Femoral endovenectomy with endoluminal iliac vein recanalization in chronic venous occlusion

Mohamed G. Elashry, Ahmed Elbadawy, Mohamed A. Eldin, Mohamed Ibrahim

Department of Vascular and Endovascular Surgery, Assiut University Hospitals, Faculty of Medicine, Assiut, Egypt

Correspondence to Mohamed Ibrahim, MD, Department of Vascular and Endovascular Surgery, Assiut University Hospitals, Faculty of Medicine, Assiut 71526, Egypt.
Mob: ++20 1014503088;
fax: ++20 88 2333327;
e-mail: mohamedibrahimahmed2017@gmail.com

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Objective

Chronic post-thrombotic iliofemoral obstruction is associated with debilitating morbidity. Venoplasty and stenting are often successful; however, in the presence of a diseased or occluded common femoral vein (CFV), failure is common. A hybrid operative procedure of open surgical CFV endovenectomy and endoluminal recanalization of the obstructed iliofemoral segment has been developed. The purpose of this report was to report safety and efficacy of this procedure in patients with incapacitating post-thrombotic iliofemoral venous obstruction.

Methods

Twenty-three patients undergoing CFV endovenectomy with endoluminal reconstruction (iliac, inferior vena cava) were analyzed. These patients were evaluated by full history taking, laboratory investigation, especially thrombophilia assessment, and imaging investigations, especially duplex scan and computed tomographic venography (CTV) with a comparison between pre- and postoperative clinical, etiology, anatomy, pathophysiology clinical classification, the Venous Clinical Severity Score (VCSS), and the Villalta Scale.

Results

Male sex was found in 15 (65.2%), while 34.8% (n=8) were females. The mean age of the study patients was 36±7.2 years (range: 22–49). Patients with active venous ulcer (C6) were the most prevalent in this study (47.8%). Significant improvement in the clinical signs and symptoms of all patients could be demonstrated, as all patients with active venous ulcer were healed during the follow-up period. Both VCSS and Villalta score show a marked decrease at 12 months of follow-up, with a median of about 6-point decrease in Villalta score and a median of about 7point decrease in VCSS. Complications: Major bleeding was present in four patients (20%), while minor bleeding was found in one patient (5.0%). Seroma was evident in four patients (20%). Early thrombosis of the endovenctomatized segment and stents occurred in two patients (10%) and contralateral DVT was reported in one patient (5.0%).

Conclusions

Femoral endovenectomy with intraoperative endoluminal recanalization of the iliac vein is effective and safe in the treatment of patients with incapacitating post-thrombotic iliofemoral venous obstruction.

Keywords:
endovenectomy, iliac venous stenting, post-thrombotic syndrome

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Introduction

Natural history studies 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 [1–3].

It is stated in the American College of Chest Physicians guidelines for “Antithrombotic Therapy for Venous Thromboembolic Disease” that good risk patients who develop iliofemoral DVT are recommended to undergo catheter-directed thrombolytic therapy or operative thrombectomy to eliminate iliofemoral obstruction. 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 post-thrombotic morbidity [4].

Post-thrombotic syndrome (PTS) is a possible long-term complication after DVT. Symptoms are those of chronic venous disease; they can vary from leg swelling to venous ulceration with disabling claudication. The estimated incidence of DVT is 0.1% per year in the general population [5]. After a first episode of lower-extremity DVT, PTS develops in 20–50% of patients, despite adequate anticoagulation [6,7]. DVT of the iliofemoral venous segments has a significantly higher risk for PTS than DVT of popliteal–crural veins as thrombus resolution occurs more slowly and is less complete in proximal venous segments [8]. Kahn and Ginsberg [9] reported that iliofemoral DVT is the strongest predictor for formation of severe PTS. PTS significantly affects the patient's quality of life and has considerable socioeconomic consequences [10,11].

Patients who present with post-thrombotic iliac vein obstruction often can be successfully treated with angioplasty and stenting alone [12,13], but if the chronic occlusive 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. Moreover, stenting across the inguinal ligament can be performed, and there is a higher risk of stent occlusion in post-thrombotic patients [12].

Because the iliofemoral venous segment is the single venous outflow channel from the leg, it is understandable that obstruction of this segment causes incapacitating morbidity [14].

The aim of this study was to report the safety and efficacy of femoral endovenectomy and intraoperative endoluminal recanalization of the iliac vein in patients with incapacitating post-thrombotic iliofemoral venous obstruction.

Methods

This study was performed prospectively in the Vascular and Endovascular Surgery Department of a tertiary referral hospital. Between January 2018 and September 2019, consecutive patients with advanced chronic venous disease, due to post-thrombotic occlusion affecting iliocaval veins, and extending into the CFV, were candidates for hybrid femoral endovenectomy and endoluminal iliac vein treatment. The study was approved by the local ethical committee.

All patients were considered for full history taking and complete physical examination was done by a specialized vascular surgeon in our dedicated venous clinic. We included patients with chronic venous occlusive manifestation more than 1 year and with significant venous disorders (Clinical Etiologic Anatomic Pathophysiologic [CEAP] clinical staging 3 or more), failed conservative treatment, despite use of high-graded thigh-long compression stocking for at least 6 months, and combined occluded iliofemoral segment with patent profunda vein and/or femoral vein. We excluded from our study patients with isolated iliac occlusive disease, contraindications or declined to receive prolonged postoperative antithrombotic medication, hypersensitivity to the dye, CEAP lower than 3, lower-limb ischemia with ankle brachial index less than 0.9, occluded both profunda and femoral veins, DVT within 1 year, and young patients (<18 years).

Patients fulfilling the inclusion criteria were fully informed about the hybrid procedure and gave their written consent to be enrolled into the study.

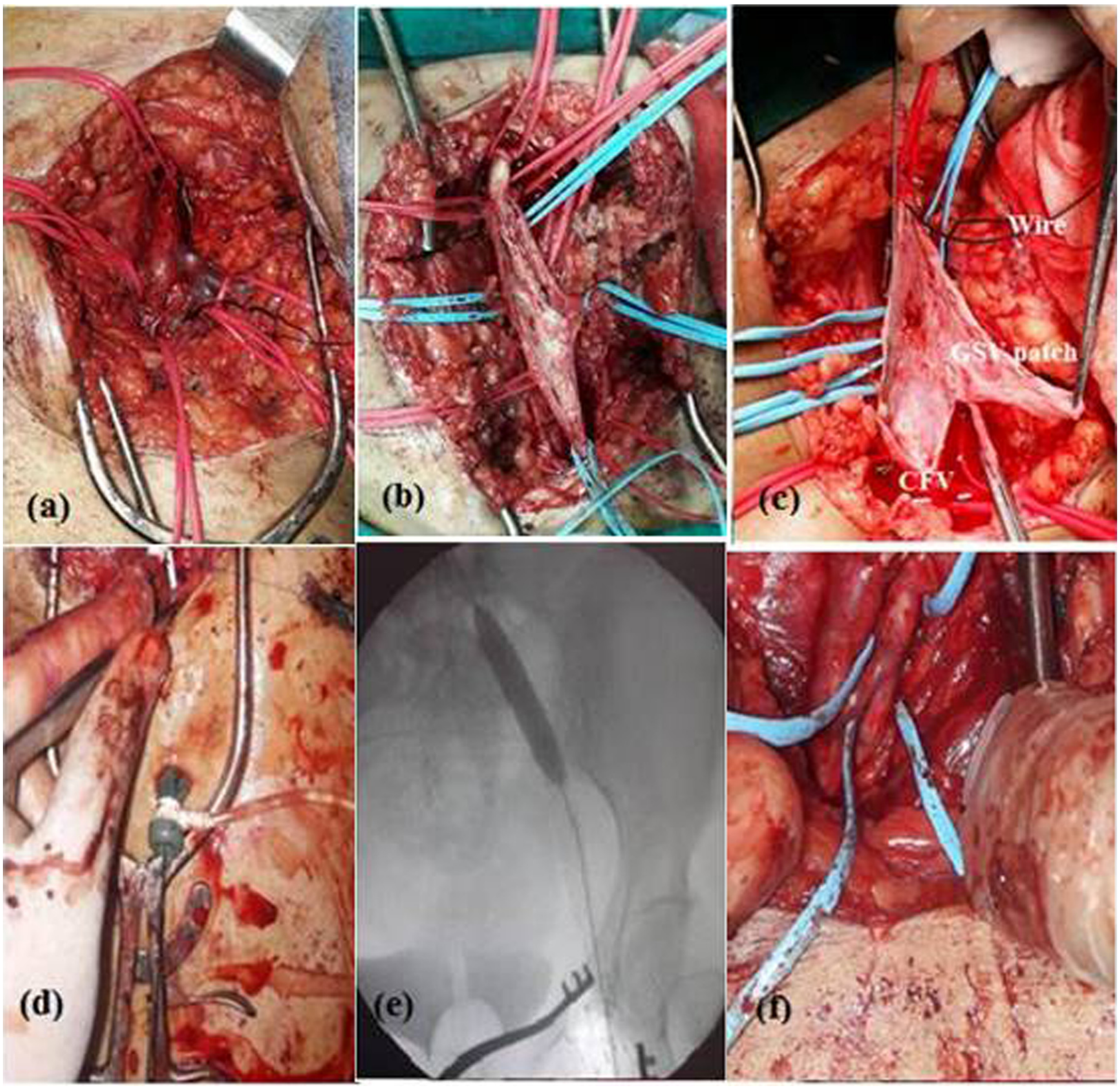
A preoperative evaluation was performed using the Venous Clinical Severity Score (VCSS) [15], the Villalta scale [16], and the Venous Insufficiency Epidemiological and Economic Study-Quality of Life/Sym questionnaires [17]. Detailed preoperative assessment was achieved for all patients by serial imaging modalities, including duplex scan, multiplanar venography, direct computed tomographic venography (CTV) axial, and reconstructed imaging.

Procedure

All patients underwent preoperative ascending phlebography to document the extent of their venous obstruction. During the preoperative phlebogram, a hydrophilic guidewire had been tested to pass through the obstructed venous segments in all patients to ensure that a channel for recanalization can be accomplished in the operating room. After that, the patient scheduled for the operation on the next day.

Two to three days before the procedure, the patient started on dual antiplatelet therapy in the form of aspirin (81 mg/d) and clopidogrel (75 mg/d). Exposure of the CFV, femoral vein, profunda femoris vein, saphenofemoral junction, and distal

Figure 1



(a) Exposure of common femoral vein (CFV) and profunda femoris venous, (b) CFV venotomy with intraluminal trabeculae, (c) patchplasty using GSV, (d) introduction of the large sheath before complete patch closure, (e) angioplasty and stenting of the iliofemoral segment, and (f) arteriovenous fistula between CFV and superficial femoral artery.

external iliac vein (EIV) (Fig. 1a) was obtained using a longitudinal femoral inguinal incision after control of all branches, especially posterior CFV branches. Small tributaries will be ligated or controlled with surgical clips. Patients were fully anticoagulated with 100 IU/kg of unfractionated heparin. An 8-cm longitudinal venotomy was performed, which often incorporated the distal EIV to the proximal femoral vein. Dense fibrinous tissue and web-like synechiae were removed with sharp and blunt dissection well into the distal EIV (Fig. 1b). Care was taken to preserve the remaining thin wall of the CFV and avoid perforation. Then, patch closure of the venotomy was performed using saphenous vein (Fig. 1c) in most patients, otherwise, the synthetic graft was used in case of unavailability of native vein, leaving the distal centimeter open to introduce a 10–12 F sheath (Fig. 1d) through which the endoluminal recanalization of the iliac venous segment will be performed. The iliac venous system and vena cava if involved were sequentially recanalized with guidewire passage, balloon dilation, and subsequent stenting. PTA of the iliofemoral tract was then performed with noncompliant balloon sizes 12–16 mm (Atlas, Bard & Mustang, Boston Scientific, USA), followed by stent placement 12–20-mm self-expandable wall stent (Boston Scientific, USA). Stents were extended partially into the inferior vena cava (IVC) (1–2 cm), only to fully treat the iliac lesion. IVC or common iliac stents were placed initially, followed by stenting of the EIV. Stents were postdilated to their target diameter (Fig. 1e). Following recanalization and venographic confirmation of unobstructed venous drainage from the CFV, the sheath was removed and closure of the patch venoplasty was completed. The CFV was examined with an intraoperative Doppler after declamping. If robust venous velocity signals were not present, a small arteriovenous fistula (AVF) is constructed between the superficial femoral artery and CFV (Fig. 1f). The incision was closed in layers of running absorbable sutures with a small drain.

Postoperative care

Low-molecular-weight heparin was started directly after the intervention; warfarin was started on the first postoperative day, provided that no active bleeding was present, INR target of 3–4 in the first 6 months. After 6 months, the INR target is reduced to 2–3. Intermittent pneumatic compression of the legs was started during and after operation in all patients and continued during the hospital stay. Postoperative compression was applied using 30–40 mm Hg elastic compression stockings, till the patient's pain quickly subsided, and edema being controlled. Routine AVF closure was planned 3 months after surgery.

Follow-up

All patients were followed at 3, 6, and 12 months after the procedure. Clinical and ultrasound evaluation were performed at each interval. In addition, postprocedure Villalta and VCSS were recorded at each clinic visit.

Definitions and outcomes

(1) Technical success was defined as guidewire crossing of the obstructed venous segment and restoration of flow on the final venography after recanalization without significant opacification of collateral veins existing before the intervention.
(2) Clinical success was defined as significant improvement in clinical scores (Villalta and VCSS) at the follow-up visit after 6 months.
(3) Primary patency was defined as confirmed patency and less than 50% restenosis on follow-up without any reintervention.
(4) Assisted primary patency was defined as confirmed patency on follow-up after intervention by venoplasty to maintain patency.
(5) Secondary patency was defined as flow re-established with thrombolysis, venoplasty, or stent placement after reocclusion of the treated vein segments.
(6) In-stent restenosis was defined as angiographic presence of more than 50% diameter stenosis at the stent site or at its edges.
(7) Stent thrombosis was defined as loss of primary patency within 30 days after the intervention.
(8) Major bleeding was defined as severe bleeding that resulted in death, surgery, cessation of therapy, or blood transfusion.
(9) Minor bleeding was defined as less severe bleeding manageable with local compression, sheath upsizing, or decreasing doses of anticoagulants.

The primary endpoint was the improvement of quality of life using different scoring systems at 12-month follow-up if compared with the baseline scores.

Secondary endpoints were stent patency rate and procedure-related complications.

Statistical analysis

Demographics and clinical characteristics of the patients were assessed with descriptive statistics. The results were tabulated using Excel™ (Version 1706, Microsoft, Redmond, Washington, USA). Statistical analysiswasperformed using SPSS 20.0 software(IBM, USA). Continuous data are presented as median (range), and categorical data as frequencies and percentages. The *t* test was used to analyze the changes in clinical scores. Patency was defined as less than 50% flow lumen reduction in a treated vein segment. Patency rates were estimated by use of Kaplan–Meier survival analyses, based on the total number of legs that received endophlebectomy and AVF. *P* value ≤05 was used to demonstrate statistical significance.

Results

A total of 23 patients (23 legs, mean age of 36±7.2) were treated. The study included 15 (65%) males. Nineteen (82.6%) patients had single DVT and four (17.3%) had recurrent DVT in their medical history. We included in our study the patients with clinical CEAP classification from C3 to C6 as illustrated in Table 1. Patients were treated with a mean interval of 3 years (range: 1–10 years) after the first DVT. The inflow vein in our study was the

Table 1 The CEAP clinical scoring

CEAP clinical staging	Number of limbs (%)
C3	3 (13.04)
C4a	2 (8.7)
C4b	2 (8.7)
C5	5 (21.74)
C6	11 (47.82)

CEAP score, Clinical Etiologic Anatomic Pathophysiologic score.

Table 2 Demographic data

	N (%)
No. of patients	23
Age (mean±SD)	36±7.2
Sex ratio (female : male)	8 (34.8) : 15 (65.2)
Mean interval from DVT onset to intervention (y)	3 (1–10)
Affected side (left : right)	17 (73.9) : 6 (26.1)
Preoperative VCSS (mean±SD)	8.9±2.7
Preoperative Villalta (mean±SD)	12.9±−3.5

DVT, deep-vein thrombosis; VCSS, Venous Clinical Severity Score.

profunda vein in 18 limbs (78.2%), femoral vein in 2 limbs (8.6%), and both veins in 3 limbs (13%). Healthy great saphenous vein was found in 15 limbs (65.2%), while unhealthy and fibrotic GSV were found in 8 limbs (34.7%). Different baseline data are shown in Table 2.

Intervention

Successful endovenectomy and endovenous recanalization and stenting of the iliac segment were done to 20 patients (86.9%). Failure to pass the wire was reported in three patients. Patch closure using native veins was done to all patients, except for one, in whom a synthetic patch was used. AVF were done in 15 patients using a 2–3-cm segment of autogenous veins of average diameter 3–5 mm, which was usually the GSV. Stents were deployed from CFV-proximal part of endovenectomy to the IVC in all patients, except one patient who had significant stenotic lesion in the lower IVC and extension of stent proximal to a healthy segment in the IVC was deemed necessary. Closure of the AVF was done surgically to seven patients and was spontaneously occluded in three patients. The AVF was left patent in five cases as the inflow from the femoral and/or deep femoral vein was judged to be inadequate.

All patients were followed up for a mean period of 1 year. Only 2 patients were missed after the third month of follow-up visit, and 18 patients completed the follow-up schedule.

Early (<30 days) outcomes

Successful endovenectomy and endovenous recanalization and stenting of the iliac segment was done in 20/23 patients as we failed to pass the wire in 3 cases. There was no reported mortality in the current series. Intraoperative bleeding occurred in three patients and required blood transfusion. Postoperative hematoma formation occurred in two patients, one was managed conservatively and the other required surgical drainage. Seroma was reported in four patients and subsided by medical treatment. Early thrombosis of the endovenctomatized segment and stents occurred in two patients in whom AVF was not performed and trial lysis was not successful.

30 days) outcomes",5,0,2,0,280pt,240pt,0mm,0mm>Late (>30 days) outcomes

Twelve months after the hybrid procedure, primary, assisted primary, and secondary patency rates were 65, 80, and 90%, respectively (Fig. 2). Three patients developed in-stent stenosis at 2.5, 7, and 8 months, as confirmed by duplex and ascending venogram and required balloon angioplasty alone. Two patients developed acute lower-limb DVT due to stent occlusion at 6.5 and 9.5 months, and were treated successfully by catheter direct thrombolysis and angioplasty of the stenotic segment.

Clinical outcomes

Table 3 shows that the mean VCSS decreased from 8.9 at baseline to 6.5 at 6 months and reached 5.1 at 12-month follow-up (*P*<0⊠001). The mean Villalta score decreased from 12.9 at baseline to 8.9 at 6 months and to 6.7 at 12 months (*P*<0⊠001).

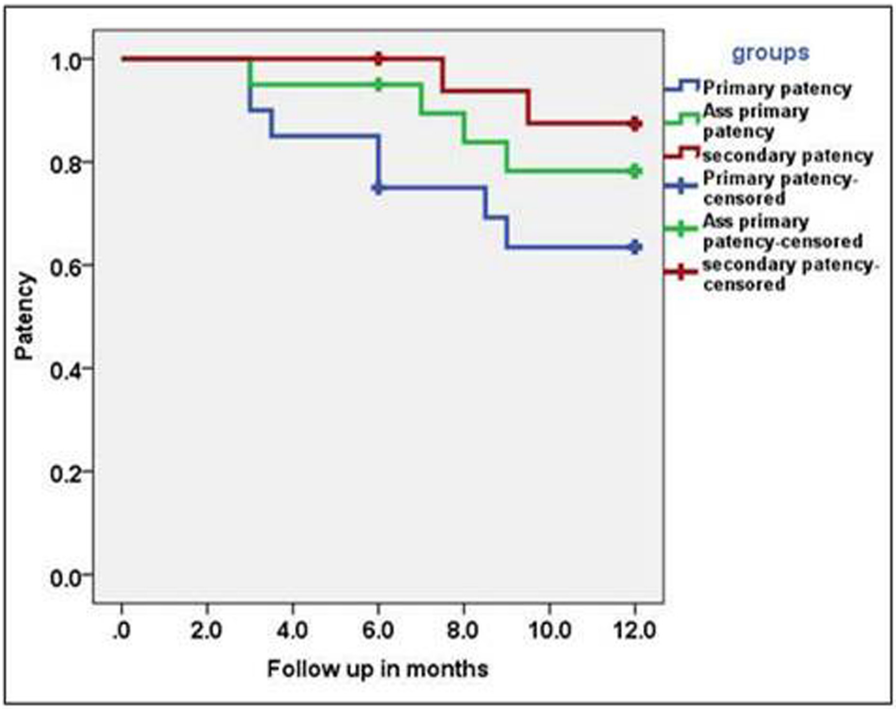
Based on the categorical Villalta scale (no, mild, moderate, or severe PTS) in the 18 limbs (18 patients) who completed 1-year follow-up, 16 limbs improved on this scale, 2 were unchanged. In total, 11 patients (with 11 limbs) with venous ulcers were healed 8 months after the intervention, without recurrence by the end of the study period.

Discussion

Endovenectomy was first described in 1964 by Manabe in the IVC for Budd–Chiari syndrome [18]. Puggioni *et al.* [19] were the first to report the feasibility of femoral endovenectomy. Hybrid techniques were developed by Gloviczki *et al.* [20], and further experience was reported by Comerota *et al.* [14] and Grommes *et al.* [21].

Endovenectomy of the CFV with recanalization of the external iliac and common iliac veins for chronic veno-occlusive disease restores unobstructed venous drainage to the vena cava from the infrainguinal venous system. The multiple recanalization channels in the CFV with webs and synechiae present technical challenges to

Figure 2



Kaplan–Meier curve shows the primary, assisted–primary, and secondary patency rates at 12-month follow-up.

Table 3 Illustrating the significant decrease in both VCSS and Villalta scores before and after the procedure

	Baseline	6 months	12 months	*P* value
VCSS scores (mean ±SD)	8.9±2.7	6.5±2.3	5.1±2.1	0.001
Villalta scores (mean ±SD)	12.9 ±3.5	8.9±2.4	6.7±3.5	0.001

VCSS, venous clinical severity score.

venoplasty and stenting. Because of these multiple channels, obstruction to the drainage from the infrainguinal venous system persists [14].

Endovenectomy has been recommended for prevention as well as for healing of venous ulcers in patients with C4b and more in the Society for Vascular Surgery guidelines for venous ulcer management [22].

Early in our series, crossing the lesion using guidewires was initially attempted in the same day of intervention. That was an essential step so as not to proceed with the subsequent surgical endovenectomy without confirming that we have a traversable iliac outflow segment. It is worth mentioning that it is an acquired skill that needs a learning curve as we reported three failures in crossing the lesion among the initial seven procedures in the current series, and that is in line with Comerota *et al.* [23].

We believe that patching of the CFV following the endovenectomy is very important to revive adequate luminal diameter to ~12 mm. The chronically diseased CFV is scarred and noncompliant, and the vein wall is sclerotic. Primary closure would lead to a narrowed vein, which might increase the risk of rethrombosis or restenosis. In our study, patch angioplasty was performed in all cases, all with native vein, except one case with synthetic patch. Contrary to that, Verma and Tripathi [24] recommended assessment of the caliber of the CFV as if adequate primary closure is done.

In the current series, stenting of iliofemoral segment was done using Wallstents (Boston Scientific) and this in line with Comerota *et al.* [23], whereas Jalaie *et al.* [25] used sinus venous stents (OptiMed, Ettlingen, Germany) and concluded that geometric problems are seen significantly less frequently when using dedicated venous stents with higher flexibility and higher radial force. Dedicated venous stents are ideal for long and tortuous lesions, especially the lesion in the iliofemoral segment with no risk of foreshortening or skip lesions after its delivery. Now, they reach 16–18-cm length in comparison with Wallstents with only 9-cm length. Worth mentioning, we used the available stent in our market and what was covered by patient reimbursement. Wallstents suffer from significant foreshortening and occurrence of skip lesions;

therefore, precise positioning is sometimes difficult in inexperienced hands. Furthermore, to prevent retrograde migration, the Wallstent has to be placed well into the IVC. The risk of contralateral iliac vein thrombosis is also reported as Wallstents potentially impair the contralateral outflow [26].

Otherwise, Wallstent has the advantage of repositioning, so the surgeon can modify the position of deployment, especially at the IVC confluence to reach the most accurate site to cover the whole length of the lesion. Also, Wallstent was made from cobalt–chromium, so better radial force was achieved, especially in the area of May–Therner syndrome compression.

Whether to perform AVF or not on concluding the procedure to optimize patency rates is still of major concern among researchers. We performed AVF only if robust venous velocity signals were not present detected by duplex after finishing the procedure and this in line with Comerota recommendations [23], but unfortunately early thrombosis of the endovenctomatized segment and stents occurred in two patients with robust venous wave in whom AVF was not created. On the other hand, van Vuuren and Jalaie *et al.* [27] recommended routine AVF because there are no objective measures to quantify adequate flow and the dissected CFV and cranial stents are highly thrombogenic after CFV obliteration.

We adopt the strategy of the caudal creation of the AVF in our current study and is in line with van Vuuren *et al.* [28], who compared cranially and caudally placed fistulas and evaluated the outcomes of the two geometry techniques between two groups, Unfortunately, no statistical significant difference in outcome could be found; however, the risk of occlusion and stent-related complications tended to be in favor of cranially placed fistulas.

In our study, we used native veins for the creation of the AVF and this is in line with Comerota *et al.* [23] to decrease the risk of infection. On the other hand, Dumantepe *et al.* [29] used loop-shaped AVF with a 6-mm ring-reinforced PTFE graft and he explained that native fistulas are usually too small. However, when created with a diameter more than 5–6 mm, it needs to be closed surgically before 8 weeks because of persistent lymphedema and swelling of the leg. The major benefit of using a loop-shaped PTFE graft is that it guarantees a high flow rate in the first month and that it can be percutaneously closed by endovascular means.

Regarding postoperative medication, all of our patients were discharged on vitamin K antagonists (INR target of 3–4 in the first 6 months and then reduced to 2–3), and dual antiplatelet (aspirin and clopidogrel) should be administered for at least 6 months. This is in line with Comerota recommendations [23]. On the contrary, Jalaie *et al.* [27] discharge the patient only on anticoagulation.

In our study, we attempted to close the AVF routinely at 3 months and this in line with Dumantepe *et al.* [29], who believe that the remodeling process in the endophlebectomy space and adequate endothelial coverage of the stents are complete at the third month. In contrast to that, Jalaie *et al.* [27] recommend closure of the AVF 6–8 weeks after its creation. van Vuuren *et al.* [28] recommend evaluation of the venous flow 6 weeks to 3 months after the initial procedure to decide whether the AVF should remain patent or whether it is possible to close the AVF. They utilized endovascular closure of the AVF by contralateral arterial access and temporary occlusion balloon of the AVF is done; phlebography was performed with contrast administration from the foot veins in the index leg. The contrast washout was evaluated and thought to be sufficient when complete washout was seen within 4 s.

Regarding the follow-up, at 12 months, the primary, assisted primary, and secondary patency rates were 65, 80, and 90%, respectively, and this in line with the results of de van Vuuren *et al.* [28] who found that the primary, assisted primary, and secondary patency rates were 51%, 70%, and 83%, at 12 months, respectively. In addition, longer follow-up was studied by van Vuuren *et al.* [29] who found that the primary, assisted primary, and secondary patency rates after 36 months were 37%, 62%, and 72%, respectively.

A significant improvement in quality of life and Villalta score could be demonstrated in our series; a median of about 6 points decreased at 12 months of follow-up, in line with van Vuuren *et al.* [30], with a median of 7 points decreasing at 12 months of follow-up.

During follow-up, three cases demonstrated recurrent stenosis in the CFV skip area (1–2-cm distance between the end of endovenectomy and the lower end of the stent), they required additional balloon angioplasty to maintain patency. It seems to be prudent to extend endovenectomy to the inguinal ligament to match the lower end of stent avoiding any skip lesions and this is in line with Comerota recommendations [23].

Neglén *et al.* [31] described stent placement peripheral to the inguinal ligament as a promising option; this treatment should not be avoided for fear of stent fractures. The most important avoided commandment was to cover the obstructed area, as stent patency is mainly related to the type of pathology. van Vuuren *et al.* [28] concluded that stent extension into a dominant inflow vein should be performed in a selected group of patients, who had an adequate deep femoral vein diameter and adequate vein quality without significant trabeculations. A hybrid surgical procedure still seems to be the best option if all inflow veins are scarred and spontaneous inflow is largely hampered.

Regarding operative morbidity and mortality, there was no mortality in our study; intraoperative bleeding was attributed to technical issues in three cases in our initial experience where a tear in the fibrotic vein occurred in the proximal part of the endovenectomized segment 1–2 cm just distal to the stent during poststent dilatation, leading to loss of blood with difficult control that was solved later on by extending the endovenectomy to match the distal end of the stent to avoid overdilation of this fibrotic segment. So preparation of blood preoperatively is mandatory. Otherwise, all bleeding was attributed to postoperative medication, an essential step to maintain early patency in such rough surface after endovenectomy. Postoperative hematoma and seroma formation were acceptable in our patients with no wound infections or dehiscence. In contrast to our result, van Vuuren [28] had a large number of patients with wound-related complications, most probably due to a small number of cases included in our series. Closed incisional negative-pressure therapy may reduce surgical-site infection rate following endophlebectomy [32].

There are a few limitations in this study, including the nonrandomized nature of the study, the number of patients included in this study was small, selection bias, short follow-up reporting only short-term results, and lack of a comparison group. Furthermore, a learning-curve effect may be present as this series also represents an early experience. However, the intervention and follow-up were standardized, and both patency rates and objective clinical scores were collected.

Future research should concentrate on a scoring system to quantify the flow and its measurement. Afterward, the evaluation of a cutoff flow value to predict stent inflow and related patency may well be performed. Next, decision making based on such a hemodynamic evaluation of duplex ultrasonography (DUS), magnetic resonance venography (MRV), venography, and intra vascular ultrasonography (IVUS) images should be evaluated with relevance of the stent patency and clinical outcome.

The indication for an invasive treatment and the selection of the procedure are mostly individual decisions. Patients should be evaluated critically under consideration of the severity of PTS, underlying pathologic process, venous anatomy, concomitant diseases, and contraindications [27].

Conclusions

Endovenectomy is a well-known but uncommonly reported procedure. Combined with iliac vein stenting, it provides technically feasible, safe, and effective practical option inpatients with extensive occlusive disease involving the CFV at the profunda ostial level. An adequate degree of axial transformation of the profunda vein should be determined before committing to such an invasive procedure.

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Conflicts of interest

There are no conflicts of interest.

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