The anatomy of the parapancreaticoduodenal vessels and the introduction of a new pylorus-preserving pancreatoduodenectomy with increased vessel preservation

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Abstract: Classical pancreaticoduodenectomy for malignant tumors of the pancreateoduodenal region or chronic pancreatitis has recently been discussed in terms of the quality of life, associated with long-term postoperative morbidity. Pylorus-preserving pancreateoduodenectomy (PPPD) for the patient with chronic pancreatitis was first reported by Traverso and Longmire. Since that time, PPPD has become an accepted surgical procedure that is being increasingly indicated for certain malignancies. Herein, we report a PPPD that also preserves the parapancreatoduodenal vessels. The reasons why PPPD with the preservation of these vessels is significant are related to the length of the preserved duodenum and the reactions of gastrointestinal hormones. However, it may appear that this new PPPD poses a little greater risk of cancer recurrence, since the surgery is less radical than the usual PD. If the indications listed below are strictly observed, this operation should enable. The indications are: (1) chronic pancreatitis with tumor formation in the pancreatic head, (2) ampullary carcinoma, (3) inferior biliary duct carcinoma, (4) early duodenal carcinoma (all without pancreatic invasion), and (5) certain benign cystic tumors. Whether this operation should also be recommended for patients with small carcinomas or islet cell tumors arising in the head of the pancreas is now being investigated.

Key words: Pylorus-preserving pancreatoduodenectomy, PPPD with vessel preservation

Introduction

Progress made in developing less invasive pancreatic surgical techniques has enabled more extensive resections to be successfully accomplished in extended operations than was previously possible, thereby enhancing the patient's postoperative quality of life. However, the feasibility of successfully using this aggressive but less invasive surgery depends, in part, on the surgeon's specific knowledge of the vessels and nerves that are connected to the pancreas and the duodenum. Further, such surgery often entails a radical dissection of regional lymph nodes. A recent study of the lymphatics surrounding the pancreas has proposed a theoretical basis for an ideal lymph node resection for cancer patients requiring radical surgery.¹

Although the survival rates of peri- and/or pancreatic cancer patients who receive a pancreateodudodenectomy (PD) remain extremely low, the overall survival rate after curative surgery has increased, even among patients who have undergone surgery for an invasive cancer. Further, the great progress made in diagnostics has brought about an increase in the detection of small early cancers of biliopancreatic origin in the pancreatic head, and aggressive surgery is often recommended for such patients.

In 1978, Traverso and Longmire² first reported the successful preservation of the pylorus in two patients given a pylorus-preserving pancreateodudodenectomy (PPPD), one patient having been diagnosed with chronic, calcific pancreatitis with a pseudocyst of the pancreatic head, and the other with a small, localized carcinoma of the second portion of the duodenum. Since that time, PPPD has become an accepted surgical procedure that is being increasingly indicated for certain malignancies.³–⁶ Herein, we report a PPPD that also preserves the parapancreatoduodenal vessels. Further, in conjunction with the introduction of the PPPD methods now in use at the authors' department, detailed information is provided on the anatomy of these vessels, since a greater knowledge of the vessels is essential for proper PPPD surgical planning.
Anatomy and variations in pancreatoduodenal vasculature

The general pattern of arterial supply of the pancreatoduodenal region is shown in Fig. 1. Physiologically, the indicated terminal division of the gastroduodenal artery (GDA) into the right gastroepiploic artery (rGEA) and the anterior superior pancreaticoduodenal artery (ASPDA) has been found to be consistent. Two arterial arcades branch around the head of the pancreas, one anterior and the other posterior, and supply the vasa recta to the second portion and the oral half of the third portion of the duodenum. As shown in Fig. 1, the retroduodenal arteries (RDA) serve the first portion of the duodenum.

In most cases, the inferior portion of the anterior arcade is formed on the dorsum of the pancreas. The posterior superior pancreatoduodenal artery (PSPDA) is a proximal branch of the GDA arising from its retroduodenal portion. The arcade is completed by an open anastomosis with arteries arising from the superior mesenteric system. The smaller arteries, issuing from the cephalic plexus in this area, are very important, since they provide the blood supply in the first portion and the oral half of the second portion of the duodenum. Although the courses of all branches from the SPDA, i.e., the inferior pancreatoduodenal arteries (IPDAs), the dorsal pancreatic artery (DPA), and the inferior pancreatic artery (IPA), must be fully described for the confident planning of the proposed surgery, the two former arteries should be given first priority, since they handle the bulk of the blood supply to the duodenum. Figure 2 shows the observed variations in the path of the SPDA, and Figure 3 shows those of the PIDA. These were first identified by Do Rio-Branco. The incidence of variations for the four subsequent decides

Fig. 1. General pattern of arterial supply of the pancreas. GDA, Gastroduodenal artery; rGEA, right gastroepiploic artery; ASPDA, anterior superior pancreaticoduodenal artery; RDA, retroduodenal artery; PSPDA, proximal branch of GDA; AIPDA, anterior, inferior PDA

Fig. 2a–c. Variations in superior pancreatoduodenal arteries. Occurrence of each pattern is 92.6% for (a), 3.4% for (b), 2.7% for (c), and 1.3% for (d)