

TECHNIQUES

**Pancreas-hanging maneuver in laparoscopic
pancreaticoduodenectomy: A new technique for the safe resection
of the pancreas head**

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Running title: Pancreas-hanging maneuver in laparoscopic PD.

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Abstract

Laparoscopic pancreaticoduodenectomy (PD) is challenging, and the performance of successful laparoscopic PD has been limited. The dissection of the pancreatic head from the right aspect of the portal vein and the superior mesenteric artery is one of the most difficult procedures in laparoscopic PD. For the safe dissection of the pancreatic head during laparoscopic PD, we developed a novel “pancreas-hanging maneuver” technique. This new surgical procedure can provide good tension and an appropriate laparoscopic view with a suitable surgical field for safely dissecting the pancreas head from the major mesenteric vessels during laparoscopic PD.

Key words

Laparoscopic PD, pancreas-hanging maneuver, new technique, Penrose drain.

Introduction

Although laparoscopic pancreatic surgery has been commonly applied to selected surgical procedures such as enucleation and distal pancreatectomy, recent improvements in surgical devices used in laparoscopic surgery have allowed surgeons to approach the pancreas laparoscopically. However, the number of successful cases of laparoscopic pancreaticoduodenectomy (PD) has been limited. In 1994, Gagner et al. [1] described the first report of laparoscopic PD. Palanivelu et al. [2] reported the application of laparoscopic PD for 42 patients for various indications, including ampullary carcinoma, pancreatic head adenocarcinoma, and cholangiocarcinoma. Laparoscopic PD is a technically challenging operation that must be performed by expert laparoscopic surgeons and requires an advanced degree of laparoscopic skills. The dissection of the uncinate process of the pancreas from the right aspect of the portal vein (PV) and the neural plexuses of the superior mesenteric artery (SMA) is one of the most difficult procedures in laparoscopic PD. Herein, we describe a new surgical technique in laparoscopic pancreatic surgery, which we refer to as the "pancreas-hanging maneuver",

for the safe dissection of the uncinate process and the neural plexuses of the pancreas.

Operative technique and patients

The patients were placed in a lithotomy position. Under general anesthesia, the first 12-mm trocar for a laparoscope was inserted at the umbilicus using an open technique, and a pneumoperitoneum was set at 8 mm Hg. Five additional trocars were inserted: two 12-mm trocars level with the right and left midclavicular lines, one 12-mm trocar level with the subxiphoid, and two 5-mm trocars level with the right and left anterior axillary lines. The first step was to expose the head and body of the pancreas by opening the lesser sac. The right gastroepiploic vessels were divided, and the first part of the duodenum was transected with a linear stapler 4 cm distal to the pylorus ring. The edge of the transecting duodenum was grasped and retracted to employ Kocher's maneuver. An upper portion of the jejunum was transected beyond the ligament of Treitz with a linear stapler, and the proximal jejunum with the fourth part of the duodenum was delivered posterior to the SMA and the superior mesenteric vein (SMV) from left to right. A tunnel was developed between the SMV and the pancreas. The pancreatic parenchyma was transected anterior to the PV using ultrasonic shears. The gastroduodenal artery and the right gastric

artery were divided. The common hepatic duct was transected just above the entrance of the cystic duct with a linear stapler following the removal of the gallbladder. Finally, the specimen including the pancreas head and uncinate process was in a condition to be connected to the neural plexuses and connective tissue of the right lateral aspect of the SMV and SMA. A 6-mm wide Penrose drain was then placed under the pancreas head. The Penrose drain was tightened lightly at the left edge of the pancreas parenchyma; this drain could be grasped by the laparoscopic forceps. Traction on the specimen with the Penrose drain to the right side opened the plane to make the planned isolation line visible with a sufficient laparoscopic view. The uncinate process was then dissected off along the right lateral aspect of the SMV-PV using ultrasonic shears. Next, the neural plexuses connecting to the SMA were transected off of the postero-lateral aspect of the SMA under appropriate traction. The specimen was removed by extending the subxiphoid port site by 5 to 7 cm.

Nine patients underwent this new surgical procedure, the "pancreas-hanging maneuver", between December 2008 and June 2009, during the course of laparoscopic pylorus-preserving PD. The mean

age of the patients was 73 years (range 60 to 85 years). Diagnoses included intraductal papillary mucinous neoplasm (IPMN) of the pancreas (n=5), ampullary carcinoma (n=2), and lower common bile duct carcinoma (n=2). Mean intraoperative blood loss was 642 ml (range 420 to 780 ml).

Discussion

Although laparoscopic PD has been the last area to be developed in the field of operation under laparoscopy, the effort of many surgeons and progress in the surgical techniques and laparoscopic instruments made laparoscopic PD possible in recent years [1-3]. During PD, the main period of intraoperative bleeding occurred during the transection between the pancreatic head and the right aspect of the SMV-PV and SMA. The main reason for the increased intraoperative bleeding from the pancreatic head was venous congestion due to the blood supply from the inferior pancreaticoduodenal artery (IPDA) after ligation of the branches draining the pancreas head and uncinate process into the portal vein. To control the bleeding at the pancreatic head, Horiguchi et al. [4] proposed the PD procedure of ligating the IPDA as the blood supply artery before the removal of the pancreatic head. Using our technique, the "pancreas-hanging maneuver", it was possible to transect the IPDA and neural plexuses in a lump using ultrasonic shears at an early stage of the pancreatic head resection under the appropriate tension and laparoscopic surgical field. In addition, the tightening of the pancreas head using a

Penrose drain prevented the venous bleeding from the pancreatic head, although it remained congested. On the other hand, our technique allowed us to avoid grasping the pancreatic parenchyma directly with laparoscopic instruments and was effective in decreasing the bleeding caused by the disruption of the pancreatic parenchyma. In addition, holding the pancreatic head, including malignant lesions, indirectly may prevent the risk of the dissemination of malignant cells. In conclusion, the pancreas-hanging maneuver can ensure a suitable tension, surgical field and laparoscopic view for the resection of the pancreatic head during PD. Our technique is simple and easy and requires no special surgical instruments. We believe that this surgical procedure is valuable for reducing intraoperative blood loss, and is useful for facilitating a safe laparoscopic PD.

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Figure legends

Fig. 1. Pancreas-hanging maneuver. **A;** Using a Penrose drain to lift the specimen to provide a suitable tension, surgical field and laparoscopic view for the resection of the pancreatic head during the PD. Arrow indicates a PV. **B;** The uncinate process of the pancreas was separated using ultrasonic shears. Arrow indicates a PV.

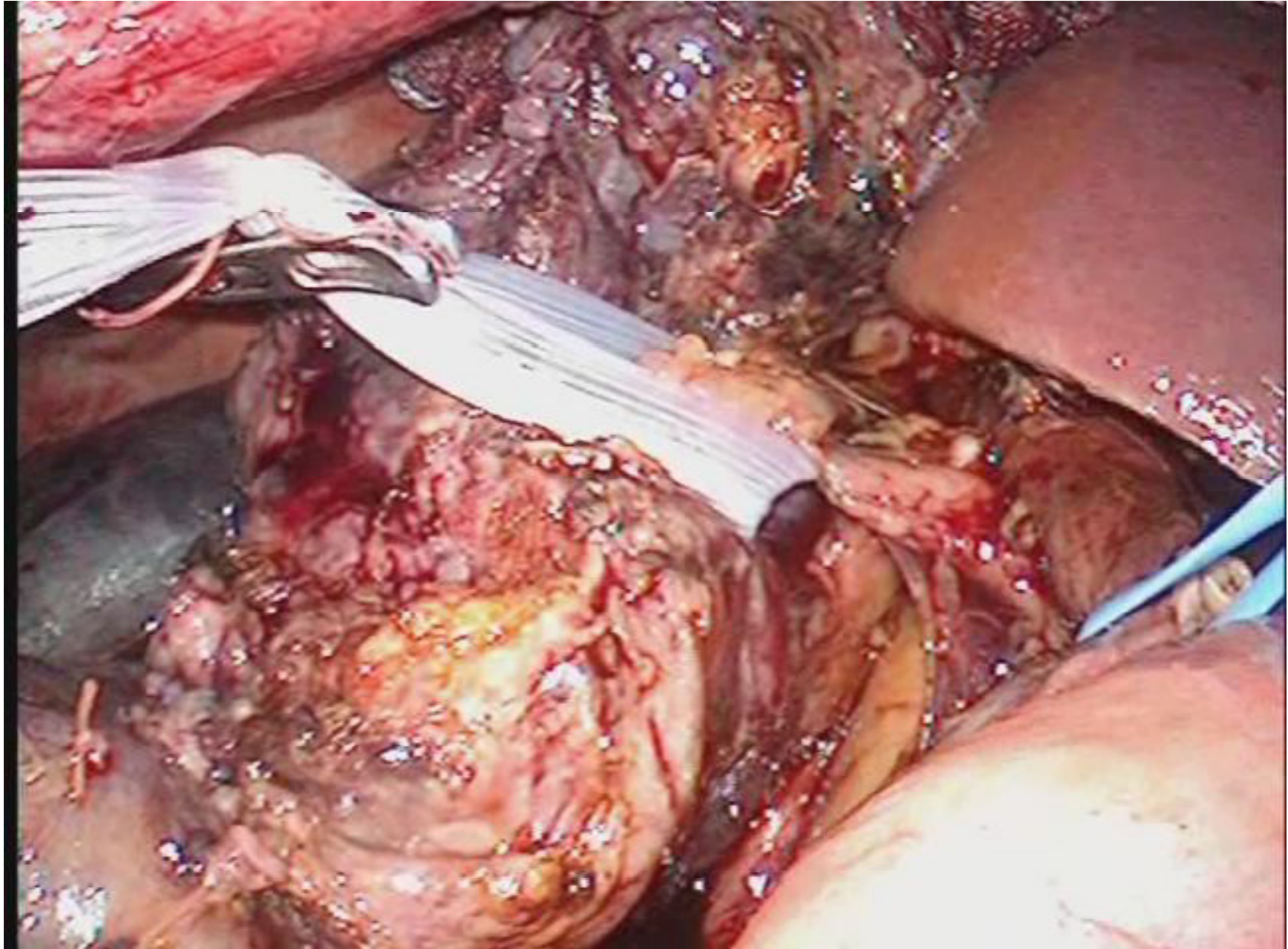


Fig. 1A

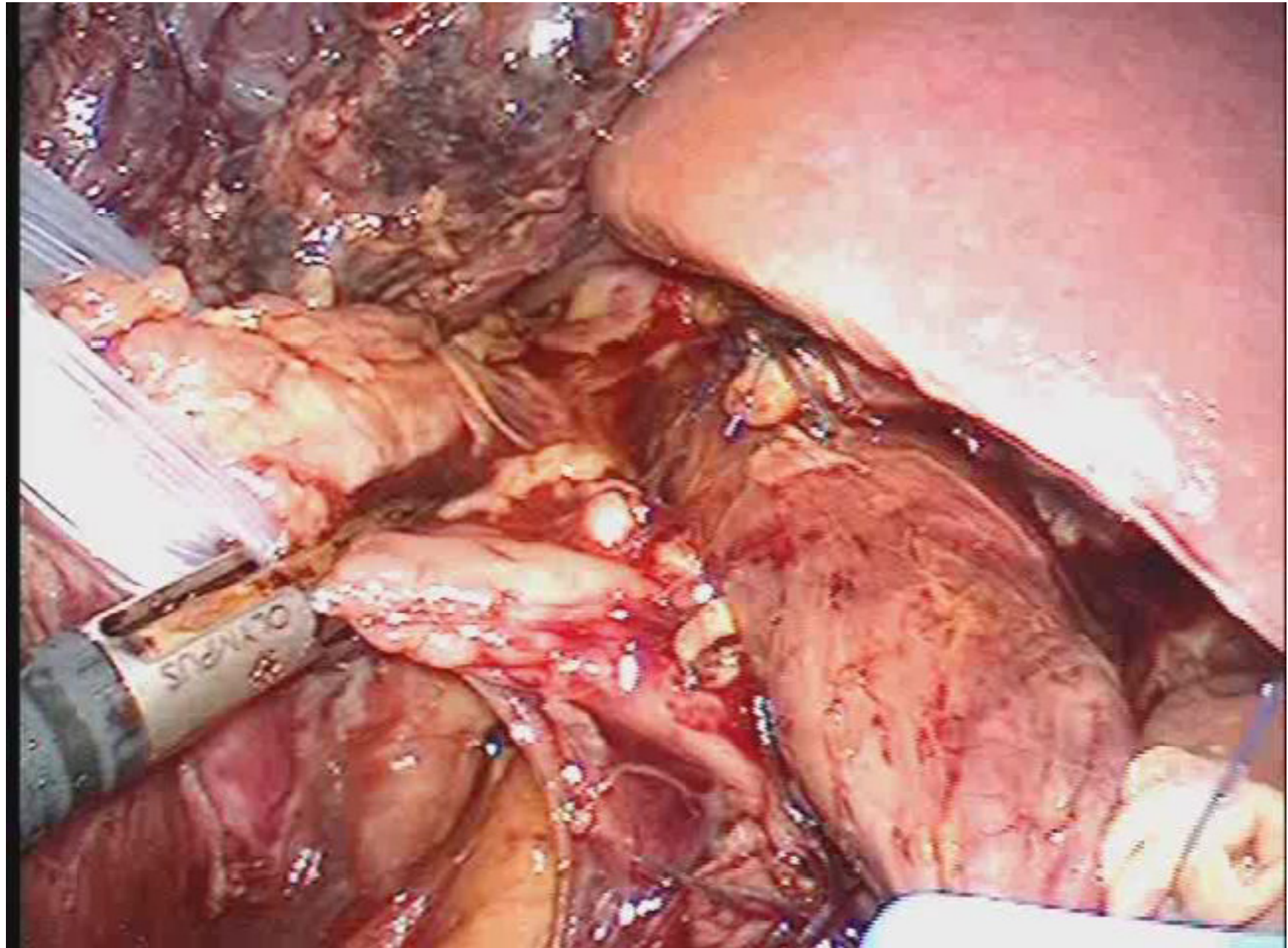


Fig. 1B