Barium Enema Reduction of Intussusception in a Developing Country

R Tota-Maharaj, B Rampersad, R Indalsingh

ABSTRACT

Objective: *To determine the current success rate of barium enema reduction of intussusception and to investigate the factors affecting successful reduction.*

Design and Methods: *All patients admitted to the Eric Williams Medical Sciences Complex during the 8-year period from January 1, 2000 to December 31, 2007 with a diagnosis of intussusception were included. Patients' demographics, date and time of admission, clinical features, success of barium reduction, surgical findings and length of stay were recorded. The SPSS 12.0 programme was used for data analysis.*

Results: *There were 65 cases of intussusception. Vomiting and rectal bleeding were the most common presenting symptoms (55, 85% / 49, 75%). Fifty-eight patients underwent barium enema reduction with 41.4% (24/58) having successful reduction. Factors which significantly increased the success rate included males older than 12 months, non-opioid analgesia or no analgesia and an admission to enema reduction time of less than 6 hours.*

Conclusion: *The successful reduction rate is relatively low (41%). A higher index of suspicion is needed in order to make a timely diagnosis and institute appropriate treatment quickly.*

Keywords: Barium enema, enema reduction, intussusceptions

Reducción de la Intususcepción Mediante Enema de Bario en un País en Vías de Desarrollo

R Tota-Maharaj, B Rampersad, R Indalsingh

RESUMEN

Objetivo: *Determinar la tasa de éxito actual de reducción de la intususcepción por edema de bario e investigar los factores que afectan la reducción exitosa.*

Plan y métodos: *Todos los pacientes ingresados en el Complejo de Ciencias Médicas Eric Williams por el período de 8 años que va del 1ero de enero de 2000 al 31 de diciembre de 2007 con diagnóstico de intususcepción, fueron incluidos. Se registró toda la información relacionada con los datos demográficos de los pacientes, fecha y tiempo de ingreso, características clínicas, éxito de la reducción por bario, resultados quirúrgicos, y duración de la hospitalización. Se usó el programa SPSS 12.0 para el análisis de los datos.*

Resultados: *Se produjeron 65 casos de intususcepción. Los vómitos y el sangramiento rectal fueron los síntomas presentes más comunes (55, 85%/49, 75%). A cincuenta y ocho pacientes se les practicó la reducción por enema de bario, logrando 41.4% (24/58) una reducción exitosa. Los factores que aumentaron la tasa de éxito de manera significativa fueron los varones con más de 12 meses, la analgesia no-opioide o ninguna analgesia, y un tiempo de ingreso para la reducción por enema, de menos de 6 horas.*

Conclusión: *La tasa de reducción exitosa es relativamente baja (41%). Se requiere un índice más alto de sospecha para hacer un diagnóstico oportuno e iniciar un tratamiento apropiado rápidamente.*

Palabras claves: Enema de bario, reducción por enema, intususcepción

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From: Department of Paediatric Surgery, Eric Williams Medical Sciences Complex, Mt Hope, Trinidad and Tobago, West Indies.

Correspondence: Dr R Tota-Maharaj, 6 Airway Circle, Apt 2a, Towson, Maryland 21286 USA, Email: rajtota@hotmail.com

INTRODUCTION

Intussusception remains one of the most commonly encountered paediatric surgical emergencies. Hirschsprung was the first to publish a series of reports on successful hydrostatic reduction in 1876 (1). Enema reduction still remains the mainstay of non-operative care today. Barium and more recently air contrast enemas have been the initial diagnostic and therapeutic investigation of choice (2). Successful reduction rates vary widely, from 42 to 95% (2). Some researchers have advocated the use of repeated reduction attempts as a safe and effective approach to increase non-operative reduction rates (3).

Barium enema reduction of intussusception is used at the Eric Williams Medical Sciences Complex in North Trinidad, one of only two paediatric surgical centres in the country. The aim of this study was to determine the success rate for non-operative reduction by barium enema and to identify the factors associated with successful reduction by this method.

SUBJECT AND METHOD

A retrospective study was conducted of patients treated for intussusception from January 1, 2000 to December, 2007 at the Eric Williams Medical Sciences Complex in Trinidad. Permission for this study was obtained from the hospital ethics committee. Informed consent was obtained from parents prior to hydrostatic enema reduction. The SPSS 12.0 programme was used for data input and analysis.

Patients' demographics, date and time of admission, presenting symptomatology, success of barium reduction, surgical findings, complications and length of stay were recorded. Inclusion criteria were diagnosis of intussusception by either ultrasound, barium enema or laparotomy. Those patients with haemodynamic instability despite intravenous hydration or with peritonitis proceeded directly to laparotomy without attempted barium enema reduction. These patients underwent demographic analysis but were excluded from further statistical analysis with respect to enema reduction. Repeated attempted reduction after an interval of a few hours was not used to treat any episode of intussusception in this study.

A rectal catheter was inserted and the buttocks manually squeezed and taped to prevent barium leakage. A column of contrast was erected 3 feet above the level of the table. Light sedation was sometimes used during the procedure. A maximum of three consecutive reduction attempts was performed under real-time fluoroscopy. A reduction was deemed successful when barium was seen refluxing into the distal ileum and filling the small intestine. In these cases, patients were admitted to the ward for observation. If barium enema reduction failed, the patient had an exploratory laparotomy.

RESULTS

There were 65 episodes of intussusception in 62 patients over the 8-year study period. Patients' ages ranged from 2 months to 3 years, with a median of 8 months. A total of 72% (47/65) presented < 1 year old and 91% at < 2 years old. A 2:1 predominance of males to females was noted (41/65, 63%). Inadequate documentation precluded a proper comparison of ethnicity. Thirty-seven per cent presented from the June-August period, concurrent with the start of the rainy season in Trinidad and Tobago (Fig. 1).

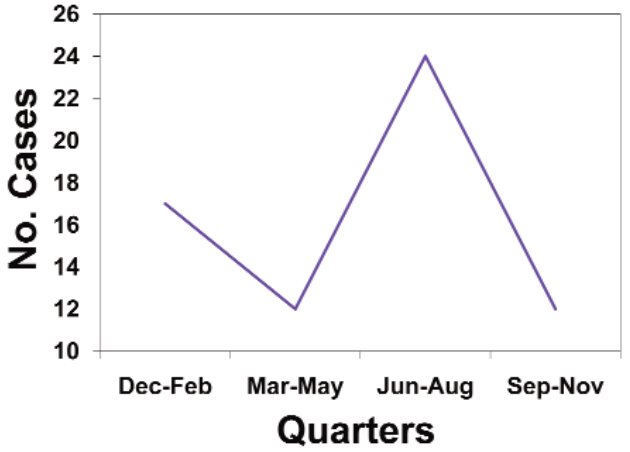

Fig 1: Seasonal variation in incidence

Vomiting and rectal bleeding were the most common presenting symptoms (Table 1). Only 18% (12) of patients presented with the classic clinical triad of abdominal pain, rectal bleeding and a palpable abdominal mass. Patients who presented with peritonitis (2/65, 3.1%) or were haemodynamically unstable (5/65, 7.6%) had laparotomy without prior barium enema attempt and were excluded from further analysis.

Table 1: Clinical features at presentation in all 65 episodes of Intussusception

Clinical Features	No. episodes/% N = 65	Age (years) < 1	1–2	2	Chi-square
Vomiting*	55/84.6	42	9	4	0.039
Rectal bleed*	49/75.4	37	11	1	0.000
Abd. pain	31/47.7	18	8	5	0.097
Lethargy	39/60.0	30	6	3	0.391
Temp >38	11/16.9	6	3	2	0.393
Dehydration	35/53.8	26	6	3	0.762
Distension	13/20.0	9	4	0	0.213
Abd. mass	31/47.7	21	7	3	0.709
Peritonitis*	2//3.1	0	2	0	0.010

* denotes statistical significance

A total of 55 patients underwent 58 episodes of barium enema reduction. There were three recurrences; two occur-

red at four and five days postoperatively after laparotomy and manual reduction and the other recurrence occurred one year later; 41.4% (24/58) had successful reduction. There were no perforations or mortalities. Forty-three per cent (13/30) presenting with symptoms < 1 day had successful reduction while 11/28 (39%) patients presenting with symptoms >1 day had successful reduction (p = 0.43). This difference was not statistically significant. While there was no statistically significant difference in reduction based solely on gender (males 18/39, 46%/; females 6/19, 32%, p = 0.22); males > 1-year old had a much higher reduction rate (p = 0.041) than younger males or females (Table 2).

Table 2: Barium reduction rates versus age

Age	Gender	Successful barium reduction (number/%)			Chi-square
		Yes	No	Total	
< 12 months	Male	9/29 (31%)	20/29 (69%)	29 (100%)	p = 0.988
	Female	5/16 (31%)	11/16 (69%)	16 (100%)	
	Total	14/45 (31%)	31/45 (69%)	45 (100%)	
> 12 months	Male	9/10 (90%)	1/10 (10%)	10 (100%)	p = 0.041
	Female	1/3 (33%)	2/3 (31%)	3 (100%)	
	Total	10/13 (77%)	3/13 (23%)	13 (100%)	

A higher proportion of patients who had either no analgesia or non-opioid analgesia had successful reduction (12/21, 57%) compared to those who received opioids prior to reduction [12/37, 32%] (Table 3). The absence of lethargy was associated with a higher chance of successful reduction when patients had non-opioid/no analgesia (8/10, 80%) *versus* opioids (9/25, 36%, p = 0.04). Those patients who had reduction within six hours of admission and were not lethargic had a higher barium reduction success rate (10/13, 77%) when compared to those for whom reduction was attempted after more than six hours (1/3, 33%, p = 0.04). This pattern was not replicable for other symptoms.

Table 3: Multiple factors and Barium reduction rates

Time from admission to barium*	Lethargy	Successful barium reduction (number/%)			Chi-square
		Yes	No	Total	
> 6 hours	No	10/13 (77%)	3/13 (23%)	13 (100%)	p = 0.04
	Yes	10/24 (42%)	14/24 (58%)	24 (100%)	
	Total	20/37 (54%)	17 (46%)	37 (100%)	
> 6 hours	No	1/3 (33%)	2/3 (66%)	3 (100%)	p = 0.583
	Yes	1/6 (17%)	5/6 (83%)	6 (100%)	
	Total	2/9 (22%)	7/9 (78%)	9 (100%)	
Analgesia: None/non-opioid	No	8/10 (80%)	2/10 (20%)	10 (100%)	p = 0.044
	Yes	4/11 (36%)	7/11 (64%)	11 (100%)	
	Total	12/21 (57%)	9/21 (43%)	21 (100%)	
Opioids	No	3/12 (25%)	9/12 (75%)	12 (100%)	p = 0.503
	Yes	9/25 (36%)	16/25 (64%)	25 (100%)	
	Total	12/37 (32%)	25/37 (68%)	37 (100%)	

* Times only documented in 46 out of 58 case notes

All 34 patients who had failed barium reduction had laparotomy. Fifteen per cent (5/34) needed bowel resection and 9% (3/34) had a pathological lead point. These lead points included a jejunal haemangioma, an ileal lymphoid polyp and an inflamed appendix. Spontaneous reduction at laparotomy was noted in three patients. The remaining patients had manual reduction at laparotomy. Mean hospital stay was 1.7 days for successful reduction and 4.1 days for failed reduction.

DISCUSSION

The incidence of intussusception in North Trinidad has remained relatively constant over the last three decades. Naraynsingh *et al* documented 94 cases over 12 years from

Black arrow depicts intussusceptum being reduced by barium past hepatic flexure of large bowel.

Fig. 2: Barium enema reduction of intussusception

1974–1985 (4), while this study found 65 cases over 8 years. Both studies describe an incidence of approximately 8 cases per year.

Clinical features can vary remarkably but vomiting, colicky abdominal pain and rectal bleeding are generally more common. The present study reflected the general consensus of a high proportion of patients presenting with vomiting and rectal bleeding. Only 18% (12) of patients presented with the classic clinical triad of abdominal pain, rectal bleeding and a palpable abdominal mass. This is consistent with other research (2).

Some researchers noted a higher incidence of fever and abdominal distention with longer duration of history (2). No significant disparity was noted in this study when comparing symptomatology with duration of history. Vomiting and rectal bleeding were much more likely to occur in children < 1 year old (Table 1). Older children are however more likely to present with atypical symptoms (3, 5).

Lethargy is an independent variable found to be associated with intussusception (6), although opioids may contribute to decreased responsiveness. A significantly higher success rate was noted in those subsets of patients who were not lethargic and had either reduction in < 6 hours from presentation or were not prescribed opioids. Shiels *et al* (7) noted that the Valsalva manoeuvre produced by crying or straining is both protective and increases intra-colonic pressure during enema reduction. We speculate that early enema reduction, the absence of lethargy and not prescribing opioids all facilitate an effective Valsalva manoeuvre during reduction.

Barium reduction is rapidly being replaced by pneumatic methods (3, 5, 8, 9). Pneumatic reduction has advantages including shorter fluoroscopy times, less radiation exposure and less peritoneal soiling if perforation occurs, but requires specialist training in paediatric radiology not presently available at our centre. Some studies have shown increased success with air over barium reduction, while others have shown no difference (9, 10, 11).

Success rates for barium enema reduction vary widely ranging from 40% to > 90% (1, 4, 7, 12). In developing countries, there is an increased incidence of longer duration of symptoms and barium enema failure and non-viable bowel (4, 13, 14). Duncan *et al* (15) noted a hydrostatic enema success rate of 92% when patients presented within 12 hours of symptom onset. However, in the present study there was no association between duration of symptoms and barium enema reduction success. The reasons for this may be more dehydration or lethargy than would be expected for the group with symptoms less than one day or inadequate optimization of hydration status prior to barium enema.

Perforations occur in < 1% of patients undergoing enema reduction (16, 17). Perforation has been found to be more likely to occur in younger patients (< 6 months) and in those with a longer duration of symptoms. Daneman *et al* (16) reported 14 perforations, 8 of which were attributed not to necrotic bowel but to other technical factors such as high pressures. No perforations were noted in the present study. Ravitch and McCune (18) established the rule of threes (3 attempts, column of contrast 3 feet above the table) for enema reduction. This guideline is useful in order to prevent excessively high pressures during reduction.

One previous study from Trinidad conducted from 1974−1985 (4) noted a 6.4% mortality rate in a similar population. This series therefore represents a substantial improvement in the mortality rate. The reasons for this are numerous and may include differences in duration of symptoms before presentation, time to diagnosis and greater availability of barium enema reduction thereby preventing laparotomy.

In summary, the successful barium reduction rate is relatively low (41%). Factors increasing the success rate of barium enema reduction include males older than 12 months, the absence of lethargy, the use of non-opioid analgesia or no analgesia and an admission to enema reduction time of less than 6 hours.

While the mortality rate has dramatically decreased from the 1980s (4), greater awareness is needed to prevent the delays in presentation noted in this series. The potential complications of a major surgical procedure in a sick child mean that every attempt should be made to improve non-operative reduction rates and avoid surgery.

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