

# Role of Gastrografin Challenge in Diagnosis and Treatment of Small Intestinal Obstruction

Ranjitha NR

Department of Pharmacy Practice, Sri Adichunchanagiri College of Pharmacy, Adichunchanagiri Hospital and Research Center, Adichunchanagiri University, B.Gnagara, Nagamangala, Karnataka 571448, India, Mobile:7019808775  
E-mail:ranjithanr19[at]gmail.com

**Abstract:** ***Background:** Acute small bowel obstruction is a main cause of morbidity and mortality. SBO can arise as a result of various causes either mechanical such as adhesions, inflammation, tumors, volvulus, and hernia or non-mechanical such as paralytic ileus, metabolic abnormalities, or mesenteric ischemia. Gastrografin is a water-soluble, high osmolality contrast medium that can be used diagnostically to define, and therapeutically to relieve adhesive small bowel obstructions. **Objective:** To evaluate the diagnostic and therapeutic value of Gastrografin in small bowel obstruction diagnosis and management. **Conclusion:** Gastrografin role in diagnosis and management of SBO has facilitated early identification of complete obstruction, replaced the repetitive CT use and mitigated the high contrast dose effect on patient's health and, in the future, may also be used to accelerate inpatient discharge for a wide variety of obstructive bowel pathology.*

**Keywords:** Gastrografin, Small Bowel Obstruction, Diagnostic Techniques, Therapeutic Applications, Contrast Medium.

## 1. Introduction

Acute small bowel obstruction (SBO) is a main cause of morbidity and mortality. SBO can arise as a result of various causes either mechanical such as adhesions, inflammation, tumors, volvulus, and hernia or non-mechanical such as paralytic ileus, metabolic abnormalities, or mesenteric ischemia. Immediate surgery is required when there are any findings that suggest strangulation [1,2].

In practice, it can be difficult to decide which patients can be managed expectantly compared to those that will require surgery. Due to the high rate of morbidity and mortality related to delay in surgical management, there is a need for a diagnostic tool to help to anticipate which patients are more likely to require surgery. If that diagnostic tool could also be therapeutic, this potentially could help decrease the morbidity and mortality associated with adhesive SBO [3].

Administration of a water-soluble contrast agent (WSCA) has shown to be a very accurate predictor of nonoperative resolution of SBO and allows for earlier decision-making for those patients needing surgery [4]. Gastrografin (GGF) is a radiopaque contrast medium recommended for the radiographic examination of segments of the gastrointestinal (GI) tract (oesophagus, stomach, proximal small intestine, and colon). It is an iodinated hyper-osmolar agent being progressively used to establish which patients will require an operation after the conservative management of non-resolving adhesional small bowel obstruction (ASBO) [5].

The early use of Gastrografin has also been advocated by the Bologna guidelines. This is in addition to further measures such as ensuring nil per os, intravenous fluids, and nasogastric tube decompression. The use of Gastrografin serves dual purposes. First, gastrografin can be visualized on x-ray. If the contrast agent can be noted in the colon, then surgeons can be assured that the point of obstruction has been passed and there will be a lower need for operative exploration. Second, the hyperosmotic property of

gastrografin theoretically draws edema present in the obstructed bowel wall into the bowel lumen thereby helping to reverse the obstruction. Failure of conservative management within 72 hours should be operatively managed [5][6].

## 2. Discussion

Acute small bowel obstruction (ASBO) is a common general surgery emergency need hospital admission and is the most frequent disorder of the small intestine necessitating surgical admission. It is characterized by an acute blockage of the passage of intestinal contents through the lumen of the small bowel [7]. Adhesive disease is among the most common disorders of the small intestine, and as such comprises a great burden both on patients and on the medical community. Although it is impossible to determine the true incidence of adhesions because not all become clinically significant, some suggest almost all patients who undergo an operation will develop adhesions [8].

Surgical intervention may be needed which can result in further adhesions over time. Some prophylactic measures such as adhesive films have been tried in the past but are generally considered futile. As a novel approach, Gastrografin, a water-soluble contrast medium, was used in the management of adhesive small bowel obstruction with promising results [9].

### What is Gastrografin:

Gastrografin is a water-soluble, high osmolality contrast medium that has been used diagnostically to define, and therapeutically to relieve adhesive small bowel obstructions [10]. GG is radiopaque and can be visualized on either serial X-Rays or CT. As a hyperosmotic agent, GG also causes a shift of water into the lumen of bowel which may help relieve the obstruction [11][13][14]. The mechanism of the action of Gastrografin is thought to be based on its properties as an osmotic compound and a wetting agent, shifting water into the bowel lumen and facilitating bowel

motility [12]. Adverse effects of contrast media are mostly gastrointestinal as patients may suffer from diarrhea, nausea, and vomiting, anaphylaxis remains another possibility. In contrast injections, the radiologist should be attentive of thrombosis, arrhythmias, plexopathies, and signs of hypersensitivity/anaphylaxis. Gastrografin should never be administered intrathecally [1].

### Small Bowel Obstruction:

A small bowel obstruction is an occlusion in the small intestine. Small bowel obstructions are generally caused by scar tissue, hernia, or cancer. The bowel repeatedly forms bands of scar (called adhesions) after being handled during an operation. If the bowel becomes trapped in adhesions, it may give rise to a small bowel obstruction. In critical cases, the blood supply might be compromised, and the bowel tissues might die. This is a life-threatening situation [15].

SBO is included in the differential diagnosis when a patient came with nausea, vomiting, abdominal pain, abdominal distension, and constipation. Rarely are all of these symptoms present. Pain ascribed to mechanical SBO is intermittent, described as crampy or colicky owing to increased peristalsis against the physical obstruction. Patients can present with diarrhea even in the presence of a complete SBO owing to this increased intestinal activity [16].

Twisting of the intestine cause proximal bowel distention and distal bowel decompression. Initially, peristalsis may increase, leading to persistent bowel movements. Vomiting may happen due to the proximal bowel distention. The twisted bowel will first stop venous blood flow and lead to bowel wall edema and inflammation. The third spacing of fluid often happens as well. The thickened and inflamed bowel wall is at risk for ischemia and bacterial migration. Bacterial migration can cause peritonitis and bacteremia,

most commonly from Escherichiacoli. As the bowel further twists, the arterial flow will be cut off, leading to bowel ischemia and eventually perforation, peritonitis, and death if untreated [17].

### Diagnosis and Management of Small Bowel Obstruction:

In high-income countries, where surgical volumes are large, postoperative adhesion is the most common cause of SBO, whereas in low-income and middle-income countries, small bowel volvulus, incarcerated abdominal wall hernia, and intussusception have been the most common causes [18].

Due to the safety, low cost, speed and widespread availability of X-ray technology, plain film radiography is often the initial imaging modality used to confirm the presence of SBO. Plain film radiography is an equally accurate investigation for determining the presence or absence of obstruction but lacks the ability to provide any greater detail [19].

CT has been shown to have superior capabilities to plain film radiography regarding the aetiology and severity of obstruction, as well as providing additional information that may influence management [19].

The use of water-soluble contrast agents (WSCAs) such as Gastrografin with serial abdominal radiographs a 'Gastrografin protocol' is effective for stratifying patients with adhesive SBO into those requiring surgery and these symptoms will resolve with conservative management, thereby shortening decision time to surgery. Diagnostically, WSCA is well documented to successfully estimate the need for surgical interventions. The diagnostic criterion for complete bowel obstruction probably requires surgical intervention is failure of WSCA to reach the colon on abdominal radiograph within 24 h of admission [18].

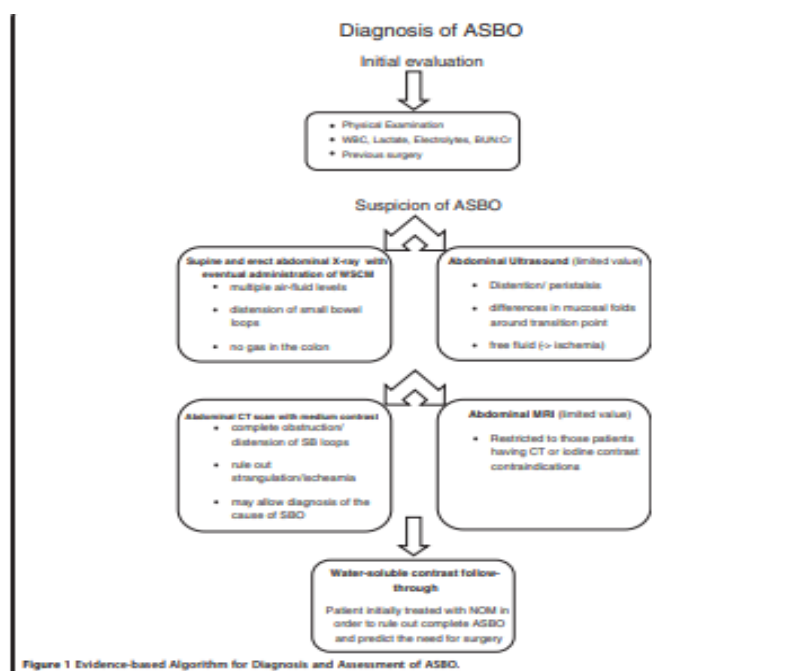


Figure 1: Evidence based algorithm for diagnosis and assessment of ASBO

The initial goal of management is to resuscitate and stabilize the patient by correcting fluid and metabolite imbalances, as well as symptom control. A patient's suitability for conservative versus surgical management needs to be determined. Clinical signs alone accurately identify ischemic bowel only 40–50% of the time, indicating urgent surgical intervention [19].

Majority of ASBO patients do not display overt signs of strangulation. In order to avoid unnecessary surgery in this

majority, a trial of conservative management is widely practiced [19]. Gastrografin promotes shifting of fluid into the bowel lumen and increases the pressure gradient across an obstructive site. The bowel content is diluted, and in the existence of the wetting agent, passage of bowel contents through a narrowed lumen is facilitated. Gastrografin also decreases edema of the bowel wall and enhances bowel motility [25].

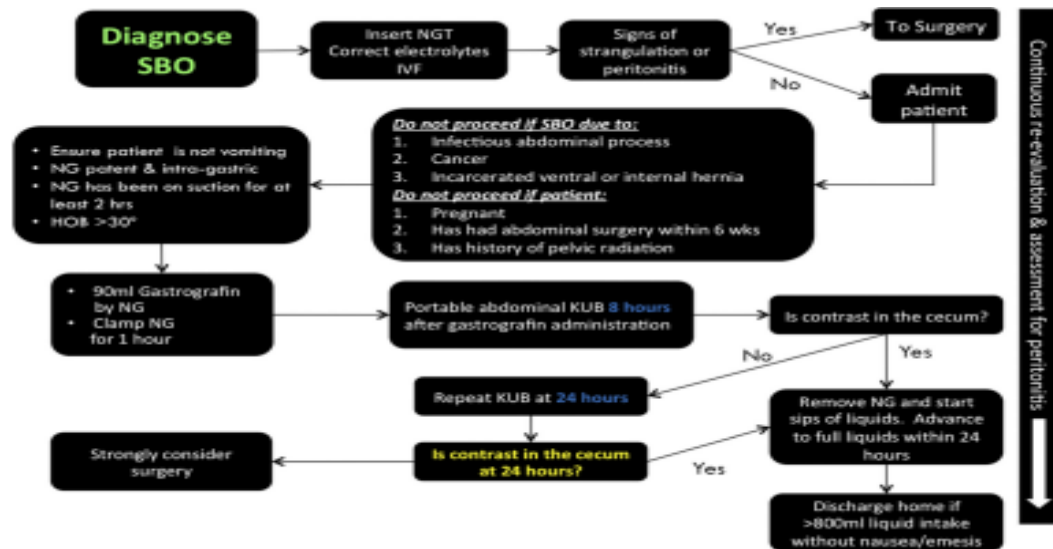


Figure 2: Management protocol for patients undergoing the Gastrografin challenge

Hok-Kwok Choi et al. studied Value of gastrografin in adhesive small bowel obstruction after unsuccessful conservative treatment. This study aimed to evaluating the effectiveness of gastrografin in adhesive small bowel obstruction when conservative treatment failed. From the study they concluded that the use of gastrografin in adhesive small bowel obstruction after unsuccessful conservative treatment is safe and reduces the need for surgical intervention [20].

Jordi Miquel et al. conducted a study on conservative treatment with Gastrografin for adhesive small bowel obstruction after colorectal surgery. The objective of the study was to identify risk factors related with failure of conservative management of adhesive small bowel obstruction in patients with previous colorectal surgery. This study includes patients admitted with the diagnosis of ASBO after previous colorectal resection. From the study they concluded that the use of Gastrografin in ASBO after colorectal resection is a safe and useful tool for the indication of conservative management. Age over 75 years is a predictive factor for need of surgery. Surgery should be performed no later than the following 24 h of confirmed complete obstruction [21].

Hirota Nishie et al. suggested that Gastrografin through a nasogastric tube followed by LT can be a promising treatment strategy for ASBO, with long-term efficacies equivalent to initial LT placement [22]. Yaser M.K. Baghdadi et al. mentioned that Gastrografin challenge is a clinically useful tool in treating SBO patients with

comparable long-term recurrence rates compared to traditional management of SBO [23].

### 3. Conclusion

Gastrografin role in diagnosis and management of SBO has facilitated early recognition of complete obstruction, replaced the repetitive CT use and mitigated the high contrast dose effect on patient's health and, in the future, may also be used to accelerate inpatient discharge for a wide variety of obstructive bowel pathology. Early resolution of obstruction and decrease in hospital stay are its advantages higher than operative management, thus decreasing the overall cost of treatment. The use of Gastrografin for incarcerated hernias and tumors is discouraged. Surgery has to be done immediately in the case of clinical deterioration.

### References

- [1] Alsimail, Mohammed Wasel H, Abdulrahman Ahmed A Alnaim, Fatimah Alramadhan, Banan Khalid M Sagg, Lojein, Faisal A Alnomari, Norah Abdu Almeashi, Sama Kamel Jambi, Fatemah Ali Alaithan, Reem Ahmed Alshoura, Norah Nashmi, Alaaly Alotaibe and Abdulaziz Abdullah Alshalawi. "Role of Gastrografin Challenge in Diagnosis of Small Intestinal Obstruction." (2020).
- [2] Pandove, Paras. (2019). gastrograffin study. 10.7860/IJARS/2017/28170:2285.
- [3] D'Agostino R, Ali NS, Leshchinskiy S, Cherukuri AR, Tam JK. Small bowel obstruction and the gastrografin

- challenge. *Abdom Radiol (NY)*. 2018 Nov;43(11):2945-2954.
- [4] Alnachoukati O, Ray-Zack M, Godin S, Apodaca T, Zielinski M, Dunn J. Optimal Timing of First Abdominal Radiography after Gastrografin Administration for Small Bowel Obstruction. *J Surg Res*. 2020 Dec;256:193-197.
- [5] Almafrefji I, Chinaka U, Hussain A, Lynch M, Cottrell R. Role of Gastrografin in Patients With Small Bowel Obstruction. *Cureus*. 2020 Aug 12;12(8):e9695.
- [6] Zielinski MD, Haddad NN, Cullinane DC, Inaba K, Yeh DD, Wydo S, Turay D, Pakula A, Duane TM, Watras J, Widom KA, Cull J, Rodriguez CJ, Toschlog EA, Sams VG, Hazelton JP, Graybill JC, Skinner R, Yune JM; EAST SBO Workgroup: Martin D. Zielinski, MD; Nadeem N. Haddad, MD; Asad J. Choudhry, MBBS; Daniel C. Cullinane, MD; Kenji Inaba, MD; Agustin Escalante; D. Dante Yeh, MD; Salina Wydo, MD; David Turay, MD; Andrea Pakula, MD; Therese M. Duane, MD; Jill Watras, MD; Kenneth A. Widom, MD; John Cull, MD; Carlos J. Rodriguez, DO; Eric A. Toschlog, MD; Valerie G. Sams, MD; Joshua P. Hazelton, DO; John Christopher Graybill, MD, Ruby Skinner, MD, Ji-Ming Yune, MD. Multi-institutional, prospective, observational study comparing the Gastrografin challenge versus standard treatment in adhesive small bowel obstruction. *J Trauma Acute Care Surg*. 2017 Jul;83(1):47-54.
- [7] Cengarle A, Weber DG, Taib AG. Acute small bowel obstruction: one-year retrospective study of admissions to inner city Royal Perth Hospital. *ANZ J Surg*. 2020 Sep;90(9):1689-1693.
- [8] Weiss A, Sood D, Greenway SE, Tomassi M. Value of gastrografin in adhesive small bowel obstruction. *Langenbecks Arch Surg*. 2017 Dec;402(8):1233-1239.
- [9] Paily A, Kotecha J, Sreedharan L, Kumar B. Resolution of adhesive small bowel obstruction with a protocol based on Gastrografin administration. *J Med Life*. 2019 Jan-Mar;12(1):10-14.
- [10] Ekladios A, Wheeler LP, Yamanaka M. Gastrografin: a diagnostic and therapeutic agent. *Intern Med J*. 2018 Dec;48(12):1547-1549.
- [11] Long S, Emigh B, Wolf JS Jr, Byrne C, Coopwood TB, Aydelotte J. This too shall pass: Standardized Gastrografin protocol for partial small bowel obstruction. *Am J Surg*. 2019 Jun;217(6):1016-1018.
- [12] Cohen RB, Olafson SN, Krupp J, Parsikia A, Kaplan MJ, Moran B, Leung PS. Timing of Gastrografin administration in the management of adhesive small bowel obstruction (ASBO): Does it matter? *Surgery*. 2021 Aug;170(2):596-602.
- [13] Gu L, Zhu F, Xie T, Feng D, Gong J, Li N. Use of the Water-Soluble Contrast Medium Gastrografin in Treatment of Adhesive Small Bowel Obstruction in Patients with and Without Chronic Radiation Enteropathy: A Single-Center Retrospective Study. *Med Sci Monit*. 2021 Mar 27;27:e930046.
- [14] Köstenbauer JK. Managing Adhesive Small Bowel Obstruction with Water-Soluble Contrast Should Be Protocolized: A Retrospective Analysis. *Surg J (N Y)*. 2018 Jul 20;4(3):e123-e128.
- [15] Baiu I, Hawn MT. Small Bowel Obstruction. *JAMA*. 2018;319(20):2146.
- [16] Bower KL, Lollar DI, Williams SL, Adkins FC, Luyimbazi DT, Bower CE. Small Bowel Obstruction. *Surg Clin North Am*. 2018 Oct;98(5):945-971.
- [17] Schick MA, Kashyap S, Meseha M. Small Bowel Obstruction.
- [18] Nichole Starr, Mekdim Tadesse, Chinaemere Igwebuike, Kalid Sherefa, Abraham Genetu, Yohanna Aregawi, Ebenezer Zewdu, Daniel Tamirat, Migbar Desalegn, Bantie Getahun, Hobart Harris, Daniel Zemenfes, Feasibility of Gastrografin Use for Adhesive Small Bowel Obstruction in Low-Income Countries, *Journal of Surgical Research*, Volume 293, 2024, Pages 239-247, ISSN 0022-4804,
- [19] Köstenbauer J, Truskett PG. Current management of adhesive small bowel obstruction. *ANZ J Surg*. 2018 Nov;88(11):1117-1122.
- [20] Choi HK, Law WL, Ho JW, Chu KW. Value of gastrografin in adhesive small bowel obstruction after unsuccessful conservative treatment: a prospective evaluation. *World J Gastroenterol*. 2005 Jun 28;11(24):3742-5.
- [21] Miquel J, Biondo S, Kreisler E, Uribe C, Trenti L. Failure of conservative treatment with Gastrografin® for adhesive small bowel obstruction after colorectal surgery. *Int J Colorectal Dis*. 2017 Jul;32(7):1051-1055.
- [22] Nishie H, Shimura T, Katano T, Iwai T, Itoh K, Ebi M, Mizuno Y, Togawa S, Shibata S, Yamada T, Mizushima T, Inagaki Y, Kitagawa M, Nojiri Y, Tanaka Y, Okamoto Y, Matoya S, Nagura Y, Inagaki Y, Koguchi H, Ono S, Ozeki K, Hayashi N, Takiguchi S, Kataoka H. Long-term outcomes of nasogastric tube with Gastrografin for adhesive small bowel obstruction. *J Gastroenterol Hepatol*. 2022 Jan;37(1):111-116.
- [23] Baghdadi YM, Choudhry AJ, Goussous N, Khasawneh MA, Polites SF, Zielinski MD. Long-term outcomes of gastrografin in small bowel obstruction. *J Surg Res*. 2016 May 1;202(1):43-8.
- [24] Kuehn F, Weinrich M, Ehmman S, Kloker K, Pergolini I, Klar E. Defining the Need for Surgery in Small-Bowel Obstruction. *J Gastrointest Surg*. 2017 Jul;21(7):1136-1141.
- [25] Choi HK, Chu KW, Law WL. Therapeutic value of gastrografin in adhesive small bowel obstruction after unsuccessful conservative treatment: a prospective randomized trial. *Ann Surg*. 2002 Jul;236(1):1-6. doi: 10.1097/0000658-200207000-00002.
- [26] Maienza E, Godiris-Petit G, Noullet S, Menegaux F, Chereau N. Management of adhesive small bowel obstruction: the results of a large retrospective study. *Int J Colorectal Dis*. 2023 Sep 5;38(1):224. doi: 10.1007/s00384-023-04512-8.
- [27] Khasawneh MA, Ugarte ML, Srivantstian B, Dozois EJ, Bannon MP, Zielinski MD. Role of gastrografin challenge in early postoperative small bowel obstruction. *J Gastrointest Surg*. 2014 Feb;18(2):363-8.
- [28] Azagury D, Liu RC, Morgan A, Spain DA. Small bowel obstruction: A practical step-by-step evidence-based approach to evaluation, decision making, and management. *J Trauma Acute Care Surg*. 2015 Oct;79(4):661-8.
- [29] Lawrence EM, Pickhardt PJ. Evaluating suspected small bowel obstruction with the water-soluble contrast

challenge. Br J Radiol. 2022 Feb  
1;95(1130):20210791.

- [30] Lawrence EM, Pickhardt PJ. Water-Soluble Contrast Challenge for Suspected Small-Bowel Obstruction: Technical Success Rate, Accuracy, and Clinical Outcomes. AJR Am J Roentgenol. 2021 Dec;217(6):1365-1366.
- [31] Thompson JS. Contrast radiography and intestinal obstruction. Ann Surg. 2002 Jul;236(1):7-8.
- [32] Mulder MB, Hernandez M, Ray-Zack MD, Cullinane DC, Turay D, Wydo S, Zielinski M, Yeh DD. A Significant Proportion of Small Bowel Obstructions Require >48 Hours to Resolve After Gastrografin. J Surg Res. 2019 Jan;233:408-412.