Common femoral endovenectomy with iliocaval endoluminal recanalization improves symptoms and quality of life in patients with postthrombotic iliofemoral obstruction

David Vogel, MD, Anthony J. Comerota, MD, Mustafa Al-Jabouri, MD, and Zakaria I. Assi, MD
Toledo, Ohio; and Ann Arbor, Mich

Background: The postthrombotic syndrome is a debilitating condition occurring in 30% to 50% of patients with lower extremity deep vein thrombosis (DVT). Following iliofemoral DVT, however, postthrombotic morbidity is especially severe, due to occlusion of the common femoral vein (CFV) and iliac veins. While endoluminal recanalization appears effective in restoring patency to the iliac venous system, infrainguinal obstruction of the CFV remains a problem. The purpose of this study is to report preliminary observations of common femoral endovenectomy and intraoperative endoluminal recanalization of the iliac veins in patients with incapacitating postthrombotic iliofemoral obstruction.

Methods: Ten patients underwent common femoral endovenectomy with endoluminal iliocaval recanalization. The Venous Clinical Severity Score (VCSS), a validated tool to assess chronic venous disease, the Villalta scale, a validated tool to quantify postthrombotic syndrome, the clinical classification of CEAP, and the Venous Insufficiency Epidemiological and Economic Study-Quality of Life (VEINES-QOL)/Sym questionnaires were completed preoperatively and readministered postoperatively at 8.8 months (mean).

Results: Five patients were followed for more than 6 months and form the basis of the long-term analysis. All demonstrated significant improvement in their venous scores postoperatively. The VCSS preoperatively was 17 and fell to 9.8 postoperatively (P = .02). The Villalta scale dropped from 13.6 preoperatively to 6.0 postoperatively (P = .002). The VEINES-QOL/Sym questionnaire, a sensitive marker of patient quality of life and symptom status, was improved (P = .01 and .02, respectively).

Conclusion: Chronic postthrombotic iliofemoral venous obstruction treated with common femoral endovenectomy and endoluminal recanalization improves objective outcome measures of patients with chronic postthrombotic obstruction. By restoring unobstructed venous drainage through the CFV to the vena cava, patients’ postthrombotic morbidity is reduced and quality of life is improved. (J Vasc Surg 2012;55:129-35.)

Natural history studies of anticoagulation for iliofemoral deep venous thrombosis (DVT) treated with anticoagulation alone have shown that, at 5 years, over 90% of patients have venous insufficiency, 15% have experienced venous ulceration, 15% have developed venous claudication, and 40% have restricted ambulation. Many demonstrate hemodynamic impairment and reduced quality of life. A prospective observational study has shown that iliofemoral DVT patients have the most severe postthrombotic morbidity.

It is suggested in the American College of Chest Physicians (ACCP) “Antithrombotic Therapy for Venous Thromboembolic Disease” guidelines (8th edition) that patients who develop iliofemoral DVT and are of good risk undergo catheter-directed thrombolytic therapy or operative thrombectomy to eliminate iliofemoral obstruction (grade 2B). However, most patients are treated with anticoagulation alone rather than a strategy of thrombus removal, as many physicians fail to appreciate the connection between iliofemoral venous obstruction and the subsequent severity of postthrombotic morbidity.

The pathophysiology of postthrombotic venous insufficiency is ambulatory venous hypertension, defined as elevated venous pressures during exercise, which is particularly severe when valvular incompetence and venous obstruction coexist. Whereas valvular function can be quantified through ultrasonography, residual venous obstruction often goes undetected, even as it adversely affects venous hemodynamics. This inability to quantitate venous obstruction has led to widespread under-appreciation of its contribution to postthrombotic morbidity.

Patients who present with postthrombotic iliac vein obstruction often can be successfully treated with angioplasty and stenting alone, but if the chronic occlusive obstruction persists, endovenectomy with iliocaval endoluminal recanalization may be required.
disease includes the common femoral vein (CFV), treatment is more challenging. Relative obstruction of the CFV can persist, even after percutaneous intervention, leading to incomplete drainage of the femoral and profunda femoris venous systems and mitigating the benefit of iliac vein recanalization. Although stenting across the inguinal ligament can be performed, there is a higher risk of stent occlusion in postthrombotic patients. Moreover, personal observations show that when a CFV stent compromises drainage from the profunda femoris veins, the patient’s postthrombotic symptoms worsen. Based on these observations, it seems appropriate to surgically eliminate the CFV obstruction and endoluminally recanalize the obstructed iliocaval segments. The purpose of this communication is to report the short-term outcome of patients with chronic postthrombotic iliofemoral venous obstruction who have undergone CFV endovenectomy and operative endoluminal recanalization.

METHODS

Ten patients who presented with severe postthrombotic iliofemoral obstruction underwent CFV endovenectomy and intraoperative endoluminal iliofemoral/caval recanalization. Patients followed for a minimum of 6 months postoperatively form the basis of this study. The study protocol was approved by The Toledo Hospital/ProMedica Health System’s institutional review board, and all patients gave written informed consent.

Operative procedure. All patients underwent preoperative ascending phlebography to document the extent of their venous obstruction (Fig 1). During the preoperative phlebogram, a guidewire was maneuvered through the obstructed venous segments in most patients to ensure that a channel for recanalization can be accomplished in the operating room. When the need for a combined approach was agreed on by the senior surgeon and the interventional radiologist based on the amount of disease in the CFV, the patient was scheduled for the procedure. Two to 3 days prior to the procedure, the patient was started on combined platelet inhibition with aspirin (81 mg/d) and clopidogrel (75 mg/d). Chlorhexidine showers twice daily were implemented and vitamin K antagonists (VKA) discontinued.

Exposure of the CFV, femoral vein, profunda femoris vein, saphenofemoral junction, and distal external iliac vein (EIV) is obtained via a longitudinal femoral inguinal incision. Control of all branches, especially posterior CFV branches, is obtained. Small tributaries are ligated or controlled with surgical clips (Fig 2). Patients are fully anticoagulated with 100 IU/kg of unfractionated heparin (UFH). A longitudinal venotomy is then performed, which often incorporates the distal EIV to the proximal femoral vein (Figs 3 and 4). Dense fibrinous tissue and web-like synchiae are removed with sharp and blunt dissection well into the distal EIV (Fig 5). Careful attention is given to the orifice of the profunda femoris vein(s) (Fig 5). In most patients, sharp excision is required, usually with small angled scissors, as the fibrous evolution of thrombus forms dense adherence to the vein wall. One can generally get an impression as to the proper plane, although venous excision is unlike arterial endarterectomy, where the plaque peels

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Fig 1. A, B, and C, Preoperative venogram demonstrates extensive venous obstruction from the midthigh to the vena cava in a patient incapacitated following iliofemoral and femoropopliteal deep vein thrombosis (DVT) 7 months earlier.
away from the vessel wall. Patch closure of the venotomy is performed using bovine pericardium or saphenous vein, leaving the distal centimeter open to introduce an 8 to 10F sheath through which the endoluminal recanalization of the iliac venous segment is performed.

A separate stab incision is made below the inguinal wound through which the sheath is passed, traversing the subcutaneous tissue, and enters the CFV with minimal or no angle. A vascular tourniquet placed around the distal CFV secures the sheath (Fig 6). The iliac venous system and, if necessary, vena cava are sequentially recanalized with guidewire passage, balloon dilation, and subsequent stenting. In general, Wallstents are preferred because of their high radial strength, with 14- to 16-mm stents used for the common iliac veins and 12 to 14 mm for the EIVs. Stents are extended partially into the inferior vena cava (IVC), only to fully treat the iliac lesion. Common iliac or IVC stents are placed initially, followed by stenting of the EIV. Stents are postdilated to their target diameter. We have found intravascular ultrasound (IVUS) valuable in assessing the limits of the procedure and final result, and it is now being used routinely.

Following recanalization and venographic confirmation of unobstructed venous drainage from the CFV to the
IVC (Fig 7), the sheath is removed and closure of the patch venoplasty is completed (Fig 8). A 7F silastic closed suction drain is brought through the stab incision used for the sheath and maintained on suction postoperatively until drainage volume is <20 mL/12 h. The incision is closed with several layers of running absorbable suture, obliterating dead space and ensuring lymphostatic and hemostatic closure of the subcutaneous tissue. Heparin is not reversed with protamine. In some patients, a silastic intravenous catheter was placed in a dorsal foot vein to infuse postoperative heparin; the intent was to achieve high concentrations of heparin in the treated veins while reducing the need for supratherapeutic systemic anticoagulation. The remainder received standard intravenous therapeutic UFH infusion. The CFV is examined with a continuous-wave Doppler after clamps are removed. If robust venous velocity signals are not present, a small arteriovenous fistula (AVF) is constructed.

Patients are anticoagulated postoperatively with unfractionated heparin converted to warfarin. Since most patients have had recurrent DVT, indefinite anticoagulation is planned. Clopidogrel is discontinued at 8 weeks postoperatively.

Subjects and outcomes measurement. Ten patients underwent combined CFV endovenectomy and iliac venoplasty and stenting for postthrombotic iliofemoral/caval venous obstruction. Obstruction was assessed physiologically with noninvasive studies, including measuring venous outflow with air plethysmography (APG), and confirmed with ascending phlebography. A preoperative evaluation was performed using the Venous Clinical Severity Score (VCSS), the Villalta scale, which is the validated measure of postthrombotic syndrome, the clinical classification of CEAP, and completion of the validated Venous Insufficiency Epidemiological and Economic Study-Quality of Life (VEINES-QOL)/Sym questionnaire. The same evaluation was performed postoperatively at a mean of 8.8 months. The VCSS, Villalta, and CEAP evaluations were completed by the same physician before and after surgery.

The VCSS identifies nine clinical characteristics of chronic venous disease that are graded from 0 to 3 (absent, mild, moderate, severe) with specific criteria to avoid overlap or arbitrary scoring.10 The Villalta scale consists of six clinician-rated physical signs and five patient-rated venous symptoms, of which each are rated on a four-point scale (0 = none, 1 = mild, 2 = moderate, 3 = severe). Points are summed to produce a total...
score (range 0-33). Subjects are classified as having post-thrombotic syndrome if the score is ≥5 or if a venous ulcer is present in a leg with previous DVT. The Villalta scale is a validated, reliable method of identifying patients with the postthrombotic syndrome.

The CEAP clinical classification is based on a seven-point clinical assessment of venous disease. The anatomical distribution of venous obstruction included the CFV and iliac venous segments in all patients.

The VEINES-QOL/Sym questionnaire is a tool designed to assess quality of life (QOL) and symptoms of chronic venous insufficiency and is modeled after the SF-36. All patients are followed at 3, 6, and 12 months and every 6 months thereafter. Ultrasound evaluation is performed at each interval.

Statistical analysis. The paired t test was used to test the population mean score difference between preoperative and postoperative clinical assessment tools. The VCSS and Villalta scores were compared using the Wilcoxon test.

RESULTS

Ten patients underwent CFV endovenectomy with endoluminal recanalization of the iliofemoral/vena caval segments, with two having an adjunctive AVF. The mean time from acute iliofemoral DVT to operation was 6.8 years (7 months–25 years). Five patients were followed for 6 months or more and form the basis of the follow-up data beyond 6 months. Two patients had bilateral CFV endovenectomy with recanalization of both occluded iliac venous segments and a chronically occluded vena cava with a filter that was occluded to the renal veins. He was aggressively anticoagulated through bilateral dorsal foot veins postoperatively. His subsequent wound hematoma required evacuation. His wound edge separation was treated with vacuum-assisted closure (VAC) therapy with successful wound healing. A second patient who had a hematoma requiring evacuation had also been aggressively anticoagulated through a dorsal foot vein on the operated side.

Clinical assessment. All clinical outcome measurements improved at 6 months and after following endovenectomy and iliac recanalization (mean follow-up 8.8 months). Preoperative VCSS improved from 17 to 9.8 (P = .02). Villalta scores improved from 13.6 preoperatively to 6 (P = .002). Overall QOL and symptoms improved as assessed by VEINES-QOL/Sym (P = .01 and .02, respectively). Preoperative CEAP scores in the study patients ranged from C4 (pigmentation changes, venous eczema, lipodermatosclerosis) to C5 (healed venous stasis ulceration) and C6 (active venous stasis ulceration). Two patients with preoperative ulcers had a CEAP classification change from 6 to 5 due to their ulcers healing post-endovenectomy. The remaining patients who had preoperative CEAP scores of 4 demonstrated improvements in all their symptoms.

Ultrasound evaluation at follow-up showed one segmental occlusion of the CFV; however, the patient was improved compared with preoperative status. The remaining patients continue to have patent veins.

DISCUSSION

Common femoral endovenectomy with endoluminal iliac vein recanalization is a promising treatment to eliminate proximal venous obstruction and reduce incapacitating postthrombotic morbidity. Since the iliofemoral venous segment is the single venous outflow channel from the leg, it is understandable that obstruction of this segment causes incapacitating morbidity.

As observed in this preliminary analysis, this procedure has the potential of substantially improving patient function and quality of life. Although the technical details have been previously reported, several key elements are worth emphasizing. Complete control of all branches of the CFV is mandatory, as endovenectomy must be performed in a completely dry field. Ensuring unobstructed venous drainage from the profunda femoris vein into the patent vena cava is mandatory. Although IVUS was not used in all of these patients, it is a valuable adjunct and may have averted our one postoperative thrombosis. Its use is now routine.

The construction of an adjunctive AVF was not performed in most cases because of the robust venous velocity signals obtained postoperatively. However, aggressive anticoagulation of our patients (with combined platelet inhibition) led to a return to the operating room for evacuation of wound hematomas in two patients, which might have been avoided if AVFs had been constructed and less intense anticoagulation used.

Endovenectomy (or endophlebectomy) has been an infrequently reported procedure for venous obstruction. Early reports of removing obstruction from the superior vena cava were followed by the case report of Breslau et al who described successful treatment of an occluded saphenous vein functioning as a bypass graft. Giovizcki and Cho suggested that CFV endovenectomy could be performed and Puggioni et al reported that endovenectomy could be performed as part of a venous reconstructive procedure. More recently, Garg et al described outcomes of 12 patients who underwent CFV endovenectomy, patch angioplasty, and stenting for chronic iliofemoral venous obstruction. They reported rather pessimistic results, which do not agree with our observations thus far.

Iliac venous stenting has become the method of choice for correcting iliac venous obstruction. Iliac stenting has for the most part been successful, with primary, assisted-primary, and secondary patency rates of 57%, 80%, and 86%, respectively, in postthrombotic patients, with low complication rates. However, if the stent is extended below the inguinal ligament, there is at least a 3.8-fold risk...
of stent occlusion in postthrombotic limbs.\textsuperscript{8,24} Despite the increased risk of occlusion, many postthrombotic patients require stenting into the CFV to adequately treat skip lesions and areas of residual stenosis which, if left untreated, might lead to recurrent thrombosis.\textsuperscript{25,26} We believe that many of the failures in these patients are due to residual and underappreciated obstructive disease in the CFV.

As noted by Raju et al.,\textsuperscript{25,26} postthrombotic limbs are at a higher risk of recurrent occlusion and are the cause of the majority of failures (82\% vs 100\% 5-year patency in non-thrombotic iliac vein lesions).

Based on personal experience, stenting into the CFV and potentially restricting drainage from the orifice of the profunda femoris vein in a postthrombotic CFV can lead to further compromise of venous outflow as a result of the stent compressing a fibrous flap across the profunda’s orifice. When this occurs, there is notable progression of obstructive symptoms, with increasing edema, pain, and venous claudication.

Chronic central venous obstruction was the overriding pathology in our patients. Although all of our patients also had infrainguinal postthrombotic venous disease with damaged valves, their severe disability resulted from their iliofemoral/caval obstruction. Maleti and Lugli\textsuperscript{27,28} reported constructing a neovalve in patients with postthrombotic syndrome. The neovalve was constructed in the femoral vein of patients without proximal obstruction, which is a different subset of patients than reported here. We did not perform any intervention below the common femoral vein.

By performing a hybrid procedure of open endovenectomy and endoluminal iliac recanalization, several important anatomical derangements can be corrected. First, the profunda femoris orifices can be disobliterated, thus allowing maximal drainage from the thigh and lower leg. Second, the multiple recanalization channels of outflow from dense fibrous tissue with the synechiae in the CFV or CFV occlusions are cleared into the distal EIV. Once completed, the iliac venous stenosis or occlusion can be stented into the endovenectomized portion of the EIV or CFV, ensuring unobstructed flow to the inferior vena cava. This approach avoids skip lesions that might otherwise lead to reocclusion. While we attempted to keep stents above the inguinal ligament in the first several patients, we now believe it is reasonable to extend the stents below the inguinal ligament into the endovenectomized CFV if necessary; however, we believe it is imperative to keep the distal end of the stent above the saphenofemoral junction to ensure preservation of profunda femoris venous drainage. In several patients with severe disease of the femoral vein, it was ligated and the cephalad femoral vein resected. Occluded and incompetent saphenous veins are also ligated and the portion exposed by the incision resected. This procedure has resulted in remarkable improvement in the clinical signs and symptoms of the postthrombotic syndrome in patients followed clinically up to 24 months. No patients have clinically or physiologically deteriorated following their objective outcome assessment. Postoperative morbidity was acceptable, although with refinement of the technique as experience is gained, less operative morbidity should be expected. All patients returned to full daily activities, including employment for those not retired. Both patients with open venous ulcers healed without need for further surgical intervention.

**CONCLUSION**

Common femoral endovenectomy with iliocaval endoluminal recanalization is a safe and promising procedure for patients with chronic extensive postthrombotic iliofemoral/vena caval venous obstruction. It restores unobstructed venous drainage from the CFV to the vena cava, resulting in improved quality of life and reduced postthrombotic morbidity.

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**REFERENCES**


