Chirurgia (2022) 117: 472-479
No. 4, July - August

http://dx.doi.org/10.21614/chirurgia.2758

Spleen Preserving, Splenic Vessels Spearing, Pure Laparoscopic Total Duodenopancreatectomy for Intraductal Papillary Mucinous Pancreatic Neoplasia (IPMN): Case Report and Technique

Adrian Bartoș[1,2], Patricia Pleșa-Furda[2]*, Raluca Stoian[3], Lidia Ciobanu[4,5], Dana Iancu[2,6], Cornel Iancu[2], Caius Breazu[7,8]

[1]Department of Surgery, "Iuliu Haţieganu" University of Medicine and Pharmacy, Cluj-Napoca, Romania
[2]Department of Surgery. "Prof. Dr. Octavian Fodor" Regional Institute of Gastroenterology and Hepatology, Cluj-Napoca, Romania
[3]Department of Surgery, Gherla County Hospital, Romania
[4]Department of Gastroenterology, "Iuliu Haţieganu" University of Medicine and Pharmacy, Cluj-Napoca, Romania
[5]Department of Gastroenterology, "Prof. Dr. Octavian Fodor" Regional Institute of Gastroenterology and Hepatology, Cluj-Napoca, Romania
[6]Anatomy and Embryology Department, "Iuliu Haţieganu" University of Medicine and Pharmacy, Cluj-Napoca, Romania
[7]Department of Anesthesiology and Intensive Care, "Iuliu Haţieganu" University of Medicine and Pharmacy, Cluj-Napoca, Romania
[8]Department of Anesthesiology and Intensive Care, "Prof. Dr. Octavian Fodor" Regional Institute of Gastroenterology and Hepatology, Cluj-Napoca, Romania

***Corresponding author:**
Patricia Pleșa-Furda, MD
Department of Surgery
"Prof. Dr. Octavian Fodor" Regional Institute of Gastroenterology and Hepatology, Cluj-Napoca, Romania
E-mail: patricia.furda.pf@gmail.com

Received: 07.06.2022
Accepted: 10.08.2022

Rezumat

Duodenopancreatectomie totală laparoscopică cu prezervarea splinei și a vaselor splenice, pentru neoplazie mucinoasă pancreatică intraductală (IPMN): prezentare de caz și tehnică chirurgicală

Duodenopancreatectomia totală (DPT) realizată exclusiv pe cale laparoscopică este considerată una dintre cele mai complexe intervenții chirurgicale abdominale. DPT cu prezervarea vaselor splenice (operația Kimura) este o variantă tehnică mai solicitantă pentru chirurg, dar cu beneficii pentru cazurile bine selecționate. În timp ce unele centre cu volum mare au câştigat experință în pancreatectomii prin abord minim invaziv, chirurgia laparoscopică rămâne o recomandare pentru cazuri bine selecționate de pacienți prezentând tumori pancreatice benigne sau cu grad redus de malignitate şi ar trebui să fie realizată cu precauție, doar de către chirurgi HPB experimentați. În acest articol, vă prezentăm cazul unui pacient ce a beneficiat în serviciul nostru de duodeno-pancreatectomie totală cu prezervarea vaselor splenice şi a splinei, efectuată pe cale pur laparoscopică, pentru diagnosticul de IPMN difuz. Articolul ilustrează principalii timpi operatori.

Cuvinte cheie: pancreatectomie totală laparoscopică, neoplazie

mucinoasă pancreatică intraductală, pancreatectomie cu prezervarea splinei, prezervarea vaselor splenice

Abstract

Total duodenopancreatectomy (TDP), performed exclusively by laparoscopic approach is considered one of the most complex abdominal surgical procedures. TDP with preservation of spleen vessels (operation Kimura) is a more technically-demanding procedure, but is beneficial in selected cases. While some high-volume centers have gained experience in minimally-invasive pancreatectomies, laparoscopic approach remains a recommendation for well selected patients with benign or low-grade malignant tumors and should be performed with caution, by experienced HPB surgeons. In this paper, we present a spleen preserving, splenic vessels spearing, pure laparoscopic TDP on a 40-year-old patient diagnosed with diffuse IPMN performed in our center, illustrating the operative steps.

Key words: laparoscopic total pancreatectomy, intraductal papillary mucinous pancreatic neoplasia, spleen preserving pancreatectomy, splenic vessels spearing

Background

Total duodenopancreatectomy (TDP), performed exclusively by laparoscopic approach is considered one of the most complex abdominal surgical procedures. While some high-volume centres have gained experience in minimally-invasive pancreatectomies, most recommendations advise caution when choosing a laparoscopic approach for a well-selected group of patients (1-3). Current recommendations advice for a laparoscopic approach mostly for benign or low-grade malignant tumours (3).

Despite the fact that the literature indicates that this surgery is feasible and can be as safe as the open approach DP (4,5), because of the technical complexity and the risk of complications, this technique was not embraced as a standard one, and multiple centres still perform hybrid (laparoscopic-open) techniques, in particular to facilitate the reconstructive time (6-8).

Although there is no need for pancreato-digestive anastomosis, few cases of pure laparoscopic total duodenopancreatectomy (TDP) or laparoscopically-assisted TDP have been reported in the literature, most of which are case reports or limited series of cases (8-12).

More technically demanding, preservation of spleen and spleen vessels (Kimura technique) can be facilitated by the contribution of robotic surgery (13–16)., with some series showing the non-inferiority of the robotic approach compared to the open approach regarding occurrence of severe post-operative complications (17). As an alternative to maximise function preserving of organs, some authors proposed laparoscopic duodenum and spleen-preserving total pancreatectomy with favourable postoperative outcomes (18).

Methods

In this report, we present a spleen preserving, splenic vessels spearing, pure laparoscopic TDP on a 40-year-old patient diagnosed with diffuse IPMN, followed by hepatico-jejunal anastomosis by "in situ" ascended loop and precolic gastro-jejunal anastomosis. We will emphases the main operative steps, illustrating both the resection and the reconstruction aspects.

Case Report and Technique

We present the case of a 40-year-old patient with associated diabetes mellitus and acute pancreatitis in the medical history, with the diagnosis of diffuse main-duct IPMN.

Diagnosis was established after US and contrast-enhanced CT examinations and was confirmed by guided echo-endoscopic biopsy; the cytologic exam didn't reveal any signs of malignancy. Pre-operative liver function, pancreatic enzymes, as well as all the other blood tests were normal. Although the benign biopsy, due to the diffuse imagistic aspect of the disease, with cysts larger than 3 cm, according to international consensus and after informing the patient about the evolutive risks of the disease, surgical treatment was indicated.

In this case, spleen preserving, splenic vessels spearing, pure laparoscopic total duodenopancreatectomy was performed.

Patient Positioning and Exploration

The patient was positioned in dorsal decubitus, inferior limbs in abduction, main operator in between the patients' legs, with ports placed according to have access form pancreatic area (*Fig. 1*).

General exploration of the abdomen was performed, we accessed the bursa omentalis through the gastro-colic ligament using an advanced tissue sealing device. The right gastroepiploic pedicle was sectioned between clips to facilitate a better exposure of the cephalopancreatic region.

The Kocher maneuver was performed and the IVC exposed. This was done using the ultrasonic dissector. The main surgeon's and first-hand assistant's traction were particularly important on this time of surgery. The dissection continues towards D3-D4 segments of the duodenum.

Pancreatic Dissection

Dissection of the inferior margin of the pancreas was done with the monopolar hook,

Figure 1. Trocar placement (* optic port)

with the identification of the middle colonic vein, whose sectioning between the clips makes the identification of the porto-mesenteric complex much easier in this patient. Once the superior mesenteric vein is identified, the dissection is carried out on its anterior surface, along the portal vein using the monopolar hook (*Fig. 2*). Small postero-pancreatic venous tributaries are identified and sectioned with the ultrasound dissector.

The dissection continues towards the left, with the identification of the splenic vein and its' dissection from the corporeo-caudal pancreatic segment (*Fig. 3*). The dissection is done with the monopolar hook, the posterior

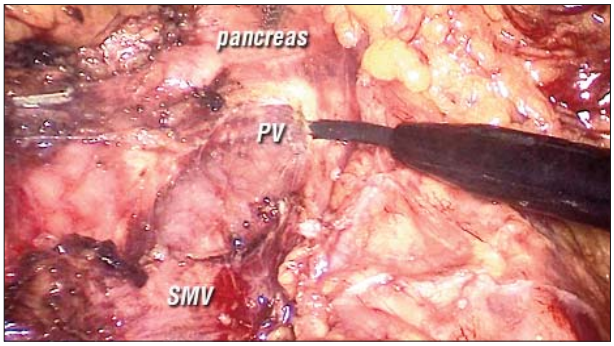

Figure 2. Dissection of the inferior border of the pancreas, exposing the superior mesenteric vein (SMV) and portal vein (PV)

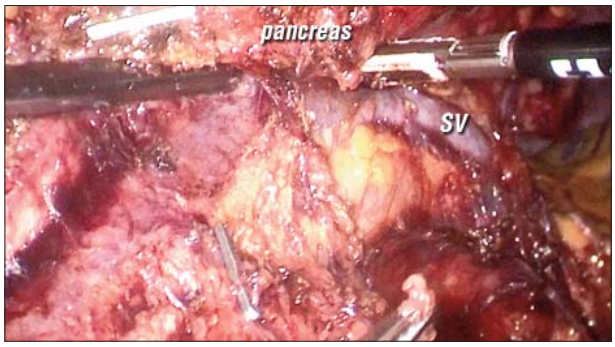

Figure 3. Dissection of the inferior border of the pancreas, exposing the splenic vein (SV)

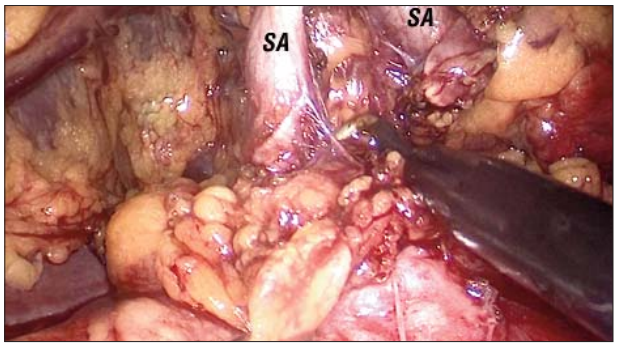

Figure 4. Dissection of splenic artery (SA)

pancreatic venous branches being identified, dissected, and sectioned between clips or directly with the ultrasound dissector. Again, an important role in this dissection is the traction-countertraction exerted on the tissues by the main surgeon and first assistant.

Vascular Dissection

The splenic artery is identified at the level of the pancreatic tail, dissected, and preserved (*Fig. 4*). Dissection is facilitated by the right tilting of the corporeo-caudal pancreatic segment.

Dissection continues and the right flank of the portal vein and inferior pancreatico-duodenal venous pedicles are identified, isolated and sectioned between clips (*Fig. 5*).

Sectioning of the gastric antrum with an Endo GIA green cartridge stapler will facilitate the exposure and dissection of the hepatic pedicle.

The common hepatic artery is identified at the level of the superior pancreas margin, removal the fat tissue at this level being performed with the monopolar hook and ultrasound dissector. Since we had no preoperative signs of malignancy, an extended lymphadenectomy was not considered. The other lymph nodes aimed for a standard lymphadenectomy were removed together with the surgical specimen at the end of resection time. Gastro-duodenal artery is identified and sectioned between clips with the Harmonic scalpel. We preferred mounting Hem-o-Lok clips on the proximal segment of the artery (*Fig. 6*).

Since we had a diffuse intrapancreatic neoplasia and we had no tumoral proximity with the superior mesenteric artery (SMA), we used a posterior approach of this vessel; no artery first approach needed.

Cholecystectomy and Biliary Dissection

Cholecystectomy is performed in the antero-

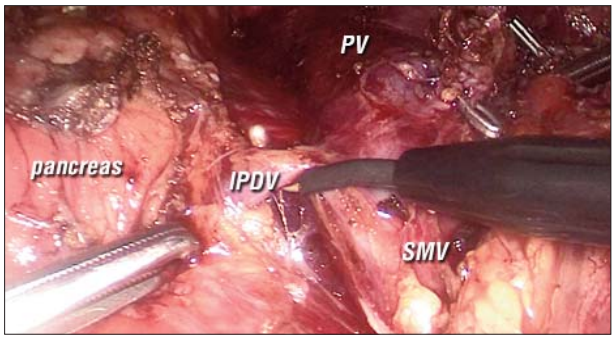

Figure 5. Dissection of right side of the porto-mesenteric axis, exposing the inferior pancreato-duodenal vein (IPDV)

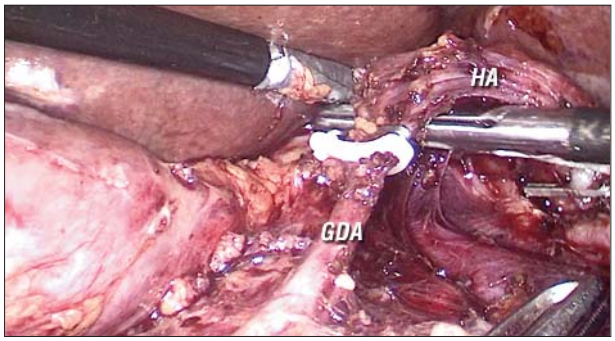

Figure 6. Dissection of the hepatic artery (HA) and the isolation of gastroduodenal artery (GDA), with clips

grade manner. The cystic duct is dissected till the cystic-hepatic junction, its' sectioning being performed superior to this area, with the ultrasound dissector; at the reconstruction time, recutting the bile duct with scissors (to remove the distal scar of the ultrasound dissector) is mandatory to avoid the complications consecutive to thermic lesions. In that idea, using clips is better to prevent leakage of the bile into the peritoneal cavity.

Completion of the Dissection and Specimen Extraction

The duodeno-jejunal angle and the distal segment of D4 is mobilized using the ultrasound dissector.

After sectioning the first jejunal loop with the Endo GIA stapler, the dissection of the resection piece is completed by cutting the adhesions at the level of the uncinated process and mesopancreas. The small vessels at this level are clipped, the tissue being cut with the Harmonic scalpel (*Fig. 7*).

After the removal of the surgical specimen and standard lymphadenectomy, the preserved splenic vessels, porto-mesenteric complex and hepatic pedicle can be seen. A narrow CBD is observed (*Fig. 8*).

Biliary Anastomosis

The first jejunal loop is ascended in situ, posterior to the mesenteric vessels. Reconstruction time begins with the hepatico-digestive anastomosis. The anastomosis was performed with separate Vicryl 4/0 threads after certifying macroscopically that the resection margins of the CBD were free of any electrocautery marks, the recutting of the duct being done with scissors. The maneuvers done at this time of surgery are of great importance; the first-hand assistant must maintain in position the first jejunal loop without applying too much pressure on the anastomosis, ensuring this way an intact biliary wall (*Fig. 9*).

Digestive Anastomosis

The gastro-jejunal anastomosis is performed in a precolic manner, side-to-side, with an Endo GIA 60 mm green cartridge stapler. The closure of the entero-gastric breach was done with 3-0 barbed suture, absorbable thread, in continuous suture, double layer (*Fig. 10*).

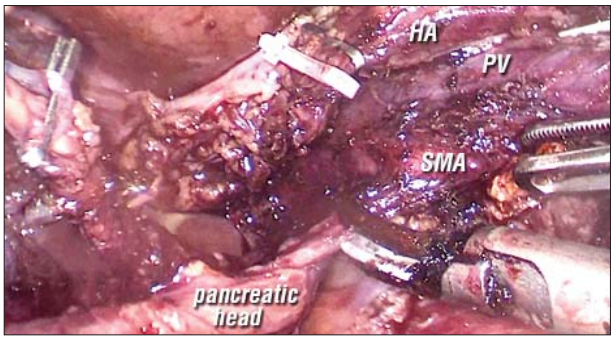

Figure 7. Sectioning the retroportal tissue ("mesopancreas"); HA=hepatic artery; PV=portal vein; SMA=superior mesenteric artery;

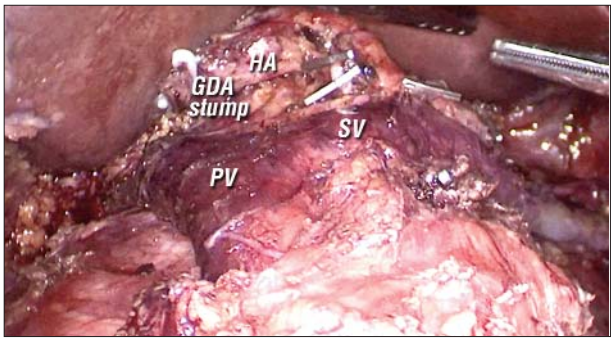

Figure 8. Retroperitoneal subhepatic space after removing the surgical specimen; HA=hepatic artery; SV=splenic vein; PV=portal vein; GDA=gastroduodenal artery

Figure 9. End to side hepatico-jejunal anastomosis

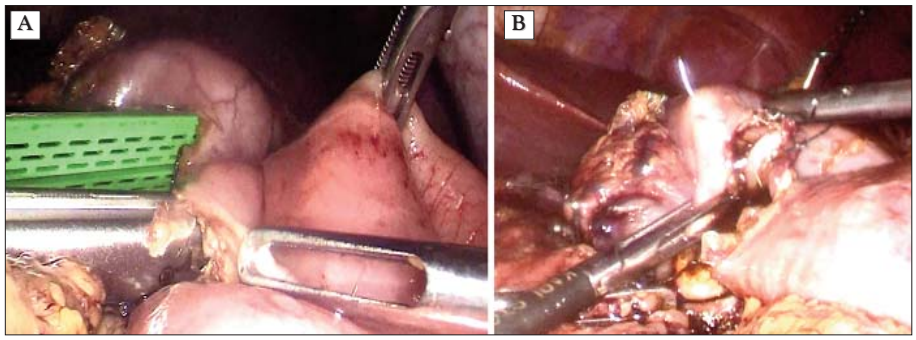

Figure 10. Stapled gastro-jejunal anastomosis **(A)**; Closing the entero-gastric breach **(B)**

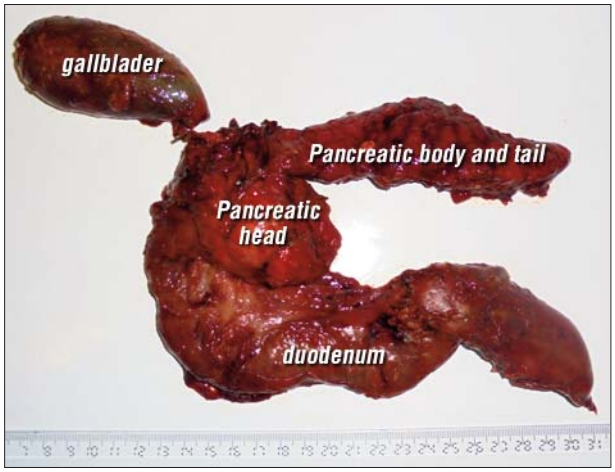

Figure 11. Surgical specimen

Figure 12. Abdomen aspect after finishing the procedure, with peritoneal drains in place

After the surgical specimen was extracted through a mini-laparotomy, Pfannenstiel type, the surgery concluded with the drainage of the peritoneal cavity (*Figs. 11, 12*).

Postoperative Management

Resumption of per os nutrition was done early and progressively with first flatus on post-operative day 3 with good digestive tolerance. Blood glucose was monitored 4 times a day and subcutaneous insulin was administered as needed. The postoperative evolution was marked by the occurrence of an obstructive jaundice in the fifth postoperative day, possibly due to an inflammatory stenosis at the level of the bilio-jejunal anastomosis, considered the preoperative narrow CBD. In these conditions, on the 12th postoperative day, because of biliary hyper pressure, a biliary fistula occurred. The fistula was drained externally through the subhepatic drainage tube. A surgical procedure was performed through a right subcostal mini-laparotomy and a separate thread suture plasty was made at the level of the anterior wall of the bilio-jejunal anastomosis.

Outcome

The postoperative outcome was favorable with discharge form hospital on postoperative day 16.

On the surgical resection specimen, the histopathological examination confirmed the presence of main-duct IPMN with low- and intermediate-grade dysplasia on chronic

pancreatitis parenchyma.

Postoperative controls performed to date have not shown recurrent signs or any other intraabdominal pathological processes.

Discussions

Total duodenopacreatectomy is proposed when the pancreatic parenchyma is affected multicentrically or diffuse and high risk of recurrence is estimated in the remaining organ. Such clinical situations would include IPMN, ductal adenocarcinomas or multifocal neuro-endocrine tumors, especially if associated with refractory chronic pancreatitis, in which case correct assessment of other synchronous pancreatic tumors could be extremely difficult (19-24).

The oncological advantage of increasing the resectability, with potentially higher chances of obtaining a R0 resection, was for many teams the main argument for performing total duodenopancreatectomy (25). Spleen preservation with resection of spleen vessels (Warshaw technique) can also be safely performed when tumoral invasion imposes vascular resection, with similar morbidity and mortality compared to the conventional TDP and splenectomy strategy (26). In addition to that, the elimination of pancreatic fistula risk (especially for extraordinary high-risk pancreatic texture), which is the main cause of postoperative mortality, was thought to increase the overall outcomes (25,27).

Nevertheless, TDP has high impact on the quality of life, with insulin-dependent diabetes mellitus and malnutrition due to malabsorption and diarrhea, all these factors heavily influencing long-term postoperative outcomes (28). Total pancreatectomy with islet autotransplantation (TPIAT) has shown good long-term results in pain relieve and reducing narcotic usage (especially for patients with chronic pancreatitis), but long-term insulin indepen-dence is yet to be achieved (22). However, pharmacological improvements have been made, with long-acting insulin, insulin pumps and improvements in pancreatic enzyme formulas, with major role in ameliorating the quality of life post total duodenopancreatectomy (29).

Laparoscopic approach in TDP could potentially offer the general benefits of laparoscopic techniques, such as faster recovery after surgery, decreased need of drugs and cosmetic benefits, with similar outcomes in terms of safety, effectiveness or operative efficiency when compared to open TDP with islet autotransplantation (30).

Even though, dissection of the pancreatic neck during laparoscopic TDP, with separation into two specimens (cephalic duodenopancreatectomy and distal pancreatectomy) has been described as an alternative to facilitate the retropancreatic dissection, it does not respect the oncological principle of 'no touch' and en-bloc resection, which is the reason why most teams, ours included, recommend en-bloc resection and extraction of the specimen (21).

The absence of a mechanical jaundice, with a non-pathological, narrow CBD could lead to a more exposed to complications biliary-digestive anastomosis, like the stenosis followed by biliary leak, as in our situation. In these cases, a better solution than a direct anastomosis with 4-0 resorbable sutures (like we used in our case) could be represented by intraoperative protection of the anastomosis by a CBD stent or tube (spontaneously expelled Nelaton tube or transparietal trans-jejunal CBD stenting) and using thinner sutures (5-0/ 6-0 resorbable sutures).

Conclusions

Pure laparoscopic approach is feasible for radical surgery of the pancreas, a very important aspect being the careful selection of patients, their anatomic particularities (non-dilated bile ducts), surgical technique and the experience of the surgical team in advanced laparoscopic procedures. All this can influence the outcome of the surgery.

Author's Contributions

Adrian Bartoş, Dana Iancu, Cornel Iancu has the same contributions, being main authors of this article.

Disclosures

Dr. Adrian Bartoş, Patricia Pleşa-Furda, Caius Breazu, Raluca Stoian, Lidia Ciobanu, Cornel Iancu and Dana Iancu have no conflicts of interest or financial ties to disclose.

References

1. Wang X, Li Y, Cai Y, Liu X, Peng B. Laparoscopic total pancreatectomy: Case report and literature review. Medicine (Baltimore). 2017;96(3):e5869.
2. Cai H, Feng L, Peng B. Laparoscopic pancreatectomy for benign or low-grade malignant pancreatic tumors: outcomes in a single high-volume institution. BMC Surg. 2021;21(1):412.
3. Asbun HJ, Moekotte AL, Vissers FL, Kunzler F, Cipriani F, Alseidi A, et al. The Miami International Evidence-based Guidelines on Minimally Invasive Pancreas Resection. Ann Surg. 2020;271(1):1–14.
4. Zhang H, Wu X, Zhu F, Shen M, Tian R, Shi C, et al. Systematic review and meta-analysis of minimally invasive versus open approach for pancreaticoduodenectomy. Surg Endosc. 2016;30(12):5173–84.
5. Kim SC, Song KB, Jung YS, Kim YH, Park DH, Lee SS, et al. Short-term clinical outcomes for 100 consecutive cases of laparoscopic pylorus-preserving pancreatoduodenectomy: improvement with surgical experience. Surg Endosc. 2013;27(1):95–103.
6. Sa Cunha A, Rault A, Beau C, Laurent C, Collet D, Masson B. A single-institution prospective study of laparoscopic pancreatic resection. Arch Surg. 2008;143(3):289–95; discussion 295.
7. Gumbs AA, Rodriguez Rivera AM, Milone L, Hoffman JP. Laparoscopic pancreatoduodenectomy: a review of 285 published cases. Ann Surg Oncol. 2011;18(5):1335–41.
8. Asbun HJ, Stauffer JA. Laparoscopic vs open pancreaticoduodenectomy: overall outcomes and severity of complications using the Accordion Severity Grading System. J Am Coll Surg. 2012;215(6):810–9.
9. Dallemagne B, de Oliveira ATT, Lacerda CF, D'Agostino J, Mercoli H, Marescaux J. Full laparoscopic total pancreatectomy with and without spleen and pylorus preservation: a feasibility report. J Hepatobiliary Pancreat Sci. 2013;20(6):647–53.
10. Choi SH, Hwang HK, Kang CM, Yoon CI, Lee WJ. Pylorus- and spleen-preserving total pancreatoduodenectomy with resection of both whole splenic vessels: feasibility and laparoscopic application to intraductal papillary mucin-producing tumors of the pancreas. Surg Endosc. 2012; 26(7):2072–7.
11. Zakaria HM, Stauffer JA, Raimondo M, Woodward TA, Wallace MB, Asbun HJ. Total pancreatectomy: Short- and long-term outcomes at a high-volume pancreas center. World J Gastrointest Surg. 2016;8(9):634–42.
12. Cai Y, Gao P, Peng B. A novel surgical approach for en-bloc resection laparoscopic total pancreatectomy. Medicine (Baltimore). 2020;99(28): e20948.
13. Giulianotti PC, Addeo P, Buchs NC, Bianco FM, Ayloo SM. Early experience with robotic total pancreatectomy. Vol. 40, Pancreas. United States; 2011. p. 311–3.
14. Takagi K, Koerkamp BG. Robotic Total Pancreatectomy: A Narrative Review. In Vivo. 2021;35(4):1907–11.
15. Ji S, Xu X, Yu X. Laparoscopic spleen-preserving total pancreatectomy for intraductal papillary mucinous neoplasm (with). J Visc Surg. 2020; 157(5):441–2.
16. Takagi K, Koerkamp BG. Robotic Total Pancreatectomy: A Novel Pancreatic Head-First Approach (with Video). J Gastrointest Surg Off J Soc Surg Aliment Tract. 2021;25(6):1649–50.
17. Kauffmann EF, Napoli N, Genovese V, Ginesini M, Gianfaldoni C, Vistoli F, et al. Feasibility and safety of robotic-assisted total pancreatectomy: a pilot western series. Updates Surg. 2021;73(3):955–66.
18. Wu J, Hu Q, Jin L, Yao W, Zhang C, Hu Z, et al. Laparoscopic duodenum and spleen-preserving total pancreatectomy: A novel surgical technique for pancreatic intraductal papillary mucinous neoplasms. Biosci Trends. 2019; 13(5):456–60.
19. Chapman BC, Paniccia A, Ryan C, Schulick RD, Edil BH. Laparoscopic Spleen-Preserving Total Pancreatectomy for a Main-Duct Intraductal Papillary Mucinous Neoplasm. Ann Surg Oncol. 2017;24(2):560.
20. Johnston WC, Hoen HM, Cassera MA, Newell PH, Hammill CW, Hansen PD, et al. Total pancreatectomy for pancreatic ductal adenocarcinoma: review of the National Cancer Data Base. HPB Off J Int Hepato Pancreato Biliary Assoc. 2016;18(1):21–8.
21. Blair AB, Burkhart RA, Hirose K, Makary MA. Laparoscopic total pancreatectomy with islet autotransplantation for chronic pancreatitis. J Vis Surg. 2016;2:121.
22. Shindo Y, Kanak MA. Total pancreatectomy with islet autotransplantation: recent updates and outcomes. Curr Opin Organ Transplant. 2017; 22(5):444–51.
23. Gumbs AA, Daskalaki D, Milone L. Laparoscopic Total Pancreatectomy for Chronic Pancreatitis. Surg Laparosc Endosc Percutan Tech. 2018; 28(2):e62.
24. Petrucciani N, Nigri G, Giannini G, Sborlini E, Antolino L, de'Angelis N, et al. Total Pancreatectomy for Pancreatic Carcinoma: When, Why, and What Are the Outcomes? Results of a Systematic Review. Pancreas. 2020;49(2): 175–80.
25. Del Chiaro M, Rangelova E, Segersvärd R, Arnelo U. Are there still indications for total pancreatectomy? Updates Surg. 2016;68(3):257–63.
26. Yang F, Jin C, Warshaw AL, You L, Mao Y, Fu D. Total pancreatectomy for pancreatic malignancy with preservation of the spleen. J Surg Oncol. 2019; 119(6):784–93.
27. Grace PA, Pitt HA, Tompkins RK, DenBesten L, Longmire WPJ. Decreased morbidity and mortality after pancreatoduodenectomy. Am J Surg. 1986; 151(1):141–9.
28. Scholten L, Stoop TF, Del Chiaro M, Busch OR, van Eijck C, Molenaar IQ, et al. Systematic review of functional outcome and quality of life after total pancreatectomy. Br J Surg. 2019;106(13):1735–46.
29. Poiraud C, El Amrani M, Barbier L, Chiche L, Mabrut JY, Bachellier P, et al. Total Pancreatectomy for Presumed Intraductal Papillary Mucinous Neoplasms: A Multicentric Study of the French Surgical Association (AFC). Ann Surg. 2018;268(5):823–30.
30. Berger M, Bellin MD, Kirchner V, Schwarzenberg SJ, Chinnakotla S. Laparoscopic-assisted versus open total pancreatectomy and islet autotransplantation: A case-matched study of pediatric patients. J Pediatr Surg. 2020;55(3):558–63.