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Pancreaticoduodenectomy with preservation of gastric tube blood flow after esophagectomy: Report of a case



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ABSTRACT

INTRODUCTION: During pancreaticoduodenectomy (PD), the gastroduodenal artery (GDA) is commonly divided. In this study, we described the clinical features of PD in which the GDA was preserved in order to avoid gastric tube ischemia in a patient who had previously undergone esophagectomy.

PRESENTATION OF CASE: A 70-year-old man had previously undergone esophagectomy. Esophagectomy and gastric tube reconstruction were performed 10 years earlier due to superior thoracic esophageal cancer. The patient was referred to our hospital for the treatment of obstructive jaundice and was diagnosed with middle bile duct cancer. We performed PD and preserved the GDA. The postoperative course was uneventful, and the gastric tube continued functioning well.

DISCUSSION: In a patient with a prior esophagectomy and gastric tube reconstruction, the blood flow to the gastric tube is supplied only by the GDA via the right gastroepiploic artery (RGEA). Therefore, we carefully chose a technique that would preserve the GDA and avoid gastric tube ischemia. Oncologically, this procedure may be debatable because the efficiency of lymph node dissection along the GDA and RGEA may be compromised. PD involving GDA preservation in common bile duct (CBD) cancer may be acceptable because the CBD is behind the pancreatic head, and the CBD lymph flows into the para-aorta lymph nodes behind the pancreas.

CONCLUSION: This procedure is suitable for patients who have previously undergone esophagectomy and this procedure prevents digestive function disorders. Using this method, preoperative angiographic assessment and meticulous surgical technique may lead to successful outcomes.

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1. Introduction

In the last decade, patients with either coexisting synchronous or metachronous cancers have often been encountered.^{1–3} In such cases, if removal of two organs is necessary, the procedure is necessarily more invasive. However, improvements in surgical techniques and perioperative care, as well as advances in chemotherapy, have reduced the associated postoperative mortality and morbidity. This has allowed the extension of the indications for these types of surgeries.

The blood flow to the reconstructed gastric tube following esophagectomy is usually supplied only by the gastroduodenal artery (GDA) via the right gastroepiploic artery (RGEA). During pancreaticoduodenectomy (PD), the GDA is commonly divided. In this report, we describe the clinical features of PD in which the GDA

was preserved to avoid gastric tube ischemia in a patient who had previously undergone esophagectomy.

2. Case report

A 70-year-old man was referred to our hospital for treatment of obstructive jaundice. Ten years earlier, the patient had undergone esophagectomy with gastric tube reconstruction due to superior thoracic esophageal cancer (T1bN0M0, stage 2). Laboratory tests revealed hyperbilirubinemia, elevated hepatobiliary enzymes, and elevated tumor markers, such as total bilirubin (TBil), 10.7 $\mu\text{mol/L}$; alkaline phosphatase, 3034 IU/L; γ -glutamyl transpeptidase, 650 IU/L, and carbohydrate antigen 19-9, 5362 U/mL.

An abdominal, contrast-enhanced computed tomography showed a 30-mm, enhanced tumor in the middle common bile duct (CBD) and dilatation of the intra- and extra-hepatic bile duct (Fig. 1A; the bile ductal tumor was suspected of invading the pancreas.) The presence of the gastric tube in the posterior mediastinum was also detected. Endoscopic retrograde cholangiography

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Fig. 1. (a) Contrast enhanced abdominal computed tomography. This figure shows a 30-mm enhanced tumor in the middle common bile duct (white arrow); dilatation of the intra- and extra-hepatic bile duct is also evident (black arrow). (b) Endoscopic retrograde cholangiography. The narrowing of the middle common bile duct is shown (arrow). (c) Angiography. Blood flow to the gastric tube was supplied only by gastroduodenal artery (GDA) via the right gastroepiploic artery (RGEA) (arrow).

showed narrowing of the middle CBD, and endoscopic nasobiliary drainage was performed to treat jaundice (Fig. 1B). The tumor was diagnosed as an adenocarcinoma by pathological examination of a biopsied specimen and cytological examination of the bile juice. Angiography revealed that the blood flow to the gastric tube was supplied only by the GDA via the RGEA (Fig. 1C). Therefore, we planned PD to preserve the GDA with radical resection of the middle bile duct cancer, while also avoiding gastric tube ischemia. Because of the biliary drainage, the serum TBil level had declined to 1.4 μmol/L.

During the surgery, abdominal exploration revealed a tumor in the hepatoduodenal ligament, without any evidence of metastatic disease. After mobilizing the duodenum and the pancreatic head, branching of the right hepatic artery (RHA) from the superior mesenteric artery (SMA) was identified. The right gastroepiploic vein (RGEV), one of the veins draining the gastric tube was identified and preserved along Henle's gastrocolic trunk. The right gastric vein (RGV), another vein draining the gastric tube, was directly connected to the portal vein (PV) and was also identified and preserved. The GDA was detached from the pancreas head by meticulously ligating the anterior superior pancreaticoduodenal artery (ASPDA) and the posterior superior pancreaticoduodenal artery (PSPDA). After complete isolation of the GDA, RGEA, and RGEV, the duodenum was divided along a line 1 cm anal to the pyloric ring.

The GDA was then exposed at its origin from the common hepatic artery (CHA). After the cholecystectomy, the replaced RHA and the left hepatic artery (LHA), which branched from the CHA, were skeletonized and dissected free from the surrounding tissue. The PV was exposed, and the CBD was divided at its bifurcation. The pancreas was ligated proximally and transected at the PV.

The Treitz ligament was opened, and the proximal jejunum was divided (Fig. 2). Sequentially, the digestive route was reconstructed during pancreatojejunostomy, choledochojejunostomy, duodenojejunostomy, and while creating a Braun anastomosis.

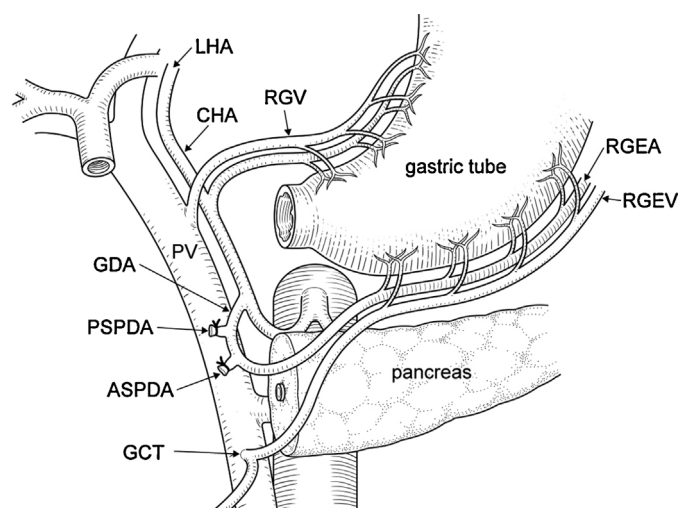


Fig. 2. A schematic illustration of the specimen. Pancreatoduodenectomy (PD) with preservation of the gastric tube, its feeding arteries (the gastroduodenal artery [GDA], the right gastroepiploic artery [RGEA]), and its two drainage veins (the right gastroepiploic vein [RGEV], and the right gastric vein [RGV]). PV, portal vein; LHA, left hepatic artery; CHA, common hepatic artery; ASPDA, anterior superior pancreaticoduodenal artery; PSPDA, posterior superior pancreaticoduodenal artery; GCT, gastrocolic trunk.

The total operative time was 549 min, with a total blood loss of 630 mL. A pathological examination revealed a poorly differentiated tubular adenocarcinoma of the CBD, without lymph node metastases; the surgical margins were also negative for malignancy. The postoperative course was complicated by a grade B pancreatic fistula that was managed conservatively.⁴ Postoperative abdominal computed tomography showed the presence of blood flow to the gastric tube via the RGEA. The patient was discharged on postoperative day 46.

3. Discussion

Among abdominal surgeries, esophagectomies and PDs are known to be highly invasive procedures, with high morbidity rates. However, modern surgical techniques and appropriate perioperative care have reduced the morbidity rates, extending the indications for these types of surgeries.^{5–7} Advances in imaging modalities have also contributed to the early detection and the treatment of diseases warranting these procedures. Furthermore, because the vascular anatomy and the location of the tumor can be precisely identified, we can plan appropriate surgical procedures during the preoperative period. Such careful planning is critical when performing highly invasive surgeries, such as PDs and esophagectomies, in patients with double cancers and histories of previous abdominal surgeries.

During surgery, performing a radical tumor resection and maintaining a functional digestive system are both important. In patients who have previously undergone esophagectomy and gastric tube reconstruction, these requirements are indispensable. They are particularly important because the development of postoperative malnutrition, caused by a digestive system deficiency, may increase postoperative morbidity. Furthermore, malnutrition may also impact the efficacy of adjuvant chemotherapy and immune suppression, ultimately affecting the patient's long-term survival.

Double cancer involving the esophagus and bile duct, whether synchronous or metachronous, is rare. Therefore, only a few cases of PD following esophagectomy and gastric tube reconstruction have been reported.¹ During the PD procedure for either malignant or benign disease, the GDA is usually divided. However, in a patient with a prior esophagectomy and gastric tube reconstruction, the blood flow to the gastric tube is supplied only by the GDA, via the RGEA. In our case, preoperative angiography revealed a similar situation without the development of a collateral artery. Therefore, we carefully chose a technique to preserve the GDA and avoid gastric tube ischemia. If sacrifice of the GDA is necessary in such cases, a vascular reconstruction for the gastric tube has to be performed, creating an anastomosis between the CHA or another artery and the remaining RGEA stump. Otherwise, if the gastric tube is removed, reconstruction of the alimentary tract by anastomosing the large or small bowel to the cervical esophagus is required; the technical aspects of this procedure are particularly important. On the other hand, the venous outflow of the gastric tube is mainly via the RGEV. Thus, both the GDA and RGEV need to be preserved to avoid congestion. In this case, the RGV, in addition to the RGEV, drained blood from the gastric tube; both veins were preserved during the present surgery. Although preservation of the RGEV-gastrocolic trunk is difficult because of their fragility, the pancreas head may be divided in front of the SMV since the gastrocolic trunk flows into the front or left side of the SMV.

Oncologically, this procedure may be debatable because the efficiency of lymph node dissection along the GDA and RGEA may be compromised. In particular, pancreatic head cancer may have directly invaded the areas around the GDA and metastasized to the surrounding lymph nodes. On the other hand, PD involving preservation of the GDA in CBD cancer may be acceptable because the

CBD is behind the pancreatic head, and the CBD lymph flows into the para-aorta lymph nodes behind the pancreas.⁸

The indications for this surgery are extremely limited. However, descriptions of GDA-preserving PD have previously been reported, including for pancreatic or bile duct cancers in patients who had previously undergone esophagectomy, similar to our case.^{1,9–11} Prevention of lethal postoperative bleeding from the GDA stump in the presence of a pancreatic fistula was another reason for this type of surgery.¹² A third reason for selecting this technique was prevention of delayed gastric empty due to the preservation of the pyloric blood supply and innervation.¹³

4. Conclusion

We report a PD procedure in which the GDA was preserved in a patient with CBD cancer that had occurred after esophagectomy and gastric tube reconstruction; this procedure does not require additional vascular system or alimentary tract reconstruction. Using this method, preoperative angiographic assessment and a meticulous surgical technique may lead to successful outcomes.

Conflict of interest

All authors have nothing to disclose.

Funding

All authors have nothing to disclose.

Ethical approval

All procedures used in this research were approved by the Ethical Committee of Hiroshima University Hospital.

Author contributions

Sho Okimoto carried out conception and design of the study, data collection and writing the paper. Tsuyoshi Kobayashi carried out critical revision of the article for important intellectual content. All authors read and approved the final manuscript.

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