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ORIGINAL ARTICLE

Placement of a Long Intestinal Tube in Patients with Early Postoperative Small Bowel Obstruction under Fluoroscopic Guidance

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Key words: small bowel obstruction; long intestinal tube; fluoroscopic guidance

Objective To investigate the placement of a long tube into the small intestine under fluoroscopic guidance and to evaluate its decompression effect on early postoperative small bowel obstruction (EPSBO).

Methods Fifty-four patients with EPSBO requiring decompression between April 2010 and July 2014 were enrolled in the study. Insertion of a long tube was guided by fluoroscopy. We first used the guide wire to pass the pylorus and then used the 10 Fr feeding tube as an exchangeable tube to put the superstiff wire into the duodenum. Finally the long tube could be passed over the guide wire through the pylorus into the intestine. The total procedure time, the radiation exposure time, and the incidence of complications were evaluated.

Results The long tubes passed into the jejunum on initial insertion for all patients, so the success rate of this technique was 100%. The long tube was inserted into ileum in 18 patients. The mean total procedure time was 34.4 ± 8.6 minutes, and the mean radiation exposure time 18.9 ± 6.8 minutes. A total of 47 patients (87%) experienced full recovery following long-tube decompression and without the need for surgical intervention.

Conclusions Using the wire-exchange technique, it is easy to place a long tube into the small bowel under fluoroscopic guidance. This decompression method is safe and effective for management of EPSBO.

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EARLY postoperative small bowel obstruction (EPSBO) was usually defined as obstruction occurring within the first 30 days after surgery.¹ Surgical procedures most often complicated by EPSBO include colorectal resections, hysterectomy, small

bowel operations, penetrating abdominal trauma and appendectomy.² EPSBO may contribute to significant postoperative morbidity, including delaying enteral nutrition, causing discomfort, and prolonging hospitalization.^{3,4}

In terms of management of small bowel obstruction, many reports favored initial conservative management with intestinal decompression using gastrointestinal tubes in the belief that this approach was safe and may ultimately avoid surgical operations in the majority of patients.⁴⁻¹⁰

However, these reports mainly focused on small bowel obstruction that develop long after operation rather than EPSBO,⁵⁻¹⁰ and most gastrointestinal tubes were placed under endoscopic guidance.⁷⁻¹⁰ Previous research on gastrointestinal tubes placement under fluoroscopic guidance is very limited. It is difficult to directly insert a long tube into the small bowel, which results in a protracted procedure, severe patient distress, increased X-ray exposure, and a low success rate. In this report, we described our experience using a wire-exchange technique to place a long tube into the small bowel under fluoroscopic guidance, and evaluated the efficacy of this procedure to achieve decompression for treatment of EPSBO.

PATIENTS AND METHODS

Patients

This retrospective study did not require institutional review board approval. We retrospectively reviewed the medical records of patients with clinical and radiographic evidence of EPSBO between April 2010 and July 2014 in Peking Union Medical College Hospital. A total of 54 patients who underwent small intestine decompression by long tubes placement under fluoroscopic guidance were included in this study. Nasogastric intubations were initially performed for all patients to reduce gastric distension (Fig. 1). None of the patients had contraindications for long-tube decompression, such as strangulation obstruction, incarcerated hernias, radiation enteritis, and peritonitis. Written informed consent was obtained from all the patients before intestine decompression.

Materials and instruments

The tube used in this study was a hydrophilic long tube (Create Medic, Tokyo, Japan) with an outer diameter of 16F, a working length of 3000 mm, an anterior balloon and a posterior balloon at its tip, a guidewire channel, and an injection channel with an anti-reflux valve. In addition to the tip hole, there are 8 side holes near the distal end of the tube. The super stiff wire was 1.24 mm in diameter and 3500 mm long (Create Medic).

Tube insertion procedure

Placement of the long tube was performed under fluoroscopic guidance. Vital signs of the patient were monitored using pulse oximetry, blood pressure, and electrocardiography. Topical nasal and pharyngeal anesthesia was performed using lidocaine. The nasogastric tube was removed. A 100-cm-long, 5-F angled angiographic catheter (Cook, Bloomington, IN, USA) with a 260-cm-long,

0.035-inch-diameter exchange guide wire (Radiofocus M, Terumo, Tokyo, Japan) was inserted through the nose and down the esophagus into the stomach. After injection of iohexol (350 mg I/ml, Omnipaque, GE Health, Shanghai, China) to demonstrate the pylorus, the guidewire was advanced through the pylorus to the duodenum with fluoroscopic guidance and the help of the catheter (Fig. 2). The angiographic catheter was then removed and a feeding tube (10F, 145 cm, Flocare Benchmark, Nutricia, Wuxi, China) was inserted into the upper jejunum along the steerable guidewire (Fig. 3). The guidewire was carefully removed and a superstiff wire was placed through the feeding tube as exchangeable wire. Finally, a long tube was gently inserted through the nose into the jejunum along the superstiff wire and advanced as far as possible (Fig. 4). Once the long tube was correctly inserted, the superstiff wire was removed, and the anterior balloon was fully inflated by injecting 15-20 ml of distilled water (Fig. 5).

All the procedures involved in the insertion of the long tube were exclusively performed by interventional radiologists, who all had more than 8 years of gastroenterological interventional experience. Successful intubation was defined as insertion of the long tube into the jejunum, past the ligament of Treitz. The time required for the tube insertion procedure and radiation exposure of each patient were recorded.

We divided our patients into two groups according to the tip position of the long tube at initial insertion: group 1 (tip in the jejunum, $n=34$) and group 2 (tip in the ileum, $n=20$). The tube could be further advanced by gastrointestinal peristalsis. Intermittent continuous suction was performed to reduce intraluminal pressure in the small bowel. Fluid and electrolyte disturbances were corrected. Abdominal X-ray images were taken to evaluate the progress of the tube and the degree of decompression. The long tube was removed when small bowel obstruction completely disappeared. Clinical success was defined as resolution of the obstructive symptoms following tube placement without the need of operation.

Statistical analysis

Statistical analysis was performed using statistical software SPSS version 13.0 (Chicago, IL, USA). Inter-group difference was assessed using Fisher exact test. $P<0.05$ was considered statistically significant.

RESULTS

General information

The selected patients included 29 men and 25 women, with

the mean age of 57.4 ± 17.1 years. The abdominopelvic surgeries were colorectal surgery ($n=24$), uterine and adnexal surgery ($n=8$), bladder surgery ($n=4$), nephrectomy ($n=4$), surgery for trauma ($n=6$), hernia repairing surgery ($n=2$), and intestine adhesiolysis ($n=6$). The interval from initial surgery to the development of small bowel obstruction ranged from 5 to 28 days, with a median of 13 days. EPSBO were all distal in location as revealed by X-ray and/or CT examination. The long tubes passed into the jejunum on initial insertion in all the patients, so the success rate of the technique was 100%. The long tube was inserted into the ileum in 20 patients. The mean total procedure time was 34.4 ± 8.6 minutes, and the mean radiation exposure time was 18.9 ± 6.8 minutes.

Clinical effect of long-tube decompression

Clinical improvements in EPSBO were apparent within 3 days after management commenced in 50 patients. The median duration of intubation for these patients was 10 days (range, 5-16 days). Four patients failed to respond to long-tube decompression within 3 days due to complete EPSBO and underwent adhesiolysis.

The clinical improvement rate was 94% (32/34) in group 1, and 90% (18/20) in group 2, with no significant difference ($P=0.609$).

Four patients with initial clinical improvement experienced recurrence of small bowel obstruction within 10 days after the long tube was removed, in whom CT scan was performed. Two cases had neoplasms in the terminal ileum and transverse colon respectively, for which they received bowel resections. The long tube was placed into the jejunum

once again for the other two patients. The long tube decompression at the second time was successful in one patient, but the other one failed to respond to decompression and underwent adhesiolysis. A total of 47 patients (87%) experienced full recovery following long-tube decompression, without the need for surgical intervention (Fig. 6).



Figure 2. The guidewire was advanced across the pylorus to the jejunum under fluoroscopic guidance and the help of the angiographic catheter.

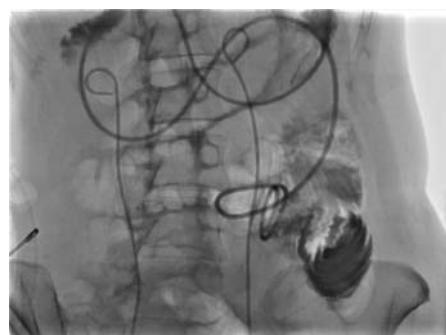


Figure 3. The angiographic catheter was removed and the feeding tube inserted into the upper jejunum along the steerable guidewire as exchangeable catheter.

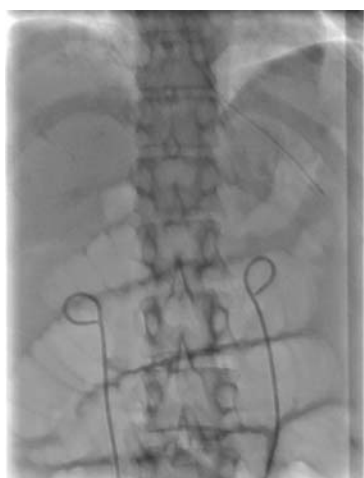


Figure 1. X-ray examination showed diffuse dilated loops of the small bowel of a patient after ovarian surgery, although the nasogastric tube had been inserted for this patient.

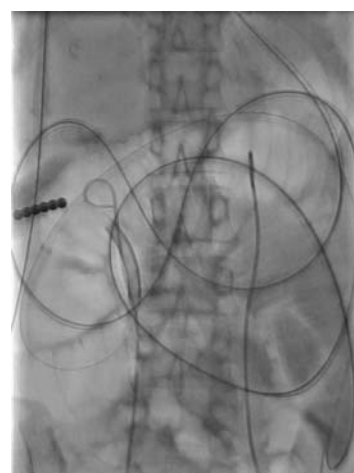


Figure 4. The superstiff wire was inserted in the feeding tube, and then a long tube was gently inserted through the nose into the jejunum along the superstiff wire.

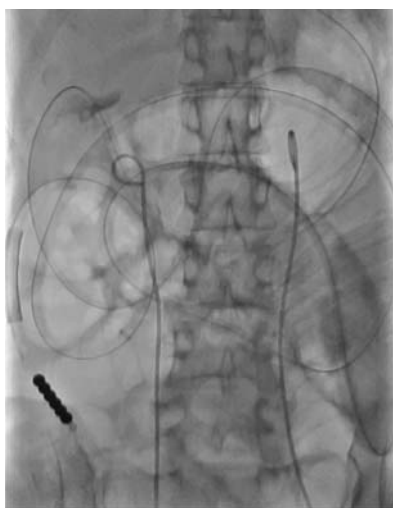


Figure 5. The superstiff wire was removed, and the anterior balloon of the long tube was fully inflated by injecting 15-20 ml of distilled water.



Figure 6. X-ray examination showed full recovery of this patient with small bowel obstruction.

Complications

Nasal oozing occurred in 10 patients during the tube placement. No other complications occurred during or after the tube placement. None of the 47 patients (87%) who experienced full recovery following long-tube decompression had recurrent obstruction at a median follow-up of 6.7 (range, 2-29) months.

DISCUSSION

EPSBO is a common postoperative complication, leading to markedly lower quality of life, longer hospital stays, and increased hospitalization costs.^{11,12} Therefore, the appearance of EPSBO symptoms is alerting in postoperative care.

There are likely three important factors that play a role in the development of EPSBO, including adhesion formation, internal herniation, and inflammation.¹³ Sajja and Schein¹

defined EPSBO as occlusion taking place within the first 30 days after surgery. In this study the median time before the diagnosis of EPSBO was reported as 13 (range, 5-28) days.

Reoperation for EPSBO is associated with significant morbidity related to fistula formation, abdominal sepsis, wound sepsis, wound herniation, and persistent obstruction, therefore should be avoided in these patients with EPSBO.¹ Many surgeons faced with EPSBO cases apply initial conservative management including gastrointestinal decompression.¹

Traditionally, nasogastric intubation is one of the most common procedures performed after abdominal surgery to reduce gastric distension. In the presence of an intact pylorus, a nasogastric tube can provide effective decompression only if the pressure of backed-up small intestinal fluid and gas is sufficient to overcome the action of the pyloric sphincter. Since 1933, when Wangsteen used a long tube to decompress the obstructed intestine and achieved favorable results,¹⁴ this method has been widely used in clinical practice with improved technique.¹⁵⁻¹⁷ Clinical application of a long tube to decompress the obstructed intestine by aspirating the intestinal contents has achieved favorable outcomes.⁷⁻¹⁰ Previous studies demonstrated that the decompression effect achieved with a long tube is superior to that of a nasogastric tube.^{18,19}

However, many physicians have been faced with the problem of intubating the long intestinal tube through the pylorus and beyond the ligament of Treitz. Direct advancement of a long tube beyond the pyloric sphincter under fluoroscopic guidance is usually not easy, which results in a protracted procedure, severe patient distress, and increased X-ray exposure. Jeong et al⁷ used fluoroscopic guidance in 78 cases of long tube insertion, in which the long tubes were advanced through the pylorus under fluoroscopic guidance. In 60 of the 78 cases (76.9%), the long tubes passed into the small bowel at the first attempt, with a trial time of 10-20 minutes. An alternative method used to advance the long tube into the small bowel is gastrointestinal endoscopy.⁸⁻¹⁰ Gowen⁹ reported a good success rate of 90% using an improved tube designed for endoscopic intubation. Recently, most gastrointestinal tubes were placed under endoscopic guidance.⁸⁻¹⁰ In this procedure, however, endoscopy is performed transorally, evoking anxiety, a feeling of vulnerability, and discomfort.²⁰ Sato et al¹⁶ used transnasal endoscopy with an ultrathin transnasal esophagogastrroduodenoscope (outer diameter 5.9 mm) to insert the long tube, and most patients well tolerated this procedure. However, in two cases (13%) of unsuccessful passage of the transnasal endoscope due to a

narrow nasal cavity, the endoscope was inserted transorally. In this study, we improved the technique to insert the long tube under fluoroscopic guidance. A guidewire was first applied to pass the pylorus and then a 10 F feeding tube was used as an exchangeable tube to put the superstiff wire into the duodenum. With a superstiff guidewire inserted beyond the pylorus, the long tube could be readily passed over the guidewire through the pylorus into the small intestine without difficulty. Using this modified technique, the success rate of long tube placement in this study was 100%.

Initial placement of nasogastric tube is very important for long tube insertion as a large dilated stomach could not provide mechanical support to the wire-delivery system. And properly positioned long tube provides no direct means of gastric decompression, because the suction ports are located within the small bowel. Lack of effective gastric decompression in patients with EPSBO may result in gastric dilatation and aspiration pneumonia.⁷ Therefore, we adopted a sequential approach in this study, where a nasogastric tube was followed by a long tube.

In a classic analysis of the mechanics underlying gastrointestinal tube decompression, it was demonstrated that kinks and trapped air between distended loops of small bowel prevent the free transmission of negative pressure along the bowel toward the site of obstruction.¹⁹ So the effectiveness of intraluminal decompression varies inversely with the distance between the tip of the tube and the site of blockage. EPSBO is commonly distal in location, hence the efficacy of decompression would substantially reduce if there was considerable distance between the tube and the point of obstruction. In the study of Guo *et al*,⁸ the long tube was placed in the descending part of the duodenum. In the study of Gowen,^{9,10} the long tube could be advanced into the jejunum. In this study, the long tube advanced much further in initial insertion than in previous studies, which was inserted into the ileum in 20 patients. However, there was no significant difference in terms of clinical improvement between different tip positions. Pushing the long tube as far as possible would inevitably increase the patients' discomfort and X-ray exposure. Therefore, advancing the long tube into the jejunum is enough as the tube could be further advanced by gastrointestinal peristalsis.

In this study, most patients with small bowel obstruction were relieved from obstruction within 3 days. 87% of the patients experienced full recovery following long-tube decompression without the need for surgical intervention, which is consistent with previous re-

ports.⁷⁻¹⁰ Moreover, no severe complications were found during the long-tube decompression treatment, which is also similar to the observation in other studies.⁷⁻¹⁰

Most EPSBO could be resolved with long tube decompression alone, if a patient fails to respond to or even worsens after insertion of a long tube, then surgery should be considered. Although adhesions account for the majority of small bowel obstructions in the early postoperative period, several other etiologies must be considered such as tumors. Two cases in this study had neoplasms in the intestine and transverse colon respectively, which were not detected before surgery.

In conclusion, decompression with a long tube should be considered for all patients with clinical and radiographic evidence of EPSBO but without a strangulation obstruction or other contraindications.

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