

Management of Adhesive Small Bowel Obstruction Using Gastrografin - A Prospective Study

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Abstract: Background: Adhesions are the most common cause of small bowel obstruction (SBO), especially in patients with a history of previous abdominal surgery¹. In fact, any patient who undergoes abdominal surgery, that involves opening of the peritoneal cavity, will have an increased lifetime risk for formation of adhesions which may cause bowel obstruction at any point in time. Methods: This prospective open randomized controlled clinical trial study was conducted on 100 patients suffering from adhesive small bowel obstruction with history of previous abdominal surgeries. The Institutional Ethical Clearance was obtained and patients were included in the study after obtaining informed written consent from each patient. Results: This prospective open randomized controlled clinical trial study was conducted on 100 patients suffering from adhesive small bowel obstruction with history of previous abdominal surgeries. These patients were randomly divided into two equal groups. Group A (n=50) received gastrografin and Group B (n=50) were treated conventionally without gastrografin. Conclusion: From our results, we can conclude that Gastrografin is safe and it can be used therapeutically in resolution of ASBO. Clinical and radiological evidences help in identifying the patients who can be treated conservatively.

Keywords: Adhesive small bowel obstruction, Gastrografin, conservative line of treatment

1. Introduction

Adhesions are the most common cause of small bowel obstruction (SBO), especially in patients with a history of previous abdominal surgery¹. In fact, any patient who undergoes abdominal surgery, that involves opening of the peritoneal cavity, will have an increased lifetime risk for formation of adhesions which may cause bowel obstruction at any point in time.

It is thought that 93% of adhesions are caused by previous surgery, 7% are thought to be congenital and 2% are inflammatory². These are strands or membranes of fibrous tissue that are attached to the various intra-abdominal organs, gluing them together. Common surgeries associated with early postoperative SBO are large bowel, rectal, appendiceal and gynecological surgeries^{3,4}.

Formation of adhesions after abdominal surgery is a part of the complex healing process that starts with a localized inflammatory reaction. It involves multiple growth mediators and coagulation factors causing deposition of fibrin and ends a few weeks later with fibrin deposits, which have undergone invasion by collagen producing fibroblasts and neovascularization, starting to remodel and form firm fibrous tissue^{5,6}.

In general, procedures in the lower abdomen, pelvis or both and those resulting in damage to a large peritoneal surface area tend to put patients at higher risk for subsequent adhesive obstruction⁷. It is estimated that the risk of SBO is 6.4% after open cholecystectomy⁸, 1% to 10% after appendectomy [8,9] and 10% to 25% after intestinal surgery^{10,11}. Other identified surgical risk factors for developing adhesions include foreign bodies, glove powder, mesh, suture materials, postoperative leak, and spilled gallstones^{12,13}.

Small bowel obstruction is responsible for one of the most common emergencies in general surgery, and is also a major cause of morbidity and financial expenditure worldwide. Improvements in surgical technique, suture material,

removal of powdered gloves, and possibly the introduction of laparoscopic surgery have reduced the risk of adhesions and consequent SBO. Despite this, SBO from adhesions remains a common cause for hospitalisation and operative intervention.

Recurrence of adhesive small bowel obstruction is a particularly challenging problem. Adhesions seem to affect relatively young patients with a high risk for lifetime risk for recurrence. It is thought that the risk of adhesions is less with age. There is a possible role for a decrease in gastrointestinal motility with aging in postoperative adhesion formation, which may be responsible for higher risk in young patients¹⁴.

Although, adhesive small bowel obstruction is one of the most common surgical causes for admission, its treatment is still understudied. Emergency surgery is mandatory when strangulation or complete obstruction occurs. Non-operative conservative management is indicated in the case of incomplete obstruction¹⁵.

Conservative management for up to 5 days is suggested by few surgeons provided that no obvious signs of intestinal strangulation are present. On the other hand, it has been suggested that a delay in surgical intervention of more than 24 h increases complication rates and prolongs postoperative hospital stay¹⁶.

Introduction of water-soluble contrast media in the form of Gastrografin has changed the management of adhesive SBO. It has proven to be safe, predicts the need for surgery and does not increase morbidity. The use of Gastrografin in the management of adhesive small bowel obstruction has been evaluated in the recent years^{17,18}.

Gastrografin is a water-soluble contrast medium composed of sodium diatrizoate, meglumine amidotrizoate, and a wetting agent (polysorbate 80). It has an osmolarity of 1900 mOsm/L, which is approximately six times that of extracellular fluid.

It has been used in the non-operative management of patients with postoperative SBO based on its biochemical properties and its being non-irritating to gut. It acts as an osmotic agent within small bowel, causing decrease in oedema and enhancing bowel motility. It has a normal transit time (stomach to colon) of 30 to 60 mins and shows effectiveness in resolving of features of obstruction, reducing the length of hospital stay and reducing the need for surgery. So, Gastrografin may have a therapeutic effect in adhesive small bowel obstruction. However, this topic is still debated, because some authors did not find any therapeutic advantage^{19,20}. The present prospective study was planned to evaluate the therapeutic effect of Gastrografin in adhesive small bowel obstruction.

Aim

To study the therapeutic effects of gastrografin in adhesive small bowel obstruction.

Objectives

- 1) To study the use of gastrografin in management of adhesive small bowel obstruction.
- 2) To compare patients of adhesive small bowel obstruction been treated with gastrografin and conventional conservative management.

2. Materials and Methods

This prospective open randomized controlled clinical trial study was conducted on 100 patients suffering from adhesive small bowel obstruction with history of previous abdominal surgeries. The Institutional Ethical Clearance was obtained and patients were included in the study after obtaining informed written consent from each patient.

Period of study: 24 months.

Inclusion criteria:

- 1) Patient of all age group and gender.
- 2) Diagnosed with adhesive small bowel obstruction diagnosed clinically and radiologically (X-ray erect abdomen and USG abdomen and pelvis).

Exclusion Criteria:

- 1) Patient who didn't give consent
- 2) Patient with documented intra-abdominal malignancy, inflammatory bowel disease, abdominal tuberculosis.
- 3) Patient suffering from hypokalemia, deranged renal function test
- 4) Small bowel obstruction due to other cause.
- 5) Patient suffering from strangulation due to obstruction.
- 6) Allergy to Gastrografin and asthmatics.

All the patients admitted to surgical ward with clinical features of adhesive small bowel obstruction were studied. A detailed history, including information on previous abdominal surgery (type of surgery and number of surgeries) and adhesive obstruction, was taken and a complete physical examination was performed for every patient. A nasogastric tube was inserted for decompression, with strict measurement of output. Intravenous fluid replacement was given and electrolyte imbalances were corrected as required.

Supine and erect abdominal radiographs were taken along with USG abdomen and pelvis.

Clinical features¹

Clinical features referred to symptoms, signs and radiological evidence of SBO, with a history of previous intra-abdominal surgery.

Symptoms

The symptoms included were colicky abdominal pain (origin, onset, duration, progression and radiation), vomiting (number of episodes, type of vomitous), abdominal distension (origin, duration and progress), inability to pass flatus and constipation (duration).

Signs

The signs included were tachycardia, hypotension, fever, dehydration, abdominal tenderness, high-pitched bowel sounds and an empty rectum.

Radiological features^{2,3}

Radiological features were based on plain radiographs. The diagnosis was made through: plain abdominal radiography with the patient in supine and erect postures, and plain chest radiography with the patient in an erect posture.

Small bowel obstruction was identified by the presence of centrally positioned bowel loops, with prominent valvulae conniventes, distension, > 3 cm diameter dilatation of the small bowel, perturbed air-fluid levels and absence of colonic gas.

Abdominal ultrasonography was performed by radiologists. Patients were not given any particular preparation except nasogastric intubation before the examination. Interference by gas echoes from distended bowel was avoided by scanning the distended abdomen in the oblique or lateral direction. Re-examinations were performed when necessary to record intermittent peristaltic activity of dilated small bowel, to check changes in the ultrasonograms and to assess the effect of non-operative treatment in obstruction.

Ultrasonographic diagnosis of strangulation or simple obstruction was made on the basis of the following criteria. The criterion for small bowel obstruction was the presence of dilated small bowel proximal to collapsed small bowel or ascending colon. The criterion for simple obstruction was the presence of peristaltic activity in the entire dilated proximal small bowel.

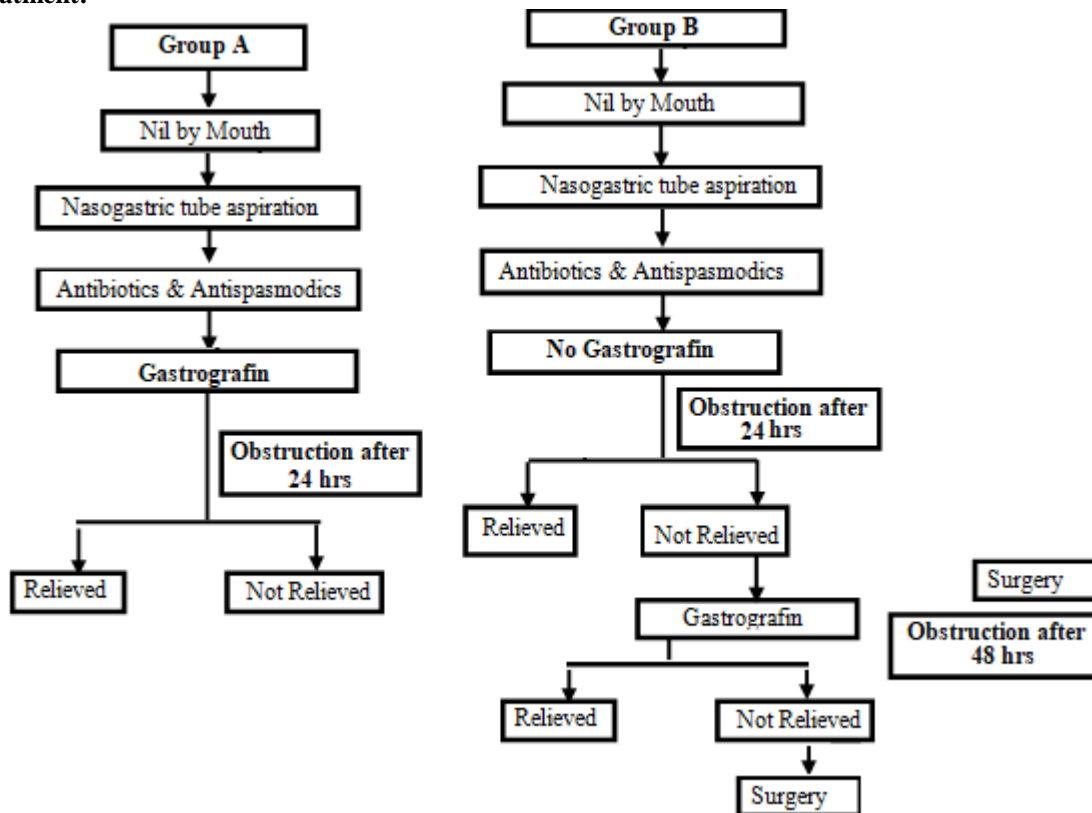
Gastrografin administration

Gastrografin (diatri zoatemglumine and diatrizoate sodium solution) was the oral contrast medium used for the Gastrografin treatment group's patients. It is a palatable lemon-avored water-soluble iodinated radiopaque contrast medium. Each mL contained 660 mg diatrizoatemglumine and 100 mg diatrizoate sodium, with a pH adjusted to 6.0 – 7.6 with sodium hydroxide. It also contained 367 mg of organically bound iodine per mL, an essential constituent given its relatively high atomic weight making it sufficiently radio-dense for radiographic contrast with surrounding tissues. Administration was conducted by an investigator or trained assistant, with adults receiving 100mL, children 5 to

10 years old receiving 60 mL, while infants and children less than 5 years old received 30 mL, through a NGT in the sitting position. The NGT was clamped for 2 to 3 hours with the patients kept in a propped-up position. To minimise the chance of aspiration, Gastrografin was given only using a

NGT of appropriate size corresponding to the age of the patient. Side effects monitored for were allergic reaction and aspiration pneumonia.

Plan of Treatment:



The included patients were randomly divided in two equal groups.

Group A: received gastrografin and

Group B: treated conventionally as shown in the flow chart.

On admission first X-ray erect abdomen was taken followed by routine laboratory investigations, such as, complete blood count, renal function tests, liver function tests, blood sugar levels.

Group A

Once all investigations were done, patient from Group A was given gastrografin and series of X-rays erect abdomen was taken at 6,12,24 hours after giving gastrografin.

Resolution of obstruction in the patients was decided by clinical abdominal examination and X-ray erect abdomen. Then the patient was kept on liquid diet for first 2 days. If tolerated followed by soft diet. Nasogastric tube was removed once the patient tolerated sips orally. In case the patient got operated the stay of the patient varies. Once discharged patient was asked to follow –up in outpatient department.

Clinical improvement was defined as the presence of decreased abdominal pain, distention, tenderness, or nasogastric tube output, or bowel opening if the patient had constipation on admission. Radiologic improvement was defined as a decrease in the number of dilated bowel loops or in the diameter of dilated small bowel.

Complete resolution of bowel obstruction was established when the symptoms and signs of obstruction subsided and abdominal radiographs showed no dilated small bowel.

If the obstruction still persisted in gastrografin group after 24 hrs, patient was taken to surgery developed strangulation of bowel loop between the study he was immediately taken for surgery.

Group B

Once all investigations were done, conservative line of treatment was given to patients in these group. NBM, nasogastric tube decompression, I.V fluids, antibiotics and antispasmodics. But no gastrografin was given to these patients.

For Group B patient just one x-ray erect abdomen was taken after 24 hours. Resolution of obstruction in the patients was decided by clinical abdominal examination and X-ray erect abdomen. Then the patient was kept on liquid diet for first 2 days. If tolerated followed by soft diet. Nasogastric tube was removed once the patient tolerated sips orally. In case the patient got operated the stay of the patient varies. Once discharged patient was asked to follow –up in outpatient department.

Clinical improvement was defined as the presence of decreased abdominal pain, distention, tenderness, or nasogastric tube output, or bowel opening if the patient had

constipation on admission. Radiologic improvement was defined as a decrease in the number of dilated bowel loops or in the diameter of dilated small bowel.

Complete resolution of bowel obstruction was established when the symptoms and signs of obstruction subsided and abdominal radiographs showed no dilated small bowel.

If the obstruction still persisted in these group after 24 hrs. gastrografin trail was given to these patient for 24 hrs following same protocol as Group A. after undergoing ultasonography for signs of strangulation.

Even if after 48 hrs obstruction still persisted then patient was taken for surgery.

Equipments Used:

- 1) 100ml of gastrografin as the oral contrast agent.
- 2) X-ray machine
- 3) USG Machine
- 4) Nasogastric tube(NGT).

Statistical analysis

Data were prospectively collected and entered into a computer database. SPSS software Version 16 (SPSS Inc., Chicago, IL) was used for data analysis. Univariate analysis was performed by the Student *t* test or the Mann-Whitney test for continuous variables and by chi-square or Fisher exact tests for categorical variables. *P* < .05 was considered statistically significant.

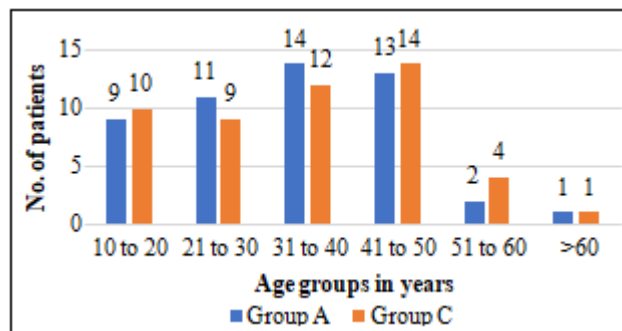
3. Results

This prospective open randomized controlled clinical trial study was conducted on 100 patients suffering from adhesive small bowel obstruction with history of previous abdominal surgeries. These patients were randomly divided into two equal groups. Group A (n=50) received gastrografin and Group B (n=50) were treated conventionally without gastrografin.

Table 1: Age distribution of patients

Age groups (years)	Group A (Gastrografin)		Group B (Conservative)	
	Number	Percentage	Number	Percentage
10-20	09	18	10	20
21-30	11	22	09	18
31-40	14	28	12	24
41-50	13	26	14	28
51-60	2	4	4	8
>60	1	2	1	2
Total	50	100	50	100

In present study, majority of the patients were between age group of 21 to 50 years in both the groups. Thus, >90% of the patients were below the 50 years of age in both the groups. There was no significant difference between the two groups as far as age and sex were concerned (Table 1 and Graph 1).

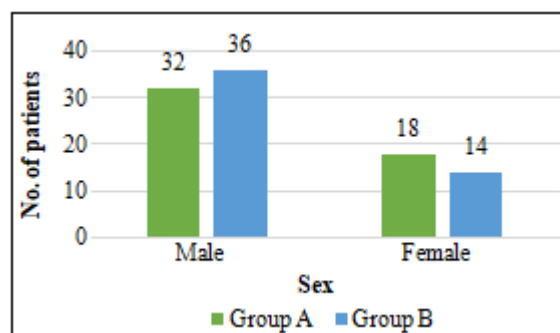


Graph 1: Age distribution of patients

Table 2: Sex distribution of patients

Sex	Group A (n=50)		Group B (n=50)	
	Number	Percentage	Number	Percentage
Male	32	64	36	72
Female	18	36	14	28
Total	50	100	50	100

It was observed that males were more commonly affected than females i.e., 32 (64%) in Group A and 36 (72%) in Group B. There was no significant difference between the two groups as far as age and sex were concerned (Table 2 and Graph 2).

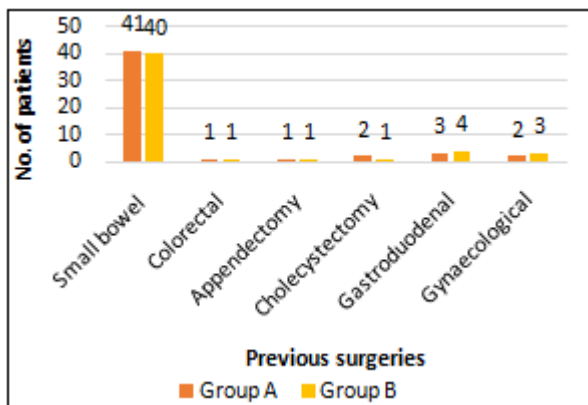


Graph 2: Sex distribution of patients

Table 3: Antecedent Surgical Procedures

Surgical Procedure	Group A (n=50)		Group B (n=50)	
	Number	Percentage	Number	Percentage
Small bowel	41	82	40	80
Colorectal	01	02	01	02
Appendectomy	01	02	01	02
Cholecystectomy	02	04	01	02
Gastroduodenal	03	06	04	08
Gynaecological	02	04	03	06
Total	50	100	50	100

Most of the patients in our study had history of small bowel procedures i.e., in 41 (82%) and 40 (80%) patients from Group A and C respectively. Three (6%) and two (4%) patients each had history of gastroduodenal and gynaecological and cholecystectomy procedures respectively. In Group B, four (8%) and three (6%) patients had history of gastroduodenal and gynaecological procedures respectively. The difference between the number of previous surgeries in both the groups was not statistically significant, (*P* > 0.05).

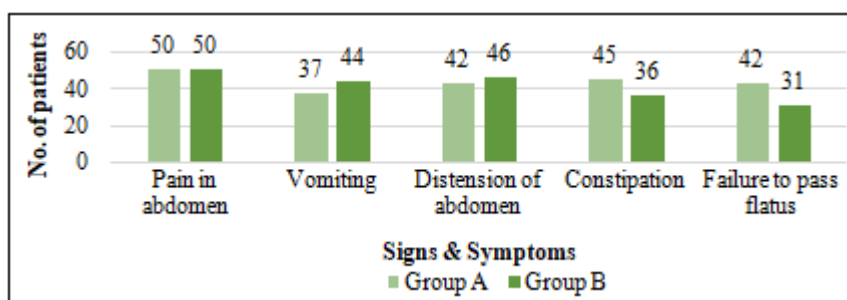


Graph 3: Antecedent Surgical Procedures

Table 4: Distribution of signs and symptoms

Signs and symptoms	Group A (n=50)		Group B (n=50)	
	Number	Percentage	Number	Percentage
Pain in abdomen	50	100	50	100
Vomiting	37	64	44	88
Distension of abdomen	42	84	46	92
Constipation	45	90	36	72
Failure to pass flatus	42	84	31	62

All patients from both the groups presented with abdominal pain (100%), with the least frequent presenting complain being vomiting 37 (64%) in Group A and failure to pass flatus in 31(62%) patients. The difference in the distribution of signs and symptoms was not statistically significant (p>0.05).



Graph 4: Distribution of signs and symptoms

Table 5: Distribution of Clinical Findings

Clinical finding	Character	Group A (n=50)		Group B (n=50)	
		Number of patients	Percentage	Number of patients	Percentage
Severity of pain	Mild	0	0	0	0
	Moderate	18	36	10	20
	Severe	32	64	40	80
Previous ASBO	Yes	15	30	14	28
	No	35	70	36	72

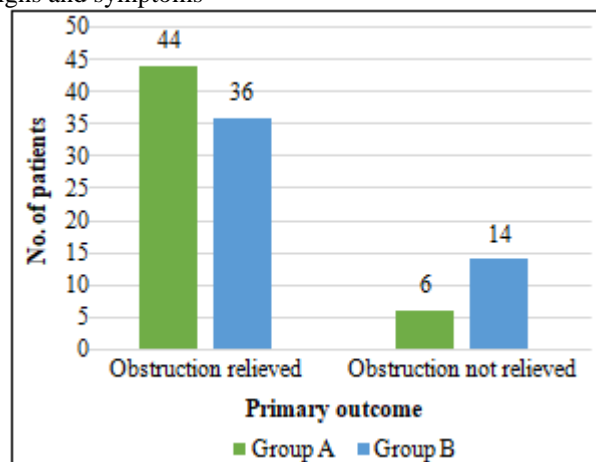
In Group A, 32 (64%) patients had severe and 18 had moderate pain in abdomen. Whereas in Group B, 40 (80%) patients had severe and 10 (20%) patients had moderate pain in abdomen. In Group A, 15 patients had history of ASBO and 14 patients from Group B had history of ASBO.

Any differences between the distribution of the severity of abdominal pain, and whether the patient had previous episode of ASBO or not, were not statistically significant (P > 0.05).

Table 6: Outcome after primary treatment in both groups

Outcome	Group A (n=50)		Group B (n=50)	
	Number	Percentage	Number	Percentage
Obstruction relieved	44	88	36	72
Obstruction not relieved	06	12	14	28
Total	50	100	50	100

In our study, after primary treatment of gastrografin and conservative treatment in study groups the obstruction was relieved in 44 (88%) patients of gastrografin group. In Group B who were managed conservatively, the obstruction was relieved in 36 (72%) patients.

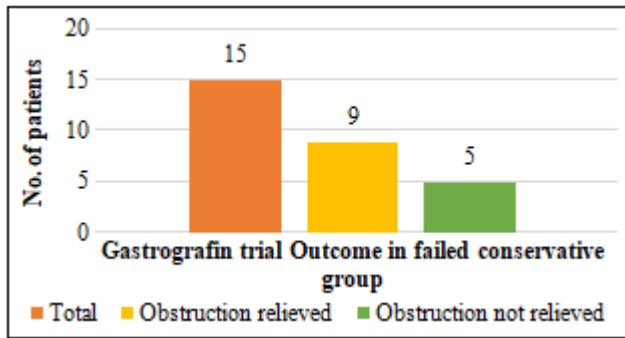


Graph 5: Outcome after primary treatment in both groups

Table 7: Out come after gastrografin in failed conservative group

Outcome	Number	Percentage
Obstruction relieved	09	64.29
Obstruction not relieved	05	35.71
Total	14	100

The 14 patients in which obstruction was not relieved after 48 hrs of conservative treatment, gastrografin trial was given for next 24 hrs. After gastrografin trial in these patients, obstruction was relieved in 9 (64.29%) patients. The remaining 5 patients were taken for surgery.

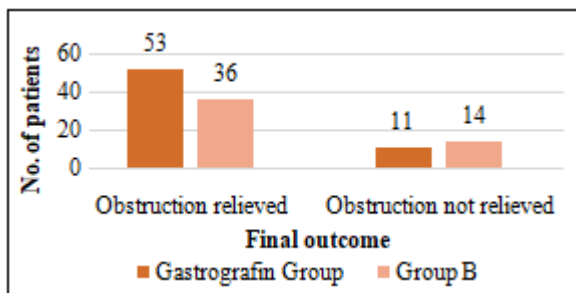


Graph 6: Outcome after gastrografin in failed conservative group

Table 8: Final Outcome in both groups

Outcome	Gastrografin group (group A+ group B)		Group B (n=50)	
	Number	Percentage	Number	Percentage
Obstruction relieved	53 = Group A (44) + Group B (9)	82.81	36	72
Obstruction not relieved	11 = Group A (6) + Group B (5)	17.18	14	28
Total	64	100	50	100

If gastrografin was not used in 14 patients who showed no response to conservative treatment within 48 hours, they would undergo surgery and the estimated overall operative rate would be about 20% (20/100 cases). But we had given gastrografin trial to these 14 failed cases and in 9 cases obstruction was relieved. Thus, making the overall operative rate of about 11% (11/100 cases).



Graph 7: Final Outcome in both groups

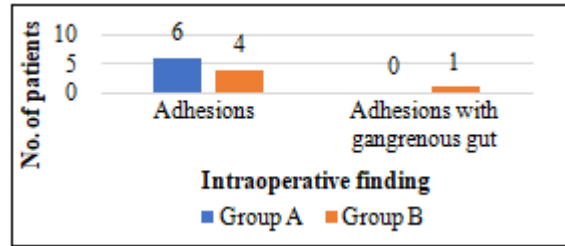
Table 9: Hospital stay in both the groups

	Obstruction relieved in both the groups(89)	Taken for surgery in both the groups(11)
Stay in Hospital	5 days	11 days

Table 10: Intra-operative findings

Outcome	Group A (n=6)		Group B (n=5)	
	Number	Percentage	Number	Percentage
Adhesions	6	100	4	80
Adhesions with gangrenous gut	0	0	1	20

Only 11 (11%) patients underwent surgery while the other 89 (89%) patients had successful treatment non-operatively. Adhesions were present in all operated patients of gastrografin group. Adhesions were present in 4 patients of conservative group and one patient had adhesions with gangrenous gut.

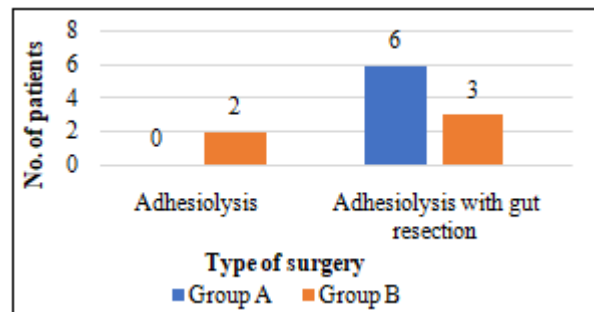


Graph 9: Intra-operative findings

Table 11: Type of Surgery done

Surgery done	Group A (n=6)		Group B (n=5)	
	Number	Percentage	Number	Percentage
Adhesiolysis	0	0	2	40
Adhesiolysis with gut resection	6	100	3	60

Resection of gut was done in all 6 patients due to total obstruction of gut. Adhesiolysis was done in 2 patients and gut resection was done in remaining 3 cases of conservative group.



Graph 10: Type of Surgery done

4. Discussion

- The present study comprised of 100 patients suffering from small bowel obstruction with history of previous abdominal surgeries. These patients were randomly divided into two equal groups. Group A (n=50) received gastrografin and Group B(n=50) were treated conventionally without gastrografin.
- Patients with obstruction that improved clinically or radiologically in the initial 24 hours continued to receive conservative treatment. Patients who showed neither clinical nor radiologic improvement within 24 hours were considered to have failed conservative treatment.
- If the obstruction still persisted in gastrografin group after 24 hrs, patient was taken to surgery. In conventional group if obstruction still persisted after 24 hrs, then the patient was given gastrografin trial. Still the obstruction persisted then the patient was taken for surgery. In case patient developed strangulation of bowel loop between the study he was immediately taken for surgery.
- Majority of the patients (>90%) were below the 50 years of age in both the groups. All of them had undergone previous surgery and had adhesive small bowel obstruction irrespective of age.
- Males were more commonly affected than females i.e., 32 in Group A and 36 in Group B.
- Most patients in our study had history of small bowel procedures in 41 (82%) and 40 (80%) patients from Group A and C respectively. Gastroduodenal and

gynaecological procedures were the next common surgeries.

- All patients from both the groups presented with abdominal pain (100%), with the least frequent presenting complaint being vomiting 37 (64%) in Group A and failure to pass flatus in 31(62%) patients.
- In Group A, 32 (64%) patients had severe and 18 had moderate pain in abdomen. Whereas in Group B, 40 (80%) patients had severe and 10 (20%) patients had moderate pain in abdomen.
- In Group A, 15 patients had history of ASBO and 14 patients from Group B had history of ASBO.
- The mean time for resolution of the signs and symptoms of ASBO was 24.67 hours for gastrografin group. In case of conservative group, it was 71.41 hours ($p < 0.05$). Thus, it was observed that Gastrografin treatment yields an earlier resolution of the signs and symptoms of ASBO.
- After primary treatment of gastrografin and conservative treatment in study groups the obstruction was relieved in 44 (88%) patients of gastrografin group. In Group B who were managed conservatively, the obstruction was relieved in 36 (72%) patients.
- The 14 patients in which obstruction was not relieved after 24hrs of conservative treatment, gastrografin trial was given for next 24 hrs. After gastrografin trial in these patients, obstruction was relieved in 9 (64.29%) patients. The remaining 5 patients were taken for surgery.
- When gastrografin trial was given to 14 failed cases, in 9 cases obstruction was relieved. Thus, making the overall operative rate of about 11% (11/100 cases).
- In our study, only 11 (11%) patients underwent surgery while the other 89 (89%) patients had successful treatment non-operatively.
- Adhesions were present in all operated patients of gastrografin group. Resection of gut was done in all 6 patients due to total obstruction of gut. Adhesions were present in 4 patients of conservative group and one patient had adhesions with gangrenous gut. Adhesiolysis was done in 2 patients and gut resection was done in remaining 3 cases of conservative group.
- To conclude, Gastrografin is safe and it can be used therapeutically in resolution of ASBO. It reduces the need for surgery when conservative treatment fails.

5. Conclusion

From our results, we can conclude that Gastrografin is safe and it can be used therapeutically in resolution of ASBO. Clinical and radiological evidences help in identifying the patients who can be treated conservatively.

In patients with ASBO, Gastrografin helps in earlier resolution of obstruction and reduces the need for surgery compared with standard conservative management, without causing any adverse effects. Considering the primary outcomes, Gastrografin treatment reduced the duration of hospital stay when compared to standard conservative management. Therefore, we recommend the use of Gastrografin in the management of partial ASBO in the absence of other complications.

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