Evaluation of the Role of Water-Soluble Contrast Administration in Management of Patients with Adhesive Intestinal Obstruction

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Research

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Abstract

**Background:** Adhesive intestinal obstruction is a common post-operative cause of hospitalization. This study aims to evaluate the oral administration of water-soluble contrast on the outcome of patients with adhesive intestinal obstruction in regard to recovery, operative rate and hospital stay.

**Methods:** In this prospective randomized trial, patients were randomized into two groups: gastrografin (GG) and traditional treatment group (TT). In the gastrografin group (GG) after stomach was emptied through a nasogastric tube, the water soluble contrast follow-through was performed within 24 h of hospital admission using 100 mL of 76% gastrografin injected through the nasogastric tube and erect, supine abdominal x-ray was taken (at 8, 12, 24h) later. The endpoints of the study were to evaluate the time interval between admission and relief of obstruction, the length of hospital stay and the need for surgery.

**Results:** Fifty-four patients with a mean age 45 ±2.4 years, 25(46.3%) males and 29(53.7%) females. The number of patients who were successfully conservatively treated in the gastrografin group was 22(81.5%), which was significantly higher than 13(48.1%) in the traditional group. Among these patients, mean hospital stay in gastrografin group was 31.3±4.5 hours, which was significant shorter than 48.9±8.2 hours in traditional group (p=0.004).

**Conclusions:** Administration of an oral water-soluble contrast agent in postoperative adhesive bowel obstruction helps in the earlier resolution of the obstruction, decreases the length of hospital stay and the need for surgery.

Introduction

Intestinal obstruction is a common occurrence in the emergency, representing 25% of all cases of abdominal pain, and it is associated with repeated hospitalization and high morbidity and mortality. It accounts for 20% of all surgical admissions in the emergency setting [1]. The most common cause of intestinal obstruction is postoperative adhesions, which is followed by neoplasms and hernias [2]. The estimated rate of adhesion after laparotomy is from 94–95%. However, this rate is much lower for laparoscopic procedures, but the exact percentage is unknown [3]. Prior to the 1990s, the mortality rate associated with intestinal obstruction was between 30% and 50% [4]. Currently, the correct diagnosis of symptoms and adequate treatment lowered the mortality rate to 5–8% [5, 6].

The majority of postoperative adhesive bowel obstruction (ABO) in the absence of signs of bowel ischemia or peritonitis can be managed by nonoperative conservative management, which leads to an excellent outcome and shorter length of hospital stay. However, in at least 10% of cases, there is no response to conservative management, which necessitates surgical intervention [7, 8].

Several attempts have been made to improve the management of intestinal obstruction, one of the most well-known has been the administration of water-soluble contrast [9]. The use of these contrast agents provide a more accurate diagnosis of partial or complete obstruction according to whether the contrast...
passes into the large intestine, which thus makes it easier to decide whether to operate on cases of obstruction that do not improve with medical treatment [10]. The therapeutic effect of these water-soluble contrast agents is unclear, although some studies say that the effect is demonstrated when the contrasts have been administered more than 24 h after conservative treatment [8].

Water-soluble contrast media are valuable in predicting the need for surgery for ABO in the small intestine [11]. They promote the shift of fluid into the intestinal lumen and increase the pressure gradient across an obstructive site, reducing edema of the bowel wall and improving motility of the bowel [12]. Thus, we aimed to assess the association of gastrografin and resolution of ABO without surgical intervention and hypothesize that the administration of gastrografin decrease the need for operative intervention and length of hospital stay.

**Subjects And Methods**

This prospective randomized control study was conducted at the General Surgery Department of Suez Canal University Hospital between March 2015 and March 2016. Inclusion criteria patients with clinical (history of abdominal operations > 6 weeks, abdominal pain, vomiting, abdominal distention and constipation) and radiological (erect and supine abdominal x-ray show multiple air fluid level) evidence of adhesive intestinal obstruction over 18 years were included in the study. Exclusion criteria the following Patients were excluded. Patients with peritonitis, signs of strangulation or with irreducible hernia Patients with grossly dilated small gut > 10 cm in transverse diameter on abdominal x ray. Patients with terminal malignancy or carcinomatosis peritoni. Contraindiction for contrast administration (allergy). Sample size: The sample size was determined by using the following equation: n = (z/e) 2p (100 − p) (19), where p is the incidence of the adhesive small bowel obstruction among acute abdomen presentation (25%), Za/2 is the percentile of standard normal distribution determined by 90% confidence level (1.96), and e is the width of the confidence interval (10%). The calculated sample size is 54 patients. Methods Patients were subjected to the following: Full medical history including personal data, history of any medical illness, onset and duration of symptoms, previous operations, site of incision, time of operation, type of pathology (cause), usage of drainage, elective or emergent operation, mild or moderate complications (e.g., wound sepsis, delayed healing, and/or wound dehiscence), and severe complications (e.g., burst abdomen, fecal fistula, foreign bodies, and/or anastomotic dehiscence). Complete clinical examination including general and local abdominal examination (abdominal distention, intestinal sound, abdominal scar, hernia, rigidity and guarding). Laboratory workup including complete blood count, prothrombin time, partial thromboplastin time, serum electrolytes, and creatinine. Imaging workup including erect chest X-ray excluding perforated viscus (air under the diaphragm), Erect abdominal X-ray to determine air-fluid levels (more than three diagnoses for intestinal obstruction), Supine abdominal X-ray to determine the site of obstruction and CT scans to determine the cause of obstruction. Patients included in the study were admitted to the surgical ward. Gastric decompression was performed with the placement of a nasogastric tube then 100 mL of 76% gastrografin water-soluble contrast was injected slowly through the nasogastric tube and follow-up erect, supine abdominal X-rays were done at 8, 12, and 24 h. The post contrast x-ray was reviewed by single radiologist. The result was interpreted as (1) significant obstruction
if the contrast failed to reach colon and/or if there is clear cut-off of the contrast in the gastrointestinal tract (2) insignificant obstruction if the contrast reaches the colon. The decision to operate was based on clinical and radiological grounds and patients were operated on if there was: (1) deterioration in clinical signs (2) no progress in symptoms and signs of intestinal obstruction for 48 h from start of conservative management. Time was allowed for resuscitation and for conservative treatment in the event that adhesive obstruction would resolve spontaneously and emergency operation to be avoided. The final outcome of the patients (surgery or no surgery) and the contrast examination results were reviewed after the patient were discharged from hospital. Statistical analysis The gathered data were processed using SPSS version 18 (SPSS Inc., Chicago, IL, USA). Quantitative and qualitative data were expressed as means ± SD and numbers and percentages, respectively. Moreover, Student's t-test and chi-square test were used to test the significance of the difference for quantitative and qualitative variables, respectively. A p < 0.05 was considered statistically significant. In addition, written informed consent was obtained from the patients or patients' relatives before study inclusion.

Results

During study period 54 patients with (mean age 45 ± 2.4 years), 25(46.3%) males and 29(53.7%) females were diagnosed in our hospital with adhesive bowel obstruction divided into two group gastrografin group (GG) and traditional treatment group (TT) each group included 27 patients. There was no significant difference between age, gender, number of previous attack or operation of adhesive bowel obstruction in both groups.

The time between the surgery and the episode of adhesive intestinal obstruction was very variable, ranging from 6 weeks to 11 years with a mean of 57 months.

Duration of symptoms before admission were range from 1 to 3 days with no significant difference (p = 0.47) in both groups.

The incidence of adhesive intestinal obstruction post CS higher than other operation (31.4%) but nearly equal in both group (GG = 8, TT = 9).

The contrast was observed in the colon after 8h in 15 patients (55.5%), after 12h in 5 patients (18.5%) and after 24h in 2 patients (7.4%), the contrast had not passed into the colon after 24h in 5 patients (18.5%).

The number of patients who were successfully conservatively treated in the gastrografin group was 22(81.5%), which was significantly higher than 13(48.1%) in the traditional group (p = 0.01). among these patients, mean hospital stay in gastrograffin group was 31.3 ± 4.5 hours, which was significant shorter than 48.9 ± 8.2 hours in traditional group (p = 0.04).
Table 1
Comparison between the two studied groups according to different parameters

|                                | Gastrografin group \( (n = 27) \) | Traditional group \( (n = 27) \) | \( P \) |
|--------------------------------|------------------------------------|---------------------------------|--------|
| **Age**                        |                                    |                                 |        |
| Min–Max                        | 19–80                              | 19–83                           | 0.331^a|
| Mean ± SD                      | 42.6 ± 18.2                        | 47.6 ± 19.2                     |        |
| **Sex**                        |                                    |                                 |        |
| Male                           | 13 (48.1%)                         | 12 (44.4%)                      | 0.785^b|
| Female                         | 14 (51.9%)                         | 15 (55.6%)                      |        |
| **No. of previous ABO episodes**|                                    |                                 |        |
| Min–Max                        | 1–3                                | 1–3                             | 0.226  |
| Mean ± SD                      | 1.3 ± 0.5                          | 1.4 ± 0.6                       |        |
| **History of previous operation for adhesive bowel obstruction** | 5 (18.5%) | 6 (22.2%) | 0.509^b |
| **Duration of symptoms before presentation** |                                    |                                 |        |
| Min–Max                        | 1–3                                | 1–3                             | 0.473  |
| Mean ± SD                      | 2 ± 0.8                            | 2.1 ± 0.8                       |        |
| **Previous abdominal surgery** |                                    |                                 |        |
| CS                             | 8 (29.6%)                          | 9 (33.3%)                       | 0.770^b|
| Appendectomy                   | 5 (18.5%)                          | 4 (14.8%)                       | 1.000^c|
| Cholecystectomy                | 4 (14.8%)                          | 4 (14.8%)                       | 1.000^c|
| Abdominal exploration\(trauma) | 7 (25.9%)                          | 2 (7.4%)                        | 0.142^c|
| Gynecological                  | 2 (7.4%)                           | 1 (3.7%)                        | 1.000^c|

^a Student’s \( t \)-test

^b Chi-square test

^c Fisher’s exact test

*p* ≤ 0.05 statistical significance
|                               | Gastrografin group (n = 27) | Traditional group (n = 27) | P     |
|-------------------------------|-----------------------------|---------------------------|-------|
| Volvulus                      | 0 (0%)                      | 2 (7.4%)                  | 0.491c|
| Laparoscopic surgery          | 1 (3.7%)                    | 2 (7.4%)                  | 1.000c|
| Perforated peptic             | 0 (0%)                      | 3 (11.1%)                 | 0.236c|
| Contrast in colon             |                             |                           |       |
| No contrast in colon after 24h| 5 (18.5%)                   |                           |       |
| Plan of management            |                             |                           |       |
| Conservative                  | 22 (81.5%)                  | 13 (48.1%)                | 0.01b*|
| Operative                     | 5 (18.5%)                   | 14 (51.9%)                |       |
| Duration of hospital stay     |                             |                           | 0.04* |
| Mean ± SD                     | 31.3 ± 4.5 hours            | 48.9 ± 8.2 hours          |       |

*a*Student’s *t*-test  
*b*Chi-square test  
*c*Fisher’s exact test  
*p ≤ 0.05 statistical significance

**Discussion**

ABO is a common surgical emergency whose global management remains controversial. The duration of this treatment is very variable although non operative management is usually indicated in the absence of signs of strangulation. The early use of GGF has also been advocated by the Bologna guidelines. This is in addition to other measures such as ensuring nothing per mouth, intravenous fluids, and nasogastric tube decompression. Again, failure of conservative management within 72 hours should be operatively managed. Their proposed indications for immediate surgery included signs of bowel strangulation, bowel ischemia, and peritonitis[13].

NASBO standards recommend gastrografin administration within 48 hours of admission for ABO[13]. Our results showed that administration of a water-soluble oral contrast associated with significant
improvement and reduction in hospital stay of patient with ABO using a cut-off point of 48 hours after administration of gastrograin for making decision to operate patients with persistent symptoms.

Adhesive obstruction of the intestine can occur after any type of abdominal surgery. ASBO risk varies from 0.5% in abdominal wall surgery, 1.2% after upper gastrointestinal tract surgery to 3.2% in lower gastro-intestinal tract surgery and 4.2% in pediatric surgery[14]. Previous studies have reported appendectomy and colorectal surgery were the most common causes of adhesive bowel obstruction[15]. In our study, CS is the most common cause of adhesive intestinal obstruction in both groups (31.4%).

The overall success rate of conservative treatment of adhesive intestinal obstruction has been described as 78% in all cases [16]. our study had a success rate of 65% in all patients which is lower than previous study.

Our second aim was to demonstrate the therapeutic effect of gastrograin in ABO. From our study, more than 81% of cases of ABO resolved with gastrograin administration demonstrating a significant benefit in conservative management of ABO. This benefit is supported by evidence from randomized controlled trials that detailed further benefits, as providing expedited resolution of obstruction, allowing earlier discharge and reducing the need for surgery in some patients[17, 18].

In three studies [19–21], the length of hospital stay was given as the mean and standard deviation in patients. These studies were included for meta-analysis using the weighted mean difference (WMD) and the fixed-effect model. Gastrograin patients had a shorter length of hospital stay (WMD, −1.83; 95% CI, −2.21 to −1.45 days; P<001). Our study finds the mean hospital stay in gastrograin group was 31.3 ± 4.5 hours, which was significant shorter than 48.9 ± 8.2 hours in traditional group(p = 0.04).

**Conclusion**

Our study showed that GG patients had less operative rate than TT patients. Hospital stays and the duration between hospital admission and surgery was also less in GG patients.

**Declarations**

**Ethical approval and consent to participate**

All procedures performed in our study involving human participants was approved by the ethical committee of Suez Canal University Hospital (ref # 70134). A written and verbal consent was obtained from all participant in the current study.

**Consent for publication**

We obtained consent from all the patients included in our study with institutional consent forms.

**Availability of data and materials**
The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request. All data generated or analyzed during this study are included in this published article [and its supplementary information files].

**Competing interests**

The authors declare that they have no competing interests.

**Funding**

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**Authors’ contributions**

MF, HS & AAB conceived the study, participated in study design and sequence alignment, and drafted the manuscript. ABB, MF & ST helped to draft and critically revise the manuscript. MF, HS & ST participated in data collection and performance of the statistical analysis. HS, MF, AAB & ST participated in study coordination, and critical revision. All authors have read and approved the final manuscript.

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