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Case Report

Stent implantation technique through PEG-like pathway for treatment of malignant gastroduodenal obstruction

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Abstract: Objective: To investigate feasibility and safety of stent implantation technique through percutaneous endoscopic gastrostomy (PEG)-like pathway for treatment of malignant gastroduodenal obstructions. Methods: Twelve patients with malignant gastroduodenal obstructions accepted PEG-like operations. A stent implantation pathway was established in abdominal wall under endoscopic guide. A guide wire and a stent release device were introduced through this pathway followed by an intestinal stent implantation. After operation, efficacy and safety of this technique were assessed by collecting data such as operation time, complications, postoperative medication, and hospitalization time during postoperative 2-12 months of follow-up. Results: Twelve patients were successfully treated with stent implantation technique through PEG-like pathway for the first time. The average operation time was 31 minutes. No severe complications occurred during treatment. On the fourth days after operation, patents were give liquid diet and treatment of rehydration, acid suppression, hemostasis and anti-inflammation. The average hospitalization time was 5 days. The follow-up time was 2-12 months. Twelve (100%) patients achieved complete remissions. The stent related complications and obstruction did not appear within 2 months after operations. The quality of life improved significantly. Conclusion: The stent implantation technique through PEG-like pathway for treatment of malignant gastroduodenal obstruction is a feasible, effective, and safe choice.

Keywords: Pyloric obstruction, duodenal obstruction, percutaneous endoscopic gastrostomy, stent implantation

Introduction

Malignant gastrointestinal obstruction is caused by tumor compression and invasion. For example, obstruction of pylorus and duodenum mainly occurs in end stage of gastric antrum cancer, duodenal cancer, pancreatic cancer, biliary duct cancer and other malignant diseases. Previously, most of such obstruction was treated by palliative gastroenterostomy. However, for the patients without surgical indications or with surgery intolerance due to advanced age, weakness and relatively many complications, endoscopic or C-arm X-ray equipment-assisted intestinal metallic stent implantation has become another effective option for treating this obstruction. The actual operation for placing a stent into distal pylorus, duodenum and proximal jejunum, however, is often difficult technically. In particular, long-term obstruction results in gastric retention and extreme expansion of the gastral cavity, and under this circumstances a guidewire would circle in the gastral cavity so that it is unable to effectively support a stent releaser, which extends operation time greatly and even leads to operation failure. For such patients, intestinal metallic stent implantation via percutaneous endoscopic gastrostomy (PEG)-like pathway were adopted, which solved this technological problem. 12 patients with malignant gastrointestinal obstruction were all given successful intestinal metallic stent implantation via PEG-like pathway from March 2011 to March 2014 in our hospital. The details were presented below.

Materials and methods

Clinical data

There were a total of 12 patients with malignant gastrointestinal obstruction (7 males and 5 females; age: 35 to 81 years old). Among them,

3 cases suffered pyloric obstruction due to gastric antrum cancer, 1 case pyloric and duodenal bulb obstruction due to gastric lymphoma, 2 cases descending segment obstruction due to duodenal cancer, 2 cases duodenal obstruction due to pancreatic head cancer, 1 case duodenal descending part obstruction due to recurrent tumor invasion after surgery for colon cancer, 2 cases gastrointestinal anastomosis obstruction due to recurrence after surgery for gastric cancer and 1 case intestinal anastomosis obstruction (Roux-en-Y). All the patients had pathological diagnosis evidence without surgical indications or with surgery intolerance due to advanced age, weakness and relatively many complications, and they all suffered from obstruction for over 7 days with varying degrees of nausea, vomiting and other symptoms. Moreover, before gastrointestinal decompression, a significant expansion of the gastral cavity and stenosis and obstruction with a length of 1 to 9 cm were confirmed by radiography with 60% meglumine diatrizoate.

Main equipment and materials

All operations were completed in a minimally invasive composite operating room equipped with at least a C-arm and electronic endoscope. The equipment and materials from our hospital were as follows: Germany AXIOM Artis FA C-arm, Japan Olympus Gastroscope, Ni-Ti shape memory alloy stent from Micro-tech (Nanjing) Co., Ltd as an intestinal (pylorus) stent with a diameter of 20 to 30 mm, a length of 60 to 120 mm, one or two double spherical ends and no burr on the port, a 6×1400 mm or 3.3×1600 mm stent releaser (push type inserter), a Cobra catheter from Terumo with 8-12 F catheter sheath, a ultra-smooth hard guidewire or superhard guide wire equipped with a soft head with a diameter of 0.96 mm (0.038) and a length of 2600 mm, and a balloon dilatation catheter from Changzhou Jiuhong Medical Instrument Co., Ltd with a diameter of 10-30 mm and a length of 60-120 mm.

Technology and method

Preoperative preparation: In 12 patients with gastrointestinal obstruction, their stomachs and intestines were decompressed and the gastral cavities were rinsed for 1 to 3 days. While they kept fasting, they were given nutrition intravenously to maintain a water-electrolyte balance. 0.5 mg of atropine was injected intramuscularly 30 min before a surgery, and tetracaine mucilage was taken orally.

Operation steps of a PEG-like pathway: The lights of the operating room were turned down, and patients were kept in a horizontal position. The puncture point was selected generally at the lower margin of left ribs 3-5 cm outside the subcostal medioventral line of the left upper quadrant, which was corresponding to the middle and lower part of an anterior gastric body wall. The connection line between this puncture point and a pylorus and the long axis of pyloric canal showed a parallel or obtuse angle. After a gastroscope was inserted, retention substance was taken out first if any. Then, whether tumors, ulcers, esophageal varices and other conditions affecting a gastric wall puncture or not were conformed present. Meanwhile, whether the obstruction site changed compared with the preoperative evaluation indexes were observed. Following that, the air was injected into a stomach until the gastric wall was sufficiently filled and the anterior wall of the stomach was tightly close to the abdominal wall. The lens of the gastroscope was adjusted to aim at the anterior wall of the gastric body, and a red spot formed by the lights of the gastroscope could be seen outside the abdominal wall at this time. This point could be taken as the puncture point of the abdominal wall. The selected puncture site was pressed gently by a middle finger, and a puncture could be performed immediately when an obvious fluctuation was seen under the gastroscope. After completing the routine disinfection of the surgical field and draping, 0.5% lidocaine was applied for local anesthesia of the skin and the subcutaneous tissues. A about 0.5 cm long incision was made with a scalpel after successful anesthesia. The trocar pierced the gastral cavity across the abdominal wall and gastral wall at the incision site, and the guidewire was inserted into the gastral cavity through outer sleeve after removing the core of the trocar needle. Following that, the trocar was removed, and 8 F or 10 F sheath catheter was placed along with the guidewire, keeping a proper length in the gastral cavity under the direct vision with the help of the gastroscope. Besides, the sheath catheter outside the abdominal wall was fixed appropriately. Finally, the operations similar to PEG were completed to establish the pathway of stent placement (**Figure 1A** and **1B**).

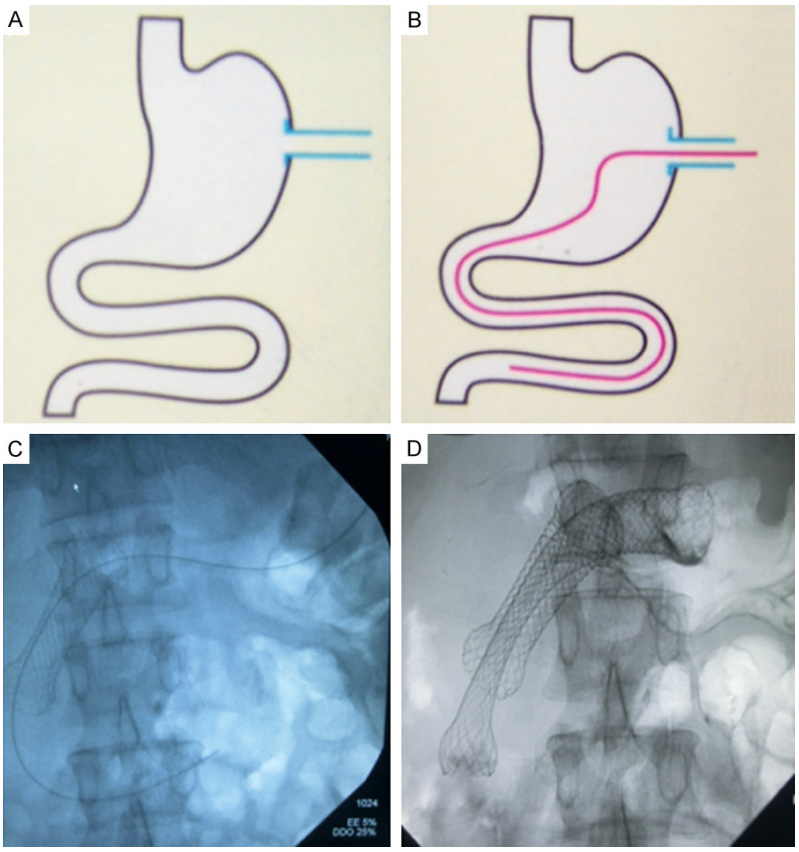

Figure 1. A. Establishment of the PEG-like pathway for stent implantation; B, C. Introduction of a guidewire and stent releaser along with the PEG-like pathway; D. A successful implantation of intestinal stent.

Stent placement: Under a C-arm, a super-smooth hard guidewire with a diameter of 0.038 was inserted into distal small intestine through pylorus and duodenum stenosis segment or anastomotic stenosis segment with help of Cobra catheter by using the sheath catheter in the abdominal wall (**Figure 1C**). When it was difficult to pass through the stenosis, the gastroscope could be used to help inserting the guidewire, which was able to be removed if it was not needed. Then, the catheter was replaced, and contrast agent was injected to show the size, form and length of a stenosis segment, thus facilitating operators to select an intestinal stent with an appropriate length. The catheter was further inserted into the distal small intestine of the obstruction to replace the hard guidewire with a soft head, and a releaser equipped with a stent was introduced in the stenosis site with the help of hard guidewire. The stenosis site was positioned accurately, and then the core of the releaser was fixed. After the sheath was removed, a stent was released, and radiography was performed immediately to observe whether the obstruction was opened.

For patients with a stenosis of diameter <5 mm and complete obstruction, dilation was first performed in the stenosis and obstruction site. A balloon dilation catheter was introduced into the stenosis site by using a guidewire while dilating, and the middle part of balloon was located in the finest segment of stenosis under X-ray. Contrast agent was injected slowly with a pressure pump, so that the diameter of balloon dilated to 12-15 mm, keeping for 5 s. This operation was repeated several times until a satisfaction effect was achieved, and then stent was implanted.

After a successful implantation of stent was confirmed by radiography, the sheath catheter in the abdominal wall was removed, and the puncture site was locally pressed and dressed.

Outcome measures: The related data including operation time, complications, postoperative medication, hospitalization time, follow-up visits (telephone follow-up + outpatient follow-up) within 2-12 months after surgery and so on, were collected and evaluated preliminarily.

Results

All 12 patients with malignant gastrointestinal obstructions successfully received the stent implantation by the PEG-like technology for the first time, with good stent patency.

2 patients chose painless gastroscopy, and the other 10 patients only underwent topical anesthesia with tetracaine mucilage. The average operation time was 31 (range: 20 to 57) min.

No asphyxia, aspiration, bleeding, perforation and other symptoms occurred throughout the treatment process, and no infection, bleeding,

discharge was observed at the puncture site of the abdominal wall. One patient with malignant pyloric obstruction exhibited severe abdominal pain at balloon dilatation, which was suspected as gastric perforation. This patient was given orthostatic fluoroscopic examination immediately after treatment was discontinued, however the gastric perforation was excluded and pain was relieved 2-hour after symptomatic treatment. Eventually, it was considered to be caused by intestinal spasm due to excessive air inflation during gastroscopy. Two patients complained about mild abdominal pain at a early stage after surgery, and were not treated specifically. The other nine patients did not suffered from any complications. No fever was found.

After surgery, patients continued fasting for 3 days, began a liquid diet at day 4 and semi-liquid diet at day 5. Fluid infusion, acid suppression, hemostasis, anti-inflammation and other treatments were administered appropriately.

The average hospital stay was 5 (range: 3 to 8) days.

After the gastrointestinal obstruction was relived, 4 patients did not receive any anti-tumor therapy, 4 patients underwent systemic che-motherapy alone, 2 patients received vascular intervention therapy alone, and 2 patients received vascular intervention therapy combined with systemic chemotherapy.

During the follow-up within 2 to 12 months, with a median follow-up time of 10 months, all the patients were followed up. The gastrointestinal obstructions in 12 patients were all relieved after surgery, with a remission rate of 100%. Within 2 months after surgery, no stent implantation-related complications and re-obstruction occurred, and their quality of life improved significantly. Nevertheless, at 3 and 4.5 months after surgery, gastrointestinal obstructions were found again in 2 patients, which was confirmed by gastroscopy to be caused by food embedding (one for peach skin and one for cabbage leaf, respectively) in the stent head, and the obstructions were relieved after the food was removed or pushed to the distal end of stent. Besides, one patient was found to have gastrointestinal obstruction again at 5 months after surgery, which was caused by excessive growth of tumor in the distal end of stent, as shown by gastroscopy and contrast examination; then this patient was given a second stent implantation (sleeve, **Figure 1D**) by the same method above. To another patient suffering from black stools and anemia, but with stent patency by angiography, hemostasis, blood infusion and maintenance treatments, as well as intravenous nutrition in a fasting state were given, for tumor bleeding at the stent site was considered, but the patient died of extreme exhaustion. The rest 5 patients died of cachexia at an advanced stage of tumor and did not exhibited gastrointestinal obstruction before death; the death occurred at 6.5, 9.5, 10, 10.5, 12 months after stent implantation respectively (calculation method for less than 1 month: less than 10 days were attributed to the last month, 10 to 20 days were recorded as 0.5 months, more than 20 days were attributed to the next month). No stent migration and falling was found.

This data showed that the stent implantation technology through the PEG-like pathway was safe, but still needed to be confirmed by randomized controlled trials with larger samples and longer follow-up visits in improving qualities of life and prolonging survival periods.

Discussion

The endoscope or C-arm X-ray equipment-assisted metallic stent implantation for treating gastrointestinal obstruction is a new minimally invasive treatment technique developed in recent 20 years. Intestinal stent implantation could produce a series of benefits, such as permanently and stably dilating gastrointestinal tract, treating obstruction, partly preventing growth of a tumor towards intracavity, avoiding trauma and pain induced by open surgery, significantly reducing postoperative complications and allowing oral feeding within a short term, which greatly improves quality of life. The traditional transoral stent implantation under X-ray is not difficult to operate in esophagus and cardia. However, it is time-consuming and difficult to operate in distal pylorus, duodenum and proximal jejunum for a stent releaser lacks of support during an operation process, which easily bends laterally along with greater gastric curvature and needs to be repeatedly adjusted under X-ray. Thereby, the patients are difficult to tolerate. Besides, lacking of support also easily results in stent migration in the releasing process of releaser.

According to a large number of domestic and foreign literatures [1-7], metallic stent implantation has obtained good efficacy in treating gastric and duodenal obstructions. Nevertheless, in most of them, the stent was placed first under guidance of guidewire alone, and then a gastroscope was inserted to observing stent implantation. Stent implantation only through a guidewire, a relatively blind method, may lead to injury, and even bleeding and perforation when passing through wide-angle bending sites such as physiological curvature in esophagus, fundus and greater curvature. Meanwhile, a stent releaser is difficult to reach the stenosis site of pylorus and duodenum and needs to be adjusted repeatedly due to hard materials and unadjustable direction. This method needs 1 to 1.5 h in average to be completed. In order to overcome these shortcomings, some researchers introduced a guidewire under an endoscope, and then the subsequent operations were performed under X-ray after the endoscope was removed. For those patients in whom an endoscope cannot pass through the stenosis site, a supermicro gastroscope could be used. Bethge and Feretis et al. advocated that for those with relatively severe stenosis, a soft gastroscope for children could be used to pass through the stenosis segment, and then a guidewire was placed to complete the subsequent operations. Wei Li et al. [8] reported that intestinal stent implantation under a duodenoscope via a large pore path combined with X-ray succeeded in 6 patients, with an average time of about 0.3 to 0.6 h. The advantages of this method are that a stent releaser can reach smoothly the site above stenosis with help of a duodenoscope' s support, meanwhile, in the process of releasing, the releaser can be supported strongly and easily controlled; a stent can be positioned accurately. According to a report by Zhang Ping et al. [9], metallic stent implantations under colonoscope-assisted biopsy channel (diameter: 3.8 mm) combined with X-ray were performed to treat 38 patients with malignant gastric or duodenal obstructions due to malignant gastrointestinal tumors, and a satisfactory efficacy was obtained. Ethically speaking, however, colonoscope is not suitable for treating upper gastrointestinal tract diseases for its larger diameter and difficulty in transoral placement. Although colonoscopy combined with X-ray ensures an accuracy of the operation, it requires repeated transoral placements which increase the pain of patients.

PEG is a "pull-type" gastrostomy under endoscopic guidance. With advantages of unneeded laparotomy, simple operations, few complications, economical effectiveness and convenient care, it is a minimally invasive surgery with a minor injury on a human body. PEG is mainly indicated in patients needing long-term enteral nutrition. Although PEG as a routine method has been widely applied, PEG pathway used for stent implantation to treat malignant gastrointestinal obstructions is not reported at home and abroad currently. The author succeeded in treating 12 patients with pyloric and duodenal obstructions through gastrointestinal stent implantation by using this method, with a success rate of 100%. The stent implantation pathway was established at a puncture site of the abdominal wall (i.e., gastrostomy site), while making the path line to be parallel to or show a obtuse angle with the long axis of pyloric canal, which is mechanically be beneficial for a guidewire or stent releaser reaching distal obstruction sites. This successfully resolves technological difficulties in transoral stent implantation into obstruction sites of pylorus or lower parts. In order to distinguish PEG technology, the author named this method as PEG-like stent implantation technology. According to the results of patients in this study, stent implantation technology through the PEG-like pathway is a feasible, efficient and safe option, and is worthy of promotion.

For patients with following conditions, the PEG-like technology is not recommended: a) the expected survival time less than 30 days; b) extensive injuries in abdominal wall and wound infection; c) severe and uncorrectable bleeding/coagulation mechanism disorders; d) massive ascites; e) stomach disorders, especially lesions in anterior wall of gastric body affecting surgical procedures; f) too small remnant stomach after subtotal gastrectomy. In addition, patients should try not to choose painless gastroscopy, for there are risks of intraoperative aspiration and asphyxia under unconscious states in case of too much gastric retention.

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Disclosure of conflict of interest

None.

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