From the Society for Clinical Vascular Surgery

Gastroduodenal artery aneurysm degeneration after coiling necessitating open repair

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ABSTRACT

A 77-year-old male presented for an incidental 5-cm gastroduodenal artery aneurysm (GDAA). He underwent an endovascular GDAA coil embolization with 6 months of no aneurysmal growth on surveillance imaging. His 12-month scan revealed aneurysmal growth from 5 cm to 7.5 cm involving the hepatic confluence. He underwent successful open aneurysm resection and primary anastomosis of the hepatic artery. Although less invasive interventions are recommended for GDAAs, many vascular surgeons prefer to proceed with an open repair. Continued GDAA enlargement after perceived endovascular success demonstrates the importance of long-term surveillance and viability of open intervention, sparing patients from a potentially fatal rupture. (J Vasc Surg Cases Innov Tech 2025;11:101652.)

Keywords: Coil embolization; Gastroduodenal artery; Surveillance imaging; Visceral aneurysms

Gastroduodenal artery aneurysms (GDAAs) are rare, with high risk of fatality in the event of rupture.[1,2] Open intervention for non-ruptured visceral artery aneurysms (VAAs), including GDAAs, is associated with perioperative morbidity and mortality of 9.4% and 1.3% respectively.[3,4] Open intervention for rupture increases the mortality to 22%, with an associated 34.1% risk of major postoperative complications.[3,4] Endovascular therapy, with coil embolization and/or covered stent placement, is an attractive alternative.[5,6] With post-procedure surveillance, a subset of aneurysms are known to progress despite fluoroscopically successful intervention. We present a patient who underwent endovascular GDAA coil embolization with a 6-month period of stabilization followed by aneurysmal enlargement seen on 12-month imaging. This underscores the need for long-term surveillance post-intervention. Written informed consent was obtained for publication of case details and imaging studies.

CASE PRESENTATION

A 77-year-old male with a history of cirrhosis was referred to our clinic for a 3.7-cm GDAA incidentally found on cross-sectional imaging to evaluate for liver disease by his primary care physician. Multiple conversations regarding his diagnosis and the risks and benefits of open or endovascular interventions were conducted. The patient refused any intervention, including surveillance imaging and follow-up. Two years later, imaging by his primary care physician revealed aneurysmal growth to 5 cm (Fig 1, *A* and *B*). The patient was seen by our team, and after a thorough discussion, he was ultimately only amenable to endovascular intervention. Mesenteric arteriography confirmed a large GDAA with an accessible neck and superior pancreaticoduodenal branch and right gastroepiploic arteries as the outflow. Using a calculated coil-sac ratio, high-density packing of the aneurysm sac and exclusion of afferent inflow was achieved using Penumbra Ruby packing and framing coils. Due to the size of the aneurysm, we could not exclude the efferent arteries. Completion angiography confirmed lack of flow to the aneurysm and preserved liver perfusion (Fig 2, *A-D*). The GDAA remained stable in size on surveillance imaging at 1, 3, and 6 months postoperatively; computed tomography angiography was utilized for initial follow-up, followed by duplex ultrasound for subsequent appointments. The 12-month imaging revealed a 7.5-cm sac near the hepatic artery bifurcation and enlargement of the GDAA neck confirmed on diagnostic angiography (Fig 3, *A-C*).

As endovascular repair was not feasible, the patient consented to an open approach planned in conjunction with our hepatobiliary colleagues. After gaining access to the lesser sac, the celiac axis origin was identified and controlled. Significant adhesions to the pancreas and small bowel were encountered due to the mass effect of the aneurysm and reactive inflammation from previous coil embolization. Proximal and distal control of the proper hepatic bifurcation was achieved. Duodenal kocherization allowed for full circumferential exposure of the GDAA and identification of the superior mesenteric artery inferior to the pancreas. Anticipating the possible need for interposition, the great saphenous vein was harvested. After heparinization, the inflow and outflow were controlled with

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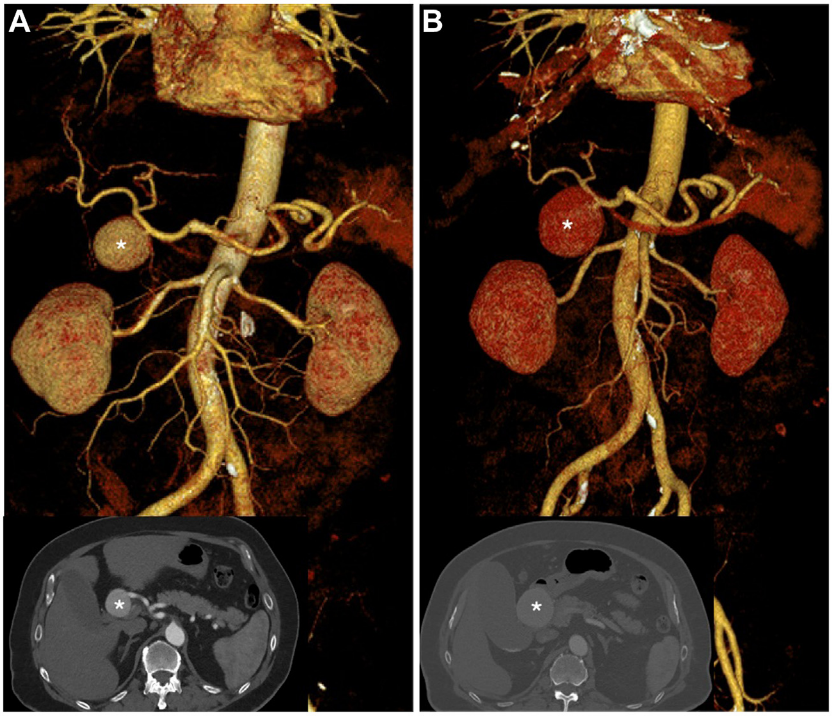

Fig 1. Cross-sectional imaging with three-dimensional reconstruction at presentation **(A)** with 3.7-cm gastroduodenal artery aneurysm (GDAA) (*) and at follow-up **(B)** with growth to 5 cm (*).

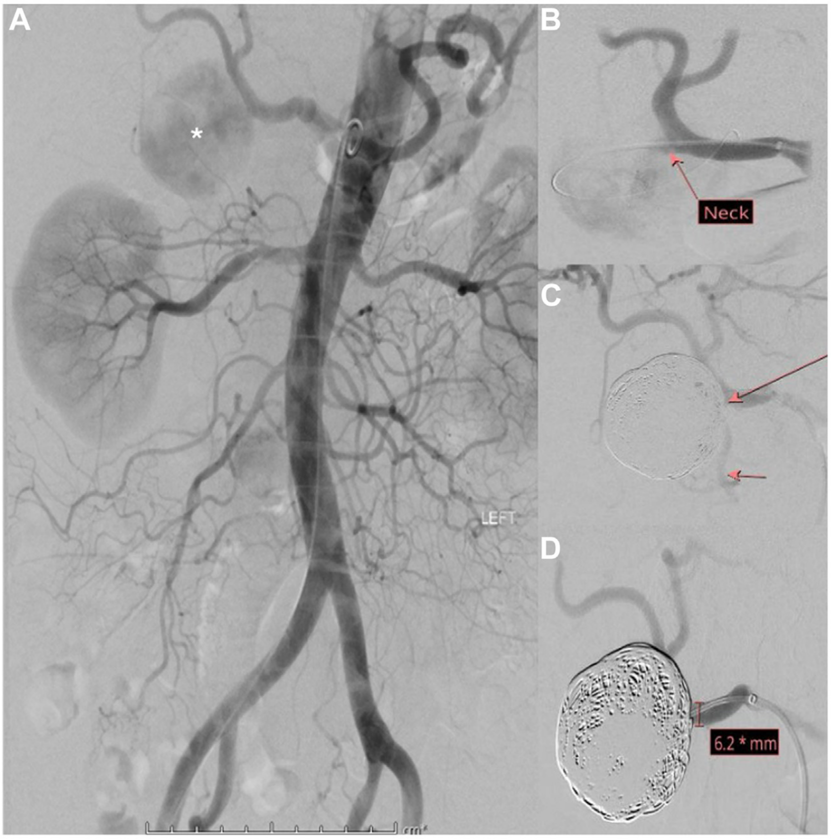

Fig 2. Diagnostic aortogram **(A)** highlighting a 5-cm gastroduodenal artery aneurysm (GDAA)(*). **(B)** Selective arteriogram identifying neck of GDAA off the hepatic confluence (*red arrows*). **(C)** Small aneurysm outflow branches through the right gastroepiploic and superior pancreaticoduodenal branches (red arrows). **(D)** High density coiling of GDAA with maintained flow through the hepatic artery.

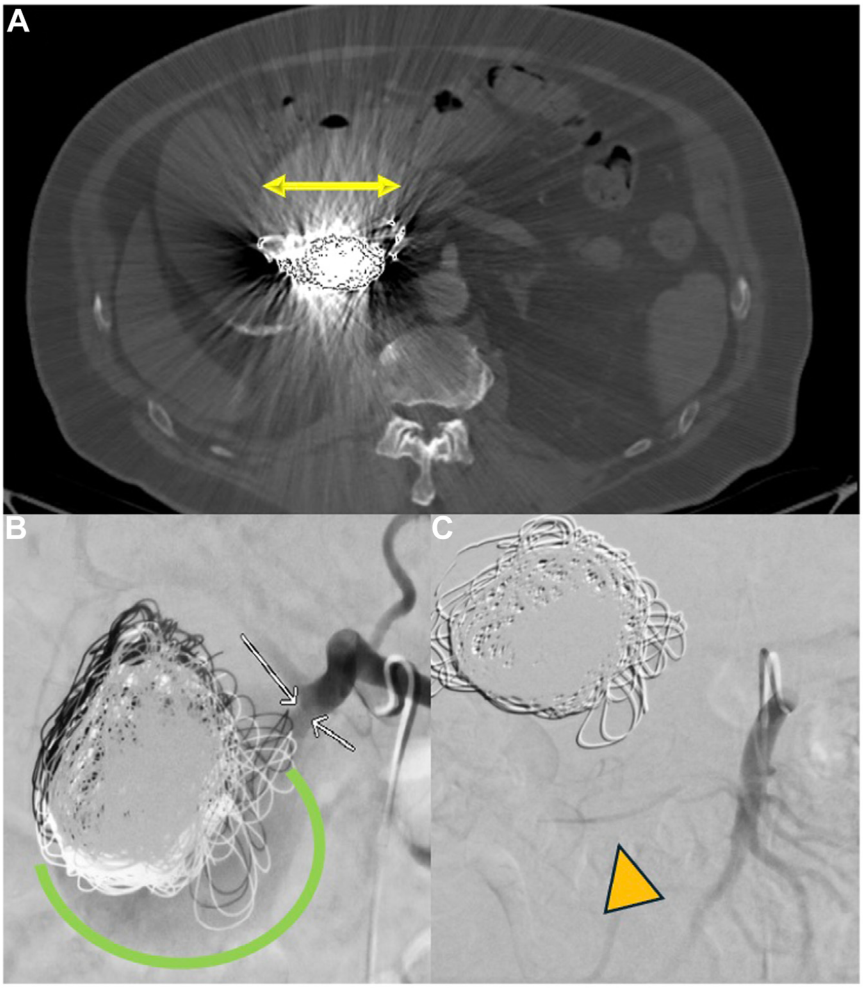

Fig 3. Computed tomography scan **(A)** gastroduodenal artery aneurysm (GDAA) enlargement (*yellow arrow*) beyond placed coils and diagnostic angiogram revealing **(B)** flow through aneurysm sac (*green arch*) **(C)** and lack of perfusion source from pancreaticoduodenal and right gastroepiploic arteries (*orange arrowhead*).

absence of aneurysmal flow confirmed with intra-operative doppler. Approximately 5 cm of the hepatic artery was resected to excise the origin of the GDAA. To our benefit, hepatic artery redundancy allowed for primary end-to-end anastomosis with excellent Dopplerable flow (Fig 4). Intraoperative tissue cultures were negative. Aneurysm sac, as well as pancreatic tissue pathology, revealed segmental arterial degeneration in addition to pancreatic parenchymal findings consistent with acute on chronic pancreatitis. In keeping with the morbidity of open repair, the patient suffered several postoperative complications, including gastric perforation on postoperative day 6 from a stress ulcer despite being on proton pump inhibitor therapy and chronic type B pancreatic fistula. The patient underwent a partial antrectomy and Bilroth-II gastrojejunostomy. Pathology revealed features of portal hypertensive gastropathy congruent with known cirrhosis. His pancreatic fistula was managed conservatively with drain placement for 8 weeks, serial labs including amylase, parenteral nutrition with octreotide, and diet progression after stabilization in accordance with known guidelines.[7] The patient reported no history of pancreatitis nor demonstrated the sequelae of portal hypertension seen in many GDAAs preoperatively. Likewise, preoperative imaging was without celiac artery stenosis nor stigmata of chronic pancreatitis or cirrhosis. Review of imaging at his 18-month follow-up shows a patent hepatic artery reconstruction (Fig 5).

DISCUSSION

GDAAs are rare, accounting for only 1.5% of total visceral artery aneurysms.[8] The majority of GDAAs are found incidentally during workups for unrelated diseases similarly to our patient.[9,10]

GDAAs carry high risk of rupture in those as small as 5 mm, and elective repair is recommended. Multiple surgical modalities are available to address the GDAA; of the six recommendations for the treatment of GDAAs within Society for Vascular Surgery guidelines, endovascular methods comprise the first four, coil embolization being the most strongly recommended.[5] This is followed by covered stents or stent-assisted coil embolization for those in which coil embolization is not feasible.

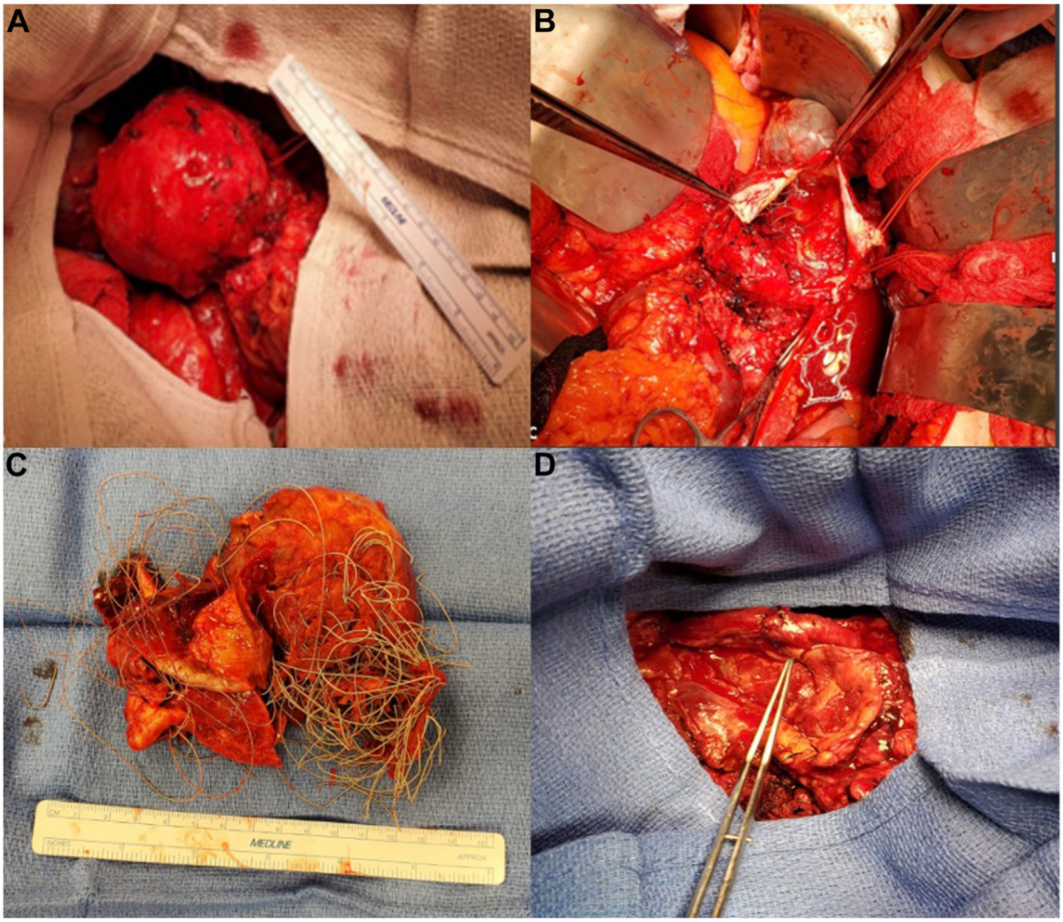

Fig 4. Operative exploration. **(A)** Gastroduodenal artery aneurysm (GDAA) isolation; **(B)** Evacuation of sac; **(C)** Specimen; **(D)** Primary hepatic artery reconstruction.

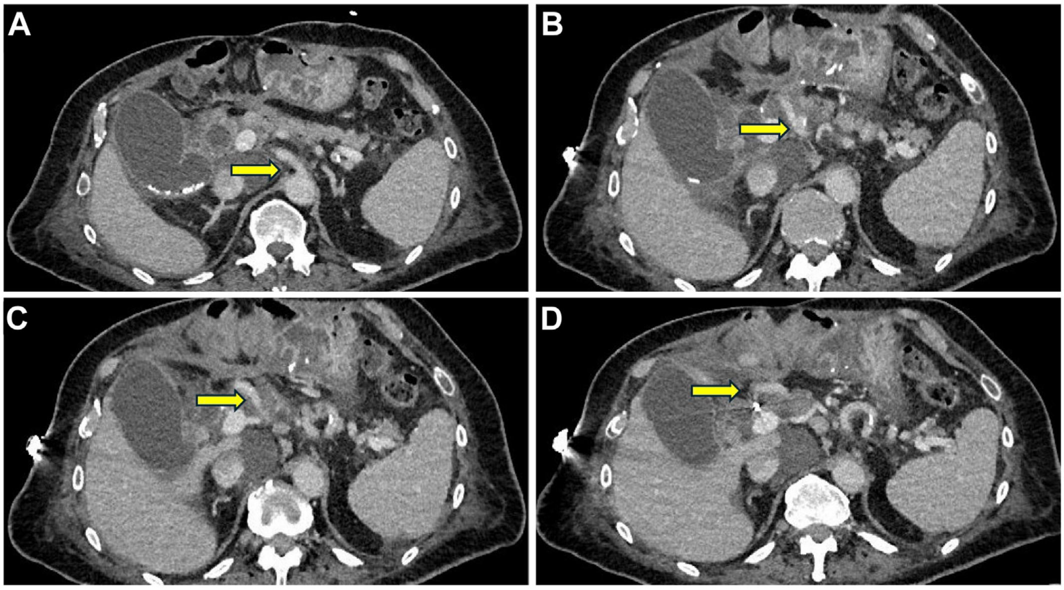

Fig 5. Cross-sectional imaging at 1-year follow-up revealing patent celiac artery **(A)**, common hepatic artery at site of gastroduodenal artery aneurysm (GDAA) resection **(B)**, patent proper hepatic artery **(C** and **D)**.

Other treatment modalities include transcatheter embolization with liquid embolic agents, flow-diverting stents, and multilayer stents, although these methods require additional research to prove their efficacy.[5] Open surgical reconstruction of non-ruptured aneurysms is recommended if it is the only feasible option to preserve blood flow to surrounding organs.[5] Limited research exists investigating recurrence rates of endovascular vs open surgical intervention of GDAAs. However, overall reintervention was found in 9% to 15% of patients for all visceral artery aneurysms, likely due to degeneration followed by reperfusion with aneurysmal expansion.[9] Although there is a paucity of literature focused on GDAAs, a study evaluating all forms of VAAs revealed only 5% of patients treated with endovascular coil embolization of VAAs had postoperative reperfusion of the aneurysmal sac occurring variably after the index intervention.[11] Therefore, the ultimate goals of endovascular intervention include exclusion of any inflow and outflow, as well as high coiling packing density relative to the size of the aneurysm itself.[5,12] We were unsuccessful in completely occluding the efferent vessels of our patient's aneurysm. However, a postoperative angiogram showed no evidence of flow into the aneurysm, and the aneurysmal growth was seen at the neck origin.

Obtaining intraprocedural completion studies and postoperative imaging primarily through contrasted cross-sectional modalities is required.[5,11,12] However, the frequency of surveillance varies throughout published cases of GDAAs postintervention. In our patient's case, reperfusion was found on 1-year postoperative imaging, indicating a potential need for extended periods of postoperative imaging beyond the timeframe of what is currently published.[11,12] The most common method, computed tomography angiography, is limited in accurately sizing the sac due to the radiopaque agents used to for embolization.[5] Alternatively, contrast-enhanced magnetic resonance angiography has been reported as a safe and effective method to better assess for reperfusion of an embolized GDAA.[10,11]

Due to low incidence, the best way to approach visceral aneurysm sac progression following endovascular embolization remains less clear.[13] Open repair is often reserved for emergent cases such as aneurysmal rupture, hemodynamically unstable patients, anatomical variants that inhibit endovascular access, and, in the case of our patient, continued enlargement after radiographically successful endovascular coil embolization.[13] With the expected morbidity of open repair, our patient underwent successful open resection of the previously coiled GDAA with primary hepatic artery repair.

CONCLUSION

GDAAs are rare and preferentially treated with endovascular therapy. A very small subset demonstrates post-intervention aneurysmal growth requiring additional intervention. There are no current guidelines describing treatment methods after continued enlargement and reperfusion after a stabilized GDAA status post-endovascular embolization. Open reconstruction of a GDAA is a feasible option in similar cases.

DISCLOSURES

None.

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