Successful Utilization of Coronary Covered Stents to Treat a Common Hepatic Artery Pseudoaneurysm Secondary to Pancreatic Fistula After Whipple’s Procedure: Report of a Case

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Abstract
A 73-year-old man underwent a pylorus-preserving Whipple’s procedure for distal cholangiocarcinoma. His postoperative course was complicated by the formation of a pancreatic fistula, which was initially managed conservatively. On postoperative day (POD) 86, he lost 100 ml of blood from the site of the pancreatic fistula. Contrast-enhanced computed tomography (CT) showed a pseudoaneurysm, 12 mm in diameter, in the common hepatic artery. The diameter of the pseudoaneurysm increased to 15 mm on POD 89, so we implanted coronary covered stents to prevent massive bleeding from rupture and to retain hepatic arterial flow. Six days after implantation, computed tomography findings confirmed a thrombosed pseudoaneurysm as well as patent hepatic arterial flow. Follow-up CT 18 months after surgery showed patent hepatic arterial flow. There have been no signs of rebleeding or abnormal liver function.

Key words Pseudoaneurysm · Covered stent · Hepatic artery · Whipple’s procedure

Introduction
Bleeding after Whipple’s procedure, which is usually caused by the formation and rupture of a pseudoaneurysm secondary to pancreatic leakage, is associated with a poor prognosis. Conventionally, this bleeding is treated with transcatheter arterial embolization (TAE). However, because the common hepatic artery is frequently involved, TAE is associated with a high risk of liver failure caused by complete embolization of the common hepatic artery. We report a case of a common hepatic arterial pseudoaneurysm secondary to a pancreatic fistula after Whipple’s procedure, which was treated successfully by the implantation of a coronary covered stent.

Case Report
A 73-year-old man with a history of hypertension underwent pylorus-preserving Whipple’s procedure for distal cholangiocarcinoma at our hospital. On postoperative day (POD) 5, an intestinal obstruction developed. On POD 7, we performed a laparotomy for suspected ischemic changes in the jejunum used for reconstruction; however, the findings were unremarkable. On POD 13, a pancreatic fistula was found in the midline of the upper abdomen. On POD 48, the fistula was found to communicate with the duodeno-jejuno-anastomosis. On POD 86, the patient lost 100 ml blood from the site of the fistula. Contrast-enhanced computed tomography (CT) showed a pseudoaneurysm, 12 mm in diameter, in the common hepatic artery. A CT scan on POD 89 showed that the pseudoaneurysm had enlarged to 15 mm in diameter (Fig. 1). Abdominal angiography also confirmed the presence of a pseudoaneurysm in the common hepatic artery (Fig. 2a). The growth of the aneurysm suggested the risk of massive bleeding from rupture. Instead of performing conventional treatment by TAE, we implanted a coronary covered stent to prevent rupture of the pseudoaneurysm and to retain the hepatic arterial flow. Two Graft Master (Abbott Vascular, Redwood City, CA, USA) stents, 3.5 mm in diameter ×16 mm in length and 4.0 mm in diameter ×16 mm in length, respectively, appropriate for the size of the common hepatic artery, were introduced with a guidewire into the common hepatic artery to obstruct the entrance of the aneurysm (Fig. 2b). The proximal side was dilated by a 4.5 mm balloon. The stent insertion did not result in an increase in transaminases, and...
Anticoagulant therapy was not given, to minimize the risk of rebleeding. Assessment of blood flow inside the stents was difficult; however, a CT scan done 6 days after implantation showed both the thrombosed pseudoaneurysm and the retention of hepatic arterial flow (Fig. 3). The patient was discharged 147 days after the Whipple procedure. At the time of writing, 18 months after the operation, CT images showed patent hepatic arterial flow. He is being followed up at our outpatient clinic and there is no evidence of rebleeding or abnormal hepatic function.

Discussion

Intra-abdominal bleeding after Whipple’s procedure generally originates from a pseudoaneurysm secondary to pancreatic leakage, and it can be massive and fatal. However, most patients experience herald bleeding 0–6 days before massive bleeding, indicating the need for immediate assessment by contrast-enhanced CT or angiography. Hemostasis is generally achieved by TAE, which is the most common treatment and thus, the treatment of choice. In fact, the liver can tolerate embolization of the main hepatic artery without major consequences because of collaterals such as the inferior phrenic artery. However, there are fewer collaterals than normal after Whipple’s procedure because of the lymphadenectomy. Embolization of the hepatic artery may result in liver abscess or cholangitis. Other authors have reported liver abscess formation (10%–13%) and a temporary increase in transaminases (30%–50%) after embolization of the common hepatic artery. If liver failure develops, mortality is as high as 25–37%. Disruption of hepatic arterial flow after TAE can result in fatal liver failure, especially in patients with no remarkable collaterals, such as those with transposition of the hepatic artery and either decreased or disrupted portal flow. Thus, for preserving hepatic arterial blood flow, the implantation of a covered stent may be better than TAE.