Open surgical repair of giant hepatic artery aneurysm

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ABSTRACT

Hepatic artery aneurysms (HAAs) are visceral artery aneurysms with a significant risk of mortality upon rupture. HAAs can be treated with open or endovascular repair. The choice of treatment modality depends on aneurysm anatomy, adequacy of visceral collaterals, and overall health status of the patient. This case report describes the successful repair of a giant 14.9-cm HAA through open aneurysm resection and end-to-end anastomosis of the distal common hepatic artery to the gastroduodenal artery. The patient recovered postoperatively with no complications and normal liver function. This case report also reviews other giant HAAs that have been reported in literature. (J Vasc Surg Cases Innov Tech 2022;8:825-9.)

Keywords: Hepatic artery aneurysms; Literature review; Surgical repair

Hepatic artery aneurysms (HAAs) are the second most common type of visceral artery aneurysm whose incidence ranges from 0.002% to 0.010%.[1-3] HAAs tend to be diagnosed in the sixth decade of life with a 3:2 male predominance.[4,5] The most common associated comorbid conditions are dyslipidemia (81%), hypertension (71%), smoking (23%), and connective tissue disease (43%).[2] Treatment options include open resection and endovascular repair. In this report, we describe the open resection and end-to-end anastomosis of a giant (>5 cm) common HAA measuring 14.9 cm in diameter in an otherwise healthy 70-year-old man. We briefly discuss the operative challenges posed by the visceral aneurysm and its management. The patient provided consent for the authors to publish their case details and images.

CASE REPORT

We present the case of a 70-year-old male with a 2-week history of vague back pain radiating to the epigastric region worsened by exertion. The patient's medical history is significant for dyslipidemia and a remote smoking with no history of abdominal surgery or trauma. The patient had no family history of aortic, peripheral, or visceral artery aneurysms. Physical examination revealed a pulsatile mass in the epigastric region. Computed tomography angiography and mesenteric angiography revealed a giant partially thrombosed HAA measuring 13.2 × 14.9 × 13.4 cm in diameter that was exerting a mass effect on the inferior surface of the liver, the head and body of the pancreas, the lesser curvature of the stomach, and the proximal duodenum (Fig 1). The perfused portion of the aneurysm seemed to arise from the common hepatic artery and measured 12.5 × 5.7 cm with no evidence of rupture. Liver enzymes and liver function tests were within normal range.

The patient was admitted for urgent repair of his symptomatic common HAA. We decided to proceed with an open approach because we believed that the aneurysm was too large for endovascular embolization, we could not visualize an adequate distal seal for a covered stent placement, and the patency of the gastroduodenal artery (GDA) was unclear on computed tomography angiography. Furthermore, endovascular management would not alleviate the compressive symptoms exerted by the aneurysm. Preoperative planning was completed in conjunction with the hepatobiliary surgery team.

The operative course began with proximal control of the aneurysm. We decided to proceed with endovascular means, because the large size of the aneurysm would prove a difficult dissection of the supraceliac aorta and celiac trunk. This procedure was initiated with a longitudinal left groin cutdown as we had anticipated a possible need of using the saphenous vein as a conduit. The common femoral artery was identified, and purse-string sutures were placed. The patient was then systemically heparinized with a weight-based bolus. We initially inserted a 5F sheath and upsized to a 45-cm 14F Ansel sheath and placed this in the perivisceral segment. We decided to use a larger sheath in case we needed to supplement our celiac control with a compliant aortic occlusion balloon. A diagnostic angiogram was performed with a pigtail catheter in a lateral C-arm position and confirmed the origin of both the celiac artery and superior mesenteric artery. We then navigated a Glidewire into the celiac artery proper and exchanged for a Rosen, and we placed an 8 × 20-mm noncompliant balloon for proximal control, this was based on preoperative computed tomography imaging. We confirmed placement under fluoroscopy. The abdomen was then opened with a right subcostal incision (Fig 2). We encountered an inflammatory aneurysm almost immediately; we mobilized the stomach off the aneurysm

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Author conflict of interest: none.

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The editors and reviewers of this article have no relevant financial relationships to disclose per the Journal policy that requires reviewers to decline review of any manuscript for which they may have a conflict of interest.

2468-4287

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https://doi.org/10.1016/j.jvscit.2022.10.013

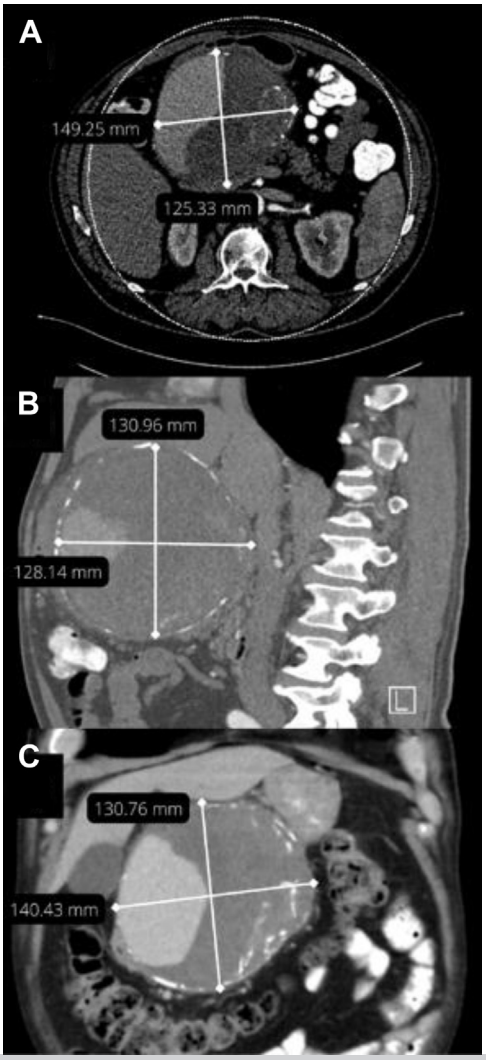

Fig 1. Preoperative computed tomography angiography images. **(A)** Preoperative transverse view of the aneurysm measuring 14.9 × 12.5 cm. **(B)** Preoperative sagittal view of the aneurysm measuring 13.1 × 12.8 cm. **(C)** Preoperative coronal view of the aneurysm measuring 14.0 × 13.1 cm.

because the inferior aspect was adhered to it. Once we visualized the celiac artery, we inflated our balloon and the aneurysm was not pulsatile. Once proximal control was obtained, the aneurysm was opened, partially resected, and the intramural thrombus was evacuated. The distal hepatic artery was identified and controlled with Alice clamps after aneurysm evacuation. Initially, simple ligation of the proximal and distal common hepatic artery was performed with Prolene running sutures after deflating the balloon and removing our wires owing to vigorous back bleeding from the distal hepatic artery. However, no Doppler signal into the hepatic artery could be heard after ligation. We then selectively cannulated the superior mesenteric artery and our angiogram showed poor filling of the hepatic artery and the liver. The HAA was then carefully dissected off the transverse colon, pancreas, duodenum, and stomach to identify the GDA, which was coursing posterior to

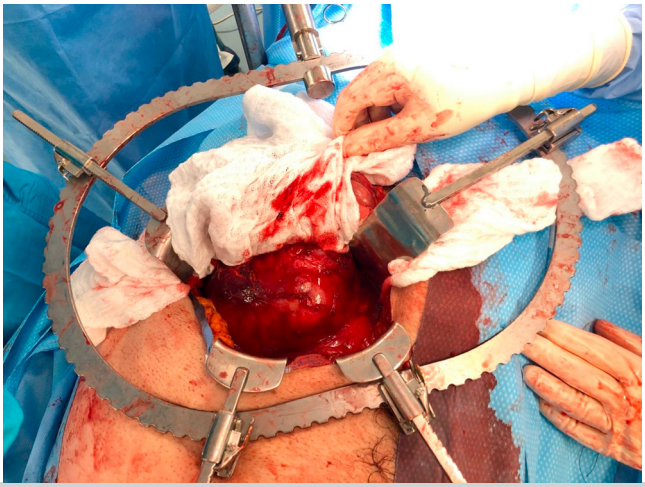

Fig 2. Intraoperative image of the giant hepatic artery aneurysm (HAA) through the subcostal incision.

the distal common hepatic artery, which was controlled with a clamp (Fig 3). The distal ligation was reversed, and an end-to-end anastomosis was made between the distal common hepatic artery and GDA without an interposition saphenous vein graft because there was enough length after mobilization of the aneurysm that no conduit was needed. There was multiphasic flow into the hepatic artery after completion of the bypass as confirmed by Doppler ultrasound examination (Fig 4). A cholecystectomy was subsequently performed prophylactically by the hepatobiliary team to prevent ischemic cholecystitis. The femoral artery access site was hemostatic once the purse-string sutures were tightened.

Postoperatively, the patient progressed well with no complications. Liver enzymes and liver function tests remained unremarkable at time of discharge (Table I). The patient was discharged home after 5 days and seen with no complications at the 2-month follow-up visit.

DISCUSSION

HAAs are associated with nonhepatic visceral artery aneurysms in 31% of patients, with splenic artery aneurysm being the most common (20%). HAAs are associated with nonvisceral aneurysms in 42% of patients with abdominal aortic aneurysm being the most common (20%).[3] Classic symptoms of HAA include right upper quadrant pain, obstructive jaundice, and gastrointestinal haemorrhage.[2,4] Most HAA patients are asymptomatic and diagnosed as incidental findings on imaging in 75% of cases.[3]

HAA rupture occurs in up to 25% of patients at presentation, with a mortality of 40% after treatment owing to hemorrhagic shock.[2,5] Current guidelines recommend operative management of asymptomatic HAAs of more than 2.0 cm in diameter in patients with few comorbidities and more than 5.0 cm in patients with high comorbidities requiring open repair.[5] Operative management is

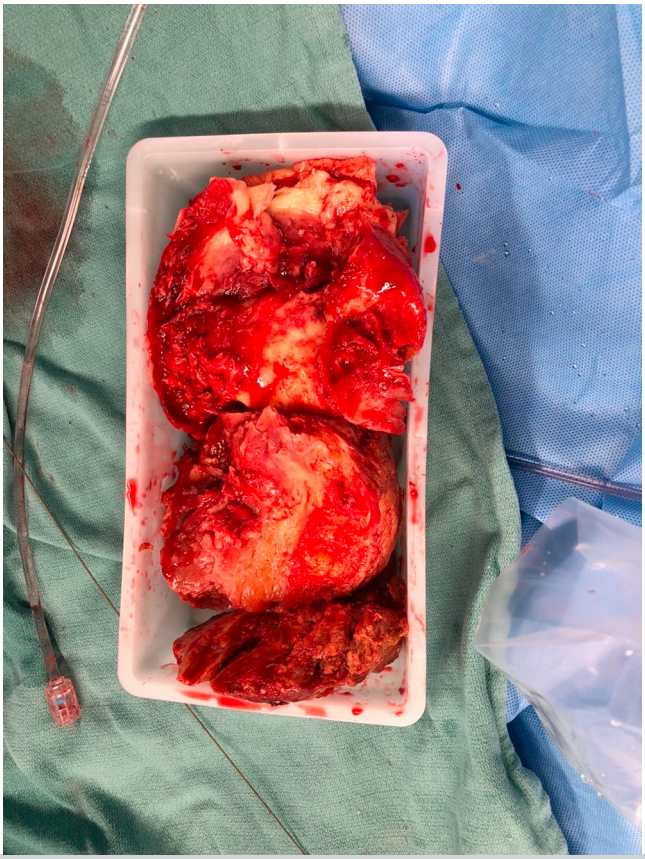

Fig 3. Resected giant hepatic artery aneurysm (HAA) and mural thrombus.

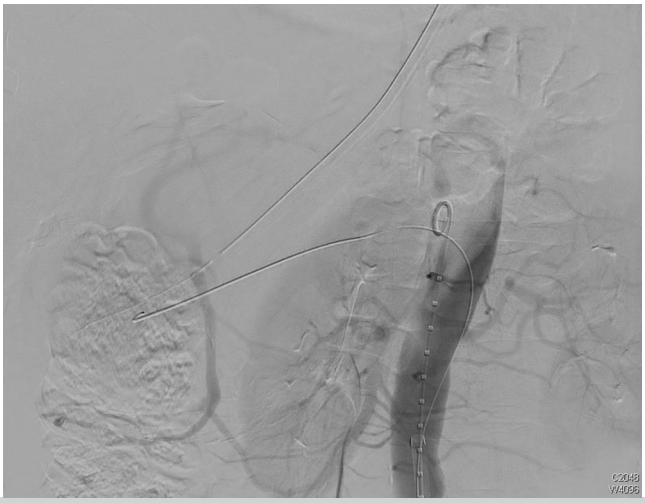

Fig 4. Intraoperative angiography showing filling of the hepatic artery through the gastroduodenal artery (GDA).

recommended in all symptomatic HAAs, regardless of size.[5]

Giant HAAs (>10 cm in diameter) are exceptionally rare with only a few documented cases in the literature.[6-16] Outcomes of giant HAAs in literature are reported in Table I. The management of giant HAAs remains an operative challenge owing to the significant risk of rupture and distortion of natural anatomy. Operative management options for HAA include open ligation, open resection with reconstruction, endovascular embolization, and endovascular stenting.

Indications for open versus endovascular repair depends on anatomy of the aneurysm, adequacy of visceral collaterals, and overall health status of the patient.[4,17] Open repair is preferred in extrahepatic HAAs with inadequate visceral collateral supply.[4,17] Hepatic necrosis and gangrenous cholecystitis are rare but serious complications of endovascular embolization and open ligation (–18 to 22). Complication rates of liver ischemia and outcomes from previous case series are reported in Table II. The exact incidence of liver ischemia secondary to embolization and ligation of HAA is difficult to estimate owing to the rarity of the condition. However, given the potential lethal implications of the complication, most interventionalists recommend careful assessment of collateral circulation and preservation of hepatic blood supply when possible. The GDA is a particularly important collateral that supplies blood to the liver from the superior mesenteric artery. Ligation distal to the GDA without revascularization is not recommended owing to the significant risk of liver ischemia. Endovascular procedures are not recommended when there is GDA stenosis or occlusion for the same reason. Additionally, open resection was preferred in this case due to mass effect imparted by the HAA which would not have been alleviated with an endovascular approach.

In the case of our patient, the patency of the GDA could not be visualized owing to distortion of natural anatomy by the aneurysm. We chose to proceed with an open repair as an occluded GDA would pose a significant risk of liver ischemia. Additionally, we felt that the risk of ischemia or embolization to the liver was high with endovascular embolization given the size of the aneurysm. We had initially intended to proceed with open resection and revascularization using saphenous vein graft. However, after evacuation of the aneurysm, we were able to perform an end-to-end anastomosis between the distal hepatic artery and GDA without interposition saphenous vein graft, which we felt would decreased the risk of graft occlusion. Should the GDA be occluded or poor back bleeding was identified, we would have needed to establish in-line flow preferable with a saphenous vein graft, which was dissected out at the start of the procedure.

CONCLUSIONS

This case demonstrates the successful open repair of a challenging giant 14.9-cm common HAA through careful dissection of the aneurysm sac from surrounding structures and an end-to-end anastomosis from distal

Table I. Literature review of giant hepatic artery aneurysms (*HAAs*) greater than 10.0 cm in size

Author (year)	Aneurysm location	Size, cm	Treatment	Outcome
Cimsit et al[6] (2006)	Common HAA	12.0	Open ligation, cholecystectomy	Unremarkable recovery
Rebonato et al[7] (2013)	Common HAA	10.6	Conservative management	Rupture and death 2 weeks later
Calvalcante[8] (2014)	Common, right HAA	12.5	Embolization	Complete occlusion
Angiletta et al[9] (2015)	Common, proper HAA	14.0	Aneurysmectomy with prosthesis bypass grafting	Asymptomatic graft occlusion 1 month later
Rossi et al[10] (2015)	Common, proper, right and left HAA	10.0	Embolization	Complete occlusion
Abdallah et al[11] (2017)	Common HAA	11.0	Embolization, upper GI endoscopy and clips	Complete exclusion
Ramely et al[12] (2018)	Common HAA	12.0	Open resection and saphenous vein graft between proximal and distal common hepatic artery	Wound infection treated with debridement; pancreatic fistula treated with endoscopic retrograde cholangiopancreatography stent
Asano et al[13] (2020)	Common HAA	11.0	Open ligation	Unremarkable recovery
Corion rt al[14] (2020)	Common, proper HAA	13.0	Open resection and saphenous vein graft between common and proper hepatic artery	Unremarkable recovery
Prasath et al[11] (2021)	HAA	15.0	Aneurysmorrhaphy	Unremarkable recovery

Table II. Literature review of liver ischemia and gangrenous cholecystitis after exclusion of hepatic artery aneurysms (HAA)

Author (year)	Treatment	Total No. patients	No of patients with liver ischemia (%)	Outcome
Mathisen et al[18] (1982)	Open ligation	12	1 (8.3)	Death secondary to liver ischemia
Hidalgo et al[19] (1995)	Embolization	12	2 (16.7)	1 died secondary to liver ischemia 1 died secondary to gangrenous cholecystitis
Lumsden et al[20] (1996)	Open ligation	22	1 (4.5)	Central lobular necrosis
Nagaraja et al[21] (2013)	Embolization	21	2 (9.5)	1 died secondary to liver ischemia and accidental embolization of superior mesenteric artery 1 died secondary to liver and bowel ischemia
Imazuru et al[22] (2018)	Open ligation	1	1 (100)	Postoperative liver ischemia and gangrenous cholecystitis managed with conservative treatment and cholecystectomy

common hepatic artery to the GDA. Assessment of adequate collaterals and prophylactic cholecystectomy are important considerations in repair of giant HAAs to prevent serious complications such as hepatic ischemia and ischemic cholecystitis.

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Submitted Jul 20, 2022; accepted Oct 19, 2022.