

Reconstruction of the Replaced Right Hepatic Artery at the Time of Pancreaticoduodenectomy

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Abstract

Background The arterial anatomy supplying the liver is highly variable. One of the most common variants is a completely replaced right hepatic artery which is seen in about 11% of the population. Interruption of arterial flow to the right hepatic artery at the time of pancreaticoduodenectomy has been associated with biliary fistula and the consequent complications, as well as stenosis of the biliary enteric anastomosis. Malignancies of the posterior aspect of the head of the pancreas can encase a replaced right hepatic artery without involvement of other vascular structures. In this situation, it is possible to resect and reconstruct the replaced right hepatic artery to maintain oxygen delivery to the biliary enteric anastomosis.

Summary Herein we describe a technique to reconstruct a replaced right hepatic artery following resection of the vessel en bloc with the tumor during a pancreaticoduodenectomy, using inflow from the gastroduodenal artery.

Keywords Replaced · Right hepatic artery · Vascular reconstruction · Pancreaticoduodenectomy · Surgery · Whipple

Background

The arterial anatomy supplying the liver is highly variable. No less than ten anatomic variants have been described.¹ In the configuration typically described as ‘normal’ in anat-

my textbooks, the celiac trunk gives rise to the common hepatic artery which then branches into the gastroduodenal and proper hepatic arteries. The right and left hepatic arteries are then branches of the proper hepatic artery. This anatomy is seen in about 55% of patients,¹ while the remainder will exhibit an anatomic variant. One of the most common variants is a completely replaced right hepatic artery which is seen in about 11% of the population.¹ A replaced right hepatic artery originates from the superior mesenteric artery, courses either within the pancreatic head or posterior to it, and then superiorly along the right posteriolateral border of the common bile duct before entering the right lobe of the liver (Figs. 1 and 2).

Ligation of the right hepatic artery can have grave consequences for the patients undergoing pancreaticoduodenectomy because most of the blood supply to the common bile duct remnant is derived from the right hepatic artery following ligation of the gastroduodenal artery at the time of resection. Interruption of arterial flow to the right hepatic artery at the time of pancreaticoduodenectomy has been associated with biliary fistula and the consequent complications, as well as stenosis of the biliary enteric anastomosis. These complications are presumed to be a function of ischemia of the distal end of the common bile duct remnant.^{2,3}

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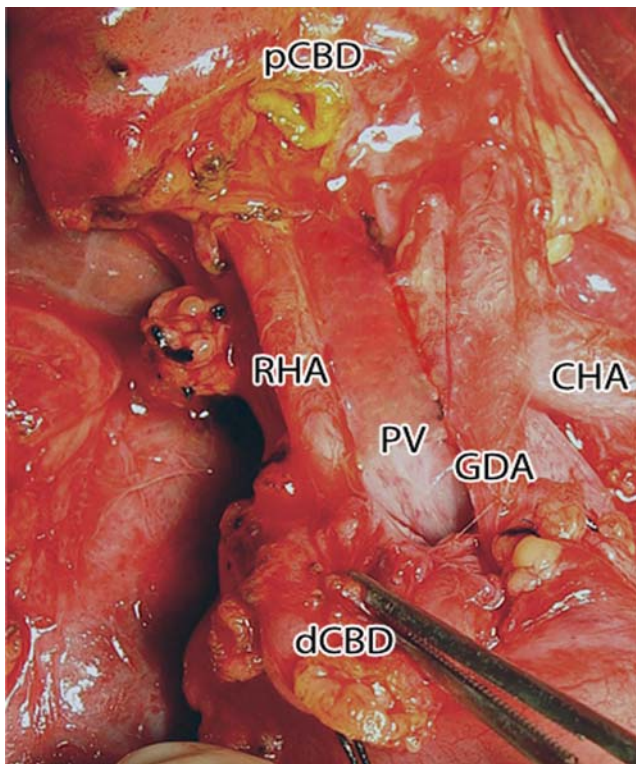


Figure 1 Operative photograph of the hepatoduodenal ligament demonstrating the aberrant anatomy of the replaced right hepatic artery. The bile duct has been transected and the distal portion has been reflected inferiorly. *pCBD* proximal common bile duct, *dCBD* distal common bile duct, *RHA* replaced right hepatic artery, *CHA* common hepatic artery, *GDA* gastroduodenal artery, *PV* portal vein.

Malignancies of the posterior aspect of the head of the pancreas can encase a replaced right hepatic artery without involvement of other vascular structures. In this situation, it is possible to resect and reconstruct the replaced right hepatic artery to maintain oxygen delivery to the biliary enteric anastomosis. Sarmiento et al. previously described using inflow from the gastroduodenal artery to reconstruct an injured proper hepatic artery.⁴ Herein we describe a similar technique to reconstruct a replaced right hepatic artery following resection of the vessel en bloc with the tumor during a pancreaticoduodenectomy.

Technique

Once it has been determined that the tumor involves the replaced right hepatic artery, but is otherwise resectable, the hepatoduodenal ligament is dissected. The neck of the pancreas is divided. The patient is heparinized after obtaining vascular control of the common hepatic, proper hepatic artery, and replaced right hepatic arteries. The gastroduodenal artery is divided preserving as much length as possible. The uncinate dissection is completed,

excising the segment of replaced right hepatic artery that is encased in tumor. The replaced right hepatic artery is ligated at its origin with the superior mesenteric artery. The remaining cut ends of the replaced right hepatic artery and gastroduodenal artery are then anastomosed to each other in an end-to-end fashion with interrupted sutures of 8-0 prolene. Vascular control is released and pulsatile flow is confirmed in the right hepatic artery (Figs. 3 and 4).

Comment

Several options are available for reconstruction of the replaced right hepatic artery after it has been resected with the specimen. Techniques involving venous or prosthetic interposition have been described.^{5,6} Prosthetic material has the disadvantage of being placed in a field that is not sterile. Vein grafts require harvesting the vessel, often through a second incision. Any interposition graft will require two anastomoses. The gastroduodenal artery transposition technique described above eliminates the need for prosthetic

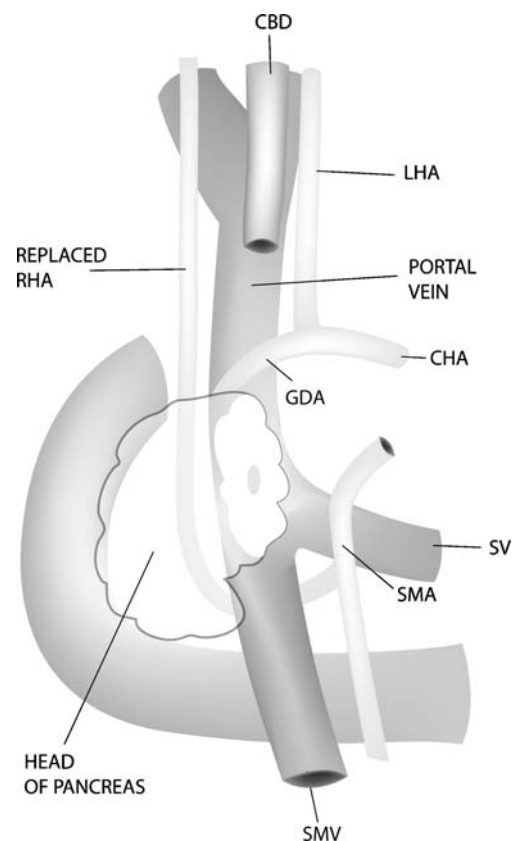


Figure 2 Line drawing depicting the anatomy of the replaced right hepatic artery. *CBD* common bile duct, *RHA* right hepatic artery, *LHA* left hepatic artery, *CHA* common hepatic artery, *GDA* gastroduodenal artery, *SMA* superior mesenteric artery, *SV* splenic vein, *SMV* superior mesenteric vein.

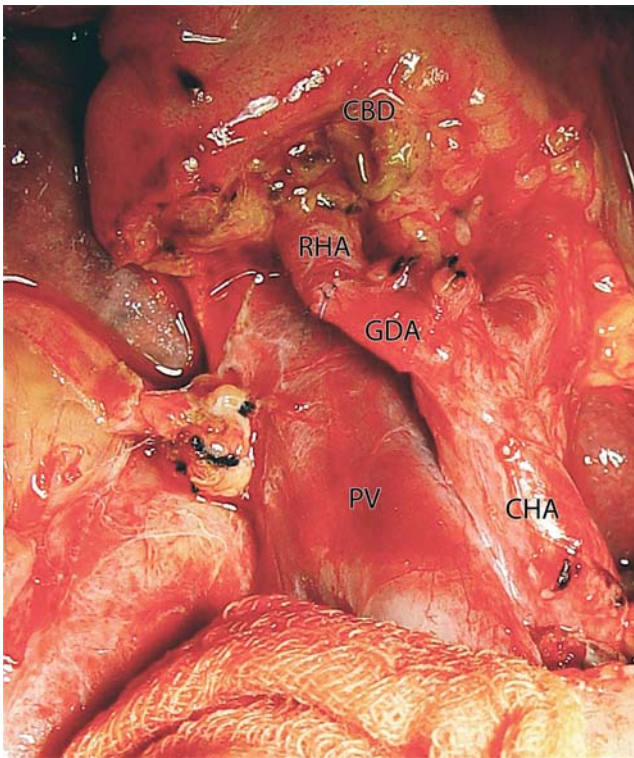


Figure 3 Operative photograph of the hepatoduodenal ligament following segmental resection and reconstruction of the replaced right hepatic artery demonstrating the end-to-end anastomosis between the right hepatic artery and the gastroduodenal artery. *RHA* replaced right hepatic artery, *GDA* gastroduodenal artery, *CHA* common hepatic artery, *PV* portal vein, *CBD* common bile duct.

material, provides arterial inflow with a size matched vessel, and requires a single anastomosis, enabling the surgeon to extend the safe limits of pancreatic resection to this unique patient population.

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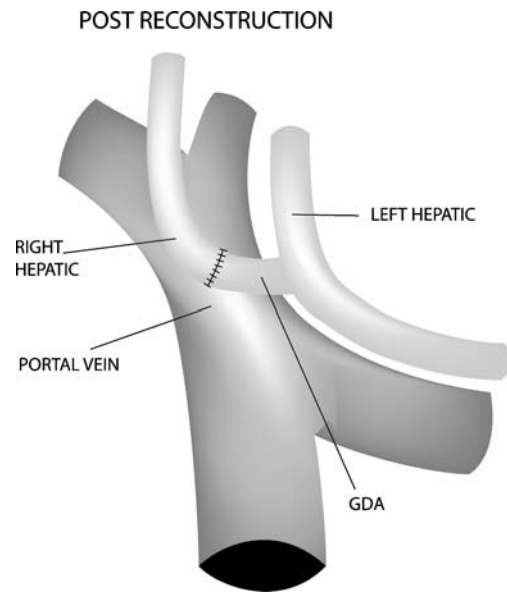


Figure 4 Line drawing depicting the vascular anatomy following the reconstruction of the replaced right hepatic artery. *GDA* gastroduodenal artery.

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