

Successful Laparoscopic Pancreaticoduodenectomy for Intraductal Papillary Mucinous Neoplasm: A Case Report and a Reliable Technique for Pancreaticojejunostomy

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Abstract

Like other forms of laparoscopic surgery, laparoscopic pancreaticoduodenectomy (Lap-PD) is a minimally invasive procedure that can greatly reduce bleeding during surgery. We performed Lap-PD for a case of intraductal papillary mucinous neoplasm. To remove the resected tissue from the body, we made a small incision directly above the line of transection of the distal pancreas (the cut stump). This procedure requires complex reconstructive procedures, which we performed through the same small incision. All reconstructive procedures, except for hepaticojejunostomy, were performed under direct visualization; hepaticojejunostomy was performed laparoscopically. The reconstructive surgery was effective and was as safe as open abdominal surgery. We also discuss the value of using an endoscopic linear stapler for Lap-PD pancreatic transection, to reduce extravasation of pancreatic fluid into the abdominal cavity during the resection of tumors involving the pancreatic ducts, such as intraductal papillary mucinous neoplasm.

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Key words: pancreaticoduodenectomy, laparoscopic surgery, pancreatic transection, reconstruction, intraductal papillary mucinous neoplasm

Introduction

A relatively large number of laparoscopic pancreaticoduodenectomies have recently been reported in Asia, Europe, and North America^{1,2}. Reports indicate that, like other forms of laparoscopic surgery, laparoscopic pancreaticoduodenectomy (Lap-PD) minimizes intraoperative bleeding¹⁻³. This technique thus

appears to be a useful form of minimally invasive surgery.

However, pancreaticoduodenectomy requires a minimum of 3 reconstructive procedures (pancreaticojejunostomy, hepaticojejunostomy, and gastrojejunostomy). The possible postoperative complication of pancreatic fistula is a real concern when any anastomosis is performed between the pancreas and gastrointestinal tract. The possibility of pancreatic fistula makes Lap-PD both technically

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and psychologically challenging for the surgeon.

In addition, intraoperative time is longer for Lap-PD than for open pancreaticoduodenectomy (open-PD). This difference is of particular concern in cases of neoplastic lesions that affect the pancreatic duct, because tumor cells from the neoplastic lesion may be present in the pancreatic fluid within the pancreatic duct and may leak into the abdominal cavity during surgical resection.

In this article we will discuss the usefulness of endoscopic linear staplers in pancreatic transection during Lap-PD procedures for intraductal papillary mucinous neoplasms (IPMNs) and will describe our procedures for reconstruction.

Case

The patient was a 62-year-old Japanese man 172 cm tall and weighing 56.6 kg (body mass index, 19.1 kg/m³). The patient had been treated for 10 years with insulin for diabetes. The family medical history was unremarkable. There was no history of alcohol or tobacco use.

Six months before diagnosis, the patient began to have irregular episodes of upper abdominal pain and back pain. The pain resolved without treatment but began to recur with increasing frequency. The patient was seen by a physician, who detected a cystic lesion at the head of the pancreas and referred the patient to our department. Imaging studies showed a cystic lesion with a maximum diameter of 3.6 cm in the head of the pancreas. In the head of the pancreas the main pancreatic duct was noted to be slightly and abnormally dilated and to communicate with the cyst through the branching pancreatic duct (**Fig. 1**). No mural nodules were detected within the cyst. No other disease was noted within the abdominal cavity. Symptomatic IPMN was diagnosed, and Lap-PD surgery was scheduled.

Surgical Procedures

The patient was immobilized in a supine position with the lower limbs apart. The scopist stood between the patient's lower limbs, and the surgeon

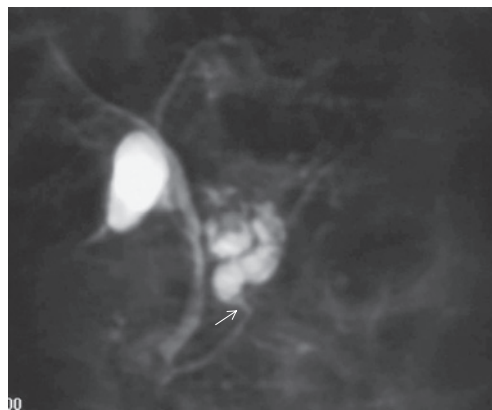


Fig. 1 Magnetic resonance cholangiopancreatography showed a cystic lesion, maximum diameter 3.6 cm, in the head of the pancreas. In the head of the pancreas the main pancreatic duct was noted to be slightly and abnormally dilated and to communicate with the cyst through the branching pancreatic duct (**arrow**).

moved to the patient's left or right side as needed. Laparoscopy was performed with a flexible scope, with pneumoperitoneal pressure set at 7 to 10 mm Hg. **Figure 2** shows postoperative wounds and trocar placement.

All resection procedures including regional lymphadenectomy were performed laparoscopically. The posterior surface of the pancreas was detached from the superior mesenteric vein, the portal vein, the common hepatic artery, and the splenic vessels, from the neck of the pancreas to approximately 3 cm to the left of the planned cut line of the pancreas (tunneling). For pancreatic transection, we used an endoscopic linear stapler to stop extravasation of pancreatic juice from within the pancreatic duct and to prevent bleeding from the pancreatic parenchyma. Immediately after pancreatic transection, pneumoperitoneum was discontinued. A small incision (4 cm) was made directly above the cut stump of the distal pancreas, and a wound protector was positioned over the incision. Stay sutures were placed, with 1 needle used for each side of the resected stump. The sutures were then pulled upwards, and the pancreatic stump was easily pulled through the incision (**Fig. 3a**). The staples in the main pancreatic duct were removed with mosquito Péan forceps, and the cut portion of the

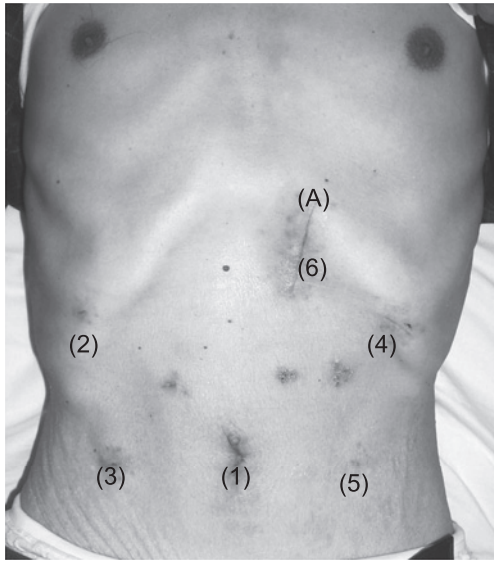


Fig. 2 Trocar placement and postoperative wounds. The open method was used. A umbilical trocar (12 to 15 mm) was used to insert the laparoscope and the automatic stapler (1). On the right side, a 5-mm trocar was inserted below the right costal arch between the clavicular midline and the anterior axillary line (2), and a 12-mm trocar was inserted at the height of the umbilicus (3). On the left side, a 12-mm trocar was placed below the left costal arch on the clavicular midline (4), and a 5-mm trocar was positioned at the height of the umbilicus (5). The resected tissue was removed through a 4-cm incision directly above the stump of the distal pancreas (A). This incision was also used for anastomosis of the pancreas, stomach, and small intestine. The incision was shifted to the left of the upper abdominal median line in order to place it directly over the distal pancreatic stump. Hepaticojejunostomy was performed entirely with the laparoscope. The 12-mm trocar (6) in incision (A) was attached to a glove that covered the incision. That trocar (6) was used for liver retraction and hepaticojejunostomy.

main pancreatic duct was opened (**Fig. 3b**). A drainage tube for pancreatic juice was placed in the main pancreatic duct and positioned so that the pancreatic juice would drain outside the body (**Fig. 3c**). The other end of the tube was passed through a glove to the outside of the body. With this glove method, pneumoperitoneum was restarted. Subsequent resection procedures were performed entirely with a laparoscope.

For reconstruction, anastomosis was performed in the following sequence with the Child method: hepaticojejunostomy, pancreaticojejunostomy, and gastrojejunostomy with Braun anastomosis. The

pancreaticojejunostomy, gastrojejunostomy, and Braun anastomosis were performed under direct visualization through the small incision above the distal pancreatic stump. The hepaticojejunostomy was performed laparoscopically.

For pancreaticojejunostomy and gastrojejunostomy, the surgeon stood on the patient's right side and used the small incisions that had previously been used for tissue removal. Pancreaticojejunostomy was performed with the Kakita method, just as for open PD⁴. A curved 3-0 polygalactin needle was used to place interrupted sutures for end-to-side anastomosis. We were able to pull the pancreatic stump to the small opening (**Fig. 3a, b**). Thus, suturing of the pancreas, including direct anastomosis between the jejunal wall and the pancreatic duct, was performed under direct visualization (**Fig. 3c**). Sutures were tied directly with the fingers, which allowed the surgeon to proceed with increased confidence.

For gastrojejunostomy with Braun anastomosis, we used the same incision. The stomach and jejunum were drawn outside the body, and an endoscopic linear stapler was used for anastomosis under direct visualization.

Operating time was 557 minutes, and intraoperative blood loss was 50 mL.

Histopathologic Examination

Epithelial findings of papillary proliferation with atypia were noted in the cystic wall, branching pancreatic duct, and the main pancreatic duct (**Fig. 4**). These findings were diagnosed as dysplasia, rather than as cancer.

Postoperative Clinical Course

The patient began walking on postoperative day 2. First passage of gas was noted on postoperative day 3, and oral food intake was started. Laboratory studies showed that the level of C-reactive protein peaked at 7.4 mg/dL (normal <0.3 mg/dL) on postoperative day 3. Discharge was delayed because of an earthquake, so the patient remained in the hospital for 33 days after surgery. However, no

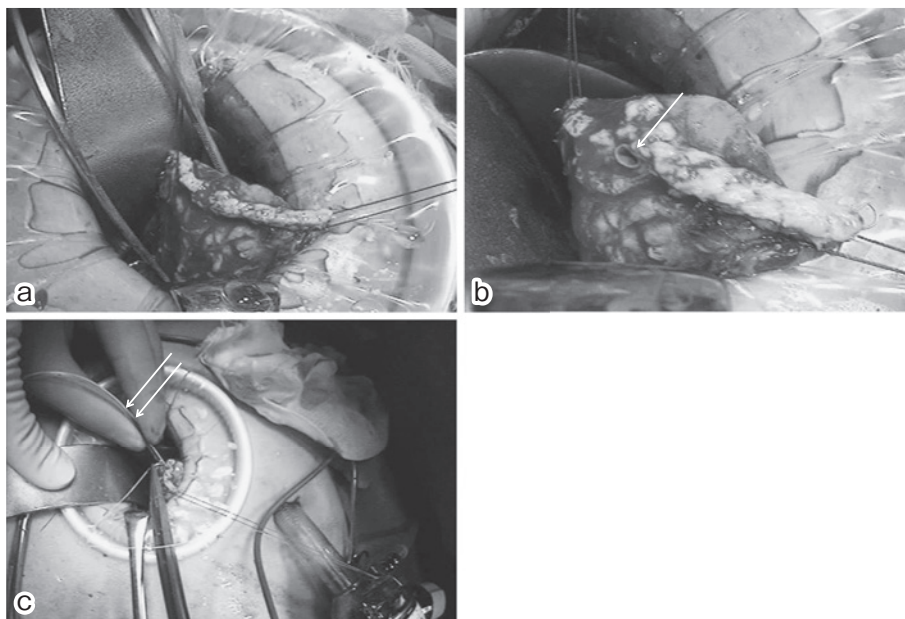


Fig. 3 An endoscopic linear stapler was used for pancreatic transection to stop the extravasation of pancreatic juice from within the pancreatic duct and to prevent bleeding from the pancreatic parenchyma. Immediately after pancreatic transection, pneumoperitoneum was discontinued. A small incision (4 cm) was made directly above the cut, and the incision was covered with a wound protector. Stay sutures were placed, with 1 needle used for each side of the cut stump. The sutures were then pulled upwards, and the stump was easily removed through the incision (a). The staples in the main pancreatic duct were removed with mosquito Péan forceps, and the cut portion of the main pancreatic duct (**arrow**) was opened (b). A drainage tube for pancreatic juice (**paired arrows**) was placed in the main pancreatic duct and connected so that the pancreatic juice would drain outside the body (c). The pancreas was sutured under direct visualization, as in traditional open pancreaticoduodenectomy (c).

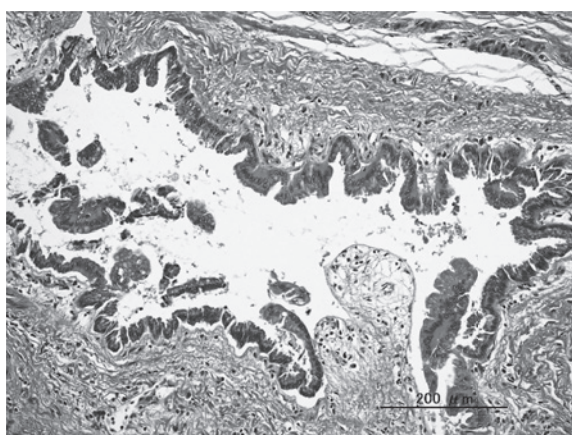


Fig. 4 The main pancreatic duct showed papillary proliferation with atypia (hematoxylin-eosin stain, $\times 200$).

complications, including complications of pancreatic fistula, were noted.

Discussion

Lap-PD ordinarily requires a relatively large surgical incision to permit the removal of the resected tissue. Our Lap-PD technique is characterized by a small incision (4 to 5 centimeters). This small incision is feasible because the incision for removal of resected tissue is positioned directly over the distal pancreatic cut. Following resection, anastomosis between the pancreas and gastrointestinal tract can be performed by direct visualization through the same incision³. Although the pancreas is a retroperitoneal organ, the neck and body of the pancreas lie in front of the spinal column. They are thus displaced forward, close to the abdominal wall. As a result, the drainage tube

for pancreatic juice can be inserted into the pancreatic duct through a small incision, and suturing and ligation for pancreaticojejunostomy can be performed under direct visualization through the small incision. This enables the surgeon to perform anastomosis with as much confidence as in open PD. In contrast, the common hepatic duct is located in the right hypophrenium and is generally some distance from the abdominal wall. Direct visualization is problematic, because a small incision cannot provide a satisfactory field of view for anastomosis. We thus use a laparoscope for hepaticojejunostomy.

Because few reports are available on long-term prognoses after Lap-PD, to date we have used this procedure only for lower bile duct carcinoma and cancer of the duodenal papilla having a TNM classification of T2 or below and for benign to low-malignant tumors in the pancreatic head³. Noninvasive IPMN can be classified as a low-malignant pancreatic tumor and as a suitable indication for Lap-PD. However, a definitive differential diagnosis between adenoma and cancer may be difficult to achieve before or during surgery⁵. Careful and deliberate surgical technique is thus required because cancer cells may be present in any pancreatic tumor. Because the IPMN tumor lies within the pancreatic duct, if the tumor cells become cancerous, then cancer cells can be found floating freely in the pancreatic juice within the pancreatic duct even in the case of noninvasive intraductal papillary mucinous carcinoma⁶. Cases of pseudomyxoma peritonei have been reported after IPMN surgery, suggesting that mucosal fluid containing tumor cells may have leaked into the abdominal cavity during surgery^{7,8}. In pancreaticoduodenectomy, pancreatic juice can leak into the abdominal cavity from the time of the first cut into the pancreas until all resected tissue is

removed and anastomosis of the pancreas and gastrointestinal tract is completed. We used an endoscopic linear stapler to cut the pancreas and closed the pancreatic stump to prevent extravasation of mucosal fluid from within the pancreatic duct into the abdominal cavity during subsequent surgical procedures. The endoscopic linear stapler was also available to reduce bleeding from the pancreatic stump.

References

1. Palanivelu C, Jani K, Senthilnathan P, Parthasarathi R, Rajapandian S, Madhankumar MV: Laparoscopic pancreaticoduodenectomy: technique and outcomes. *J Am Coll Surg* 2007; 205: 222-230.
2. Kendrick ML, Cusati D: Total laparoscopic pancreaticoduodenectomy. *Arch Surg* 2010; 145: 19-23.
3. Nakamura Y, Uchida E, Nomura T, Aimoto T, Matsumoto S, Tajiri T: Laparoscopic pancreatic resection: some benefits of evolving surgical techniques. *J Hepatobiliary Pancreat Surg* 2009; 16: 741-748.
4. Kakita A, Yoshida M, Takahashi T: History of pancreaticojejunostomy in pancreaticoduodenectomy: development of a more reliable anastomosis technique. *J Hepatobiliary Pancreat Surg* 2001; 8: 230-237.
5. Cone MM, Rea JD, Diggs BS, Douthit MA, Billingsley KG, Sheppard BC: Predicting malignant intraductal papillary mucinous neoplasm: a single-center review. *Am J Surg* 2011; 201: 575-579.
6. Shimizu M, Hirokawa M, Manabe T, et al: Cytologic findings in noninvasive intraductal papillary-mucinous carcinoma of the pancreas. *Acta Cytol* 1999; 43: 243-246.
7. Zanelli M, Casadei R, Santini D, et al: Pseudomyxoma peritonei associated with intraductal papillary-mucinous neoplasm of the pancreas. *Pancreas* 1998; 17: 100-102.
8. Kato K, Inoue S, Sugimoto H, et al: A case of Pseudomyxoma peritonei associated with intraductal papillary-mucinous neoplasm of the pancreas. *Jpn J Gastroenterol Surg* 2007; 40: 1822-1827 (Japanese literature with English abstract).

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