Introduction

Intestinal obstruction is responsible for 20% of emergency surgical admissions [1]. Approximately 60% occur in the small bowel, 10 to 15% in the colon, and the remainder in the stomach and esophagus [2]. The most common cause of small bowel obstruction in adults is adhesion. Its management is still controversial, but significant complications have been reported in operations that were delayed for more than 48 h in patients with complete obstruction [3].

Diagnosis of small bowel obstruction is usually based on clinical history, physical examination and supine and erect radiographs of the abdomen. However, these techniques fail to deliver a diagnosis in 30% to 40% of patients [4]; normal plain abdominal X-ray does not exclude this diagnosis, and the detection of fluid levels is not specific for obstruction. The diagnosis of incomplete or complete small bowel obstruction is also a considerable challenge. In cases of complete obstruction, immediate surgery is often recommended whereas a trial of medical therapy is acceptable in incomplete obstruction [5]. In addition, conservative treatment can be proposed only if neither bowel strangulation nor necrosis are suspected. However, whereas a diagnosis of bowel strangulation can be often suggested on the basis of physical examination and laboratory data, it is difficult to establish a reliable diagnosis of partial or complete obstruction based on clinical, biochemical, hematological and radiographic data [6].

The efficacy of contrast studies using Gastrografin in acute small bowel obstruction has been evaluated by retrospective and prospective studies [3, 7-13]. This procedure has been reported to be safe [11], more accurate in the correct diagnosis of small bowel obstruction than plain abdominal X-rays [12], and highly predictive of outcome with a cut-off point in the 4-24 h range [3, 12, 13]. This technique also seems to produce therapeutic effects, as it does in cases of meconium ileus [14] and partial small bowel obstruction due to Ascaris lumbricoides in children [15]. However, the technique both in diagnostic and therapeutic terms remain controversial and some authors report that this
technique is of no help in reaching a diagnosis [16] and offers no advantage in treatment [6].

In this study, we reviewed a consecutive series of patients with adhesive small bowel obstruction to evaluate the diagnostic and therapeutic value of another water-soluble contrast agent, Telebrix Gastro.

Patients and methods

Patient selection

During a 5-year period (January 1st 1995 through December 31st 2000), 399 patients were admitted for small bowel occlusion at Bicêtre Hospital, Le Kremlin Bicêtre, France.

The diagnostic criteria for adhesive small bowel obstruction included: (1) history of previous laparotomy (defined as initial laparotomy); (2) clinical features of mechanical ileus, such as abdominal pain, vomiting, abdominal distention and constipation; (3) evidence of small bowel obstruction on plain X-ray of the abdomen; and (4) exclusion of other organic diseases. In patients with a past history of cancer leading to the initial laparotomy, recurrence was ruled out by meticulous examinations (clinical examination, tumor markers, ultrasonography and/or CT scan, depending on types of malignancy). Other clinical findings recorded included the presence or absence of fever, tachycardia, rebound tenderness (peritoneal signs), leukocytosis, and elevation of alkaline phosphatase and serum amylase, as well as assessment of the progress and severity of the small bowel obstruction. The diseases or organs accounting for the initial laparotomy in each patient were recorded. The entire medical records for each patient was examined to determine how many hospitalizations they had had in the past for adhesion-related small bowel obstruction. The interval between the initial laparotomy and any subsequent admissions were also recorded. Type of management undertaken, medical (conservative) or surgical (re-laparotomy), was recorded, as well as length of stay for each.

Medical management might include the following: no oral intake; decompression by nasogastric intubation; intravenous fluids, with electrolytes (and nutrition as needed); administration of parenteral antibiotics when leukocytosis was present. Analgesics, spasmylic or steroids were not used.

For patients surgically treated, the location of adhesions and the presence or absence of local complications such as gangrene and/or strangulation were identified.

Water soluble contrast test

A water-soluble contrast test was performed in cases of adhesive small bowel obstruction with no indication for immediate surgical treatment.

The water-soluble contrast test was performed according to the following protocol: 100 mL of Telebrix Gastro 300 mg/mL (Guerbet, Aulnay-sous-bois, France), was administered through the nasogastric tube. The tube was then clamped for 3 hours. Supine abdominal X-ray examinations were performed after 4 and 8 hours. The 8-hour film was used as the time limit for deciding whether the test was positive or negative. If the test was positive, the small bowel was obstructed and no contrast was seen in the colon at this time. If the test was negative, the small bowel was not obstructed and contrast was seen in the colon by the 8th hour. If contrast was seen in the colon before the 8th hour, the test was considered positive, and proceeded to be negative. Continuing symptoms, signs of strangulation (continuous versus colicky pain, fever, tachycardia, peritoneal signs, and leukocytosis) or clinical deterioration implied the failure of conservative management and laparotomy or computed tomography was performed. On the contrary, conservative treatment was concluded to have been successful if the patient was free of all obstructive symptoms and signs, and if the contrast material was observed in the right colon at the last X-ray examination.

During hospitalization, the radiographs were evaluated by the surgeon to determine the result of the water-soluble contrast test. For this study, the radiographs were also reviewed by two radiologists (JP, AL). The radiography was classified as poor if it did not provide sufficient information to make a radiological diagnosis of cause, or good if it provided sufficient information to make an adequate radiological diagnosis of cause.

The hospital institutional review board approved the study and each patient gave informed consent before inclusion.

Statistical analysis

Data were compared using Student’s t-test. Differences were assumed to be statistically significant if P < 0.05.

Results

Patients

During the study period, 399 patients were admitted for supposed small bowel occlusion in our Hospital. For 142 patients, the diagnosis of small bowel occlusion was eliminated on clinical and X-Rays examinations. For the 257 remaining patients, the diagnostic of small bowel occlusion was retained including 132 cases due to adhesive cause. Among these, 35 were operated on immediately due to the presence of signs of complications including one or more than following signs: fever, tachycardia, rebound tenderness (peritoneal signs), leukocytosis, and elevation of serum amylase and alkaline phosphatase, as well as assessment of the progress and severity of the small bowel obstruction.

The ninety-seven remaining patients underwent a water-soluble contrast test including 47 men and 50 women ranging in age from 16 to 92 years (mean 61 years). The organs involved in the initial laparotomies were the female genital organs in 21 cases (including incidental appendectomy in 5 cases); appendix in 23 cases; colon and rectum in 16 cases (including appendectomy in 2); gallbladder, biliary tract and pancreas in 14 cases; stomach and duodenum in 7 cases; small bowel in 7 cases; and others (including soft tissue trauma, kidney, and spleen) in 9. The interval between initial laparotomy and subsequent admissions varied widely. The shortest was 8 weeks, while the longest approached 29 years.

Eleven of the 97 patients underwent several tests during the five-year period of the study (mean number of tests 3.64, ranging from 2 to 9) because of recurrent small bowel obstructions.

A total of 126 water-soluble contrast tests were assessed corresponding to 126 episodes of adhesive small bowel obstructions.

Test results

For 113 of the 126 cases of small bowel obstruction (89.7%), plain radiographs showed contrast media reaching the colon within 8 hours (negative test). Conservative treatment was successful in the 111 cases of these 113 (98.2%). In two cases (1.7%), surgery was performed because of persistence of abdominal pain and no return of spontaneous bowel action 12 hours after admission. The operative diagnoses were for each case incomplete obstruction due to adhesion with no sign of necrosis on the small bowel.

The 13 patients (10.3%) in whom contrast medium did not reach the colon within 8 hours (positive test) underwent surgery. There was no postoperative death. Necrosis of the small bowel was observed in two patients. There was no statistical difference for hospital stay between the patients with and without necrosis (12.5 and 9.7 days, respectively).

The sensitivity, specificity and accuracy of the finding of contrast media reaching the colon as an indicator for non-operative treatment were 98%, 100%, and 98%, respectively.

Analysis of plain abdominal X-rays was unable to provide the diagnosis of cause of obstruction or the accurate localization of obstruction for all patients in this study. No complications attributable to Telebrix Gastro (e.g. fluid and electrolyte disturbances, aspiration pneumonia, or exacerbation of the obstruction) were observed.
In the group of 11 patients admitted for recurring adhesive obstruction, 40 episodes of small bowel obstruction were analyzed. The test was negative for 37 episodes (92.5%); conservative treatment was successful in 36 of 37 episodes (97.3%) and in only one (2.7%), surgery was required 6 days after the initial diagnosis. The test was positive in 3 episodes (7.5%) and all patients showing adhesion but no signs of complications underwent surgery. In all, only two patients required surgery (18.0%). The remaining patients (82.0%) underwent conservative treatment for each episode of small bowel obstruction.

**Discussion**

This study shows that Telebrix Gastro may help to differentiate between patients requiring operation and those who can be treated conservatively for adhesive small bowel obstruction. To our knowledge, this is the first time that a study has demonstrated the usefulness of this specific agent in this application.

The clinical effects of water-soluble contrast material remain a topic of discussion. Two studies have shown no therapeutic effect using contrast material [6, 16]. In the first one, negative findings could be explained by two points: 1) the use of only 30 to 40 mL of Gastrografin whereas we used 100 mL of Telebrix Gastro 2) the inclusion of all causes of small bowel obstruction and not only those due to adhesion [6]. In the second study designed by Cheadle et al., barium was used as contrast medium leading to barium peritonitis in 2 cases, which explains the authors’ lack of enthusiasm for this technique [16]. Similarly, the majority of studies report significant effects in patients with small bowel obstruction [3, 8, 10, 13, 17-23]. Two mechanisms can be proposed to explain this therapeutic effect; 1) the hyperosmolarity of the media could generate diarrhea, enhance peristalsis and decrease localized bowel wall edema; 2) the dilution resulting from the influx of large volumes of fluid into the lumen of the bowel could increase the pressure gradient across the obstructed segment facilitating passage through the stenotic bowel. These two mechanisms could be linked; since Telebrix Gastro is a hyperosmotic agent (1 500 mOsm/L) its ability to draw large volumes of fluid into the lumen of the bowel could increase its effects on obstruction. Because of these two mechanisms, water-soluble contrast should be used as a viable adjuvant for conservative treatment of small bowel obstruction in which the bowel wall is normal (i.e. in adhesion). Conversely, it should be avoided in cases of small bowel obstruction due to tumor, carcinoma, previous radiotherapy or all causes in which the bowel wall may be abnormal.

Patients who suffer multiple episodes of small bowel obstruction represent a major therapeutic challenge. There is an understandable reluctance to operate on a patient who has already undergone repeated abdominal procedures, particularly in case of adhesive obstruction. Little is known of the recurrence rate or severity of repeated episodes of adhesive small bowel obstruction and on benefit of preventive surgery. It has been suggested that 15-30% of patients with adhesive small bowel obstruction will suffer a further episode [12]. Provided there are no clear indications of peritonitis or ischemia, a course of non-operative therapy is indicated [12]. Our study shows that a water-soluble contrast test can be helpful in these patients, so surgery can be avoided in 82% of patients. Further studies are nevertheless required to compare this method with preventive surgery and conservative treatment.

Our study confirms that the method is safe: no complication was observed. Aspiration of the contrast material causing pulmonary edema has nevertheless been reported by other authors [23]. We believe that aspiration can be avoided by close patient supervision, in particular in a context of deteriorating mental status, by keeping the head of the bed elevated in all patients, and by appropriate decompression of the nasogastric tube before beginning the examination. Other theoretical risks have been suggested, such as irritative damage of the mucosa, leading to a risk of perforation as a result of sudden distention and hyperperistalsism [17]. However, only one case has been reported to date in a patient with an obstructive lesion of the ascending colon [24]. We attribute the lack of complications in our patients to the proper use of the test and the precautions taken. Telebrix Gastro was given via the nasogastric tube after aspiration. The patients were treated for dehydration and lastly, if the treatment was not successful, early laparotomy was performed.

In addition to safety, this method incurs a low cost: Telebrix Gastro is cheap, a dose of 100 mL costing 7.71 Euros. Other contrast materials are often more expensive and do not seem to produce better results [7]. Our complete procedure has a cost of 56.19 Euros, compared to the cost of computed tomography (CT) in France of about 165 Euros.

Other radiological procedures, including CT and ultrasound scanning, have been reported to be useful in the management of small bowel obstruction. In fact, the choice depends on the answer to the question “what is the best way to answer the questions posed by the surgeon in the context of small bowel obstruction?” These questions are: 1) how to diagnose the obstruction; 2) how to determine which patients can be managed non-operatively; and 3) how to establish the underlying cause.

For the diagnosis of intestinal obstruction, the sensibility and the specificity of CT scanning are 90% and 57%, respectively, which seem to be better than the corresponding values for the oral contrast test, 56% and 57%, respectively [1]. However, there is only one study which compared CT and a water-soluble contrast test so that further studies are required to confirm this finding. Concerning the second issue, Taourel et al. [25] have shown that CT can also lead to decisions to treat patients surgically in a significant number of cases; CT is highly specific (93% in 100 patients) in identifying strangulation but not very sensitive (only 83% in the same study).

For the third issue, i.e. establishing the underlying cause, most reports on the CT scanning note that its superiority over all others techniques lies in its ability to establish the cause of obstruction, in particular where the obstruction is secondary to a neoplastic or ischemic process [25-29]. However, CT has no therapeutic effect, is relatively expensive, exposes to more radiation than water soluble contrast test, and is of limited availability at many centers.

In conclusion, our findings indicate that water-soluble contrast study should be considered as an informative exploration in small bowel obstruction due to adhesion; the low-cost procedure is safe, involves a low level of irradiation, and helps identify patients who can be managed non-operatively. Considering our daily practice, we propose the following indications for water soluble contrast test in the context of presumed small bowel obstruction: (1) to clarify the diagnosis in patients with poorly contributive abdominal films or an atypical clinical presentation; (2) to determine the best therapeutic option if diagnosis remains unclear despite CT, particularly in subsets of patients in whom conservative therapy would be highly desirable: (a) patients who have already undergone multiple operations for adhesion, (b) patients in poor general condition, in whom increased surgical risk argues against aggressive operative therapy. Contrast tests and CT should also be regarded as complementary and a CT is always possible after contrast tests.

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**REFERENCES**


