

Overview of endovascular treatment for ilio caval venous obstruction

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Abstract

Various causes can lead to ilio caval venous obstruction. These pathologies include non-thrombotic or thrombotic that may be conducive to venous hypertension or extensive lower deep vein thrombosis. The most frequent pioneer to chronic pelvic venous outflow obstruction is iliofemoral DVT. Awareness of endovascular treatments for ilio caval venous obstruction in recent years will help the clinicians to increase their knowledge to achieve improving the final results of treatment of these patients.

Keywords: Endovascular treatment, Ilio caval venous obstruction, Venous stents, Thrombectomy

Introduction

Endovascular treatment of ilio caval occlusion has progressed rapidly and is now the mainstay for iliac or ilio caval vein occlusion (ICVO). It depends on determining the cause of the obstruction, the severity of the symptoms, and the presence or absence of thrombus (non-thrombotic ICVO vs. thrombotic ICVO) [1]. In many patients, iliac vein compression may trigger acute Deep Vein Thrombosis (DVT) and chronic venous insufficiency in patients with specific risk factors [2]. Therefore, a review of the anatomy of the ilio caval venous system, the incidence of venous thrombosis, and the recognition of symptoms due to obstruction of these veins can be effective in designing treatment for patients. Patient history, clinical examination, and appropriate imaging are required to determine the ilio caval reconstruction plan. Regardless of the cause, the clinical features of ilio caval venous occlusion (ICVO) include chronic venous insufficiency with pain, heaviness, and swelling, or acute Deep Vein Thrombosis (DVT) with swelling and acute limb pain. When taking a history, attention should be paid to the duration of symptoms, any functional impairment related to venous occlusion, underlying diseases that may affect anesthesia or treatment options, a history of anticoagulants, and any previous interventions.

Accurate imaging is very important in determining the extent of venous disease and the detection of possible anatomical abnormalities. Ultrasound can show femoral vein and peripheral lower extremity thrombosis, whether acute or chronic. Also Computed tomography venography or magnetic resonance venography may indicate ilio caval thrombosis and may play a key role in treatment planning. Contrast venography, especially with venous pressure measurements, can be diagnostic for ICVO and determine the acute or chronic nature of the lesions. On the other hand, Intravascular Ultrasound (IVUS) may be the most sensitive diagnostic test and is typically performed during therapeutic venography to confirm ICVO prior to proceeding with venoplasty and stenting [3].

Indications for ilio caval reconstruction are recurrent deep venous thrombosis, severe post-thrombotic syndrome, or related symptoms that restrict normal activity or significantly reduce the quality of life [4]. If the patient is a candidate for endovascular treatment, it should initiate within two weeks of onset in the acute setting or after four months for chronic occlusion [5]. To eliminate the obstructive disease in the iliac veins the following endovascular treatment is considered.

Overview of endovascular treatment for ICVO

Catheter-directed thrombolysis (CDT)

Catheter-directed thrombolysis is a momentous treatment of ICVO, especially proximal extensive lower extremity deep vein thrombosis (DVT) [6]. The most important factor in determining the time of intervention is the severity of the patient's symptoms. For acute obstructions due to ilio caval venous thrombosis, the timing of thrombolytic therapy in the first fourteen days is most effective [7, 8]. Although a benefit in patients with a duration of symptoms of >14 days cannot be excluded" [9] in most interventions, physicians intervene for thrombotic obstruction up to four weeks after the onset of acute symptoms. The detail of the procedure involves the placement of a catheter into the thrombus. The main advantage of catheter treatment is the direct injection of a concentrated thrombolytic agent into the thrombus bulk for dissolves the clot. Two types of CDT are available for this purpose and include pulse spray techniques and ultrasound-assisted thrombolysis. Pulse spray can be started after placement of a suitable multi-side hole catheter and deliver the thrombolytic agent. Ultrasound-assisted CDT also uses a multi-side hole catheter to deliver the thrombolytic agent, but a core wire, which emits high-frequency, low-intensity ultrasound, is included as a part of the catheter system. Ultrasound waves break down the clot fibrin fibers, thus increasing the internal surface of the thrombus and allowing more penetration of the thrombolytic agent [10].

Percutaneous mechanical thrombectomy (PMT)

In mechanical thrombectomy, a wide variety of devices mechanically destroy the clot. These devices macerate thrombus by use of physical cutting blades, vortex, high-pressure or low-pressure saline jets, suction alone, or ultrasonic liquefaction. Occasionally, concomitant thrombolysis can use with this procedure. PMT appears feasible and safe, though the level of evidence available is poor. Until these data are available there is little substantial evidence to support the routine use of PMT over CDT alone [11].

Pharmaco-mechanical thrombolysis

Concomitant administration of pharmacological catheter-directed thrombolysis with mechanical thrombectomy has found a lot of fans in recent years. The added benefit of mechanical thrombolysis is to fractionate the load of the thrombus to facilitate the pharmacologic phase of therapy. Many studies have shown a significant reduction in thrombolytic dosage, hospital stay, and intensive care unit utilization [12, 13].

Venoplasty and Stenting

Endovenous venoplasty with stenting is a minimally invasive procedure that is the preferred method for symptomatic ilio caval venous obstruction and stenosis. It is safe with low complication rates and is efficient that suitable for permanent and long-term patency of venous outflow [14-18]. Primary and secondary patency rates are 57% and 86% in post-thrombotic obstructions and are 79% and 100% in symptomatic non-thrombotic ilio caval lesions (such as may-turner syndrome) [15]. Studies show that the combination treatment of catheter-directed thrombolysis with venoplasty and stenting in iliofemoral DVTs gives a longer patency rate than anticoagulation therapy alone and reduces the post-thrombotic symptoms [19]. To achieve desired outcomes, large and self-expanding stents are needed. Currently, the most commonly used types of stents are the uncovered stents, among which the "Wallstents" (most use) and "Gianturco Z-stent" are FDA-approved [14-16]. The stent diameters used by the interventionists are varying, but the most used are 24 mm for inferior vena cava, 14 mm and 16 mm for common iliac vein, and 12 mm and 14 mm for the external iliac vein [16]. It should note that the use of Wallstents due to the possibility of protrusion into the vena cava from the iliac vein and development of pseudo-intima, increases the risk of contralateral DVT (termed "jailing"); to prevent this complication, the use of Z-stent adjustment or stents which are cut at 45 degrees at the top, is suggested [15]. Although the use of uncovered stents has shown desired results in non-thrombotic veins, these are not satisfactory for formerly thrombosed veins because of higher rates of in-stent-thrombosis and re-thrombosis. To improve the outcome in these cases, use of covered stents

suggests as a novel approach. Covered stents remove the prothrombotic source and can use in areas that respond poorly to the uncovered stents, including external iliac vein and common iliac vein [14]. Two types of covered stents currently available are “Gore Viabahn BX” balloon-expandable covered stents (BECS) and stent-grafts for aneurysm repair that are self-expanding covered stents (SECS) [14]. Intravascular ultrasound (IVUS) is the method of choice for diagnosing the type and extent of venous lesions. This method shows venous wall thickness, neointimal hyperplasia, more details, and also measures the degree of stenosis more accurately. Therefore, it can use as guidance in the procedure [16, 20]. Anticoagulant therapy should start immediately after the procedure to reduce the risk of in-stent-thrombosis. For this purpose, Aspirin, Clopidogrel, and novel oral anticoagulant are the most used, respectively, and the duration of treatment can vary depending on the case from 3 to 6 months [16, 21].

Conclusion

Endovascular treatment techniques are now the mainstay for iliac and ilio caval vein occlusion (ICVO). Using each approach depends upon determining the cause of the obstruction, the severity of symptoms, and the presence or absence of thrombus. More studies are needed to determine the efficacy and safety of each approach more clearly.

Author contribution

Conception and design: PT; Analysis and interpretation: Not applicable; Data collection: PT, FM, KV, FM; Writing the article: PT, FM, KV, FM; Critical revision of the article: PT, FM; Final approval of the article: PT, FM, KV, FM

Conflicts of interest

The authors have nothing to disclose.

Ethical declaration

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References

1. Mousa AY, AbuRahma AF. May-Thurner syndrome: update and review. *Ann Vasc Surg.* 2013; 27(7):984-95.
2. Kibbe MR, Ujiki M, Goodwin AL, Eskandari M, Yao J, Matsumura J. Iliac vein compression in an asymptomatic patient population. *J Vasc Surg.* 2004; 39(5):937-43.
3. Montminy ML, Thomasson JD, Tanaka GJ, Lamanilao LM, Crim W, Raju S. A comparison between intravascular ultrasound and venography in identifying key parameters essential for iliac vein stenting. *J Vasc Surg Venous Lymphat Disord.* 2019; 7(6):801-7.
4. Hage AN, Srinivasa RN, Abramowitz SD, Cooper KJ, Khaja MS, Barnes GD, et al. Endovascular ilio caval reconstruction for the treatment of ilio caval thrombosis: From imaging to intervention. *Vasc Med.* 2018; 23(3):267-75.
5. Williams DM. Iliocaval reconstruction in chronic deep vein thrombosis. *Tech Vasc Interv Radiol.* 2014; 17(2):109-13.
6. Fleck D, Albadawi H, Shamoun F, Knuttinen G, Naidu S, Oklu R. Catheter-directed thrombolysis of deep vein thrombosis: literature review and practice considerations. *Cardiovasc Diagn Ther.* 2017; 7(Suppl 3):S228-s37.
7. Bashir R, Zack CJ, Zhao H, Comerota AJ, Bove AA. Comparative outcomes of catheter-directed thrombolysis plus anticoagulation vs anticoagulation alone to treat lower-extremity proximal deep vein thrombosis. *JAMA Intern Med.* 2014; 174(9):1494-501.
8. Enden T, Haig Y, Kløw 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(9810):31-8.
9. Meissner MH, Głowiczki P, Comerota AJ, Dalsing MC, Eklof BG, 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(5):1449-62.
10. Baker R, Samuels S, Benenati JF, Powell A, Uthoff H. Ultrasound-accelerated vs standard catheter-directed thrombolysis—a comparative study in patients with iliofemoral deep vein thrombosis. *J Vasc Interv Radiol.* 2012; 23(11):1460-6.
11. Karthikesalingam A, Young EL, Hinchliffe RJ, Loftus IM, Thompson MM, Holt PJ. A systematic review of percutaneous mechanical thrombectomy in the treatment of deep venous thrombosis. *Eur J Vasc Endovasc Surg.* 2011; 41(4):554-65.
12. Kim HS, Patra A, Paxton BE, Khan J, Streiff MB. Adjunctive percutaneous mechanical thrombectomy for lower-extremity deep vein thrombosis: clinical and economic outcomes. *J Vasc Interv Radiol.* 2006; 17(7):1099-104.
13. 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(6):788-800.

14. Flynn S, Jensen R, Lane J, Bandyk D, Malas M, Barleben A. Novel Approach to Treatment of Chronic Iliocaval Occlusion Utilizing Covered Stents. *Ann Vasc Surg.* 2020; 67:300-5.
15. Głowiczki P, Lawrence PF. Iliac vein stenting and contralateral deep vein thrombosis. *J Vasc Surg Venous Lymphat Disord.* 2017; 5(1):5-6.
16. Hage AN, Srinivasa RN, Abramowitz SD, Gemmete JJ, Reddy SN, Chick JFB. Endovascular Iliocaval Stent Reconstruction for Iliocaval Thrombosis: A Multi-Institutional International Practice Pattern Survey. *Ann Vasc Surg.* 2018; 49:64-74.
17. Hartung O, Loundou AD, Barthelemy P, Arnoux D, Boufi M, Alimi YS. Endovascular management of chronic disabling ilio-caval obstructive lesions: long-term results. *Eur J Vasc Endovasc Surg.* 2009; 38(1):118-24.
18. Mickley V, Schwagierek R, Rilinger N, Görlich J, Sunder-Plassmann L. Left iliac venous thrombosis caused by venous spur: treatment with thrombectomy and stent implantation. *J Vasc Surg.* 1998; 28(3):492-7.
19. Fraser DG, Moody AR, Morgan PS, Martel A. Iliac compression syndrome and recanalization of femoropopliteal and iliac venous thrombosis: a prospective study with magnetic resonance venography. *J Vasc Surg.* 2004; 40(4):612-9.
20. Neglén P. Chronic deep venous obstruction: definition, prevalence, diagnosis, management. *Phlebology.* 2008; 23(4):149-57.
21. Desai KR, Xiao N, Karp J, Salem R, Rodriguez H, Eskandari M, et al. Single-session inferior vena cava filter removal, recanalization, and endovenous reconstruction for chronic ilio-caval thrombosis. *J Vasc Surg Venous Lymphat Disord.* 2019; 7(2):176-83.