RESEARCH PAPER

Intussusception: Single Center Experience of 10 Years

NITHISH MATHEW SIMON[1], JOHN JOSEPH[1], RUHAMAH RACHEL PHILIP[1], TU SUKUMARAN[2] AND RAJEEV PHILIP[3]

From Departments of [1]Pediatric Surgery, [2]Pediatrics, and [3]Endocrinology; Pushpagiri Institute of Medical Sciences and Research Center, Thiruvalla, Kerala, India.

Correspondence to: Dr John Joseph, Professor and Head of Department, Department of Pediatric Surgery, Pushpagiri Institute of Medical Sciences and Research Center, Thiruvalla, Kerala, India. johnjmaveli@gmail.com
Accepted: February 15, 2018; Initial review: July 19, 2018; Accepted: November 20, 2018.

Objective: To analyze the association between the clinical presentation, clinical course, management and outcome in intussusception with emphasis on safety of saline hydrostatic reduction. **Methods:** This retrospective study included 375 patients of intussusception diagnosed between March 2007 to February 2017. Symptoms at presentation, mode of reduction of intussusception and associated complications were recorded. **Results:** 336 (89.6%) patients were aged below 3 years. Classical triad of abdominal pain, vomiting and red stools was present in 111 (29.6%) patients. While 64 (17.1 %) patients had spontaneous resolution, hydrostatic reduction and surgery cured 283 (75.5 %) and 28 (7.4 %) patients, respectively; overall recurrence rate was 13.1%. Among the patients who underwent operative reduction, blood in stools was present in 15 (53.6%) patients. **Conclusion:** Hydrostatic reduction of intussusception is effective irrespective of duration of symptoms and number of recurrences.

Keywords: *Intestinal obstruction, Intussusception, Outcome, Recurrence.*

Intussusception is one of the most commonly encountered pediatric surgical emergencies with myriad clinical symptoms; the classical triad of intermittent abdominal pain, vomiting, and red currant jelly stools is seen in <20% of cases [1-3]. The practice of air enema and hydrostatic reduction under imaging guidance has significantly reduced the need for surgery. Intestinal ischemia, perforation and peritonitis can occur with delayed diagnosis and therapy, necessitating emergent surgical intervention, whereas the in-hospital mortality rate is less than 4% when managed early [4,5].

In this study, we describe the clinical presentation, clinical course, management and outcome of children with intussusception, and analyze the factors affecting the outcome.

METHODS

This retrospective study was performed in the Department of Pediatric Surgery at one of the largest referral centers in the state of Kerala, India. The study was approved by the Institute Ethics Committee with a waiver for the need of informed consent due to retrospective nature of the study. The study comprised of consecutive patients who satisfied diagnostic certainty criteria of Brighton Collaboration Working Group during the 10-year period from March 2007 to February 2017, irrespective of age and anatomical subtype after exclusion of those who denied admission or had incomplete clinical data.

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We reviewed the medical records of the patients, and extracted relevant data using a proforma. The patients underwent saline hydrostatic reduction (SHR) when there was a lack of clinical or imaging findings of pathological lead point and absence of peritonitis or bowel necrosis. Surgical management was preferred in patients who were excluded from SHR or after failed reduction. The reduction was called 'successful' after the disappearance of intussusception, visualization of ileocecal valve, reflux of saline/bowel contents into ileum with fluid distension of the distal small bowel *i.e*., honey comb appearance and absence of intussusception following evacuation. Recurrence was defined as the occurrence of symptoms post-reduction with visuali-zation of intussusception on follow-up ultrasound. Enteritis was defined as increased frequency of loose stools. Asymptomatic patients without recurrence were discharged after 48 to 72 hours. The institutional management protocol for intussusception followed from 2003 is as illustrated in ***Fig.* 1**.

Statistical Analysis: Analysis was performed with SPSS version 22.0 (IBM, Armonk, New York). The continuous variables (age, duration of symptoms and duration of hospital stay) were compared with the Kruskal Wallis test and categorical variables (symptoms and associated

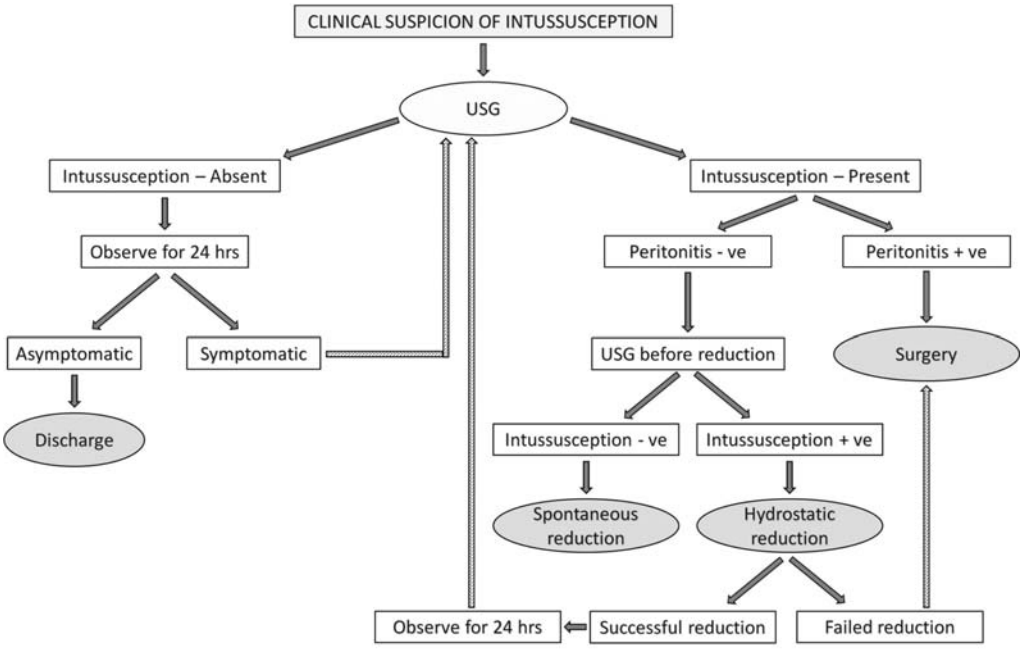

FIG. I *The institutional protocol for diagnosis and management of intussusception (since 2003).*

co-morbidities) with Chi-square test. A *P* value of <0.05 was considered to indicate statistically significant.

RESULTS

Out of 582 children who were suspected to have intussusception, 375 sonologically diagnosed patients of intussusception were included. Most of patients (*n*=102, 48.5%) presented to the hospital within 24 hours of symptom onset with mean (SD) age at presentation being 21.4 (15.9) months. We had a male: female ratio of 1.7:1 and 187 (49.8%) cases occurred below one year of age.

The most frequent symptoms encountered were a typical cry or abdominal pain (371, 99%), poor feeding (349, 93%) and vomiting (332, 88.5%). Abdominal mass could be appreciated in 230 (61.3%) patients on repeated examination. The classical triad of intussusception was present only in 111 (29.6 %) patients. The association between the clinical symptoms and the mode of reduction of intussusception is presented in ***Table* I**. The presence of vomiting, red stools, abdominal mass and enteritis showed statistical significance with the mode of reduction of intussusception. Significantly higher proportion of patients who underwent operative reduction had vomiting, red stools, and mass per abdomen. Enteritis was predominantly seen at presentation in higher proportion of the patients who had spontaneous reduction. The association between the age

TABLE I CLINICAL SYMPTOMS IN INTSSUSCEPTION AND SIGNIFICANCE OF ASSOCIATION WITH MODE OF REDUCTION

Symptoms	*Spontaneous reduction (n=61), No. (%)*	*Saline hydrostatic reduction (n=286), No. (%)*	*Operative reduction (n=28), (No. %)*	*P value*
Typical cry	58 (96.6)	286 (99.6)	27 (96.4)	0.05
Poor feed	56 (93.3)	268 (93.3)	25 (89.2)	0.71
Vomiting	48 (80)	257 (89.5)	27 (96.4)	0.04
Red stools	11 (18.3)	91 (31.7)	15 (53.6)	<0.01
Mass per abdomen	34 (56.7)	261 (90.9)	26 (92.8)	<0.01
Respiratory infection	15 (25)	41 (14.3)	5 (17.8)	0.12
Enteritis	13 (21.7)	32 (11.1)	1 (0.3)	<0.02
New food	9 (15)	79 (27.5)	7 (25)	0.12

TABLE II ASSOCIATION BETWEEN THE AGE AT PRESENTATION, DURATION OF SYMPTOMS AND HOSPITAL STAY WITH MODE OF REDUCTION

Variable	*Spontaneous reduction (n=61)*	*Saline hydrostatic reduction (n=287)*	*Operative reduction (n=28)*	*P value*
Age (mo)	27.2 (20.1)	19.8 (14.4)	23.0 (18.6)	0.03
Duration of symptoms (d)	2.2 (2.3)	1.9 (1.4)	2.8 (5.4)	0.83
Duration of hospitalization (d)	2.3 (1.1)	3.3 (1.0)	7.2 (2.2)	<0.01

Values in mean (SD).

at presentation, duration of clinical symptoms and hospital stay and the mode of reduction of intussusception is presented in ***Table* II**. The age at presentation was higher in patients with spontaneous reduction.

Majority of the patients were managed with saline hydrostatic reduction (304 patients, 81 %); with direct surgical intervention in 11 patients (~3%) and spontaneous reduction in 60 patients (16%). The recurrence rate of SHR following first, second, third and fourth attempt was 16.4% (49/297), 27.3% (11/44), 42.8% (3/7) and 0% with a failed reduction in 7, 5, 4 and one patient, respectively. A total of 17 children underwent surgery following failed SHR without major procedure-related complications. Per-operative findings included Meckel's diverticulum (*n*=3), malrotation (*n*=3), inflamed appendix (*n*=2), ileal duplication cyst (*n*=1) and ulceration involving ileocecal junction (*n*=1). The success rate of SHR was 94% (270/287) without any major complications, and the median duration of hospital stay was 4 days.

DISCUSSION

In this large series of children with intussusception, we observed that the classical triad of abdominal pain, vomiting and currant jelly stools was reported in less than one-third of patients. The mass per abdomen, red stools and vomiting were seen predominantly in patients who underwent operative reduction suggesting a possible compacted intussusception reflecting the lower success rate of nonsurgical methods in such patients. However, enteritis was seen predominantly in patients who underwent spontaneous reduction of intussusception.

The age at presentation was higher in our study as compared to earlier studies [6]. Our findings of higher proportion of presence of abdominal pain, vomiting and red stools in children who required operative intervention is in agreement with some earlier studies [7-10]. Majority of patients in our series had successful reduction of intussusception by SHR. There are no standard guidelines for the management of pediatric intussusception [11]. SHR with ultrasound guidance was the primary conservative technique followed at our center to avoid radiation exposure, which is a significant drawback in other modalities. Operative reduction (7.4%) in our study was considerably less than the average reported rate [11,12]. Our study failed to demonstrate an association between duration of presenting complaints and increased likelihood of surgical reduction, contrary to previous studies [13].

The reported rate of recurrent intussusception is up to 20% in those who underwent non-operative reduction and about 1 to 3% in those who underwent operative reduction of intussusception [14,15]. The recurrence rates post SHR was similar for first and second attempts in our study. However, the success in third and fourth attempts in our study showed considerable variation from reported literature, possibly due to a relative smaller number of patients. There was no recurrence observed following operative reduction. Hsu, *et al*. [13] suggested operative reduction following the third attempt due to increased probability of recurrence following the fourth attempt of SHR. On the contrary, 66% of our patients had a cure after the fourth recurrence. Hence, we suggest that recurrence beyond the third attempt of SHR should not be an absolute contraindication for non-operative management when the clinical and radiological findings are not leading to any pathological cause. The absolute contraindication for the same should be a high index clinical suspicion of bowel necrosis or peritonitis [7]. The increased clinical experience with these procedures improves the outcome

WHAT THIS STUDY ADDS?

- Duration of symptoms, recurrence and age are not contraindications for conservative management of intussusception.

irrespective of reduction technique [4]. Hence SHR should only be attempted at a tertiary centre, in the presence of a radiologist, by an experienced pediatric surgeon who can identify complications and proceed to surgery.

The main limitation of our study was its retrospective nature, and absence of any controlled comparisons of interventions.

We conclude that age and number of recurrence cannot be regarded as absolute pointers to indicate failure of nonsurgical intervention. The patients with delayed presentation can be managed with SHR in the absence of clinical and radiological suspicion of pathological lead point or peritonitis. SHR should be the preferred conservative intervention for reduction of intussusception as it is economical, safe, efficacious and avoids the risk of radiation exposure.

Contributors: NMS: concept and design of the study, acquisition of data, analysis and interpretation of results, drafting of the manuscript; JJ,TUS,RP: analysis and interpretation of results, revision of the manuscript; RRP: acquisition of data, analysis and interpretation of results.
Funding: None; *Competing interest*: None stated.

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