Are we doing better? Barium enema reduction of intussusception

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ABSTRACT

INTRODUCTION Intussusception remains one of the most common surgical abdominal emergencies in the paediatric population. The aim of this study was first to re-evaluate our non-operative reduction rate of intussusception using multiple interval barium enemas and second to investigate or discuss an audit cycle, providing evidence and validating the modification of clinical practice.

MATERIALS AND METHODS This five-year retrospective study performed at one of two institutions at which a paediatric surgical service is offered. Individuals included were all patients under 12-years of age who were diagnosed with intussusception. Factors considered to be influential in the reduction of the intussusception were collected. End points were defined as successful barium enema reduction or surgical intervention. Results were compared with similar research published in 2010.

RESULTS Overall prevalence was found to be 12 cases/year, with a sample size of 60 patients, the mean age at presentation of 13.6 months. Barium enema reduction was attempted in 56/60 patients, while 4/60 patients had operative management as a first intervention. Overall reduction rate was 66% (37/56), 78% occurring on first attempt and 22% on the second attempt. There was no evidence of intussusception in 3/19 patients who had operative management as a second intervention. Delayed interval barium enema reduction demonstrated an improved reduction rate of 66% compared with single-use barium enema reduction of 41% (chi square 0.02).

CONCLUSION A significant benefit was achieved by performing delayed interval enema reduction, which contributed to a 61% increased reduction rate, the actual reduction rate approaches 71%. The audit cycle remains of paramount importance to ensure optimum patient care.

KEYWORDS

Intussusception – Audit – Barium enema reduction

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Introduction

An intussusception occurs when a proximal portion of bowel (intussusceptum) invaginates into the distal, adjacent portion of bowel (intussusceptiens). It remains one of the most common surgical abdominal emergencies in the paediatric population; with an incidence of over 56/100,000 patients.¹ Successful management of paediatric intussusception depends on early diagnosis, ample resuscitation and prompt reduction, either surgical or non-surgical. Overtime, radiological guided enema (air or liquid) reduction has been preferred as the initial management technique. Successful non-operative reduction rates have been reported to range between 42% and 95%.² Currently there are no randomised trials to support the superiority between barium enema and pneumatic reduction of intussusception with respect to complications, length of hospital stay, in addition to success rates. However, pneumatic reduction has been reported to

have higher success rates when compared with barium enema reduction.^{2–4} In Trinidad and Tobago, paediatric surgery is practised at two institutions, one of which is the Eric Williams Medical Sciences Complex, which has a catchment of approximately half of the paediatric population.

Barium enema reduction continues to be the mainstay of non-surgical treatment for intussusception at Eric Williams Medical Sciences Complex. A previous study has shown a low success rate; hence, our practice was modified to include delayed reduction.⁵ International data have provided evidence that an improved reduction rate can be achieved with delayed repeat enemas.^{5–8} The aim of this study was first to re-evaluate the non-operative reduction rate of intussusception using multiple interval barium enemas. Second, to investigate or discuss an audit cycle providing evidence and validating the modification of clinical practice. Clinical audit is an essential tool in the drive to improve quality of patient care and thus forms a foundation of clinical

governance. Furthermore, completing an audit cycle demonstrates the effectiveness of implementing new management strategies for patient care.

Materials and methods

A retrospective review was performed of all cases diagnosed and treated for intussusception at the Eric Williams Medical Sciences Complex over a five-year period, commencing 1 January 2009 to 31 December 2013. Approval for this study was granted by the hospital and the University of the West Indies research and ethics committee. Retrospective review of operative and radiological records for the period identified all patients under 12 years of age with a diagnosis of intussusception. Those patients who exhibited signs of peritonitis and haemodynamic instability despite adequate intravenous fluid resuscitation were taken directly to the operating theatre without any attempts at barium enema reduction. These patients were subjected to demographic analysis but were excluded from further statistical analysis.

Enema reduction was conducted by the paediatric surgical officer and resident radiologist on duty. In some cases, mild sedation was required, after which a rectal catheter was introduced and the buttocks manually pinched together and taped to avoid contrast leakage. A column of barium was erected three feet above the level of the table for three minutes at a time. An interval of three to five minutes was allowed, followed by repeating the previous step for a total of three times. This was considered to be one attempt at barium enema reduction being performed under real-time fluoroscopy. Reduction was only considered to be achieved if contrast entered the distal ileum and small bowel. If reduction was unsuccessful and there were no signs of peritonitis and the patient remained clinically stable, a second attempt was performed two to six hours later. A maximum of three

delayed interval reductions were carried out. If all attempts were unsuccessful, the patient developed peritonitis or became haemodynamically unstable the patient was subjected to operative management.

Data recorded included patients' demographics, date and time of admission, presenting signs and symptoms, use of analgesia, number of reduction attempts and success of reduction, intraoperative findings, complications, recurrence and duration of stay post reduction. The data collected were entered on a Microsoft Excel spreadsheet and analysed using SPSS version 12.0. Variables such as incidence, age, gender, success rate and factors affecting success rate were compared with a similar study completed in 2007.

Results

This study included 60 patients diagnosed and managed for intussusception over a five-year period. Patients' ages ranged from two months to four years, with a median age of one year; 65% of sample size presented at less than one year of age and 85% were less than two years of age. There was a male predominance of three to two.

Thirty per cent of cases were noted to occur during the March to May period (Fig 1). The onset of symptoms in most cases were less than 24 hours (38/60). Vomiting (48/60) was the most common presenting symptom followed by abdominal pain (34/60). A palpable abdominal mass (23/60) was the most frequent sign detected on physical examination (Table 1). Approximately one-third (20/60) of patients revealed no signs on physical examination. No patients exhibited the classical clinical triad of abdominal pain, bloody stools and a palpable abdominal mass. Four cases presented with signs of peritonitis and subsequently underwent emergency laparotomy without any attempts at barium

Figure 1 Seasonal variation of incidence of intussusception

enema reduction. Additionally, they were excluded from further statistical analysis.

Barium enema reduction was attempted in 56 of 60 patients in this study population. Successful barium enema reduction was achieved in 37/56 (66%) of children in whom barium enema was attempted, a figure that matches the UK experience. One attempt of barium enema reduction was made in 39 cases, 2 attempts in 15 cases and 3 attempts in 2 cases (Table 2). Approximately 75% were successful on the first attempt at enema reduction and 53% on the second attempt. Interestingly, the two cases that were subjected to three attempts were unsuccessful. Reduction rates were higher in males, independent of the number of attempts but this was not statistically significant since the majority of the sample population were males. Children less than one year of age had a much higher reduction rate (48% on first attempt and 100% on second attempt). Significantly, the two cases that were unsuccessful after three attempts occurred in children more than one year of age.

Patients for whom the initial enema reduction was within six hours from the time of presentation appeared to have

higher reduction rates compared with a delay of more than six hours: for the first attempt, 59% compared with 41% and for the second attempt 75% compared with 25%. Prior use of analgesia demonstrated minimal effect on non-operative management irrespective of the number of attempts, as successful reduction rates were 48% and 37.3% for first and second attempts. The use of non-opioid analgesia proved to have greater effect in comparison to opioid analgesia. The combination of both opioid and non-opioid analgesia illustrated little consequence on reduction rates.

Approximately one-third of the patients in the sample (23/60) underwent operative management. These were inclusive of four patients being taken for operative management as a first intervention, as they showed signs of peritonitis on admission. The remaining 19 had failed non-operative reduction regardless of the number of attempts and went on to have operative management as a secondary intervention. Three patients required bowel resection with primary anastomosis. A pathological lead point was found in three cases for patients managed operatively. In all instances, a Meckel's diverticulum was found to be the underlying cause. These included two patients who were managed surgically as a first intervention and one case in which non-operative reduction failed. A negative laparotomy was performed in three cases who underwent operative management as a secondary intervention and no surgical lead point was identified. There were three recurrences; all three occurred within 24 hours of previous successful barium enema reduction. Two of the three patients had successful repeat barium reduction. The other patient underwent laparotomy but the only significant finding was enlarged mesenteric nodes and the intussusception was found to be reduced. There were no mortalities and the mean hospital stay for successful and failed enema reduction was 1.5 days and 4.4 days, respectively.

Audit results

An increased in prevalence is noted in this study period (12.5 cases per annum) compared with the previous study conducted in 2006 (9.7 cases per annum). Both studies demonstrated that there was a male preponderance and majority cases occurring in infants less than one year old. In addition, the study conducted by Tota-Maharaj *et al.* demonstrated that 18% of sample size presented with the classical clinical triad whereas there were no cases in this study.⁵ The use of interval barium enema reduction resulted in a 66% diagnosed (71% actual reduction rate) success rate compared with 41% success rate for single enema reduction (chi square 0.02). Males and infants less than one year were two similar variables that corroborated a greater success rate in both studies.

Discussion

Clinical auditing is a process by which there is analysis and amendment of clinical practices to ensure that superior care is delivered to patients. The term 'audit' is not well acknowledged by many, since there is a limited understanding about its origin, the process of conducting an audit, as well as the

Table 1 Signs and symptoms experienced by 60 patients with intussusception.

Sign/symptom	Episodes		Age (years)		
	(n)	(%)	< 1 (n)	1–2 (n)	> 2 (n)
Vomit	48	80	34	7	7
Abdominal pain	34	63	17	10	7
Bloody stool	22	37	19	3	0
Lethargy	19	32	16	2	1
No signs	20	33	10	8	2
Abdominal distension	9	15	7	0	2
Abdominal mass	23	38	18	2	3
Temperature >38 degrees C	7	12	5	1	1
Peritonitis	3	5	2	0	1
Dehydration	13	12	9	1	3

Table 2 Barium enema reduction rates at multiple attempts (n = 56 patients).

	Attempts (n)		
	1	2	3
Successful	29	8	0
Unsuccessful:			
Total	27	9	2
Proceeded to delayed interval enema	17	2	0
Proceeded to surgical intervention	10	7	2

impact on patient care. Quality assessment of patient care originated in the mid-1800s. Several definitions have been postulated since that time to demonstrate the concept of clinical audit. In 1989, the White Paper *Working for Patients* was one of the first in the UK to recognise the importance of a clinical audit in enhancing patient's wellbeing.⁹ Medical audit, as it was then called, was defined as 'the systematic critical analysis of the quality of medical care including the procedures used for diagnosis and treatment, the use of resources and the resulting outcome and quality of life for the patient'.⁹ The term 'medical audit' later evolved into 'clinical audit' and a revised definition was provided by the NHS Executive: 'Clinical audit is the systematic analysis of the quality of healthcare, including the procedures used for diagnosis, treatment and care, the use of resources and the resulting outcome and quality of life for the patient'.¹⁰ The National Institute for Health and Clinical Excellence (NICE) defined clinical audit as 'a quality improvement process that seeks to improve patient care and outcomes through systematic review of care against explicit criteria and the implementation of change. Aspects of the structure, processes, and outcomes of care are selected and systematically evaluated against explicit criteria. Where indicated, changes are implemented at an individual, team, or service level and further monitoring is used to confirm improvement in healthcare delivery'.¹⁰ The common feature of an audit described in these definitions is to improve quality, effectiveness and efficiency of patient's care by comparing it to standard of practices and implementing change when necessary.

Audit is one of the main pillars of clinical governance which is 'a framework through which the NHS organizations are accountable for improving the quality of their services and safeguarding high standards by creating an environment in which excellence in clinical care will flourish'.¹¹ A clinical audit is conducted through a series of systematic steps, termed the audit cycle. The first stage is to identify an interest of concern. In this report, the topic to be addressed is that the use of delayed repeated barium enemas may improve the non-operative success rate of intussusception compared with single-use enema reduction. The second stage is to define the criteria and to ensure that the outcome is matched with present-day surgical methods. In this case, a total of three successive enema reduction attempts was deemed to be a single attempt and a successful reduction occurred once there was free flow of contrast in the small bowel. If the attempt was unsuccessful and there were no signs of peritonitis, another attempt was made two to six hours later. A total of three attempts were made. The success rate for the use of repeated, delayed non-operative reduction ranges from approximately 60–95% according to published studies.^{6–8}

The third step is to observe the exercise and record the data to ensure correct documentation of findings. In our scenario, each case diagnosed with intussusception and its associated management technique was carefully recorded.

The next step is to compare the audit results against the criteria and the standard. The results of this audit displayed an increase in the reduction rate from 41% to 66% (chi square 0.02) as a result of the modification from single enema to multiple delayed barium enema reduction. The final step is to discuss the results and implement a change. These results demonstrate that the use of delayed interval barium enema reduction increases the rate of successful non-operative reduction of intussusception.

Conclusion

There has been an increased occurrence of diagnosis of intussusception at our institution. There is a male preponderance, with 85% of cases occurring in children less than two years. Delayed, multiple-interval barium enema was found to be a superior intervention as compared with a single barium enema reduction. This has been validated by completion of the audit cycle at our institution, which demonstrated increase in the reduction rate from 41% to 66% (chi square 0.02). There was no increased associated morbidity and no mortality with the modification of practice and thus has since become the standard of care at our institution. The audit cycle is dynamic and so it is a constantly evolving process. Further research is required in our setting, in which the use pneumatic reduction may prove to be the way forward.

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