Endovascular treatment of a patient with an aneurysm of the proper hepatic artery and a duodenal fistula

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Aneurysms of the proper hepatic artery comprise a rare but potentially dangerous entity for which treatment is performed both surgically and endovascularly. Covered stents are generally used for endovascular treatment of such aneurysms. When the aneurysm is contaminated due to an enteric fistula, however, use of a covered stent is considered inappropriate. This case report describes the endovascular repair of a proper hepatic artery aneurysm using overlapping bare metal stents after the patient was surgically treated for duodenal hemorrhage. (J Vasc Surg 2011;53:814-7.)

Hepatic artery aneurysms (HAAs) are rare, with an estimated incidence up to 0.4%.[1,2] Of all visceral artery aneurysms, 20% are confined to the hepatic arteries.[1-3] A subdivision can be made between true HAAs and pseudo-HAAs. Pseudo-HAAs, accounting for approximately 20% of all HAAs, mostly have a post-traumatic or iatrogenic origin.[3] True HAAs are generally confined to the extrahepatic vessels, and the most common etiology is atherosclerosis, although rare conditions, such as vasculitis, have also been reported.[3,4]

HAAs can remain asymptomatic or present with symptoms ranging from abdominal discomfort to acute abdominal hemorrhage. Owing to the increased use of diagnostic imaging, asymptomatic HAAs are more frequently discovered.[1,5,6] The risk of rupture for all HAAs is significant and may be as high as 21% to 80%.[4,7-9] Mortality rates after rupture range between 21% and 43%.[1,4]

Treatment options for HAAs include endovascular embolization or stenting, as well as traditional surgical ligation or grafting.[5] Reported treatment indications are symptomatic HAAs, pseudo-HAAs, or a diameter >2 cm.[1,10] Surgical treatment is generally used in common HAAs and in HAAs with enteric fistula. Endovascular treatment is preserved for proper HAAs because surgical ligation can result in cholangitis due to absent collateral flow toward the liver by the gastroduodenal artery.[3,11]

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In this case report we present our experience with endovascular repair of a proper HAA by open stenting, after the patient was surgically treated for a duodenal hemorrhage due to an enteric fistula.

CASE REPORT

A 48-year-old man, without significant medical history, was referred from a local hospital to our center with acute duodenal hemorrhage due to an aneurysm of the hepatic artery. At admission, physical examination showed a heart rate of 111 beats/min, a blood pressure of 148/75 mm Hg, and a slightly elevated rectal temperature of 38.1°C (100.6°F). Laboratory tests revealed a hemoglobin level of 9.4 g/dL, a C-reactive protein of 128 mg/L, and a leukocyte count of 17.5×10^9 cells/L. An abdominal computed tomography (CT) scan (Fig 1) showed a large, partly thrombosed HAA, 63 mm in diameter, without contrast extravasation.

For further work-up, angiography was performed, during which a decrease in blood pressure occurred, indicative of hemorrhage. However, no contrast extravasation was observed, so the exact location of the hemorrhage could not be identified. The angiography was stopped, and the patient was stabilized at the medium care unit before surgical exploration of the aneurysm.

Under general anesthesia and antibiotic prophylaxis (2 g cephazolin/500 mg metronidazole intravenous), a median laparotomy was performed. No free fluid was detected in the abdominal cavity. Significant gastric distension was seen. After opening of the proximal duodenum, the fistula between aneurysm and duodenum was found. Complete hemostasis was achieved by oversewing the fistula. The aneurysm was located ventrally of the hepatoduodenal ligament. Preparation in the ligament was started but was too challenging due to inflammatory changes of the aneurysm and surrounding tissues. Therefore, the abdomen was closed and the patient was returned to the angiography suite for endovascular exclusion of the aneurysm.

A combination technique was performed, namely, the placement of a bare-metal stent (BMS) and thrombosis of the aneurysm. The right femoral artery was punctured, and the celiac artery was

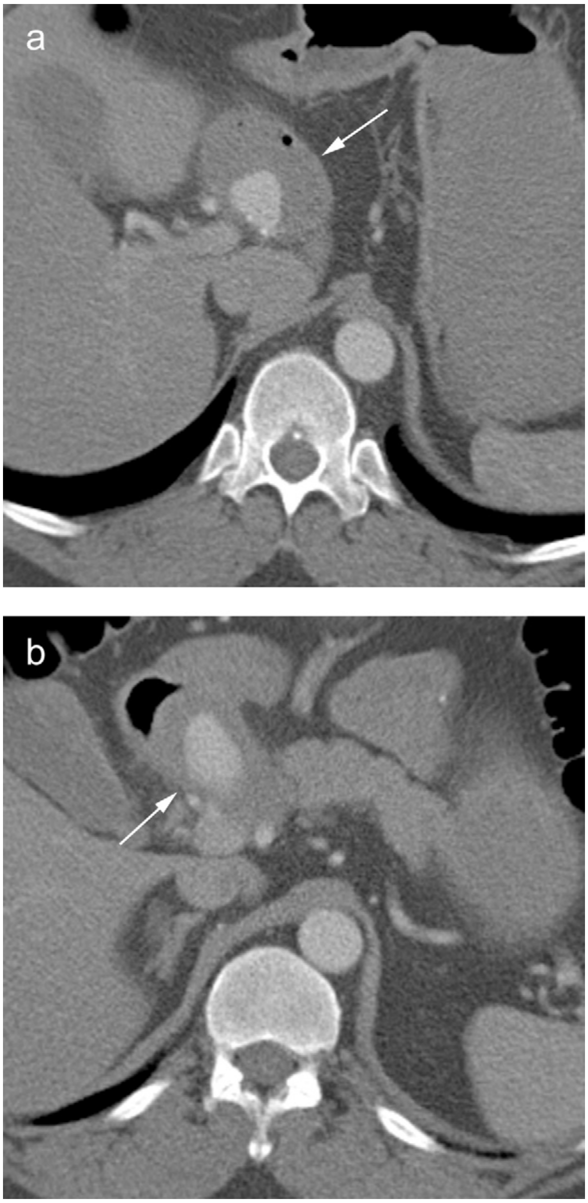


Fig 1. a, Preoperative computed tomography (CT) of the abdomen shows a large, partly thrombosed, hepatic artery aneurysm (*arrow*). Air bubbles in the aneurysmal sac indicate possible fistulization and contamination. **b,** CT-image just caudal to panel **a** shows the extent of the aneurysm, the *arrow* indicating the outer wall; iv-contrast is visible within the lumen.

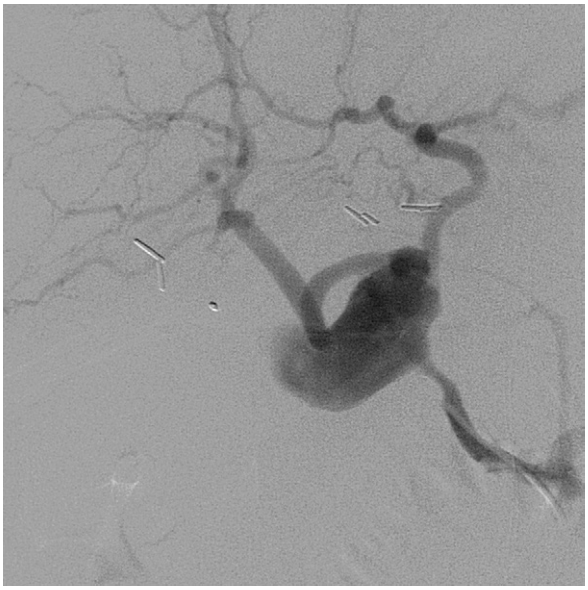


Fig 2. Angiogram with the catheter positioned in the common hepatic artery shows the aneurysm of the proper hepatic artery.

catheterized with a 5F SIM2-slip cath catheter (Cook, Bloomington, Ind). The catheter was advanced with a Terumo wire (Terumo; Europe NV, Leuven, Belgium) into the common hepatic artery.

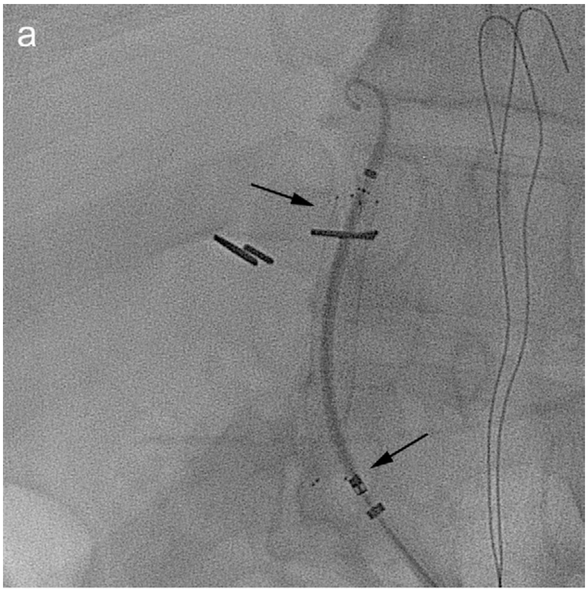
Subsequent angiography showed a wide-necked aneurysm arising from the proper hepatic artery without any aneurysmal alterations of the adjacent arteries (Fig 2). After placement of a Rosen exchange guidewire (Cook) into the left hepatic artery, a 6F guiding sheath (Boston Scientific, Natick, Mass) was placed in the common hepatic artery. Subsequently, a self-expanding 6 × 40 mm Protégé BMS (Everflex self-expanding stent systems; EV3 Inc, Plymouth, Minn) was placed over the aneurysm orifice into the proper hepatic artery (Fig 3, *a*). Then, a microcatheter (Progreat, Terumo, Europe NV) was advanced and placed in the aneurysmal lumen through the stent interstices.

Under fluoroscopic guidance, fibrin glue (Tissuecol; Baxter AG, Vienna, Austria) was injected at a rate of 1 mL every 3 seconds. After each injection of 1 mL of glue, a control angiography was performed to detect stasis.

Subsequent angiography revealed residual aneurysmal flow, so a second EV3 self-expanding 6 × 40 mm BMS was placed in the previous implanted stent, to enhance flow diversion. Finally, a completion hepatic angiogram (Fig 3, *b*) showed absence of aneurysmal flow and patency of the left hepatic artery, right hepatic artery, and gastroduodenal artery.

The patient's postoperative recovery was unremarkable. The day after the procedure, anticoagulant therapy with acetylsalicylic acid (100 mg/d) was started. At 14 days, a follow-up contrast-enhanced abdominal CT scan confirmed adequate stent position and shrinkage of the aneurysm size from 6.3 cm to 4.2 cm.

The patient was discharged 15 days after stent placement. Prophylactic Cipro floxacillin/clindamycin was started postoperatively and continued for 6 weeks. During the follow-up visit at 6 weeks, the patient underwent a positron emission tomography scan to identify possible infection of the excluded aneurysm. No active inflammation of the aneurysmal sac was measured. Additional laboratory tests revealed a C-reactive protein of 8 mg/L and a leukocyte count of 6 × 10^9 cells/L. Consequently, the patient was refrained from further antibiotic therapy. At 8 months postoperatively, a CT angiography showed adequate shrinkage and persistent exclusion of the aneurysm.



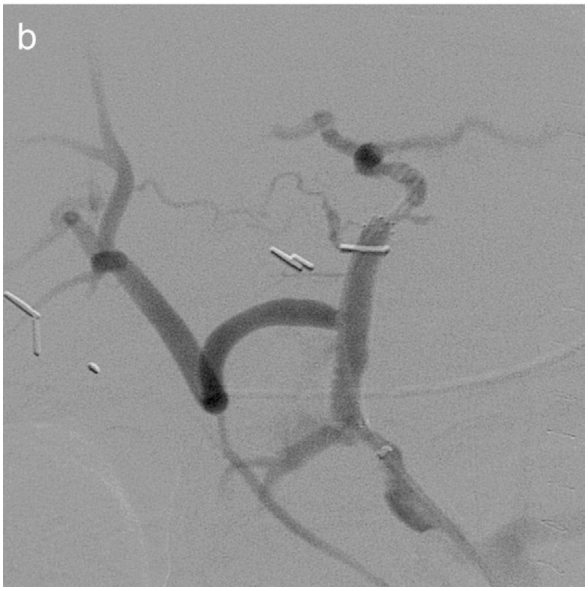


Fig 3. a, A self-expanding bare metal stent was placed over the aneurysm orifice into the proper hepatic artery, the *arrows* indicating the outer margins of the stent. **b,** An angiogram after stent placement shows no flow in the hepatic artery aneurysm, and a patent gastroduodenal artery, right hepatic artery and left hepatic artery.

DISCUSSION

Inherent to the rarity of the disorder, no standard treatment protocol exists for HAAs. Because of the risk of rerupture of this large aneurysm and associated mortality of such events,[1] observation would not have been adequate. As described, surgical repair of the aneurysm was not possible. Coiling was not an option because of the wide aneurysmal neck. Although stent graft placement has been described, a covered stent was considered contraindicated because of aneurysmal contamination resulting from the enteric fistula. BMSs can become infected, but the risk appears much lower than in covered stents.[12] BMSs are generally not used for repair of visceral aneurysms.[5,6,10-15] Nevertheless, the use of BMSs for aneurysmal repair has been described, predominantly involving the aortic arch or cranial aneurysms.[16,17] To date, no literature was found describing application of BMSs in HAAs.

Paradoxically, BMSs appear to function even though they do not exclude the aneurysmal sac from the circulation. This could be attributed to the redirection of blood flow resulting from shear stress caused by the stent alignment.[18] In this case, two overlapping BMSs were placed, resulting in reduced hole sizes in the stent matrix (approaching a flow diverting stent), in combination with fibrin glue administration. This approach has resulted in redirection of the blood flow and subsequent shrinkage of the aneurysm. The presented technique has shown to be successful in this patient. Possible future applications of this approach include repair of splanchnic artery aneurysms in high-risk patients with aneurysmal contamination. In addition, this technique could be used in aneurysms relatively unattainable for the larger and less flexible covered stent grafts. To provide the best care in unconventional cases, however, risks and benefits should be carefully weighed and interdisciplinary expertise should be applied.

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