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Indications for Repeated Enema Reduction of Intussusception in Children

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SUMMARY

Introduction Intussusception is a common abdominal emergency in early childhood. It is idiopathic in more than 90% of cases with incidence of 1.5-4 per 1,000 live births. The treatment of choice is non-operative hydrostatic or air enema reduction.

Objective The aim of the study was to evaluate the influence of clinical presentation and symptom duration in non-operative treatment, considering the indications for delayed enema reduction and its efficacy.

Methods From the total number of 107 patients with intususssception, aged from 2 months to 14 years (median 9 months), 102 (95%) patients with ileo-colic intussusceptions were treated initially by ultrasound guided saline enema. Records were reviewed for patients with failed initial treatment and delayed repeated enemas or operative procedure. The predictor variable included duration of presenting symptoms.

Results Successful treatment by hydrostatic saline enemas had 58/102 (57%) patients. Success in reduction was greater if symptom duration was <24 hours (54/62 cases; 87%, p<0.001), compared with >24 hours, (4/45 cases; 9%). Despite failed initial attempts, enema reduction was reattempted in 12 patients, with success in 7/12 (60%) patients. Children with symptom duration >24 hours had a greater risk of requiring surgery (41/45 cases; 91%, p<0.001), including 5 (5%) patients with ileo-ileal intussusceptions.

Conclusion The accuracy of ultrasound guided saline enema in intussusception reduction is high. Delay in presentation decreases success of non-operative treatment. Delayed enema reduction is important therapeutic option for intussusceptions. Surgical treatment is indicated in cases of complications.

Keywords: intussusception; nonsurgical reduction; delayed enema

INTRODUCTION

Intussusception is the most common cause of bowel obstruction in patients aged less than 2 years, with a peak incidence at 3 to 9 months and male-to-female ratio of approximately 2:1. Most cases (about 90%) are idiopathic [1], but identifiable lesion acting as a lead point could be found in the average of about 2-12%. Pathological apex of intussusceptum is noticed in less than 5% in a typical age for intussusception, but it is more frequent later in life, i.e. in about 60% of all patients older than 5 years [2].

According to pathophysiology, intussusception is intestinal obstruction with progressive mesenteric strangulation. Ischemia of the intestinal mucosa and venous stasis cause bleeding and mucous outpouring, that result in a red "currant jelly" stool. The classic triad of vomiting, abdominal pain, and passage of blood per rectum during digital examination is a typical constellation of signs and symptoms of intussusception, although it occurs in only one third of patients. Usually, it is accompanied with a sausage-shaped palpable abdominal mass in the right hypochondrium, which is present in about 60% of cases [3].

The traditional diagnostic approach to childhood intussusception is ultrasonography, which is highly accurate with specificity and sensitivity of almost 100% [4]. The most specific plain radiographic findings, the target and meniscus signs, are present in only 25-50% of cases, so the role of plain radiography nowadays is to allow the exclusion of complications, such as intestinal perforation [5]. Contrast enema examination requiring x-ray exposure has been the standard of reference for the diagnosis of intussusception for many years, but the superior performance of ultrasound, a high level of patients' comfort and safety, and ability to arrive at alternative diagnosis has led physicians to reserve enemas for therapeutic purposes [6].

The treatment of choice for intussusception is non-operative, hydrostatic or air enema to achieve an exerting pressure on the apex of intussusceptum in the colon until complete reduction pushing it from the pathologic into the original position is achieved [7]. There are several techniques of nonsurgical reduction, but the use of ultrasound guidance instead of fluoroscopy permits an even more liberal approach to enema therapy owing to the lack of radiation exposure. Being a very safe, because the whole procedure is visualized with real time ultrasound, and also a non-invasive method with a high success rate this procedure has emerged as a useful alternative to surgical treatment [8].

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OBJECTIVE

The purpose of this study was to evaluate the influence of clinical presentation and symptom duration on success of non-operative treatment, as compared to the rate of operative management, with evaluation of the indications and efficacy of delayed enema reduction, the number of reattempts and intervals between them.

METHODS

This is a retrospective and partly prospective cross-sectional study of 107 children diagnosed with intussusception who were treated at the University Children's Hospital in Belgrade, during the period from 1995 to 2012, by nonsurgical reduction or operatively, excluding cases of spontaneous reduction. All patients were subjected to unique diagnostic procedure concerning a thorough history, physical and ultrasound examination, but only some of them had a native abdominal radiography. Records were reviewed for patients who had failed initial saline enema reduction attempts under ultrasonographic guidance and subsequent delayed repeated enemas (in 30-60 minutes from the initial attempt) or operative procedure. The primary outcome variable was success of both initial and delayed repeated enema reduction. The predictor variable was evaluated concerning the duration of presenting symptoms and the effect of delay in presentation on outcome of intussusception. Next, the records were statistically analyzed using the methods of descriptive statistics and Chi-square test.

RESULTS

A total of 107 patients with intussusception were identified, aged from 2 months to 14 years, median 9 months, with prevalence of 66 (62%) boys. The majority of 66 (62%) patients were presented with most common symptoms: pain in the abdomen, vomiting and bloody stool (Table 1). The patients were divided into three groups according to symptom duration: majority of them, i.e. 50 (47%) belonged to the group with symptom duration from 12-24 hours, only 12 (11%) of patients expressed symptoms for less than 12 hours, and 45 (42%) patients for more than 24 hours. Success of non-operative hydrostatic reduction was greater if symptom duration was <24 hours, i.e. in 54 of 62 cases (87%, p<0.001) (Table 2), while patients with symptom duration >24 hours had a greater risk of requiring surgery, i.e. in 41 of 45 cases (91%, p<0.001) (Graph 1). The diagnosis was established by ultrasonography in all patients, with high sensitivity and specificity of 100%. Native abdominal radiography was reliable in only 27 (31%) cases, with 18 (20%) more who were positive but atypical, which indicated the sensitivity of native radiography in only 45 (51%) cases (Table 3). Hundred and two or 95% of patients had ileo-colic intussusceptions. Twenty-seven (25%) of them were confirmed as ileo-cecal, intraoperatively after failed initial

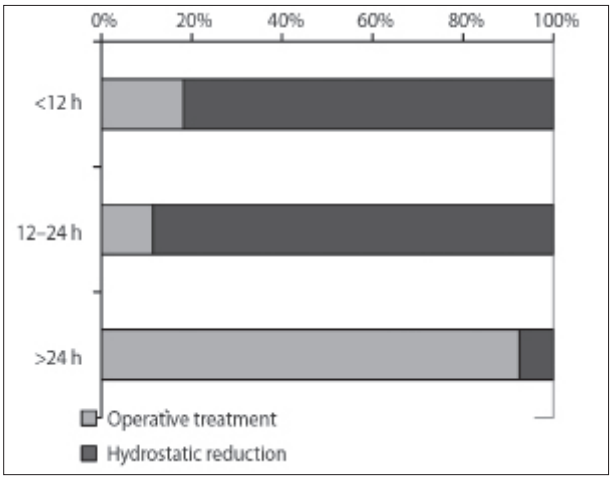
Table 1. Incidence of intussusception according to sex, age and symptoms

Parameter		Number of patients
Sex	Male	66 (62%)
	Female	41 (38%)
	Total	107 (100%)
Age (years)	<2	86 (80%)
	>2	21 (20%)
	Total	107 (100%)
Symptoms	Pain	105 (94%)
	Vomiting	105 (94%)
	Bloody stool	69 (64%)
	All	66 (62%)

Table 2. Influence of symptom duration on the success of treatment modality

Symptom duration (hours)	Operative treatment	Hydrostatic reduction	Total
<12	2 (17%)	10 (83%)	12 (100%)
12–24	6 (12%)	44 (88%)	50 (100%)
>24	41 (91%)*	4 (9%)	45 (100%)
Total	49 (46%)	58 (57%)	107 (100%)

* p<0.001



Graph 1. Correlation between symptom duration and modality of treatment

Table 3. Diagnostic procedures for intussusceptions

Procedures		Number of patients
Ultrasound	Sensitive cases	107 (100%)
	Total diagnosed	107 (100%)
Plain radiography	Sensitive cases	45 (51%)
	Total diagnosed	89 (100%)
Contrast enema	Sensitive cases	2 (2%)
	Total diagnosed	107 (100%)

Table 4. Types of intussusceptions and etiology

Type		Number of patients
Intussusceptions	Ileo-ileal	5 (5%)
	Ileo-colic	102 (95%)
	Total	107 (100%)
Etiology	Idiopathic	85 (79%)
	PLP	22 (21%)
	Total	107 (100%)

PLP – pathologic lead point

Table 5. Modalities of successful treatment for intussusceptions

Treatment modalities			Number of patients
Hydrostatic reduction	Attempt	No	5 (5%)
		Yes	102 (95%)
		Total	107 (100%)
	Successful	<24 h	54 (93%)
		>24 h	4 (7%)
		Total	58 (57%)
	Repeated <24 h	Successful	7 (60%)
		Unsuccessful	5 (40%)
		Total	12 (11.2%)
Operative treatment	Surgery	Required	49 (46%)
		Total	107 (100%)
	>24 h		41 (83%)
	PLP		22 (45%)

Table 6. Type of operative procedures in our study

Type of operation	Number of patients
Manual reduction	27 (55%)
Excision of PLP	15 (32%)
Intestinal resection	7 (14%)
Total	49 (49%)

Table 7. Type of pathologic lead point as a cause of intussusceptions

Pathologic issue	Number of patients
Meckel's diverticulum	11 (10%)
Intestinal duplication	4 (4%)
Peutz–Jeghers syndrome	2 (2%)
Lymphoma	2 (2%)
Polyp	1 (1%)
Pyogenic granuloma	1 (1%)
Trichobezoar	1 (1%)
Total	22 (21%)

treatment. Five (5%) infants less than 6 months of age, with ileo-ileal intussusceptions were initially operated because of the delayed onset of symptoms due to atypical presentation (Table 4). Hydrostatic saline enemas under ultrasound guidance were performed with successful reduction in 58 of 102 (57%) patients, 54 (93%) from the group with symptom duration <24 hours, and only 4 (7%) with symptom duration >24 hours. Despite failed prior attempts, delayed enema was repeated in 12 patients with partial reduction initially, all from the group with symptom duration <24 hours, who were in a good general condition, with success in 7 of 12 (60%) patients (Table 5). The rest of 49 (46%) patients still required surgical treatment without any reattempt of delayed enema, because of their severely disturbed condition. After primary resuscitation, 27 (55%) of them underwent manual reduction of intussusception and 7 (14%) bowel resection (Table 6). In this group, intussusceptions were idiopathic in 85 (79%) patients. Pathologic lead points were encountered in 22 (21%) cases, and Meckel's diverticulum as most frequent in 11 (10%) of those patients (Table 7). There were no intestinal perforation and no patient death. The length of stay after nonsurgical reduction was <48 hours, which was significantly shorter than the stay of 3.25 days after operative treatment, especially 6.3 days if bowel resection was required.

DISCUSSION

Symptom duration before diagnosis is a very important predictor value in the treatment of intussusceptions determining the way of reduction and its outcome [9]. The reduction rate of nonsurgical treatment of intussusception in our series significantly depended on symptom duration. A longer delay in presentation results in a more rapid progression of invaginating bowel with its mesentery to the distal portions, leading to edema of intestinal wall and vascular impairment. The absence of blood flow at the Doppler ultrasonography suggests that intussusception cannot be reduced. This lessens the chances for non-surgical treatment and, as a sign of irreducibility, could be of predicting value for the low rate of enema reduction [10].

It was also noticed that the patients with ileo-colic intussusception expressed symptoms earlier than those with ileo-ileal intussusception, who were of a younger age and initially asymptomatic or of atypical presentation but consequently with a significant delay in diagnosis. Bowel resection was required in all patients with ileo-ileal intussusception. This data confirm the direct influence of symptoms duration on the number of surgical interventions and the need for bowel resection [11].

Plain radiography in the evaluation of children suspected to have intussusception has low specificity, but when the clinical suspicion of intussusception is low it is reasonable to perform plain radiography as the initial diagnostic procedure [12]. Barium or liquid contrast enema used to be the method of choice for the diagnosis of intussusception, but nowadays it is not advantageous over ultrasonography. Ultrasound guided saline enema is an optimal, non-invasive and safe, both diagnostic and therapeutic procedure [13].

The non-operative management remains the treatment of choice for intussusception with intension for modifying techniques with attempts to increase the number of successful reductions. In this light, to assess the current enema reduction rate of intussusceptions we have to focus on the value and safety of using delayed repeated reduction attempts [14, 15]. Delay in presentation, especially more than 48 hours, decreases the success of non-operative reduction and increases the risk of operative treatment, but despite initial failure, the enema therapy should be reattempted [16, 17]. Delayed enema was repeated in 12 (11.2%) patients from our series, with less severe signs of intestinal obstruction and dehydration, even with bloody stools, with symptom duration <24 hours, but with a partial reduction after the initial saline enema. The reduction rate was significantly successful in 60 %. No delayed enema attempt was done in other patients who expressed more severe signs of clinical presentation, with symptom duration >24 hours in the majority of them.

Since 1980, when Lanocita and Castiglioni [18] presented the first successful, reattempted enema reduction, the use of delayed repeated reduction attempts have been mentioned in several series, but a more thorough evaluation of its use and impact in larger groups of patients has been reported only by a few authors [19-22]. They have shown that hydrostatic enema associated with the use of

Table 8. The estimated success of delayed, repeated enema reduction of intussusception

Series	Delayed repeat enema reduction				
	Timing in between	Number of patients	Success	Successful reduction	
				Without DRE	With DRE
Navarro et al. [15]	18 min – 12 h	26	50%	84%	91%
González-Spínola et al. [22]	30 min – 24 h	-	-	71%	82%
Gorenstein et al. [20]	45–60 min	19	83%	48%	91%
University Children's Hospital	30–60 min	12	60%	50%	57%

DRE – delayed repeat enema

delayed repeated reduction attempts is a safe and effective technique for intussusception reduction with a high success rate. In our series, the percentage of patients that underwent delayed repeated reduction attempts (11.2%) and the success rate of these attempts (60%) were similar to the series of Navarro et al. [15] (12% and 50%, respectively) (Table 8). Enema therapy is attempted in almost all cases because even patients in shock can be resuscitated with rapid intravenous hydration. Patients who ultimately underwent surgery could also benefit from partial reduction of intussusception, making it prone to complete reduction or lesser resection at surgery. The use of delayed repeated reduction attempts was not complicated with bowel perforation. Although there are not enough data in our review or in the literature to propose a specific number of attempts, some clinicians advocate subsequent attempts within a few minutes to a few hours after the first attempt [23]. Although this procedure has emerged as a useful alternative to a surgical intervention, operative treatment is warranted in the cases of complications, such as peritonitis and intestinal perforation [24].

CONCLUSION

Intussusception can account for the leading cause of abdominal surgical emergencies in children younger than 5 years. Ultrasonography is an optimal, non-invasive and safe diagnostic and therapeutic procedure. The accuracy of ultrasound guided saline enema in achieving intussusception reduction is high, but delay in presentation decreases success of this treatment.

Delayed repeated enema is the second therapeutic option in the management of intussusceptions, except in the cases of very young infants, long duration of symptoms, especially if over 48 hours, significant bleeding and dehydration, obstruction of the small intestine or absence of blood flow at Doppler ultrasonography. The success rate of delayed repeated enemas is highest when there is initially a partial reduction of intussusceptum. It appears that there is no fixed optimal timing between attempts because success can be achieved with a great variability of intervals. Surgical treatment is indicated in the cases of complications.

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Индикације за понављање клизме у нехируршкој редукцији инвагинација код деце

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КРАТАК САДРЖАЈ

Увод Инвагинација је чест узрок акутног абдомена у раном детињству. Идиопатска је у више од 90% случајева и јавља се код 1,5–4 на 1.000 живорођене деце. Метода избора у лечењу је нехируршка, хидростатска или пнеуматска дезинвагинација.

Циљ рада Циљ рада је био да се одреде утицај клиничке презентације и трајања симптома на успех нехируршког лечења инвагинација, уз процену индикација за примену поновних, одложених клизми, и њихова ефикасност у погледу постизања редукције.

Методе рада Испитано је 107 болесника узраста од два месеца до 14 година (медијана: девет месеци), од којих су 102 болесника (95%) била са илеоколичном инвагинацијом и иницијално су лечена клизмама физиолошког раствора уз контролу на ултразвуку. Посматран је утицај трајања симптома на успех терапијског поступка, с нагласком на избор одложене, поновљене хидростатске редукције или хируршког лечења.

Резултати Хидростатска клизма је успешно примењена код 58 болесника (57%). Нехируршка редукција је била успешнија уколико су симптоми пре постављања дијагнозе трајали до 24 сата, што је забележено код 54 од 62 болесника (87%; $p<0,001$), у поређењу са трајањем симптома дуже од 24 сата, када је терапија била успешна код четири детета од 45 болесника (9%). Упркос почетном неуспеху, хидростатска клизма је поновљена код 12 деце, успешно код седам болесника (60%). Четрдесет и једно дете од 45 деце код које су симптоми трајали дуже од 24 сата подвргнуто је хируршкој интервенцији (91%; $p<0,001$), укључујући и пет болесника (5%) са илеоилеалном инвагинацијом.

Закључак Хидростатска клизма уз контролу ултразвука је метода избора у лечењу инвагинација. Дуже трајање симптома умањује успех нехируршког лечења. Поновна одложена редукција је важна опција лечења инвагинација. Операција је индикована уколико се развију компликације.

Кључне речи: инвагинација; нехируршка редукција; поновна одложена редукција

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