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ABOUT COVER

Editorial board member of World Journal of Gastrointestinal Endoscopy, Dr. Vedat Goral graduated medical school at Diyarbakir University (Turkey). He completed his PhD degree at Dicle University (Turkey) in 1986 and went abroad for postdoctoral study at Chiba University, School of Medicine Department of Gastroenterology, Japan (1990-1991), Giessen University, School of Medicine Department of Gastroenterology, Germany (1992) and the Chelsea & Westminster Hospital, Department of Gastroenterology, England (1998). He speaks English and Japanese, and his publication record spans English-language peer-reviewed journals covered by SCI and Turkishlanguage books. He has also published many abstracts at national and international congresses. Currently, Dr. Goral is Professor in the Department of Gastroenterology at Istanbul Medipol University School of Medicine. (L-Editor: Filipodia)

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WJGE mainly publishes articles reporting research results and findings obtained in the field of gastrointestinal endoscopy and covering a wide range of topics including capsule endoscopy, colonoscopy, double-balloon enteroscopy, duodenoscopy, endoscopic retrograde cholangiopancreatography, endosonography, esophagoscopy, gastrointestinal endoscopy, gastroscopy, laparoscopy, natural orifice endoscopic surgery, proctoscopy, and sigmoidoscopy.

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CASE REPORT

Preemptive endoluminal vacuum therapy after pancreaticoduodenectomy: A case report

Flaubert Sena de Medeiros, Epifanio Silvino do Monte Junior, Romero de Lima França, Heli Clóvis de Medeiros Neto, Juliany Medeiros Santos, Eligio Alves Almeida Júnior, Samuel Oliveira da Silva Júnior, Mario Herman Santos Moura Pedreira Tavares, Eduardo Guimarães Hourneaux de Moura

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Author contributions: França RL,

da Silva Júnior SO, Tavares MHSMP and Almeida Junior EA performed

pancreaticoduodenectomy. de Medeiros FS, de Medeiros Neto HC, and de Moura EGH performed the endoscopic procedure. Santos JM and do Monte Junior ES reviewed the case and edited the manuscript; all authors contributed to finalizing the present version of the paper and approved the manuscript for publication.

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Abstract

BACKGROUND

Pancreaticoduodenectomy is a technically demanding operation, with reported morbidity rates of approximately 40%-50%. A novel idea is to use endoscopic vacuum therapy (EVT) in a preemptive setting to prevent anastomotic leakage and pancreatic fistulas. In a recent case series, EVT was proven to be effective in preventing leaks in patients with anastomotic ischemia. There have been no previous reports on preemptive EVT after pancreaticoduodenectomy.

CASE SUMMARY

We describe the case of a 71-year-old woman with hypertension and diabetes who was admitted to the emergency room with jaundice, choluria, fecal acholia,



conflicts of interest.

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abdominal pain, and fever. Admission examinations revealed leukocytosis and hyperbilirubinemia (total: 13 mg/dL; conjugated: 12.1 mg/dL). Abdominal ultrasound showed cholelithiasis and dilation of the common bile duct. Magnetic resonance imaging demonstrated a stenotic area, and a biopsy confirmed cholangiocarcinoma. Considering the high risk of leaks after pancreaticoduodenectomy, preemptive endoluminal vacuum therapy was performed. The system comprised a nasogastric tube, gauze, and an antimicrobial incise drape. The negative pressure was 125 mmHg, and no adverse events occurred. The patient was discharged on postoperative day 5 without any symptoms.

CONCLUSION

Preemptive endoluminal vacuum therapy may be a safe and feasible technique to reduce leaks after pancreaticoduodenectomy.

Key Words: Preemptive; Endoluminal; Vacuum; Pancreaticoduodenectomy; Case report

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Core Tip: Leaks and fistulas represent a high cost burden to health systems worldwide, with high morbidity and mortality rates in affected patients. Preventing these transmural defects remains challenging. Despite the progress in surgical techniques, pancreaticoduodenectomy still has a high risk of adverse events, including leaks and pancreatic fistulas. Here, we present a feasible technique to reduce these complications of pancreaticoduodenectomy. To the best of our knowledge, this is the first report of preemptive endoluminal vacuum therapy after pancreaticoduodenectomy.

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INTRODUCTION

Pancreaticoduodenectomy is a technically demanding operation, with reported morbidity rates of approximately 40%-50%^[1,2]. Gastroparesis and bleeding are the most frequent complications, while pancreatic fistula, which can cause intra-abdominal abscess, sepsis, and occasionally death, is the most serious^[3]. Patients may require another operation, representing a therapeutic challenge that directly impacts mortality, morbidity, and cost to health systems worldwide^[4,5]. Several techniques, such as pancreatic duct occlusion, pancreatogastric anastomosis, Wirsung-jejunal duct-tomucosa anastomosis, and drainage to the pancreatic duct, have been developed to prevent complications^[6-8].

In recent years, endoscopic procedures have begun to fill the large gap between medical and surgical treatments aimed at avoiding fistulas and leaks^[9-12]. There have been no previous reports of preemptive endoscopic vacuum therapy (EVT) after pancreaticoduodenectomy.

CASE PRESENTATION

Chief complaints

A 71-year-old woman was admitted to the emergency room with jaundice, choluria, fecal acholia, abdominal pain, and fever.

History of present illness

The patient had a 6-day history of worsening abdominal pain and fever 2 d before



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admission at the emergency unit.

History of past illness

She had a medical history of hypertension and type 2 diabetes mellitus, controlled with oral agents.

Personal and family history

She had not undergone any prior abdominal surgery.

Physical examination

Physical examination revealed fever (38.5°C), jaundice, and tenderness in the upper abdomen.

Laboratory examinations

Laboratory tests revealed elevated serum bilirubin levels (total: 13 mg/dL; conjugated: 12.1 mg/dL), leukocytosis (white blood cells: $16500/\mu$ L), and reduced serum albumin levels (2.1 g/dL). Carbohydrate antigen 19-9 and carcinoembryonic antigen levels were within normal limits.

Imaging examinations

Abdominal ultrasonography showed cholelithiasis and intrahepatic and extrahepatic dilatations. Magnetic resonance imaging (MRI) demonstrated a circumferential tumor of the middle bile duct with upstream biliary dilatation, cholangitis, and cholelithiasis (Figure 1). The pancreas and caliber of the duct of Wirsung were normal. Endoscopic retrograde cholangiopancreatography (ERCP) was performed, although drainage was unsuccessful because the guidewire could not be passed across the lesion.

FINAL DIAGNOSIS

The patient was diagnosed with moderately differentiated biliary adenocarcinoma pT4pN0pM0 (stage group IIIB).

TREATMENT

Considering the success of ERCP, we opted for percutaneous drainage. The patient had a history of weight loss, reduced serum albumin levels (2.1 g/dL), and lower oral food intake. Therefore, enteral nutrition was initiated through a nasoenteral feeding tube and high-protein oral supplementation.

Pancreaticoduodenectomy (Figure 2) was performed on hospital day 14, after tumor staging and perioperative nutrition. A laparoscopic approach was attempted, although the procedure was converted to open pancreaticoduodenectomy because of bleeding from a branch of the portal vein. A harmonic power clamp was applied to a pancreatic section, showing a thin duct of Wirsung. End-to-side duct-to-mucosa pancreaticojejunostomy and choledochal-jejunal anastomosis were performed with Caprofyl. The surgical procedure lasted 10 h, requiring blood transfusion (4 units of red blood cells). The patient was admitted to the intensive care unit, where she remained for 1 d.

Preemptive endoluminal vacuum therapy was provided during surgery. The system implemented the Dr. Flaubert Sena technique^[12] (Figure 3), using a nasogastric tube, antimicrobial incise drape, and gauze. The negative pressure was constant at 125 mmHg. The nasoenteral feeding tube was placed through the alimentary limb (Figure 4), and enteral feeding was initiated 12 h postoperatively. The endoscopic vacuum system was removed on postoperative day 3, without adverse events or symptoms.

The peripancreatic abdominal drain was removed on postoperative day 5, and the amylases were measured. The patient was discharged 5 d after pancreaticoduodenectomy.

OUTCOME AND FOLLOW-UP

At the time of drafting this manuscript, the patient was being followed up in the



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Figure 1 Magnetic Resonance Cholangiopancreatography demonstrated a circumferential tumor of the middle bile duct with upstream biliary dilatation, cholangitis and cholelithiasis. Magnetic Resonance Imaging showing gallbladder invasion.



Figure 2 Surgical specimen following pancreaticoduodenectomy.



Figure 3 Endoscopic vacuum system.

outpatient clinic and had developed no complications related to the procedure. The Oncology Group opted for no adjuvant therapy.

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Figure 4 Endoscopic vacuum system placed through the right nostril and the nasoenteral feeding tube placed through the left nostril.

DISCUSSION

Pancreaticoduodenectomy is a technically demanding operation, with morbidity rates of approximately 40%–50%. The mortality rate is around 2.6%, and 37%–43% of deaths are directly linked to pancreatic fistulas^[1,2,13,14]. However, the prevention of this complication remains challenging, being related to non-modifiable factors (patient's age, comorbidities, pancreatic texture, and pancreatic duct size) and modifiable variables (anastomosis technique, somatostatin analogs, bleeding, and massive blood transfusions)[6,8,14]. These variables influence the development of leaks and pancreatic fistulas.

Although cavity drainage is unlikely to influence the rate of these adverse events, we proposed the use of an endoscopic vacuum system to prevent pancreatic fistulas^[9,15,16]. The system is feasible and effective for the treatment of transmural defects^[12]. Tools for building the system include a nasogastric tube (14 Fr), gauze, an antimicrobial incise drape, and a nylon suture. The first step is to make several holes in the nasogastric tube and cut the antimicrobial incise drape to match the size of the fenestrated portion. Subsequently, using an 18-G needle, several holes are made in the antimicrobial incise drape. The next step is wrapping the fenestrated portion of the nasogastric tube using gauze and then with an antimicrobial incise drape. Finally, a 2.0 nylon suture is used to fix the gauze and antimicrobial incise drape at the nasogastric tube (Figure 5). Polyvinyl alcohol foam and polyurethane foam are alternatives for making the system. However, gauze is just as safe and effective as these materials, and is less expensive.

Similar to the therapeutic vacuum, the endoscopic preemptive vacuum may also promote continuous exudate evacuation, reduction of inflammatory edema, improvement of blood supply, and lymphatic drainage. The negative pressure also promotes microdeformation and macrodeformation, leading to angiogenic factors that increase local healing.

Liu *et al*^[17] proposed that the increased pressure in anastomosis associated with</sup>pancreatic enzymes (proteases and phosphatases) could lead to increased leakage in non-hermetic anastomoses due to self-digestion of the anastomosis, and a negative pressure could prevent this process. Therefore, we believe that the endoscopic vacuum system decreases pressure in the biliopancreatic limb and reduces contact between the anastomosis and pancreatic juice. Thus, the preemptive vacuum can prevent leaks and pancreatic fistulas.

In a systematic review of 60739 patients, Sergio Pedrazzoli^[7] supported this theory, stating that for fluid flow from one lumen to another, there must be a pressure differential between the means to overcome gravity and peristaltic activity. However, at present, these pressures are not documented. Furthermore, the use of endoluminal drains would favor the removal of biliopancreatic secretions and could be used for the infusion of protease inhibitors.

With regard to complications, a recent systematic review with a meta-analysis published by do Monte Junior *et al*^[18] demonstrated bleeding, stricture, and difficulty in removal as the main adverse events. Difficulty in removing the system only occurred in one patient. Considering that the preemptive vacuum therapy system remains in the anastomosis for no longer than 3 d, and the novel system has no sponge, the risk of those complications is small, although they may still exist. Neumann *et al*^[19] performed preemptive vacuum therapy for the treatment of anastomotic ischemia after esophageal resection. Using a continuous suction of 125





Figure 5 Modified endoscopic vacuum system (distal part).

mmHg, complete mucosal recovery was achieved in 75% of cases. Thus, ischemia caused by this regimen of negative pressure is improbable.

To diagnose pancreatic fistulas, we used the criteria of the International Pancreatic Fistula Study Group modified in 2016^[20]. Our patient had several risk factors for the development of this complication, such as age, malignancy, fat-substituted pancreas, pancreatic duct size < 3 mm, intraoperative transfusion, and preoperative malnutrition. Nevertheless, there were no complications during her evolution^[21]. An early oral diet was initiated on postoperative day 2 when peristaltic movements returned.

Various techniques are used to minimize the risk of anastomosis dehiscence, including the application of a fibrin sealant or a fibrin glue-coated collagen patch. The first advantage of preemptive vacuum therapy is that it allows enteral feeding while reducing the risk of leak and fistulas. Compared with the modified vacuum system, a preemptive vacuum is a feasible and cost-effective method for preventing those circumstances. Aside from this, recent studies demonstrated that fibrin sealant patches had no significant effect on the rate of postoperative pancreatic fistula^[22,23].

CONCLUSION

Preemptive endoluminal vacuum therapy might be a safe and feasible technique to reduce leaks after pancreaticoduodenectomy.

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