

Single-session total endovascular ilio caval reconstruction with stent grafting for the treatment of inferior vena cava agenesis and concurrent iliac venous aneurysm rupture

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ABSTRACT

Iliac venous aneurysms are rare vascular abnormalities that may be manifested by abdominal masses, pelvic tenderness, or hypovolemia and may lead to rupture, thrombosis, pulmonary embolism, paradoxical embolism, or death. Inferior vena cava agenesis, like venous aneurysm, is an uncommon condition that may present with deep venous thrombosis. This report describes a patient with inferior vena cava agenesis and iliac venous aneurysm rupture treated with emergent ilio caval reconstruction and endovascular stent graft placement. (*J Vasc Surg Cases and Innovative Techniques* 2017;3:132-5.)

Iliac venous aneurysms are vascular abnormalities that may lead to rupture, thrombosis, pulmonary embolism, or death.¹ Described in the setting of trauma, venous aneurysms have been treated using balloon angioplasty, stenting, staple plication and resection over a balloon mandril, aneurysmectomy, and lateral venorrhaphy.^{2,3} Inferior vena cava (IVC) agenesis, like venous aneurysm, is an uncommon condition.⁴ Thought to arise from embryologic dysgenesis or early IVC thrombosis, the spectrum of IVC agenesis and hypoplasia may present with deep venous thrombosis.⁴ Such patients have been treated conservatively with anticoagulation and compression stockings or aggressively with open thrombectomy and caval reconstruction or endovascular ilio caval reconstruction.^{4,5} This report describes a patient, who consented for this publication, with IVC agenesis and iliac venous aneurysm rupture treated with emergent ilio caval reconstruction and endovascular stent graft placement.

CASE REPORT

Institutional Review Board approval was not required for the preparation of this report. The patient's consent was obtained for creation of this report.

A 49-year-old man with history of left deep venous thrombosis after rotator cuff repair in 2008 managed with anticoagulation

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presented after "bending over, feeling a popping sensation, and developing right lower quadrant pain." In the emergency department, heart rate was 143 beats/min and blood pressure was 78/46 mm Hg. Hemoglobin concentration was 6.6 mg/dL. Computed tomography (CT) of the abdomen and pelvis demonstrated absence of the infrarenal IVC with bilateral common and external iliac venous aneurysms and a right-sided 20- × 14- × 9-cm retroperitoneal hematoma concerning for venous aneurysm rupture or a hemorrhagic malignant neoplasm (Fig 1). There was high attenuation material within both common iliac veins, thought to represent acute deep venous thromboses. Right common iliac arteriography showed no extravasation, pseudoaneurysm, nor neovascularity to suggest neoplasm. Right ascending ilio caval venography revealed a venous aneurysm involving the common and external iliac vein, measuring up to 5.5 cm (Fig 2). Extravasation was seen at the mid-right external iliac vein with eccentric thrombus within the periphery. Fifteen endovascular biopsy specimens were obtained throughout multiple areas of the venous aneurysm using 5.5F forceps (Cordis, Fremont, Calif), confirming the presence of acute thrombus with no neoplastic cells.

As the patient remained stable, with blood pressure of 102/74 mm Hg, and given the extravasation, a decision was made to endovascularly treat the aneurysm using stent graft placement. In the setting of IVC agenesis or hypoplasia, it was thought that ilio caval reconstruction, with good venous outflow, would be required to maintain stent graft patency. From a right internal jugular (IJ) approach, a NaviCross guiding catheter (Terumo Medical Corp, Tokyo, Japan) and stiff angled Glidewire (Terumo Medical Corp) were used to traverse the occluded IVC. Venous integrity was confirmed using contrast agent injections (Isovue 300; Bracco Diagnostics, Monroe Township, NJ) in conjunction with intravascular ultrasound (IVUS) (Volcano Medical, San Diego, Calif). A baseline activated clotting time (ACT) was obtained, 5000 units of unfractionated heparin were given, and the ACT was repeated at 30-minute intervals with goal ACT of 200 to 250 maintained with repeated heparin boluses. From a right great saphenous vein approach, mechanical thrombectomy of the left popliteal, femoral, common femoral, and external iliac veins was performed using the Indigo reperfusion

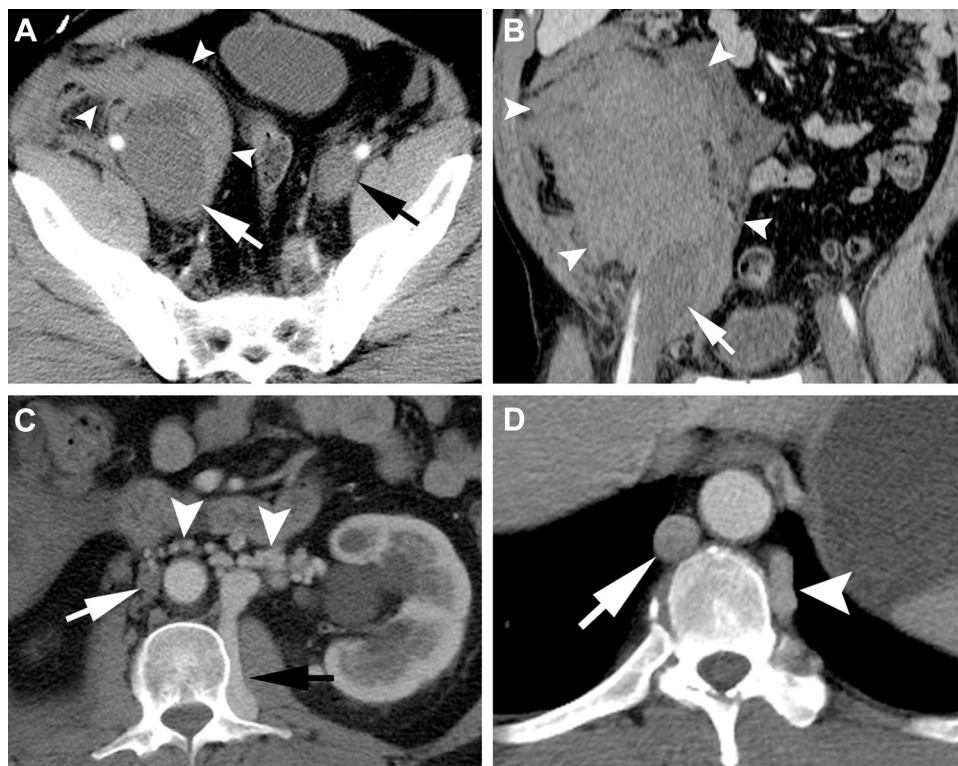


Fig 1. **A**, Axial computed tomography (CT) image with intravenous administration of contrast material demonstrating the ruptured right common iliac vein aneurysm (*white arrow*) with surrounding retroperitoneal hematoma (*arrowheads*), as well as a left common iliac vein aneurysm (*black arrow*). **B**, Coronal CT image showing the ruptured right iliac vein aneurysm (*arrow*) with adjacent retroperitoneal hematoma (*arrowheads*). **C**, Dilated retroperitoneal collateral veins (*arrowheads*) with a diminutive inferior vena cava (IVC; *white arrow*). **D**, Dilated azygos (*arrow*) and hemiazygos (*arrowhead*) veins with absence of the IVC consistent with IVC agenesis.

system (Penumbra, Alameda, Calif). Angioplasty of the right common iliac vein and IVC was then performed using 14-mm and 16-mm balloons (Bard PV, Tempe, Ariz) because of concomitant multifocal stenoses with thrombus. Next, angioplasty of the entire IVC was performed with an 18-mm balloon; 20- × 55-mm Wallstents (Boston Scientific, Marlborough, Mass) were then deployed in the hepatic IVC, below the hepatic vein confluence and within the infrarenal IVC. Overlapping 20-mm × 5-cm Gianturco Z-stents (Cook Medical, Bloomington, Ind) were placed at the level of the renal veins to preserve renal vein inflow.

Using the double barrel technique, two 14- × 90-mm Wallstents were deployed simultaneously in the inferior IVC extending into the common iliac veins. From a right IJ vein approach, mechanical thrombectomy of the right lower extremity was performed using the AngioJet thrombectomy device (Boston Scientific). To exclude the ruptured right iliac vein aneurysm, overlapping 16- × 16- × 156-mm and 16- × 16- × 93-mm Endurant II stent grafts (Medtronic, Minneapolis, Minn) were delivered across the right-sided aneurysm, extending from the inguinal ligament into the common iliac vein Wallstent. Exclusion of the ruptured aneurysm was confirmed with venography and IVUS.

Additional attempts were made to remove the remaining thrombus within the lower extremity using the AngioJet thrombectomy device with suboptimal results, prompting the decision to perform thrombolysis. A 5F UniFuse thrombolysis

catheter (AngioDynamics, Latham, NY) was placed into the left lower extremity extending from the left common iliac vein to the left popliteal vein. Tissue plasminogen activator was administered at 1 mg/h with heparin infusion at 500 units/h.

After 24 hours of thrombolysis, left iliofemoral venography was performed, revealing complete resolution of thrombus throughout the left popliteal and femoral veins, with thrombus remaining within the left common femoral and external iliac vein aneurysms. There was no evidence of hemorrhage from the left iliac venous aneurysm. To exclude the thrombus and to promote flow from the left lower extremity, 14- × 60-mm, 16- × 60-mm, and 18- × 60-mm overlapping Wallstents were deployed. Postdeployment venography demonstrated brisk in-line flow. Completion venography demonstrated excellent in-line flow throughout the ilio caval reconstruction without significant residual stenosis, thrombosis, hemorrhage, or aneurysm opacification (Fig 3); 90 mg of enoxaparin (Sanofi-Aventis, Paris, France), 300 mg of clopidogrel (Bristol-Myers Squibb, New York, NY), and 81 mg of aspirin were administered. Repeated CT of the abdomen and pelvis with intravenous administration of contrast material demonstrated a stable 20- × 14- × 9-cm right retroperitoneal hematoma with widely patent ilio caval stents and stent grafts (Fig 3). The patient was discharged 5 days later.

The patient was seen in the interventional radiology clinic 2 weeks later without complaints. The patient was transitioned

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