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ORIGINAL ARTICLE

Does the length of the history influence the outcome of pneumatic reduction of intussusception in children?

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Abstract
Purpose Intussusception is the most common cause of acute abdomen in infants and preschool children. Nonoperative reduction using air enema is an established treatment in children with intussusception. The aim of this study was to determine whether length of the history influences the outcome of pneumatic reduction of intussusception in children?
Methods The medical records of 256 consecutive children with intussusception between July 1998 and June 2010, who underwent air enema reduction regardless of the length of the history were reviewed. In all 256 patients, intussusception was confirmed by ultrasound before proceeding to air enema.
Results The length of history ranged from 2 to 240 h with median time of 18.5 h. The median age in 256 patients was 7 months (range 1 day to 12 years). The presenting clinical features included irritability/abdominal pain (77%), vomiting (80%), bleeding per rectum (36%) and palpable abdominal mass (50%). Air enema reduction was successful in 234 (91.5%) of the 256 patients. In 22 (8.5%) patients, air enema failed to reduce the intussusception and 3 (1.1%) of these patients had colonic perforation during the procedure. All 22 patients required surgery. The duration of symptoms did not influence the outcome of pneumatic reduction. 37 (14%) patients developed recurrence after successful pneumatic reduction of intussusception, with 58% presenting within 48 h of the initial procedure.
Conclusion Our data suggest that pneumatic reduction should be first-line treatment in all children with intussusception regardless of the length of the history.

Keywords Intussusception · Pneumatic reduction · Length of history · Outcome

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Introduction

Intussusception is the most common cause of acute abdomen in infants and preschool children [1]. The earliest description of intussusceptions is attributed to Paul Barbette of Amsterdam in 1674, who described intestinal invagination and suggested operative intervention [2]. In 1836, Samuel Mitchill reported the first case of successful reduction in childhood using an enema tube and a common pair of bellows [3]. Diagnosis of intussusception can be difficult sometimes and may be hampered by the variability of its clinical presentation [4, 5]. Ultrasound is currently used as the initial imaging modality in the assessment of these patients. Once the diagnosis of intussusception is made, non-operative reduction using air or hydrostatic enema is presently considered the treatment of choice. A delayed diagnosis with longer duration of symptoms has long been associated with higher rates of surgical intervention [6, 7]. The aims of this study were to determine whether the history influences the outcome of pneumatic reduction of intussusception in children?

Methods

The medical records of 256 consecutive children with intussusception between July 2007 and June 2010, who underwent air enema reduction regardless of the length of the history were reviewed. In all 256 patients, intussusception was confirmed by ultrasound before proceeding to air enema. Microsoft excel was used for both data collection and statistical analysis. During air enema reduction, a Foley catheter (12–18 fr) was inserted into the patient's rectum. Tape was applied to secure the catheter and keep the buttocks together ensuring a tight anal seal. Air was introduced manually to a pressure range of 80–120 cm of water, by means of a pressure monitoring device linked to a T-connector. The procedure was considered to be successful when the mass was fully reduced, and air was seen to fill small bowel.

Results

There were 181 (70%) males and 75 (30%) females in total, giving a male:female ratio of 2.3:1. The median age in 256 patients was 7 months (range 1 day to 12 years; Table 1). The length of history ranged from 2 to 240 h with median time of 18.5 h (Table 2). The presenting clinical features included irritability/abdominal pain (77%), vomiting (80%), bleeding per rectum (36%), withdrawing up of legs (39%), pallor (38%), diarrhoea (16%) and palpable abdominal mass (50%). Air enema reduction was successful in 234 (91.5%) of the 256 patients. In 22 (8.5%) patients, air enema failed to reduce the intussusception and in 3 (1.1%) of these patients colonic perforation occurred during the procedure. The duration of symptoms did not influence the outcome of pneumatic reduction. There was no difference in air enema reduction outcome amongst children presenting within 24 h, 1–2 days or >2 days (Fig. 1). A total of 37 (14%) patients developed recurrence after initial successful pneumatic reduction of the intussusception, with 58% presenting within 48 h of the initial procedure. There were 50 episodes of recurrence amongst the 37 patients. Redo air enema was successful in 44 (88%) of the recurrences. In 6 (12%) patients, air enema failed to reduce the intussusception and 1 of the patients had colonic perforation during the repeat procedure. In total, 28 patients underwent surgery. Of these, 20 patients (71%) underwent a successful open reduction of intussusceptions and 8 patients (30%) required resection and anastomosis. One patient had recurrence following operative reduction which was reduced easily with air enema reduction.

We found a lead point in only three patients (Meckel's diverticulum, caecal duplication and small bowel polyp). The average length of stay for pneumatic reduction was 2 days and for operative reduction 5.5 days.

Discussion

Intussusception is a common acute problem in infancy and childhood. Delay in diagnosis and treatment can lead to serious complications, such as bowel ischaemia, perforation and peritonitis [4, 8]. The 'classic' symptoms and signs of intussusception, such as abdominal pain, vomiting, red current jelly stool and palpable abdominal mass are not always present in children with intussusceptions as revealed in our study [4, 8]. Broader knowledge of the variable presentation of this condition coupled with a high index of suspicion may aid in its early diagnosis. Ultrasound is now the gold-standard as it has high sensitivity and specificity and is radiation free [9]. It can aid in

Table 1 Age distribution

Age (months)	No. (%)
0–6	85 (33)
6–12	116 (45)
12–24	46 (18)
>24	09 (4)

Table 2 Length of history

Length of history (days)	No. (%)
0–24	162 (63)
1–2	42 (16)
2–7	46 (18)
>7	06 (3)

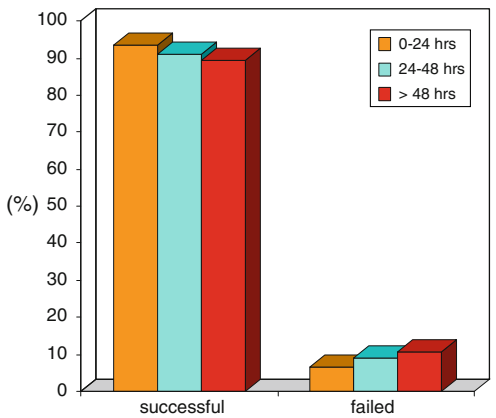

Fig. 1 Air enema reduction in 256 patients. No correlation between length of history and pneumatic reduction outcome

differentiating between ileo-ileal and ileo-colic intussusceptions as well as diagnose any pathological lead points [9]. In our study, the majority of cases were ileocolic intussusception and only three patients had lead points.

Once diagnosed, air enema reduction should be attempted in all cases except in those with established perforation and peritonitis [10].The advantages of pneumatic reduction under fluoroscopy include high success rates, ease of performing procedure and decreased cost [10, 11]. When compared with barium, fluoroscopy screening times are shorter with reduced radiation doses and morbidity rates lower when perforation occurs [12, 13]. US-guided pneumatic reduction is non-invasive with high success rate, but the results are operator dependent [13, 14].

The duration of history before reduction has been found to be a significant factor in outcome of pneumatic reduction and previous studies revealed that longer duration of symptoms was associated with higher failure rates [8, 15]. Studies also reported higher complication rates in those patients with prolonged symptoms [13]. The high success rate (91.5%) of pneumatic reduction under fluoroscope in our patient population regardless of length of history contradicts previous reports. We did not find any significant relationship between failed reduction and duration of symptoms. There were 3 (1.1%) colonic perforations during the pneumatic reduction and one patient had perforation during redo air enema reduction. Our overall colonic perforation rate was 1.5% which was similar to previous reports [4, 16].

The recurrence rate (14%) in our study was slightly higher than that reported elsewhere [17–19]. Of the recurrences, 58% occurred within 2 days of pneumatic reduction. Five of these had a recurrence within 6 h of pneumatic reduction which may represent either unresolved intussusception or early recurrence. Higher success rates (88%) of air enema reduction in recurrent intussusception in our cases show that this treatment modality is also highly successful in recurrent intussusception. Lower rates of surgical intervention have been reported in centres with specialised paediatric radiological facilities [18, 20]. All pneumatic reductions in our institution were done by consultant radiologists and this may contribute to our high success rate in pneumatic reduction. Our data suggest that pneumatic reduction should be first-line treatment in all children with uncomplicated intussusceptions. Previously failed reductions and prolonged history do not preclude attempts at non-operative management.

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