

## Case Report

# Pancreatoduodenectomy with uncut-Roux-en-Y reconstruction in patients with previous radical gastrectomy

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Gastric cancer is very common. Many patients have undergone radical gastric cancer surgery in Korea. Recently, the number of cases with secondary cancer occurring in other organs such as periampullary cancers is increasing as survival rate of gastric cancer patients increases. There are some clinical issues in managing patients with periampullary cancer who have undergone radical gastrectomy previously. Considering that pancreatoduodenectomy (PD) has two phases (i.e., resection and reconstruction), it can be very complicated and controversial to perform safe and effective reconstruction following PD in patients with a previous radical gastrectomy. In this report, we present our experiences of uncut-Roux-en-Y fashioned reconstruction in PD for patients with a previous radical gastrectomy and discuss its technical characteristics and potential advantages.

**Key Words:** Pancreatoduodenectomy; Radical gastrectomy; Periampullary cancer; Uncut Roux-en-Y

## INTRODUCTION

Reconstruction methods after pancreatoduodenectomy (PD) for periampullary cancer in patients with a previous radical gastrectomy for gastric cancer have been reviewed previously [1-9]. The most recently used method is to divide efferent loop (E-loop) while maintaining the previous gastrojejunostomy and perform side-to-side jejunojunctionostomy (JJ) for retrocolic pancreaticojejunostomy (PJ) and hepaticojejunostomy (HJ) using distal bowel loop after dividing E-loop [6]. However, we once experienced severe clinically relevant delayed gastric emptying (DGE) after this surgical method. Previous gastrec-

tomy itself can lead to malnutrition in a patient. Unexpected prolonged DGE should be considered in such patients and pancreatic surgeons should try to improve perioperative outcomes. However, clinical experience for such patients is limited because this patient group is thought to be very rare. Thus, it is necessary to draw conclusions based on the experience of a large number of patients.

In the reconstruction of the Roux-en-Y type by dividing the E-loop, it was hypothesized that the segmented E-loop between the previous gastrojejunostomy site and the neo-JJ could impair mobility. In addition, this method might cause a problem of blood supply to the divided small bowel in the process of dividing the E-loop.

In this case report, we present the difference and advantages of the uncut-Roux-en-Y fashioned reconstruction in PD for patients with previous radical subtotal (Fig. 1A) and total gastrectomy (Fig. 1B).

## CASE

### Case presentation

A 75-year-old male patient was referred to our hospital due to abnormal liver function tests in the national health examination. The patient had a surgical history of radial subtotal gas-

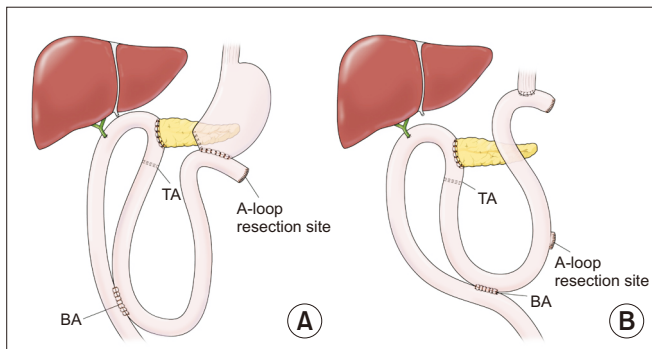
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**Fig. 1.** Uncut-Roux-en-Y reconstruction after pancreatoduodenectomy (PD) in patients with radical gastrectomy. Final operative scheme after PD in patients with radical subtotal (A) and total (B) gastrectomy. Instead of dividing E-loop, it is pulled-up for pancreaticojejunostomy (PJ) and choledochojejunostomy (CJ). TA stapler is applied to prevent food materials from PJ/CJ site and additional BA is provided. TA, transverse anastomosis; BA, Braun anastomosis.

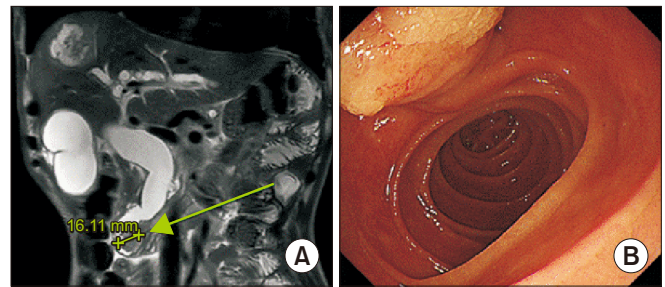
trectomy (RSTG) with Billroth Type II anastomosis for gastric cancer 31 years prior. Portal-venous phase contrast-enhanced computed tomography of the abdomen and pelvis revealed 1.6 cm mass lesion in ampulla of Vater (AoV), causing diffuse biliary and pancreatic duct dilatation. Thus, AoV cancer was suspected. Some enlarged lymph nodes (LNs) in hepatoduodenal ligament suggested LN metastasis. Multiple enhancing lesions were seen in the liver, indicating liver abscess. Gadolinium-enhanced magnetic resonance image (MRI) demonstrated a mass in the AoV with bile duct dilatation and secondary liver abscess (Fig. 2A). The patient subsequently underwent endoscopic evaluation and biopsy (Fig. 2B), confirming diagnosis of AoV adenocarcinoma that was well differentiated, arising in the tubular adenoma.

Due to initial obstructive jaundice, he underwent preoperative percutaneous transhepatic biliary drainage (PTBD) insertion at right anterior intrahepatic duct due to liver abscess. Elective radical surgery was performed after liver abscess and biliary obstruction were resolved.

This study was approved by our IRB (2022-2334-001).

### Operation

Open PD was performed using the existing upper midline skin incision on July 1, 2021. We have previously described surgical procedure of PD in a patient with previous radical gastrectomy [6]. Subsequent adhesio-bandlysis was carefully done. Common hepatic artery and proper hepatic artery were dissected according to the surgical scope of radical gastrectomy for gastric cancer. There were few soft tissues around blood vessels. Thus, care was taken not to injure blood vessels with sharp dissection. Usually, this area has severe adhesions with the left lobe and quadrate lobe of the liver. By peeling off the pancreatic neck's lower portion, SMV was exposed first. It was used as a landmark for dissection. In particular, when



**Fig. 2.** Preoperative image. (A) Preoperative magnetic resonance image. Green arrow indicates periamпуляр tumor. (B) Preoperative endoscopic evaluation. Note protruding periamпуляр lesion at left upper area of the figure.

performing PD, the previous gastrojejunostomy should be preserved and only the afferent loop (A-loop) should be divided. The A-loop was divided by a stapler near the previous gastrojejunostomy. The staple line was re-enforced with interrupted Lambert suture. After delivery of surgical specimen, subsequent pancreaticojejunostomy (PJ) and choledochojejunostomy (CJ) were performed by pulling-up distal E-loop to the remnant pancreas and resected bile duct in a retrocolic fashion at about 50 cm from the previous gastrojejunostomy site. A small window was made on the small bowel mesenteric border at 3 to 5 cm of the PJ proximal and transverse anastomosis (TA) stapler was applied after PJ and CJ were performed. Subsequent Braun anastomosis was performed below colonic mesentery to complete uncut-Roux-en-Y reconstruction of PD in the patient with a previous RSTG.

### Postoperative course

The total operation time was 370 minutes. The amount of bleeding was minimal. From the 4th day after surgery, amylase and lipase levels from closed suction drain were high (amylase was over 50,000 U/L and lipase was over 6,000 U/L), suggesting postoperative pancreatic fistula (POPF) [10]. On the 8th day after surgery, C-reactive protein elevation and leukocytosis were observed and intravenous piperacillin-tazobactam and subcutaneous octreotide were started. On day 16, the patient's condition improved and finally drain was removed (postoperative pancreatic fistula-biochemical leak). On the 20th day, when cholangiogram was performed through the previous PTBD, passage of the contrast medium was smooth. There were no findings suggestive of fistula or leakage. The patient was discharged on the 23rd day. He was followed-up at the outpatient clinic more than one year after surgery without evidence of tumor recurrence.

### Institutional experiences

Between September 2020 and June 2022, we had performed uncut-Roux-en-Y reconstruction for six patients who had PD (Table 1). Patients had a median age of 69 years (range, 63–79

**Table 1.** Case series of pancreatoduodenectomy with uncut Roux-en-Y reconstruction in patients with radical gastrectomy

	Case 1	Case 2	Case 3	Case 4 <sup>a)</sup>	Case 5	Case 6 <sup>b)</sup>
Sex/age (yr)	M/71	M/65	M/63	M/75	M/64	F/79
Previous gastrectomy type	RSTG & BI	RSTG & BII	RSTG & Roux-en-Y GJ	RSTG & BII	RSTG & BII	RSTG & Roux-en-Y GJ
Stage (gastric cancer)	pT1b pN0	pT0 pN0	pT2pN1	(Thought to be) Stage IA	pT1a pN0	pT1apN0
Time interval <sup>c)</sup>	15 years	12 years	37 months	31 years	11 years	2 years
Initial bilirubin (mg/dL)	2.2	2.8	2.4	5.5	0.9	0.5
Biliary decompression	ERBD	PTBD, ERBD	PTBD	PTBD	PTBD, ERBD	None
Preoperative bilirubin (mg/dL)	0.7	0.6	1.5	0.9	0.9	0.3
Pancreatoduodenectomy (OP date)	2020-09-29	2020-10-14	2021-06-30	2021-07-01	2022-04-13	2022-06-08
Diagnosis	Bile duct cancer	Bile duct cancer	Bile duct cancer	AoV cancer	AoV adenoma	Pancreatic cancer
Stage (AJCC 8th)	pT2 pN0	ypT1 ypN0	pT3a pN1	pT1b pN1a		ypT2N0
OP time (min)	355	355	430	130	249	232
EBL (mL)	200	400	600	100	250	100
Transfusion	None	None	None	none	None	None
LOH	11	8	9	23	13	10
POPF	None	None	BL	Grade B	BL	None
DGE	None	None	None	None	None	None
30-day mortality	None	None	None	None	None	None
90-day mortality	None	None	None	None	NA	NA
Follow-up (mon) <sup>d)</sup>	21	20	12	11	2	1

M, male; F, female; OP, operation; RSTG, radical subtotal gastrectomy; GJ, gastrojejunostomy; EBL, estimated blood loss; LOH, length of hospital stay; POPF, postoperative pancreatic fistula; DGE, delayed gastric emptying; BL, biochemical leak.

<sup>a)</sup>Present case; <sup>b)</sup>neoadjuvant chemotherapy; <sup>c)</sup>Time period between 1st gastrectomy and PD; <sup>d)</sup>Time period from PD.

years). Median length of time between PD and radical gastrectomy was 12 years (range, 2–31 years). All of them had radical subtotal gastrectomy with one Billroth I, three Billroth II, and two Roux-en-Y gastrojejunostomy cases.

PD was done for three patients with common bile duct cancers, one patient with AoV cancer, and one patient with pancreatic cancer. Median length of operating time was 291 minutes (range, 130–430 minute) and median intraoperative estimated blood loss was 275 mL (range, 100–600 mL). None had intraoperative blood transfusion. Median length of hospital stay after PD was 12 days (range, 8–23 days). One case had clinically relevant postoperative pancreatic fistula which was managed conservatively with drainage tube inserted during surgery. DGE was not observed in any cases. Regular follow-up appointments were made for patients.

## DISCUSSION

Gastric cancer is very common. Many patients have undergone radical gastric cancer surgery in Korea. Recently, the number of cases of surgery for secondary cancer occurring in other organs is increasing as the survival rate of gastric cancer patients increases. There are some clinical issues in managing periampullary cancer in patients with a previous radical gastrectomy. When periampullary cancer occurs concurrently,

endoscopic access to AoV for tissue biopsy might be difficult depending on the reconstruction method after radical gastrectomy. In addition, endoscopic treatment is difficult in the case of obstructive jaundice, leading to inconvenience of PTBD. Especially, surgical approach is thought to be more complicated and difficult due to previous massive dissection around major vessels and altered alignment of gastrointestinal tract.

Although precise dissection is required for radical PD, it might be difficult to identify and expose the pancreas and major blood vessels due to severe adhesions in patients with previous radical gastrectomy. Such patients require sophisticated surgeries and a lot of experience. However, till now, there is no standardized surgical approach to PD in patients with a previous radical gastrectomy. According to our previous experiences [2,5,9] and a recent multicenter study published in Korea [7], PD after radical gastric cancer surgery is a safe procedure. The number of such cases is expected to increase further in the future.

The following should be taken into account when performing PD in patients with a previous radical gastric cancer surgery. Depending on the extent of dissection for gastric cancer surgery, the right side of left gastric artery, upper part of common hepatic artery, and right side of hepatoduodenal ligament are strongly attached to the lower part of the left liver due to severe adhesion, making it difficult to detach the upper border of the pancreatic neck from surrounding vascular structures. There-

fore, when performing pancreatic dissection, it is advantageous to first dissect the lower border of the pancreatic neck first and use it as an anatomic landmark for surgical procedure.

In addition, since the colon mesentery covers the anterior aspect of the pancreatic body and head, it is important to dissect carefully so as not to damage the main blood supply of the colonic mesentery.

Third, since the major artery was already dissected and skel-etalized during a previous gastric cancer surgery, there are few soft tissues around the blood vessel (no buffering effect from external injury). Therefore, careful gentle dissection is required when peeling off the vessel because it may cause damage with just a small touch.

Finally, when reviewing literatures [1,2,4-9,11,12], the most commonly used method is to raise the distal small bowel in a retrocolic and Roux-en-Y fashion after dividing distal E-loop for PJ, HJ, and JJ. This method has to bear the inconvenience of dividing the functional E-loop with mesentery and potential risk for vascular insufficiency. Authors have experienced several cases of severe DGE, which might have occurred due to disturbances in the motility of the remaining E-loop [2,7,13]. Therefore, we present the uncut-Roux-en-Y reconstruction method when performing PD in patients with previous radical gastrectomy, suggesting it could result in comparable postoperative outcomes while maintaining the continuity of the functional E-loop. This method is thought to be easy, simple, and more physiologic because E-loop is not divided. Thus, ingested food materials could flow along the previous altered gastrointestinal tract.

Due to limited experiences, it is unclear whether this approach is appropriate. However, patients with this type of PD show very smooth postoperative recovery in our case series. Some concerns are arising that it might result in malabsorption due to ileal bypass effect or inadvertent ileal anastomosis. Although PJ and CJ were performed at distal jejunal limb about 50 cm from previous gastrojejunostomy, the length of the uncut-Roux-en-Y loop was less than 50 cm. Additional braun anastomosis is thought to invite some food materials into distal part of uncut-Roux-en-Y loop. Thus, it is expected that there will be no severe adverse impact of malabsorption. This issue also needs to re-evaluated based on long-term functional outcomes of patients. A further study is mandatory.

In the near future, a large-scale multicenter study will be conducted based on these accumulated experiences so that pancreatic surgeons can provide an answer to the optimum surgical approach to PD in patients with a previous radical gastrectomy.

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## CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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Conceptualization: CMK. Data curation: SHP, HYY. Methodology: SHP, HYY, CMK. Writing - original draft: HJK, HSS. Writing - review & editing: CMK.

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