Hepatic artery aneurysm involving the proper hepatic and gastroduodenal artery treated using a gastroepiploic artery in situ bypass

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We herein present the first known case of common hepatic artery aneurysm involving the proper hepatic artery treated with in situ bypass by using right gastroepiploic artery. A 55-year-old man was hospitalized after the incidental discovery of a low-echogenic mass with blood flow in the hepatic artery. Selective visceral arteriography demonstrated a hepatic artery aneurysm that filled via the superior mesenteric artery. The most proximal part of the common hepatic artery was occluded. A resection of aneurysm was performed, and the arterial blood flow was restored to the liver by mobilizing the right gastroepiploic artery and anastomosing the proper hepatic artery. This technique is preferable to grafting in that only one anastomosis is necessary and predicts that the results may be at least as good as with vein or prosthetic grafts. (J Vasc Surg 2007;45:1069-71.)

Recent developments in imaging techniques such as computed tomography and ultrasound scans have greatly helped the diagnosis of visceral artery aneurysms, and they are now often discovered incidentally during an assessment for abdominal pain or other disorders.[1] The first choice of treatment is a ligation[2] and/or bypass, endovascular embolization,[3] or endovascular stent graft.[4] The treatment choice depends on the adequacy of collateral flow, the clinical presentation, location, etiology, general health status, and comorbidity factors. Conversely, the right gastroepiploic artery (GEA) has been used as an arterial graft for coronary artery bypass grafting,[5] and the outcome has been satisfactory.[6] We herein describe the first known case of a hepatic artery aneurysm treated by surgical resection and an in situ right GEA bypass.

CASE REPORT

A 55-year-old normotensive man presented with pain in the right upper quadrant, and an abnormal mass with blood flow in the hepatic artery was found by abdominal ultrasonography. There was no history of abdominal injury due to a previous operation. On physical examination, his abdomen was not tender, and the electrolyte and complete blood cell counts were normal. Abdominal computed tomographic scan demonstrated a 15-mm abnormal mass that was enhanced by contrast medium near the common hepatic artery. An aneurysm related to the bifurcation of the common hepatic artery was identified, and the aneurysm was filled via the superior mesenteric artery according to the findings of a selective superior mesenteric arteriogram (Fig 1, *A*). The most proximal part of the common hepatic artery was occluded according to a selective celiac arteriogram (Fig 1, *B*).

At operation, the results of general exploration were normal. We approached through the lesser omentum, and an aneurysm involving the proper hepatic artery and the gastroduodenal artery measuring 2 cm in diameter was identified (Fig 2, *A*). Therefore, we needed to divide the arteries to exclude the aneurysm. After the aneurysm was resected, the arterial blood flow was restored to the liver by mobilizing the right GEA, which was prepared by using the same technique as that used during coronary artery bypass grafting. In brief, the GEA was palpated to confirm that it was a suitable conduit. The anterior layer of the greater omentum was then incised throughout the necessary graft length by using the ultrasonic scalpel with coagulating shears (Harmonic Scalpel; Ethicon Endo-Surgery, Cincinnati, Ohio). All arterial branches with surrounding tissues were put between the vibrating tip and the tissue pad and simply divided as a pedicle graft. After systemic heparinization, the distal end of the graft was divided, milrinone solution was instilled in it, and then a hemoclip was applied. The right GEA was anastomosed to the proper hepatic artery by using an 8-0 polypropylene suture in an end-to-end fashion. The ischemic time for the liver was 20 minutes. A calcium blocker was administered to prevent graft spasm after surgery. A histologic examination of the aneurysm specimen showed severe intimal thickening with cystic degeneration and thinning disarrayed elastic fiber and smooth muscle cells in the media (Fig 2, *B*).

The patient recovered from the operation without any major complications. A postoperative arteriogram showed a patent bypass graft (Fig 3) and no evidence of any aneurysm. He was discharged in good condition and has demonstrated no adverse events during a 5-year follow-up period.

DISCUSSION

This is first case of a hepatic artery aneurysm treated with in situ bypass by using the right GEA. In this case, the restoration of the blood flow to the proper hepatic artery was definitely required because the aneurysm involved the proper hepatic artery and the gastroduodenal artery, which

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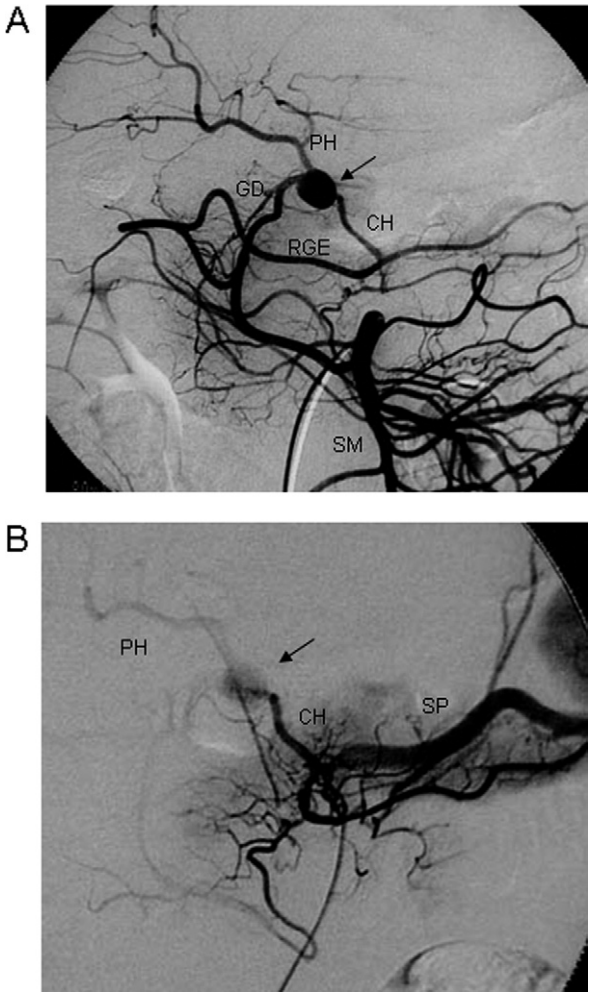

Fig 1. Preoperative selective angiogram. A selective superior mesenteric arteriogram demonstrated a hepatic artery aneurysm that filled via the superior mesenteric artery, and it was related to the bifurcation of the common hepatic artery (**A**). In addition, a selective celiac arteriogram demonstrated the most proximal part of the common hepatic artery to be occluded, whereas the collateral flow was poorly observed (**B**). The *arrow* points to the aneurysm. *CH,* Common hepatic artery; *GD,* gastroduodenal artery; *RGE,* right gastroepiploic artery; *SM,* superior mesenteric artery; *SP,* splenic artery; *PH,* proper hepatic artery.

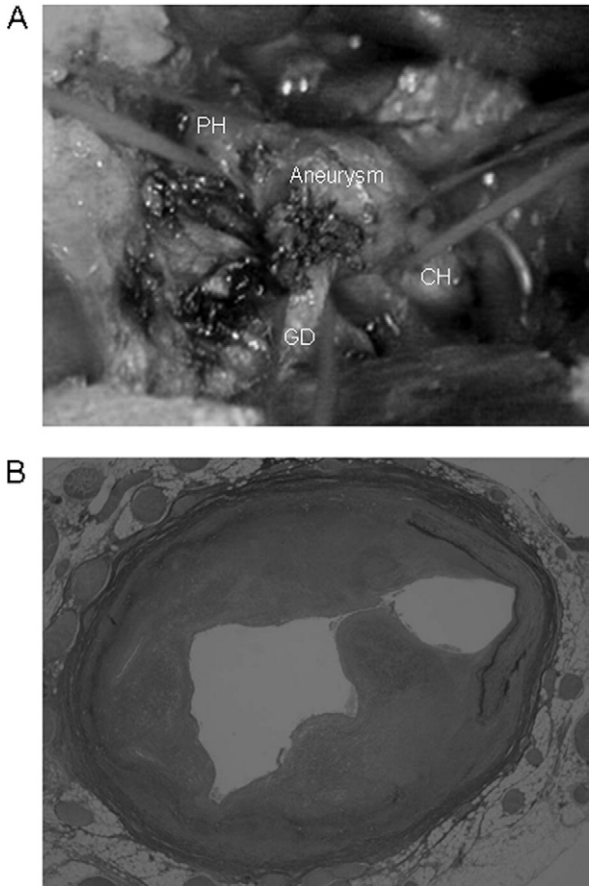

Fig 2. (**A**) Operative view showing a hepatic artery aneurysm. *A,* Aneurysm; *CH,* common hepatic artery; *GD,* gastroduodenal artery; *PH,* proper hepatic artery. (**B**) Histopathologic findings of the excluded aneurysm (stain, Elastica–von Giessen; original magnification, ×40).

was thus determined to demonstrate the major collateral flow.

Alternatively, we considered that the proper hepatic artery might be able to anastomose to the gastroduodenal artery directly after exclusion of the aneurysm before surgery. However, the procedure was not successful because the artery could not be sufficiently mobilized to anastomose to the proper hepatic artery. We therefore chose this option. Gardner et al[7] reported a case of splenic artery bypass in the same situation. However, the splenic artery for use as a bypass graft leaving the spleen might cause splenic ischemia, and it is therefore considered to be more complicated than the right GEA regarding the overall surgical technique. The right GEA has been used as a graft for coronary artery bypass grafting. It has the appropriate size and length for use as an in situ graft, it tends to show little evidence of arteriosclerosis,[5] and the outcome has been shown to be satisfactory.[6] In addition, it is easy to mobilize the GEA without making an additional incision to obtain a sufficient graft length, and only one anastomosis is required to restore the blood flow. Furthermore, GEA in situ grafts may have a flow adaptability that allows them to respond to the flow demand of the recipient artery such as internal thoracic artery grafts have the adaptability.[8] For this reason, we believe that the outcome it thus expected to be at least as good as with vein grafts[6] or prosthetic grafts, although there is a risk of graft spasm in the early postoperative period.

Hepatic artery aneurysms are the second most common visceral aneurysms, which represent approximately 30% of visceral artery aneurysms.[9] They are rare, but they can rupture and pose a difficult therapeutic challenge, especially

Fig 3. Postoperative selective superior mesenteric angiogram showing a patent artery bypass graft. The *arrow* points to the anastomotic site.

in emergency cases.[10,11] Although their exact natural history is not clear, a size of 2 cm or greater is considered significant enough to warrant treatment if the patient's overall condition permits. Recently, various minimally invasive techniques, including transcatheter embolization,[3] endovascular stent grafts,[4,12] and laparoscopic surgery,[13] have been developed. However, their techniques are not always indicated because of heterogeneity of these aneurysms.[14] In our case, there were two goals for the operation. One was a complete resection of the aneurysm, and the other was the preservation of the end-organ flow. Therefore, we thought that this patient required revascularization to the liver.

Possible causes include atherosclerosis, trauma, infection, fibromuscular hyperplasia, and arteritis. In this case, occlusion of the common hepatic artery was found on preoperative angiography. The major collaterals are developed through the gastroduodenal and the inferior pancreaticoduodenal arteries. Sutton and Lawton[15] reported saccular aneurysm formation of the collateral arterial pathway in celiac axis occlusion and suggested that a high-flow state in a collateral artery may thus lead to an aneurysmal formation. We suspect that such an aneurysm may be caused by increased and turbulent blood flow in the vessels.

In conclusion, a case of a hepatic artery aneurysm treated by means of a right GEA bypass was herein described, and this technique is thought to be a safe and effective treatment alternative for visceral artery aneurysms.

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