Endovascular Stent Reconstruction of the Inferior Vena Cava Complicated by Duodenocaval Fistula

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ABSTRACT

A patient with retroperitoneal metastatic uterine adenocarcinoma resulting in symptomatic occlusion of the inferior vena cava underwent palliative endovascular stent reconstruction and subsequent radiation therapy. She then developed sepsis and massive lower gastrointestinal bleeding. Computed tomography (CT) and cavography demonstrated a fistulous communication between the duodenum and the stented segment of inferior vena cava. Deployment of endovascular stent graft devices successfully occluded the fistulous communication and resulted in clinical improvement.

KEYWORDS: Inferior vena cava, stent graft, enteric fistula, cancer, complication

CASE REPORT

A 67-year-old woman with a history of stage IIIA endometrial adenocarcinoma presented with back pain and bilateral lower extremity edema. Three years prior, she had undergone transabdominal hysterectomy and bilateral salpingoopherectomy with subsequent therapeutic radiation, and she had been feeling well until this presentation. Computed tomography (CT) of the abdomen and pelvis revealed a 5.8×5.9 cm retroperitoneal mass centered in the aortocaval space (Fig. 1). The mass displaced the duodenum anteriorly and appeared intimately associated with the posterior duodenal wall, right ureter, and aorta. It also markedly compressed the inferior vena cava, a portion of which appeared entirely occluded by the mass. The mass extended inferiorly to encase the proximal common iliac vessels. Ultrasound-guided percutaneous biopsy demonstrated metastatic endometrial adenocarcinoma. The mass was not amenable to resection.

Another course of external beam radiation therapy was undertaken in an attempt to decrease the size of the mass. However, the patient's lower extremity edema continued to worsen, progressing to the point that she was having significant difficulty ambulating. Deep venous thrombosis of the left lower extremity was diagnosed, and therapeutic anticoagulation was begun. However, despite a period of anticoagulation, her symptoms continued to worsen. At this point, the interventional radiology service was consulted.

Ultrasound guidance was used to obtain micropuncture access to the thrombosed left popliteal vein. Venography demonstrated complete thrombosis of the left popliteal, femoral, and iliac veins. The thrombosed iliac vein was traversed with a catheter, which was eventually passed across the thrombosed inferior vena cava into the patent suprarenal inferior vena cava (Fig. 2). Power pulse spray pharmacomechanical thrombolysis was performed across the entire thrombosed left

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Figure 1 (A) Axial and (B) coronal computed tomography scans. Extent of unresectable retroperitoneal metastatic endometrial adenocarcinoma demonstrated at presentation. Retroperitoneal tumor centered in the aortocaval space displaces the duodenum anteriorly and is intimately associated with the posterior duodenal wall, right ureter, aorta, and inferior vena cava.

lower extremity venous system. Follow-up venography demonstrated good effect.

Micropuncture access to the patent right popliteal vein was then obtained. Venography revealed occlusion of right common iliac vein, which was traversed with a hydrophilic catheter. After placement of a catheter into the patent suprarenal inferior vena cava, bilateral simultaneous deployment of 14 × 80 mm SMART[®] stents (Cordis Endovascular, Miami Lakes, FL) was performed across the occluded lower portion of the inferior vena cava extending into the right and left common iliac veins. The left iliac vein stent was extended caudally with an additional 14-mm SMART stents to the level of the inguinal ligament. Bilateral simultaneous 12 mm angioplasty was performed across the entire stented segment of the inferior vena cava and bilateral iliac veins. Completion venography revealed restored patency (Fig. 3). The patient tolerated the procedure well, and there were no immediate complications.

Within 48 hours, there was a marked decrease in the patient's lower extremity edema and marked

Figure 2 Complete thrombosis of the left lower extremity venous system extending from the popliteal space up to include a majority of the infrarenal inferior vena cava as well as the right common iliac vein.

Figure 3 Venographic result after mechanical thrombectomy, pharmacologic thrombolysis, and endovascular stent reconstruction extending from the upper portion of the infrarenal IVC into the left external iliac vein and right common iliac vein with excellent subsequent flow.

improvement in ambulation. External beam radiotherapy to the retroperitoneal mass was resumed.

On the third postoperative day, however, the patient reported feeling chills. She developed a fever of 102 degrees. Continued high fevers, rigors, and general clinical decline over the ensuing 24 hours led to triple antibiotic implementation. She then developed frankly bloody diarrhea, experiencing more than 10 episodes on postoperative day 5, prompting transfer to the intensive care unit. Blood cultures grew gram-negative rods. The differential diagnosis included radiation enteritis and gastrointestinal tumor invasion. Persistent fevers and rigors despite appropriate antimicrobial therapy also raised concern for seeding of residual intravascular thrombus or of the newly placed stents. By postoperative day 10, the patient had developed intractable septic shock. Blood cultures had since demonstrated haemophilus species, gram-positive cocci, and yeast. Meanwhile, ongoing gastrointestinal bleeding necessitated transfusion of ~4 units of red blood cells per day. Ultimately, the etiology was revealed when abdominal CT was obtained that demonstrated air within the vena cava as well as an outpouching of contrast material from the third portion of the duodenum posteriorly, with an air-containing fistulous tract between the duodenum and the inferior vena cava (Fig. 4).

Consideration was given to deploying a covered duodenal stent to address the fistula. However, the consultants felt that the risks of endoscopic intervention outweighed the few potential benefits, citing that stent expansion could potentially perforate the friable necrotic tissue mass, and that the duodenal lumen was not narrowed enough to hold an enteral stent in place.

Thus, a transvenous approach was elected. The inferior vena cava was accessed via the right internal jugular vein. A Tulip filter (Cook Medical, Bloomington, IL) was deployed just below the left renal vein. Access was obtained to both femoral veins. The right femoral and iliac veins were demonstrated to be widely patent. Injection of contrast into the left limb of the

Figure 4 Fistulous communication between the duodenum and the IVC, evidenced by air within the inferior vena cava.

stented inferior vena cava demonstrated rapid extravasation of contrast material into the adjacent necrotic tumor as well as the adjacent duodenal lumen (Fig. 5).

12-French vascular sheaths were advanced from the femoral access sites into the inferior vena cava. Simultaneous deployment of two 14.5-mm × 100-mm Gore Excluder[®] (W.L. Gore & Associates, Flagstaff, AZ) limbs was performed, extending from the top of the indwelling inferior vena cava stents into the iliac veins bilaterally. Simultaneous 12-mm angioplasty was then performed along the entire length of the deployed stent grafts. Completion cavography revealed occlusion of the fistula (Fig. 6). The temporary inferior vena cava filter was then removed.

The patient's clinical course improved almost immediately, with resolution of fevers and gastrointestinal bleeding and return of hemodynamic stability. Repeat CT demonstrated no evidence of persistent fistula. She was discharged several days later on oral trimethoprim/sulfamethoxazole as prophylaxis against stent graft infection.

One week after discharge, however, follow-up CT demonstrated rethrombosis of the infrarenal IVC despite pharmacologic anticoagulation. One month later, she returned to the emergency department with fevers and chills, and she was found to be in septic shock once again, with a temperature of 103 degrees and central venous pressure of 1 mm Hg. CT at that time showed foci of air within the inferior vena cava, both within the stented portion and cranial to it, which raised

Figure 5 Injection of contrast into the left limb of the stented inferior vena cava demonstrated rapid extravasation of contrast material into the adjacent necrotic tumor as well as the duodenal lumen.

Figure 6 Completion cavogram after deployment angioplasty of endovascular stent grafts.

concern for recurrence of fistula and/or stent infection despite antibiotic prophylaxis (Fig. 7).

In accordance with the patient's overall prognosis and goals of care, and as the initial stent was understood to be a palliative measure, no further procedural interventions were indicated. After a course of parenteral antibiotic therapy with resolution of her sepsis, the patient was discharged to hospice care. She eventually died approximately 8 months after the original intervention.

Figure 7 Recurrence of air within the inferior vena cava—concerning for fistula recurrence or endovascular stent infection. Note that the tumor has responded to radiation treatment.

DISCUSSION

Duodenocaval fistula (DCF) is a rare but lethal entity, with only about 50 reported cases, most commonly in men ages 40 to 50.^{1,2} There are numerous etiologies, including as a complication from migration of IVC filters, peptic ulcer disease, penetrating abdominal injury, transmural migration of ingested foreign bodies (including toothpicks, chicken bones, and fish bones), and, as in the present case, retroperitoneal tumors with subsequent radiation therapy.²⁻⁶ A review of 35 cases of DCF found that the most common etiology was trauma, followed by resection of a retroperitoneal tumor with adjuvant postoperative radiation therapy.² Reviews have suggested that postirradiation DCF are commonly preceded by ulcers.⁷ Adherence of the duodenum and IVC within an irradiated field coupled with mucosal damage and fibrosis due to irradiation disposes even shallow ulceration to transmural penetration and fistula formation.²

DCF is a diagnosis made frequently in the post-mortem setting. Although the clinical picture can be broad and nonspecific, the classic presentation is, as in any condition with fistulous communication between the digestive tract and the vascular system, one of sepsis coupled with gastrointestinal bleeding.⁸ Nearly 70% of patients with DCF demonstrated gastrointestinal bleeding or septicemia, but only 45% presented with both.² They may not have been concomitantly present or may have been simply occult, as these entities can range from isolated fever to lethal septic shock, or from trace blood in the stool to overt hypovolemic shock.^{2,7} Septicemia, when present, is generally polymicrobial, most commonly involving gram-positive bacteria, gram-negative enteric bacteria, and/or fungemia, as in the present case. A wide spectrum of nonspecific symptoms and findings have also been described, including abdominal pain, weight loss, fever of unknown origin, diarrhea, small bowel obstruction, respiratory distress, and stroke secondary to cerebral air embolism after gastroduodenoscopy.³

In a review of 38 cases of DCF, CT led to an accurate diagnosis in 5 of 10 patients.⁷ Although CT demonstrating gas or an incarcerated foreign body within the IVC, migrated caval filter, or a periduodenal abscess should place DCF prominently into the differential diagnosis, these findings are often not present.^{2,7,9} In one case, DCF resulted in hyperdense hepatic and splenic images as a result of venous passage of oral contrast, but this is not an expected finding.¹⁰ However, air in the IVC is a relatively specific finding. Although air may be produced by enteric bacteria, it is more likely physically translated into the IVC via gut peristalsis. The air seen in the IVC in the present case, correlated with the clinical picture, confirmed the diagnosis. However, repeat CT examinations may be necessary if the appearance and clinical picture are not as straight-forward. The

above review also reported that the diagnostic sensitivity of other modalities was less than reassuring: Contrast swallow radiography (38%), cavography (33%), and endoscopy (30%) were often nondiagnostic.⁷ In this case, cavography did show both enteric contrast medium and thrombus in the IVC, which was fully consistent with the prior CT diagnosis. Upper endoscopy in DCF may disclose a duodenal ulcer that may have active bleeding, but the depth of penetration of the ulcer can be difficult to appreciate.⁷ Ultrasound has been reported to have been effective in detecting DCF in two patients when highly echogenic foreign bodies were implicated.¹¹

The general recommendation is that CT or MRI should be chosen as a first-line exam for suspected diagnosis of DCF.¹² Because of the potential severity of the condition, however, some surgical journals suggest that recurrent septicemia after resection of a retroperitoneal tumor without evidence of abscess, regardless of the presence of gastrointestinal bleeding, should prompt urgent abdominal exploration out of concern for enterovascular fistula.¹³

Mortality overall in patients with DCF has been reported at 39.5%.^{2,7} Although emphasis in the literature has been placed on the diagnostic aspects of DCF, definitive intervention in these patients remains imperfect, with postoperative morbidity rate reported at 61%.² Clinical instability in patients diagnosed with DCF has traditionally mandated prompt laparotomy, with various surgical techniques described based on the mechanism of fistulization and the presence of IVC thrombosis.¹⁴ Most involve simple suturing of the duodenum and IVC as well as placement of an epiploic or jejunal patch to prevent recurrence.^{2,7} Truncal vagotomy, antrectomy, and duodenal exclusion have also been adjunctly performed, particularly in cases caused by a peptic ulcer.² Pancreaticoduodenectomy with gastrojejunostomy and choledochojejunostomy and division or excision of the IVC with graft interposition have also been described.^{2,7} Although this surgery is often performed urgently, there has been suggestion that, in some cases, antibiotic therapy may be utilized until a period of defervescence is obtained. One case report of favorable evolution of a patient with conservative treatment with subsequent migration of the insulting foreign body may support this rationale.⁶

Of note, fatal pulmonary embolization composed of intestinal contents through a DCF has been reported.¹⁵ As such, this may prompt discussion of standardized implementation of IVC filters in these patients, at least temporarily, as there is often associated thrombosis.

Endovascular techniques for repair of DCF, or any vascular-enteric fistula, are unreported. In this case,

the therapy was known to be a palliative measure from the outset, as the patient was not a surgical candidate. However, the period between repeat endograft placement and apparent fistula recurrence was shorter than expected, only 6 weeks. Further studies may be undertaken to evaluate the efficacy of endovascular repair of endograft-enteric fistula, with cases in clinically similar patients providing excellent opportunity to implement this technique.

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