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**ORIGINAL ARTICLE**

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## **An Audit of the Upper Gastrointestinal Contrast Examination Protocol in Patients with Suspected Small Bowel Obstruction**

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### **ABSTRACT**

**Objective:** Small bowel follow-through examination with Gastrografin (diatrizoate meglumine and diatrizoate sodium solution) is important for delineating the cause of small bowel obstruction. However, whether the standard protocol should include the 24-hour delayed image is uncertain. This retrospective study was performed to review the usefulness of the 24-hour delayed image and the subsequent treatment of patients suspected to have small bowel obstruction.

**Methods:** All urgent Gastrografin follow-through examinations conducted from 1 January 2007 to 31 December 2007 were evaluated. Clinical data, including demographic data, presenting symptoms, imaging findings, subsequent treatment, and clinical outcomes were reviewed from the Electronic Patient Record, Radiology Information System, and medical records.

**Results:** Seventy five examinations were performed, and 4 patients were excluded because of intolerance and subsequent incomplete examination. The commonest indication was acute small bowel obstruction ( $n = 66$ ; 93%). Of 21 patients (30%) with positive results, 6 had significant small bowel obstruction diagnosed by imaging within 8 hours with no 24-hour delayed image, and 5 of these patients underwent emergency operation; the sixth patient rapidly worsened preoperatively. Of 15 patients with positive results confirmed by 24-hour delayed images, 14 required emergency operation, with complete bowel obstruction confirmed intraoperatively. For the 50 patients with negative results, 9 (18%) required 24-hour delayed images to confirm the radiological diagnosis, 3 (33%) of whom underwent emergency operation due to their deteriorating clinical condition; complete bowel obstruction was confirmed intraoperatively for all 3 patients.

**Conclusions:** This audit of the role of 24-hour delayed imaging had a high false-negative rate (30%). Therefore, the standard protocol may be amended to eliminate the 24-hour delayed image to avoid delay to effective management of small bowel obstruction.

**Key Words:** Clinical audit; Diatrizoate meglumine; Fluoroscopy; Intestinal obstruction

### **INTRODUCTION**

Small bowel follow-through study with Gastrografin (diatrizoate meglumine and diatrizoate sodium solution; Bracco Diagnostics Inc, Princeton, USA) is one of the commonest urgent requests to the fluoroscopy unit at the Department of Radiology, Princess Margaret Hospital,

Hong Kong. The most common indication for this urgent request is small bowel obstruction. Clinicians generally use this investigation to delineate the transit time of the small bowel and detect the site of obstruction, if present. Additionally, some clinicians believe that hypertonic Gastrografin can help to relieve partial small bowel obstruction due to its osmotic effects.

This study was performed to assess the nature of requests for small bowel follow-through examination with Gastrografin made by clinicians, the diagnostic yield of upper gastrointestinal (GI) contrast examination,

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and the subsequent treatment according to the relevant fluoroscopic findings.

### METHODS

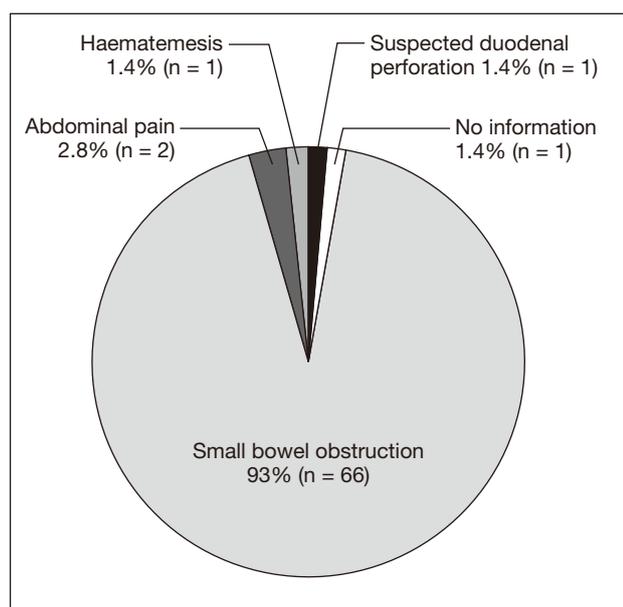
This retrospective study evaluated all urgent Gastrografin follow-through examinations conducted from 1 January 2007 to 31 December 2007. All corresponding studies during the period were included. Clinical data, including demographic data, presenting symptoms, imaging findings, subsequent treatment, and clinical outcomes, were reviewed from the Electronic Patient Record, Radiology Information System, and medical records.

### RESULTS

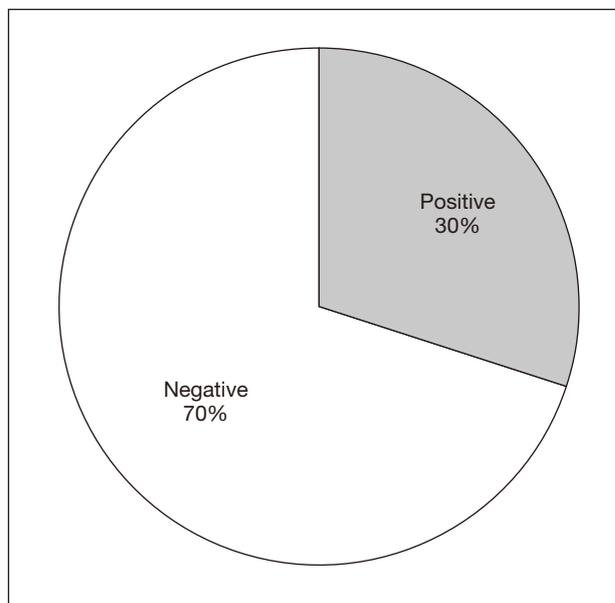
During the study period, 75 patients underwent urgent Gastrografin follow-through examination. Four patients were excluded from the audit because the examinations were abandoned due to patient intolerance.

The patients' ages ranged from 17 to 90 years. There were 44 men and 27 women. Sixty six patients (93.0%) had clinical indications of small bowel obstruction as the reason for the fluoroscopy request, 2 (2.8%) presented with abdominal pain only, 1 (1.4%) had haematemesis, 1 (1.4%) had suspected duodenal perforation, and 1 (1.4%) had no written indication (Figure 1).

All urgent upper GI contrast examinations were performed within 24 hours of the requests. All images were interpreted by the radiologists at the Princess Margaret Hospital and written reports were provided.



**Figure 1.** Indications for urgent upper gastrointestinal contrast examination.



**Figure 2.** Results for urgent upper gastrointestinal contrast examination.

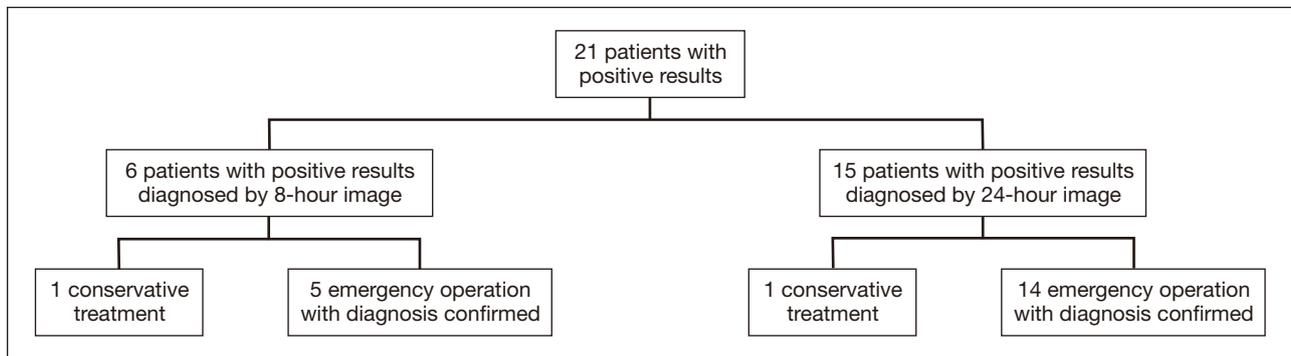
**Table 1.** Causes of positive upper gastrointestinal contrast examination (n = 19).

Cause	Number of patients (%)
Small bowel adhesion	15 (79.0)
Appendiceal abscess	1 (5.3)
Small bowel malignancy	1 (5.3)
Obturator hernia	1 (5.3)
Food bolus	1 (5.3)

Twenty one of 71 patients (30%) had positive results (Figure 2) Among the 21 patients, 6 had significant small bowel obstruction diagnosed by imaging within 8 hours, with no 24-hour delayed image done.

Of the 21 patients with positive results, 19 underwent prompt emergency operation and 2 were treated conservatively and gradually recovered. One of the operated patients died of complications, while the other 18 had a satisfactory postoperative course. Small bowel adhesion was the most common intraoperative diagnosis (n = 15; 79%), and the remaining 4 patients had appendiceal abscess, small bowel tumour obstruction, obturator hernia, or food bolus obstruction (Table 1).

Of the 6 patients with positive results for the 8-hour image, 5 underwent emergency operation and were found to have complete small bowel obstruction intraoperatively (Figure 3). No surgery was performed for the sixth patient because of his worsening condition preceding the operation. For the 15 patients with positive results confirmed by 24-hour delayed image, 14 required emergency operation with complete bowel obstruction



**Figure 3.** Treatment for patients with positive results for urgent upper gastrointestinal contrast examination.

confirmed intraoperatively. One patient refused operation and had a positive clinical outcome.

Among the 50 patients with negative results, 9 (18%) required 24-hour delayed image to provide a radiological diagnosis because the large bowel was not opacified in the 8-hour image. Three (33%) of the 9 patients eventually underwent emergency operation due to deteriorating clinical condition and all 3 had complete bowel obstruction confirmed intraoperatively.

## DISCUSSION

Urgent upper gastrointestinal follow-through examination with Gastrografin comprises a significant proportion of the urgent requests for fluoroscopy, and they are always performed within 24 hours. The main indication is to exclude small bowel obstruction.

The protocol for upper gastrointestinal contrast examination with Gastrografin is to take abdominal radiographs 1, 2, 4, 6, 8, and 24 hours after oral contrast administration, but this is subject to modification by individual radiologists. Whether the 24-hour image should be taken is a practical concern for radiologists and radiographers, and there is no formal research on this topic to date.

In this study, both the 8- and 24-hour images had a high positive predictive value. Five of 6 patients (83%) with positive results from the 8-hour image had the diagnosis confirmed intraoperatively and 14 of 15 patients (93%) with positive results from the 24-hour image had the diagnosis confirmed intraoperatively. However, for the negative results, 3 of 9 patients (33%) and 8 of 41 patients (20%) had false-negative results with the 24-hour and 8-hour images, respectively. This low negative predictive value is due to contrast passage, even through a high-grade obstruction. The normal small bowel transit time is approximately 3 to 9 hours for food bolus.<sup>1</sup>

Therefore, a positive result for the 8-hour delayed image for Gastrografin follow-through implies an important finding. It is worth considering amending the protocol to eliminate the 24-hour delayed image to avoid delay to further management for a clinically significant small bowel obstruction, which may need operation even if the examination is negative.

The therapeutic value of Gastrografin is interesting, as it has been shown to relieve small bowel obstruction by its osmotic effect, hence reducing the operation rate.<sup>2</sup> Gastrografin is used for the treatment of meconium ileus in infants and distal intestinal obstruction in cystic fibrosis.<sup>3-5</sup>

The fluoroscopy service could provide prompt responses to clinicians' requests for GI contrast examinations. When considering whether the 24-hour delayed image should be included in the standard examination protocol, this study suggests that there is a high false-negative rate (33%) for the 24-hour delayed image. Therefore, the protocol might be amended to eliminate the 24-hour image so as not to delay further management of small bowel obstruction.

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