

Symptomatic occlusion of the inferior vena cava and bilateral iliac veins due to malignant seminoma: Percutaneous recanalization, thrombectomy, and stenting to restore patency

Daniel Nguyen, MD,^{a,b} Scott S. Berman, MD, MHA, RVT, FACS, DFSVS,^{a,b} and Joseph E. Sabat, MD, PhD, FSVS,^{a,b} Tucson, AZ

ABSTRACT

Testicular seminoma is rarely associated with occlusive venous thrombosis. Several investigators describe percutaneous guidewire recanalization for iliofemoral vein thrombosis; however, this technique is ill-documented for occlusion of the inferior vena cava, and even less information is available on managing pervasive ilio caval obstruction. Furthermore, there is limited data on percutaneous mechanical thrombectomy for malignancy-induced venous thrombosis. We present a case of symptomatic chronic occlusion of the inferior vena cava and iliac veins following remission for metastatic seminoma, with percutaneous intervention necessitating a unique combination of sharp wire recanalization, mechanical thrombectomy, and stenting to restore ilio caval patency. (*J Vasc Surg Cases Innov Tech* 2024;10:101516.)

Keywords: Metastatic testicular seminoma; Occlusive venous thrombosis; Percutaneous mechanical thrombectomy; Sharp wire recanalization

Venous thromboembolism (VTE), including deep vein thrombosis (DVT) and pulmonary embolism, occurs at an incidence of approximately 1 per 1000 adults annually.¹ Occlusive thrombosis of the inferior vena cava (IVC) represents an uncommon subtype of VTE thought to occur in 2% to 4% of patients with lower extremity DVT.² Even rarer are spontaneous cases of IVC thrombosis induced by tumor malignancy.³

There is a paucity of literature available to define the surgical management of chronic DVT and IVC thrombosis due to malignancy. Percutaneous mechanical thrombectomy (PMT) has recently gained popularity for its potential to restore venous outflow within a single session.⁴ Nevertheless, its role in metastatic disease remains largely case specific. Chronic total occlusion (CTO) of the ilio caval vessels also represents a major obstacle during endovascular intervention. Unfortunately, many institutions consider CTO an inoperable disease, and patients are often left with inadequate symptom management through anticoagulation and compression therapy. Although there are many case reports describing DVT due to invasion or compression by seminoma, no

literature discussing interventional management of CTO in the context of seminoma is available.

We present a case of symptomatic IVC and bilateral iliac vein occlusion following remission of metastatic seminoma for which the patient underwent a unique sequence of femoral and internal jugular vein access, sharp recanalization, PMT, and stenting to restore patency. The patient provided written informed consent for the report of his clinical care details and imaging studies.

CASE REPORT

The patient is a 60-year-old man with history of orchiectomy for seminoma. Two years before his vascular surgery presentation, he was found to have recurrence with a 13-cm retroperitoneal mass. His computed tomography (CT) scan showed extensive retroperitoneal adenopathy causing left-sided hydronephrosis and obliteration of the infrarenal IVC and iliac veins (Fig 1). Bilateral lower extremity venous duplex ultrasound from that time offered no evidence of acute DVT. He completed four cycles of cisplatin-based combination chemotherapy, and his restaging CT scan showed improved tumor burden. Several months later, he was diagnosed with extensive left iliofemoral DVT and treated with apixaban. It was not until he underwent restaging positron emission tomography-CT imaging 1 year later, which identified CTO of the IVC and iliac veins (Fig 2), that he was referred to vascular surgery. The positron emission tomography-CT scan showed he was in remission; however, he had significant retroperitoneal scarring with nonvisualization of the infrarenal IVC. Physical examination revealed exquisitely tender abdominal varices and marked bilateral lower extremity edema. A repeat duplex ultrasound scan showed resolution of the lower extremity DVT, however. Given the patient's severe symptoms, he was offered venography with possible percutaneous reconstruction of the ilio caval vessels.

From the Pima Heart and Vascular^a; and the Division of Vascular and Endovascular Surgery, Department of Surgery, The University of Arizona College of Medicine.^b

Correspondence: Joseph E. Sabat, MD, PhD, Pima Heart and Vascular, 2404 E River Rd, Ste 251, Tucson, AZ 85718 (e-mail: joseph.sabat@gmail.com).

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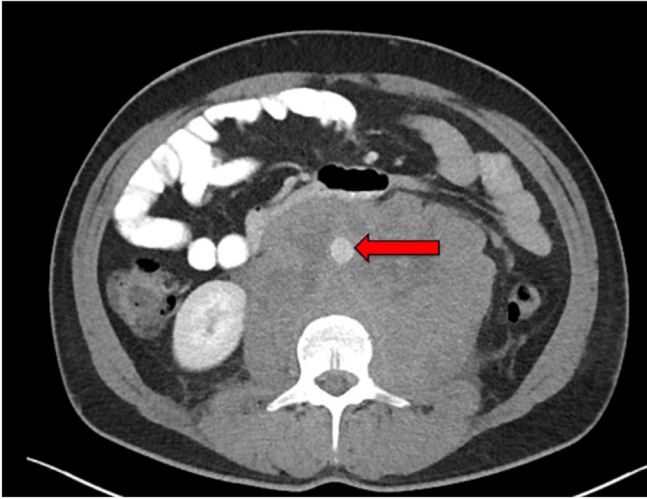


Fig 1. Axial view of computed tomography (CT) scan of the abdomen showing recurrent metastatic seminoma with obliteration of the infrarenal inferior vena cava (IVC). The patent abdominal aorta (red arrow) is shown for reference.



Fig 2. Axial view of restaging computed tomography (CT) scan of the abdomen demonstrating obliteration of the inferior vena cava (IVC) and bilateral iliac veins.

Bilateral proximal femoral vein access was obtained. Subtraction venography confirmed CTO of the external iliac veins bilaterally without reconstitution of the IVC (Fig 3). Multiple attempts were made to pass a wire from below the IVC via left femoral vein approach without success. Using a long sheath for support, a wire was introduced via right internal jugular vein access, passing it through the occluded IVC and right iliac vein before retrieving it through the right femoral vein access site. We were similarly unable to cross the left common iliac vein occlusion; thus, sharp recanalization was attempted using the back of a floppy guidewire to pierce the obstruction from above. The wire was passed down to the left femoral vein access and then snared out. Intravascular ultrasound identified thrombus in the iliac veins, and mechanical thrombectomy was performed bilaterally with the ClotTriever device (Inari Medical). A small amount of thrombus was retrieved (pathological examination findings were negative for tumor). Serial angioplasty was performed, followed by placement of kissing, bilateral 14-mm self-expanding Venovo stents (BD) from the renal veins to the bilateral common femoral veins. Completion venograms (Fig 4) and repeat intravascular ultrasound illustrated excellent patency and full expansion of the stents. The estimated blood loss was <50 mL. He had an uneventful postoperative recovery, reported immediate symptom relief, and was discharged home the same day with oral anticoagulation of apixaban 5 mg twice daily.

Surveillance venous duplex ultrasound scans at 1, 6, and 18 months confirmed patent stents without recurrent thrombotic occlusion. By this point, he had dramatic improvement of his bilateral lower extremity edema and resolution of his abdominal varicosities.

DISCUSSION

Testicular germ cell tumors (TGCTs) are the most frequently occurring malignancy among young men

aged 15 to 39 years.^{3,5} Despite accounting for more than one half of all TGCTs, testicular seminomas exhibit a promising survival rate of 95% when discovered and managed early.^{5,6} Nevertheless, VTE remains the second leading cause of death among all cancer patients, second only to the malignancy itself.⁷

TGCTs display a propensity for hematogenous and lymphatic spread; however, their association with IVC thrombosis is poorly understood. It is believed their retroperitoneal spread might instigate IVC obstruction by external compression, invasion of the vessel wall, or propagation as tumor thrombus.⁸ An investigation of testicular cancer patients revealed only 4% of ilio caval DVT were identified by CT compared with 11% by autopsy.⁹ Some investigators also raise concerns regarding the thrombogenic effects of cisplatin-based chemotherapy, the same regimen our patient received.¹⁰ The most dreaded sequelae of occlusive IVC thrombosis is pulmonary embolism, which can result in sudden death.^{9,11}

Percutaneous recanalization with stenting is the current mainstay treatment of symptomatic CTO of the iliofemoral veins. Endovascular management of occlusive IVC thrombosis, however, remains poorly defined owing to smaller patient cohorts and higher likelihood of operative challenges.¹² Percutaneous recanalization was first described by Gupta et al¹³ in 1998. They crossed a right subclavian vein occlusion using an 18-gauge hollow-core needle.¹³ Sharp recanalization of iliofemoral DVT has since been achieved using a variety of puncturing devices, including the GoBack catheter (Bentley US Inc), the Rösch-Uchida transjugular liver needle (Cook Medical Inc), and endovascular guidewires.¹⁴⁻¹⁶ Nevertheless, the success rates vary considerably, and the technique itself might require an extended fluoroscopy time due to multiple attempts to relieve the obstruction.¹⁷

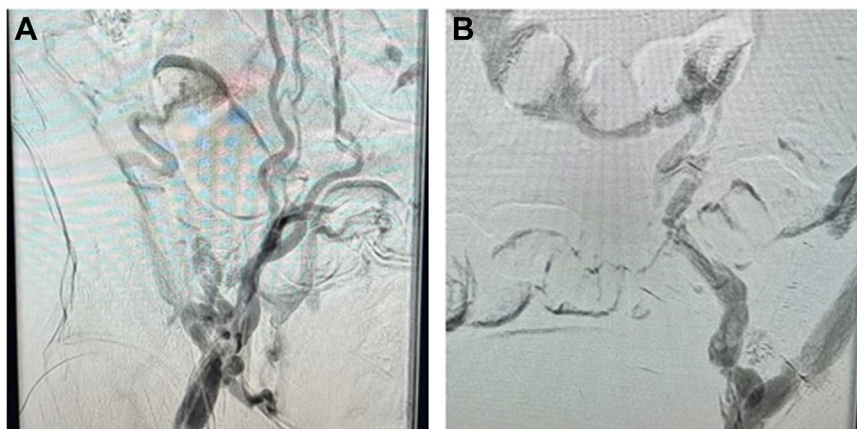


Fig 3. Preprocedural subtraction venography of the right (A) and left (B) lower extremities revealing complete total occlusion of the external iliac veins without reconstitution of the inferior vena cava (IVC).



Fig 4. Postprocedural subtraction venograms of the right (A) and left (B) lower extremities illustrating patency of the inferior vena cava (IVC) and kissing bilateral iliac vein stents.

In the present study, we demonstrate the feasibility of percutaneous guidewire recanalization for even the most extensive cases of CTO. Our first attempt to cross the occluded IVC from below via the left femoral access vein proved challenging due to preferential wire buckling and passage toward collateral veins. The right internal jugular vein approach allowed for guidewire purchase into a trabeculated segment of the right common iliac vein, with subsequent sheath advancement to reinforce its passage. Similar attempts to penetrate the occluded left common iliac vein, however, resulted in failure. Only after exhausting multiple wire and catheter combinations did we resort to using the stiff back end of the guidewire to sharply puncture the obstruction.

In recent years, PMT has emerged as a safe and effective strategy to extract occlusive venous thrombus and restore patency within a single treatment session.⁴ Compared with catheter-directed thrombolysis, PMT offers superior primary patency at 6 months, with equivalent efficacy and a reduced risk of bleeding.^{4,18,19} This

approach also avoids systemic thrombolysis, decreases usage rates for the intensive care unit, and lowers health-care costs. However, its role in malignancy-induced ilio-caval DVT remains largely unexplored. Our comprehensive review of the literature yielded no other reports describing PMT or recanalization for metastatic seminoma-induced destruction of the IVC and bilateral iliac veins. Nor did we find literature describing any interventional therapy for CTO after seminoma. Only recently did Qiu et al²⁰ report their experience with the ClotTriever in single-session extraction of IVC and right iliofemoral vein tumor thrombosis in which a patient who underwent mechanical thrombectomy for their DVT was incidentally found to have recurrent squamous cell carcinoma on pathological review of the specimen.

CONCLUSIONS

Malignant seminomas are an unusual cause of occlusive IVC and iliac vein thrombosis. Although complete remission is often obtained with chemotherapy, there is

no guidance on management of the resulting ilio caval venous obstruction, particularly with recanalization and PMT. We present an innovative approach, using jugular and femoral vein access, sharp recanalization, and mechanical thrombectomy to treat CTOs and restore venous patency within a single session of therapy. This approach was noted to be safe and effective and has thus far provided sustained venous patency and symptom relief at 18 months of follow-up.

DISCLOSURES

None.

REFERENCES

- Cushman M. Epidemiology and risk factors for venous thrombosis. *Semin Hematol*. 2007;44:62–69.
- Alkhouli M, Morad M, Narins CR, Raza F, Bashir R. Inferior vena cava thrombosis. *JACC Cardiovasc Interv*. 2016;9:629–643.
- Durand X, Rigaud J, Avancès C, et al. Recommandations en oncurologie 2013 du CCAFU : Tumeurs germinales du testicule [CCAFU Recommendations 2013: Testicular germ cell cancer]. *Prog Urol*. 2013;23:S145–S160.
- Dexter DJ, Kado H, Schor J, et al. Interim outcomes of mechanical thrombectomy for deep vein thrombosis from the All-Comer CLOUT Registry. *J Vasc Surg Venous Lymphat Disord*. 2022;10:832–840.e2.
- Bokemeyer C, Nichols CR, Droz JP, et al. Extragonadal germ cell tumors of the mediastinum and retroperitoneum: results from an international analysis. *J Clin Oncol*. 2002;20:1864–1873.
- Dieckmann KP, Richter-Simonsen H, Kulejewski M, et al. Testicular germ-cell tumours: a descriptive analysis of clinical characteristics at first presentation. *Urol Int*. 2018;100:409–419.
- Khorana AA, Francis CW, Culakova E, Kuderer NM, Lyman GH. Thromboembolism is a leading cause of death in cancer patients receiving outpatient chemotherapy. *J Thromb Haemost*. 2007;5:632–634.
- Hassan B, Tung K, Weeks R, Mead GM. The management of inferior vena cava obstruction complicating metastatic germ cell tumors. *Cancer*. 1999;85:912–918.
- Dusaud M, Bayoud Y, Desfemmes FR, Molimard B, Durand X. Unusual presentation of testicular cancer with tumor thrombus extending to the inferior vena cava. *Case Rep Urol*. 2015;2015:160560.
- Mano MS, Guimarães JL, Suttmöller SF, Reiriz AB, Suttmöller CS, Di Leo A. Extensive deep vein thrombosis as a complication of testicular cancer treated with the BEP protocol (bleomycin, etoposide and cisplatin): case report. *Sao Paulo Med J*. 2006;124:343–345.
- Bredael JJ, Vugrin D, Whitmore WF. Autopsy findings in 154 patients with germ cell tumors of the testis. *Cancer*. 1982;50:548–551.
- Murphy EH, Johns B, Varney E, Raju S. Endovascular management of chronic total occlusions of the inferior vena cava and iliac veins. *J Vasc Surg Venous Lymphat Disord*. 2017;5:47–59.
- Gupta H, Murphy TP, Soares GM. Use of a puncture needle for recanalization of an occluded right subclavian vein. *Cardiovasc Interv Radiol*. 1998;21:508–511.
- Rodriguez LE, Tabrizi R, Malgor RD, Wohlauser M, Jacobs DL. Sharp recanalization with the upstream GoBack catheter for chronic occlusive ilio-caval thrombosis. *Ann Vasc Surg*. 2021;74:e7–e11.
- Ito N, Isfort P, Penzkofer T, Grommes J, Greiner A, Mahnken A. Sharp recanalization for chronic left iliac vein occlusion. *Cardiovasc Interv Radiol*. 2012;35:938–941.
- Adam L, Wyss TR, Do DD, Baumgartner I, Kucher N. Endovascular stent reconstruction of a chronic total occlusion of the inferior vena cava using bidirectional wire access and a balloon puncture by a re-entry device. *J Vasc Surg Venous Lymphat Disord*. 2015;3:442–445.
- Chen B, Lin R, Dai H, et al. XperCT facilitates sharp recanalization for the treatment of chronic thoracic venous occlusive disease in hemodialysis patients. *J Vasc Access*. 2023. <https://doi.org/10.1177/11297298231151459>.
- Lichtenberg MKW, Stahlhoff S, Młyńczak K, et al. Endovascular mechanical thrombectomy versus thrombolysis in patients with iliofemoral deep vein thrombosis - a systematic review and meta-analysis. *Vasa*. 2021;50:59–67.
- Benarroch-Gampel J, Pujari A, Aizpuru M, Rajani RR, Jordan WD, Crawford R. Technical success and short-term outcomes after treatment of lower extremity deep vein thrombosis with the Clot-Triever system: a preliminary experience. *J Vasc Surg Venous Lymphat Disord*. 2020;8:174–181.
- Qiu J, Kapadia S, Bowens N, et al. Mechanical thrombectomy of squamous cell carcinoma tumor thrombus presenting as extensive deep venous thrombosis. *Ann Vasc Surg Brief Rep Innov*. 2023;3:100177.

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