Journal of Pediatric Surgery (2013) **48**, 1032–1036

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Journal of Pediatric Surgery

www.elsevier.com/locate/jpedsurg

Risk factors for surgery in pediatric intussusception in the era of pneumatic reduction☆

Sara C. Fallon, Monica E. Lopez, Wei Zhang, Mary L. Brandt, David E. Wesson, Timothy C. Lee, J. Ruben Rodriguez*

Division of Pediatric Surgery, Michael E. DeBakey Department of Surgery, Baylor College of Medicine, Houston, TX 77030, USA

Received 26 January 2013; accepted 3 February 2013

Key words:
Intussusception;
Pediatrics;
Pneumatic reduction;
Operative reduction

Abstract

Introduction: Surgical treatment is still necessary for intussusception management in a subgroup of patients, despite advances in enema reduction techniques. Early identification of these patients should improve outcomes.

Methods: The medical records of patients treated for intussusception at our institution from 2006 to 2011 were reviewed. Univariate and multivariate analyses, including stepwise logistic regression, were performed.

Results: Overall, 379 patients were treated for intussusception, and 101 (26%) patients required operative management, with 34 undergoing intestinal resection. The post-operative complication rate was 8%. On multivariate analysis, failure of initial reduction (OR 9.9,p=0.001 95% CI, 4.6–21.2), a lead point (OR 18.5,p=0.001 95% CI, 6.6–51.8) or free/interloop fluid (OR 3.3,p=0.001 95% CI, 1.6–6.7) or bowel wall thickening on ultrasound (OR 3.3,p=0.001 95% CI, 1.1–10.1), age <1 year at reduction (OR 2.7,p=0.004, 95% CI, 1.4–5.9), and abdominal symptoms>2 days (OR 2.9,p=0.003, 95% CI, 1.4–5.9) were significantly associated with a requirement for surgery. Similarly, a lead point (OR 14.5, p=0.005 95% CI, 2.3–90.9) or free/interloop fluid on ultrasound (OR 19.8, p=0.001 95% CI, 3.4–117) and fever (OR 7.2, p=0.023 95% CI, 1.1–46) were significantly associated with the need for intestinal resection.

Conclusion: Abdominal symptoms>2 days, age<1 year, multiple ultrasound findings, and failure of initial enema reduction are significant predictors of operative treatment for intussusception. Patients with these findings should be considered for early surgical consultation or transfer to a hospital with pediatric surgical capabilities.

Intussusception is a common cause of bowel obstruction and hospitalization of pediatric patients, with an incidence of over 56/100,000 patients [1]. While the diagnosis of intussusception can be readily made by ultrasound, the classic picture of vomiting, currant jelly stools, age less than 2 years, and a palpable abdominal mass is seen in less than

☆ Disclosures: The authors have no financial support or funding to disclose with regards to the preparation of this manuscript.

* Corresponding author. Tel.: +1 832 822 3135; fax: +1 832 825 3141.
E-mail address: rxrodri2@texaschildrens.org (J.R. Rodriguez).

0022-3468/$ – see front matter © 2013 Elsevier Inc. All rights reserved.
http://dx.doi.org/10.1016/j.jpedsurg.2013.02.021

25% of children, resulting in delays in diagnosis [2]. The resultant delays can lead to bowel wall thickening and ischemia, making the reduction of the intussusception by air or contrast enemas either difficult or unsafe. The reported success rates of enema reduction range from 42% to 95% [3].

To date, no randomized trial has investigated the superiority of either pneumatic or contrast enema rates with respect to complication profiles, lengths of stay, and reduction rates. Retrospective reviews have conflicting conclusions with regards to the optimal approach, although certain risks and benefits are inherent in each technique [3–5]. As individual centers gain more experience with the pneumatic reduction technique, practice patterns continue to evolve. At our own center, pneumatic reduction has been the primary reduction method used for the past six years. However, other centers still prefer to use contrast enema reduction as a first line therapy [3,6].

The purpose of this study is to identify variables related to the need for operative management in the current era of intussusception treatment, which includes higher rates of pneumatic reduction and greater experience with ultrasound. We investigated variables related to the patients' clinical history and physical exam, the initial ultrasound findings, and the reduction procedure to identify predictors of both operative reduction and intestinal resection at a high-volume, pediatric tertiary care center. These findings should help to risk-stratify patients who are most likely to require surgical consultation or transfer to a center with pediatric surgical capabilities.

1. Methods

Patients identified with the ICD-9 diagnosis code of intussusception from 2006 to 2011 were included in the study. After IRB approval, a chart review was performed and clinical data information was collected, including basic demographics, imaging and procedural information, operative details, hospital course, and evidence of recurrence. Patients who had an intussusception diagnosed on ultrasound with spontaneous resolution in the emergency room were not included in the study.

At our institution, multiple, repeated attempts of reduction are allowed as long as progressive movement of the intussusceptum is seen during each attempt. Indications for an operation include failed reduction attempt(s), peritonitis on physical exam, signs of sepsis, evidence of perforation on imaging or during attempted enema, or significant concern for a pathologic lead point.

Statistical analysis was performed using SAS (Version 9.3). Univariate analysis was performed using a chi-square test for categorical variables, and a Student's t-test for continuous variables. Mann–Whitney U tests were used for nonparametric data. Failure of an initial enema reduction attempt was defined as those patients who had a distinct (>2 h) delay between attempts at reduction or were taken directly to the OR after the first attempt. Ultrasound characteristics were determined based on the radiology report and included bowel wall thickening, "diffuse, free fluid" or "interloop" fluid, and an indication that a potential lead point was identified. Patients who required an operative reduction of the intussusception were compared to those successfully managed without surgery. Of the patients who underwent surgery, those who required a bowel resection due to evidence of perforation, necrosis, or persistent bowel ischemia after reduction were compared to those managed with a simple manual operative reduction. A stepwise logistic regression analysis, evaluating for predictors of surgery and predictors of intestinal resection, was performed. A p-value of <0.05 was considered to be significant.

2. Results

A total of 379 patients with intussusception were treated at our institution over a 6 year period. The median age at admission was 11.9 months (range 2.2 months–13.9 years). Enema reduction was successful in 278 patients; 101 (26%) patients either failed reduction and required operative intervention or were taken directly to the operating room for treatment. Characteristics and outcomes of the surgical cohort are described in Table 1. Approximately one-third required intestinal resection at surgery, and 20% of the surgical patients demonstrated a distinct pathologic abnormality in the resected specimen that was felt to be a lead point for the intussusception.

Notably, two patients with bowel resections were diagnosed with malignant conditions. One patient found to

Table 1 Characteristics and outcomes of surgically treated patients (n=101).

Variable	Median (range)
Age at time of operation	8.9 months (2.2–167)
Patients with intestinal resection	34 (34%)
Ileoileostomy	17 (17%)
Ileocolostomy	10 (10%)
Resection of Meckel's/Cyst	7 (7%)
Pathology of resected specimen	
Meckel's Diverticulum	10 (10%)
Polyp	4 (4%)
Duplication Cyst	4 (4%)
Mucinous Adenocarcinoma	1 (1%)
B-Cell Lymphoma	1 (1%)
Patients with a frank perforation at operation	7 (7%)
Post-operative length of stay (days)	4 (1–40)
Complications	
Small bowel obstruction	3 (3%)
Recurrence (reoperation at same admission)	2 (2%)
Wound Infection	2 (2%)
Delayed Bowel Perforation	1 (1%)
Late Recurrence (reduced with enema)	3 (3%)