Role of lower extremity fasciectomy plus fasciotomy for patients with persistent leg pain after stenting for chronic iliofemoral venous obstruction

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ABSTRACT

Although clinical improvement after stenting for symptomatic iliofemoral venous obstruction has been demonstrated in multiple large studies, a small proportion of patients will experience persistent quality of life–impairing symptoms. Swelling in such a setting represents the concomitant presence of lymphedema and will respond to treatment directed at the lymphedema. In contrast, persistent pain likely arises from venous hypertension in the lower leg, leading to the development of chronic compartment syndrome. Evaluation of intracompartmental pressures in such patients can help confirm the diagnosis, and fasciectomy combined with fasciotomy will treat the issue. In the present series, we evaluated six patients (six limbs) who had undergone fasciectomy combined with fasciotomy and their outcomes. (J Vasc Surg Cases Innov Tech 2022;8:616-9.)

Keywords: Chronic compartment syndrome; Chronic iliofemoral venous obstruction; May-Thurner syndrome; Post-thrombotic syndrome; Venous hypertension

Stenting for chronic iliofemoral venous obstruction (CIVO) has become the standard of care for patients presenting with quality of life–impairing manifestations for whom standard conservative therapy has failed.[1-6] Although most patients will experience complete or at least partial improvement of their symptoms and/or signs to the point that no further intervention is required, a cohort of patients will experience persistent swelling (18%-35%) or persistent pain (11%-15%) that impairs their quality of life.[7,8] Concomitant lymphedema will be the issue for patients with persistent swelling and will respond to complex decongestive therapy. In contrast, the pain component has been hypothesized to arise from chronic compartment syndrome (CCS) of the posterior superficial compartment (calf pump) due to venous hypertension, meriting a different approach. For such patients, we will evaluate the intracompartmental pressure (ICP) in the posterior superficial compartment of the lower leg with the patient supine and at rest and after activity. When the ICP was elevated, we performed a combination of fasciectomy and fasciotomy. In the present report, we have described the diagnostic protocol, technique, and outcomes for a series of six patients (six limbs) who had undergone the procedure.

METHODS

We performed a review of prospectively collected electronic medical record data for a 4-year period from 2018 to 2021. The inclusion criteria were the presence of quality of life–impairing symptoms from CIVO despite initial conservative therapy, intravascular ultrasound (IVUS) findings confirming the diagnosis and/or stenting, and the use of fasciectomy plus fasciotomy for persistent pain due to CCS.

Conservative therapy included the use of compression stockings, leg elevation when feasible, anticoagulation therapy when appropriate, and regular exercise as tolerated. IVUS (Visions PV 0.035 digital IVUS catheter; Philips, Amsterdam, Netherlands) confirmation of the diagnosis of CIVO was through the use of normal minimal luminal areas (125 mm^2, 150 mm^2, and 200 mm^2 in the common femoral, external iliac, and common iliac veins, respectively). Any luminal area reduction below these cutoffs merited stenting, which was performed using either a nondedicated composite stent configuration or a dedicated venous stent. The composite stent configuration involved the use of a Wallstent body (Boston Scientific, Marlborough, MA) and Zenith stent top (Cook Medical Inc, Bloomington, IN), with the latter used to overcome the iliocaval choke point effect. The dedicated venous stent used was the Venovo stent (Becton, Dickinson and Co, Franklin Lakes, NJ). The technique of stenting and the protocol for perioperative care have been reported in previous studies.[5,9,10] Follow-up after stenting was lifelong in the form of a combination of clinic visits and duplex ultrasound examinations to evaluate the stent at regular intervals.

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Table I. Patient characteristics

Pt. No.	Age, years	Laterality	PTS or NIVL	CEAP clinical class	Stent type	Baseline PS compartment pressure, mm Hg	
						Supine, at rest	After activity
1	40	Left	PTS	2, 3, 4a	C	18	26
2	28	Left	PTS	2, 3	V	30	33
3	49	Left	PTS	2, 3, 4a	C	19	23
4	50	Right	PTS	3, 4a	C	16	52
5	67	Right	PTS	3, 4a	V	10	16
6	44	Left	PTS	3, 4a	C	13	27

C, Composite Wallstent with Z stent configuration; *CEAP,* clinical, etiologic, anatomic, pathophysiologic; *NIVL,* nonthrombotic iliac vein lesion; *PS,* posterior superficial; *Pt. No.,* patient number; *PTS,* post-thrombotic syndrome; *V,* Venovo stent.

Patients presenting with persistent pain that impaired their quality of life despite stenting to correct their CIVO underwent ICP measurements. The ICPs were measured using the STIC intracompartmental pressure monitor system (C2DX Inc, Schoolcraft, MI). An ICP >15 mm Hg either at rest or with activity was used to diagnose CCS. Fasciectomy and fasciotomy were performed using a 5-cm-long incision in the medial calf approximately two finger breaths posterior to the medial border of the tibia and three finger breaths inferior to the tibial condyle. After exposure of the posterior superficial compartment, a 5-cm × 5-cm area of fascia overlying the soleal muscle was excised with an additional fasciotomy (~6-8 cm cranially and caudally). The wound was then closed in layers with interrupted 3-0 braided absorbable suture and subcuticular 4-0 monofilament suture with a 15F fluted drain in place. Bed rest was used for 48 hours, with prophylactic anticoagulation therapy started after 24 hours. Physical therapy was initiated after 48 hours. Discharge from the hospital was determined by the physical therapy recommendations and was usually by day 3, with drain removal before discharge as long as the output was <10 mL. Standard perioperative antibiotics were administered. The preoperative antithrombotic regimen was restarted at discharge. Postoperative follow-up was at 2 weeks and then at 6 weeks. Additional follow-up was determined by the patient's stent follow-up protocol. The visual analog scale for pain (score, 0-10) and the venous clinical severity score for pain (score, 0-3) were administered at each follow-up visit. The hospital institutional review board approved the present study of de-identified patient data. All included patients had provided written informed consent for the procedure.

RESULTS

Our review of the electronic medical records revealed a total of six patients (six limbs) who had undergone fasciectomy and fasciotomy of the lower extremity for persistent quality of life–impairing pain after iliofemoral venous stenting. All six patients had undergone ICP measurements of the posterior superficial compartment in the resting supine position and after activity. At the adjunct fasciectomy plus fasciotomy procedure, all the patients had had widely patent stents. During the study period, a total of 410 unilateral stents had been placed for stenotic CIVO lesions, for a cumulative incidence of 1.5% for limbs with persistent quality of life–impairing pain due to CCS after stenting. The patient characteristics are presented in Table I. The median age was 47 years, and the median body mass index was 30 kg/m^2. Three of the six patients (50%) had had a prior diagnosis of lower leg deep vein thrombosis. Two of the six patients (33%) had had a diagnosis of a connective tissue disorder. Overall, improvement had occurred in the median visual analog scale for pain score and the venous clinical severity score for pain after fasciectomy plus fasciotomy compared with the scores after stenting. The clinical outcomes are presented in Table II. The median follow-up after fasciectomy plus fasciotomy was 10 months (range, 3-29 months). The median time from stenting to fasciectomy plus fasciotomy was 43 months (range, 11-84 months). Four of the six patients had undergone one or more stent reinterventions (total of six) before fasciectomy plus fasciotomy and one patient had undergone stent angioplasty 13 months after fasciectomy plus fasciotomy.

No major adverse events or complications associated with surgery had occurred in any of the six patients. In addition, issues pertaining to the wound, including delayed healing, were not encountered.

DISCUSSION

CCS due to venous hypertension is a relatively rare complication encountered in patients with CIVO. The culprit compartment is the superficial posterior compartment because it constitutes the calf pump with its extensive venous reservoirs. The deep posterior, anterior, and lateral compartments can also develop CCS. However, CCS in these compartments will not be due to venous hypertension but rather from a musculoskeletal etiology, such as occurs in chronic exertional

Table II. Changes in clinical parameters after fasciectomy and fasciotomy

	VAS score for pain			VCSS for pain		
Pt. No.	Before stenting	After stenting	After FF	Before stenting	After stenting	After FF
1	10	8	NA	2	2	2
2	5	5	4	2	2	1
3	8	8	0	2	2	1
4	10	8	4	2	1	1
5	6	6	3	2	1	1
6	10	8	7	2	2	2
Total median score	9	8	4	2	2	1

FF, Fasciectomy and fasciotomy; *NA,* not available; *Pt. No.,* patient number; *VAS,* visual analog scale; *VCSS,* venous clinical severity score.

compartment syndrome or functional popliteal entrapment syndrome.[11] The normal ICP is <15 mm Hg.[12,13] We used a criterion of an ICP >15 mg Hg for symptomatic patients for the diagnosis of CCS due to venous hypertension and warranting surgery. Engelbert and Turnipseed[14] had diagnosed CCS in a patient with a history of deep vein thrombosis and had proceeded with fasciectomy plus fasciotomy as the first option. However, in our experience and view, a thorough evaluation of the entire venous system in the limb is essential for an accurate diagnosis. Relief of any iliofemoral outflow obstruction should be provided initially before the diagnosis of CCS is considered. If, despite correction of any venous system abnormalities, the patient still experiences limiting pain, one should evaluate for CCS and corrective surgery pursued following confirmation of the diagnosis. This is important because such patients will often have other symptoms in addition to pain, which can also involve the thigh. Fasciectomy plus fasciotomy in the lower leg is unlikely to be helpful in such settings. Additionally, in the setting of lymphedema, such surgery can be detrimental with an increased likelihood of wound complications, including drainage. Furthermore, the cumulative incidence of CCS from venous hypertension warranting surgery was only 1.5% of patients who had undergone venous stenting for quality of life–limiting symptoms. Also, fasciotomy alone will be insufficient without an adequate fasciectomy, because once the fasciotomy has healed, the pain can recur owing to repeat restriction of muscle expansion. Another point is that all six of our patients had had a diagnosis of postthrombotic syndrome. Thus, these patients seem to have a higher risk of disruption of the venous milieu in the lower leg, with the onset of recalcitrant venous hypertension and the consequent development of CCS compared to patients with nonthrombotic iliac vein lesions.

The limitations of the present series included its small size and relatively short median follow-up. Also, ICP measurements require an invasive procedure, and fasciectomy plus fasciotomy is open surgery, with its own set of potential complications, including nerve injury, bleeding, and surgical site infection.

CONCLUSIONS

Patients with persistent leg pain impairing their quality of life after iliofemoral venous stenting for CIVO should be evaluated for CCS. A combination of fasciectomy and fasciotomy appeared to provide relief in our small cohort of patients. However, further study is required.

REFERENCES

1. 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;38:118-24.
2. Gutzeit A, Zollikofer CL, Dettling-Pizzolato M, Graf N, Largiader J, Binkert CA. Endovascular stent treatment for symptomatic benign iliofemoral venous occlusive disease: long-term results 1987-2009. Cardiovasc Intervent Radiol 2011;34:542-9.
3. Seager MJ, Busuttil A, Dharmarajah B, Davies AH. Editor's choice — a systematic review of endovenous stenting in chronic venous disease secondary to iliac vein obstruction. Eur J Vasc Endovasc Surg 2016;51:100-20.
4. Ye K, Lu X, Li W, Huang Y, Huang X, Lu M, et al. Long-term outcomes of stent placement for symptomatic nonthrombotic iliac vein compression lesions in chronic venous disease. J Vasc Interv Radiol 2012;23:497-502.
5. Neglen P, Hollis KC, Olivier J, Raju S. Stenting of the venous outflow in chronic venous disease: long-term stent-related outcome, clinical, and hemodynamic result. J Vasc Surg 2007;46:979-90.
6. Jayaraj A, Raju S. Clinical improvement after stenting for chronic iliofemoral venous obstruction: a review of large studies. Vasc Invest Ther 2022;5:22-7.
7. Jayaraj A, Noel C, Kuykendall R, Raju S. Long-term outcomes following use of a composite Wallstent-Z stent approach to iliofemoral venous stenting. J Vasc Surg Venous Lymphat Disord 2021;9:393-400.e2.
8. Powell T, Jayaraj A, Raju S. Comparison between a dedicated venous stent and standard composite Wallstent-Z stent approach to iliofemoral venous stenting—intermediate term outcomes [e-pub ahead of print]. J Vasc Surg Venous Lymphat Disord, https://doi.org/10.1016/j.jvsv.2022.05.012. Accessed July 30, 2022,
9. Jayaraj A, Buck W, Knight A, Johns B, Raju S. Impact of degree of stenosis in May-Thurner syndrome on iliac vein stenting. J Vasc Surg Venous Lymphat Disord 2019;7:195-202.
10. Jayaraj A, Noel C, Kuykendall R, Raju S. Long-term outcomes following use of a composite Wallstent-Z stent approach to iliofemoral venous stenting. J Vasc Surg Venous Lymphat Disord 2020;8:565-71.

11. Turnipseed WD. Atypical claudication associated with overuse injury in patients with chronic compartment, functional entrapment, and medial tibial stress syndromes. Cardiovasc Surg 2003;11:421-3.
12. Giannoudis PV, Tzioupis C, Pape HC. Early diagnosis of tibial compartment syndrome: continuous pressure measurement or not? Injury 2009;40:341-2.
13. Vandervelpen G, Goris L, Broos PL, Rommens PM. Functional sequelae in tibial shaft fractures with compartment syndrome following primary treatment with urgent fasciotomy. Acta Chir Belg 1992;92:234-40.
14. Engelbert TL, Turnipseed WD. Chronic compartment syndrome secondary to venous hypertension: fasciectomy for symptom relief. Ann Vasc Surg 2014;28:1798.e11-4.

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