

Gastrografin in the management of adhesive small bowel obstruction in children: a pilot study

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Background/purpose Adhesive small bowel obstruction (ASBO) is a common emergency problem in children with previous abdominal surgery. Management protocols usually start with a conservative approach that may be successful in some cases, whereas in others it will end eventually by laparotomy with its associated morbidity and mortality. Our aim was to assess the role of water-soluble contrast, gastrografin, in the conservative management of ASBO.

Patients and methods During the period January 2009 to July 2010, 33 patients with ASBO were presented at the Pediatric Surgery Unit at the Ain Shams University Hospitals. Patients who failed to improve after 48 h of conservative management in the absence of signs of strangulation were subjected to gastrografin administration. Patients were evaluated clinically and radiologically to determine the resolution of the adhesive attack, with estimation of hospital stay time.

Results An oral administration of gastrografin successfully completed the conservative management in eight of 12 patients (66.6%), thus avoiding surgery and subsequently reducing hospital stay.

Conclusion Gastrografin may have a valuable role in the management of ASBO, whether diagnostic or therapeutic, but a randomized controlled trial is needed to prove its effectiveness in reducing surgical intervention rate and hospital stay time. *Ann Pediatr Surg* 7:3–6 © 2011 Annals of Pediatric Surgery

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Introduction

Adhesive small bowel obstruction (ASBO) is considered as a significant cause of postoperative morbidity in children. Appendectomy, stoma formation and closure, Nissen fundoplication, and Ladd's procedures are the most common procedures leading to ASBO [1]. Its incidence in the literature ranges from 2 to 30% and is greater in neonates, mostly occurring within the first 2 years after surgery [1,2].

Conservative therapy is the preferred approach in selected patients with ASBO, which is successful in 74% of patients, but with a high rate of recurrence [3]. Some investigators reported that 70.5 to 84% of these patients will eventually require surgery. This differs markedly from the results obtained in adults in which most of the cases resolved nonoperatively. Pointing to ASBO as a distinct disease entity in children, the younger the patient, the more likely is the failure of conservative trials with a tendency toward more complications [1,4].

Gastrografin, an oral water-soluble contrast agent, has been used in the nonoperative management of adult patients with ASBO [5], and many prospective studies were carried out to evaluate its diagnostic and therapeutic values in the conservative management of ASBO in adults [6]. However, till date no reported study was carried out to assess the therapeutic effect of upper gastrointestinal series in cases of ASBO in children.

The purpose of this study was to evaluate the possible use of gastrografin in the management protocol of ASBO in the

pediatric age group, and its safety and effectiveness in reducing the hospital stay and operative intervention rate.

Patients and methods

Children, aged between 1 and 16 years, who presented to the Pediatric Surgery Department of the Ain Shams University Hospitals with clinical and radiological evidence of ASBO at least 1 month after last abdominal surgery, were included in this study.

Exclusion criteria included patients with a picture suggestive of strangulation or peritonitis at the time of presentation, patients with a known history of allergy or hypersensitivity to iodinated contrast agents, patients with asthma or atopy, patients with inflammatory bowel disease or tuberculosis, and patients with a history of irradiation to the abdomen or documented intra-abdominal malignancy.

Initial workup for all patients was carried out: Detailed surgical and medical history, complete physical examination with emphasis on signs of bowel strangulation and/or peritonitis and initial investigations, and both laboratory 'complete blood count, serum Na, K, and, creatinine' and radiological 'plain erect and supine abdominal radiographs.'

Patients presenting with signs of strangulation or peritonitis were explored immediately after resuscitation. Other patients were managed conservatively for the next 48 h.

In our institute, the usual conservative protocol has been to wait for 48 h. Patients who developed signs of bowel strangulation and/or peritonitis at any time during the

conservative period would undergo would be operated upon (exploration). Patients who passed the period of conservative management and did not show significant improvement both clinically and radiologically would be subjected to surgical interference even in the absence of ischemic signs due to failure of conservative management.

In this study, gastrografin (a mixture of sodium amidotrizoate and meglumine amidotrizoate) manufactured by Sanochemia Pharmazeutika AG, Austria, Sanochemia Diagnostics Deutschland GmbH, was applied to patients who failed to respond to conservative management as an intermediate step before surgical intervention. Gastrografin administration was preceded by infusion of intravenous Ringer's solution bolus to guard against dehydration caused by the hygroscopic effect of gastrografin. Gastrografin was given according to the age of the patient (Table 1) after dilution with equal volume of Ringer's solution. The prepared mixture was given through the nasogastric tube that was kept closed for 3 h and was then reopened.

Patients were subjected to serial plain supine abdominal radiographs at 3, 6, 12, and 24 h after contrast administration. Successful management was considered when the contrast reached the cecum in association with clinical improvement. Once successful, the nasogastric tube was

removed and clear fluids were commenced followed by a liquid diet and then solid food. If the contrast failed to reach the large bowel within 24 h, the patient was diagnosed as having complete obstruction and was proceeded to laparotomy.

We assessed the patients with regard to the percentage of cases resolved after gastrografin administration, time taken by the dye to reach the colon, and hospital stay in hours after gastrografin administration.

Results

From the period January 2009 and July 2010, 33 patients were admitted for 35 attacks of ASBO. Their age ranged from 1 to 13 years. There were 19 boys and 14 girls. Four patients were explored immediately after initial resuscitation; three underwent resection and anastomosis, and one had adhesiolysis.

The remaining 31 attacks were subjected to conservative management for 48 h under close observation. Within these 48 h another two cases developed signs of peritoneal irritation and were explored; both had adhesiolysis.

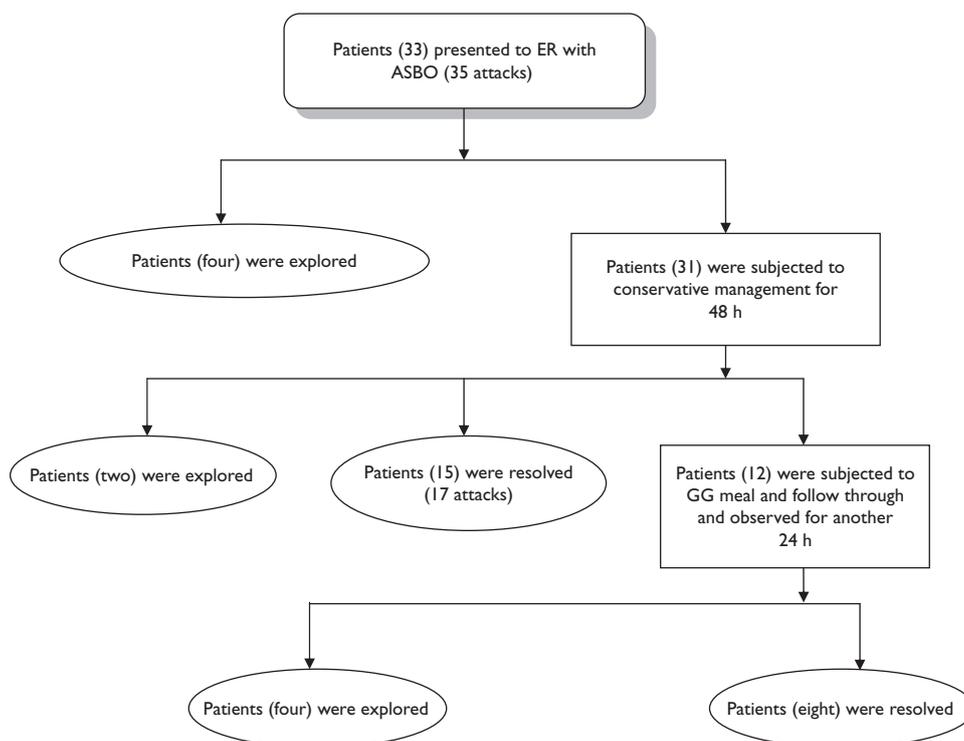
Seventeen attacks in 15 patients had resolved within the 48 h period of conservative management.

The other 12 cases that did not resolve conservatively within 48 h were subjected to gastrografin administration through a nasogastric tube. Eight of them had their attack clinically resolved, in addition to radiological improvement proved by passage of the contrast to the cecum within 3–12 h. Their clinical picture improved. The other four

Table 1 Gastrografin dose according to age group

Age in years	Amount of gastrografin (ml)
1–4	20
4–8	30
8–12	40
12–16	50

Fig. 1



A schematic presentation for management of the 33 cases. ASBO, adhesive small bowel obstruction; GG, gastrografin.

Table 2 Detailed data for the 12 cases managed with gastrografin

Patient number	Age (year)	Sex	Earlier operation(s)	Time passed since last exploration (ms)	Duration of current attack (ds)	Contrast appear at colon after (h)/ exploration	Total hospital stay (h)	Hospital stay after GG (h)
1	1.5	Male	Perforated Mickel's ileostomy, multiple biopsies, closure of ileostomy	5	3	3	60	12
2	13	Male	Appendicular mass, Lap appendectomy	1	1	12	70	22
3	1	Female	Diaphragmatic hernia	4	2	12	72	24
4	3	Male	Colostomy, PSARP closure of colostomy	24	3	Explored after 9 h of adhesiolysis	102	-
5	1.5	Female	Intussusceptions, open reduction	8	4	Explored after 24 h of adhesiolysis	120	-
6	2	Male	Malrotation, adhesiolysis	12	2	6	62	14
7	1	Male	Intussusceptions, resection, and anastomosis	6	2	6	64	16
8	12	Female	Complicated appendicitis, open appendectomy	24	3	Explored after 24 h of resection and anastomosis	152	-
9	2	Female	Intussusceptions, right hemicolectomy and primary anastomosis, leakage redo anastomosis	12	2	3	72	24
10	1.5	Female	Diaphragmatic hernia	18	4	Explored after 24 h of resection and anastomosis	150	-
11	3	Male	Colon bypass	24	3	6	66	18
12	10	Female	CBD exploration	9	2	12	72	24

CBD, common bile duct; GG, gastrografin; PARR, posterior sagittal anorectoplasty.

patients were explored, as the contrast showed complete small bowel obstruction with failure to reach the cecum. Two of these four cases underwent adhesiolysis, whereas the other two underwent resection and anastomosis (Fig. 1).

It should be noted that all four patients who did not respond to gastrografin administration vomited the contrast, and in two of them on follow-up radiographs, the contrast was found to be excreted by the kidneys.

In 66.6% of the patients subjected to gastrografin administration, the attack of ASBO resolved within 3–12 h (average 7.5 h). Their average hospital stay after gastrografin administration was 19.25 h. Two patients complained of temporary colicky abdominal pains when the nasogastric tube was closed, whereas all patients experienced diarrhea denoting successful passage of the contrast to the colon (Table 2).

Discussion

ASBO continues to impose common and significant postlaparotomy morbidity in infants and children, yet there has been no standard protocol for its management. In the absence of bowel strangulation, adhesive obstruction can be managed conservatively. However, the optimal duration for this trial of conservative treatment is controversial; in our institution, conservative management is usually continued for 48 h. A high incidence of surgical interference with its subsequent morbidities and complications is still present.

The therapeutic effect of gastrografin in ASBO may be attributed to its hyperosmolarity. Gastrografin promotes shifting of fluid into the bowel lumen and increases the pressure gradient across the site of obstruction. This fluid shift also dilutes the bowel content and in the presence of the wetting agent allows easier passage of bowel content through a narrowed lumen. Gastrografin also decreases edema of the bowel wall and enhances bowel motility [7].

In the literature about adult patients, many studies were carried out to evaluate the role of a water-soluble contrast (gastrografin) in the management of ASBO. A controversy was present about its role either diagnostic or therapeutic and its role in shortening the hospital stay time and reducing the need for surgical intervention [5–7].

Some studies have shown that failure of the contrast to reach the colon after a designated time indicates complete intestinal obstruction that is unlikely to resolve with conservative treatment, whereas when the contrast reaches the large bowel it indicates partial obstruction and thus patients are likely to respond to conservative treatment [8].

In a meta-analysis study, it was observed that although gastrografin did not reduce the need for surgical intervention, it seemed to shorten the hospital stay for those who did not require surgery [6]. Other studies showed that the use of gastrografin in ASBO was safe and reduced the need for surgery in adult patients when conservative treatment fails [8].

In this study, two-thirds of patients who were subjected to gastrografin responded well and had their attack resolved within 12 h. Although this study is limited by its small number of patients, this group of patients being heterogeneous and not being a controlled one, results suggest that gastrografin may have a valuable role in the conservative management of children with ASBO. In addition, gastrografin may have a predictive value if given from the start as it will help in the early diagnosis of cases with complete obstruction. These cases will be subjected to early surgical management; therefore, unnecessary periods of conservative management will be avoided. Randomized controlled trials are recommended to prove the effect of gastrografin in shortening the hospital stay and in reducing surgical intervention. In addition, long-term follow-up studies are recommended to determine the rate of recurrent adhesive attacks after gastrografin administration.

Conclusion

Gastrografin may have a beneficial role in the conservative management of children with ASBO. However, randomized controlled trials are recommended to prove

its diagnostic and therapeutic effect in shortening the hospital stay and in reducing surgical intervention in the pediatric age group.

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