The Implications of the Presence of an Aberrant Right Hepatic Artery in Patients Undergoing a Pancreatectoduodenectomy

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Abstract

Purpose. An aberrant right hepatic artery (ARHA) is a common anomaly and its implications for patients undergoing a pancreaticoduodenectomy (PD) have not yet been previously reported. We compared the outcomes following PD in patients with and without an ARHA. A novel classification of the anatomical course of ARHA, and surgical techniques for its identification and preservation are described herein.

Methods. All patients undergoing PD between June 1, 2002, and May 31, 2007, were divided into two groups, one with ARHA and the other without. These groups were compared to identify differences in the intraoperative variables, the oncological clearance, the postoperative complications, and the survival.

Results. A total of 135 patients underwent PD of which 28 (20.8%) patients were found to have either accessory or replaced right hepatic arteries (ARHA group). There were no significant differences in the intraoperative variables (blood loss and operative time) and the incidence of postoperative complications (pancreatic leak and delayed gastric emptying). Oncological clearance (nodal yield and resection margins) and survival were also similar in the two groups.

Conclusions. The surgical and oncological outcomes of PD remain unaffected by the presence of ARHA provided that the anatomy is recognized and appropriately managed. Aberrant right hepatic artery can be classified into three types according to their anatomical relationship with the head of the pancreas.

Key words Aberrant right hepatic artery · Pancreatectoduodenectomy · Whipple’s resection

Introduction

Aberrant hepatic arterial anatomy is found in as high as 41% of the population. The commonest anomaly relates to the origin of the right hepatic artery which has been reported in 13%–26% of all cases. In addition, arteriovenous malformations have been reported in the pancreas.

The importance of aberrant vascular anatomy in pancreatic surgery has been reported in numerous publications. An aberrant right hepatic artery (ARHA) originating from the superior mesenteric artery (SMA) has a close relationship with the head of pancreas, rendering it vulnerable to damage during pancreatic head resections. Conversely, an attempt to preserve the ARHA can lead to a compromised cancer resection.

It is widely accepted that the right hepatic arterial supply should be preserved whenever possible. Most publications on this subject relate either to descriptive anatomy, preoperative “mapping,” or to technical considerations during surgery. However, the impact of the presence of ARHA in patients undergoing pancreatectoduodenectomy (PD) is not known. The aim of this study was to describe the anatomical course of ARHA, technique of surgical dissection, and to compare the operative and oncological implications of presence of ARHA in patients undergoing PD.

Patients and Methods

All patients undergoing PD in the Cambridge Surgical HPB Unit between June 1, 2002 and May 31, 2007 were studied from a prospectively maintained Pancreatectic Resection Database. The presence or absence of an ARHA was documented during surgery and on this basis two patient groups were identified, one with and other without ARHA. These groups were then compared to identify differences in the intraoperative
variables (operative time and blood loss), oncological clearance (resection margins and nodal yield), and postoperative complications such as pancreatic leak or delayed gastric emptying.

Surgical Technique

The operations were performed by three surgeons in the department, each using similar techniques for dissection and reconstruction. The dissection for PD commenced with a full Kocherization of the duodenum up to the origin of SMA followed by an exposure and assessment of the infra- and retropancreatic superior mesenteric vein (SMV). The key to identifying the ARHA was the suprapancreatic dissection of the hepatoduodenal ligament. Before this dissection, a careful palpation of the free edge of the hepatoduodenal ligament and a further confirmation by intraoperative ultrasonography were carried out to detect the presence of ARHA. As part of a lymphadenectomy, all of the tissues around the hepatic artery and the portal vein were cleared. The common hepatic duct (CHD) was divided without including any surrounding tissue to minimize the risk of inadvertent ligation of the ARHA. An ARHA, if present, would be encountered at this stage lying posterior and lateral to the CHD. If identified, the ARHA was dissected along its entire course (inferior) up to its origin from the SMA, and preserved. This might require a dissection within the posterior pancreatic capsule and at this stage it was confirmed whether ARHA was traversing through the pancreatic parenchyma. The ARHAs traversing the head of the pancreas were resected en bloc with or without arterial reconstruction. The plane of division of retropancreatic tissue and the duodenal mesentery was kept close to the SMA in order to facilitate preservation of ARHA and for adequate tumor clearance. All patients underwent PD with reconstruction using a 70-cm Roux-en-Y loop of jejunum for pancreatic and biliary anastomoses. An extended lymphadenectomy was not routinely performed in our unit.

During the later part of the series, with the aid of a multidetector computed tomography (CT) scanners and using a dedicated pancreatic CT protocol, the presence of ARHA was reliably identified in the preoperative period. Mesenteric angiography was not used in the preoperative workup of our patients. The operative time was calculated from the time of incision to the time of skin closure. The blood loss was calculated from the weight of the swabs and the total amount of fluid retrieved in the suction after excluding the volume of any irrigation solution used. The adequacy of resection was judged by the absence of tumor within 1 mm of the resection margins and the total nodal yield as reported by the histopathologist. The patients with benign disease were excluded from the analysis for oncological clearance. Pancreatic leak was defined as the persistent drainage of amylase-rich fluid (more than 3 times the serum level) for more than 5 days or a clinical leak requiring radiological and/or surgical intervention. Delayed gastric emptying (DGE) was defined as the inability to re-establish a normal oral intake within 2 weeks after surgery due to persistent vomiting or large nasogastric aspirate. In these patients the mechanical obstruction was ruled out with a water-soluble contrast study or a dual-contrast CT scan.

All patients with cancer were subsequently considered for inclusion in the ESPAC III trial for adjuvant chemotherapy and were followed up every 6 months indefinitely. The 1- and 5-year survivals were compared between the two groups.

The statistical analysis was performed using SPSS for Windows, version 11.0.0 (SPSS, Chicago, IL, USA). An independent samples t-test and a chi-square test were used to assess significance. Survival was calculated using the Kaplan–Meier method. A P value of less than 0.05 was considered to indicate a significant difference.

Results

A total of 135 patients underwent PD during the 5-year period between June 1, 2002, and May 31, 2007, of which 28 (20.8%) patients were found to have either accessory or replaced right hepatic arteries (ARHA group). The remaining 107 (79.2%) patients had standard right hepatic arterial anatomy (non-ARHA group). Of the 28 ARHAs, 25 were aberrant right hepatic artery arising from the SMA, while the other 3 were completely replaced common hepatic artery also arising from the SMA. The demographic profile of the patients with respect to age and gender distribution was similar in the two groups. In 14 cases, the final histology was benign, 1 of these patients was in the ARHA group while the others were in the non-ARHA group. These patients were excluded from the analysis of the oncological outcomes and survival. From the oncological point of view, both groups were comparable with regards to the histological type and the location of the tumor (Table 1). Similarly, there was no difference in the TNM stages of the tumors in the two groups.

After originating from the SMA, 24 of the 28 ARHAs (85.7%) followed a course along the posterior surface of the head of the pancreas to the posterolateral border of the hepatoduodenal ligament, and were preserved (Type 1). However, in 3 cases (10.7%) the ARHA was traversing though the pancreatic parenchyma (Type 2). In these 3 cases the ARHA was resected en bloc with the pancreatic head of which one was reconstructed by anastomosing the divided ARHA.