—Report on Experiments and Clinical Cases—

A Safe Technique for Laparoscopic Distal Pancreatectomy Involving a Large Cystic Tumor

Yoshiharu Nakamura, Satoshi Matsumoto, Takashi Tajiri and Eiji Uchida

Surgery for Organ Function and Biological Regulation, Graduate School of Medicine, Nippon Medical School

Abstract

Background: In patients with large tumors, securing sufficient working space to perform laparoscopic resection can be difficult. The purpose of this technical note is to describe a technique for easy performance of laparoscopic distal pancreatectomy involving large cystic pancreatic tumors.

Surgical Technique: Early in surgery, a small incision was made in the abdominal wall directly above the tumor to remove the laparoscopically resected tissues from the abdominal cavity. After the margin of the incision was secured with a wound protector, a double-balloon catheter was used to remove the contents of the tumor under direct observation, without allowing any leakage into the abdominal cavity. The volume of the tumor could, thus, be safely reduced. As a result, laparoscopic distal pancreatectomy was safely performed, even for 17-cm-diameter mucinous cystic neoplasm of the pancreas.

Conclusion: A wound protector and a double-balloon catheter are helpful for removing the contents of a cystic tumor. A small abdominal incision for removing the resected tissues can be used during the resection procedure to aspirate the tumor contents, and, as a result, laparoscopic distal pancreatectomy can be performed safely, even for large cystic pancreatic tumors.

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Key words: laparoscopic distal pancreatectomy, large cystic tumor, mucinous cystic neoplasm, pancreas, laparoscopic surgery

Introduction

The safety, usefulness, and economy of laparoscopic distal pancreatectomy have recently been validated, and this technique is now being extensively applied worldwide[1–5]. Pancreatic mucinous cystic neoplasms commonly develop in young women, and, for these patients, laparoscopic distal pancreatectomy has considerable cosmetic benefits. However, for tumors with a diameter greater than 10 cm, securing sufficient working space to perform laparoscopic resection can be difficult. Here, we describe our successful modification of the laparoscopic distal pancreatectomy technique as applied to a patient with a 17-cm-diameter mucinous cystic neoplasm of the pancreas. We used a double-balloon catheter to safely aspirate the contents of the tumor through a 4-cm-long incision in the abdominal wall, without allowing any leakage into the abdominal cavity. This aspiration reduced the volume of the tumor and

Correspondence to Yoshiharu Nakamura, Department of Surgery, Nippon Medical School, 1–1–5 Sendagi, Bunkyo-ku, Tokyo 113–8603, Japan
E-mail: keishun@nms.ac.jp
Journal Website (http://www.nms.ac.jp/jnms/)

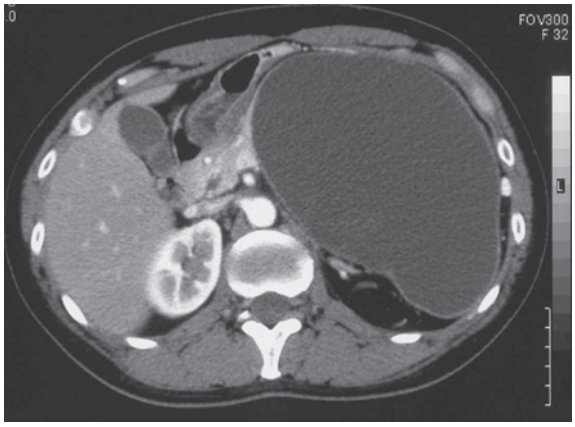

Fig. 1 Computed tomography revealed a 17-cm-diameter cystic tumor that occupied almost the entire distal portion of the pancreas. No nodular lesion was observed in the cyst, and the tumor was diagnosed as a mucinous cystic neoplasm of the pancreas.

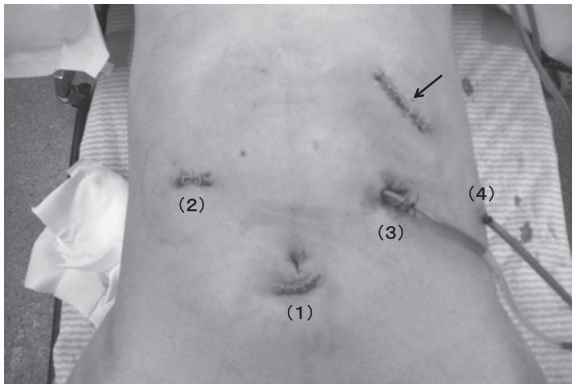

Fig. 2 The patient was immobilized in the supine position. Trocars were inserted at a 4 sites: (1) below the umbilicus (15 mm), (2) on the right mammillary line, 8 cm caudal to the xiphoid process (12 mm), (3) the mirror image of (2) on the left (12 mm), and (4) on the anterior axillary line below the costal margin (12 mm). During surgery, a 4-cm incision was made in the abdominal wall, below the left costal margin (**arrow**) and immediately above the tumor, through which the tumor contents were aspirated under direct observation.

created adequate working space to resect the tumor laparoscopically.

Case Report

The patient was a 37-year-old Japanese woman. She was 169.7 cm tall, weighed 61.5 kg, and had a body mass index of 21.4 kg/m^2. Her personal and family medical histories were unremarkable. She had no history of alcohol or tobacco use. She was not, and had never been, pregnant.

An examination performed 6 months before the patient's visit to our hospital had revealed the presence of an intra-abdominal tumor. Another hospital had recommended that the tumor be resected via laparotomy, but the patient refused because of the large scar laparotomy would leave. She expressed a desire for the resection to be performed via laparoscopy and was referred our hospital.

Imaging studies revealed that a 17-cm-diameter cystic tumor occupied almost the entire distal portion of the pancreas **(Fig. 1)** and that the spleen was enlarged. No nodular lesion was observed in the cyst, and the tumor was diagnosed as a mucinous cystic neoplasm.

We explained to the patient the absolute necessity of making an abdominal incision to remove the tumor from the abdominal cavity, and a surgical plan for laparoscopic distal pancreatectomy with splenectomy was drawn up.

Intraoperative Findings

The patient was placed in the supine position, and 4 trocars—1 with a diameter of 15 mm and 3 with a diameter of 12 mm—were inserted at the positions shown in **Figure 2**. The abdominal air pressure was set at 8 mm Hg.

The left upper quadrant of the abdomen was occupied by the pancreas, which was greatly enlarged owing to the tumor **(Fig. 3a)**. The pancreatic neck, which had not been infiltrated by the tumor, was dissected free of the surrounding tissue and transected with an endoscopic linear stapler. Then, while the cut end of the pancreas on the resected side was grasped and pulled upward and forward, the splenic artery and, then, the splenic vein were divided.

The distal pancreas, which was occupied by the tumor, was detached from the medial to lateral, and it was confirmed that adequate working space could not be obtained through simple ablation of the tumor volume **(Fig. 3b)**. Accordingly, a 4-cm incision was made in the abdominal wall below the left costal

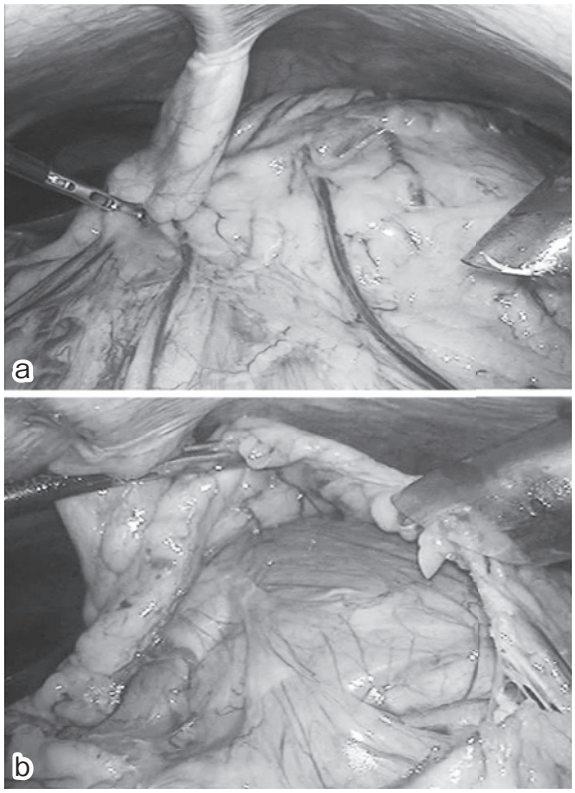

Fig. 3 **a**: The left upper quadrant of the abdomen was occupied by the pancreas, which was greatly enlarged owing to the tumor.
b: The distal pancreas, which was occupied by the tumor, was detached from the medial to the lateral, and it was confirmed that adequate working space could not be obtained through simple ablation of the tumor volume.

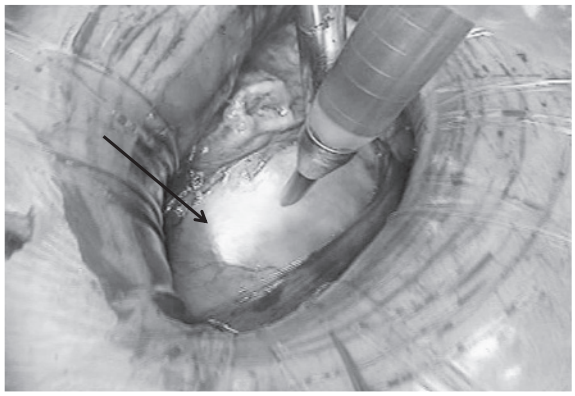

Fig. 4 A 4-cm incision was made in the abdominal wall below the left costal margin, and the tumor **(arrow)** was exposed immediately below.

margin and immediately above the tumor **(Fig. 2)**, pneumoperitoneum was ceased, and when a wound protector was attached to the incision site, the tumor was exposed immediately below **(Fig. 4)**. A double-balloon catheter (S.A.N.D. balloon catheter; Hakko Shoji Co., Ltd., Tokyo Japan) was used to remove the contents of the tumor **(Fig. 5a, b)**. This catheter has 2 balloons, and after the catheter is inserted into a tumor, the cyst wall can be sandwiched between the outer and inner balloons[6]. Before insertion, the outer balloon was inflated with 10 cc of air. The inflated outer balloon was then passed through the small incision in the abdominal wall and inserted into the tumor, and the balloon was adhered to the tumor wall. Then, at the same time as insertion, the inner balloon was inflated with 10 cc of air while the contents of the tumor was aspirated, and the tumor wall was sandwiched between the outer and inner balloons **(Fig. 5a)**. Because the balloons are transparent, it was possible to confirm—throughout the procedure—that none of the tumor contents had leaked from the puncture site into the abdominal cavity. Aspiration of the tumor contents released the tension in the cyst wall, and the puncture site of the tumor gradually protruded outside the body through the abdominal incision **(Fig. 5b)**. In this way, 1,000 mL of tumor contents was removed, the air was released from the balloons while the tumor wall was grasped with forceps, and the catheter was retracted. The puncture site of the tumor was sutured outside the body under direct observation **(Fig. 5c)**, and then the tumor was returned to the abdominal cavity. The wound protector was attached with a glove (glove method), and the laparoscopic procedure was then continued. The tumor, distal pancreas, and spleen were separated. Because the contents of the tumor had been aspirated, separation was possible through opening the operative field as in conventional laparoscopic distal pancreatectomy **(Fig. 6)**.

The resected tissues were placed in a surgical bag, which was then removed from the body through the small abdominal incision, to which the wound protector had been attached. At that time, the spleen was crushed inside the bag.

The abdominal cavity was rinsed with physiological saline, and then a closed drain was placed near the cut end of the pancreas.

The duration of the operation was 400 minutes,

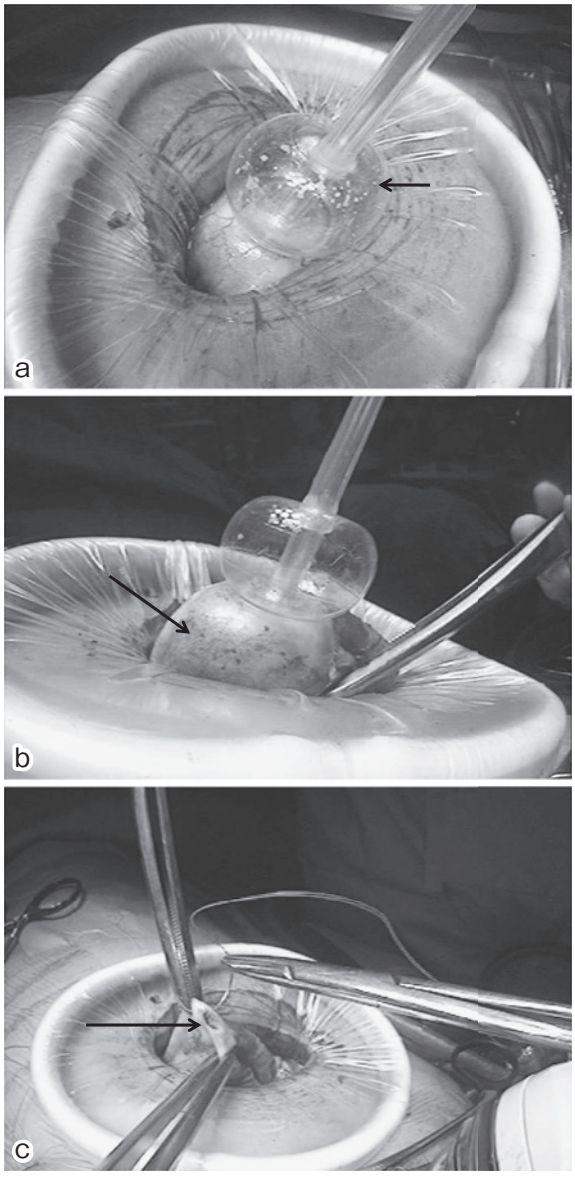

Fig. 5 **a**: The inflated outer balloon **(arrow)** was then passed through the small incision in the abdominal wall and inserted into the tumor, and the balloon was adhered to the tumor wall. At the same time, the inner balloon was inflated with 10 cc of air while the contents of the tumor were aspirated and the tumor wall was sandwiched between the outer and inner balloons.
b: Aspiration of the tumor contents released tension in the cyst wall **(arrow)**, and the puncture site in the tumor gradually protruded outside the body through the abdominal incision.
c: The puncture site **(arrow)** in the tumor was sutured outside the body, under direct observation, and then the tumor was returned to the abdominal cavity.

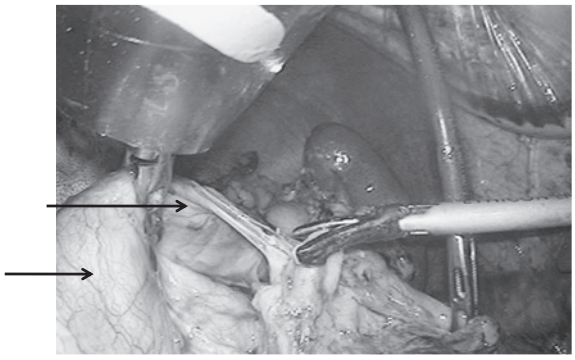

Fig. 6 Because the tumor contents had been removed, the tumor, distal pancreas **(arrows)**, and spleen could be separated by opening the operative field as in conventional laparoscopic distal pancreatectomy.

and blood loss was 280 mL.

Postoperative Course

The patient passed gas on postoperative day 2. According to the classification of the International Study Group of Pancreatic Fistula, a grade A pancreatic fistula developed after surgery but responded to conservative treatment; the patient was discharged on postoperative day 14. The final pathological diagnosis of the tumor was mucinous cyst adenoma of the pancreas. As of this writing, 38 months since the operation, the patient is in good health, with no late complications, such as diabetes mellitus or abdominal incisional hernia.

Discussion

In laparoscopic surgery, the resected organs and tissues must always be removed from the abdominal cavity. To remove giant tumors, such as that in the present patient, an additional incision of about 4 cm must be made in the abdominal wall, even if the contents of the tumor has been aspirated, and the spleen has been crushed. If the incision is made early in the surgery, it can thereafter be efficiently used for various purposes during the resection procedure. We applied this approach to the laparoscopic pancreaticoduodenectomy technique that we reported previously[5]. The key point is that the incision should be made where it can be most effectively used. In the present case, we selected a site where the tumor was closest to the abdominal

wall, because our objective was to directly puncture the tumor and extract its contents. As a result, we were able to use the incision to maximal effect during the surgery. We also note that, in laparoscopic pancreaticoduodenectomy, an incision directly above the resected end of the pancreas is extremely useful, because the pancreaticojejunal anastomosis, including duct-mucosa anastomosis, can then be performed via the incision under direct observation[5].

Mucinous cystic neoplasms have high malignant potential[7]. However, before surgery, determining whether a tumor is benign or malignant is difficult. Accordingly, when removing the contents of the cyst at the time of resection, extreme care must be taken so that no material leaks into the abdominal cavity. Here, we used a double-balloon catheter to puncture the tumor. In previous reports this device has been used to remove the contents of ovarian cysts[6]. The outer and inner balloons attached to the needle can sandwich the cyst wall and prevent the tumor contents from leaking during puncture. This feature is an important attribute of the double-balloon catheter.

An important advantage of laparoscopic surgery is that delicate surgical procedures are possible because of the greatly magnified visual field. However, because laparoscopic surgery is performed in the closed space of the abdominal cavity, its application can be limited by the volume of the organ or tumor to be removed. As in the present patient, some pancreatic tumors are giant mucinous tumors, and, because of their size, the surgeon might choose laparotomy over laparoscopy. One method for overcoming this problem is to remove the contents of the tumor, thereby reducing its volume. However, this method is dangerous because laparoscopic puncture and drainage of a tumor can cause the tumor contents to leak into the abdominal cavity and, if the tumor is malignant, can cause malignant tumor cells to disseminate. In the method we have described here, we secure the small abdominal incision with a wound protector, which allows the tumor contents to be aspirated under direct observation. During aspiration, the site of tumor puncture protrudes outside the patient's body. For these reasons, we believe this technique is extremely safe because it prevents both dissemination of tumor cells into the abdominal cavity and their implantation in the margins of the incision.

Conclusion

A wound protector and a double-balloon catheter are useful for removing the contents of a cystic tumor. A small abdominal incision for removing the resected tissues can be used during the resection procedure to aspirate the tumor contents, and, as a result, laparoscopic distal pancreatectomy can be safely performed, even for large cystic pancreatic tumors.

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