First Successful Total Laparoscopic Pancreaticoduodenectomy and Reconstruction in Turkey: Report of a Case and Technical Details

Türkiye'nin Başarılı ve Tamamen Laparoskopik İlk Pankreatikoduodenektomi ve Rekonstrüksiyon Ameliyatı: Vaka Takdimi ve Teknik Detaylar

Mehmet Kaplan

Medical Park Hastanesi, Genel Cerrahi, Gaziantep, Türkiye

ABSTRACT

Although the rapid development in laparoscopic surgery, pancreaticoduodenectomy (PD) is still one of the most discussed and technically demanding surgery performed only at few centers in the world. This report describes a total laparoscopic pylorus-preserving PD for a tumor of ampulla of Vater with a successful outcome, representing the first description of this laparoscopic procedure in Turkey.

The patient was a 58-year-old male patient with the diagnosis of ampullary tumor. The operation was performed with 5 ports. Following resection, all anastomoses were made intracorporeally. A double layer pancreaticogastrostomy, an end-to-side choledocho-jejunostomy, a two layer duodeno-jejunustomy and drain placements completed the operation. The operating time was 510 minutes, and estimated blood loss was 350 ml. Surgical margins were negative and number of retrieved lymph nodes was 14. The patient was discharged on postoperative day 7 without complication.

This case demonstrates that laparoscopic PD is a feasible operative procedure in carefully selected patients. This technique can achieve adequate margins and follow oncological principles. However randomized comparative studies are needed to establish the superiority of minimal invasive surgery over traditional open surgery.

Key Words: Laparoscopic pankreaticoduodenectomy, Whipple procedure, pancreatic neoplasms, duodenal neoplasms, common bile duct, treatment, surgery, laparoscopy

Received: 02.11.2013 **Accepted:** 09.17.2013

ÖZET

Laparoskopik cerrahide görülen hızlı ilerlemeye rağmen, pankreatikoduodenektomi hala en çok tartışılan, teknik yönden oldukça güç ve dünyada sadece bir kaç merkezde yapılabilen ameliyatlardan biridir. Bu makalede Türkiye'de ilk defa ampulla Vateri tümörü nedeniyle pilor koruyucu ve tamamen laparoskopik yapılan başarılı bir pankreatikodu-odenektomi ameliyatı tarif edilmektedir.

Hasta ampulla vateri tanısı alan 58 yaşında bir erkekti. Ameliyatta toplam 5 port kullanıldı. Rezeksiyon sonrası tüm anastomozlar intrakorporeal olarak gerçekleştirildi. Çift tabaka pankreatikogastrostomi, uç yan koledokojejunostomi, çif tabaka duodenojejnostomi ve dren yerleştirilmesiyle ameliyat tamamlandı. Ameliyat süresi 510 dakika, hesaplanan kan kaybı 350 ml idi. Cerrahi sınırlar negatif ve çıkarılan lenf nodu sayısı 14 idi. Hasta komplikasyon yaşanmadan postoperatif 6. günde taburcu edildi.

Bu vaka, dikkatle seçilmiş hastalarda laparoskopik pankreatikoduodenektominin yapılabileceğini, ameliyat tekniğinin onkolojik prensiplere uygun ve cerrahi sınırların yeterli olduğunu göstermektedir. Ancak, klasik açık cerrahiye göre minimal invazif cerahinin üstün olduğunu kanıtlamak için randomize ve karşılaştırmalı çalışmalara ihtiyaç vardır.

Anahtar Sözcükler: Laparoskopik pankreatikoduodenektomi, Whipple prosedürü, pankreatik neoplaziler, duodenal neoplaziler, koledok, tedavi, cerrahi, laparoskopi

Geliş Tarihi: 11.02.2013 **Kabul Tarihi:** 17.09.2013

INTRODUCTION

Laparoscopic surgery has become the gold standard for the management of gallstones, gastroesophageal reflux disease, and achalasia. It is also the preferred approach for most adrenal and splenic pathology. Laparoscopic colectomy is being offered to an increasing number of patients with both benign and malignant diseases. In the past 15 years significant advances in laparoscopic surgical skills and techniques combined with explosive advances in laparoscopic technology have encouraged the application of laparoscopy to the evaluation and treatment of solid organs including the pancreas.

There are basically three main types of laparoscopic pancreatectomy, which include enucleation, distal pancreatectomy and pancreaticoduodenectomy (PD) (1). Laparoscopic PD (LPD) is a technically demanding surgery performed only at few centers in the world. The feasibility of this procedure has been demonstrated by many studies. While the majority of them are case reports (2, 3), there are some relatively large series published in the last decade (4-6). In these series, it has been understood that, while the resection is technically possible, the problem arises at the time of performing the reconstruction. Therefore, very few patients actually underwent a total laparoscopic procedure. Rather, many surgeons performing the resection laparoscopically, and then following it up by a mini-laparotomy for the reconstructions (7-10).

Address for Correspondence / Yazışma Adresi: Dr.Mehmet Kaplan, Medical Park Gaziantep Hospital, General Surgery Department, Gaziantep, Turkey Phone: + 90 342 211 16 00, Fax: + 90 342 324 88 60, E-mail: dr.kaplan27@gmail.com

doi: http://dx.doi.org/10.12996/gmj.2013.27

These hybrid approaches preclude any meaningful assessment of the feasibility and outcomes of a total laparoscopic approach to resection and reconstruction.

This report describes a total laparoscopic pylorus-preserving pancreatico-duodenectomy (PPPD) for a tumor of ampulla of Vater with a successful outcome. The case presented here has been published previously elsewhere (11). Because of representing the first description of this laparoscopic procedure in Turkey, instead of issues discussed before, this publication focuses more on the surgical technique and postoperative progress of the patient.

CASE REPORT

A 58-year-old male patient was admitted to Medical Park Gaziantep Hospital complaining of progressive jaundice and weakness. He had a medical story of an urgent laparoscopic surgery, 1 month ago, because of spontaneous biliary peritonitis with unknown etiology. Blood tests showed total bilirubin of 11.2 mg/dl with direct bilirubin 9.6 mg/dl, and moderate elevation of liver function tests whereas tumor markers, such as CA19.9 and CEA, were normal. Ultrasonography revealed diffuse dilation of common bile ducts with no biliary stones. He underwent MRCP, which detected a tumor mass, 1 cm in size at the ampulla of Vater, and common bile duct dilatation as shown in Fig. 1. Endoscopic retrograde cholangiopancreatography (ERCP) was performed and after papillotomy, a plastic stent was inserted for drainage. The biopsy, taken during the procedure, was reported as adenocarcinoma. Operability and tumor staging was assessed according to the preoperative radiologic imaging tests, which demonstrated T1N0M0 and tumor stage I. For further detailed information read the publication 11.

A laparoscopic procedure was planned for definitive treatment. The reasons and criteria for choosing laparoscopic instead of conventional open surgery were as follows: (1) the early stage of the tumor, (2) the absence of a systemic disease that contraindicated long-term general anesthesia, (3) the absence of a pathology that absolutely required avoiding laparoscopic surgery, (4) the patient had a very suitable body mass index of 24 kg/m^2 for laparoscopic surgery, (5) the presence of a surgeon who had sufficient experience in laparoscopy, having carried out more than 100 intracorporeal gastrointestinal and biliary anastomoses (both in humans and swine) and more than 500 advanced laparoscopic surgeries including distal pancreatic resections, enucleations and extrahepatic biliary tract surgeries, and (6) the preference of the patient.

This patient was the first in whom a TLPD was attempted. So that, the possible advantages and complications of this new surgical procedure and, at any stage the possibility of conversion to traditional open surgery were described in detail to the patient. Thereafter the patient gave his written informed consent, thereby choosing this method instead of conventional surgery. The procedure was approved by the local ethical review board.

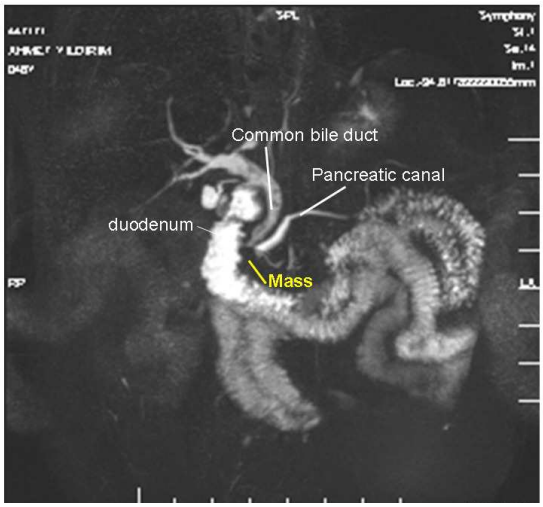

Figure 1. MRCP of the patient showing a tumor mass, 1 cm in size at the ampulla of Vater and common bile duct dilatation (arrows).

Surgical Technique

Adequate hydration, broad spectrum antibiotics and prophylaxis for venous thrombosis were followed. The operation was performed by the author~~s~~ (MK) who had performed more than 100 intracorporeal gastrointestinal and biliary anastomoses (both in human and swine) and more than 500 advanced laparoscopic surgeries.

1.Position of the patient and ports: Under general endotracheal anesthesia, the patient was placed in the supine position with both legs abducted. During the procedure, changes in operating table and surgeon positions were made for technical ease. After pneumoperitoneum was created by a closed Veress needle technique, the ports were placed (Fig. 2). 5 ports were used: (1) Umbilical 10-mm port for endo-camera, (2) Left subcostal 5-mm port for right hand working and retraction, (3) Right subcostal 5-mm port for left hand working, (4) Right pararectal 5-mm port for retraction and dissection, and (5) Left pararectal 14-mm port for including stapler, stomach retraction and duodeno-jejunal mobilization. Because of the adhesions between liver and diaphragm, associated with the previous peritonitis and surgery, there was no need for further port for liver retraction.

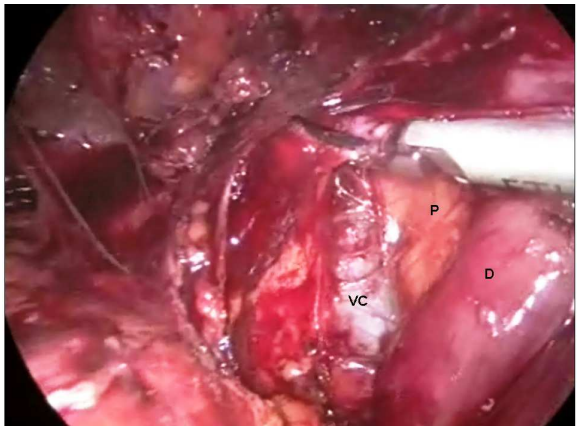

Figure 2. Extensive Kocherisation of duodenum. Abbreviations: VC: vena cava, D: duodenum, P: pancreas.

2. Kocherisation of duodenum and dissection into lesser sac: Following diagnostic laparoscopy in excluding tumor dissemination, the lesser sac was entered with the division of gastrocolic ligament using Harmonic Scalpel. Duodenum was then extensively kocherised using both sharp and blunt dissection until the anterior surface of vena cava and a part of the aorta were exposed (Figure 2). The superior mesenteric vein was immediately identified below the pancreatic lower border where the middle colic vein is joining to it. After gaining a better exposure by dividing the duodenum at about the distal of its first part using endo-GIA stapler (Autosuture, United States Surgical Corp., Norwalk, CT, USA; Figure 3), a tunnel was then created between the neck of pancreas and superior mesenteric vein using hook electrode. Pancreatic neck is prepared for subsequent transection (Figure 4).

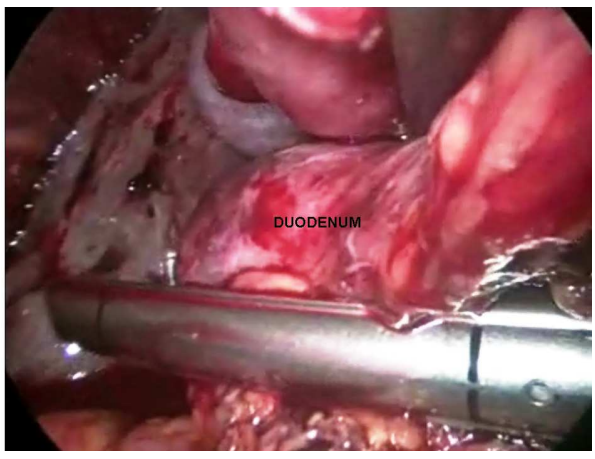

Figure 3. Dividing the duodenum at the distal of its first part.

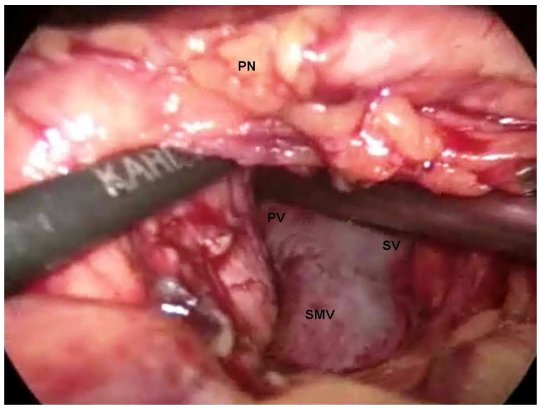

Figure 4. Creation of retropancreatic tunnel. Abbreviations: PV: portal vein, SV: splenic vein, SMV: superior mesenteric vein, PN: pancreatic neck.

3. Bile duct dissection & mobilization of ligament of Trietz: The gallbladder was freed from liver bed using retrograde approach and it is then used for traction to facilitate isolation of common bile duct. The common bile duct was then isolated and transected just proximal to the cystic duct insertion with a scissors after temporary tieing, which prevents spillage of any contaminated bile (Figure 5). Lymph nodes along the porta hepatis are cleared until both hepatic artery and portal vein were skeletonised (Figure 6).

Ligament of Trietz was taken down with ultrasonic dissector, so that the mesentery of duodenojejunal flexure was clearly defined, dissected and then jejunum transected with endo-GIA stapler (Autosuture, United States Surgical Corp., Norwalk, CT, USA). The third and fourth parts of duodenum were freed towards the right side until a tunnel was created behind the pedicle of superior mesenteric artery and vein. Thereafter the duodenum was pushed to the right and become ready for the final detachment from superior mesenteric pedicle.

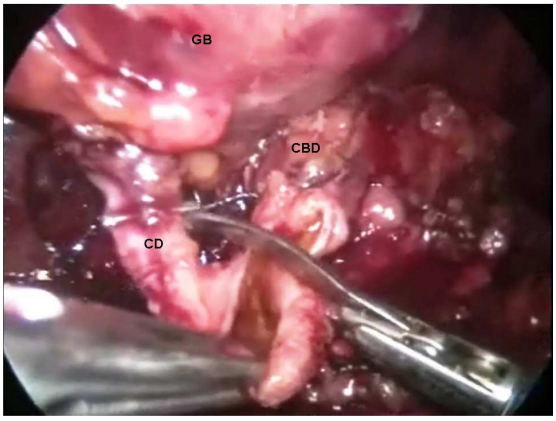

Figure 5. Transection of common bile duct, just proximal to the cystic duct insertion. Abbreviations: GB: gallbladder, CBD: common bile duct, CD: cystic duct.

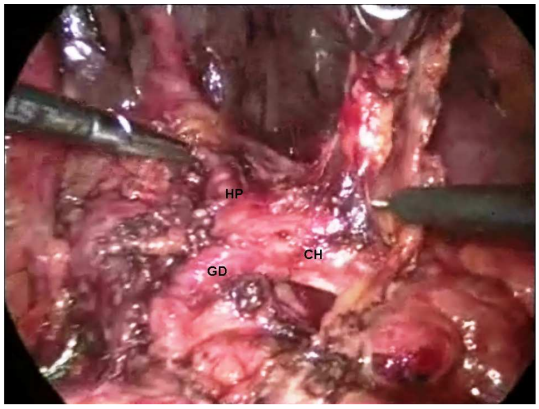

Figure 6. Dissection of lymph nodes along the porta hepatis. Abreviations: CH: common hepatic artery, GD: gastroduodenal artery, HP: arteria hepatica propria.

4. Pancreatic transection: With the neck of pancreas elevated using a grasper, it was then transected with ultrasonic dissector. Lymph nodes located at the superior border of pancreas and along the common hepatic artery were cleared carefully all the way back to coeliac trunk. The gastroduodenal artery was identified, freed and divided between endoclips just distal to the junction, which it branches off from common hepatic artery. The pancreas was further mobilized from the superior mesenteric vein. Once an adequate resection margin was ascertained, the uncinate process of pancreas is detached from retroperitoneum using ultrasonic dissector (Figure 7).

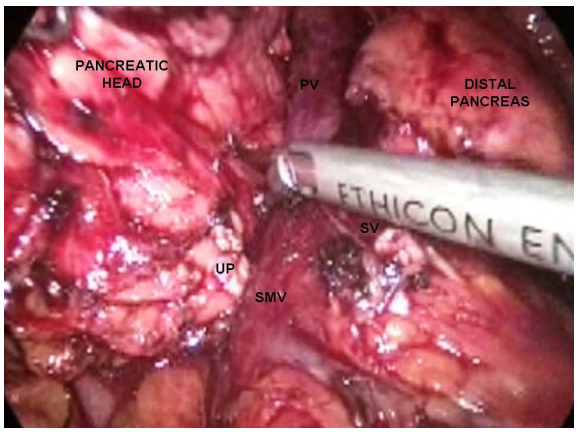

Figure 7. Porto-uncinate dissection. Abbreviatons: PV: portal vein, SV: splenic vein, SMV: superior mesenteric vein, UP: uncinate process.

5. Reconstruction of Anastomoses: Although at this stage it is possible to perform some of the anastomoses through a mini-laparotomy incision at the upper quadrant, our preference was to have all anastomoses performed intracorporeally.

First of all, remnant of pancreas was sutured to the side of posterior wall of gastric remnant employing "dunking technique". It is basically a matter of choice to choose either jejunum or stomach, but due to technical ease of it we performed pancreaticogastrostomy. It was a 2-layered anastomosis using 4/0 polydiaxonone with the pancreatic remnant invaginated into the stomach (Figure 8). A piece of 5-F drainage tube was used to stent the anastomosis.

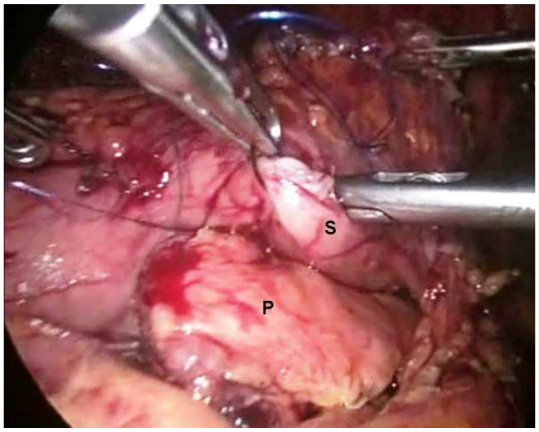

Figure 8. Performing an anastomosis between stomach (S) and pancreas (P).

Distal jejunum was passed to the supracolic compartment under the root of mesentery (retrocolic) for anastomosis. The end of the common bile duct was trimmed freshly and end-to-side choledochojejunostomy was performed with single layer continuous 4/0 polydiaxonone suture material using duct to mucosa technique (Figure 9). Lastly, a double layer end-to-side duodenojejunostomy was undertaken with the same suture material and same manner as we do in open surgery (Figure 10).

Two large bore drains were inserted next to the anastomoses. A 5-centimeter transvers incision was made suprapubically and intact specimen was retrieved through this incision in accordance with the oncologic principles (Figure 11). All incisions were then closed.

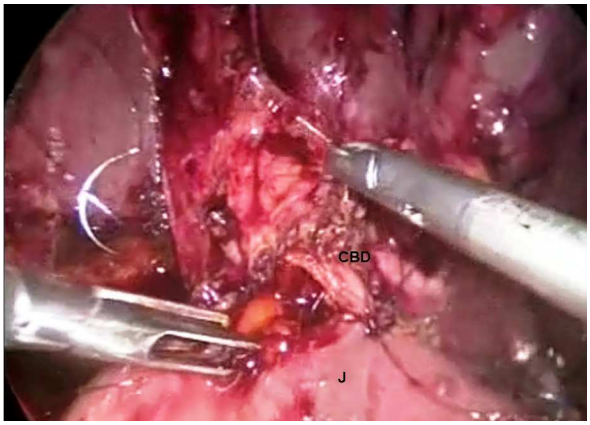

Figure 9. Performing a single layer anastomosis between the common bile duct (CBD) and jejunum (J).

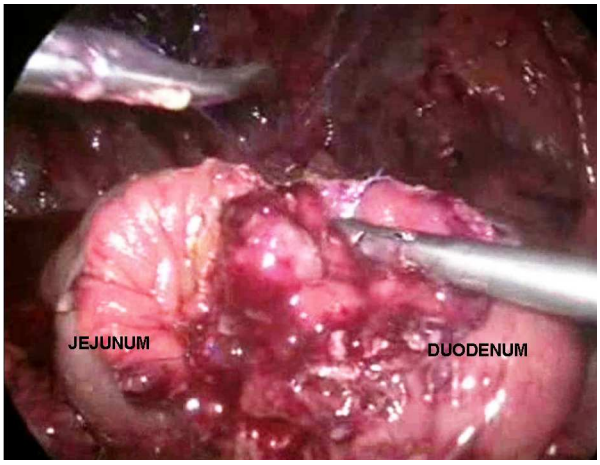

Figure 10. Performing a double-layer end-to-side duodeno-jejunostomy. The posterior inner layer is sutured.

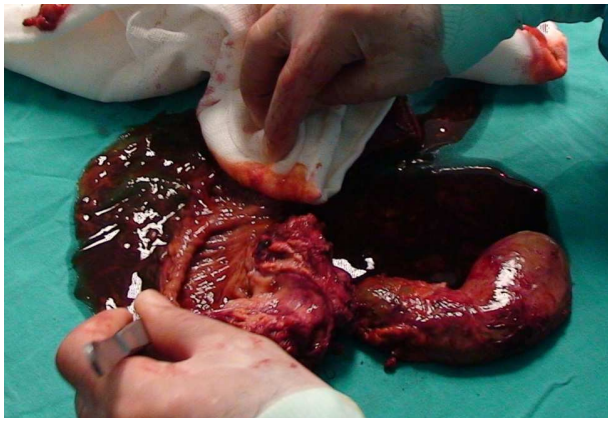

Figure 11. General appearance of the retrieved specimen.

The operation was performed at Medical Park Gaziantep Hospital in October 2009. The operation time was 510 min. The intraoperative blood loss was only 350 ml with no need for intraoperative blood transfusion. At intensive care unit, he was weaned off from the respirator at 6th hour and extubated in the next few hours. The pain scores on visual analog scale (VAS) were between 3 to 5 out of 10 for the first 3 days after operation. So that pain-killers was given in accordance with the hospital protocols with no need for narcotic analgesics. Because of prolonged gastric dilatation, nasogastric tube was be able to removed in day 5, postoperatively and thereafter the patient was allowed to take liquid diet. The patient was eventually discharged in the next day. Pathologic examination showed well-differentiated adenocarcinoma of ampulla of Vater's with free margins. Overall 14 lymph nodes were harvested without tumor metastasis. The general condition of the patient had been keeping very well on the follow up examination after 29 month of the operation with no any evidence of tumor recurrence.

DISCUSSION

Laparoscopic pancreatic tumor surgery is still uncommon because of the anatomic location of the pancreas, technical difficulties of pancreatic resections, the requirement of highly experienced, skilful laparoscopic surgeons, and the necessity of complicated techniques and technological advances. Therefore, the experience worldwide is still very limited, a fact well reflected in the literature describing mainly small series and case reports. In fact, laparoscopic surgery for the pancreas is still considered experimental by many surgeons.

On the other hand, in the past 15 years significant advances in laparoscopic surgical skills and techniques combined with explosive advances in laparoscopic technology have encouraged the application of laparoscopy to the evaluation and treatment of solid organs including the pancreas. Although open surgical procedures remain the standard for both benign and malignant diseases of the pancreas, in recent years a wide variety of surgical procedures performed on the pancreas have been completed laparoscopically. Single and multi-institutional case series have demonstrated these various types of laparoscopic pancreatic surgery can be performed with low complication rates (4-6, 11-13), all comparable with results reported in various series of open PD, although randomized prospective trials that evaluate the safety, benefits, and cost of laparoscopic pancreatic surgery in comparison with open pancreatic surgery have yet to be conducted.

Laparoscopic PD is a technically demanding procedure due to mainly four reasons which we have encountered before and during this surgery: (1) need to be experienced in minimal invasive surgery, (2) anatomical location and dissection, (3) reconstructions, and (4) oncologic principles.

1. Need a special experience on minimal invasive surgery: At the beginning, case selection is important. Therefore, initially the first cases would be appropriate for LPD if the tumor is small with early stage, there is no associated systemic disease, severe malnutrition status and patient is not obese, as in the present case. Laparoscopic pancreatic resections are complicated procedures and should be undertaken by surgeons with advanced laparoscopic skill sets. Surgeons should be comfortable with intracorporeal suturing, the use of endomechanical staplers, and possess the ability to control intraoperative bleeding. In addition, surgeons should have experience with open pancreatic surgery in case the procedure must be converted to an open pancreatic resection.

To shorten the learning curve of laparoscopic approach, the hand-assisted hybrid technique had been used with favorable results. Recently, robotic Whipple using the daVinci System has also been shown to be feasible and efficient (14).

2. Anatomical location and dissection: The pancreas is perhaps the most unforgiving organ in the human body. Situated retroperitoneal and deep in the center of the abdomen, the pancreas is intimate association with surrounding numerous important gastrointestinal and major vascular structures, making accessibility a key issue. It is friable and has numerous blood vessels, so that requires skilful and meticulous dissection, haemostasis and anastomoses, all of which are exceedingly difficult to perform with the limited hand co-ordination and feedback currently inherent in laparoscopic surgery.

At the stage of the division of the neck of the pancreas and dissection of porto-uncinate process there are two important points to be considered. The first is to be aware that the pancreatic neck and uncinate process is extremely rich in vessels, notably the inferior-posterior pancreaticoduodenal artery, and the inferior pancreatic vein. Therefore, the dissection must be extremely careful and hemostasis meticulous because hemorrhage arising from the uncinate may itself requires conversion to open surgery and can be life threatening in the postoperative period. We first incised the pancreas transversally directly with ultrasonic scissors, and our results suggest that this technique is safe. Then we moved toward uncinate process. Although the groove is very narrow, many thanks to the magnifying help of the laparoscope, after drawing the neck of the pancreas toward the right, we were successfully able to divide and incise the vessel between the head of the pancreas and portal veins using the harmonic scalpel and clip applicator. The second issue is to try not to use endovascular stapler devices, although it has been reported that they may facilitate uncinate process dissection (15).

3. Need for reconstructions: Although laparoscopic dissection and resection of proximal pancreas is technically feasible, completion of laparoscopic reconstructions has not yet become general practice.

Therefore, many of the procedures are carried out as either hand- or laparoscopic-assisted procedures, with the resection being performed laparoscopically and the reconstruction being completed via a "mini" laparotomy or through the hand port. (7-10).

It has been found that there are no statistically significant differences between the patients treated with PPPD or classical Whipple procedure with regard to morbidity, mortality, incidence of delayed gastric empty (DGE), overall and disease free survival. Thus, both techniques are recommended operations for resectable periampullary and pancreatic head tumors (16). Because the patient had a small tumor limited to the ampulla of Vater, we performed PPPD to preserve stomach and pyloric functions and reduce the morbidity associated with an antrectomy.

Several prospective randomized trials showed no difference in leakage and fistula rate between pancreaticogastrostomy and pancreaticojejunostomy (17), thus the pancreaticogastrostomy was used in the present case because of closer anatomy and ease to perform.

Unfortunately, DGE occurred postoperatively and lasted after 5 days when we were able to start a liquid diet. Tani et al. published recently the results of a randomized, controlled trial to determine if an antecolic or a retrocolic duodenojejunostomy during PPPD was associated with a lower incidence of DGE (18). Forty patients were enrolled in this trial in which patients were randomly assigned to undergo either an antecolic or a retrocolic duodenojejunostomy. DGE occurred in 5% of patients with the antecolic route for duodenojejunostomy versus 50% with the retrocolic route (p<0.05). The authors conclude that a PPPD with antecolic duodenojejunostomy is the safer operation. These findings are consistent with our case whom we performed duodenojejunostomy with retrocolic route.

4. Oncologic principles: It is unclear whether an adequate cancer operation can be performed with respect to lymph node harvest and margin status in patients with pancreatic malignancy. As for nearly all epithelial malignancies, the presence of nodal metastases is a significant prognostic factor in pancreatic cancer. In a standard PD, peripancreatic, duodenal and subpyloric nodes are generally removed. The high risk of locoregional recurrence following PD prompted the hypothesis that a more "extensive" lymphadenectomy may favorably impact recurrence and overall survival.

In a randomized controlled study, it has been found that; extended lymphadenectomy was associated with a longer hospital stay, and an increased incidence of pancreatic fistula, DGE and postoperative complications (p < 0.05). In addition, extended PD was not associated with a survival benefit (median survival, 28 versus 30 months: 3-year survival, 38% versus 36%). These results suggest that extended PD is associated with an equivalent mortality, but higher morbidity rate (19). For oncologic concern, the procedure was performed using the same principles as the open surgery, including en bloc resection of tumor with adequate margins. Because currently there are no convincing data to suggest that an extended lymphadenectomy improves the rates of recurrence or survival, the extensive node dissection had not been performed in the present case. But we gave special attention to dissect uncinate process carefully and clearly from the superior mesenteric vessels without any parenchimal remnant left behind. Unlike some authors (15), to achieve this purpose we find the ultrasonic scissors to be very useful in the current case. The clear margins in the specimen demonstrate that a successful standard oncologic resection was achieved. Recent reports have also supported our results in terms of yielding adequate surgical margins and a lymphadenectomy (4-6, 8, 11-13).

In Turkey, although laparoscopic distal pancreatectomy and enucleation has been performed with good results (20, 21), a case of PD performed with fully laparoscopic, has never been reported yet. This report represents the first total LPD, successfully performed in October 2009 at Medical Park Gaziantep Hospital, in Turkey. Although the operative time of the case was similar, compared to the other study, however, the length of hospital stay was significantly shorter. Traditional open operation requires at least 20-cm incision for the abdomen to be clearly exposed. Because of severe operative trauma, patients often complain of serious postoperative pain. Postoperatively, the current patient needed only non-narcotic analgesia intravenous drip for 3 days with acceptable pain score of VAS between 2 to 5 out of 10.

Many authors believe that the distal pancreatic resection with the laparoscope is entirely possible and effective; however, because PD requires a long operative time, can have multiple complications and a high death rate, several authors don't advocate doing this operation with a laparoscope.

On the other hand, general experience with minimally invasive abdominal surgery suggests that benefits of laparoscopic pancreatic surgery may include decreased incisional complications, less postoperative pain, faster return of digestive function, faster return to normal activities, development of fewer intra-abdominal adhesions, and diminished procedure-related inflammatory responses and alterations in host immune function that may be one of the important advantages toward the cancer patients, while providing enhanced vision and magnification of anatomic structures.

I think no significant difference exists between laparotomy and laparoscopy concerning mortality, morbidity and postoperation recovery; however, laparoscopy causes less pain and requires a small incision. This case report supports the others that, in selected cases, total LPD surgery is feasible and can be done safely in well-experienced centers. The performance of minimally invasive surgery in pancreatic diseases will increase in the future because of accompanying technological advances and technical refinements in laparoscopic instruments.

Conflict of Interest

No conflict of interest was declared by the authors.

REFERENCES

1. Al-Taan OS, Stephenson JA, Briggs C, Pollard C, Metcalfe MS, Dennison AR. Laparoscopic pancreatic surgery: a review of present results and future prospects. HPB 2010;12:239-43.
2. Khaimook A, Borkird J, Alapach S. The first successful laparoscopic Whipple procedure at Hat Yai Hospital: surgical technique and a case report. J Med Assoc Thai 2010;93:1098-102.
3. Cho A, Yamamoto H, Nagata M, Takiguchi N, Shimada H, Kainuma O, et al. A totally laparoscopic pylorus-preserving pancreaticoduodenectomy and reconstruction. Surg Today 2009;39:359-62.
4. Lu B, Cai X, Lu W, Huang Y, Jin X. Laparoscopic Pancreaticoduodenectomy to Treat Cancer of the ampulla of Vater. JSLS 2006;10:97–100.
5. Palanivelu C, Rajan PS, Rangarajan M, Vaithiswaran V, Senthilnathan P, Parthasarathi R, et al. Evolution in techniques of laparoscopic pancreaticoduodenectomy: a decade long experience from a tertiary center. J Hepatobiliary Pancreat Surg 2009;16:731-40.
6. Kendrick ML, Cusati D. Total laparoscopic pancreaticoduodenectomy: feasibility and outcome in an early experience. Arch Surg 2010;145:19-23.
7. Dulucq JL, Wintringer P, Stabilini C, Feryn T, Perissat J, Mahajna A. Are major laparoscopic pancreatic resections worthwhile? A prospective study of 32 patients in a single institution. Surg Endosc 2005;19:1028-34.
8. Dulucq JL, Wintringer P, Mahajna A. Laparoscopic pancreaticoduodenectomy for benign and malignant diseases. Surg Endosc 2006;20:1045–50.
9. Uyama I, Ogiwara H, Iida S, Takahara T, Furuta T, Kikuchi K. Laparoscopic minilaparotomy pancreaticoduodenectomy with lymphadenectomy using an abdominal wall-lift method. Surg Laparosc Endosc 1996;6:405–10.
10. Kimura Y, Hirata K, Mukaiya M, Mizuguchi T, Koito K, Katsuramaki T. Hand-assisted laparoscopic pylorus-preserving pancreaticoduodenectomy for pancreas head disease. Am J Surg 2005;189:734–7.
11. Kaplan M. A case report of an ampullary tumor presenting with spontaneous perforation of an aberrant bile duct and treated with total laparoscopic pancreaticoduodenectomy. World J Surg Oncol 2012;10:142-6.
12. Palanivelu C, Jani K, Senthilnathan P, Parthasarathi R, Rajapandian S, Madhankumar MV. Laparoscopic pancreaticoduodenectomy: technique and outcomes. J Am Coll Surg 2007;205: 222–30.
13. Gagner M, Palermo M. Laparoscopic Whipple procedure: review of the literature. J Hepatobiliary Pancreat Surg 2009;16:726-30.
14. Narula VK, Mikami DJ, Melvin WS. Robotic and laparoscopic pancreaticoduodenectomy: a hybrid approach. Pancreas 2010; 39: 160-4.
15. Kleeff J, Friess H, Büchler MW. Dissection of the uncinate process and pancreatic head behind the portal vein using endovascular staplers. J Hepatobiliary Pancreat Surg 2007;14:480–3.

16. Iqbal N, Lovegrove RE, Tilney HS, Abraham AT, Bhattacharya S, Tekkis PP, et al. A comparison of pancreaticoduodenectomy with pylorus preserving pancreaticoduodenectomy: A meta-analysis of 2822 patients. Eur J Surg Oncol 2008; 34: 1237-45.
17. D'souza MA, Shrikhande SV. Pancreatic resectional surgery: an evidence-based perspective. J Cancer Res Ther 2008;4:77-83.
18. Tani M, Terasawa H, Kawai M, Ina S, Hirono S, Uchiyama K, Yamaue H.Improvement of delayed gastric emptying in pylorus-preserving pancreaticoduodenectomy: results of a prospective, randomized, controlled trial. Ann Surg 2006;243:316-20.
19. Yeo CJ, Cameron JL, Lillemoe KD, Sohn TA, Campbell KA, Sauter PK, et al. Pancreaticoduodenectomy with or without distal gastrectomy and extended retroperitoneal lymphadenectomy for periampullary adenocarcinoma, part 2: randomized controlled trial evaluating survival, morbidity, and mortality. Ann Surg 236: 355-66, discussion 366-8.
20. Barbaros U, Sümer A, Demirel T, Karakullukçu N, Batman B, Içscan Y, et al. Single incision laparoscopic pancreas resection for pancreatic metastasis of renal cell carcinoma. JSLS 2010;14:566-70.
21. Bozbora A, Barbaros U, Erbil Y, Ozarmagan S, Mercan S. Is laparoscopic enucleation the gold standard in selected cases with insulinoma? J Laparoendosc Adv Surg Tech A 2004;14:230-3.