

ORIGINAL ARTICLE

Circumportal pancreas – a hazardous anomaly in pancreatic surgery

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Abstract

Background: Circumportal pancreas (CP) is an anatomical anomaly in the form of abnormal parenchymal fusion between the uncinate process and the pancreatic body, and it requires an additional parenchymal dissection during pancreaticoduodenectomy (PD). This study aimed to investigate the prevalence of CP in PD and to evaluate the incidence of postoperative pancreatic fistula (POPF) among CP patients.

Methods: Patients who underwent PD from 2002 to 2012 (n = 552) were included. Operative records and preoperative images were independently reviewed to identify the presence of CP. The incidence of POPF was compared between CP and non-CP patients and was evaluated via multivariate analysis.

Results: CP was confirmed from operative records in 7 (1.3%) patients, and abnormal parenchymal fusion was identified from preoperative images in 8 (1.4%) patients. The incidence of POPF was significantly higher in CP patients than in non-CP patients (71% vs 32%, $P = 0.039$). On multivariate analysis, CP was an independent predictive factor for POPF (odds ratio, 9.97; 95% confidence interval, 1.76–56.6; $P = 0.009$).

Discussion: Surgeons should heed the presence of CP in PD because this rare anomaly requires an additional parenchymal dissection and may increase the incidence of POPF.

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Introduction

Pancreaticoduodenectomy (PD) is a standard procedure for periampullary tumors and requires a detailed knowledge of the complex anatomy in the vicinity of the pancreas. In some cases, surgeons encounter an anatomical anomaly of the pancreas during surgery, which may require them to modify the procedures or perform additional procedures. Therefore, not only anatomical knowledge of pancreatic anomalies but also familiarity with the appropriate surgical procedures is important when performing PD on patients with such anomalies.

Circumportal pancreas (CP), one of the anomalies of the pancreas, is characterized by abnormal parenchymal fusion between the uncinate process and the pancreatic body.¹ The

prevalence of this anomaly has been reported to be 1.14–2.5% from radiological findings alone,^{2,3} whereas the prevalence has not been confirmed by operative findings. In addition, the concordance between the radiological diagnosis and operative findings and the clinical significance of this anomaly in pancreatic surgery have scarcely been investigated. We hypothesized that this anomaly may be a significant risk factor for postoperative pancreatic fistula (POPF) because of the complexity of the anomaly. In this study, we retrospectively confirmed the prevalence of CP in more than 500 consecutive patients who underwent PD by independently reviewing their operative records and preoperative radiological images. Furthermore, we assessed the influence of the presence of CP on postoperative outcomes via multivariate analysis.

Previous presentation: This paper did not presented at previous meeting.

Methods

Patients

A prospectively maintained database of the Division of Hepato-Biliary-Pancreatic Surgery at Shizuoka Cancer Center Hospital was reviewed to identify patients who underwent PD for peri-ampullary tumors between 2002 and 2012. Patients who underwent hepatopancreaticoduodenectomy were also included. We reviewed these patients' electronic medical charts, operative records, preoperative summaries, discharge summaries and preoperative radiological diagnostic images to identify the following data: gender, age, primary disease of PD, body mass index (BMI), operative time, blood loss, blood transfusion, combined colectomy, combined portal vein resection and hepatopancreaticoduodenectomy. In addition, we reviewed the patients' intraoperative completion photos to confirm the presence of abnormal parenchymal fusion representing CP and how the abnormal parenchymal fusion was dissected.

This study was conducted in accordance with the Declaration of Helsinki. Our Institutional Review Board approved this retrospective study (28-J139), and the requirement for informed consent was waived.

Anatomical and radiological definitions of CP

Anatomically, we used a definition of CP as an abnormal parenchymal fusion between the uncinate process and the pancreatic body at the left dorsal side of the portal vein based on a previously reported definition.¹ In patients with CP, an additional parenchymal dissection at the abnormal fusion is theoretically needed to complete PD (Fig. 1A); therefore, we defined patients with CP as those whose operative records included a description of the additional dissection at the abnormal parenchymal fusion. In addition, we reviewed their intraoperative photos to confirm the presence of the anomaly (Fig. 1B).

Radiologically, we used a definition of CP as abnormal pancreatic parenchyma that surrounds the portal vein and is fused with the pancreatic body, based on previous imaging studies³ (Fig. 1C). Preoperative enhanced multidetector computed tomography (MDCT) images were obtained in 4 phases (early, late arterial, portal and equilibrium phases) using Aquilion 16 (Toshiba, Tokyo, Japan). Non-ionic contrast medium (150 mL) was administered with a power injector at a rate of 3.5 mL/s. During each of the four phases, scans were acquired at 20, 40, 70 and 120 s after contrast injection. The images were independently reviewed to confirm the presence of the abnormal pancreatic parenchyma by two experienced hepatobiliary pancreatic surgeons (R.K. and T.M.) who were blinded to the clinical data. CP was classified according to the topological classification of the main pancreatic duct⁴ and the subdivision in relation to the portal confluence.²

Surgical procedure

The details of our standard surgical PD procedure were described in our previous publication.⁵ A modified Child's method with an

end-to-side pancreaticojejunostomy was used for reconstruction. All anastomosed main pancreatic ducts were externally drained and stented at the anastomosis. The abdominal cavity was routinely drained with prophylactic drains located anterior and posterior to the pancreaticojejunostomy surfaces. Post-operatively, bacterial cultures and drainage fluid amylase levels were routinely examined on postoperative days 1 and 3, and the drains were removed if the drainage fluid was grossly serosanguinous and no pancreatic fistula or bacterial contamination was present.⁶ To decrease the incidence of grade C POPF, we aggressively exchanged the surgical drains in patients with suspected POPF and left the drains until the pancreatic external secretion completely dried up in patients with POPF. POPF was classified according to the International Study Group of Pancreatic Fistula (ISGPF) definition,⁷ and POPFs of grades B and C were defined as clinically relevant POPFs. Postoperative complications were classified according to Clavien-Dindo classification,⁸ and complications higher than grade 2 were defined as clinically relevant complications. Postoperative mortality was defined as all deaths related to surgery.

Statistical analysis

Continuous variables were compared using the Mann–Whitney test, and categorical variables were compared using the χ^2 or Fisher's exact test, as appropriate. The multivariate analysis was performed using logistic regression models with backward elimination for variables with a *P* value < 0.1 in univariate analyses to avoid overfitting. *P* values < 0.05 were considered statistically significant. The statistical analyses were performed using SPSS Statistics software version 21 (IBM, Chicago, IL).

Results

Demographics and patients

A total of 552 patients, including 53 patients who underwent hepatopancreaticoduodenectomy, were identified during the study period. The patients consisted of 373 men (67.6%) and 179 women (32.4%) with a median age of 68 years. Pancreatic cancer was the most common causative disease for surgery (*n* = 237, 42.9%). From the operative records, CP was confirmed in 7 patients (1.3%). There were no significant differences in the patient background data between the CP and non-CP patients, except for intraoperative blood loss (862 mL vs 1100 mL, *P* = 0.041) (Table 1). In the 7 CP patients, the abnormal fusion representing the CP was dissected using surgical stapler (*n* = 5) or electrical cautery (*n* = 2) (Table 2). In all 7 patients, the orifice of the main pancreatic duct was confirmed at the cut surface of the normal pancreatic body, and the abnormal parenchymal fusion existed at the cranial side of the splenoportal confluence. The 7 CP patients underwent pancreaticojejunostomy in the same manner as the non-CP patients did. Thus, the 7 CP patients were classified as having type IIIA CP based on the topological classification.⁴

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