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Symptomatic Celiac Artery Aneurysm Managed with Celiac Plexus Ablation

Shiwei Huang[1*], Muhammad Azharuddin[2], Prudence Kho Dy[2], Wael Ghali[2] and Faisal Naseer[3]

[1]Department of Medicine, Drexel University School of Medicine, 2900 W Queen Ln, Philadelphia, PA, 19129, USA.
[2]Department of Internal Medicine, Monmouth Medical Center, 300 2nd Ave, Long Branch, NJ, 07740, USA.
[3]Civil Hospital Karachi, Karachi, Pakistan.

Authors' contributions

This work was carried out in collaboration between all the authors. Author WG designed the study. Author SH managed the literature search and wrote the first draft of the manuscript. Author MA wrote the second draft with assistance from authors PKD and FN. All authors read and approved the final manuscript.

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Case Study

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ABSTRACT

A 57-year-old male presented to the ED complaining of severe abdominal pain. Further investigations ruled out gastritis and gastroparesis. Computed tomography (CT) angiography of the abdomen revealed a dissecting aneurysm with a maximum diameter of 1.5 cm at the celiac trunk extending into proximal splenic artery with mural thrombosis. Due to the patient's medical history, surgical or endovascular repair of the aneurysm carried too much risk. The patient was discharged to home, and symptoms were managed with pain management and celiac plexus ablation as an adjunct to pain medications.

**Corresponding author: E-mail: shiweihuang@yahoo.com;*
Co-author: E-mail: azhar_uddin203@yahoo.com;

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1. INTRODUCTION

Celiac artery aneurysm (CAA) is the rarest form of visceral artery aneurysms, constituting only 4% of the visceral artery aneurysms [1]. The estimated incidence of CAA ranges from 0.005% to 0.01%, making it one of the rarest forms of splanchnic artery aneurysm [2]. The most common causes are atherosclerosis, medial degeneration, and trauma [1,3]. 18-67% of celiac artery aneurysm patients have peripheral artery aneurysms [1]. Most of the cases are asymptomatic and are discovered incidentally on imaging studies or during autopsies [2]. However, patients can experience moderate to severe epigastric discomfort when the aneurysm is greater than 2 cm in diameter, and the aneurysm in general has 6% risk of rupture that is often fatal [1,4,5]. Previous studies have demonstrated the efficacies of open surgery and endovascular repair in preventing rupture [5]. However, in symptomatic patients who are poor candidates of vascular surgeries, the ideal management it is still uncertain [5,6].

Celiac artery aneurysms represent the fourth most common visceral arterial aneurysm. Although rare, they carry a definite risk for rupture and/or other complications. The reported risk for rupture appears to range from 10-20% [3]. Recently, advances in diagnostic imaging and early surgical intervention have lowered the rupture rate from up to 87% to 7%. Early recognition and intervention are critical, since mortality rate of ruptured celiac artery aneurysms is 40% compared to only 5% for non-ruptured aneurysms [2].

2. CASE PRESENTATION

A 57-year-old African American male had a medical history of diabetes and end stage kidney disease, and recently started undergoing hemodialysis three times a week. His family history is only significant for diabetes. He presented to the emergency department with severe abdominal pain. At baseline, the patient described the pain as unbearable and stabbing in the right upper quadrant and radiated to the back and left upper quadrant. The patient did not notice any changes of pain associated with food intake. The pain was occasionally associated with nausea and vomiting. The patient was started on dilaudid for pain control, but the pain was not relieved.

His blood pressure was 137/86, heart rate 88 beats per minute, respiratory rate of 18 per minute, body temperature of 98.4 Fahrenheit. His abdomen was soft with normal bowel sounds. The abdomen was tender in the epigastric region and right upper quadrant. The rest of the physical exam was normal.

On admission, his complete blood count and complete metabolic panel were normal except for elevated blood urea nitrogen (41 mg/dL) and serum creatinine (6.64 mg/dL). A nuclear medicine gastric emptying study revealed a mild gastroparesis. An esophagogastroduodenoscopy (EGD) only revealed mild gastritis. CT angiography was ordered to evaluate any ischemia in the superior (SMA) and inferior mesenteric arties (IMS), and an aneurysm was revealed. CT angiography of the visceral arteries was performed, and a dissecting aneurysm with a maximum diameter of 1.5 cm was found at the celiac trunk extending into the proximal splenic artery (Fig. 1).

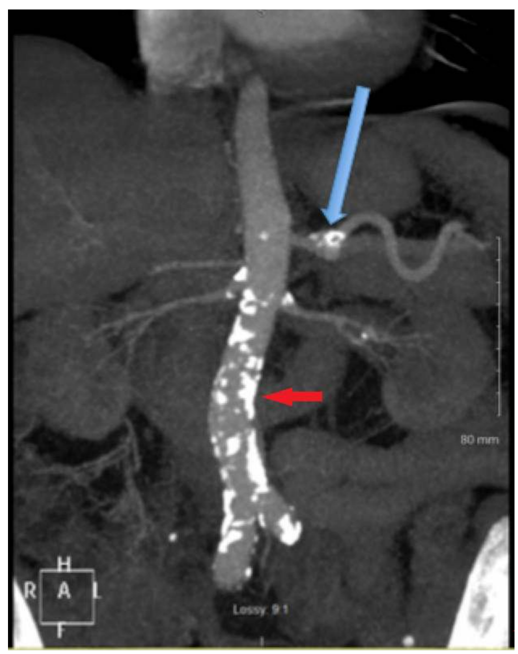

Fig. 1. CT angiography of dissecting aneurysm within the celiac axis. Red arrow indicated bright calcium signal in abdominal aorta, celiac and iliac arteries. This signal indicates the presence of atherosclerosis, which is the independent predictor of adverse cardiovascular events such as stroke and coronary artery disease [H]

After consultation with a vascular surgeon, the patient was discharged to home with opiods, and was instructed to follow up with out-patient interventional radiology for celiac plexus ablation. Six weeks after the patient underwent the procedure, the patient reported that the pain was managed with Tylenol 3 three times daily, and that the hemodialysis was more tolerable. Although symptomatic treatment was done, the patient was followed for 3 months after discharge, and his abdominal pain was controlled and aneurysm in repeated angiography was also stable (same size).

3. DISCUSSION

Visceral artery aneurysm is a rare condition with an incidence of 0.1-2% [7]. For celiac artery aneurysm about 180 cases have been reported since the first case was discovered in 1745 [2,6]. The most common causes of celiac artery aneurysm are atherosclerosis, medial degeneration, and trauma [1,3]. Very rarely, syphilis and autoimmune vasculitis can also cause celiac artery aneurysm.

Most CAA cases are asymptomatic and discovered as incidental findings on imaging studies or during autopsies [3]. Since CAAs can be asymptomatic or commonly cause only abdominal discomfort, some patients may be unaware until having an aneurysmal rupture. In previous studies, 69% of CAA patients presented with abdominal pain, and 14% were asymptomatic. Patients can experience moderate to severe abdominal pain, upper gastrointestinal hemorrhage, and epigastric discomfort radiating to the back especially if the aneurysm is greater than 2 cm in diameter. Worsening abdominal pain is a common sign of quickly expanding aneurysm or rupture [1]. Rupture is the most dangerous clinical presentation of CAA [6,8]. Aneurysmal rupture is generally quite low with 6% of risk [9]. One study has shown the diameter of the aneurysm, calcification, presence of thrombus, gender, and comorbidities are not risk factors of rupture [C]. However, another study determined that aneurysms with a diameter less than 22 mm have a 5% chance of rupture, and aneurysms with a diameter greater than 32 mm has a 50-70% chance of rupture [8]. The aneurysm can rupture into peritoneal cavity, often being fatal [3,6].

The aneurysm can rupture into the peritoneal cavity, retroperitoneum, or thorax. CAA dissection has also been reported causing end-organ infarction. Rare manifestations of CAAs include extrinsic compression of the pancreatic duct, palpable mass, bleeding gastric varices due to splenic vein compression, and hepatic and portal obstruction due to extrinsic compression [2].

Management options for CAAs include observation for small aneurysms, endovascular treatment with catheter-based embolization, and for certain patients, stent-graft therapy or surgical repair [1]. Surgical and endovascular treatment were found to be most common interventions, and are the ideal management for treating CAAs [2]. Previous studies have demonstrated comparable success rates of open surgical and endovascular elective repair. In revascularization, prosthetic grafts have a lower risk of obstruction compared to saphenous vein grafts. If the aneurysm ruptures, ligation or percutaneous trans-catheter embolization are possible interventions [1,5]. CAAs can be treated with celiac ligation, followed by aorto-hepatic bypass or direct aortic re-implantation. Some studies suggest that aneurysmal repair should be considered if the aneurysm is greater than 2 cm in diameter [9], but it is still unclear when a asymptomatic aneurysm should be repaired [3].

Surgery is the conventional treatment of CAA, and has been performed in most CAA cases. Surgery for CAA is well documented to be efficient and durable, with a 5% mortality rate for elective repair [10]. Surgical techniques have a technical success rate of 95% [10]. Various techniques were successful, including aneurysmorrhaphy, aneurysmectomy alone, or paired with aortoceliac anastomosis, hepatic–celiac anastomosis, hepatic/splenic–thoracoabdominal aorta graft bypass, hepatic/splenic–celiac interposition graft, hepatic–superior mesenteric artery bypass, aortoceliac bypass, and aortohepatic bypass, using a saphenous vein or prosthetic graft. Surgical indications include all symptomatic aneurysms, growing size of aneurysms, aneurysms that are 3 to 4 times larger than normal vessel diameter (8 mm), and calcified aneurysms larger than 3 cm [2]. Recently, two surgical reports showed a 5-year survival rate of 64%, a 9-year assisted primary graft patency rate of 79%, and a 30-day mortality rate of about 5% associated with surgical revascularization [10].

Endovascular management is generally a safe, efficient, and effective means of treating aneurysms involving the celiac artery. It has been associated with a lower morbidity and shorter hospital stay [4]. Endovascular repair is recommended in patients with rupture, comorbidities including malignancy, and hemodynamic instability [4,5,6]. Vascular anatomy is a good option for endovascular management, as anatomic feasibility has been reported to be up to 80% [11]. Since the use of endovascular techniques, treatment options for CAAs have greatly expanded beyond the original options of excision, bypass, and ligation [4]. Advances in endovascular techniques have resulted in successful endoluminal exclusion of aortic aneurysms and selective exclusion of smaller vessels. Some studies have also reported successful transluminal embolization and branch graft exclusion of pseudoaneurysms with the celiac trunk and its branches [2].

Stent grafts in the celiac and common hepatic arteries preserve the openness of the hepatic and gastroduodenal arteries, and allow arterial flow without occlusion. When anatomy and aneurysmal dilatation of CAA is complex, several stent grafts are used for sufficient proximal aortic neck length and diameter. Stent grafts extension in the artery is especially necessary for short or aneurysmal celiac arteries for safe positioning and sealing [11]. The diameter of the stent is usually 1 mm larger than the diameter of the celiac artery for stent stability, and the stent length is typically 20 mm longer than the length of the aneurysm neck for a complete aneurysm seal (atleast 10 mm at the distal and proximal margins). Stent placement is performed with road mapping [7]. Previous studies with stent grafts using abdominal CT angiography displayed no cases of endo leak or stent blockage during follow-up. This suggests that stent insertion for CAA is safe, and that it may provide good long-term results [7].

Another endovascular approach is coil embolization of the aneurysmal lumen, the proximal and distal aneurysmal neck, or both [10]. Compared to celiac plexus blockage, endovascular coil embolization repair is minimally invasive, with low complication rate, and is linked with a decreased length of stay about 2.4–1.6 days [10]. This safe and effective procedure in CAAs is performed as an ambulatory procedure, and for most patients, it is the first preferred treatment [4]. Coils are used to embolize celiac arteries that are less than 6.5 mm in diameter [11]. The conventional strategy of celiac artery embolization uses a pushable coil to block endoleaks and potential reflux. Conventional pushable coil embolization for the occlusion of the celiac artery is known to be effective, with an initial technical success rate of about 95% [11]. Recently, controlled-release coils (i.e., detachable interlocking microcoils) have been developed, in which the coil and its pusher wire are mechanically joined. Compared to conventional pushable coil, the detachable interlock microcoil was linked with decreased procedure time, lower radiation dose for coil deployment, and lower amount of coil [11].

Another management options is the percutaneous transarterial angioplasty (PTA) stent method, which can be easy and safe for patients whose ruptured CAA was treated with a hemostatic operation without correcting celiac axis stenosis [12]. PTA can also be used for patients with ruptured CAA who have suddenly stopped bleeding. It can also be used be used as a primary treatment for patients with unruptured CAA linked with celiac axis stenosis, in order to lower the collateral blood flow in the aneurysmal artery and to inhibit potential rupture [12]. Several studies of patients undergoing PTA and placement of stent had immediate improvement in symptoms and long term pain relief in most of the patients [13]. In addition, the safety and efficacy of PTA and stenting was found to be similar to open surgical revascularization in terms of length of hospital stay, morbidity, 30-day mortality, long-term survival, and repeated stenosis rates. When endovascular procedures are performed, the length of hospital stay, complication and mortality rates of PTA and stenting can be reduced, and survival and clinical success rate similar to surgical revascularization can be attained [13].

Although endovascular treatment or surgery is ideal, an alternative method called celiac plexus blockage was used to manage this patient's pain. Aortic aneurysm at the level of celiac plexus is contraindicated in celiac plexus blockade since it makes the trans-aortic approach risky and can lead to dissection and bleeding [14]. Other contraindications are coagulopathy, local infection, sepsis, tumor distorting anatomy, or pleural adhesions. Celiac plexus blockage technique takes anywhere from 10 to 30 minutes. The pain relief is almost immediate in most patients [14]. The effect of injection by celiac plexus ablation can last typically for 2-3 hours, but can even extend to a few days, depending on the number of injections administered. This procedure provides an average of 14 weeks of relief (anywhere from 4 weeks to 1 year) [15]. About 40% of patients get no relief at all from this method [15]. Celiac plexus blockage is known to be an efficacious approach to managing visceral upper abdominal pain, especially pancreatic cancer pain [14]. This technique has a 85% success rate (range: 70-100%) [14].

There are various approaches/techniques to perform celiac plexus block, but the most common is the bilateral posterior paravertebral antecrural approach. With this approach, patients are either in prone or lateral decubitus position, and the neurolytic agent is injected into the antecrural space with needles on both sides of the posterior paravertebral route. The needle tip is placed about 1–2 cm anterior of the aorta, between the celiac trunk and the SMA. Preliminary unenhanced abdominal CT is performed. After the needle tip position is confirmed at CT, the needle must be aspirated to know if blood is present. If no blood is present, 5 mL of diluted iodinated contrast material is injected into the antecrural space in the axial CT section to avoid streaking artifacts, which can distort the antecrural space anatomy. At needle entry point the skin is cleaned, and a sterile field is prepared. After subcutaneous infiltration with 1% lidocaine, a 20–24-gauge bevel-tipped needle is placed through the vertebral bodies into the antecrural space, with caution to avoid the rib, transverse process, vertebral body, kidneys, and major vascular structures [16]. About 40 mL (20 mL on each side) of absolute ethanol (95%–100%) is injected into the antecrural space without resistance, and the neurolytic agent should diffuse through the anterolateral wall of the aorta into the retroperitoneal space. This process is then repeated on the contralateral side [16].

This patient's aneurysm was managed by CT-scan guided celiac plexus blockage technique, which allows for exact placement of the needles, lowers risk of organ injury, and used when there is distorted anatomy due to malignancy as in the case of this patient [14]. The CT-guided technique involves a through-the-back or posterior approach, and requires a scout film to find the T12-L1 interspace [14,15]. When a scan is obtained through the interspace, the aorta position is identified relative to the vertebral body, which is where the intra-abdominal and retroperitoneal organs can be viewed. Distorted anatomy (due to tumor, previous surgery, adenopathy) can be found. At this level, the aorta is studied for any aneurysm, mural thrombus or calcification. After pursuing the standard method for celiac plexus localization, a CT scan at the needle tip level is taken and reviewed for needle placement and for the spread of contrast medium. This is viewed in the pre-aortic area and surrounding the aorta, with no contrast media in the retrocrural space [14]. The needle is passed through the vertebrae and the vertebral muscles and positioned anterior to the aorta, and then passed through the aorta and then inject. Some practitioners go around the aorta to inject [15]. For the patient, the pain level after 12 weeks post procedure was significantly lower compared to managing with pain medications alone [17].

4. CONCLUSION

This is a case of a 57-year-old African American male with symptomatic celiac artery aneurysm. This case emphasizes the importance of alternative approaches for management of symptomatic celiac artery aneurysm. Patients who are poor candidates for aneurysm repair, symptomatic relief can be achieved like celiac plexus ablation which can improve life quality.

CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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