A novel pancreaticoduodenectomy reconstruction for a patient with Roux-en-Y hepaticojejunostomy after radical extended left hepatectomy for perihilar cholangiocarcinoma

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Short Report

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Abstract

Background:

Metachronous cholangiocarcinoma in the remnant distal bile duct (BD) has been reported after the resection of perihilar cholangiocarcinoma. A pancreatoduodenectomy (PD) after radically extended hepatectomy with Roux-en-Y hepaticojejunostomy has significant surgical complexity in both extensive adhesiolysis and digestive tract reconstruction. Herein, we reported a novel method of digestive tract reconstruction using the Y limb of pre-existing Roux-en-Y hepaticojejunostomy for pancreaticoduodenostomy and, subsequently, the Roux jejunal limb for gastrojejunostomy.

Case presentation:

A 74-year-old male developed distal BD cholangiocarcinoma six months after extended left hepatectomy for perihilar cholangiocarcinoma and subsequent adjuvant chemotherapy. The patient underwent extensive adhesiolysis followed by PD. His digestive tract was reconstructed by a novel method of PD reconstruction: the Y limb of the pre-existing Roux-en-Y hepaticojejunostomy was used for pancreaticoduodenostomy, and the Roux jejunal limb was used for the gastrojejunostomy. The tumor pathology demonstrated histologically stage Ib biliary duct adenocarcinoma with fibromuscular invasion. There were no complications of a pancreaticojejunostomy fistula.

Conclusions:

This novel method of PD reconstruction for patients with Roux-en-Y hepaticojejunostomy could take advantage of the previous surgically altered anatomy and avoid further adhesiolysis for obtaining the adequate length of a new jejunal loop for pancreaticojejunostomy and gastrojejunostomy. This can be an optional PD reconstruction for patients with Roux-en-Y hepaticojejunostomy in cases of early-stage bile duct cancer and/or less likely to have lymph node metastasis.

Background

Synchronous/metachronous double cancers of the gallbladder and bile duct (BD) that are either associated or independent of the anomalous junction of the pancreaticobiliary duct system are well known. Similarly, synchronous/metachronous multiple cholangiocarcinomas of the perihilar and the distal BD have been reported. The incidence of multicentric BD cancer was reported to be 2.5–3.7%. Although the second surgery for metachronous cancer is technically demanding, repeated resection for metachronous lesions might improve the patients’ survival. In those patients, the initial surgery is typically pancreaticoduodenectomy (PD) or major hepatectomy with biliary reconstruction. Therefore, severe adhesions and complex digestive tract reconstruction are anticipated in the second resection. Herein, we report a case of metachronous intrapancreatic cholangiocarcinoma arising in a patient who received radical extended left hepatectomy with Roux-en-Y (RY) hepaticojejunostomy for perihilar...
cholangiocarcinoma. The intrapancreatic cholangiocarcinoma was resected with PD, and a novel digestive tract reconstruction method was applied.

**Case Report**

A 74-year-old Asian male with a history of diabetes and Stage II colon cancer seven years ago was found to have elevated carbohydrate antigen 19–9 up to 4,237 U/L and normal carcinoembryonic antigen 2.9 U/L during the screening process for exacerbation of diabetes. A contrast-enhanced abdominal computed tomography, magnetic resonance imaging, and cholangiopancreatography found perihilar cholangiocarcinoma with left portal vein invasion and positive perihilar lymph node metastases. A completely replaced right hepatic artery from the superior mesenteric artery was seen. Endoscopic brush cytology showed class IIIb. Preoperative diagnosis was T3N1Mo Stage IIIc, the AJCC 8th edition. Future remnant liver volume was 71.5% and function of the remnant liver was sufficient; indocyanine green retention 15 minutes (ICG 15) 3.0%, Indocyanine green clearance (ICG K) 0.244.

On laparotomy, perilymph nodes of the common hepatic artery were soft, and the frozen section was negative for metastatic carcinoma. Then, extended left hepatectomy, caudate process resection, and extrahepatic BD resection combined with regional lymphadenectomy were performed. The postoperative course was uneventful and the patient was discharged on postoperative day 20.

The surgical specimen showed a tumor in the left hilar BD, 25x12mm in size, and showed intraductal growth. The histological diagnosis was moderately differentiated adenocarcinoma, no, PV1, VVo, im0, and classified as pT2bNOM0, stage II, Ro resection.

After six months of adjuvant chemotherapy using S-1, a follow-up enhanced CT scan showed dilatation of the remaining distal BD and contained a faintly enhanced papillary tumor (Fig. 1a). There was no recurrence in the remnant liver, hepatic hilar lymph nodes, and lung. Retrospective reviewing the previous enhanced CT, MRI, and endoscopic retrograde cholangiopancreatography (ERCP), the intra-pancreatic distal BD showed neither mass, filling defect, nor abnormal diffusion reduction. The tumor came out of the papilla of Vater by ERCP (Fig. 1b), and a biopsy showed adenocarcinoma.

The preoperative diagnosis was multicentric distal BD cancer with no lymph node metastases (Bd, T1NoMo stage I, the AJCC 8th edition). Subtotal stomach-preserving pancreaticoduodenectomy and en-bloc removal of regional lymph nodes were performed, and the replaced right hepatic artery was preserved carefully. The pancreas head was divided at the level of the midline of the superior mesenteric vein. The pre-existing RY hepaticojejunostomy limb was preserved and used for digestive tract reconstruction. The Y-limb of the RY hepaticojejunostomy was divided at the level of the superior mesenteric artery (SMA) in the third part of the duodenum to allow for pancreatic reconstruction (Fig. 2). The end-to-side pancreaticoduodenal anastomosis was made 3 cm distal from the duodenal stump of the Y-limb. The pancreatic duct was 3.0 mm in diameter which was reconstructed using the pancreatic duct-mucosal running suture method. The gastrojejunostomy was created 5 cm distal from the
hepaticojejunostomy of the Roux limb with a tension-free anastomosis. Gastrointestinal continuity was restored in the following order: the pre-existing hepaticojejunostomy, a new gastrojejunostomy, and ensuing duodenopancreatostomy, i.e., a RY-type novel reconstruction (Fig. 3). The total operative time was 435 min and the estimated blood loss was 850 mL without blood transfusion. There was no pancreas anastomotic leak, but the patient developed a Clavin-Dindo II gastrojejunostomy leak. The patient was discharged on postoperative day 28.

The surgical specimen showed an 8x8x10 mm pedunculated polypoid tumor in the intrapancreatic distal BD (Fig. 4). The histological diagnosis was Bd, papillary, type Ip, moderately differentiated adenocarcinoma, and the depth T1 (FM) vascular permeation negative. The surgical margin of the proximal BD was negative. There was no biliary intraepithelial neoplasia. The final pathology stage was classified as a pT1N0M0, stage I Ro resection.

**Ethical standard**

IRB is not applicable. Consent has been obtained in Japanese from the patient to publish clinical data and imaging for the purposes of this manuscript.

**Discussion**

A pancreaticoduodenectomy in patients with a previous extended hepatectomy and RY hepaticojejunostomy patients has significant surgical complexity. Many technical challenges exist including adhesiolysis, preservation of remaining hepatic inflow, and complex digestive tract reconstruction. The biggest challenge is reconstructing the gastrointestinal continuity after PD in patients with a prior RY hepaticojejunostomy. However, previous reports do not describe detailed reconstruction methods after PD in patients with hepaticojejunostomy.3-5 Usually, PD for patients with a history of previous RY hepaticojejunostomy requires resection of the pancreatic head and duodenum, including the entire Y-limb of the RY hepaticojejunostomy. The possible reconstruction methods are as follows: 1) pancreaticojejunostomy and gastrojejunostomy using a new jejunal loop constructed using the distal from the anastomotic site of the Y-limb of the RY hepaticojejunostomy, 2) pancreaticojejunostomy to the new jejunal loop and gastrojejunostomy to the Roux loop of the RY hepaticojejunostomy, 3) gastrojejunostomy to the new jejunal loop and pancreaticogastrostomy, 4) pancreaticogastrostomy and gastrojejunostomy to the Roux loop of the pre-existing RY hepaticojejunostomy without creating a new jejunal loop.

In this case, the intrapancreatic distal BD cholangiocarcinoma was not invasive and had negative lymph node metastasis. Therefore, we could choose the Y limb of the pre-existing RY hepaticojejunostomy to reconstruct the pancreatic anastomosis. We performed careful adhesiolysis of the Roux loop and the Y-limb of the pre-existing RY hepaticojejunostomy for use in reconstruction. The Y-limb was divided as long as possible at the SMA level of the duodenum. In our novel reconstruction method, the remnant pancreas was anastomosed to the Y-limb of the pre-existing RY hepaticojejunostomy (end-to-side
pancreaticoduodenostomy) and gastrojejunostomy was anastomosed to the Roux loop of the pre-existing RY hepaticojejunostomy.

Other reconstruction methods have drawbacks and require additional adhesiolysis, longer operating time, and more digestive tract fluid loss. Especially in this case, in order to obtain the adequate length of a new jejunal loop, it would additional adhesiolysis would have been required due to a previous sigmoid colon resection and the hepaticojejunostomy loop creation. Moreover, if we had tried to apply a pancreaticogastrostomy in this case, further mobilizing the pancreatic remnant from the underlying splenic vein/artery and the retroperitoneum as well as adhesiolysis of the whole stomach from the liver resection surface and the diaphragm would be required to allow for a tension-free anastomosis.

We believe that our novel reconstruction using the Y limb of the pre-existing RY hepaticojejunostomy for the pancreaticoduodenostomy and the subsequent gastrojejunostomy to the Roux loop of the RY hepaticojejunostomy was the best choice among possible reconstructions in this case. This novel reconstruction method could be applied widely for PD in patients with pre-existing RY hepaticojejunostomy because multicentric bile duct adenocarcinomas are more likely to be early-stage papillary adenocarcinomas and are less likely to have lymph node metastasis. However, in cases where the lower BD carcinoma is advanced, the Y limb of the RY hepaticojejunostomy loop should be resected, and our novel reconstruction method would not be a good option.

**Conclusion**

This novel method of PD reconstruction for patients with pre-existing RY hepaticojejunostomy takes advantage of previous surgically altered anatomy and avoids further adhesiolysis for obtaining an adequate length of a new jejunal loop for pancreaticojejunostomy and gastrojejunostomy. This method is an optimal PD reconstruction for patients with pre-existing RY hepaticojejunostomy.

**Abbreviations**


**Declarations**

**Ethical standard:** IRB is not applicable. Consent has been obtained in Japanese from the patient to publish clinical data and imaging for the purposes of this case report.

**Consent for publication**

All authors have read and agreed to publication.

**Availability of data and materials**
Data sharing does not apply to this article as no datasets were generated or analyzed during the current study.

**Competing interests**

The authors declare that they have no competing interests.

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Not applicable.

**Authors Contributions**

Kazunari Sasaki helped to draft the manuscript and critically revised the manuscript. Susumu Kawate, Yuhei Nakano, Yasushige Kashima, Hideki Matsuyama and Masato Hoshino are the surgeons and participated in its design and coordination. Gastroenterologists, Naohiro Noda and Hideki Maruyama, and a radiologist Kenzo Okauchi participated in its diagnosis. Misa Iijima is the pathologist.

Acknowledgment:

**References**


**Figures**

![Image](image1.png)  ![Image](image2.png)

**Figure 1**

Imaging findings of the patient. An enhanced CT showed dilatation of the remaining distal BD which contained a faintly enhanced papillary tumor (Fig 1a). There were no metastases in the remnant liver, hepatic hilar lymph nodes, and lung. The papillary tumor came out of the papilla of Vater by ERCP (Fig 1b),
Subtotal stomach preserving was performed (arrow a).

The pre-existing RY hepaticojejunostomy limb was preserved and used for reconstruction. The pancreas head was divided at the level of the midline of the superior mesenteric vein (arrow b). The Y-limb of the RY hepatojejunostomy loop was divided at the level of the superior mesenteric artery in the third part of the duodenum to allow for pancreatic anastomosis (arrow c).
Figure 3

The pancreas end-to-side duodenal anastomosis was made 3 cm distal from the duodenal stump of the Y-limb. The pancreatic duct was 3.0 mm in diameter and anastomosed using the pancreatic duct-mucosal running suture method (arrow a). The gastrojejunostomy was created 5 cm distal from the hepaticojejunostomy of the Roux limb (arrow b).
Figure 4

The surgical specimen showed a pedunculated polypoid tumor measuring 8x8x10 mm in the intrapancreatic distal BD (Fig 4). The histological diagnosis was Bd, papillary, type Ip, moderately differentiated adenocarcinoma, depth T1 (FM), and vascular permeation was negative.