Surgical repair of a symptomatic celiac artery aneurysm with resection and end-to-end anastomosis

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ABSTRACT

A true aneurysm of the celiac artery is a rare form of a visceral aneurysm, constituting ∼4% of visceral aneurysms. Mortality in ruptured cases is high; thus, early recognition and treatment are crucial. Recent guidelines suggest endovascular therapy; however, numerous complications are associated with endoluminal treatment. Open repair in select cases, using an individualized strategy fit for the patient's anatomy still provides excellent early and long-term results. Our patient was treated with open surgical resection and end-to-end anastomosis of the celiac and common hepatic arteries. A 43-month follow-up computed tomography angiogram revealed excellent hepatic artery patency and no pseudoaneurysm formation. (J Vasc Surg Cases Innov Tech 2023;9:1-5.)

Keywords: Aneurysm; Celiac artery; Endovascular; Stent graft

Celiac artery aneurysms (CAAs) are rare, although the frequency of the diagnosis of CAAs has been reported.[1-3] Endovascular therapy (EVT) should be considered first-line treatment because of the resulting better early survival.[4] However, the surgical techniques and perioperative care advances have decreased open surgical morbidity and mortality. We report the case of a 57-year-old White man with a symptomatic CAA, who was treated by open surgical repair, with aneurysm resection, end-to-end anastomosis of the celiac and common hepatic arteries, and suture ligation of the splenic and left gastric arteries. At 43 months of follow-up, the patient was in excellent general condition, and computed tomography angiography (CTA) revealed no pseudoaneurysm formation and good patency of the common hepatic artery.

CASE REPORT

A 57-year-old man with epigastric discomfort was referred to our outpatient clinic to manage a CAA, measuring 25 mm in diameter. The patient was examined by a gastroenterologist, and other etiologies for the epigastric pain were excluded before vascular consultation. CTA revealed the aneurysm

originating 6 mm from the celiac artery origin from the aorta. The CAA extended into bifurcation into the common hepatic and splenic arteries (Fig 1). Because of the risk of rupture, the patient was offered surgical repair. Endovascular therapy was not chosen because the short neck of the CAA raised concerns regarding the long-term outcome. The patient was in good general condition, without comorbidities and, thus, was offered open repair. We planned to resect and either anastomose the approximated common hepatic artery if intraoperative mobilization would suffice or perform a bypass with the great saphenous vein if the arterial mobilization would not be sufficient, with ligation of the proximal part of the splenic and left gastric arteries. The risk of stomach ischemia was low, because the collateralization was very good with uncompromised hepatic flow through the right gastric and right gastroepiploic arteries. The risk of ischemia would be increased in patients with compromised circulation, including patients with atherosclerosis, heart failure, or small vessel disease, such as those with diabetes or renal insufficiency. The present study was retrospective, and the requirement for ethics approval was waived. The patient provided written informed consent for the report of his case details and imaging studies.

With the patient under general anesthesia, a chevron incision was performed in the upper abdomen. A Condor GoldLine retractor (Condor Medtec GmbH) was used to facilitate exposure. The lesser omentum was opened, and the CAA was exposed. The arcuate ligament of the diaphragm and celiac ganglion were cut, allowing for exposure of the aorta above and below the celiac artery trunk to facilitate secure clamping. The proximal part of the common hepatic, splenic, and left gastric arteries were exposed. After systemic heparinization, aortic side clamping was used, and the dissected parts of the common hepatic, splenic, and left gastric arteries were clamped. The CAA was resected in its entirety. The common hepatic artery was sufficiently mobilized and approximated to the proximal stump of the celiac trunk to facilitate a tension-free anastomosis. A direct end-to-end anastomosis was performed
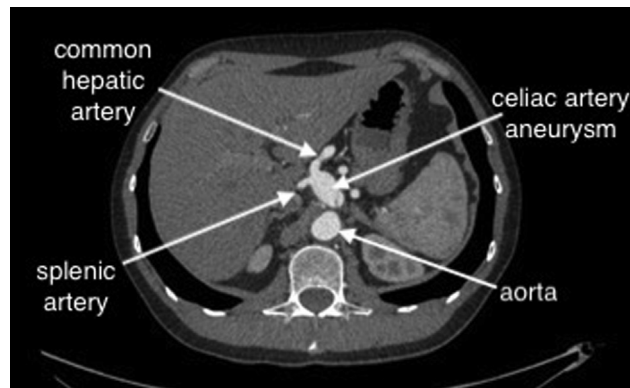
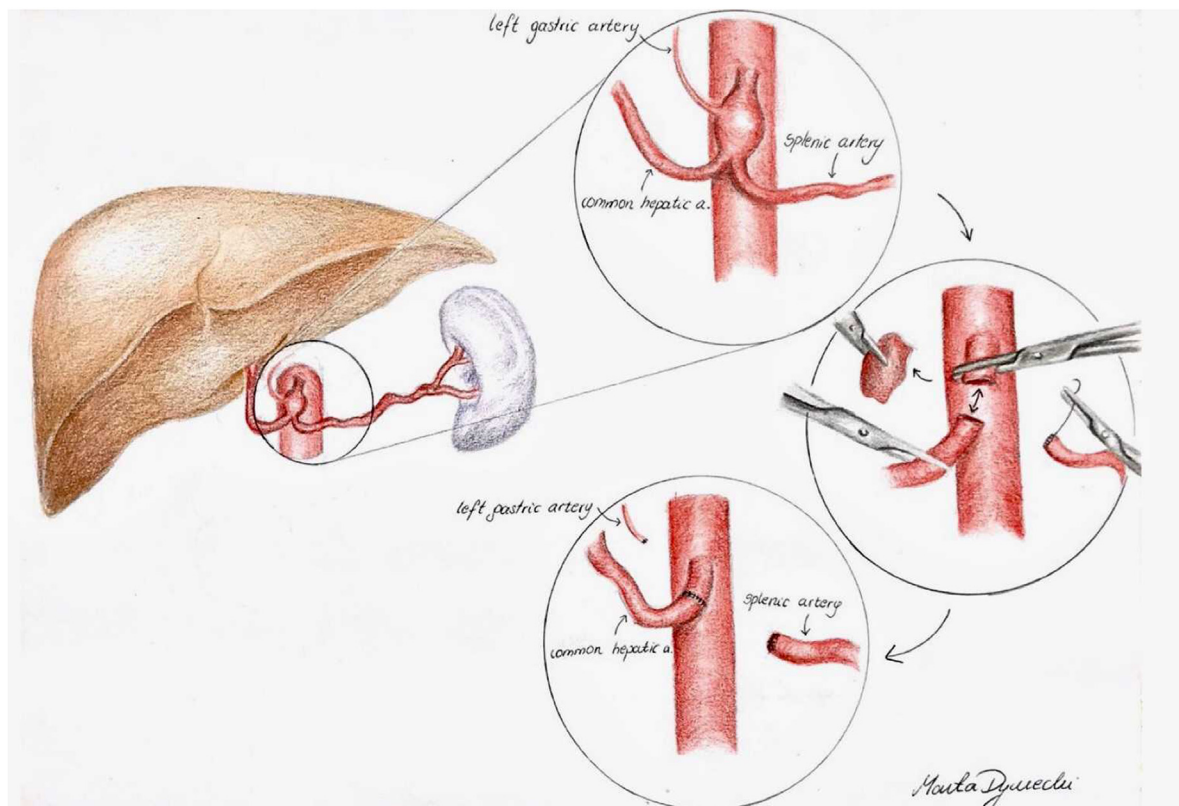**Fig 1.** Preoperative computed tomography angiogram.

Fig 2. Schematic of surgery performed.

with running Surgipro 5-0 suture (Medtronic; Fig 2). The splenic and left gastric arteries were suture ligated in the proximal sections. The procedure lasted for 150 minutes. The postoperative period was uneventful. The patient returned to oral feeding on the first postoperative day and was discharged home on day 4. He received low-molecular-weight heparin at a prophylactic dose for 10 postoperative days. Because the patient did not have atherosclerosis or coronary artery disease, he was not prescribed antiplatelet or statin therapy. CTA was performed at his 43-month follow-up visit. No pseudoaneurysm formation was found, and flow to the hepatic artery was preserved (Fig 3).

DISCUSSION

A true CAA is a rare condition, with an estimated incidence of 0.005% to 0.01%.[2] Atherosclerosis, medial degeneration, injuries, connective tissue disorders, vasculitis, and infections are the leading causes of CAAs.[5,6] In addition, 15% to 20% of cases are complicated by rupture, with a mortality rate of ≤80%.[7] In the present case, the patient was referred to our department because of an ultrasound finding of a CAA, after the exclusion of all other causes of epigastric pain. No other intra-abdominal aneurysms were revealed by CTA.
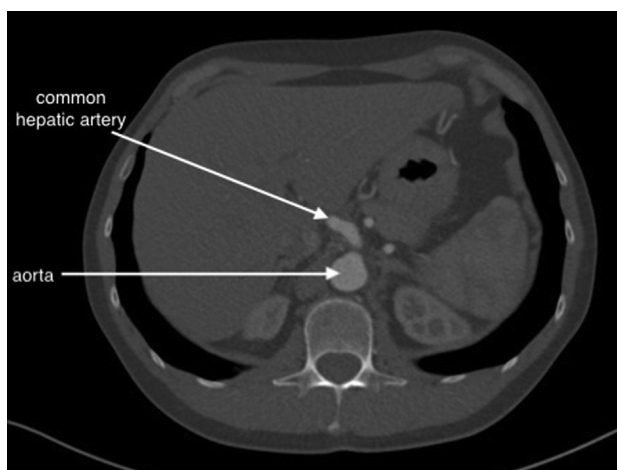
Fig 3. Follow-up computed tomography angiogram.

Table I. Endovascular repair of celiac artery aneurysms (CAAs)

Investigator	Patients, no.	Observation time, months	CAA obliteration rate, %	Patency rate, %	Type of operation
Gabelmann et al,[18] 2002	2	51 (1 patient lost to follow up)	100	—	Coil embolization
Tulsyan et al,[19] 2007	3	16 (mean)	66.7	—	Coil/glue embolization
Waldenberger et al,[20] 2007	3	21 (mean)	100	—	Coil embolization
Etezadi et al,[21] 2011	4	45 (mean)	100	100	Coil embolization
Carrafiello et al,[22] 2011	1	12	100	100	Self-expanding stent
Zhang et al,[23] 2016	5	19 (mean)	100	100	Stent graft
Venturini et al,[8] 2018	3	12 (mean)	100	100	Stent graft
Xia et al,[24] 2019	3	24 (mean)	100	100	Covered stent
Yuan et al,[25] 2020	4	34 (mean)	100	100	Covered and uncovered stents
Dwivedi et al,[26] 2021	1	12	100	100	Stent graft and coil embolization

It has been recommended to treat symptomatic CAAs >2 cm, with EVT considered as first-line treatment.[1,4] However, to the best of our knowledge, the open surgical and endovascular strategies for this type of aneurysm have not yet been compared in any study. Aneurysm isolation, sac exclusion with a covered stent or coil packing, and the use of liquid embolic agents can be considered.[6] Good long-term results can be obtained using modern peripheral stent grafts.[8] However, specific anatomic criteria must be met to obtain success with EVT, and compromising these criteria can lead to treatment failure.[9] The limitations of EVT include the risk of contrast toxicity, access-related injury, and end-organ embolization.[6] A significantly higher reintervention rate after EVT has been reported, raising concerns for the long-term durability.[1] The lack of a proximal landing zone makes EVT for CAAs inadequate significantly often.[10] Treatment failure such as persistent sac perfusion, coil migration, and sac recanalization have been observed, with an early reperfusion rate as high as 10.3%.[6] Even an initially successful EVT procedure can eventually fail owing to possible recanalization and sac reperfusion, which can lead to late rupture.[11] For our patient, stent grafting was not an option, because the 6-mm proximal landing zone was thought to be too short for secure endograft fixation. Surgical repair was considered because of these technical issues and because our patient was in good health.

Shumaker and Siderys[12] reported the first resection with concomitant revascularization of a CAA in 1958. Advances in surgical treatment and perioperative care have decreased the morbidity and mortality of open surgical repair in well-selected cases to levels previously reserved for EVT. Also, open surgical repair of CAAs yields excellent long-term results.[4,13,14] If surgical treatment is considered, either resection with celiac artery ligation or reconstruction can be considered. Simple celiac artery ligation has been reported in ≤35% of cases, is well tolerated in

Table II. Open repair of Celiac Artery Aneurysm

Investigator	Patients, No.	Observation, months	Postoperative complications	Early mortality, %	Long-term success, %	Type of operation
Stone et al,[13] 2002	8	99 (mean)	In 2 patients, ventral herniation of abdominal wound developed; in another 2 patients, saphenous vein conduits were occluded at 1 and 6 months of follow-up	0	78	Aneurysmectomy plus revascularization or prosthetic graft
Sessa et al,[27] 2004	5	no info	1 Thrombosis (nonruptured aneurysm); 1 pulmonary embolism and death (ruptured aneurysm)	20	60	No information
D'Ayala et al,[28] 2004	1	5	—	0	100	Aneurysmectomy plus prosthetic graft
Taberkant et al,[29] 2006	1	18	—	0	100	Aneurysmectomy plus revascularization
Lipari et al,[30] 2006	2	19 (mean)	Pulmonary thickening with pleural effusion	0	100	No information
Popov et al,[31] 2007	4	1 (mean)	1 Patient died during surgery of hemorrhagic shock; 2 patients had prolonged intestinal ischemia and diarrhea	25	75	No information
Pulli et al,[16] 2008	3	82 (mean)	—	0	100	Aneurysmectomy plus prosthetic graft
Vasconcelos et al,[32] 2010	3	10 (mean)	—	0	100	Aneurysmectomy plus revascularization or prosthetic graft
Higashiyama et al,[14] 2011	1	37	—	0	100	Aneurysmectomy plus revascularization
Uchida et al,[15] 2017	1	6	—	0	100	Aneurysmectomy plus revascularization
Azimi-Ghomi et al,[33] 2017	1	3	—	0	100	Aneurysmectomy plus prosthetic graft

most cases, and is an especially viable option for ruptured cases.[7] For elective cases, revascularization is suggested.[13] When arterial reconstruction is required, bypass surgery from the aorta using a prosthetic vascular graft or autologous vein graft is often necessary.[3] The performance of aortic anastomosis in the supraceliac aorta is the challenging step of the procedure. The use of a sutureless anastomotic device (PAS-port; Cardica) has been reported to facilitate aortic anastomosis.[15] Aneurysmectomy with primary end-to-end anastomosis has also been reported.[16,17] In our case, no conduit was used, because we performed a primary end-to-end anastomosis of a short stump of healthy celiac artery to a mobilized part of the common hepatic artery. This made the procedure safer and less demanding, with no need for an aortic anastomosis. The chance for good long-term patency of the repaired common hepatic artery was also improved, because early and mid-term vein graft occlusions have been reported in CAA repair.[13] A primary

end-to-end anastomosis also decreases the risk of late pseudoaneurysm formation, because vein grafts can degenerate with time, and prosthetic grafts are prone to infection. CTA follow-up at 43 months confirmed our assumption, revealing excellent patency and no pseudoaneurysm formation. A brief literature review and comparison of operative methods are included in Tables I and II.[8,13,14,16,18-33]

CONCLUSIONS

The morphology of the aneurysm and that mobilization of the common hepatic artery was possible made this procedure safer and less demanding than a bypass from the supraceliac aorta. By offering the patient open repair, all possible late complications of EVT were avoided.

The data supporting the findings of this study are available from University Clinical Centre, Gdansk, but

restrictions apply to the availability of these data, which are not publicly available. Data are, however, available from the authors on reasonable request and with permission from the University Clinical Centre, Gdansk.

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