

Role of Gastrografin Challenge in Diagnosis of Small Intestinal Obstruction

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Abstract

Background: Acute small bowel obstruction (SBO) is a major cause of morbidity and mortality. It results in the use of significant healthcare resources, particularly in cases of delayed proper management. The "Gastrografin challenge" has been used for decades as a diagnostic modality in (SBO), involving serial abdominal radiographs. **Objective:** In this study, we aimed to evaluate the diagnostic and therapeutic value of Gastrografin in small bowel obstruction diagnosis and management **Methods:** PubMed database was used for article selection, and the following keywords were used in the mesh: "Gastrografin Challenge" [Mesh], "Small Bowel Obstruction"[Mesh], and "Evaluation"[Mesh] or "Management"[Mesh] or "Diagnosis"[Mesh]. **Conclusion:** Gastrografin has an important role in the diagnosis and management of SBO from early recognition of complete obstruction. It has replaced the repetitive CT use and triumphed over the high contrast dose effect on patient's health caused by CT imaging.

Keywords: Gastrografin, Intestinal obstruction

INTRODUCTION

Acute small bowel obstruction (SBO) is a major cause of morbidity and mortality. SBO can arise as a result of various causes such as adhesions, intussusception, and volvulus. Patients with SBO needs careful assessment and management. Immediate surgery is required when there are any findings that suggest strangulation. In the case of partial obstruction, a trial of conservative management can be done [1]. The "Gastrografin challenge" has been used for decades as a diagnostic modality in (SBO), involving serial abdominal radiographs. SBO is considered once the flow of digestion, is compromised along the length of the intestine, being physically blocked by mechanical barriers or the digestive fluid is stagnated due to non-mechanical obstruction [1]. Stagnation of the food particles causes waste of matter and gases to build up in the portion above the blockage and also interfere with the absorption of nutrients and fluids, prone the body into imbalances and deficiencies [1]. Oral water-soluble contrast agents, most commonly Gastrografin, have been applied to the daily practice in recent years to predict patient path for either surgical or medical interventions. An algorithm has been designed for interpretation; the appearance of diluted contrast in the small bowel, contrast concentrating effect, and details of surgical history and anatomy are key for diagnosis. Its applicability allows it to be

of a treating step, sometimes where one of the many uses of the Gastrografin challenge in SBO is determining triage in the emergency department [2]. Another approach has been designed for interpretation; the appearance of diluted contrast in the small bowel, contrast concentrating effect, and details of surgical history and anatomy are key for diagnosis [3]. One of the many uses of the Gastrografin challenge in SBO is determining triage in the emergency department. An urgent operation may be needed when developing leukocytosis,

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fever, and evidence of bowel strangulation, often supplemented with computerized tomography ^[4].

METHODOLOGY

PubMed database was used for article selection, and the following keywords were used in the mesh; “Gastrografin Challenge”[Mesh], “Small Bowel Obstruction”[Mesh], and “Evaluation”[Mesh] or “Management”[Mesh] or “Diagnosis”[Mesh]. In regards to the inclusion criteria, the articles were selected based on the inclusion of one of the following topics; SBO evaluation, Gastrografin role in management, diagnosis, and prognosis of SBO, and investigation of choice in a patient complaining of SBO. Exclusion criteria were all other articles, which did not have one of these topics as their primary endpoint, or repeated studies, and systematic reviews or meta-analysis.

DISCUSSION

Intestinal obstruction is one of the most common causes of abdominal emergencies, and it is associated with a significant rate of morbidity and mortality. A variety of diseases such as the superior mesenteric artery are eventually complicated by causing an intestinal obstruction ^[5]. Most commonly, small intestinal obstruction occurs as a result of adhesions, which mostly occur after abdominal surgeries ^[6].

In order to prevent post-surgical intestinal adhesions, surgeons have used multiple techniques, but up to the moment, no method has proved its full effectiveness. Recently, surgeons tried to use water-soluble contrast as a tool to treat and predict the surgery needs in patients with intestinal obstruction ^[6].

What is Gastrografin?

Gastrografin is an iodinated contrast medium, used in many procedures including contrast-computerized tomography of the brain, aorto/angio/arteriography, excretion urography, and as discussed below, relieve of intestinal obstruction. Gastrografin is a combination of diatrizoate meglumine and diatrizoate sodium. Other forms of enema are available and these can be divided into cleansing and retention enema. Cleansing enema removes feces from the intestines; retention enema breaks down and softens hard lumps and lubricates the rectum with its oils. Retention (or retained) enema can be further subdivided into pneumatic, hydrostatic, and barium (see Table 1) ^[7].

Table 1: Types of Retention Enema.

Type	Advantages	Disadvantages
Pneumatic	Cleanses the bowels fast	Needs experienced practitioner, would still be hard to detect intussusceptions with proximal small intestine air entrapment

Hydrostatic (e.g. Gastrografin)	No staining of the peritoneum, less irritating in cases of perforation	If non-iso-osmolar fluids then rapid fluid compartment shifting may occur
Barium	Commonly used enema	May complicate in perforation, and peritoneal infection

Adverse effects of contrast media are mainly gastrointestinal as patients may suffer from diarrhea, nausea, and vomiting; anaphylaxis remains another possibility. In contrast injections, the radiologist should be wary of thrombosis, arrhythmias, plexopathies, and signs of hypersensitivity/anaphylaxis. Gastrografin should never be administered intrathecally ^[7].

Small Bowel Obstruction

Small Bowel Obstruction (SBO) is a condition where small intestinal passage is being blockaded, functionally due to intestinal wall or splanchnic nerve dysfunction or mechanically, via an actual mechanical barrier. Many conditions may cause functional bowel obstruction as a consequence or mimicking symptoms of SBO, including Large Bowel Obstruction (LBO), acute functional dilatation named as colonic pseudo-obstruction, paralytic ileus, so it is important to have a wide range of thinking and correlation of symptoms and investigation plan ^[2]. The mechanical SBO can occur as a result of an object that blocks the flow from inside the lumen or extrinsic compression preventing the normal transit of intestinal contents ^[8]. The high rate of mortality and morbidity associated with the disease occurrence, being untreated, or complications development cost the health organizers and ministries around \$3 billion with 30 thousand deaths/year in the USA alone ^[9]. Schrufnagel et al. (2009) reported that of all cases diagnosed as SBO, delay in surgery was associated with increased hospital length of stay (HLOS) and mortality ^[10]. Commonly, patients complain of cramping abdominal pain and distention, nausea and vomiting, with progressive tenderness. Indication of possible complications includes high fever, severe and rebound localized tenderness, severe leukocytosis, tachycardia, and metabolic acidosis as a result of multiple deteriorations including bowel ischemia and necrosis, perforation or generalized peritonitis. Small Bowel Mechanical Obstruction occurs due to different causes, such as Adhesions, Hernias, Pseudo, and Neoplasm (see Table 2) ^[8].

Regardless of the cause, the obstruction will lead to stagnation of food in the obstructed bowel segment, creating a suitable condition for the bacterial growth and metabolism of food. Gas production by the metabolized agents increases the vascular compression as a result of the distended wall, diminishing oxygen supplementation leading to cellular death, slowed peristalsis and enhancing further bacterial growth, all of which to develop toxicity and sepsis in the

circulating blood and worsen the condition. Additionally, breathing builds up additional distention and compression upon the wall, leading to loss of water and electrolytes into the bowel, and resulting in hypotension and shock. Upon the additional distention, the brain is triggered to cause vomiting creating an additional loss of water and electrolytes. This distended segment eventually will either cause bowel ischemia and necrosis, perforation or sepsis and inevitable septic shock ^[11].

Table 2: Etiologies of Mechanical Small Bowel Obstruction.

Type	Characteristic
Adhesion (55-75%)	- Formation of fibrous bridges between bowel segments that cause extrinsic compression.
	- The most common type of SBO
	- Most commonly to occur postoperatively in any operation involving the abdomen
Hernias (15-25%)	- Adhesion may be partial or complete.
	- Protrusion of part of the intestine through a weak area in the abdominal wall, then got strangulated to develop obstruction
Pseudo-	- Myopathy and muscular disorder result in absence or weakness in the peristaltic wave result in the stasis of the food and obstruction
	- Neuropathy, absence of innervation, diminishing the peristaltic wave
	- Hirschsprung's disease, a congenital condition where the absence of nerve at the distal end of the bowel results in the absence of the peristaltic wave; to be corrected surgically.
Neoplasm (5-10%)	- Colorectal cancer is the main cause of the bowel, a serious condition that may be lethal and rapidly deteriorate to cause SBO and death.
	- Risk factor to develop colorectal cancer cases include age, obesity, positive family history, inflammatory bowel disease (IBD), and certain diets.
	- Carcinomatosis, endometriosis, inflammatory bowel disease stenosis, intussusception, ischemic stenosis, radiation stenosis, post anastomotic stenosis, gallstones, foreign bodies, and bezoars
Others (15%)	- May cause as well LBO, where the main victor for LBO is cancer (60%); Volvulus and diverticular disease account for 30%

The approach of Intestinal Obstruction Management

Treatment in intestinal obstruction revolves around three pillars resuscitation, definitive investigation, and close monitoring. Physicians must have a high clinical suspicion according to the patient profile whenever presented with crampy abdominal pain and distention with unstoppable diarrhea and reported elevated leukocytosis and peritonism suggesting small bowel obstruction with possible ischemia. A definitive radio-image should be obtained if the patient is fit and has been successfully resuscitated ^[12]. A computerized tomography scan with intravenous contrast must be performed as soon as possible. If a CT scan confirms adhesive small bowel obstruction with ischemia or perforation, then the patient must go to surgery as soon as possible to relieve the adhesion thus the obstruction and to save the bowel segment or remove it if died already. If computed tomography shows adhesive small bowel obstruction without ischemia or perforation, then a conservative treatment should be initiated: nasogastric suction for the stagnated food particles and fluid replacement therapy for further stabilization and recurrence of balance with a wait-and-see and close on monitor strategy. After gastric contents are cleared, a water-soluble contrast administration challenge should be performed ^[8].

Barium enema or Gastrografin

A barium enema is utilized when the surgeon is suspecting colonic carcinoma as a cause of obstruction; other possibilities include volvulus and stricture. A question arises on which modality most would benefit the patient with the least harm. The answer depends on the presentation of obstruction; if the patient is in acute obstipation, then barium is preferred. However, the advantage of Gastrografin over barium lies during the complicated acute abdomen, as the risk of extravasation of the contrast media into the peritoneal space is prevented by Gastrografin use ^[13, 14]. Perforation of a diverticulum or colonic carcinoma are possible offenders where the advantage of Gastrografin is most needed. Gastrografin can be used for example in evaluating peritoneal carcinomatosis ^[13].

Kapoor et al. ^[15] studied patients with partial adhesive small intestinal obstruction and the role of gastrografin in the management of obstruction. They noted that the passage of gastrografin to cecum occurred within 24 hours, which indicates the resolution of obstruction. These findings are fortunate for patients not fit for surgery and those not fulfilling the criteria for operative intervention. However, Kapoor et al. reported that Gastrografin reached the cecum in 91.3% of patients.

Baghdadi et al. ^[16] investigated small bowel obstruction recurrence after gastrografin treatment, which reported a 25% recurrence rate of obstruction and 12% exploration for recurrence. Goussous et al. ^[17] reported a higher rate of exploration in patients who failed the Gastrografin challenge test. Khawsawneh et al. ^[18] suggested the Gastrografin

challenge as safe in patients with a previous history of abdominopelvic malignancies; while there was no difference in obstruction recurrence, a significantly reduced mortality in patients receiving Gastrografin over non-receivers was reported. When comparing Gastrografin to non-Gastrografin treatment the results show the superiority of Gastrografin and its effectiveness in treating adhesive small bowel obstruction [19, 20].

Singla *et al.* mentioned that the use of Gastrografin has an important role in the management of intestinal obstruction as it leads to early resolution of obstruction, decrease in hospital staying time and cost [14].

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 expedite inpatient discharge for a wide variety of obstructive bowel pathology. Gastrografin has an important role in causing early resolution of the obstruction, decrease in the hospital stay and the overall cost. However, the patient has to be monitored with regard to ischemia (peritonism, white blood cells, and lactate). Surgery has to be performed immediately in the case of clinical deterioration, preferably beginning with a laparoscopic technique.

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