Endovascular Angioplasty of Celiac Axis Obstruction Prior to Pancreaticoduodenectomy in a Patient with Pancreatic Neuroendocrine Carcinoma

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In patients with celiac axis stenosis or occlusion, a pancreaticoduodenectomy procedure can increase the risk of hepato-pancreato-biliary and other organ ischemia or failure unless a complete revascularization of the celiac axis is performed prior to or simultaneous with such surgery. Celiac axis occlusion does not appear to be an uncommon finding in cases of pancreaticoduodenectomy. Preoperative abdominal angiography can play an important role in diagnosing this high risk comorbid disease, and adequate intervention can lead to a successful operation and good postoperative outcome. Herein, we reported a patient with periampullary malignancy and metastatic liver cancer, whose preoperative diagnosis of severe celiac axis stenosis was proved by preoperative abdominal angiography. Preoperative angioplasty was subsequently performed. After angioplasty, pancreaticoduodenectomy with resection of segments 4, 6 and 7 of liver was done and the postoperative course was uneventful.

Key Words: Celiac axis occlusion • Endovascular angioplasty • Pancreaticoduodenectomy

INTRODUCTION

Pancreaticoduodenectomy, which involves ligation and division of the gastroduodenal artery (GDA) is a standard surgical procedure in patients with periampullary malignancy. In patients who have pancreatic head tumor and occlusion of the celiac axis, pancreaticoduodenectomy involves sacrifice of the GDA which may cause ischemic complications in the liver, stomach, pancreas, bowel, and hepatico-jejunal and pancreatico-jejunal anastomoses, with a potentially lethal outcome.[1] However, occlusion of the celiac axis does not seem to be an uncommon finding in the general population or patients who have undergone pancreaticoduodenectomy. The incidence in the former was 7.3%[2] and in the latter was 2-10%.[1,3,4] Preoperative abdominal angiography to detect stenosis or occlusion of the celiac axis and prompt intervention by endovascular revascularization or bypass surgery can reduce the risk of ischemic complications.[1,5,6] Herein, we reported a patient with periampullary malignancy and metastatic liver cancer, whose preoperative diagnosis of severe celiac axis stenosis was proved by preoperative abdominal angiography. Preoperative angioplasty was subsequently performed. After endovascular therapy by balloon angioplasty was used to open the obstructed celiac trunk and stent deployment to maintain the lumen, pancreaticoduodenectomy with resection of hepatic metastasis was performed. Thereafter, the postoperative course was uneventful.

Received: February 20, 2013 Accepted: July 24, 2013
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CASE REPORT

A 51-year-old woman who presented with poor

appetite and body weight loss of unknown origin for 3 months was transferred to our hospital from another hospital on Jan 15, 2010. The patient's laboratory findings showed serum total bilirubin of 0.3 mg/dl (reference range: 0.2-1.2 mg/dl), direct bilirubin of 0.1 mg/dl (reference range: 0-0.2 mg/dl), aspartate aminotransferase (AST) of 19 U/l (reference range: 8-38 U/L), alanine aminotransferase (ALT) of 14 U/l (reference range: 10-50 U/L), alkaline phosphotase of 72 U/l (reference range: 50-190 U/L), alphafetaprotein (AFP) of 4.88 ng/ml (normal cut-off value: < 12 ng/ml), carcinoembryonic antigen (CEA) of 1.09 ng/ml (normal cut-off value: < 5.0 ng/ml), carbohydrate antigen (CA) 19-9 of 0.6 U/ml (normal cut-off value: < 34.0 U/ml), and cancer antigen (CA)-125 of 199 U/ml (normal cut-off value: < 35 U/ml). Abdominal sonogram showed dilatation of the common bile duct and intrahepatic bile duct. Abdominal computed tomography showed a pancreatic head tumor, 5.2 × 2.5 cm^2, with liver metastasis. Magnetic resonance imaging (MRI) of the liver showed a periampullar tumor with multiple hepatic metastases (Segments 4, 6, and 7). Esophagogastroduodenoscopy (EGD) was performed and a tissue biopsy pathology report revealed neuroendocrinoma, so the patient was referred to our hospital for surgical treatment. Abdominal angiography prior to the surgery demonstrated a severe celiac axis stenosis with well-developed collateral circulation retrograde flow to the area of celiac trunk from the superior mesenteric artery (Figure 1A and B). An interventional cardiologist was consulted to perform percutaneous transluminal angioplasty of celiac axis prior to pancreaticoduodenectomy.

Percutaneous revascularization of the celiac artery was performed using a right femoral artery approach, with a 7Fr Judkins Right (JR4) guiding catheter (Boston Scientific, Baja California, Mexico) inserted into the celiac artery. Obstruction of the celiac artery was first confirmed with selective contrast medium injected into the celiac trunk (Figure 2A). The occluded celiac axis was crossed with a 0.018-inch guidewire, and pre-dilated with a 2.5 × 20 mm balloon catheter (BC) (Sprinter legend RX, Medtronic, Baja California, Mexico) (Figure 2B). However, the lesion could not be further dilated by a 5.0 × 20 mm BC (Wanda™, Boston Scientific, Galway, Ireland) because the balloon catheter failed to cross the acute angulation between the celiac axis and abdomi-

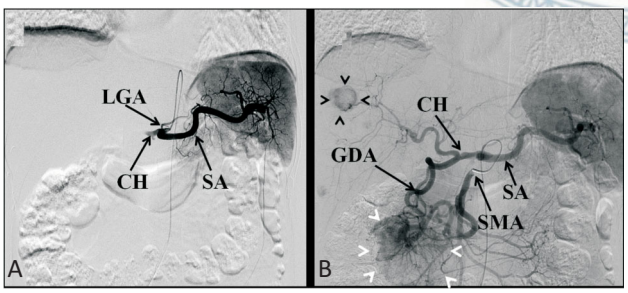

Figure 1. *Preoperative abdominal angiography. (A) Selective celiac arteriography (AP projection) demonstrates patency of the left gastric, splenic arteries, and non-visualization of the common hepatic artery. (B) Selective superior mesenteric arteriography shows well-developed collateral circulations of pancreaticoduodenal arcade and retrograde filling of the common hepatic artery, and splenic artery. CH, common hepatic; GDA, gastroduodenal artery; LGA, left gastric; SA, splenic artery; SMA, superior mesenteric artery.*

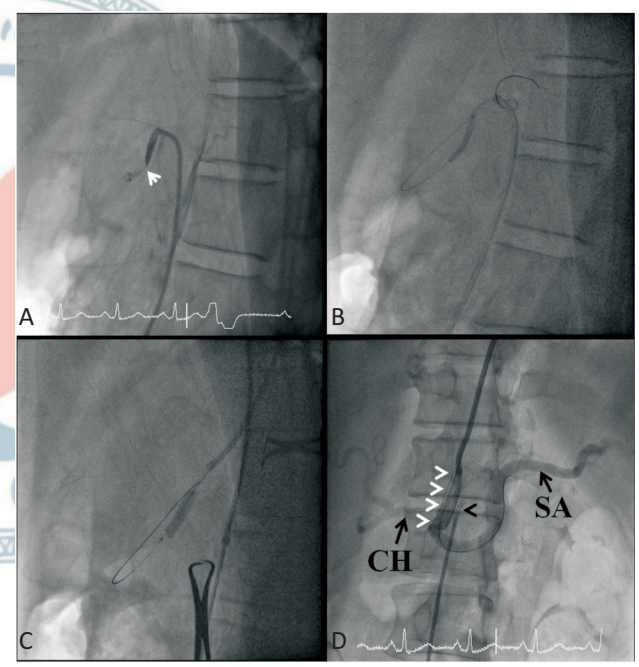

Figure 2. *Endovascular angioplasty and stenting. (A) The baseline angiography with selective contrast medium injection from celiac artery (lateral projection) shows a total occlusion of the celiac axis. (B) Wire (0.018 inch) was extended across the occluded lesion and the lesion was opened with a 2.5 × 20 mm balloon catheter (BC). (C) Wire (0.018 inch) was placed across the occluded lesion from left brachial arterial approach and the lesion was further dilated by a 5.0 × 20 mm BC. (D) Angiography (AP projection) taken immediately after angioplasty and stenting (white arrowhead) demonstrates patency of the celiac artery, and filling of the common hepatic artery (CH) and splenic artery (SA). A JR4 guiding catheter (black arrow) was inserted from right femoral approach to help confirm the stent position while implanting a stent. CH, common hepatic; SA, splenic artery.*

nal aorta. Thereafter, an 8Fr JR guiding catheter (Boston Scientific, Baja California, Mexico) was inserted from left brachial artery access and the 5.0 × 20 mm BC was successfully advanced to open the stenotic lesion (Figure 2C). Subsequently, a 7.0 × 27 mm bare metal stent (Express® LD Iliac/Biliary, Boston Scientific, Galway, Ireland) was implanted into the stenotic lesion from the guiding catheter by using a left brachial approach. A JR4 guiding catheter was advanced near the ostium of celiac artery using a right femoral artery approach and contrast medium was injected when performing balloon angioplasty and stenting (Figure 2D). Dual-antiplatelet therapy with aspirin (100 mg qd) and clopidogrel (75 mg qd) was prescribed after endovascular therapy. There were no complications and the patient was discharged 3 days after the endovascular therapy. Pancreaticoduodenectomy was performed one month later. The pathology report revealed a neuroendocrine tumor, pathological TNM stage, pT3N0M1, with liver metastases. The postoperative course was uneventful and the patient was discharged on the 7th postoperative day.

DISCUSSION

Celiac axis stenosis/occlusion is not an uncommon disease, with the incidence of 7.3-21% in unselected and symptomatic patients,[2] and 2-10% in patients who have undergone pancreaticoduodenectomy.[1,3,4] There are two primary causes of celiac axis stenosis/occlusion: extrinsic compression by the median arcuate ligament and atherosclerosis. Fortunately, stenosis/occlusion of the celiac axis rarely causes significant symptoms in the majority of patients because of the extensive collateral circulation connecting the celiac (CA), superior mesenteric (SMA) and inferior mesenteric arteries (IMA). However, in patients with celiac axis stenosis/occlusion, pancreaticoduodenectomy involves division of the gastroduodenal artery posing a risk of ischemic complications to the liver, stomach, pancreas and hepatico-jejunal and pancreatico-jejunal anatomoses, with a potential lethal outcome.[1,5]

Therefore, it is important to fully investigate these patients for concurrent celiac axis stenosis/occlusion by abdominal computed tomography with angiography or abdominal arteriography. Prompt endovascular treatment or surgical intervention can then be initiated prior to pancreaticoduodenectomy, thereby reducing the risk of ischemic complications.[1,5,6]

Treatment of celiac axis stenosis/occlusion depends on the specific etiology. In extrinsic compression of the celiac axis caused by the median arcuate ligament, division of the median arcuate ligament is the most effective surgical technique and it can be performed intraoperatively. In celiac axis stenosis/occlusion caused by the atherosclerotic process, revascularization can be achieved via bypass grafting or endarterectomy, percutaneous transluminal angioplasty alone, or with stenting.[3,6-8] Several studies have shown mortality and morbidity to be lower, long term patency rate to be lower, and reintervention rate to be higher for endovascular interventions compared with surgical interventions. Considerably less invasive than open surgery, endovascular intervention is now a popular alternative means to treat celaic axis stenosis/occlusion. The endovascular intervention can be performed from the common femoral artery, but a brachial artery approach is sometimes necessary for severely downward pointing celiac axis, even with the higher risk of brachial artery puncture site complication. In our case, we were able to extend wiring across the totally occluded lesion and dilate the lesion with a 2.5 × 20 mm BC by starting with a femoral approach, but we could not advance a 5.0 × 20 mm BC to further dilate the lesion due to the stiffness of the balloon catheter and the downward alignment of the celiac axis, which caused acute angulation between the celiac axis and abdominal aorta. Subsequently, we were able to complete the balloon angioplasty with a bigger BC and stent deployment from the left brachial artery approach along the more coaxial angle between the guiding catheter and celiac axis. A guiding catheter positioned around the orifice of celiac axis for the point of contrast medium injection can confirm the adequate stent position before deployment, thereby ensuring stent apposition.

In conclusion, occlusion of the celiac axis in patients with periampullary malignancy undergoing pancreatoduodenectomy poses a risk of ischemic complication. Preoperative abdominal arteriography can help physicians visualize such a coincidental situation. Prompt revascularization prior to pancreaticoduodenectomy by

bypass surgery or endovascular intervention can reduce the risk of ischemic complications.

CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

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