22 Duodenum-Preserving Pancreatic Head Resection

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22.1 Introduction

Duodenum-preserving pancreatic head resection (DPPHR) was first described in the 1970s by Beger in Germany to treat patients with chronic pancreatitis [1, 2]. In 1988, Takada performed the first duodenum-preserving total pancreatic head resection (DPPHRt) to treat benign or low-grade malignant tumors of the pancreatic head by preserving the duodenum with its intact blood supply from the pancreatic duodenal arterial arcade [3, 4]. The increasing use of high resolution CT/MR and endoscopic ultrasonography has increased the diagnostic and accuracy rates of cystic tumors of the pancreatic head in recent years. Most tumors are benign but with a risk of potential malignant transformation, or are low-grade malignant tumors [5]. Some of these patients need to be treated by surgery because of symptoms like abdominal pain, distension, and jaundice, or because of the possibility of malignant transformation [6, 7]. DPPHR was initially designed for chronic pancreatitis. Although many surgeons believe that DPPHR results in improvements in intermediate and long-term outcomes which include the length of hospital stay, quality of life, postoperative rehabilitation, and preservation of exocrine function compared to PD and pylorus-preserving pancreaticoduodenectomy (PPPD) [1, 2]. Although a multi-center, randomized, controlled, double-blind ChroPac trial published in 2017 showed DPPHR to result in no difference in quality of life compared with partial pancreatoduodenectomy for chronic pancreatitis [8], DPPHR has recently been used to treat benign or low-grade malignant tumors in patients who are completely different to those with chronic pancreatitis. These patients are predominantly young females with normal pancreatic functions. A significant proportion of these patients wish to undergo minimally invasive treatment, not only because of small incisions, but also because of organ-preservation. When compared with pancreaticoduodenectomy (PD), the standard operation for pancreatic head tumors, DPPHRt maintained the integrity of the duodenum and biliary system, with non-inferiority in the short- and long-term outcomes for benign or low-grade malignant tumors [9–11]. The rapid advancements in minimally invasive technology in the past two decades have led to the increasing use of laparoscopic pancreatic surgery. Laparoscopic PD and distal pancreatectomy (DP) are now technically feasible [8], although the long-term oncological outcomes remain unclear [12, 13]. Peng et al. [14] in 2012 and Mou et al. [15] in 2016 reported the minimally invasive DPPHR. Cao et al. [16] in 2018 reported laparoscopic DPPHRt as a novel minimally invasive surgery for benign or low-grade malig-

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nant tumors of the pancreatic head. A systematic review showed DPPHR significantly preserved the levels of exocrine and endocrine pancreatic functions, with no significant differences in the rates of pancreatic fistula, delayed gastric emptying, and hospital mortality when compared to PD, the standard treatment for tumors of the pancreatic head [17, 18]. DPPHR, by preserving the integrity of the duodenum and biliary system with conservation of the peripancreatic tissues, should better maintain the exocrine and endocrine pancreatic functions in the short and long terms. In addition, the operation avoids the complications following a biliary anastomosis.

22.2 Case

The patient was a 9-year-old girl admitted to our hospital because of recurrent abdominal pain stained for more than 2 years. Laboratory examinations showed liver functions such as total bilirubin (TB), direct bilirubin (DB), aspartate aminotransferase (AST), and alanine aminotransferase (ALT) were normal. Tumor markers including carcinoembryonic antigen (CEA), carbohydrate antigen (CA)19-9, CA72-4, and CA12-5 were all normal. The abdominal CT showed a mass in the head of the pancreas, without dilation of common bile duct or pancreatic duct. Pancreatic head benign or low-grade malignant tumor was considered (Fig. 22.1).

From these findings, a diagnosis of pancreatic head benign or low-grade malignant tumor was made and laparoscopic DPPHRt was performed.

Informed consent was obtained from all participating patients, and the ethics committee of Sun Yat-sen Memorial Hospital, Sun Yat-sen University approved this study.

22.3 Details of Procedure

22.3.1 Surgical Procedures of LDPPHRt

The patient was placed in a reversed Trendelenburg position with head up 30° and leg splitting. The trocars were inserted according to the 5-port-method. Pneumoperitoneum was established with carbon dioxide at 12 mmHg. The gastrocolic ligament was opened to explore the head and neck of the pancreas and to check the location of the tumor without making a Kocher's maneuver. The common hepatic artery (CHA) was looked for after removal of the group 8a lymph nodes. The CHA was dissected along its right side, separating and protecting the proper hepatic artery (PHA) and the gastroduodenal artery (GDA) after slinging these vessels with vascular slings. The uncinate process and pancreatic neck were dissected to expose the portal vein and the superior mesenteric vein (SMV). The portal vein-pancreas tunnel was built and the pancreatic neck and SMV were slinged with vascular slings. The capsule of the pancreas was cut open at the lower part of the pancreatic neck, and subcapsular dissection was carried out to the right, paying particular attention to visualize the pancreatic duodenal arterial arcade which passes along the duodenum. The lower part of the pancreatic head and uncinate process were separated to expose the inferior pancreatic duodenal arterial arcade which includes the anterior (AIPDA) and the posterior inferior pancreatic duodenal arteries (PIPDA). Care was taken to protect the branches which go into the duodenum. The pancreatic neck was transected with a Harmonic scissors in front of the SMV. The pancreas head was separated from the right and dorsal edges of the SMV. The upper part of the pancreatic head was separated to expose the distal common bile duct (CBD) which lies inside the pancreas. The pancreas was dissected from the left and the dorsal edges of the CBD to expose and protect the posterior superior pancreatic duodenal artery (PSPDA), which comes from the GDA, with its branches going into the distal CBD and the ampulla of Vater. The anterior superior pancreatic duodenal artery (ASPDA) has to be cut usually for further deep dissection. Finally, the main pancreatic duct to the ampulla of Vater was dissected, ligated, and cut off. The pancreatic head and uncinate process was totally resected and the specimen was removed. The blood supply to the CBD and duodenum was confirmed to be good (Fig. 22.2). The main pancreatic duct of the pan-

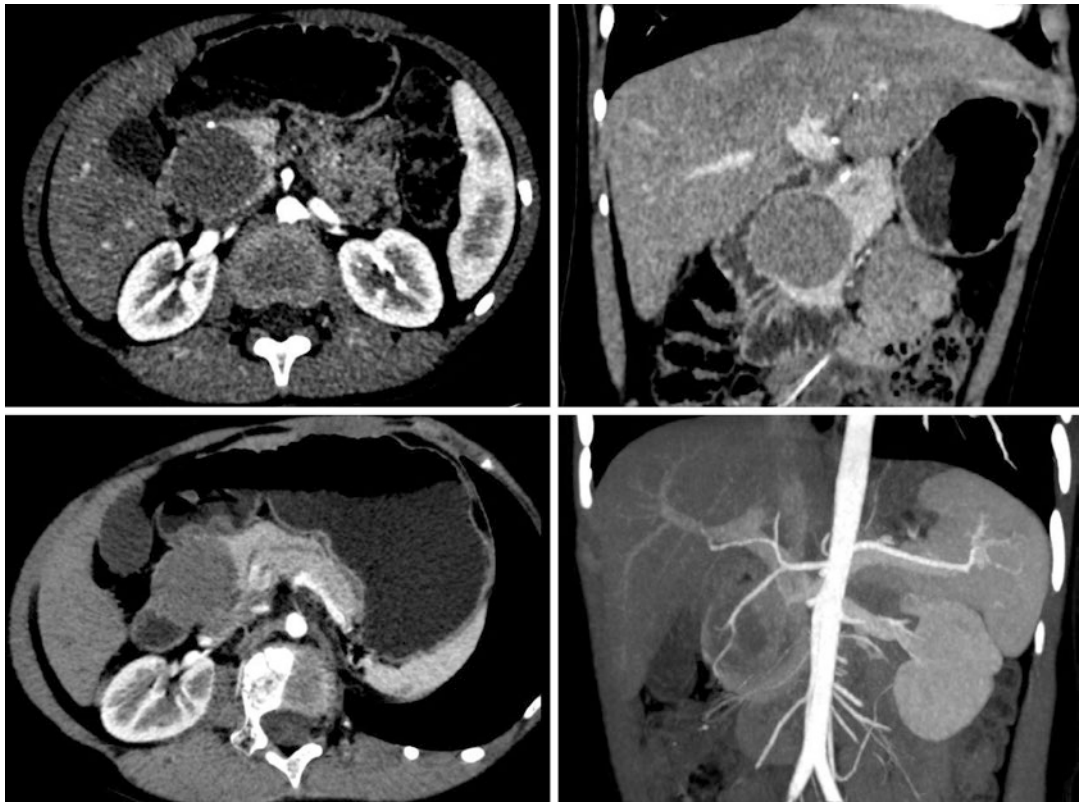

Fig. 22.1 CT image showed a mass in the head of the pancreas

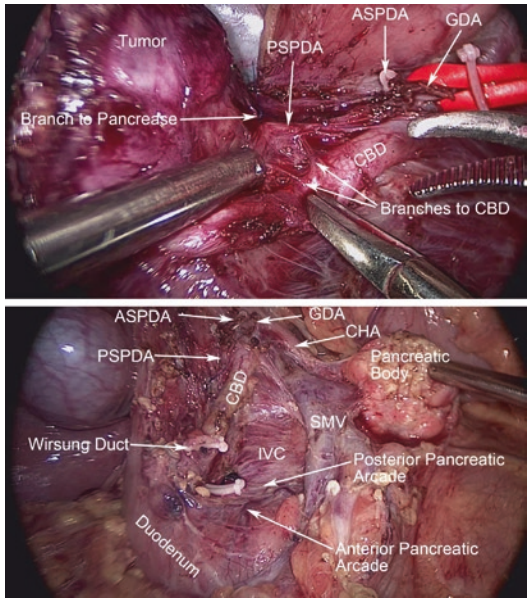

Fig. 22.2 The postoperative overview of the LDPPHRt

creatic body was found and an external ventricular drainage catheter was inserted. An end-to-side pancreaticojejunostomy (duct-to-mucosa) was done. The resected specimen was placed inside a bag and removed through a small lower abdominal incision. Two drainage catheters were positioned near the pancreaticojejunostomy and the CBD and brought out through two trocar port sites.

22.4 Pathology and Prognosis

The resected specimen is shown in Fig. 22.3. Pathologie diagnosis was intraductal papillary mucinous neoplasia (IPMN). The cutting margin was negative.

The patient recovered uneventfully and was discharged 5 days after the operation. 12 months after surgery, follow-up CT and tumor marker revealed no recurrence.

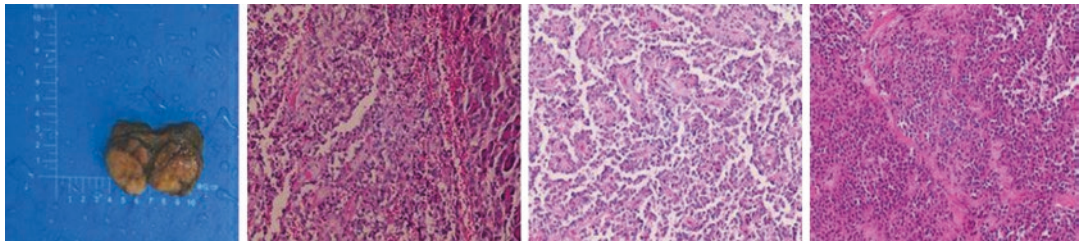

Fig. 22.3 Pathology

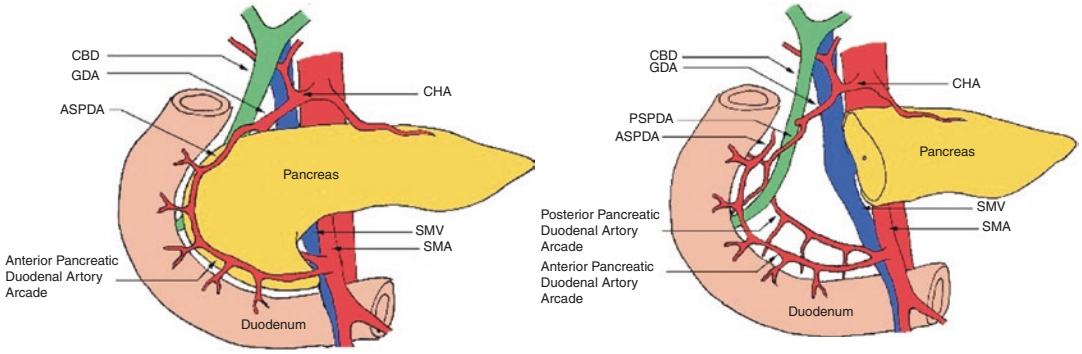

Fig. 22.4 The arterial arcades needed to be preserved

22.5 Comment

The anterior and posterior pancreatic duodenal arterial arcades are composed of the PSPDA, ASPDA, AIPDA, and PIPDA. They provide blood supply to the descending and horizontal parts of the duodenum. Preservation of these arterial arcades, especially the PSPDA and its branches which supply blood to the distal CBD and the ampulla of Vater, is the key to success in the LDPPHRt procedure (Fig. 22.4). The complex anatomy of the arcades and their branches make total pancreatic head resection challenging. Autopsy shows the anterior pancreatic duodenal arterial arcade runs typically in the capsule of the pancreas, 0.5–1.5 cm away from the duodenum. Subcapsular dissection of the pancreatic parenchyma preserves the anterior arcade and its branches which go into the duodenum. The posterior pancreatic duodenal arterial arcade runs in the mesopancreas, 1.5–2.0 cm away from the duodenum (Fig. 22.5). By avoiding the performance of Kocher's maneuver, the mesopancreas remains intact to preserve the posterior arcade, especially the communicating branch between the PSPDA and PIPDA. Laparoscopy provides a good view of these tiny vascular structures for accurate dissection. The total pancreatic head resection is carried out using a medial to lateral approach with the following precautionary steps: (1) DO NOT making a Kocher's maneuver; (2) Dissect along the GDA to expose the PSPDA to preserve its branches which go into the CBD and ampulla of Vater; (3) The PSPDA passes first along the right edge and then the back of the CBD, so dissecting the pancreas along the left and dorsal sides of the CBD is safe; (4) Dissecting the uncinate process and then the pancreatic neck to expose the portal vein and SMV, and to build the portal vein-pancreas tunnel; (5) Do subcapsular dissection at the lower part of the pancreatic head to the right to preserve the inferior pancreatic duodenal arterial arcade.

Fig. 22.5 The arterial arcades needed to be preserved

Acknowledgment Some of the contexts were reused with permission from our previous papers [16].

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