

The second trial pneumatic reduction for idiopathic intussusception: therapeutic effect and hazards

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Purpose To study the therapeutic effect of the second trial pneumatic reduction on patients with idiopathic intussusception.

Patients and methods A prospective study was carried out on patients with idiopathic intussusception presenting to our unit, between August 2009 and January 2010. We excluded patients older than 2 years of age, neglected cases with signs of peritonitis, and recurrent cases. All patients were subjected to the first trial pneumatic reduction, which was performed in three successive attempts (3 min each) under fluoroscopic guidance with pressure ranging from 80 to 100 mmHg. Patients with incomplete reduction but with satisfactory movement of the intussusceptum in the first trial were subjected to a second trial pneumatic reduction after 3 h.

Results Fifty patients underwent first trial pneumatic reduction, which was successful in 33 patients, representing an overall reduction success rate of 66%. Of the remaining 17 patients, nine immediately underwent surgery rather than undergoing a second trial of pneumatic reduction because of minimal movement of the

intussusceptum during the first trial. A second trial pneumatic reduction was offered to the remaining eight patients and was successful in six (75%), increasing the overall success rate from 66 to 78%. There were no bowel perforations among all the attempts at pneumatic reduction (first or second trials).

Conclusion In a selected group of patients, delayed repeated air enema can increase the nonoperative reduction rate of idiopathic intussusception; however, careful attention should be paid towards decreasing exposure to radiation. *Ann Pediatr Surg* 8:77–79 © 2012 Annals of Pediatric Surgery.

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Introduction

Intussusception is the second most common cause of gastrointestinal obstruction after pyloric stenosis in children, with an incidence of one in every 2000 infants and children, and peaks between 4 and 7 months of age [1]. The treatment of intussusception has changed from primarily operative management to a preference for radiological reduction with either air or barium contrast. The published success rate of radiological reduction averages 80%, but varies widely between 40 and 90% [2].

Pneumatic reduction of intussusception as an alternative to surgery was first performed in 1864 by Grieg (from Scotland) using hand bellows [3], and it has been shown to decrease the length of hospitalization, shorten recovery, reduce the risk of complications associated with abdominal surgery, and decrease the hospital cost [4]. The proportion of patients with intussusception treated by gas enema has increased markedly; however, at surgery, 10% were found to be reduced and another 40% were easily reduced manually by simple manipulation [5]. This high rate of manual reduction suggests that it might be possible to achieve a higher rate of reduction if a delayed enema is performed in those who remain in satisfactory clinical condition [6].

The use of delayed, repeated reduction attempts has been reported in several series (Table 1); however, the evaluation of its use and its impact on larger groups of patients is still required [11]. In this report, we examined the therapeutic

effect of the second trial pneumatic reduction on our patients with idiopathic intussusception.

Patients and methods

From August 2009 up to the end of January 2010, a prospective study was carried out on patients with idiopathic intussusception presenting at the Pediatric Surgery Unit (Ain Shams University), to evaluate the therapeutic effect of the delayed second trial pneumatic reduction. The study was approved by the hospital internal review board. The following were excluded from the study: patients older than 2 years of age; neglected cases (picture of peritonitis); recurrent cases; and when unsatisfactory movement of the intussusceptum was noticed in the first trial.

All patients were subjected to the first trial pneumatic reduction after initial resuscitation with intravenous fluids, double antibiotics (third-generation cephalosporin, metronidazole), and nasogastric tube insertion. The trial was performed by inserting a Foley catheter (18 Fr) into the rectum and inflating the balloon by 20–30 ml saline, and then the insufflator was attached to the other end of the catheter. Insufflation was performed in three successive attempts under fluoroscopic guidance with pressure ranging from 80 to 100 mmHg. Each attempt lasted for 3 min, with a 5-min interval between successive attempts.

Patients with incomplete reduction but with satisfactory movement of the intussusceptum under fluoroscopy in

Table 1 Different series evaluating the use of delayed repeated enema for reducing intussusception

References	Number of cases	Success rate (%)
Guo <i>et al.</i> [7]	NA	50
Collins <i>et al.</i> [8]	NA	NA (increase by 34)
Saxton <i>et al.</i> [6]	21	52.4
Gorenstein <i>et al.</i> [9]	19	82.6
Sandler <i>et al.</i> [10]	17	58.8
González Spinola <i>et al.</i> [11]	NA	NA (increase by 15)
Navarro <i>et al.</i> [12]	26	50
Pazo <i>et al.</i> [13]	17	53
This study	8	75

the first trial were subjected to a second trial pneumatic reduction after 3 h in three successive attempts similar to the first trial. During the 3 h, the patient received maintenance intravenous fluids and corticosteroids (hydrocortisone 5 mg/kg).

Successful reduction was indicated radiologically by the disappearance of the intussusceptum and free flow of air into the terminal ileum, whereas the free flow of air into the peritoneal cavity indicated a perforation.

Results

During a period of 6 months, 55 patients younger than 2 years of age presented with intussusception. There were 28 males and 27 females. The mean age was 6 months, ranging from 3 months to 2 years. Patients presented with colic (54 patients; 98%), vomiting (52 patients; 94.5%), and bloody stools (50 patients; 91%). On examination, 40 patients had abdominal distension (73%), six had a palpable abdominal mass (11%), and in four the head of intussusceptum could be felt in the rectum on PR examination (7%).

Of the 55 patients with proven intussusception, five patients had primary surgery rather than pneumatic reduction because of signs of peritonitis (neglected intussusception).

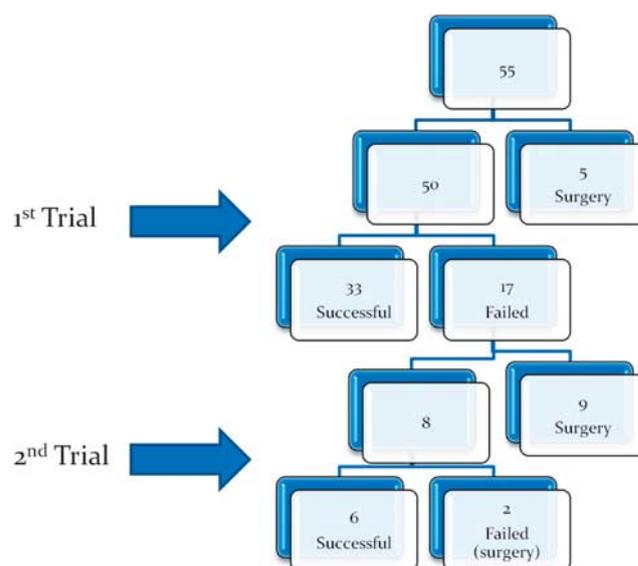
The remaining 50 patients underwent pneumatic reduction; this was successful in 33 patients, representing an overall reduction success rate of 66%. Of the remaining 17 patients, nine immediately underwent surgery rather than undergoing a second trial of pneumatic reduction because of minimal movement of the intussusceptum during the first trial. A second trial pneumatic reduction was offered to the remaining eight patients and was successful in six (75%), increasing the overall success rate from 66 to 78% as shown in Table 2.

No bowel perforations were detected in any of the attempts of pneumatic reduction (first or second trials). After successful pneumatic reduction, all the 39 patients were discharged within 24 h after tolerating oral feeding. Only one patient had a recurrence during the period of the study and was also successfully reduced by pneumatic reduction.

A longer duration of symptoms and signs was found to reduce the chance of successful pneumatic reduction (Table 3).

Discussion

The decision to perform the second trial was made on the basis of previous observations that 10–14% of the radiologically irreducible intussusceptions had undergone

Table 2 Therapeutic effect of first and second trial pneumatic enema on idiopathic intussusceptions**Table 3 Reduction rate by enema in relation to the duration of symptoms among patients with idiopathic intussusceptions**

Groups	Number of patients	Success rate
A (<24 h)	33	27 (81.8%)
B (24–48)	9	6 (66.6%)
C (>48 h)	8	5 (62.5%)

spontaneous reduction at the time of laparotomy and that 51–66% of those still present were easily reduced manually without the need for bowel resection [14]. The rationale behind the use of delayed repeated reduction attempts is that the partial reduction achieved with the first enema improves the venous drainage from the residual intussusceptions, and the interval before a repeated enema allows the congestion and swelling to subside, facilitating the subsequent reduction attempt [6].

Essential criteria for the second trial include the following: absence of signs of peritonitis, initial partial reduction of the intussusception, and stable vital signs. This group, therefore, may be quite few in number and represents a small percentage of all intussusceptions. However, the advantage of avoidance of laparotomy in any particular patient is significant [15].

In our study, delayed repeated reduction attempts were used in 14.5% of the patients and were successful in 75% of these. With this, we achieved an increase in our nonoperative reduction rate by 12% (from 66 to 78%). There were no cases of bowel perforation. Also, we found that a longer duration of symptoms and signs reduces the chance of successful pneumatic reduction, which is in agreement with other reports [16].

Although there is no clear evidence on the relation of cancer and radiation exposure from diagnostic imaging,

many reports have highlighted this issue, especially in the pediatric population, who are two to five times more sensitive to radiation than adults [17]. Fluoroscopic screening of 30 min has been estimated to produce a risk of one in 1000 for the development of radiation-induced cancer [18], which is close to the upper limit of risk acceptability [19]. Repeating trials for reducing intussusceptions under fluoroscopic control would result in prolonged periods of radiation exposure (reaching up to 18 min in our study). This necessitates careful consideration of other measures that can decrease the radiation dose to a minimum. It has been suggested that patients should be screened posteroanteriorly to reduce the dose delivered to radio-sensitive organs (e.g. gonads) [18]. Intermittent (pulsed) fluoroscopy, pneumatic rather than barium reduction, and automatic exposure control are among the other measures that should be considered. Also, coning-down of the screening image to the minimum field size required can prevent unnecessary exposure to non required organs [20]. Hydrostatic reduction under ultrasound control can be a superior alternative without ionizing radiation; however, it is not widely practiced because of the need for experienced personnel over 24 h.

The use of delayed, repeated reduction attempts and the risks of an increased radiation dose with the use of fluoroscopy have to be weighed against the risks of emergency surgery and anesthesia in sick children and the long-term risks of postoperative adhesions [18].

Bowel perforation during delayed, repeated reduction attempts has been reported in only one patient in the literature. This perforation occurred in a third trial that was performed 10 h after the first trial. This incident led to the recommendation to perform all delayed, repeated reduction attempts within 2–4 h of the initial attempt [10].

Conclusion

In a selected group of patients, delayed repeated air enema can increase the nonoperative reduction rate of idiopathic intussusception; however, careful attention should be paid to decrease exposure to radiation.

Acknowledgements

Conflicts of interest

There are no conflicts of interest.

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