Diagnosis and management of right external iliac vein “sandwich”: A rare cause of iliofemoral deep venous thrombosis

Elizabeth Tai, MD, PhD,a Arash Jaberi, MD, MEd,a George D. Oreopoulos, MD, MSc,a,b Thomas L. Forbes, MD,b Kong Teng Tan, MD,a and Sebastian Mafeld, MBBS,a Toronto, Ontario, Canada

ABSTRACT

Several anatomic abnormalities predispose patients to iliofemoral deep venous thrombosis, the most common of which is compression of the left iliac vein between the right common iliac artery and lumbar vertebrae, or May-Thurner syndrome. Other areas of venous compression can occur but are rare. This case report describes the presentation, diagnosis, and management of a patient with compression of the right iliac vein “sandwiched” between the right internal and external iliac arteries. After treatment, the patient demonstrated significant improvement in symptoms. (J Vasc Surg Cases and Innovative Techniques 2019;5:314-8.)

Keywords: Deep venous thrombosis; Venous intervention; Pharmacomechanical thrombolysis; Catheter-directed thrombolysis

Iliac vein compression syndromes result from extrinsic venous compression by adjacent structures, such as arteries, bones, muscles, and ligaments. The morphologically normal vein is entrapped between rigid or semi-rigid surfaces, usually from an underlying anatomic abnormality. Repetitive trauma from extrinsic compression can produce inflammation, venous thrombosis, and intimal proliferation.1-3 Diagnosis of iliac vein compression syndrome is based on clinical and imaging features. Clinical presentation includes pain, swelling, venous thrombosis, varicosities, and chest pain from pulmonary embolism.4 The anatomic abnormality can be identified by various imaging techniques.

This report describes diagnosis and management of a rare iliac vein compression syndrome involving the right external iliac vein presenting with acute right iliofemoral deep venous thrombosis (DVT).

Written, informed consent was obtained from the patient for publication of this report.

CASE REPORT

A 76-year-old man presented with an acutely swollen right leg. Ultrasound identified intraluminal internal echoes, non-compressibility, and absence of flow phasicity in the deep veins from occlusive acute DVT extending from the right external iliac vein to the popliteal vein (Fig 1). Past medical history included four episodes of acute bilateral DVT in 12 years and chronic DVT treated for 5 years with warfarin, which was discontinued because of gastrointestinal bleeding. There is no known history of thrombophilia. He was prescribed rivaroxaban for acute DVT.

Computed tomography (CT) of the abdomen and pelvis demonstrated compression at the right external iliac vein origin between the right internal and external iliac arteries at the bifurcation and associated DVT (Fig 2). Thrombus was redefined in the right external iliac, common femoral, and femoral veins with right leg enlargement and edema. The right popliteal vein was punctured under ultrasound guidance using a micropuncture set, and a 7F sheath was placed. Venography demonstrated occlusive thrombus with meniscus sign in the right external iliac/common femoral vein. A hydrophilic wire (Glidewire: Terumo Medical Corp, Somerset, NJ) and 5F Kumpe catheter (AngioDynamics, Latham, NY) were used to cross the acute occlusion. A 4F infusion catheter (Cragg-McNamara; Medtronic Peripheral, Minneapolis, Minn) with side ports centered on the thrombus was left in situ with 1 mg/h of alteplase for 12 hours and 500 units/h of heparin through the side arm of the popliteal sheath. Follow-up venography at 24 hours demonstrated residual thrombus in the right external iliac and common femoral veins. After unsuccessful balloon maceration and venoplasty of the segment using sequential 8-mm × 4-cm, 10-mm × 4-cm, and 12-mm × 4-cm balloons (Boston Scientific, Malborough, Mass), pharmacomechanical thrombectomy (AngioJet Solent Omni catheter: Boston Scientific) was performed after the thrombus was “power pulsed” with 10 mg of alteplase. The right external iliac vein in the region of compression was stented with a 16-mm × 6-cm nitinol self-expanding venous stent (Zilver Vena; Cook Medical, Bloomington, Ind). As there was residual clot, additional thrombolysis was performed with a 4F infusion catheter (Cragg-McNamara) with 1.5 mg/h of alteplase and 500 units/h of heparin. Follow-up venography after 24 hours demonstrated reduced clot with small-volume
**Fig 1.** Duplex venous ultrasound images on presentation to the emergency department. 

- **A**, Occlusive thrombus is noted in the right common femoral vein with intraluminal echoes and noncompressibility of the right common femoral vein.
- **B**, Intraluminal echoes with no venous waveform or filling of the right common femoral vein on spectral Doppler compatible with occlusive thrombus.
- **C**, Anechoic, noncompressible right popliteal vein compatible with acute thrombus.
- **D**, Occlusive thrombus in the right external iliac vein.

**Fig 2.** Contrast-enhanced computed tomography (CT) of the abdomen and pelvis. The arrows demarcate the position of the right external iliac artery (black arrow), right internal iliac artery (gray curved arrow), and right external iliac vein (block arrow).

- **A**, Axial portal venous phase image of the pelvis demonstrating compression of the right external iliac vein between the right internal and external iliac arteries.
- **B**, Coronal portal venous phase image demonstrating compression of the right external iliac vein between the right internal and external iliac arteries.
- **C**, Coronal maximum intensity projection image demonstrating compression of the right external iliac vein between the bifurcation of the right internal and external iliac arteries.
- **D**, Reconstructed image demonstrating compression of the right external iliac vein between the bifurcation of the right internal and external iliac arteries.
eccentric thrombus, probably chronic, and patency of the stent with improved flow through the region of vascular compression (Fig 3; Video).

At discharge, the patient was prescribed rivaroxaban and clopidogrel for anticoagulation. Right leg swelling significantly improved 1 month after intervention.

Two months after the most recent presentation, he presented again with chest heaviness and dyspnea. CT pulmonary angiography noted webs in the segmental left and right lower lobe pulmonary arteries from chronic pulmonary embolism (Fig 4).

Clinical presentation was cardiac related, unrelated to chronic pulmonary embolism, and appropriate medical care was administered.

**DISCUSSION**

Most iliac venous compression syndromes are left sided, secondary to May-Thurner syndrome (MTS), vascular constriction defined by compression of the left common iliac vein by the right common iliac artery. There are multiple MTS variants, including ipsilateral common iliac
This case report describes diagnosis and management of acute DVT from a separate rare iliac vein compression syndrome characterized by right external iliac vein compression at the bifurcation of the right common iliac artery with the vein "sandwiched" between the internal and external iliac arteries, the most common cause of right iliac vein compression. Successful management of the case was based on management of MTS and published guidelines.

In a retrospective review, 80% of patients with iliofemoral DVT had extrinsic compression from anatomic abnormalities central to the thrombosed deep vein. Our case demonstrates that the thrombotic workup should include anatomic imaging to identify extrinsic compression by anatomic variants. Intravascular ultrasound (IVUS) can also identify extrinsic venous compression, fibrosis, webs, spurs, and trabeculations in the venous system. IVUS is more sensitive than venography at characterizing the degree of stenosis, although venography is more specific. The clinical significance and role of IVUS in venous thromboembolism and obstructive lesions require further investigation. Whereas published guidelines do not recommend anatomic imaging for a cause of chronic pulmonary embolism, our case demonstrates that anatomic variants can predispose to chronic pulmonary thromboembolism. Consideration may be given to CT venography to exclude this pathologic process.

Berger et al were among the first to treat MTS with catheter-directed thrombolysis (CDT) to prevent post-thrombotic syndrome (PTS) from iliofemoral DVT and with stenting to alleviate the venous obstruction. This has become common practice for acute management of MTS. PTS is a chronic complication of DVT characterized by pain, swelling, edema, pigmentation, and venous ulcers in severe cases. Management of patients with proximal DVT is controversial, with conflicting results from two large randomized controlled trials comparing CDT with anticoagulation. The Catheter-directed Venous Thrombolysis (CaVenT) study examined 209 patients with iliofemoral DVT, with reduction in PTS in patients receiving CDT at 2- and 5-year follow-up. The Acute Venous Thrombosis: Thrombus Removal with Adjunctive Catheter-Directed Thrombolysis (ATTRACT) trial, which recruited 692 patients to evaluate pharmacomechanical CDT for DVT, demonstrated no difference in the rate of PTS with reduced severity in CDT patients. A recent meta-analysis noted that pharmacomechanical CDT significantly increases the partial lysis rate with decreased dose of thrombolytic and decreased interventional time. No prospective trials directly compare pharmacomechanical thrombectomy and CDT alone. Further studies, such as the Catheter Versus Anticoagulation Alone for Acute Primary Iliofemoral DVT (CAVA) trial (NCT00970619), may clarify the role of interventional treatment for acute DVT.

Several studies investigated stent patency in MTS patients, with 1-year patency rates ranging from 91% to 93% in acute and chronic DVT. Studies up to 36 months noted primary and secondary stent patency rates of 91% and 95%, respectively. The Society of Interventional Radiology, the Cardiovascular and Interventional Radiological Society of Europe, and the Society for Vascular Surgery support venous stenting in the management of nonthrombotic obstructive lesions.

CONCLUSIONS

Management of iliofemoral DVT should include investigation of the etiology, including anatomic causes of venous compression using cross-sectional imaging. Whereas most iliac vein compression syndromes are
left sided, right-sided anatomic causes of the venous obstruction exist. The most common right-sided anatomic variant is the right internal and external iliac arteries sandwiching the right iliac vein. Principles of management from left-sided iliac vein compression syndrome (MTS), including pharmacomechanical thrombectomy, CDT, and venous stenting, can be applied to management of right-sided iliac vein compression syndrome and associated DVT.

REFERENCES
1. White JM, Comerota AJ. Venous compression syndromes. Vasc Endovascular Surg 2017;51:155-68.
2. May R, Thurner J. The cause of the predominantly sinistral occurrence of thrombosis of the pelvic veins. Angiology 1957;8:419-27.
3. Zucker EJ, Ganguli S, Ghoshhajra BB, Gupta R, Prabhakar AM. Imaging of venous compression syndromes. Cardiovasc Diagn Ther 2016;6:919-32.
4. Butros SR, Liu R, Oliveira CR, Ganguli S, Kalva S. Venous compression syndromes: clinical features, imaging findings and management. Br J Radiol 2013;86:20130284.
5. Budnur SC, Singh B, Mahadevappa NC, Reddy B, Nanjappa MC. Endovascular treatment of iliac vein compression syndrome (May-Thurner). Cardiovasc Interv Ther 2013;28:101-5.
6. Abboud G, Midulla M, Lions C, El Ngheoui Z, Gengler L, Martinelli T, et al. ‘Right-sided’ May-Thurner syndrome. Cardiovasc Interv Radiol 2010;33:1056-9.
7. Sharafi S, Farsad K. Variant May-Thurner syndrome: compression of the left common iliac vein by the ipsilateral internal iliac artery. Radiol Case Rep 2018;13:419-23.
8. Chen F, Deng J, Hu XM, Zhou WM. Compression of the right iliac vein in asymptomatic subjects and patients with iliofemoral deep vein thrombosis. Phlebology 2016;31:471-80.
9. Chung JW, Yoon CJ, Jung SI, Kim HC, Lee W, Kim YJ, et al. Acute iliofemoral deep vein thrombosis evaluation of underlying anatomic abnormalities by spiral CT venography. J Vasc Interv Radiol 2004;15:249-56.
10. Gagne PJ, Tahara RW, Fastabend CP, Dzieciuchowicz L, Marston W, Vedantham S, et al. Venography versus intravascular ultrasound for diagnosing and treating iliofemoral vein obstruction. J Vasc Surg Venous Lymphat Disord 2017;5:678-87.
11. Gagne PJ, Casparis A, Black S, Thorpe P, Passman M, Vedantham S, et al. Analysis of threshold stenosis by multiplanar venogram and intravascular ultrasound examination for predicting clinical improvement after iliofemoral vein stenting in the VIDIO trial. J Vasc Surg Venous Lymphat Disord 2018;6:48-56.e1.
12. Neglen P, Raju S. Intravascular ultrasound scan evaluation of the obstructed vein. J Vasc Surg 2002;35:694-700.
13. Mahnkern AH, Thomson K, de Haan M, O’Sullivan CJ. CIRSE standards of practice guidelines on ilio caval stenting. Cardiovasc Interv Radiol 2014;37:889-97.
14. Mehta S, Helmersen D, Provencher S, Hirani N, Rubens FD, De Perrot M, et al. Diagnostic evaluation and management of chronic thromboembolic pulmonary hypertension: a clinical practice guideline. Can Respir J 2010;17:301-34.
15. Berger AJ, Jaffe JW, York TN. Iliac compression syndrome treated with stent placement. J Vasc Surg 1995;21:510-4.
16. Mousa AY, AbuRahma AF. May-Thurner syndrome: update and review. Ann Vasc Surg 2013;27:984-95.
17. Enden T, Haig Y, Klow NE, Slagsvold CE, Sandvik L, Ghanima W, et al. Long-term outcome after additional catheter-directed thrombolysis versus standard treatment for acute iliofemoral deep vein thrombosis (the CaVenT study): a randomised controlled trial. Lancet 2012;379:31-8.
18. Haig Y, Enden T, Grotta O, Klow NE, Slagsvold CE, Ghanima W, et al. Post-thrombotic syndrome after catheter-directed thrombolysis for deep vein thrombosis (CaVenT): 5-year follow-up results of an open-label, randomised controlled trial. Lancet Haematol 2016;3:e64-71.
19. Vedantham S, Goldhaber SZ, Julian JA, Kahn SR, Jaff MR, Cohen DJ, et al. Pharmacomechanical catheter-directed thrombolysis for deep-vein thrombosis. N Engl J Med 2017;377:2240-52.
20. Comerota AJ, Kearon C, Gu CS, Julian JA, Goldhaber SZ, Kahn SR, et al. Endovascular thrombus removal for acute iliofemoral deep vein thrombosis: analysis from a stratified multicenter randomized trial. Circulation 2018;139:162-73.
21. Wang W, Sun R, Chen Y, Liu C. Meta-analysis and systematic review of percutaneous mechanical thrombectomy for lower extremity deep vein thrombosis. J Vasc Surg Venous Lymphat Disord 2018;6:788-800.
22. O’Sullivan GJ, Semba CP, Bittner CA, Kee ST, Razavi MK, Sze DY, et al. Endovascular management of iliac vein compression (May-Thurner) syndrome. J Vasc Interv Radiol 2000;11:823-36.
23. van Vuuren T, Doganci S, Wittens CH. Patency rates and clinical outcomes in a cohort of 200 patients treated with a dedicated venous stent. J Vasc Surg Venous Lymphat Disord 2018;6:321-9.
24. Hager ES, Yuo T, Tahara R, Dillavou E, Al-Khouyr G, Marone L, et al. Outcomes of endovascular intervention for May-Thurner syndrome. J Vasc Surg Venous Lymphat Disord 2013;5:270-5.
25. Vedantham S, Millward SF, Cardella JF, Hofmann LV, Razavi MK, Grassi CJ, et al. Society of Interventional Radiology position statement: treatment of acute iliofemoral deep vein thrombosis with use of adjunctive catheter-directed intrathrombus thrombolysis. J Vasc Interv Radiol 2009;20(Suppl):S32-S5.
26. Meissner MH, Gloviczki P, Comerota AJ, Daling MC, Eklof BC, Gillespie DL, et al. Early thrombus removal strategies for acute deep venous thrombosis: clinical practice guidelines of the Society for Vascular Surgery and the American Venous Forum. J Vasc Surg 2012;55:1449-62.

Submitted Nov 26, 2018; accepted Feb 12, 2019.