

CASE REPORT

Managing Arterial Collaterals Due to Coeliac Axis Stenosis During Pancreaticoduodenectomy

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ABSTRACT

Context Coeliac artery stenosis is a condition affecting a minority of patients undergoing pancreaticoduodenectomy. In such cases, the development of collateral pathways through the blood supply of the pancreatic head provides challenges for surgical management. **Case report** We report a case of coeliac artery stenosis in a patient undergoing pancreaticoduodenectomy. The main blood supply for the coeliac axis was through a single collateral channel, formed by the anterior pancreaticoduodenal arterial arcade. We describe the preservation of this arcade, resection of the redundant artery with primary anastomosis and a review of the literature. **Conclusion** Management of coeliac artery stenosis during pancreaticoduodenectomy depends on identifying the cause and dealing with it accordingly, intraoperatively.

INTRODUCTION

Coeliac artery stenosis is not an uncommon condition, with population studies reporting a frequency ranging 12-24% in European countries and 2-7% in Asian countries [1]. However, whilst the majority of these patients are asymptomatic, coeliac artery stenosis in patients undergoing pancreaticoduodenectomy is significant.

The arterial supply of the head of the pancreas originates from both coeliac axis through the gastroduodenal artery and the superior mesenteric artery. The superior roots of the pancreaticoduodenal arcades are represented by the anterior and the posterior superior pancreaticoduodenal arteries which usually arise from the gastroduodenal artery directly or via a common trunk referred to as superior pancreaticoduodenal artery (Figure 1a). The inferior roots are represented by the anterior and the posterior inferior pancreaticoduodenal arteries, which usually arise from the superior mesenteric artery separately or via a common trunk referred to as the inferior pancreaticoduodenal artery [2]. Both arcades join on the posterior surface of the head of the pancreas, and with the exclusion of the anterior superior

pancreaticoduodenal artery, their branches run superficially on the surface of the pancreas [3]. The anterior superior pancreaticoduodenal artery is considered to be the most important artery supplying the pancreatic head. It usually arises from the gastroduodenal artery, about 3.8 cm (range: 2.2-6 cm) distal to the origin of the latter from the common hepatic artery, behind or at the lower border of the first part of the duodenum. Its calibre varies from 1 to 3 mm with a mean value of about 1.9 mm [4]. The anterior inferior pancreaticoduodenal artery is the smallest of the pancreaticoduodenal arteries, with a calibre of 1-2.5 mm [5].

In cases of coeliac artery stenosis, the pancreaticoduodenal arcades are the major collateral routes from the superior mesenteric artery to the celiac branches. In most cases both the anterior and posterior arcades develop as collateral pathways, but occasionally one arcade develops as a single dominant channel [6].

We describe here a case of coeliac artery stenosis in a patient undergoing pancreaticoduodenectomy [7], for cancer of the head of the pancreas, where the main blood supply for the coeliac axis was through a single collateral channel formed by the anterior arcade.

CASE REPORT

A 70-year-old male patient presented with painless obstructive jaundice. Initial ultrasound scan demonstrated dilated intrahepatic biliary radicles, but CT failed to show a mass in the head of the pancreas. Arterial phase scans demonstrated an atherosclerotic stenosis at the origin of the coeliac trunk and a dilated and tortuous artery lying over the anterior surface of the head of the pancreas (Figure 1b). Endoscopic

Received June 22nd, 2009 - Accepted July 14th, 2009

Keywords Celiac Artery; Collateral Circulation; Pancreas; Pancreatic Neoplasms; Pancreaticoduodenectomy

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Document URL <http://www.joplink.net/prev/200909/16.html>

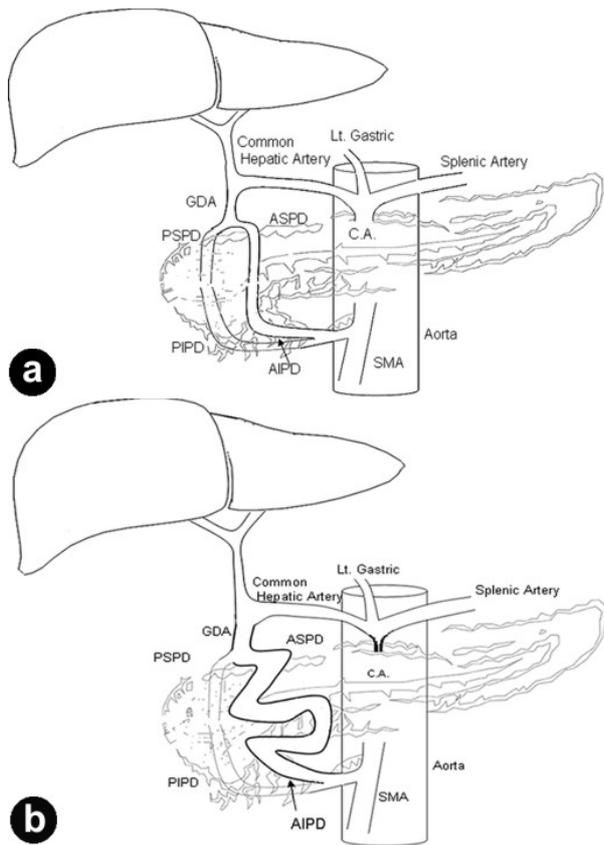


Figure 1. Normal anatomical vasculature around the head of pancreas (a.) and showing the anatomical vasculature around the head of pancreas in our case (b.), showing a stenosis of the coeliac artery and a dilated anterior pancreaticoduodenal arcade (ASPD and AIPD).

AIPD: anterior inferior pancreaticoduodenal artery; ASPD: anterior superior pancreaticoduodenal artery; CA: coeliac artery; GDA: gastroduodenal artery; PIPD: posterior inferior pancreaticoduodenal artery; PSPD: posterior superior pancreaticoduodenal artery; SMA: superior mesenteric artery.

ultrasound demonstrated a mass in the head of the pancreas with possible venous invasion and an endoscopic retrograde cholangiopancreatography demonstrated a distal bile duct stricture, which was successfully stented.

At surgery to perform pancreaticoduodenectomy [5], temporary occlusion of the gastroduodenal artery resulted in complete loss of pulsation in the hepatic, as well as other arteries of the coeliac axis. This finding in addition to the large dilated gastroduodenal artery trunk, required dissection of this artery from the pancreas and its path traced to the superior mesenteric artery. The anterior arcade was dissected from the pancreas and all pancreatic and duodenal branches were ligated and divided. This revealed a very dilated and tortuous arterial trunk, representing the anterior arcade formed by the anterior superior and inferior pancreaticoduodenal arteries, extending from the gastroduodenal artery down to the superior mesenteric artery (Figure 2a). At one point, the vessel was found to be densely adherent to the pancreatic mass. The remainder of the pancreaticoduodenectomy was uncomplicated. Post resection the abnormal, redundant

and previously adherent portion of the collateral vessel was resected and reconstructed by end-to-end anastomosis (Figure 2b). At the time of reconstruction there was minimal blood flow from the divided gastroduodenal artery end, confirming that the coeliac axis was supplied via the gastroduodenal artery and anterior pancreatic arcade from the superior mesenteric artery. The entire operative procedure took less than 6 hours of duration and was associated with minimal blood loss not requiring blood transfusion, either peri-operatively or post-operatively. The patient was discharged from hospital on day 10 after an uncomplicated postoperative recovery. Histology demonstrated a poorly differentiated adenocarcinoma of the head of pancreas with invasion into peripancreatic tissue. All margins were negative and one of 11 lymph nodes contained tumour (pT3N1Mx). The resected artery was not involved by tumour.

DISCUSSION

Coeliac axis stenosis is not rare with an incidence of 7.3% [8] in unselected cases to 7.6% [9] in populations undergoing pancreaticoduodenectomy, with the majority attributable to the median arcuate ligament, where division of this structure is adequate [10]. Treatment options for treating segmental occlusion of

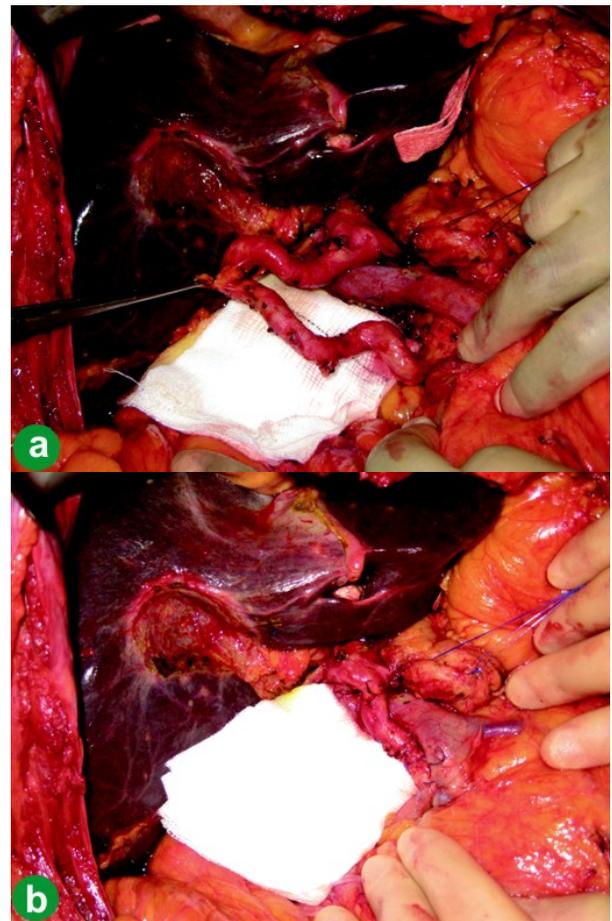


Figure 2. Intraoperative photographs demonstrating the dilated anterior pancreaticoduodenal artery (a.) and the appearances after resection and reconstruction of the vessel (b.).

the celiac artery due to atherosclerosis identified at pancreaticoduodenectomy include preoperative stenting of the celiac artery [11, 12], preservation of the collaterals during surgery and vascular reconstruction and/or bypass [13].

In this case, the stenosis resulted in a collateral arterial channel supplying all branches of the coeliac axis. This collateral was the anterior pancreaticoduodenal arcade formed by the anterior superior and inferior pancreaticoduodenal arteries, which normally measure up to 3 mm, but was over 1 cm dilated and was visualized on the arterial phase of the preoperative CT scans. The presence of such anomaly has been described in previous reports as an occasional consequence of celiac artery stenosis [6].

Although preoperative recognition of coeliac stenosis, by spiral CT, Doppler, or angiography, is stressed by previous reports [14], we found that it does not alter the decision to offer operative management of the tumour. Preoperative routine angiography and stenting is not necessary and it exposes the patient to the risk of acute ischemia in the event of stent blockage and the absence of developed collaterals. Previous reports of pancreaticoduodenectomy in the setting of coeliac artery stenosis by median arcuate ligament compression have shown that surgical division of the ligament restores adequate blood flow to proceed with resection. For atherosclerotic coeliac artery stenosis, preservation of collaterals is often necessary, but may compromise surgical clearance and as a result, vascular bypass may be necessary to achieve clearance [15]. The length of the collateral in this case allowed for resection of the redundant artery to ensure clear margins. If there was insufficient length, an interpositional graft utilising saphenous vein, would have been utilized, to ensure radicality of the procedure.

Coeliac artery stenosis is a factor in a significant minority of patients requiring pancreatic surgery and provides challenges for surgical management intraoperatively, especially its management intraoperatively. This surgery should ideally be performed in a high volume specialist centre for pancreatic surgery, and by surgeons who are able to preserve the collaterals and undertake vascular reconstruction.

Conflict of interest The authors have no potential conflicts of interest

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