Surgical Technique

Combined pancreatic resection and pancreatic duct-navigation surgery for multiple lesions of the pancreas: intraductal papillary mucinous neoplasm of the pancreas concomitant with ductal carcinoma of the pancreas

Running title: Combined pancreatic resection and pancreatic duct-navigation surgery

Tamotsu Kuroki, Yoshitsugu Tajima, Noritsugu Tsuneoka, Tomohiko Adachi, Takashi Kanematsu

Department of Surgery, Nagasaki University, Graduate School of Biomedical Sciences, 1-7-1 Sakamoto, Nagasaki 852-8501, Japan

Correspondence to: Tamotsu Kuroki, Department of Surgery, Nagasaki University, Graduate School of Biomedical Sciences, 1-7-1 Sakamoto, Nagasaki 852-8501, Japan.tkuroki-gi@umin.ac.jp

Telephone: +81-95-8497316 **Fax**: +81-95-8497319

SUMMARY

When a branch-type IPMN of the uncinate process is concomitant with ductal carcinoma of the body of the pancreas, total pancreatectomy may be recommended. However, a decrease in quality of life becomes a serious problem after total pancreatectomy because of the abolition of endocrine and exocrine pancreatic function. We proposed the combined resection, which is consists of resection of the uncinate process of the pancreas with distal pancreatectomy. This surgical procedure of combined resection is most suitable for preservation of the pancreatic functions. In addition, we recommend the pancreatic duct-navigation surgery enable us to prevent the injury of the main pancreatic duct, and to dissect at the optimal cutting point of the pancreatic branch duct.

Key words: combined resection; Multiple lesions; Intraductal papillary mucinous neoplasm; Pancreatic carcinoma; pancreatic duct-navigation surgery

INTRODUCTION

Recent improvements in surgical devices and advances in knowledge of the pancreatic anatomy have allowed surgeons to approach the minimal resection of the pancreas. In addition, many benign and low-grade malignant pancreatic lesions, including intraductal papillary mucinous neoplasms (IPMNs) and mucinous cystic neoplasms, have been detected by the improving diagnostic modalities. Therefore, several new surgical procedures for minimal resection of the pancreas with pancreatic functional reserve have been proposed, including duodenum-preserving pancreatic head resection (DPPHR), medial pancreatectomy, inferior head resection and inferior branch preserving superior head resection of the pancreas. Especially, the branch type IPMN is a good candidate for such less invasive surgery, because it is more frequently located in the head of the pancreas, and shows less malignant potential. Although several surgical techniques and devices have been advocated to avoid complications following pancreatic surgery, the incidence of pancreatic fistula is still high. In particular, the incidence of pancreatic fistula following partial resection of the pancreas is high (1, 2). A pancreatic

fistula is one of the most frequent complications and still responsible for most morbidity and mortality after pancreatic surgery, leading to an intra-abdominal abscess and/or a lethal bleeding. We report herein a case of successful combined resection for a branch-type IPMN concomitant with ductal carcinoma of the pancreas under a pancreatic duct-navigation surgery for the prevention of postoperative pancreatic fistula.

PATIENT AND TECHNIQUE

A 59-year-old Japanese woman was diagnosed as having a branch-type IPMN, 3cm in diameter, in the uncinate process of the pancreas at a local hospital 2 years ago. The IPMN was followed by an abdominal computed tomography (CT) every 6 months. A follow-up CT depicted a pancreatic body tumor, 2cm in diameter, as a new lesion, and thus the patient was referred to our hospital in July 2007 for further evaluation of the two tumors of the pancreas detected by CT. On admission, serum level of carbohydrate antigen 19-9 was elevated at 194 U/mL (normal, <37). Another tumor marker, carcinoembryonic antigen, was within the normal limit. Laboratory tests, including serum levels of amylase and total bilirubin, were normal. Abdominal ultrasonography (US) and CT demonstrated a multilobular cystic lesion, 3 cm in diameter, in the uncinate process of the pancreas and a solid tumor, 2 cm in diameter, in the body of the pancreas. Endoscopic retrograde pancreatography (ERP) showed a cystic lesion communicating with the main pancreatic duct and stenosis of the main pancreatic duct in the body of the pancreas together with dilated distal pancreatic duct (Fig. 1). Consequently, the cystic lesion was diagnosed as a

branch-type IPMN concomitant with ductal carcinoma of the pancreas, and the patient was considered to be a candidate for surgery. A distal pancreatectomy/splenectomy with the resection of the uncinate process was performed using the technique of pancreatic duct-navigation surgery.

Under general anesthesia, an incision was made in the upper midline of the abdomen, 8 cm in diameter, and a disk for hand-assisted laparoscopic surgery (HALS) (Lap-Disk; Hakko, Tokyo, Japan) was placed. First, the gastrocolic ligament was divided by using an ultrasonic device and the pancreas was exposed. The retroperitoneum was incised along the superior and inferior borders of the pancreas, and then an adequate margin of the pancreas was mobilized under direct view through the Lap-Disk. Splenic artery and vein were divided separately and ligated. A 7 mm width Penrose drain was brought under the pancreas as a hanging maneuver. Using the Penrose drain, the pancreas could be retracted away from the retroperitoneum for the prevention of vessel and/or other organ injuries. Then, the pancreatic parenchyma of the body of the pancreas was transected with an ultrasonic device. The main pancreatic duct was isolated from the pancreatic parenchyma, and

a catheter for pancreatography was inserted into the main pancreatic duct at the cut surface of the remnant pancreas (Fig. 2). This catheter was served as an important device for the pancreatic duct-navigation surgery when the IPMN in the uncinate process was removed. Following the resection of the pancreatic body, a distal pancreatectomy with spleen was done using HALS technique. The first 12-mm trocar for the 30° angled laparoscope was introduced at the umbilicus under direct vision. Under a condition of pneumoperitoneum, two additional 12-mm and 5-mm trocars were placed in the left side of the abdomen. The splenocolic/splenogastric ligaments and the remaining splenic peritoneal attachments were divided to mobilized the pancreas and spleen completely. This resection involved dissection of the regional lymph nodes. The distal pancreas and spleen were extracted through the Lap-Disk.

Under direct vision, the resection of the uncinate process was performed. Mobilization of the duodenum was not done. The communicating branches between the cystic lesion and the main pancreatic duct were carefully evaluated by using intraoperative US and pancreatography. The uncinate process was dissected from

the superior mesenteric vein, and it was separated from the third portion of the duodenum. During the resection of the uncinate process, the catheter in the main pancreatic duct was clearly and easily detected by intraoperative US, and thus both the direction and position of the main pancreatic duct and the correlation between the cystic lesion and main pancreatic duct were correctly identified (Fig. 3). At the final step of subsequent pancreatic parenchymal transection, communicating pancreatic duct was fully exposed and encircled with radiopaque marker filament, which was obtained from surgical gauze. Using this marker with intraoperative pancreatography (Fig.4), the uncinate process was dissected at the optimal cutting point of the pancreatic branch duct, and then the pancreatic branch duct was ligated. After removal of the uncinate process, pancreatography was performed and revealed no injury to the main pancreatic duct or leakage from the transected pancreatic branch ducts. Because a mixture of indigocarmine and contrast material was used for the pancreatography, we were able to detect any minor pancreatic leakage as a blue spot at the cut surface of the pancreas and close the leaking points appropriately with 4-0 absorbable monofilament

sutures. After removal of the pancreatic catheter, the main pancreatic duct was ligated at the cut surface. Intraoperative frozen section histological examination of the dissected pancreatic ducts revealed a disease-free margin.

Under direct vision, the cut edge of the proximal pancreas was detached approximately 3 cm from the retroperitoneum. Furthermore, the cut surface was fixed to the posterior wall of the gastric body for the prevention of the pancreatic leakage from the pancreatic duct including small pancreatic branch ducts. The fixation was constructed by interrupted-suturing between the pancreatic parenchyma and the seromuscular layer of the stomach with 4-0 absorbable monofilament sutures. As a consequence, the stump of the pancreas was completely covered by the gastric wall. So we called "gastric wall-covering method" for the term of the new method for the prevention of the pancreatic leakage (3). Operating time was 9 hours, and blood loss was 480 ml. The final pathological diagnosis was noninvasive intraductal papillary mucinous carcinoma of the uncinate process with invasive ductal carcinoma of the pancreatic body. The surgical margin was free of cancer cells. Her postoperative course was uneventful. The

drain was withdrawn on the 5th postoperative day and she was discharged home on the 15th postoperative day.

DISCUSSION

IPMN of the pancreas is classified into two types: main pancreatic duct type and branch type. The incidence of carcinoma in IPMN is much higher in the main pancreatic duct type than in the branch type. Although the branch type of IPMN of the pancreas shows a favorable prognosis, it is accompanied by malignant diseases of the other organs and pancreatic adenocarcinoma (4). Yamaguchi et al. (5) proposed that clinicians should pay attention to the possible presence of ductal carcinoma of the pancreas in male patients with branch-type IPMN in their 6^{th} to 8^{th} decades. Thus, IPMN may be a 'sentinel' for the diagnosis of carcinoma in situ of the pancreas (5). Tanaka et al. (6) recommended the 3-6 monthly follow-up for branch type IPMN if lesions is >20 mm in size. In the present case, the branch-type IPMN was followed by CT every 6 months. Nevertheless, an invasive ductal carcinoma of the pancreas developed in the body of the pancreas. In addition, Serikawa et al. (7) recommended to measure telomerase activity in the pancreatic juice to judge whether or not surgery is indicated.

Pancreaticoduodenectomy or distal pancreatectomy has been

indicated for the treatment of patients with ductal carcinoma of the pancreas. In addition, when a branch-type IPMN is concomitant with ductal carcinoma of the pancreas as the present case, total pancreatectomy may be recommended. However, a decrease in quality of life becomes a serious problem after total pancreatectomy because of the abolition of endocrine and exocrine pancreatic function. Therefore, we conducted a resection of the uncinate process of the pancreas combined with distal pancreatectomy for the present case. The branch type IPMN shows lower malignant potential than invasive ductal adenocarcinoma of the pancreas. In the benign or low-grade malignant IPMN, complete tumor resection is sufficient for a cure. Therefore, several pancreas-preserving surgical procedures, including the resection of the uncinate process, have been advocated in the surgical treatment for the branch type IPMN in the head of the pancreas. Resection of the uncinate process of the pancreas is an ultimately less invasive surgical procedure for branch-type IPMN of the uncinate process, which is most suitable for the preservation of pancreatic functions. However, the incidence of the complications following the pancreas-preserving surgical procedures is high,

such as pancreatic fistula (1, 2). In the present case, the insertion of a pancreatic catheter via the stump of the main pancreatic duct was useful for identifying the pancreatic ductal system in order to avoid intraoperative injury to the main pancreatic duct. The pancreatic catheter in the main pancreatic duct is easily detectable using intraoperative US, and facilitative for an intraoperative pancreatography. The additional benefit of this technique is that the identification of the anatomical relationship between the cystic lesions and main pancreatic duct can be confirmed not only by a radiological image, but also by a direct palpation. In addition, we used radiopaque marker filament for encircling the communicating pancreatic duct with intraoperative pancreatography prior to the removal of the uncinate process. These surgical inventions for pancreatic duct-navigation surgery enable us to prevent the injury to the main pancreatic duct, and to dissect at the optimal cutting point of the targeting pancreatic branch duct.

In conclusion, the resection of the uncinate process together with the distal pancreas, so called combined pancreatic resection, is the most ideal, least invasive pancreatic resection

for a branch-type IPMN of the uncinate process concomitant with ductal carcinoma of the body of the pancreas. Pancreatic duct-navigation surgery is an improved technique that allows the surgeon to more accurately determine the precise location and correlation of tumors and pancreatic ducts.

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FIGURE LEGENDS

Figure 1. Endoscopic retrograde pancreatography showed a cystic lesion communicating with the main pancreatic duct (arrow head), and stenosis of the main pancreatic duct in the body of the pancreas (arrow).

Figure 2. A catheter for pancreatography was inserted into the main pancreatic duct.

Figure 3. The catheter in the main pancreatic duct was clearly and easily detected by intraoperative ultrasonography (arrows).

Figure 4. At the final step of subsequent pancreatic parenchymal transection, communicating pancreatic duct is fully exposed and encircled with radiopaque marker filament (arrow).

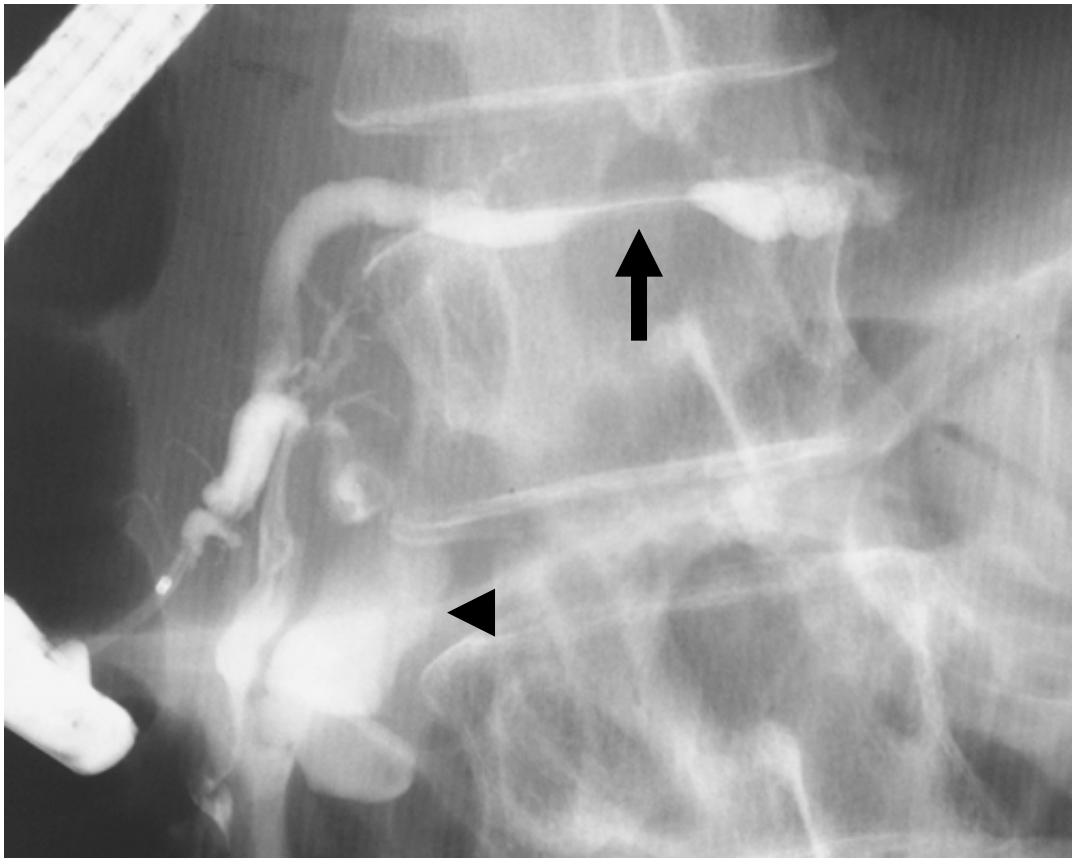

Fig. 1
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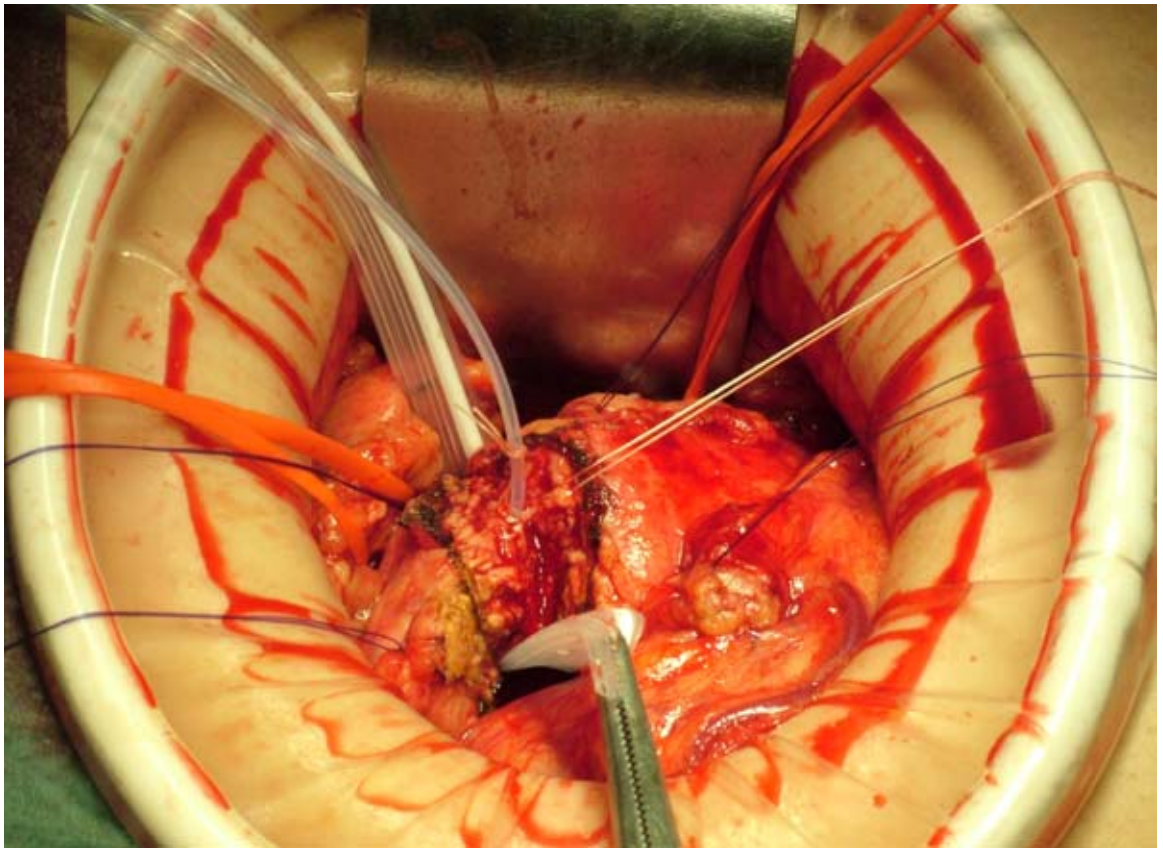

Fig. 2
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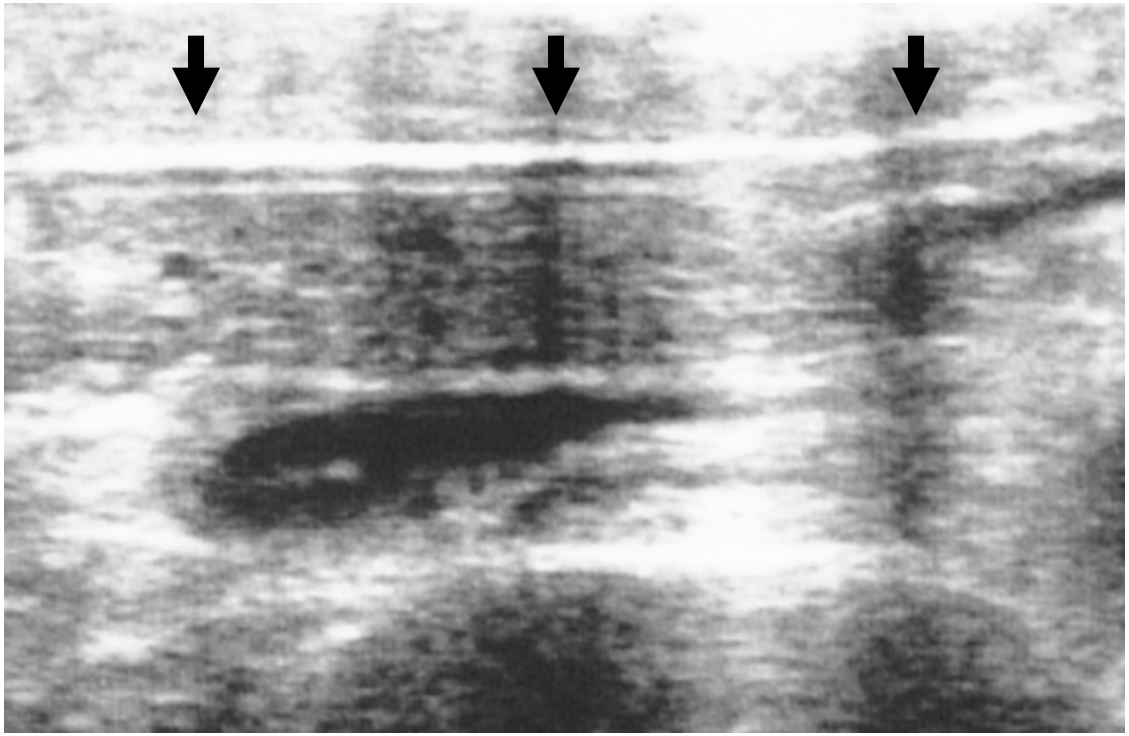

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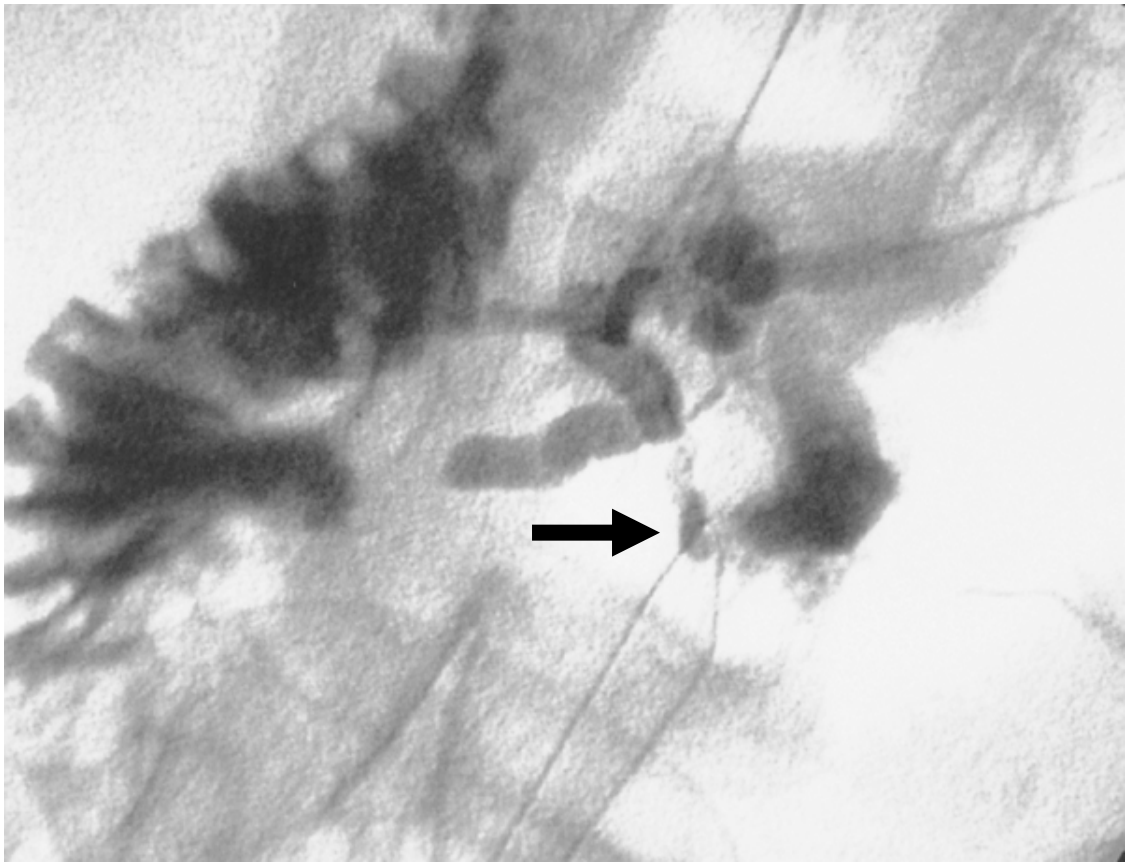

Fig. 4
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