation: if severe dehydration and/or septic shock was observed, the conservative treatment was contraindicated and direct surgical treatment was performed. For children in good general conditions initial HR under continuous ultrasonographic monitoring was attempted; if reduction failed or unstable vital signs were observed, enema was discontinued and surgical management was proposed. If intussusception recurrence was observed in the next hours, HR was performed again whenever possible.

### **Reduction technique**

After fluid and electrolyte correction, HR was performed by using saline under ultrasound guidance. With child in a supine position and his parents next to him, a Foley catheter was introduced in the rectum and maintained by inflating its balloon with 60 ml air; the buttocks were joined with a band aid in order to avoid leaks. The rectal cannula was connected to a 1.5 L warm (37°C) saline bottle suspended about

1 to 1.2 m above the table level to maintain for the reduction the appropriate hydrostatic pressure in the colon, initially about 80 cm H<sub>2</sub>O increasing up to a maximum of 120. The passage of saline into the ileum through the ileocecal valve ensures successful reduction. No time limit was imposed on the duration of the procedure; however, cessation of retrograde movement of the intussusception for more than 15 minutes was regarded as a failed attempt. The procedure was repeated 10 minutes later, with a maximum of 4 attempts.

All children received analgesia adapted to their pain score before attempted reduction (paracetamol); sedation using midazolam (intrarectal, sublingual or intravenous) was used on ad hoc basis, depending on the clinical context. All children were kept under medical supervision, no oral intake was permitted for the following 24 hours and intravenously fluids and antibiotics were given. After 12 to 24 hours ultrasonography was repeated to exclude early recurrence.

### Statistical analysis

Analysis of quantitative and qualitative data was performed for all items. Continuous data are expressed as mean. The intergroup differences were assessed by the chi-square test as needed for categorical variables; the univariate analysis of variance (ANOVA) was performed for parametric variables. P-values were two-sided and  $p < 0.05$  was considered statistically significant.

## Results

A total of 44 pediatric patients (pts) were included in the study. The demographic and patho-

logical data are summarized in **Tab. 1**. 30% of cases (13 pts) occurred below two years of age while 71% (31 pts) were in older patients. Clinical presentation and correlation with treatment was described in **Tab. 2**. The most frequent symptoms observed were paroxysmic abdominal pain (100% of cases) and vomiting (72%); characteristically it was shown that only 29% of patients presented with the classic triad of symptoms (abdominal pain, palpable mass and blood stained stools) whereas 73% presented both abdominal pain and vomiting miming gastroenteritis.

Regarding onset, in 48% (21 pts) symptoms lasted less than 24 h; 23% of patients were evaluated the day before with a diagnosis of acute gastroenteritis; duration of symptoms longer than 24 h and blood stained stool were correlated to failure of conservative treatment and primary surgery.

Ultrasonography was the method of diagnosis in 100% of cases, with typical images visualized in upper and lower right quadrant in 80% of cases and in 86% the diameter of intussusception was greater than 3 cm.

The commonest site of intussusception was ileocolic (93%) followed by ileoileal in 7% whereas left colon was involved in 32% of cases.

Among all cases, 64% (28 pts) were managed conservatively with ultrasound HR with an average of 2.8 attempts made during a single procedure. We had no perforation or other complications during or after all procedures. The 53% of the children submitted to HR were sedated by midazolam before the reduction attempt.

23% (10 pts) required primary surgical intervention because of clinical conditions with sign of acute abdomen and in 8 (18%) a pathological lead point was observed during surgery; 14% (6

**Table 1.** Demographic and pathological data.

	All	HR success *	HR failure ^	Primary surgery §	p
Number	44	28	6	10	< 0.05 * vs ^§
Age (mean years)	3.56	3.64	2.1	4.7	< 0.05 ^ vs §
Sex (M/F)	30/14	19/9	3/3	8/2	< 0.05 in *§
Onset symptoms					
< 24 h	21	20	1	/	< 0.05 * vs ^§
> 24 h	23	8	5	10	< 0.05 § vs ^
Lead points	21	9	4	8	< 0.05 *§ vs ^
Type of invagination					
Ileoileal	3	1	2	/	NS
Ileocolic	41	26	6	9	< 0.05 * vs ^§
Left colon involved	14	/	6	8	< 0.05 * vs ^§

HR: hydrostatic reduction.

**Table 2.** Clinical presentation and outcome.

	Total	HR success *	HR failure ^	Primary surgery §	p
Number	44	28	6	10	
Abdominal pain	44 (100%)	28 (100%)	6 (100%)	10 (100%)	< 0.05 * vs ^§
Vomiting	32 (73%)	17 (61%)	6 (100%)	9 (90%)	< 0.05 * vs ^§
Rectal bleeding	15 (34%)	3 (11%)	3 (50%)	9 (90%)	< 0.05 ** vs §
Diarrhea	12 (27%)	7 (25%)	4 (67%)	1 (10%)	< 0.05 * vs ^§
Abdominal palpable mass	30 (68%)	19 (68%)	2 (33%)	9 (90%)	< 0.05 * vs ^§
Abdominal pain + vomiting	32 (73%)	20 (71%)	4 (67%)	8 (80%)	< 0.05 * vs ^§
Abdominal pain + rectal bleeding + abdominal palpable mass	13 (30%)	5 (18%)	2 (33%)	6 (60%)	< 0.05 ^ vs *§

HR: hydrostatic reduction.

pts) were operated after failure of conservative approach and in 4 (9%) a pathological lead point was observed. The total percentage of operated patients was 36%, with lead points identified in 12 cases: 3 Meckel diverticulum, 1 polyp, 1 focal solid lesion and 7 hypertrophic lymph node (diameter > 1 cm). 3 patients required bowel resection. There were no complication after surgical treatment, only 1 patients had delayed oral feeding resumption with need of prolonged parenteral nutrition.

9% (4 pts) had a history of previous episodes of intussusception and of these 2 had been treated conservatively and 2 with surgery.

During the hospitalization the recurrence (early recurrence) rate was 9% (4 pts), and all after HR; of these, 1 was treated again with HR whereas 3 underwent surgery. During the follow-up of three years, only 2 patients were found to have recurrence (late recurrence): 1 treated with HR and 1 operated.

## Discussion

Pediatric intussusception is a common pediatric disorder that occurs when the proximal portion invaginates into the distal portion of the bowel as to a telescope. In most infants the intussusception involves the ileum invaginating into the cecum through the ileocecal valve. Because of twist and compression of the mesenteric blood vessels, the affected intestine becomes inflamed and edematous with further compression that can lead to bowel obstruction, vascular compromise and bowel necrosis if not treated promptly [1-3]. In some cases

the intussusception reduces spontaneously but if untreated can be fatal.

In approximately 90% of cases the pathogenesis of intussusception is idiopathic and is assumed to be related to uncoordinated peristalsis of the gut or to lymphoid hyperplasia, which may be caused by a recent gastrointestinal infection [9]. Only 10% is associated with pathological lead points (secondary intussusception, SI) as focal masses or diffuse bowel wall abnormality [4, 5]; the presence of pathological lead points does not allow the spontaneously reduction and SI is usually associated with more obvious symptoms of bowel obstruction, longer length of intussuscepted bowel and presence of free intraperitoneal fluid. Unfortunately it is impossible to predict pathological lead points based only on clinical manifestations.

Early diagnosis can be difficult because many cases have only a sudden onset of colicky pain that recurs at frequent intervals with irritability or other nonspecific complaints; they also can be comfortable and behave normally, between paroxysms of pain, making it difficult to distinguish from other benign causes of abdominal pain. Previous studies have shown that the typical presentation of abdominal pain (vomiting, rectal bleeding and palpable mass) occurs in less than 25% of patients [6, 7].

For all these reasons, imaging studies play a significant role in the management of patients with clinically suspected intussusception. Plain radiography has not been very useful in diagnosis because of the low sensitivity and specificity. Contrast or air enema has been used for diagnosis as well as therapeutic reduction but, because of

potential risk of perforation and radiation exposure, its current use has been more therapeutic than diagnostic.

Ultrasound is an invaluable imaging modality in the evaluation of pediatric gastrointestinal pathology with a sensitivity rate of 98% to 100% and a specificity rate of 88% to 100% for diagnosis of intussusception [10]; a recent review [11] noted that larger intussusception diameter and the presence of lymph nodes within the intussusception favored ileocolic type and a length greater than 3.5 cm is a strong predictor of need for surgical intervention.

The management of pediatric intussusception has evolved greatly, from immediate operative intervention after diagnosis to routine radiologic reduction and minimal morbidity. Intussusception reduction is defined as the release of the telescoped bowel and this can be performed manually with surgery or conservatively either hydrostatically or pneumatically under fluoroscopic or ultrasonographic monitoring.

Surgery is currently reserved for patients who are unstable with evidence of peritonitis or perforation, for patients in regions without radiologic expertise or most commonly for those patients in whom enema reduction is unsuccessful [12].

Therefore, without contraindications, conservative treatment is the standard and although several factors such as younger age, blood per rectum and longer duration of symptoms have been previously shown to reduce the success rate of enema reduction, none of these preclude an initial attempt [13].

The preferred method of enema reduction is not standardized: both hydrostatic and air enemas can be used to reduce intussuscepted bowel, either under the guidance of fluoroscopy or ultrasonography.

Several studies supported the use of ultrasound because it eliminates ionizing radiation exposure, ensures continuous monitoring of the retrograde movement of intussusception; the visualized free flow of saline into the ileum indicates the reduction evaluating also differences between a thickened valve and residual intussusception [14-17].

The overall recurrence rate for intussusception is approximately 10%, with an early recurrence rate (within the first 24 h) ranging from 0% to 6% after conservative treatment against 0-4% after surgical reduction, probably because of adhesions created in intestine to surrounding tissues [18-21]. Risk factors for recurrence have not been clearly defined and the management of recurrent episode is also controversial.

Our data confirm that HR is simple and safe because we had no perforation or complications with a success rate similar to literature (60%); we used it also in children with previous episode of intussusception, regardless of how they were already treated. The surgical treatment was the treatment of choice only in few cases and after failure of HR.

Comparing with literature, also in our study the classic clinical presentation was observed only in few cases with a high risk of misdiagnosis as gastroenteritis. Main differences regarded the incidence of lead points because it was higher and also in younger children; the incidence of early recurrence was lower and this probably was correlated to the effectiveness of the specific protocol we used, able to distinguish recurrence or residual intussusception from thickened ileocecal valve.

In conclusion the disease has a good prognosis with early diagnosis and treatment and therefore we recommend the tempestive use of abdominal ultrasound in all patients with symptoms of suspected intussusception, because a diagnosis delay is associated to failure of conservative treatment. Cases of recurrent episodes of abdominal pain concentrated in a short period, even without alarm sign, should have particular attention, because they could be episodes of transient intussusception that may no longer be resolved spontaneously if repeated or misdiagnosed.

### Declaration of interest

The Authors declare that there is no conflict of interest. No competing financial interests exist.

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