

# Intérêt de l'échographie dans le traitement hydrostatique des invaginations intestinales aiguës

## Interest of ultrasound in the hydrostatic treatment of acute intussusception

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### Résumé :

**Prérequis :** L'invagination intestinale aiguë est l'urgence type en chirurgie pédiatrique. Son diagnostic est facile grâce à l'apport de l'échographie. Certes la réduction sous contrôle radioscopique en l'absence de ses contre-indications est la méthode la plus utilisée, cependant sa prise en charge thérapeutique peut aussi être réalisée sous contrôle échographique.

**But :** L'objectif de cette étude est d'évaluer la prise en charge de l'invagination intestinale aiguë en mettant en valeur les différentes modalités thérapeutiques et en insistant sur l'apport de l'échographie dans le traitement de cette affection.

**Méthodes :** Notre travail est une étude rétrospective de 142 cas d'invaginations intestinales aiguës colligés dans le service de chirurgie pédiatrique de l'hôpital Habib Thameur sur une période de 13 ans.

**Résultats :** Il s'agissait de 92 garçons et 50 filles. L'âge médian était de 13 mois. En l'absence de contre-indications, la réduction hydrostatique sous contrôle radioscopique était tentée pour 90 enfants (63,4%) et nous avons eu 75 succès (83,4%). La réduction hydrostatique sous contrôle échographique a elle été tentée pour 38 patients (26,8%) avec 30 succès (78,9%) (Pas de différence significative entre les deux taux de succès des deux techniques,  $p=0,7$ ).

**Conclusion :** La nécessité de peu de matériel lors de la réduction hydrostatique sous contrôle échographique et surtout l'absence d'irradiation ainsi que le coût relativement peu élevé par rapport aux autres techniques de réduction font de cette modalité thérapeutique une technique de choix avec un taux de succès comparable.

### Abstract :

**Background :** The acute intussusception is a typical emergency in pediatric surgery. Its diagnosis is easy thanks to the contribution of the ultrasound. In the absence of contra-indications, reduction under a fluoroscopic guidance is certainly the most widely used method. However, the therapeutic care can also be performed under sonographic guidance.

**Aim :** The objective of this study is to evaluate the management of acute intussusception by highlighting the different therapeutic modalities and by emphasizing the contribution of ultrasound in the treatment of this affection.

**Methods :** This paper describes a retrospective study of 142 intussusception patients treated in the Department of Pediatric Surgery of "Habib Thameur" Hospital over a period of 13 years.

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**Results :** 92 boys and 50 girls have been studied with a median age of 13 months. In the absence of contra-indications, hydrostatic reduction under radioscopy control have been applied for 90 children (63,4%) with 75 cases have been successful (83,4%). Furthermore, hydrostatic reduction under ultrasound guidance was attempted for 38 patients (26,8% of the population). It gave a good result in 30 cases with a success rate of 78,9% (No significant difference between the rate of success of both techniques,  $p=0.7$ ).

**Conclusions :** The necessity of little material during the hydrostatic reduction under ultrasound guidance and especially the absence of irradiations as well as the cost relatively a little raised with regard to the other techniques of reduction make of this therapeutic modality a technique of choice especially as the rate of success is comparable.

**Mots-clés :** Invagination intestinale aiguë, Echographie, Lavement, Radioscopie, Chirurgie, Enfant

**Key-words :** Acute intussusception, Ultrasound, Enema, Fluoroscopy, Surgery, Child

## INTRODUCTION :

The intussusception is defined as the penetration of an intestinal segment in an underlying portion [1]. It requires a therapeutic emergency because of the ischemic and necrosis involved risks. Indeed, any clinical suspicion should trivially lead to the realization of additional tests to support the diagnosis. The echography is the unavoidable diagnostic test. The medical care in such case has become less surgical over years. It is based on a hydrostatic or pneumatic reduction under fluoroscopic or ultrasound guidance necessitating the presence of a surgeon, a radiologist and a resuscitator. The surgical treatment is reserved to failed reductions and to evolved and complicated forms [2].

## PATIENTS AND METHODS :

### 1. Patients:

Our study is a retrospective investigation on the medical care of intussusception in children. It includes 142 cases, aged under 14 years, who have been hospitalized for an acute intussusception, in the Pediatric Surgery Department of Habib Thameur Hospital in Tunis, over a period of 13 years (from January 2001 to December 2013).

### 2. Methods:

In general, the child was hospitalized once the diagnosis of an intussusception was retained after an abdominal ultrasound. All the patients were perfused, hydrated and warmed. The children who had to undergo an attempt of hydrostatic reduction have had a premedication with diazepam in an intra-rectal dose of 0.5 mg/kg. The children having contra-indications to hydrostatic reduction un-

derwent surgery.

We had the ability to follow-up the hydrostatic reduction either by radioscopy or by ultrasound. The method of choice depended on the habits of the custody team.

The child is placed in the supine position. A rectal cannula is then inserted into the anus. Hand pressure on buttocks allows avoiding leakage of the contrast agent. The liquid jar is maintained 60 to 80 cm above the patient table. After the tubing valve opening, the liquid progression into the rectum and the gastrointestinal tract, is made in the anti-peristaltic direction thanks to the gravity. The intussusceptum progression is assisted by radioscopy or by ultrasound. In the case of insufficient progression, further attempts can be accomplished without exceeding a total of three.

The radiological criteria of disinvagination are: the visualization of the stopping image, the substance progression, the visualization of caecum in place, the flooding of the small intestine with a total filling of the last ileal bight.

The sonographic criteria of disinvagination are: the tracking of a transonic fluid picture dotted with echogenicity showing air bubbles moving from the rectum to the intussusceptum. Due to the hydrostatic pressure increase, the intussusceptum is pushed down to the caecal bottom level. The disappearance of the intussusceptum and the sudden and massive serum irruption in the last small bight characterize the disinvagination.

The common disinvagination criteria are: the pain disappearance, a peaceful sleep, the child takes his bottle and releases gases.

The surgical treatment is indicated in the case of failure or a contra-indication to the hydrostatic reduction. The way is chosen by the operator according to the location of the intussusceptions: A Mac Burney or a median incision is opted for when the intussusceptum is located respectively at the right or the left hemi-abdomen.

### 3. Use of data and statistical analysis:

#### 3.1. Descriptive study:

Simple and relative frequencies have been calculated for qualitative variables. For quantitative variables, the following statistical parameters have been calculated: the mean and median values and the range extent (the difference between the extrema).

#### 3.2. Analytical study:

- Mean data comparison:

The comparison of the mean data has been performed for independent groups using the t-student test. In the case of small number of subjects, the non-parametric test of Mann-Whitney has been used.

- Percentage comparison:

The percentage comparison between independent groups has been performed using the chi-square

test of Pearson. In the case of invalidity of this method, the Fisher exact bilateral test has been used. In all statistical tests, the significance level has been set at 0.05.

## RESULTS

Our population included 142 children (50 girls and 92 boys) with a sex ratio of 1.8. The median age was 13 months, ranging from 1 month to 13 years old. 19 children had a background with an abdominal pain which disappeared spontaneously.

The clinical symptoms of the acute intussusception were polymorphic. The classical triad including rectal bleeding, vomiting and abdominal pain was observed in 35 cases (24.7%). The most common examination symptoms were: an abdominal sensitivity (observed in 70 cases – 49.3%), a rectal bleeding (observed in 40 cases – 28.2%) and an oval abdominal mass (observed in 34 cases – 23.9%).

All the patients have been examined by abdominal X-ray and ultrasound. The most common radiography symptom was the scarcity of bowel gas. It was seen in 59 cases (41.5%). The other radiographic symptoms were: a good distribution of bowel gas (45 cases – 31.7%), air-fluid levels (26 cases – 18.3%), the distension of the digestive bights (10 case – 7%) and a cockade sub-liver image (2 cases – 1.4%) (Figure 1).



Figure 1: the round sub-hepatic aspect

The ultrasound examination showed the intussusception in all cases (Figures 2 and 3).

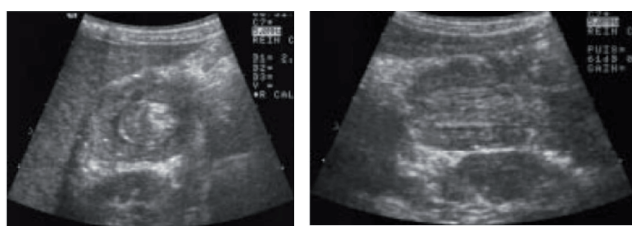


Figure 2: a cross-sectional image in « roundel » Figure 3: a longitudinal image in « sandwich »

Furthermore, the ultrasound revealed an abdominal effusion in 36 cases (25.4%), a mesenteric adenopathy in 34 cases (23.9%) and thickened bights in 6 cases (4.2%).

90 patients (63.4%) have had at least one reduction attempt under fluoroscopic guidance which has been successful in 75 cases (83.3%). 38 patients (26.8%) had at least one attempt of reduction under ultrasound guidance with 30 cases of success (78.9%). Tables I, II and III summarize the achieved results of the hydrostatic reduction under fluoroscopic and under ultrasound guidance, there is no significant difference between the rate of success and failure of both techniques ( $p=0.7$ ).

Table I: Results of the attempts of hydrostatic reduction under fluoroscopic guidance

	Number of cases	(%)	Number of attempts		
			1	2	3
Success	75	83.4	62 cases	8 cases	5 cases
Failure	15	16.6	2 cases	8 cases	5 cases
Total	90	100	64 cases	16 cases	10 cases

Table II: Results of the attempts of hydrostatic reduction under ultrasound guidance

	Number of cases	(%)	Number of attempts		
			1	2	3
Success	30	78.9	23 cases	5 cases	2 cases
Failure	08	21.1	0 cases	0 cases	8 cases
Total	38	100	23 cases	5 cases	10 cases

Table III: Results of the disinvasion under fluoroscopic guidance and ultrasound guidance  
No significant difference between the results of both techniques

	Success	Failure
Hydrostatic reduction under fluoroscopic guidance	75	15
Hydrostatic reduction under ultrasound guidance	30	08

The group of patients with hydrostatic reduction under radioscopic control and the group of patients with hydrostatic reduction under ultrasound were comparable, there was no significant difference concerning the sex, the age and the management time limit (Table IV).

Table IV: Groups of both disinvasion techniques are comparable,  $p>0.05$

	Hydrostatic reduction under fluoroscopic guidance	Hydrostatic reduction under ultrasound guidance	p
Sex ratio	2	1.9	0.91
Age (median month)	13	14	0.32
time limit of management (median hour)	10	12	0.41

The surgical way has been applied in 37 patients. It has been indicated for failure of the hydrostatic reduction in 23 cases and contra-indication to the hydrostatic reduction in 14 cases. It was a Mac Burney and a median incision in respectively 35 (94.6%) and 2 (5.4%) cases. We have found a probable spontaneous reduction in 1 cases (2.7%) with a hyperemia of the last intestinal loops. A manual reduction was performed in 30 cases (81.1%). It was carried out by manually expressing the intussusceptum in the anti-peristaltic direction, until a complete disinvasion. The resection-anasto-

mosis was performed in 6 cases (16.2%). It was indicated due to the impossibility of manual reduction (4 cases) and to an intestinal necrosis (2 cases).

## DISCUSSION

The idiopathic acute intussusception in infants typically occurs between the age of 2 months and 2 years with an incidence peak between 6 and 9 months [2]. Before the age of 2 months and over 2 years old, the intussusception is more likely to be secondary.

In our data, the median age of the children is 13 months, with extremes ranging from 1 month to 13 years old. The sex ratio is almost 3 boys for 2 girls [3,4]. Our results are similar to those in the literature: there is a marked male predominance with a sex ratio of 1.8.

Beyond the positive diagnosis, the interrogation and the clinical examination are intended to assess the severity of the intussusception and thereby to guide the chronology of further tests and the treatment. The simple front snapshot of the abdomen while standing should always be performed. However, its diagnostic confidence is insufficient to confirm the diagnosis and especially to eliminate it. In 11% of the cases, the abdomen radiograph without preparation is normal and does not indicate an intussusception [1]. In our study, it shows no signs suggesting the diagnosis in 31.7% of the cases.

The ultrasound is an essential step of the diagnosis. It is best performed on a quiet child to allow meticulous scanning of the colic frame from the right to the left. The vast majority of intussusceptions are located at the transverse colon or the sub-hepatic part of the colon, which should be particularly examined [5]. With an absolute reliability, proven by Pracros[6] 20 years ago, the ultrasound was the reference diagnosis method. The intussusceptions should then be sought throughout the colonic frame, on the sides and the inner-above-navel zone. Its superficial position makes it easily accessible in the high frequency test. There is no differential diagnosis [7].

The examination shows the position of the intussusceptum top in the colic region. Most intussusceptions are localized at the midline right, on the ascending colon, the right side of the transverse or the right colic angle which is the most usual case. It can be rarely situated at the median line left and exceptionally at the hypogastric region or at the recto-sigmoid [8].

The detection of several nodes in the intussusceptum is an argument for a mesenteric adenolymphitis suggesting a form of idiopathic intussusceptions. It is however not specific [9]. In our study, ultrasound has enabled objectifying the mesenteric lymph nodes in 23.9% of cases.

The enema is not only a diagnostic method, but also an intussusceptions treatment technique in many cases. Nowadays, it is no longer applied in

the diagnostic step [2]. It may have some interest when there is a clinical doubt and the ultrasound does not allow deciding formally on the diagnosis. In our study, the enema method has not been used as a diagnostic mean since the intussusceptions were detected in all cases using ultrasound.

Radiological criteria affirming the intussusceptions reduction using the enema method are strict [10]: the caecum back up in the right iliac fossa, regular caecal walls after reduction, no gap, no parietal notch, a massive opacification of the distal ileum and a formal absence of re-intussusception on the post-evacuation pictures.

The reduction rate depends on the diagnosis time, the location and the age. Overall, the reduction is successful in 65-85% of the cases [8,11]. In our study, we have attempted at least once the disinvagination in 63.4% of the patients under fluoroscopic guidance with a success rate of 83.4%.

The hydrostatic reduction under ultrasound guidance is a more recent technique. An isotonic warm solution, added or not to a water-soluble contrast agent, is used. Under ultrasound guidance, the intussusception is confirmed, the tank level is increased and the disinvagination is tracked by the gradual recoil of the intussusceptum in the direction of the ileocecal region, with an increasing pressure. The procedure is continued until the total disappearance of the intussusceptum and the water filling of the distal ileum. Usually, two or three attempts are required, at an interval varying from 5 to 30 minutes [5].

The strict criteria of disinvagination using the reduction under ultrasound guidance are: the disappearance of the intussusceptum, the observation of the water reflux and the air bubbles in the cecum and in the ileum ascending colon through the ileocecal valve, the ileum loop distension by water and the absence of the intussusceptum even in post-evacuation.

After the reduction, water is removed from the colon. The radiologist should finish its examination by seeking a residual lesion or an immediate recurrence of the intussusception. The average time necessary for the hydrostatic reduction is 10 minutes, with extremes for up to 60 minutes [2]. In a study of 115 patients performed by Soon OC et al. [12], the success rate of this method was 80.9%. For RosenfeldK. [13], this rate was between 50 and 70%. In our series, the success rate was 78.9%. The pneumatic reduction shows a current resurgence of interest [6]. The classical protocol established by Fiorito[14], taken up by Chinese authors and recently by Canadian physicians [15], includes diagnostic and therapeutic steps based on air or oxygen enema. The experience of the operators accounts certainly for as much in the hydrostatic reduction. In fact, this therapeutic method provided excellent results for Chinese authors, with a reduction rate of about

95% in a series of more than 6000 cases. Using a quite similar method, Gu L Toronto [15] obtained 75% as a reduction rate in a series of 118 cases.

The disinvagination under ultrasound control has the following advantages:

- The use of little equipment unlike the enema and the air reduction which requires heavy conventional x-ray equipment and an air injection device. The bowel enema disinvagination using an isotonic serum or warm tap water requires only an ultrasound scanner.

- A relatively low cost in comparison with other techniques.

- It is a non-radiating technique unlike the disinvagination under fluoroscopic guidance which exposes the infant and the medical staff to prolonged and appreciable X-ray doses. Ultrasound is harmless.

However, such a method has some disadvantages:

- The hydrostatic reduction under ultrasound guidance is a long-lasting method in comparison with the other reduction methods. The average time required for the technique application is 10 minutes, with extremes for up to 60 minutes [2]. Some authors like Riebel et al. [16] found that the procedure can last for up to 2 hours and a half.

- This method relies on the experience of the medical staff. Hence, the radiologist plays a critical role in the positive and etiological diagnosis, especially in the therapeutic stage.

The non-surgical treatment of the ileo-colic intussusceptions using the hydrostatic or the pneumatic enema has the advantage of being easy to apply, minimally invasive, efficient in 80-90% of the cases and rarely complicated. However, the lack of randomized and multi-centric studies can explain the difficulty to ascertain the superiority of such diagnostic method and/or of such reduction technique compared with another [5].

## CONCLUSION :

The acute intussusception is one of the most frequent causes of bowel obstruction in infants and young children. The use of little equipment during the hydrostatic reduction under ultrasound guidance, the relatively low-cost and the absence of irradiations in comparison with other reduction methods make this therapeutic approach a technique of choice, especially as the success rate is almost the same.

**Conflit d'intérêt :** aucun

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