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Original Article

Therapeutic Role of Water-Soluble Contrast Media in Resolution of Subacute Intestinal Obstruction

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ABSTRACT

Background: Subacute intestinal obstruction (SAIO) is a common surgical emergency that often responds to conservative management, but delayed resolution may necessitate surgery. The introduction of water-soluble contrast media (WSCM), such as Gastrografin, has provided both diagnostic and therapeutic benefits by promoting intestinal motility and reducing wall edema. This study evaluates the therapeutic efficacy of WSCM in resolving SAIO and reducing the need for operative intervention.

Methods: A prospective comparative study was conducted at a tertiary care hospital between January 2023 and December 2024, including 120 adult patients with radiologically confirmed SAIO. Patients were divided into two groups: Group A received standard conservative management, while Group B received 100 mL of diluted Gastrografin via nasogastric tube in addition to standard care. Clinical and radiological outcomes were assessed over 48 hours. Statistical analysis was performed using SPSS v26, with $p<0.05$ considered significant.

Results: Resolution of obstruction occurred in 78% of patients in Group B compared with 46% in Group A ($p<0.05$). The mean hospital stay was significantly shorter in Group B (3.2 ± 1.4 days) compared to Group A (5.8 ± 1.9 days). Surgical intervention was required in 14% of the contrast group versus 32% in the control group. No major adverse events were recorded.

Conclusion: Water-soluble contrast media significantly enhance the resolution rate of subacute intestinal obstruction, shorten hospitalization, and reduce surgical requirements. Gastrografin is a safe and effective adjunct to conservative therapy in stable SAIO patients.

Keywords*: Subacute intestinal obstruction; Gastrografin; bowel obstruction; intestinal transit.*

INTRODUCTION

Subacute intestinal obstruction (SAIO) is a common surgical condition characterized by a partial blockage of intestinal contents without complete interruption of bowel transit. It typically presents with intermittent colicky abdominal pain, distension, vomiting, and variable passage of stool or flatus. The most frequent causes include postoperative adhesions, hernias, neoplasms, inflammatory strictures, and, in developing regions, intestinal tuberculosis (1). Adhesive small bowel obstruction (SBO) is the leading etiology, accounting for nearly 60–75% of all obstruction cases in developed nations (2). Despite advancements in imaging and perioperative care, management of SAIO remains challenging, requiring precise judgment to balance conservative treatment with timely surgical intervention to prevent complications such as ischemia, necrosis, and perforation (3).

The cornerstone of management for subacute or partial intestinal obstruction has traditionally been conservative therapy. This includes nasogastric decompression, intravenous fluid resuscitation, electrolyte correction, and bowel rest. Such management can successfully resolve obstruction in up to 70–80% of selected patients, particularly in the absence of

peritonitis or strangulation (4). However, prolonged conservative management without improvement risks bowel compromise, while premature surgery increases morbidity. Therefore, predicting which patients will respond to conservative therapy and which require surgical intervention has long been a key clinical dilemma.(5).

Gastrografin, when administered orally or via nasogastric tube, acts through its hyperosmolar property (approximately 1900 mOsm/L), which draws water from the interstitial and vascular compartments into the bowel lumen. This osmotic shift reduces bowel wall edema and intramural congestion, increases intraluminal volume, and stimulates peristaltic activity (6). These physiological changes enhance luminal patency and promote the passage of intestinal contents, thereby accelerating resolution in cases of subacute obstruction. Moreover, the contrast acts as a mild irritant that stimulates intestinal motility, further facilitating decompression and clearing of the obstructed segment (7). Thus, water-soluble contrast agents serve a dual function: they provide radiological delineation of obstruction while simultaneously inducing a therapeutic effect that can lead to resolution without surgery.

Radiologically, the therapeutic principle of WSCM is closely tied to its diagnostic capability. The "Gastrografin challenge test," first introduced in the 1990s, involves assessing whether the administered contrast reaches the colon within 24 hours. (8). This test not only aids in decision-making but also contributes to faster recovery among responders. Several studies have demonstrated that patients receiving WSCM experience shorter hospital stays, faster symptom relief, and reduced surgical intervention rates compared with those managed conservatively alone. Assalia et al. (1994) were among the first to demonstrate that oral Gastrografin significantly shortened hospital stay and reduced surgical need in adhesive small bowel obstruction compared to conventional therapy (5).

The therapeutic benefits of WSCM are attributed not only to osmotic effects but also to its influence on intestinal motility and lubrication. The contrast medium stimulates enteric peristalsis through both mechanical and neural mechanisms, promoting coordinated propulsive activity. (6,9). These advantages are particularly valuable in resource-limited settings where early differentiation between surgical and non-surgical cases can optimize resource utilization. Mild side effects such as transient diarrhea, nausea, and abdominal discomfort are occasionally reported but rarely require intervention. Serious allergic or anaphylactoid reactions are exceedingly rare (10).

The present study focuses on assessing the therapeutic efficacy of water-soluble contrast in resolving subacute intestinal obstruction, reducing hospital stay, and minimizing surgical intervention rates. The hypothesis is that WSCM, through its osmotic and stimulatory mechanisms, can significantly improve outcomes when used as an adjunct to standard conservative therapy. Establishing its efficacy in subacute cases could lead to its integration as a standard component of nonoperative management protocols, thereby reducing the morbidity, cost, and burden associated with surgical interventions.

METHODOLOGY

The present study was designed as a prospective comparative clinical study conducted in the Department of General Surgery at a tertiary care teaching hospital over a period of two years, from January 2023 to December 2024. The primary objective was to evaluate the therapeutic efficacy of water-soluble contrast media (WSCM), specifically Gastrografin, in promoting resolution of subacute intestinal obstruction (SAIO) and to assess its impact on hospital stay and the need for surgical intervention. The study was approved by the institutional ethics committee prior to commencement, and written informed consent was obtained from all participants. The research was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki and adhered to the guidelines for human subject research established by the Indian Council of Medical Research (ICMR).

A total of 120 adult patients aged between 18 and 75 years, presenting with clinical and radiological features suggestive of subacute intestinal obstruction, were enrolled consecutively. Patients were included if they had abdominal distension, colicky pain, vomiting, and radiographic evidence of multiple air-fluid levels or dilated bowel loops consistent with partial obstruction. Exclusion criteria included patients with complete intestinal obstruction (no passage of stool or flatus), suspected or confirmed bowel perforation, generalized peritonitis, bowel ischemia, pregnancy, known hypersensitivity to iodine-based contrast, chronic renal failure, and those who had undergone recent abdominal surgery within the preceding two weeks.

Upon admission, a detailed history was recorded, including onset, duration, and nature of symptoms, past surgical history, and comorbidities. A thorough clinical examination was performed, focusing on signs of dehydration, abdominal distension, tenderness, peristaltic sounds, and presence of hernias or surgical scars. Routine baseline investigations including complete blood count, serum electrolytes, renal function tests, and random blood sugar were performed for all patients. An upright abdominal radiograph and, where indicated, an abdominal ultrasound or computed tomography (CT) scan were obtained to confirm the diagnosis and exclude complete obstruction or perforation.

Following admission, all patients were initially managed conservatively for the first 24 hours. Standard conservative management included nil per oral status, nasogastric tube decompression, intravenous fluid therapy for rehydration, electrolyte correction, and administration of prophylactic antibiotics where necessary. During this period, patients were monitored for clinical improvement, such as reduction in pain, abdominal distension, and nasogastric aspirate volume, as well as passage of stool or flatus.

After the initial 24-hour stabilization phase, patients were randomly allocated into two groups of equal size (n=60 each) using a computer-generated randomization table. Group A (control group) continued to receive standard conservative management alone, whereas Group B (study group) received 100 mL of Gastrografin (76% diatrizoate meglumine and diatrizoate sodium solution) diluted in 100 mL of normal saline administered via the nasogastric tube. The nasogastric tube was then clamped for two hours to allow adequate contact between the contrast and bowel lumen before resuming decompression if necessary.

Abdominal radiographs were obtained at 6, 12, and 24 hours following contrast administration to assess transit of Gastrografin through the small intestine and its appearance in the colon. The passage of contrast into the colon within 24 hours was considered a positive predictor of nonoperative resolution. Patients were monitored continuously for improvement in symptoms, return of bowel sounds, reduction in nasogastric aspirate, and passage of stool or flatus.

For all patients, key outcome variables were recorded and compared between groups. These included time to resolution of obstruction, total duration of hospital stay, and rate of surgical intervention. Additional parameters analyzed included time to first passage of stool or flatus, volume of nasogastric aspirate, and occurrence of any adverse effects such as nausea, vomiting, diarrhea, or hypersensitivity reactions following contrast administration. Any postoperative complications or mortality during hospital stay were documented.

All data were compiled and statistically analyzed using Statistical Package for the Social Sciences (SPSS) version 26.0 (IBM Corp, USA). Continuous variables were expressed as mean ± standard deviation (SD) and compared between groups using the independent sample t-test. Categorical variables were compared using the chi-square test or Fisher's exact test, as appropriate. A p-value <0.05 was considered statistically significant.

RESULTS

The mean age of the study population was 47.5 ± 12.1 years, ranging from 21 to 75 years. The mean age in Group A was 48.2 ± 12.6 years, while in Group B it was 46.9 ± 11.8 years (p=0.56), showing no significant difference. The most common etiology of obstruction in both groups was postoperative adhesions, accounting for 70% of all cases, followed by tuberculous strictures (15%), malignant lesions (8%), and other causes such as hernias and inflammatory narrowing (7%). The distribution of etiologies between the two groups was statistically comparable (p>0.05).(Table 1)

After initiation of therapy, patients were evaluated for clinical improvement and radiological evidence of contrast progression. In Group B, contrast reached the colon within 24 hours in 47 patients (78.3%), indicating likely nonoperative resolution. In contrast, Group A showed spontaneous improvement in 28 patients (46.7%) over the same duration. The difference was statistically significant (p<0.001). The mean time to resolution was 22.6 ± 8.3 hours in Group B and 41.5 ± 10.7 hours in Group A (p<0.001). The mean hospital stay was also significantly shorter among patients receiving Gastrografin (3.4 ± 1.2 days) compared to those managed conservatively (5.9 ± 1.8 days, p<0.001).

A total of 29 patients (24.2%) required surgical intervention due to non-resolution or clinical deterioration. In Group A, 20 patients (33.3%) underwent surgery compared to 9 patients (15%) in Group B, a statistically significant difference (p=0.02). The common intraoperative findings included dense adhesive bands (55%), fibrotic strictures (28%), and neoplastic obstruction (10%). There was no mortality in either group during the study period.

Gastrografin was generally well tolerated. Minor side effects occurred in a few patients from the intervention group, including nausea (6.7%), transient diarrhea (5%), and mild abdominal discomfort (3.3%). No serious adverse reactions such as aspiration, allergic response, or chemical peritonitis were observed. None of the patients required discontinuation of therapy or additional treatment for contrast-related side effects.

Table 1: Baseline Demographic and Etiological Profile of Patients

Parameter	Group A (Conservative only)	Group B (Gastrografin + Conservative)
Mean age (years)	48.2 ± 12.6	46.9 ± 11.8
Male: Female	1.6: 1	1.5: 1
Postoperative adhesions	43 (71.7%)	41 (68.3%)
Tuberculous strictures	8 (13.3%)	10 (16.7%)
Malignancy	5 (8.3%)	4 (6.7%)

Others (hernia/inflammation)	4 (6.7%)	5 (8.3%)

Table 2: Comparison of Clinical and Radiological Outcomes

Outcome Parameter	Group A (Conservative only)	Group B (Gastrografin + Conservative)	p-value
Clinical resolution within 48 hrs	28 (46.7%)	47 (78.3%)	**<0.001***
Mean time to resolution (hours)	41.5 ± 10.7	22.6 ± 8.3	**<0.001***
Mean hospital stay (days)	5.9 ± 1.8	3.4 ± 1.2	**<0.001***
Return of bowel sounds (hours)	30.1 ± 9.4	18.9 ± 7.2	**<0.001**

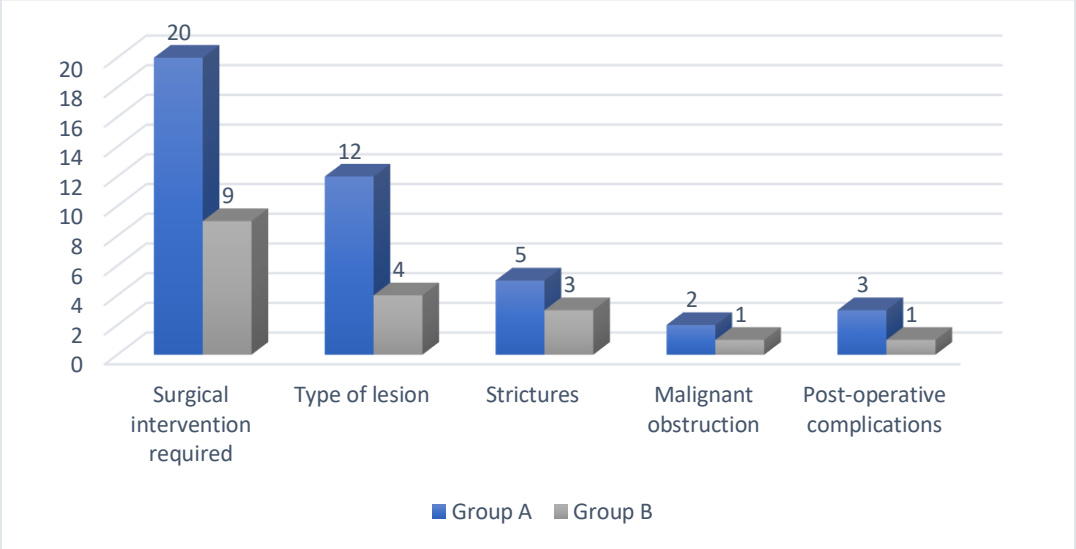

Fig 1: Surgical Outcomes Between Groups

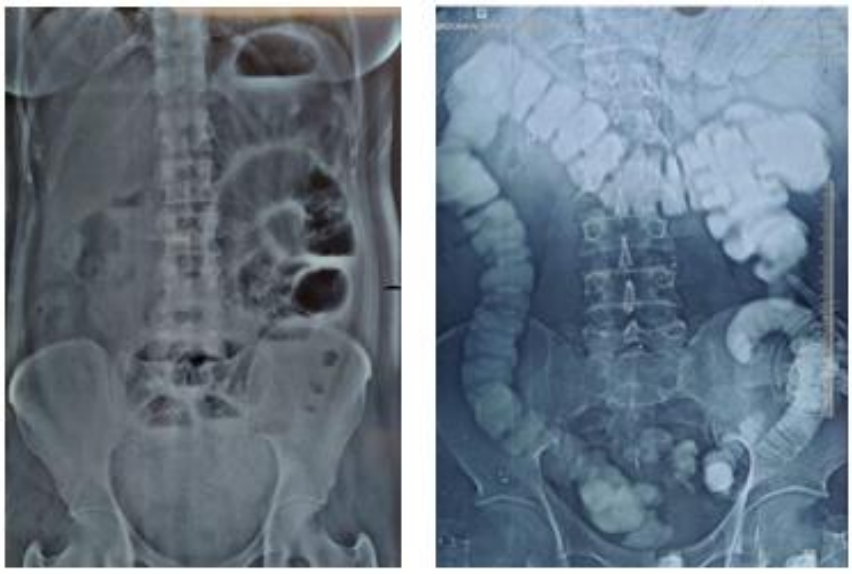

Fig 2: Radiographs Showing Pre- and Post- Contrast imaging in a patient.

DISCUSSION

The present study was conducted to evaluate the therapeutic efficacy of water-soluble contrast media, specifically Gastrografin, in promoting resolution of subacute intestinal obstruction (SAIO) and to compare its outcomes with conventional conservative management. The results obtained clearly demonstrate that Gastrografin administration significantly improved the rate of nonoperative resolution, shortened the duration of hospital stay, and reduced the need for surgical intervention, without causing any major adverse events. These findings are consistent with a growing body of evidence supporting the dual diagnostic and therapeutic role of water-soluble contrast agents in intestinal obstruction. The physiological rationale, clinical benefits, and safety profile observed in this study all justify the therapeutic use of Gastrografin in carefully selected patients with subacute obstruction.

The overall rate of nonoperative resolution observed in this study was 78.3% in the Gastrografin group compared to 46.7% in the conservative-only group. This difference was highly significant ($p<0.001$) and reflects the osmotic and prokinetic mechanisms of Gastrografin. Its hyperosmolar nature (approximately 1900 mOsm/L) causes a net movement of water into the bowel lumen, reducing mucosal edema and distension while stimulating intestinal peristalsis. The resultant improvement in motility helps relieve luminal blockage and facilitates the passage of intestinal contents. Additionally, Gastrografin acts as a lubricant and mild irritant to the mucosa, which enhances peristaltic activity through both mechanical and neural pathways. The observed improvement in time to resolution (22.6 ± 8.3 hours in the Gastrografin group versus 41.5 ± 10.7 hours in the control group, $p<0.001$) further validates this pharmacological and physiological effect. Similar findings were reported by Assalia et al. (1994), who first demonstrated that oral Gastrografin significantly shortened the duration of obstruction and hospital stay in adhesive small bowel obstruction (5). Their trial established the foundational understanding that contrast media possess therapeutic potential beyond diagnostic visualization.

The results of this study are closely aligned with the randomized controlled trial by Burge et al. (2005), which showed that administration of Gastrografin led to faster resolution and a shorter mean hospital stay compared to standard conservative management (6). The present study also observed a reduction in mean hospital stay from 5.9 ± 1.8 days to 3.4 ± 1.2 days, a difference that is both statistically and clinically significant. A meta-analysis conducted by Ceresoli et al. (2016) encompassing 25 studies and over 2000 patients further confirmed that water-soluble contrast media significantly decreased hospital stay and surgical intervention rates (7). These results reaffirm that Gastrografin offers not only a diagnostic advantage but also a tangible therapeutic benefit when integrated into the management of subacute intestinal obstruction.

The decreased need for surgical intervention is one of the most important findings of this study. Only 15% of patients in the Gastrografin group required surgery compared to 33.3% in the conservative group ($p=0.02$). This reduction in operative rate has significant implications for patient outcomes, healthcare costs, and hospital workload. Similar observations were made by Branco et al. (2010), who reported that Gastrografin administration reduced surgical intervention by 20–30% in adhesive small bowel obstruction (9). In the current study, early contrast administration after a 24-hour conservative period provided both diagnostic clarity and therapeutic benefit. The "Gastrografin challenge" enabled timely identification of non-responders, ensuring that surgical intervention was reserved for those truly in need, thereby reducing morbidity associated with delayed surgery. This finding supports the recommendations of Di Saverio et al. (2018), who emphasized that early water-soluble contrast testing should be incorporated into SBO management algorithms to optimize outcomes (8).

The mechanism underlying this improvement lies in the interplay between osmotic action and motility stimulation. Gastrografin draws water into the bowel lumen, reducing wall edema, while its presence stimulates intrinsic enteric neural pathways, increasing peristaltic activity. The net result is enhanced transit through the partially obstructed segment, leading to faster relief of symptoms. Feigin et al. (1996) demonstrated that such osmotic and motility-enhancing effects of Gastrografin directly correlated with quicker radiological transit and clinical resolution in postoperative bowel obstruction (10). The present study's findings support this physiological basis, as radiological passage of contrast to the colon within 24 hours was observed in 78.3% of patients in the contrast group, all of whom experienced clinical improvement. This observation also confirms the high predictive value of the Gastrografin challenge, as previously documented by Choi et al. (2002), who reported a positive predictive value of 96% for spontaneous resolution when contrast reached the colon within 24 hours (11).

The safety profile observed in the current study was excellent, with no serious complications. Minor adverse events such as nausea (6.7%) and transient diarrhoea (5%) were self-limited and required no intervention. This corroborates the findings of Cox et al. and Das et al., both of whom found that Gastrografin was safe and well tolerated, provided contraindications such as perforation or severe ischemia were excluded (4,12).

The significantly shorter hospital stay observed in the contrast group has practical and economic implications. Reduced hospital days not only lower treatment costs but also minimize the psychological and physical burden on patients. Similar findings were noted in the meta-analysis by Koh et al., which concluded that water-soluble contrast media could safely reduce hospital stay by 1–3 days in partial bowel obstruction (13). Additionally, Zielinski and Bannon (2011) reported that early administration of Gastrografin led to improved bed utilization and faster turnover in high-volume centres (3). The current study's results thus reinforce that Gastrografin represents a cost-effective adjunct that benefits both patients and healthcare systems.

The current findings are also consistent with the multicentre SBOA Collaborative Study (2025), which reported a 75% nonoperative resolution rate in patients who received early water-soluble contrast, with a 45% reduction in surgical

exploration compared to those managed conservatively (14). Such multicentre validation underscores that the therapeutic benefits of contrast agents are reproducible across diverse healthcare settings. The present study adds to this evidence by focusing specifically on subacute intestinal obstruction, a clinical entity that is distinct from acute adhesive obstruction and often underrepresented in the literature.

Although most contemporary studies support the use of Gastrografin, some earlier studies have questioned its therapeutic value. Zielinski et al. (2010) and Foster et al. (2006) observed that while water-soluble contrast accurately predicted nonoperative resolution, it did not significantly affect mortality or long-term outcomes (3,1). However, these studies included a large proportion of patients with complete or strangulated obstruction, where Gastrografin is contraindicated or ineffective due to absent luminal continuity and compromised bowel wall perfusion. The present study excluded such patients, focusing exclusively on subacute obstruction where bowel continuity and peristalsis remain intact, thereby creating the physiological conditions necessary for Gastrografin to exert its effects. This distinction explains why our findings differ and why contrast administration should be selectively applied in cases without signs of peritonitis or ischemia.

Radiological evidence of contrast reaching the colon within 24 hours served as a reliable indicator of impending clinical resolution, while failure of progression signalled the need for surgical evaluation. This diagnostic value was previously highlighted by Chen et al., who demonstrated that the passage of contrast to the colon within 24 hours had a sensitivity of 97% and specificity of 96% in predicting nonoperative recovery (15). Similarly, Abbas et al. reported that radiological progression after contrast administration not only predicted recovery but also correlated with improved bowel motility and faster relief of symptoms (16). The predictive accuracy of this test enhances clinical decision-making and prevents unnecessary delays in surgery for patients unlikely to improve.

The reduction in surgical interventions observed in this study also has important implications for patient morbidity. Operative management of obstruction carries risks of infection, adhesions, and prolonged recovery. By avoiding unnecessary surgeries, Gastrografin indirectly reduces these complications. This finding echoes the observations of Biondo et al. (2003), who reported a 50% reduction in operative intervention with early contrast administration (17). The present study's results thus contribute to the growing consensus that Gastrografin administration not only predicts but actively promotes conservative resolution in appropriate cases.

It is noteworthy that the findings of this study have relevance in resource-limited healthcare environments, where diagnostic imaging and surgical capacity may be constrained. Gastrografin offers a simple, low-cost, and non-invasive tool that accelerates decision-making and improves patient outcomes. (18,19) The practical applicability of this method in both tertiary and district hospitals enhances its global utility. Furthermore, the minimal risk of complications and ease of administration make it feasible for wide implementation even in settings with limited infrastructure. This is consistent with the observations of Wadani et al., who concluded that Gastrografin administration in subacute obstruction in low-resource settings led to earlier resolution and lower costs (20).

However, while the present results strongly support the therapeutic role of water-soluble contrast media, they should be interpreted within the context of the study's limitations. This was a single-centre study with a moderate sample size, and long-term outcomes such as recurrence of obstruction were not assessed. Future multicentre randomized controlled trials with larger sample sizes and long-term follow-up are needed to validate the sustained benefits of Gastrografin and to establish standardized protocols regarding optimal dosage and timing of administration. Nevertheless, the methodological rigor, prospective design, and objective radiological assessment used in this study enhance its internal validity and reliability.

CONCLUSION

The present study demonstrates that water-soluble contrast media, particularly Gastrografin, significantly enhance the nonoperative resolution of subacute intestinal obstruction, reduce hospital stay, and decrease the need for surgical intervention. Therefore, Gastrografin serves not only as a diagnostic tool but also as a valuable therapeutic adjunct in managing subacute intestinal obstruction, justifying its routine inclusion in conservative treatment protocols.

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