

# Role of Hyperosmolar Water Soluble Contrast Media in Management of Intestinal Obstruction

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## Abstract

The present study was conducted in 70 patients with a diagnosis of small bowel obstruction (SBO) to evaluate the role of water soluble contrast agents (WSCA) in its management. Patients with features of complete bowel obstruction, strangulation, impending perforation, peritonitis, adynamic ileus and hypersensitivity to iodinated compounds were excluded from the study. Plain x-ray abdomen was suggestive of intestinal obstruction in 52(74%) patients. 21(30%) patients diagnosed to be having complete obstruction were operated upon within 12 hrs of contrast administration and contrast could not be felt or seen during the surgical procedure. Out of 49(70%) patients whose contrast revealed a diagnosis of partial / resolving obstruction 46 patients were managed conservatively and 3 patients who did not settle were operated upon after 24 hrs of the contrast study. Patients were divided into two groups, adhesive obstruction 40 patients and non-adhesive 30 patients. Among the adhesive group 30 (75%) settled with conservative treatment and 10 (25%) required surgery. In non adhesive group 16 (53%) patients were managed non operatively and 14 (47%) underwent operation. Overall accuracy in diagnosing the correct mode of treatment was 95% (67/70) in the study. Patients with adhesion obstruction managed non-operatively had resolution of obstruction during contrast study by passing liquid stools along with contrast within 24 hours of administration and in them early feeding was started. These patients had a shorter hospital stay of average 3.6 days. In conclusion early administration of WSCA is safe and effective way of increasing diagnostic accuracy and deciding the final mode of treatment in SBO. These agents also help in resolving the partial obstruction particularly caused by adhesions.

## Key Words

Small Bowel Obstruction, Adhesion Obstruction, Water Soluble Contrast Agents, Gastrograffin

## Introduction

Intestinal obstruction is one of the most common surgical emergencies accounting for 20% of admission in acute abdominal conditions (1). Small bowel is usually involved and post operative adhesions being the commonest etiology present in 70-75% of cases(2,3). The success in the treatment of SBO lies in early diagnosis and skilful management, either conservative or operative. With the delay in instituting the definitive therapy, severity of fluid and electrolytes imbalance and sepsis increases, as well as complication due to bowel ischaemia ensue. The management of SBO still remains a clinical challenge as it is not always possible to decide on clinical grounds

whether patient needs surgery or can be managed non-operatively(4). Emergency surgical intervention is needed when strangulation is suspected or complete obstruction occurs. Plain x-ray abdomen accuracy in diagnosing intestinal obstruction lies between 60-70% (5) and moreover it is not of much help in deciding the final mode of treatment required. The use of contrast media in SBO is controversial (6). Barium sulphate has been used in routine radiography of GIT diseases but its use in SBO is debatable. It is not water soluble and tends to precipitate after absorption of water and can convert partial obstruction to complete (7). In recent years hyperosmolar

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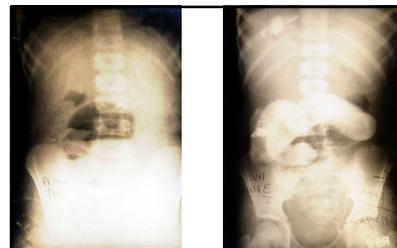
WSCA have been used in SBO based on their biochemical properties particularly in adhesion obstruction cases. WSCA help in deciding the line of treatment, resolving the features of obstruction, shortening the hospital stay and reducing the need for surgery (3). Being hyperosmolar, having osmolarity of 1900mosm/l, these agents promote shifting of fluid into bowel lumen and increase pressure gradient across the obstruction site, dilute the bowel contents and thus facilitate their passage in partial obstruction. They also decrease the edema of bowel wall and facilitate its motility. Thus, these agents have a therapeutic value (8,9). The present study has been undertaken to determine the diagnostic value of WSCA in SBO in predicting the need for early operative intervention, to evaluate the therapeutic effect of these agents particularly in adhesion obstruction, thus shortening the hospital stay and reducing overall cost of treatment.

**Material and Methods**

Seventy patients with signs and symptoms of SBO admitted in emergency department of GMC Jammu over a period of 18 months (January 2013-June 2014) were included in the study. After admission, history taking and clinical assessment was undertaken in all patients to look for obvious evidence of strangulation, perforation, peritonitis, complete obstruction, a dynamic obstruction and such cases were excluded from the study. Also patients with history of hypersensitivity to iodinated contrast agents were not taken up for study. Plain x-ray abdomen was done in both erect and supine position in all cases. Nasogastric aspiration, intravenous fluids and antibiotics were started. Patients were subjected to routine investigations -complete blood count, urine analysis, renal function test, serum electrolytes, blood grouping, electrocardiogram and x-ray chest. All patients especially children were resuscitated to maintain good hydration and adequate urine output before being taken up for contrast study using WSCA (Gastrograffin / Urografin). Dilution of contrast was carried out by adding normal saline, so as to make a concentration of 30-40%. Lower concentration of the dye was used in children as compared to adults. The dose of WSCA administered varied between 500-600mgm/kg/body weight i.e on an average 3 ampoules of the dye, 20 ml each, diluted to 120-130ml were given to adult patients. The contrast

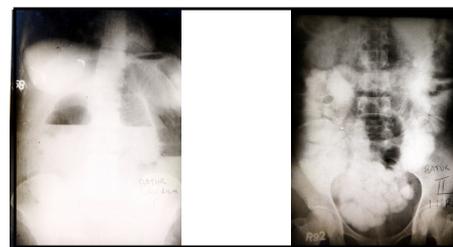
material was administered through NGT over a period of 20-30 minutes and tube was clamped for a period of 1-2 hours. Patient was placed in right lateral / upright position for 30-40 minutes. Abdominal films were taken in supine and erect position at 1hr, 2hr, 4hr interval after contrast administration and delayed films were taken at 8hrs, 12hrs, 24hrs in some patients, if required. The serial films were analysed for movement of the contrast, disparity in lumen of gut, dilatation of gut loops, complete hold up of the contrast, time interval taken by contrast to reach right colon and any extravasation of the dye. Depending upon the findings, a diagnosis of complete or partial /resolving obstruction was made and line of treatment was decided. If column of contrast material stayed in one particular area for a period of more than 4hrs-a diagnosis of complete obstruction was made and patients were subjected to laparotomy (Fig 1). In cases where contrast reached the right colon in less than or 4hrs duration but there was disparity in lumen of gut or moderate to significant dilatation of proximal gut loops, which persisted

**Fig 1 : Plain X-ray Abdomen and 3 hr Contrast Film Showing Complete Hold up in Ileum-a Case of Complete Obstruction due to Adhesions**



in subsequent films - a diagnosis of partial/ resolving obstruction was interpreted and patients were evaluated further while continuing the conservative treatment(Fig.2). During the conservative treatment, patients were monitored for hydration, temperature, nature of NGT

**Fig 2 : Plain X-ray Abdomen and 3 hr Film Showing Contrast in Ascending Colon- a Case of Partial Obstruction Due to Adhesions**



aspirate, abdominal tenderness and distension, bowel sounds and time taken to pass liquid stools /contrast. After the passage of stools/ contrast and improvement in clinical signs ,oral intake was gradually re-established. Patients in whom operative treatment was undertaken, during the surgical procedure, any side effect of the contrast on gut was looked for by gross examination. All the patients were observed for any side effect of the contrast during the treatment period and duration of hospital stay was also analysed.

### Results

The present study was conducted in 70 patients in the age range of 1 month to 80 years. Maximum 56 (80%) patients were adults more than 10 years of age and children constituted only 14(20%) cases. Males predominated over females constituting 54 (77%) cases in the study with a M:F ratio of 3.4:1.Plain X-ray abdomen was suggestive of intestinal obstruction in 52(74%) patients and in the rest it was non-contributory. Patients were divided into two groups: adhesive obstruction and non-adhesive obstruction (table 1). There were 40 patients having obstruction due to adhesions. After contrast study interpretation 9 patients (22.5%) had complete obstruction and were operated upon within 12 hours of contrast administration and obstruction was relieved. The dye could not be seen or felt during surgical procedure and no side effect of the contrast was present on gross examination of the gut. These patients had an average hospital stay

of 8.5 days(8 to 10 days).31 patients in which the contrast revealed partial/resolving obstruction were managed conservatively except 1 which did not improve and was operated upon. Most of the patients passed liquid stools and contrast adequately within 24 hours of the study and all of them were started orally the next day and were discharged within 2-4 days with an average stay of 3.5 days. Thus accuracy of contrast study in predicting the mode of treatment was 97%.Among 30 patients in non adhesive group i.e other than post operative adhesions contrast study revealed partial /resolving obstruction in 18(60%) and complete obstruction in 12(40%) patients. All the 18(60%) patients with partial obstruction were managed conservatively except 2(10%) which did not improve and were operated upon. 12(40%) cases where contrast has shown complete obstruction were also operated upon. So overall in this group 14(47%) patients needed surgery, the accuracy of contrast in correctly predicting the treatment modality was 93%.In non-adhesive group in conservative treated patients the average hospital stay was 3.6 days and operated patients had 10 days (9-11 days).The overall accuracy in the study in correctly predicting the mode of treatment was 95% with duration of average hospital stay 3.6 days in non operative and 10.5days in the operated patients. No complication was noted in this study except nausea / vomiting in 8(11%) patients. There was no morbidity or mortality in the series because of the delay in deciding

**Table 1. Showing Contrast Study Diagnosis, Final Mode of Treatment, Percentage Accuracy and Average Hospital Stay**

| Type of obstruction.<br>(No. of patients) | Contrast study diagnosis |          | Mode of Treatment |           | Percentage Accuracy   |                 |                | Average Hospital Stay  |                         |
|---|--------------------------|----------|-------------------|-----------|-----------------------|-----------------|----------------|------------------------|-------------------------|
|   | Partial/<br>resolving    | Complete | Conserva-<br>tive | Operative | Partial/<br>resolving | Complete        | Overall        | Conserva-<br>tive      | Operative               |
| Adhesive (40)                             | 31                       | 09       | 30                | 10        | 97%<br>(30/31)        | 100%<br>(9/9)   | 97%<br>(39/40) | 3.5 days<br>(2-4 days) | 8.5 days<br>(8-10 days) |
| Non- adhesive<br>(30)                     | 18                       | 12       | 16                | 14        | 89%<br>(16/18)        | 100%<br>(12/12) | 93%<br>(28/30) | 3.6 days<br>(3-5 days) | 10 days<br>(9-11 days)  |
| Total<br>(70)                             | 49                       | 21       | 46                | 24        | 94%<br>(46/49)        | 100%<br>(21/21) | 95%<br>(67/67) | 3.6 days               | 10.5 days               |

the mode of treatment or any side effect of the contrast material.

### Discussion

Obstruction of the small intestine is one of the most common cause of emergency admission in acute abdomen with adhesions being the leading etiology. The accurate diagnosis of SBO and its management, still remain enigmatic. A delay in deciding the mode of treatment may lead to increase in mortality rate from 3% to 5% when obstruction is simple to about 30% when it is strangulating or bowel becomes necrotic or perforates(10). Despite the advancement made in supportive management there is no unanimity among surgeons regarding the indication for conservative or operative treatment. Plain X ray abdomen in a suspected case of SBO has a diagnostic accuracy of 60-70% (5) and is of no help in deciding the mode of treatment required. In the present study plain X-ray was suggestive of obstruction in 74% of patients which is comparable to other studies reported in the literature. Adhesion obstruction is the most common etiology in SBO patients and incidence varies between 30-76% (2,11,12) and was present in 57% of patients in the present series. In order to further improve the diagnostic accuracy, there is need for use of contrast radiography in evaluation of SBO. Use of barium sulphate in SBO is controversial (7) but WSCA have certain properties which make them suitable in such circumstances and can be safely used. They are comparatively non-toxic, completely miscible with intestinal contents, not absorbed from the gut and are neither seen nor felt during surgical procedure and moreover, they are not harmful if leak into the peritoneal cavity (13). The diagnostic and therapeutic role of WSCA has also been reported by several authors in their studies (7,14,15). Because of their high osmolarity these agents decrease bowel wall edema and draw fluid into the bowel lumen thereby increase the pressure gradient across the obstruction site which helps in the passage of diluted bowel content, and thereby relieving the partial obstruction (4,9). WSCA also increase the contractility of smooth muscles (14). In the present series 30 patients in adhesive group where contrast reached the large bowel in less than or 4 hours duration were managed conservatively. 9(22%) patient, where contrast revealed complete obstruction and

1 (3%) patient with partial obstruction which did not settle were operated in this group. The accuracy in correctly predicting the mode of treatment in adhesive group was 97% in this series, which is comparable to other series reported in literature. Chen *et al* studied the predictive value of WSCA in adhesive SBO and found that operative intervention is required in 96% patient where contrast failed to reach the colon within 24 hours (9). Onoue *et al* reported that 98% of the patient responded to conservative treatment if contrast appears in colon within 24 hours and 80 % failure rate if contrast failed to reach the colon (16). Jaffer *et al* also found in their study that in 92% of patients where contrast reached the colon, obstruction was resolved during non-operative treatment whereas in 98% patients operative intervention was needed in whom contrast failed to reach colon within 24 hours (17). Vakil *et al* have also reported in patient with adhesive SBO using WSCA a sensitivity of 100% in correctly predicting the non-operative treatment(18) The operative rate in present study is 10 (25%) patients in adhesive groups while other authors have reported an operative rate of 27-42 % in adhesive SBO patients (17). Also noticed was the therapeutic effect of WSCA in 30 patients with adhesion obstruction managed non-operatively who passed liquid stools and contrast within 24 hours of contrast administration and were started orally, as also reported by Jaffer *et al* in their patients (17). Nasrin *et al* has also found 90% resolution using Gastrograffin in patients with adhesion obstruction in their study(19). These patients had a shorter hospital stay on an average of 3.5days (2-4 days) well comparable to other series (20, 21). Among the non-adhesive group in the study 14 (43%) patients were operated upon which included 2 (3%) patients where conservative treatment failed thereby showing an accuracy of 88% in correctly predicting the non-operative treatment. The average hospital stay in operative patient was 10.5 (8-11) days in the series. However Safamanesh *et al* have reported average stay of 8.5 days in their study (22). The overall accuracy in predicting the treatment was 100% in operative group and 94% in conservatively managed patients in the present series. Wadani *et al* found that contrast study using WSCA was helpful in 91% of the patients in correctly predicting the conservative treatment (23). Chung *et al* derived

useful information in 89% of the contrast studies performed in patient with SBO in their series (24). In conclusion we strongly recommend early use of WSCA in evaluation of patients with SBO to decide whether patient needs immediate surgery or can be managed non-operatively. Moreover, these agents have a therapeutic role and help in early resolution of partial obstruction particularly caused by adhesions and do not add to the morbidity or mortality of the patients.

#### References

1. Miller G, Boman J, Shrier I, Gordon PH. Etiology of small bowel obstruction. *Am J Surg* 2000;180:33-36.
2. Haule C, Ongom PA and Kimuli T. Efficacy of Gastrograffin compared with standard conservative treatment in management of adhesive small bowel obstruction at Mulago National referral hospital. *Jr Clinical Trials* 2013;144: 2167-68.
3. Roadley G, Cranshaw T, Young M, Hill AG. Role of Gastrograffin in assigning patients to a non-operative course in adhesive small bowel obstruction. *ANZ J Surg* 2004;74(10):830-32.
4. Burge J, Abbas SM, Roadley G, *et al.* Randomized controlled trials of Gastrograffin in adhesive small bowel obstruction. *ANZ J Surg* 2005;75(8):672-74
5. Maglinit DD, Heitkamp DE, Howard TJ, Kelvin FM, Lappas JC. Current concepts in imaging of small bowel obstruction. *Radiol Clin North Am* 2003;41(2),263-83
6. Blackman S, Lucius C, Wilson JP, *et al.* The use of water soluble contrast in evaluating clinically equivocal small bowel obstruction. *Am Surg* 2000;66:238-42
7. Anderson CA, Humphrey WT. Contrast radiography in small bowel obstruction: a prospective randomized trial. *Mil Med* 1997;162:749-52
8. Stordahl A, Lacerum F, Gjolberg T, Enge I. Water soluble contrast media in radiography of small bowel obstruction. Comparison of ionic and non-ionic contrast media. *Acta Radiol* 1988;29:53-56
9. Chen SC, Lin FY, Lee PH, *et al.* Water soluble contrast study predicts the need for early surgery in adhesive small bowel obstruction. *Br J Surg* 1998;85(12):1692-94
10. Ellis H. The clinical significance of adhesions: focus on intestinal obstruction. *Eur J Surg Suppl* 1997;577:5-9.
11. Moran BJ. Adhesion-related small bowel obstruction. *Colorectal Dis* 2007;9 Suppl 2:39-44.
12. Jusoh AC, Ismail FH, Yanzie O. Absolute benefit of Gastrograffin in adhesive small bowel obstruction. A retrospective study and review of literature. *Saudi Surgical Jr* 2014;2(3):84-87.
13. Davis LA, Huang KC and Pirkey EL. Water soluble nonabsorbable radiopaque medium in gastrointestinal tract examination. *JAMA* 1956;16:373
14. Chen SC, Chang KJ, Lee PH, Wang SM, Chen KM, Lin FH. Oral Urograffin in postoperative small bowel obstruction. *World J Surg* 1999;23:1051-54.
15. Enochsson L, Runold M, Fenyo G. Contrast radiology in small bowel obstruction, a valuable diagnostic tool? *Eur J Surg* 2001;167:120-24.
16. Onoue S, Katoh T, Shibata Y, Matsuoka Suzuki M, Chigira H. The value of contrast radiology for postoperative adhesive small bowel obstruction. *Hepatogastroenterology* 2002;49:1576-78.
17. Jaffer S, Qureshi S, Channa A, Maher M. Role of orally administered Gastrograffin in small bowel obstruction after unsuccessful conservative treatment. *Pak J Med Sci* 2012;28(5):936-39
18. Vakili R, Kalra S, Raul S, Paljor Y, Joseph S. Role of water soluble contrast study in adhesive small bowel obstruction. A Randomized controlled study. *Indian J Surg* 2007;69(2):47-51.
19. Rohmani N, Mohammadpour RA, Khoshood P. Prospective evaluation of oral gastrograffin in the management of post operative adhesive small bowel obstruction. *Indian J Surg* 2013;75(3):195-99.
20. Biondo S, Pares D, Mora L, *et al.* Randomized clinical study of Gastrograffin administration in patients with adhesive small bowel obstruction. *Br J Surg* 2003; 90:542-546.
21. DiSaverio S, Catena F, Ansaloni L, *et al.* Water soluble contrast medium (Gastrograffin) value in adhesive small intestinal obstruction (ASIO). A prospective randomized controlled trial. *World J Surg* 2008;32:2293-2304.
22. Safamanesh S, Pazouki A, Tamanniz Z, *et al.* Evaluation of Gastrograffin Therapeutic Role in the management of small bowel obstruction. *Jr Minim Invasive Surg Sci* 2012;1(3): 90-93.
23. Wadani H, AlAwad NI, Hassan K, *et al.* Role of water soluble contrast agents in assigning patients to a non-operative course in adhesive small bowel obstruction. *Oman Med J* 2011;26(6):454-56
24. Chung CCI, Meng WC, Yu SC. A prospective study on the use of water soluble contrast follow through radiology in the management of small bowel obstruction. *ANZ J Surg* 1996;66(9):598-601.